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BETWEEN EAST AND WEST: GARCIA DE ORTA'S *COLLOQUIES* AND THE CIRCULATION OF MEDICAL KNOWLEDGE IN THE SIXTEENTH CENTURY

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ABSTRACT: This paper analyses the importance of Garcia de Orta's *Colloquies on the simples and drugs of India* (Goa, 1563) in the construction and circulation of Asian botanical and medical knowledge in the sixteenth century. It begins by examining the combined importance of experience and testimony in Orta's assessment of *materia medica* from India. It then considers the relevance of interaction and exchange of medical systems between the West and the East in the Portuguese physician's understanding of medical knowledge and practices. Finally, it analyses how medical and botanical information provided by this work was reframed by Carolus Clusius and circulated in new forms in Europe.

KEY WORDS: Garcia de Orta; Carolus Clusius; *Materia médica*; Medical knowledge; Circulation.

ENTRE ORIENTE Y OCCIDENTE: LOS *COLOQUIOS* DE GARCÍA DE ORTA Y LA CIRCULACIÓN DEL CONOCIMIENTO MÉDICO EN EL SIGLO XVI

RESUMEN: En este artículo se analiza la importancia de los *Coloquios sobre los medicamentos simples y drogas de la India* [*Colóquios sobre os simples e drogas da Índia*] (Goa, 1563) de Garcia de Orta en la construcción y circulación del conocimiento médico y botánico en Asia en el siglo XVI. Se comienza examinando la importancia combinada de la experiencia y el testimonio en la evaluación de Orta sobre la *materia medica* de la India. A continuación se examina la importancia de la interacción y el intercambio de los sistemas médicos entre Occidente y Oriente en la comprensión del médico portugués sobre las prácticas y conocimientos médicos. Por último, se analiza como la información médica y botánica que ofrece este trabajo fue reformulada por Carolus Clusius y distribuida en una nueva forma en Europa.

PALABRAS CLAVE: García de Orta; Carolus Clusius; Materia médica; Conocimiento médico; Circulación.

INTRODUCTION

On April 10, 1563 a book was published in Portuguese Goa. Unlike the two previous works already produced by the printing shop of João Quinquénio and João de Endem, it did not deal with religious matters but with the natural world.[1] The *Coloquios dos simples, e drogas he cousas mediçinais da India* [*Colloquies on the Simples and Drugs of India*], as it was titled, was the culmination of a life-time project of its author Garcia de Orta (c. 1500-1568) who, "with force of reasons and audacity", attempted to present all the knowledge on simples and medicinal drugs of India gathered over his life in this territory (Orta [1563] 1891, p.6). The importance of Orta's work was immediately recognized by the Flemish naturalist Carolus Clusius (1526-1609) who promptly epitomised it into Latin. Clusius's version was published by the famous Plantin Press at Antwerp in 1567. It went through several editions and versions into French and Italian.

Although the importance of the *Colloquies* in sixteenth-century natural history and medicine has been generally acknowledged in the international historiography, there are still relatively few recent and detailed studies of the work and its influence in other texts on the subject.[2] In general, Orta and his *Colloquies* tend to be mentioned only briefly in the context of studies concerning Clusius. It is true that the latter was crucial in the dissemination of Orta's knowledge of Indian plants and *materia medica*. Yet, the great reputation of the Dutch naturalist has also contributed to overshadow Orta's perceived role in the making of modern botany and medicine.

In Portugal, a second and a third Portuguese edition of the *Colloquies* were only published in the late nineteenth century.[3] It was at this time that Orta became acknowledged as a major figure in science and Portuguese history. This was mainly due to the efforts of Count Ficalho, a professor of botany and very erudite aristocrat who deeply admired his work.[4] Ficalho was not only responsible for a third edition of the *Colloquies* which included various historical, geographical and botanical annotations, but was also the author of the first biographical essay on the Portuguese naturalist (Ficalho, 1886). Since then, Orta has become a hero of Portuguese imperial science and various contributions have been made mainly by fellow naturalists and physicians and especially in a commemorative context. Particularly relevant to the historiography, were the contributions by the physician and historian Augusto da Silva Carvalho and by the historian Charles Boxer. Carvalho was the first to reveal Orta's Jewish ancestry as well as the inquisitorial process conducted against his family and his posthumous *auto de fé* in 1580.[5] In turn, Boxer, provided the first comparative analysis between Orta's text and the work of another influential European author on materia medica, the Spanish naturalist and physician Nicolás Monardes (1512-1588). In this study, he emphasised particularly the importance of both Iberian physicians to the global circulation of botanical and medical knowledge and their pioneering role in the development of tropical medicine (Boxer, 1963).[6]

In the last decades, some well documented Portuguese studies have been published, but in general, they have not yet reflected the new concerns and increasing international interest in science and empire and on the complex circulation of knowledge during the early modern period.[7] The contribution of Orta's *Colloquies* to the subject is a vast area that still awaits a comprehensive study. Yet, a few international scholars have recently uncovered important aspects that are relevant to thisstudy (Parasher-Sen, 2006; Cook, 2007, pp. 96-99; Walker, 2009). The purpose of this paper is to further contribute to and contextualise the importance of the *Colloquies* to the production and circulation of botanical and medical knowledge in a sixteenth-century world reconfigured by geographical expansion. It will first pay attention to what Orta's work itself reveal about the subject and then how the knowledge provided by the work circulated from East to West in the period. The concept of circulation used in the article is not linear or unidirectional and presupposes the role of interaction, adaption, exchange and appropriation in the production and distribution of knowledge.[8]

EXPERIENCE AND TESTIMONY IN THE COLLOQUIES

Garcia de Orta left Lisbon for India on the 12th March, 1534 to accompany his young patron and friend, Captain General Martim Afonso de Sousa (1534-1538). Augusto Silva Carvalho first suggested that his departure was related to the increasing pressure by the Portuguese Inquisition on Jewish conversos (Silva Carvalho, 1934, pp. 20-21). On his journey to the East, Orta took in his cultural baggage a medical education at the Universities of Salamanca and Alcalá de Henares (1515-1523) as well as a short experience as a lecturer at the University of Lisbon, first in Natural Philosophy and them in Moral Philosophy (1532-1534) (Carvalho, 1915; Pina, 1963). This academic background would be crucial for the ways in which the Portuguese physician would perceive the construction and reassessment of botanical and medical knowledge.

Between 1534 and 1538, Orta attended Martim Afonso de Sousa on several military campaigns on the west coast of India, between the Kathiawar peninsula and Ceylon. He then settled in Goa, the capital of the Portuguese Empire in Asia where he was able to establish a successful and lucrative medical practice. Orta's travels and his experience in the East

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gave him the opportunity to come into contact with new cultures and a largely unknown and mysterious natural world for Europeans as well as new ways of perceiving and treating disease, an experience that he latter presented in his celebrated work. However, the *Colloquies* not only offered descriptions and findings unknown to Europeans. The work also reflected the inextricable link between old and new forms of knowledge as well as the tension between the value of erudition and the value of experience for Orta and other sixteenth-century authors. In contrast with the New World, where everything could be seen as new for the Europeans, in India there were new fruits and herbs and also others already seen or commented on by European and Arabian authors. Therefore, the *Colloquies* contain not only observations on new plants and drugs, but also critical views on the ones that had already been mentioned by other authors. One of the main aims of the work is precisely to denounce false notions concerning natural historical knowledge associated with India. In fact, the *Colloquies* simultaneously relies heavily and critically evaluates ancient and modern authorities.

The *Colloquies* clearly show how proud Orta was of his vast erudition. Indeed, it mentions a vast array of ancient and modern authors including Pliny, Theophrastus, Hippocrates, Aristotle, Dioscorides, Galen, and Razes or Avicenna (Ficalho, 1886, pp. 281-298). Especially significant in terms of the circulation of knowledge in the period from West to East is the fact that Orta refers also to recently published works such as the *Itinerario* of Ludovico de Varthema (Seville, 1520), *Sumario de la natural y general historia de las Indias* of Gonzalo Fernadez de Oviedo (Toledo, 1526) or *De natura stirpium libri tres* by Ruellius (Paris, 1536). In addition, in the *Colloquies* Orta refers to Gaspar Barreiros's *Chorographia de alguns logares* (Coimbra, 1561), published in Portugal, just two years before the Asian edition of the *Colloquies*.

The tension between tradition and new forms of experiencing the natural world is significant in understanding why the *Colloquies* use the dialogic format, a common Renaissance literary device of classical origin.[9] This format enables a creative tension to be built and invites internal debate about the relative merits of entirely different sources of medico-botanical knowledge. As Robert Multhauf has pointed out, the dialogical genre was better suited to introducing new ideas in fields dominated by doctrines made rigid through centuries of general acceptance (Debus and Multhauf, 1966, p. 44).[10] In his study of Robert Boyle, Steven Shapin has also remarked how the dialogical format had the advantage of distancing the author from a controversy since the use of characters representing various points of view allows the author to present his ideas as a reasonable new consensus (Shapin, 1984).

The *Colloquies* present a series of dialogues between someone representing Dr. Orta and one Dr. Ruano, who is characterized as having just arrived in Goa from the Iberian Peninsula where he had also been a student at Alcalá and Salamanca. Although representative of the European academic scholar of the time, Ruano is eager to acquire new knowledge from the extensive experience and numerous observations of Orta in the East. Other characters such as servants (slaves, boys, cooks or gardeners) as well as two physicians appear also in the work in a less central way.[11] The various dialogues cover more than eighty different drugs, fruits, spices, minerals and medical preparations, all of them either native to India or observed in use there during the author's perambulations in the territory. "India" is broadly defined, since the geographical area of "the Indies" comprised most of Asia. Each colloquy provides very similar information for each item: its name in various languages, aspect and place of origin, prices, the way in which it is prepared and administered, its uses, anecdotes concerning Orta's experiences with it over the years, often including the story of his first encounter with the medicinal product, and knowledge of it from ancient and modern authors as well as according to local systems of knowledge.

One of the defining attributes of the work is the vindication of personal experience in the acquisition and validation of natural and medical knowledge. This is a trope of other sixteenth-century Portuguese works of the period related to the Discoveries. In his *The Suma Oriental* [*A Suma Oriental*] (c. 1515), Tomé Pires had pointed out that "We here have been through everything, and experienced it and seen it" (Barbosa, [c. 1511-1516], 1918-1921, Preface). Similarly, Duarte Pacheco Pereira in his *Esmeraldo de Situ Orbis* (c. 1505-1508) described experience as the "mother of knowledge, [that] removes all doubt and misapprehension" (Pereira, [c. 1505-08] 1752, p.12). However, in the sixteenth century these works remained as unpublished manuscripts with a restricted circulation.[12] Orta's *Colloquies* is the first Portuguese printed text about the natural world, as well as one of the first European works, in which the value of personal experience assumes paramount importance. In opposition to other influential authors of the period, such as Monardes and Clusius, who published on the natural history of the New World and Asia but never left Europe, Orta lived for more than thirty years in India. Therefore, he had direct access to most of the natural world described in his work. He maintained a botanical garden in his house in Goa or at his land in Bombay and could easily obtain from the markets of the town many plants and spices (Orta, [1563] 1913, p. 237). In addition, he paid correspondents and agents to send him plants and seeds from various parts of India (Silva Carvalho, 1934, p. 42 and p. 65). Moreover, Orta had

the opportunity not only to directly observe many of the drugs and simples described in his *Colloquies* but also of experimenting them on himself and on his patients (Orta [1563] 1913, pp.152, 175 and 469).

The author of the *Colloquies* was aware of the vantage point given by his personal experience over established authorities and, in various parts of the *Colloquies*, appeals to his direct information on Botany and *materia medica*. Thus, when conversing about the Benjuy, he orders Ruano "not to try and frighten him with Dioscorides or Galen, because he [Orta] merely speaks the truth and says what he knows" (Orta [1563] 1913, p. 60). Latter on, when discussing pepper, he remarks that he knows the description of this plant from the testimony of his eyes and argues against classical authorities and modern authors since:

> All agree, with one accord, not to tell the truth, although Dioscorides may be pardoned because he wrote with false information and at a great distance, with intervening seas not navigated as they now are. He was copied by Pliny, Galen, Isidore, Avicenna, and all the Arabs. But those who write now, such as Antonio Musa and the Friars, have the greater fault, because they merely repeat in the same way without taking the trouble to ascertain things as well known as the appearance of the tree, pepper, the fruit, how it ripens and how it is gathered (Orta [1563] 1913, p. 369).

However, the *Colloquies* also show how personal experience is by itself insufficient to cover the botanical and medical knowledge on various simples and drugs grown and traded in the vast territories of the Indian region. Orta's personal experience of the natural world had been also greatly enlarged during his travels in India. However, the geographical scope of the *Colloquies* was in no way restricted to Goa and the regions he had visited. It extends to African and Asian territories, crossing Arabia, the trading routes of Central Asia, the ports of the Bengala Golf, the Malaya peninsula and the most remote parts of Indochina and China (Loureiro, 2008). The vast range of territories covered in the *Colloquies* meant that Orta had to rely not only in his direct experience but also on others he considered credible. Thus, when speaking about the Cocoa Palm, he remarks to Ruano that "he will not tell him anything without having been an eye-witness or having sought the testimony of persons worthy of belief" (Orta [1563] 1913, p. 145). Furthermore, in the Colloquy on Cinnamon, Orta declares that "For me, the testimony of an eye-witness is worth more than that of all physicians, and all the fathers of medicine who wrote false information" (Orta [1563] 1913, p. 125).

Portugal conducted some efforts to employ officials in the East to compile information concerning knowledge of Indian medicinal plants and drugs. Some notable results of these efforts were the letter sent by Tomé Pires from Cochim to King Manuel the First in 1516 or a later report concerning drugs from India by Simão Álvares (Cortesão, 1964; Walter, 1962). Recently, Timothy Walker has called attention to other Portuguese attempts to collect information on Asian *materia medica* in the late sixteenth and early seventeenth centuries such as an untitled report of medical recipes and Asian substances from which they were made, written by royal order in Goa in 1596 (Walker, 2009, pp. 252-253). These documents reveal the interest of the Portuguese Administration in planning and obtaining information concerning natural and medical knowledge from the East. These efforts, however, were not as organized and detailed as those shown by Antonio Barrera-Osorio to be promoted by the Spanish administration in the New World (Barrera-Osorio, 2006).[13]

It is difficult to know to what extent Orta profited from organized and formal ways of collecting natural information in Asia. Nevertheless, the *Colloquies* testify to the dependence of this author on a vast network of informants from a variety of people of different social and knowledge backgrounds, occupations and places of origin. In fact, Orta's network included not only physicians and apothecaries but also princes, Portuguese and Indian administrators as well as traders, shopkeepers, soldiers, missionaries, travellers and interpreters.[14] Therefore, although he vindicates the supremacy of experience in the construction and reassessment of botanical and medical knowledge in the *Colloquies*, his notion of experience is broadly defined. It not only concerns the experience of the author in terms of observation and experimentation but also the experience transmitted to him by others over a long period of time. Indeed, the spectrum of whom Orta considers to be credible testimony is wide and not always well defined. In addition, his circle of trust is also associated with friendship or simply personal connections. Throughout the work, the Portuguese physician claims to be always sceptical with regards to what others say but the scarcity of direct sources and long distances dictated a more inclusive approach in the construction and validation of natural and medical knowledge.

THE COLLOQUIES AT THE MEETING POINT OF DIVERSE MEDICAL TRADITIONS

As a sixteenth-century European physician, Garcia de Orta's main influences were the thoroughly predictable ones: Galen, Aristotle, Hippocrates and Avicenna. The Portuguese physician's medical knowledge was grounded in the humoural pathology advocating diet, bleeding and purges, complementarily to natural remedies, to assure the correct imbalance of human fluids. In fact, the *Colloquies* present a special concern in determining whether various simples and drugs depending on their flavour and smell, were cold, hot, dry or wet (Pearson, 2001).

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In the East, Orta encountered new infectious diseases, unheard herbs and drugs and different medical practices. Yet, he never questioned the fundamental paradigms of the medical practices he learned at the Iberian medical schools.[15] Only when European methods failed, he used Brahmin techniques or borrowed the Yunani or Ayurvedic traditions (D'cruz, 2009, p. 49). In the *Colloquies*, he explicitly states that "first I try remedies of our doctors and when they do not work I take those of the Brahims of the country" (Orta [1563] 1913, p. 134).

As a personal doctor of Martim Afonso de Sousa, Orta contacted with important patrons such as the Sultan Bahadur (Orta [1563] 1913, p. 10) or the local sovereign Nizan Shah (Orta [1563] 1913, pp.7, 210, 311) (Nizamoxa in the text). Through them, he gained access to the Arab and Malayli physicians of these Muslim Courts. The possibility of participating in discussions with these local doctors allowed him to contact with different knowledge on herbs, drugs and medical practices. Referring to Arabic physicians at the Ahmednagar Court, he remarked that "The Moors, *great physicians* who attend the Nizamoxa, gave me these stones [Armenia stones], with which they cure melancholy" (Orta [1563] 1913, p. 350). It is clear that the credibility of those "learned men" wasn't warranted only by their courtly environment. Referring to "the physicians of Persia, Arabia and Turkey", Orta added how "they know Avicenna thoroughly. They call him *Abolahi,* and his five books *Canum*. They know Rasis whom they call *Benzacaria*, and Halirodam and Mesué, although it is not the work that we use. They also have all the works of Hypocras, Galen, Aristotle and Plato, though not so complete as from the Greek fountain-head" (Orta, [1563] 1913, p.10). The familiarity of the Arabic physicians with the same medical texts Orta studied at the Iberian Medical Schools contributed to their reliability for Orta. In addition, he stressed their ability to recognise Asian *materia medica* and how their expertise in this particular knowledge was sometimes greater than that of Greek and Latin authorities.

The Portuguese physician also reminded his readers that he had "friendly relations with the physicians of Cairo and Damascus" (Orta, [1563] 1913, p. 205). These friendships allowed him to freely criticize their practices and to become aware of some of their professional secrets.[16] As a former medical student at the universities of Salamanca and Alcalá, Orta knew many of the Arabic books from their Latin versions. In his opinion, Arabic medical knowledge was generally more reliable in the original language than in the correspondent Latin versions. Perhaps, while in Asia, he had the opportunity to learn some Arabic. The transcriptions of many Arabic words suggest his contact with native speakers (Cook, 2007, p. 98; Attewell, 1997). Orta revealed that, at the princely courts, an educated patient taught him the Arabic names of "illnesses and medicines" and, in exchange, Orta told him the correspondent Latin words "which pleased him very much" (Orta, [1563] 1913, p. 306).

Orta also profited from his proximity to the Muslim Courts which enabled him to discuss more easily with the *hakims*. But, besides their familiarity with the same medical texts, Orta underlined their inability to cure fevers.[17] In the *Colloquies*, the term *fever* is used in a very broad sense (Pearson, 2001, p. 113). Sometimes it is used to describe a symptom associated to a specific pathology and other times it describes a disease, such as typhoid or malaria. According to classic medical physiology, Orta considered diseases as the result of the disequilibrium of four humors: blood (hot and wet), phlegm (cold and wet), black bile (cold and dry) and yellow bile (hot and dry) that were produced in the heart, brain, spleen and liver. To attain a cure he took recourse to bleeding, clysters as well as to the administration of natural products with diuretic, emetic or purging properties which would help to expel the toxic fluids.

Nevertheless, following the Ancients' knowledge, Orta considered that, after treatment, it was essential to feed the patient. In these cases he prescribed a special diet designed to respond to the temperament and the needs of age, completion and habits of the sick person. At this point, the medical practices of the Portuguese doctor diverged from his Oriental colleagues that, in Orta´s view, killed their infirm by starvation.

As Orta observed, the hakims cured fevers using the same methodology of the Gentios. Count Ficalho first observed the influence of indigenous medical practices in Arabic medicine. The cure of the fevers presented in the *Colloquies* is just one case that clearly shows the influence of the *Vaidak* system of the *Vaidyas* over the *Yunáni system* of the *Hakims.*

In the *Colloquies*, Orta also describes an episode when he was called, in secret, by Nizamoxa to heal his son Hussein, who was suffering of fevers, for several days. The Muslim doctors of the Court were powerless to cure him. In fact, they wanted to treat him like the *Gentios* did. Showing their support to the indigenous communities and their opposition to the Portuguese, they treated the son of the sovereign as they had learned from the *Gentios*. Orta further remarked that "[Hussein] had the wish to be cured in our way, but the custom of the country is much against it and it had to be withdraw, especially because the educated physicians at his court liked to gratify the natives and to oppose me. So when I was present they cured in one way, and when I was absent, in another" (Orta, [1593] (1913), pp. 310-311). Using medical tech-

niques, to satisfy the *Gentios* or to displease the Portuguese, was a way to affirm fidelity to the indigenous elites or opposition to the foreign power.

Undoubtly, Orta admired indigenous medical knowledge but he was also aware of some of its errors and limitations (Grove, 1991, pp.160-176).[18] He criticised the empiricism of the native medical practices. As he argued, the *Vaidyas* cured "according to experience and custom" (Orta [1563] 1913, p. 306).

He also stressed the ignorance of these physicians on anatomy by saying that "as for anatomy they do not know where the liver is, nor the spleen, nor anything else" (Orta [1563] 1913, p. 308). Besides these limitations, the *Vaidyas'* knowledge revealed to be very useful to the Portuguese living in Asia. In fact, local healers were familiarized with the properties of endemic herbs and drugs. Orta truly admired their competence in treating obstruction or local illnesses, like cholera and dysentery. These ailments were the major health problems that the Portuguese suffered in the East. In Orta's opinion, the local doctors were quite well prepared to treat these infirmities. Referring to the cure of dysentery, Orta recalled, that "when we find that our patients do not appreciate our gentle medicines, we deliver them over to Malabars to give them stronger medicines" (Orta, [1563] 1913, p. 232)." The presence of indigenous practitioners at the Royal Hospital of Goa since its foundation, testifies to the necessity of using native knowledge in the cures of local illnesses. According to Timothy Walker, local practices were soon accepted by the Portuguese living in Asia. The diminished number of Iberian doctors in the East and the virulence of some Asian diseases, made the Portuguese receptive to local medical experience and expertise. In the *Colloquies*, Ruano shows his great desire to talk about the herb that Orta uses to cure dysentery. In his words, "according to what is said in Portugal it is very efficacious" (Orta, [1563] 1913, p. 229). Thus, the fame of local herbs used by Orta had already reached the kingdom. But, as Ruano retells, Orta advised a Portuguese noble to take the remedy as the Malayalims did and not in the European way. In Orta's view, the Malabar way to cure this disease was much better. The local treatments were by then appropriated by the Portuguese doctors at Goa. And he added: "Now the Mayalims give us their water, which is compounded at the Royal Hospital" (Orta [1563] 1913, p. 232). Indigenous knowledge was, in fact, very important for Orta's reasoned critique of western ancient and modern medical authorities (Grove, 1991, p. 162). However, the *Colloquies*, do not present any clear evidence that Orta did have contact to any Indian medical text.[19]

It is significant that, in the *Colloquies*, Orta specifically attributed his authority to the variety of his sources.[20] As Malupa said: "Dr. Orta often knows better than all of us, for we only know the Gentoos, but he knows Christians, Moors, and Gentoos better than all of us" (Orta [1563], 1913, p. 436). Did Orta show any relative preference for any of these systems? He was not explicit. Instead, he chose to emphasise the relative merits of each system and to point to their weakness, when they were relevant for his argument. Therefore, we might say that overall he had a pragmatic attitude in relation to the various systems of knowledge. We should also stress that Orta's critique of western knowledge refers only to errors concerning the description and use of Asian *materia medica* and not to general therapeutic practices used in Western medicine.

Therefore, the *Colloquies* should be viewed as a profoundly eclectic text since it relies in western, Arabic and indigenous knowledge and Orta discusses their various relative advantages or inconveniences. As Zupanov wrote, "[Garcia de Orta] was always ready to try out new methods, as long as they did not contradict reason and his sense of medical practices" (Zupanov, 2002, p. 20). We may say that Orta's knowledge seems to be the result of a difficult and complex balance between the different medical systems used in India and in Europe. In fact, he was embroiled with the political Portuguese elites, Muslin patrons and some local Gentios.[21] As Richard Grove has first pointed out, Orta's scientific insight was gained through becoming part of this pattern of patronage and subordination as well as through personal friendship (Grove, 1991, pp.164-172). In sum, it seems that Orta's text stands at the intersection of various levels of individual and collective experience as well of various systems of knowledge.[22] However, ultimately, it was Orta's peculiar insight, agenda and circumstance as a foreigner living for more than thirty years in India that made the *Colloquies* a unique, challenging and attractive work.

REFRAMING THE COLLOQUIES FOR THE WEST

In the dedication to Martim Afonso de Sousa, Orta alludes to the reasons why he has chosen Portuguese instead of Latin for the publication. He considers Portuguese a more approachable language in the region adding that because he "knows that all those who live in these Indian regions, when they know to whom it is dedicated will be anxious to read it" (Orta, [1563], 1891, p. 5).[23] This seems to be a tribute to his patron and old friend. We should also take into account that there was a relatively important Iberian target audience in the East composed not only of physicians and apothecaries but also merchants, missionaries and a more general public. As we have already stressed, Orta lived for a long time in Goa and did not belong to European network of naturalists for whom Latin was the *lingua franca*. Nevertheless, the numerous refer-

ences to western authorities show that he was also thinking about European naturalists and physicians as potential readers.

The relatively modest circulation of the *princeps* edition, together with the fact that its language was only known to a few, made chance and the efforts of foreigner crucial to the circulation of Orta´s ideas. It was during his trip to the Iberian Peninsula between 1564 and 1565, when tutoring Jacob Fugger, that the Flemish naturalist Carolus Clusius, who would become one of the key figures in the European natural history of the sixteenth century, found a copy of the *Colloquies* on the 6th January 1564:[24]

> On this trip, I found by chance a book written in Goa and recently brought from Eastern India. It had been written in Portuguese and it pleased me so greatly that I decided to publish a history of Indian plants and aromas (…) It pained me very much that it had been written in a language that was understood by so few (Clusius, 1567, p. 4).[25]

Orta's work was attractive to Clusius not only because of the new knowledge presented in the work but also because of the way in which he discarded the authority of ancient and modern authors. He promptly produced an epitomised version of the text which was published in 1567 (Clusius, 1567). Why did he not simply choose to publish a translation of the *Colloquies*? What were the implications of a change from the dialogical to the monological format? In the dedicatory preface to Jacobo Fugger, Clusius explained some of the differences between "his" *Aromatum et simplicium…* and Orta´s *Colloquies*:

> I translated the *Colloquies* into Latin and afterwards reduced them to an epitome, writing each chapter individually and in an order more convenient than before, rejecting some matters that I did not judge important (…) It was necessary to establish many things in their proper place (Clusius, 1567, p. 5).

The publication of the text in a new format empowered the process of appropriation. Moreover, Clusius' editorial task was not simply one of summarizing Orta´s ideas in a new format. Firstly, it involved selection. Besides dealing with this subject, the *Colloquies* contain information not directly relevant to botanical and medical knowledge. Parts of the original text were therefore to be rejected. Secondly, it involved ordering and a clarification of parts of the original text. Clusius' preoccupation in ordering the *Colloquie*s is already visible in his various annotations on his own copy of the original work now held at the Cambridge University Library. Significantly, he adds at the end an index of names missing from Orta's text. Thirdly, it involved the addition of commentaries which included precise bibliographical references to the authors and texts alluded to in the original work, as well as additional information on the geographical origin and on the medical virtues of the plants and herbs presented in the *Colloquies*, besides news received from Clusius' informants.

Orta's text did not include any illustrations and we do not have any information on his views of the use of pictures. The genre of the work might have also contributed to the absence of illustrations and, more importantly, we should bear in mind the cost and effort involved in including illustrations in printed works and that the printing press had only recently been introduced in Goa. In the absence of illustrations, Orta´s strategy is to show differences by pointing to partial similarities with plants and herbs well-known in Europe, thus providing a visual sense of the new productions of nature presented in his work.

In opposition, and very probably because he had never left Europe, Clusius considered pictures very relevant in the validation of knowledge of objects from distant lands. He included, therefore, in the first edition of his epitome sixteen illustrations.[26] He also used them with the aim of showing his readers his own "experience" with exotic materials. The Flemish naturalist reinforced the credibility of the illustrations by remarking that they were "drawn from nature".[27] Moreover, he usually mentioned the origin of the specimens used in the illustrations, such as the cinnamon leaf given to him by a Spanish physician and the cinnamon stick owned by a physician from Bruges (Clusius, 1567, p. 81 and p. 102). The particular and individual details, as spelt out in the text, were crucial in persuading the reader that the images depicted an exotic object that truly existed. The inclusion of naturalistic representations represented an added value for Clusius and his readers. On the one hand, they reinforced the innovative value of his contribution. On the other, as Claudia Swan has remarked, naturalistic images of nature had an extra value since they were able to close the gap between textual knowledge of nature and experience of it, especially in a period when texts tended to lag behind images insofar as they tended to depend on classical authority (Swan, 2006).

The inclusion of illustrations represents an added value to the work *Aromatum simplicium*. They also reinforce the importance of Clusius´ authorship in his edition of the *Colloquies*. Significantly, their number is increased in the various editions of the work: the first edition contained sixteen, the second edition included twenty seven and the third edition twenty eight. Yet, in comparison with other botanical works of the period such as Leonard Fuchs' *De Historia Stirpium* (1542), the number of illustrations is relatively small. Sachiko Kusukawa has remarked on the modest use of pictures in Clusius' translations and suggested that, by wanting to limit financial risks and hence creating

only a small amount of woodcuts, Plantin's strategy for publishing this genre of exotic medicine remained rather conservative (Kusukawa, 2007, p. 225).

Thus, the appropriation of the text by Clusius involved a new format, adjustments to the original text, as well as the inclusion of various notes and illustrations. All of these changes contributed to the consolidation of the botanical and medical knowledge originally presented in the *Colloquies* and to adapt the content of the *Colloquies* to new kinds of audience in the West. Stripped off the controversies, inquisitiveness, and dynamic tension of the original work, *Aromatum et simplicium aliquot medicamentorum apud indos nascentium historia* became the reference text on the simples and drugs of India.

Another significant difference between the *Colloquies* and Clusius' epitomised version of the text lies in the printing houses associated with the two publications. The *Colloquies* were published by a modest printing house on the "periphery" of the Portuguese Empire and, as we have already mentioned, they were only their third publication. Indeed, there were rough and difficult conditions associated with the publication of the work. As a result, the *Colloquies* include many printing errors and twenty pages of errata at the end, some of them needing further amendments. In opposition, Clusius' epitomised version was published by the famous Plantin Press at Antwerp. This publisher could provide the best quality in books in terms not only of text but also of visual representations. The quality and reliability of the Plantin Press was crucial in making of Clusius' epitome a kind of knowledge commodity by enabling the information contained originally in the *Colloquies* to be more accessible and exchangeable.

Clusius' epitomised version of the *Colloquies* went through several editions which attempted to incorporate new knowledge and new visual representations of nature. The second edition, published in 1574, is a reprint of the first edition with a few changes: the dedication to Fugger has been dropped, the note to the reader adapted and a new poem added. There was also a clear stylistic revision of the Latin text. The third edition was published in 1579. The text is similar to the earlier one but Clusius added one illustration. In 1582, the Flemish botanist edited a short book of 43 pages where he included additional notes with some novelties recently brought by Sir Francis Drake from his circumnavigation of the world. In 1593 the fourth edition of the *Aromatum et Simplicium* appeared. For the first time, the works of Orta, Cristovão da Costa, Monardes and Pierre Belon du Mans appeared together in a volume, with separate title pages and sequential page numbering. In 1605, Franciscus II Rapheegius published in Leiden a volume of Clusius' collected works titled *Exoticorum libri decem*. The first six texts were dedicated to the results of Clusius' studies on trees, fruits, seeds, (Parts 1, 2 and 3), vegetable juices, gums, barks and roots (Part 4), birds, quadrupeds and snakes (Part 5), marine plants, corals and fishes (Part 6) brought to him by the personal contacts he had with the East Indies Company. The seventh text of this volume was a reprint of the fourth edition of *Aromatum et Simplicium.* This work became a sort of compendium of new medicines brought from outside Europe (Wille, 1993, pp.109-121).

Clusius' epitome of the *Colloquies* was fundamental in the fame he acquired as a naturalist. Before it, he had published a French translation from the Dutch of Rembert Dodoens', *Histoire des Plants* (Antwerp, 1557) as well as his *Antidotarium sive de exacta componendorum miscendorumque medicamentorum ratione ll. III ... nunc ex Ital. sermone Latini facti* (Antwerp, 1561) with which he began his fruitful collaboration with the renowned Plantin printing press. In his epitomised version of the *Colloquies,* Clusius showed for the first time his wonderful skills in linguistic facility, editorial discipline, collation of sources and careful observation which were fundamental in later editorial projects. Also crucial was his vast network of correspondents in the Netherlands and in other European countries as well as his circle of friends and important persons. They enabled him to regularly receive specimens and news on "exotic" *materia medica* which he promptly incorporated in the next edition of his works. In this way, Clusius acquired a crucial role as a mediator in the circulation of new medical and botanical knowledge in sixteenth-century Europe (Egmond, 2007; Egmond, 2010).[28] It should also be stressed that his Latin translations and various editions of works on the subject by Iberian authors such as Garcia de Orta, Nicolas Monardes and Cristovão da Costa —also known as Cristóbal Acosta— were specially aimed at an European cultural elite of scholars. As José Pardo Tomás has remarked, the very process of translation of these works was complex and worked at scientific, cultural and political levels (Pardo Tomás, 2007, pp. 175-176). Furthermore, it was not only language translation that was at stake. Clusius successful edition of these works for an European audience of scholars involved also a rendition of worldviews and of ways of perceiving and understanding culture and the natural world in the period. The new language in which they were presented, as well as his new comments, added bibliographical information and visual representations rendered them suitable to his privileged audience and fulfilled his aspirations as a reputed author in the sixteenth-century republic of letters. In addition, his rendering of the works of various authors on "exotic" *materia medica* as a collation further developed his process of appropriation and his status as an authority in the subject. His most outstanding compilation titled

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Exoticurum libri decem (1605), in which only his name appears in the frontispiece, culminates and celebrates the central position he has managed to acquire in the exchange and circulation of medical and botanical knowledge from new and distant places for most Europeans (Clusius, 1605).

CONCLUSION

The *Colloquies* were a singular venture with a global relevance. They had a bearing in the construction of global botany, medicine and even trade. Out of a lifetime's experience, curiosity and an iconoclastic spirit, Garcia de Orta constructed a work that then, and now, is difficult to define and to categorize. The juxtaposition of Orta's erudition and long personal experience in the East were one of the defining features of the *Colloquies*. Yet, we have also seen how experience and testimony was used in the work in a broad and inclusive way. We have also seen that one of the most innovative features of the *Colloquies* was the eclectic combination of different medical systems in the interpretation of disease and the effects of drugs. Indigenous and Arabic systems of knowledge stand out in the *Colloquies* but Orta is not uncritical of them. It is only in juxtaposition with the many references to Western medical knowledge that indigenous knowledge acquires true novelty and visibility in the text. Besides, Western knowledge is not always criticised and some authors are sometimes mentioned with praise.

The success of the *Colloquies* can not only be attributed to the epitomised version in Latin by Clusius. The Portuguese original version of the text was sold both in Goa and in Lisbon and the main intended audience for the original text were Portuguese physicians and apothecaries living in the former town or in other parts of Asia. In any case, the circulation of the text in Portuguese can be seen having shortcomings. Orta himself in the *Colloquies* complains about the Portuguese only paying attention to the promotion of trade and not to the encouragement of natural knowledge:

> The Portuguese, who navigate over a greater part of the world only procedure a knowledge of how best to dispose of that merchandise or what they bring here and what they shall take back. They are not desirous of knowing anything about the things in the countries they visit. If they know a product they do not learn from what tree it comes, and if they see it they do not compare it with one of our Indian trees (…), nor ask about its fruit or what it is like (Orta, [1563] 1913, pp. 86-87).

However, we should also take into account that during the first half of the sixteenth century the Portuguese remained particularly prudent in the spreading of new knowledge about Asian natural resources. In fact, during more than fifty years of the Portuguese presence in Asia, only manuscript information about Indian botany circulated between Lisbon and Goa and vice versa.[29] After 1550, some of those texts were divulgated by the Italian edition of Ramusio (Ramusio, 1550), even if the bulk of the information remained restricted to Portuguese officials and statesmen.

It is indisputable that Clusius was mainly responsible for the success of the circulation of Orta's name and ideas in Europe during the sixteenth century and afterwards. Indeed, we have seen that the way in which Clusius appropriated the text was crucial in rendering it suitable for an European readership, not only in terms of language, but also in terms of form including the presentation of comments and illustrations. In any case, both in terms of production and various forms of circulation, the *Colloquies on the simples and drugs of India* stand as one of the first medical works intrinsically connected with both East and West.

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NOTES

1 The introduction of the printing press in Goa, as well as in other towns of Portuguese Asia, happened in 1557. In accordance with the Portuguese mission of spreading Christian faith, the great majority of the works published were catechisms and praying books (Matos, 1987).

2 Exceptions include: Zupanov, (2002); Varadarajan ed., (2006); Mendes and Fragoso eds., (2008); Mendes ed., (2009).

3 A second edition of the *Colloquies,* edited by Adolfo de Vernhagen, was printed in Lisbon in 1872 and a third edition also in this city in 1891 (first volume) and 1895 (second volume). The latter was commented and edited by Count Ficalho and published by the Imprensa Nacional**.** It become the standard edition of the *Colloquies*.

4 Ficalho's edition of the *Colloquies,* but without his annotations, was translated to English by Sir Clements Markham (Orta, [1563] 1913). More recently, it was published a complete translation into French of Ficalho's edition but only part of the annotations (Orta, [1563] 2004).

5 As a result, the remains of Orta's body were exhumed and publicly burned (Silva Carvalho, 1934). The genealogical tree of Orta's family was further developed by another historian (Revah, 1960). For a comparative perspective on the lives and career of Portuguese Jewish physicians, see Arrizabalaga, (2007).

6 On Monardes contribution to natural history and medicine, see Lasso de la Vega y Cortez, (1988); López Piñero, (1990); López Piñero, (1992); López Piñero; López Terrada, (1997); Bleichmar, (2005).

7 See, among others, Macleod ed., (2000); Schiebinger, (2004); Schiebinger and Swan eds., (2004); Canizares-Esguerra, (2006). For a recent historiographical perspective on science and the Portuguese Empire, see Fontes da Costa and Leitão, (2009).

8 On the increased importance of the circulation of knowledge in the historiography of science, see González Silva and Pohl-Valero, (2009).

9 On how Garcia de Orta handled this tension in the *Colloquies* in order to construct himself as a new medical authority, see Fontes da Costa, (2012).

10 On the dialogical genre, see also Siepmann, (2008) and Baranda Leturio, (2011).

11 Based on his analysis of the *Colloquie*s, Count Ficalho first called attention to Orta's servants and his household (Ficalho, 1886, pp. 215-218). Recent references include Carvalho, (2003) and Nobre-carvalho, 2008. On the physician Dimas Bosque who appears in Colloquy Fifty Eight and who is also the author of one of the preliminary texts of the *Colloquies*, see Ficalho's annotation in Orta [1563], 1895, pp. 25-26 and Walter, (1963).

12 Some of them would be published in Ramusio, (1550).

13 On the circulation of information concerning American medicinal plants to Europe in the sixteenth and the seventeenth centuries, see Pardo Tomás and López Terrada, (1993); Huguet-Hermes (2001); González Bueno, (2007).

14 On the importance of local informants in Orta´s construction of knowledge, see Nobre-Carvalho, (2010).

15 It is important to present here some of the pioneer works on this topic: Jorge, (1936); Pina, (1945), as well as other articles that explore more profoundly the subjects studied by Orta: Grove, (1991); Mathew, (1997), or Parasher-Sen, (2006). The recent articles on circulation and appropriation of indigenous medical knowledge in the Portuguese Empire should also be consulted: Walker, (2009). Isabel Soler researches also help us to understand Orta's reconstruction of medical knowledge (Soler, 2003). Some of the works presented at the international meeting "Garcia de Orta e Alexander von Humboldt" that was held in Goa, in 2008, brought important contributes to these analyses. In particular, we would like to stress the special contribution of D'Cruz, (2009).

16 Orta met the Muslim physicians (*físicos letrados*) in the courts of Cambaia and of the Nizam Shah, and probably once or twice in Goa. Although admiring them because they knew by heart the *Canon* of Avicenna and other Ancient medical texts, he criticizes their inability to cure fevers.

17 As Pearson stresses, it is quite difficult to identify Orta's meaning of 'fever' because it is a symptom common to several diseases (Pearson, 2001, p. 113).

18 See also Parasher-Sen, (2006).

19 It should be stressed that, in the middle of the sixteenth century, some Arabic and Persian versions of these Sanskrit texts circulated already (Gaitonde, 1983, pp. 134-139 and Pearson, 2001, p. 106).

20 Boxer points out that Orta refers frequently to Dioscorides and Pliny, among the Anciens, Avicenna and Serapion among the Arabs, Antonio Musa and Manardi among the Italian contemporaries as the principal authorities whom he cites in his chosen field of study (Boxer, 1963, p. 13).

21 In relation to Orta's compromise with the Portuguese establishment in Goa, we should note that, in the Colloquy on Camphor, he laments his bad luck for not being able "to visit all those countries and should not be given leave, by those who govern them, to go beyond where they reside, because they [the Portuguese] want to make use of my old age and the learning it has acquired...' (Orta [1563], 1913, p. 87).

22 This *hybrid* medical knowledge was a particularly useful tool at the hospitals of the Portuguese seaborne Empire. According to Walker, these *mixed* practices were only adopted at the Kingdom Hospitals of Lisboa or Coimbra after the 18th century (Walker, 2009).

23 This introductory part was taken out from the English translation of the *Colloquies*.

24 At the time Clusius had published a French translation of Rembert Dodoens's herbal, published in Antwerp in 1557 by van der Loë and his *Antidotarium sive de exacta componendorum miscendorumque medicamentorum ratione ll. III ... nunc ex Ital. sermone Latini facti* (1561).

25 Clusius was on a trip on the Iberian Peninsula with the son of the rich banker Anthony Fugger who had interests in the Indo-Portuguese trade.

26 Another work substantially based on Orta's *Colloquies* is Cristovão da Costa's *Tractado de las drogas y medicinas de las Indias orientales* [*Treatise on drugs and medicines from Eastern India with their plants drawn from life*] (Costa, 1578). One of its distinctive features is the inclusion of illustrations of forty-six plants and two of the elephant. Costa (c. 1525-c.1594) was born in the African territory and come to India in 1568 as a physician/surgeon in the fleet of D. Luis de Ataide, the Portuguese Viceroy to India. In 1571 he left for Lisbon and finally Spain where he worked as a medical practitioner in the town of Burgos till 1586. A small part of his botanical work was also translated into Latin by Clusius and published in Antwerp in 1582.

27 We know that they were drawn by Van der Borcht and cut by Nicolai (Kusukawa, 2007).

28 On Clusius exchanges with Spanish scholars, see Barona and Gómes Font, (1998) and Barona, (2007).

29 On secrecy and the circulation of natural knowledge in sixteenth-century Portugal, see Fontes da Costa, (2009).

BIBLIOGRAPHY

Arrizabalaga, J. (2007), "The World of Iberian converso practitioners, from Luís Alcanyís to Isaac Cardoso". En: Navarro, V.; Eamon, W. (eds.), *Más allá de la Leyenda Negra: España y la Revolución Científica/Beyond the black legend: Spain and the scientific revolution*. Valencia, Universitat de Valencia, pp. 307–322.

Attewell, G. (1997), *India and the Arabic learning of the Renaissance: The case of Garcia d'Orta*, M.A Thesis, Warburg Institute, London, University of London.

Baranda Leturio, C. (2011), "Formas del discurso científico en el Renacimiento: tratados y diálogos", *Studia Aurea*, 5, pp. 1-21.

Barbosa, D. [c. 1511-1516] (1918-1921), *The book of Duarte Barbosa: an account of the countries bordering on the Indian Ocean and their inhabitants* [*Livro do que viu e ouviu no Oriente*], translated by Dames, M. L., London, vol. I.

Barona, J. L.; Gómes Font, X. (1998), *La correspondencia de Carolus Clusius con los científicos españoles*, Valencia, Universidad de Valencia.

Barona, J. L. (2007), "Clusius' exchange of botanical information with Spanish scholars". En: Egmond, F.; Hoftizer, P.; Visser, R. (eds.), *Carolus Clusius, Towards a Cultural History of a Renaissance Naturalist,* Amsterdam, Koninklijke Nederlandse Academie van Wetenschappen, pp. 99-116.

Barrera-Osorio, A. (2006), E*xperiencing Nature. The Spanish Ameriacan Empire and the Early Scientific Revolution,* Austin, University of Texas Press.

Bleichmar, D. (2005), "Books, bodies, and fields: Sixteenth-century transatlantic encounters with new world *materia medica*". En: Schiebinger, L.; Swan, C. (eds.), *Colonial Botany: Science, Commerce, and Politics in the Early Modern World*. Philadelphia, University of Pennsylvania Press, pp. 83-99.

Boxer, C. R. (1963), *Two Pioneers of Tropical Medicine*: *Garcia d'Orta and Nicolas Monardes*, London, The Hispanic and Luso-Brasilian Councils.

Canizares-Esguerra, J. (2006), *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World*, Stanford, Stanford University Press.

Carvalho, J. T. (1915), *Garcia d'Orta: notas sobre a sua passagem pelo estudo e Escolas Gerais de Lisboa*, Coimbra, Imprensa da Universidade.

Carvalho, J. C. F. A. de (2003), "Processos retórico-hermeneuticos nos *Colóquios dos Simples e Drogas da Índia*". En: Carvalho, J. C. F. A. de (ed.), *Ciência e Alteridade na Literatura de Viagens: Estudo de Processos Retóricos e Hermenêuticos.* Lisboa, Edições Colibri, pp. 71-120.

Clusius, C. (1567), *Aromatum et simplicium aliquot medicamentorum apud indos nascentium historia,* Antuerpiea, C. Plantin.

Clusius, C. (1605), *Exoticorum libri decem: quibus animalium, plantarum, aromatum, aliorumque peregrinorum fructuum historiae describuntur: Item Petri Bellonis observationibus* [...], Leiden, Raphelengius.

Cook, H. J. (2007), *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Age*, New Haven and London, Yale University Press.

Cortesão, A. (1964), *A propósito do ilustre boticário quinhentista Tomé Pires*, Coimbra, Coimbra Ed.

Costa, C. da (1578), *Tractado de las drogas y medicinas de las Indias orientales*. Burgos, Martin de Victoria.

D'Cruz, S. (2009), "Documenting the Medical-Botanical Traditions of India: the Colóquios of Garcia de Orta". En: Mendes, A. (ed.), *Garcia de Orta and Alexander von Humboldt. Across the East and the West. Proceedings of an International and Interdisciplinary Conference*, Lisboa, Universidade Católica Editora, pp. 45-58.

Debus, A. G.; Multhauf, R. P. (eds.), (1966), *Alchemy and Chemistry in the Seventeenth Century*, Los Angeles, William Andrews Clark Memorial, University of California.

Egmond, F. (2007), "Clusius and friends: Cultures of exchange in the circles of European naturalists". En: Egmond, F., Hoftizer, P.; Visser, R. (eds.), *Carolus Clusius, Towards a Cultural History of a Renaissance Naturalist,* Amsterdam, Koninklijke Nederlandse Academie van Wetenschappen, pp. 9-48.

Egmond, F. (2010), *The World of Carolus Clusius. Natural History in the Making, 1550-1610*, London, Pickering & Chatto.

Ficalho, C. (1886), *Garcia de Orta e o seu tempo*, Lisboa, Imprensa Nacional.

Fontes da Costa, P. (2009), "Secrecy, Ostentation and the Illustration of Exotic Animals", *Annales of Science,* 66, pp. 59-83.

Fontes da Costa, P. (2012), "Geographical Expansion and the Reconfiguration of Medical Authority: Garcia de Orta's *Colloquies on the Simples and Drugs of India* (1563)", *Studies in the History and Philosophy of Science*, 43, pp. 74-81.

Fontes da Costa, P.; Leitão, H. (2009), "Portuguese imperial science: A historiographical review". En: Bleichmar, D.; de Vos, P.; Huffine, K.; Sheehan, K. (eds.), *Science, Power and the Order of Nature in the Spanish and Portuguese Empires*, Stanford, Stanford University Press, pp. 35-53.

Gaitonde, P. D. (1983), *Portuguese Pioneers in India: Spotlight on Medicine, Bombay,* Sangam Books.

González Bueno, A. (2007), "El Descubrimiento de la Naturaleza del Nuevo Mundo: Las Plantas Americanas en la Europa del siglo XVI", *Circumscribere. International Journal for the History of Science*, 2, pp. 10-25.

González Silva, M.; Pohl-Valero, S., (2009), "Circulation of knowledge and networks of power: In the search of new historiographical perspectives on science", *Memoria y Sociedad,* 13, pp. 7-12.

Grove, R. (1991), "The transfer of botanical knowledge between Asia and Europe 1498-1800", *Journal of the Japan-Netherlands Institute*, 3, pp. 160-176.

Huguet-Hermes, T. (2001), "New world *materia medica* in Spanish renaissance medicine: From scholarly reception to practical impact", *Medical History*, 45, pp. 359–376.

Jorge, R. (1936), "La médecine et les médecins dans l'éxpansion mondiale des Portugais", in *Actes, conférences et comunications du IIIe Congrés International d' Histoire des Sciences*, Lisboa, pp. 55-67.

Kusukawa, S. (2007), "Uses of pictures in printed books: The case of Clusius´ *Exoticorum libri decem"*. En: Egmond, F.; Hoftizer, P.; Visser, R. (eds.), *Carolus Clusius, Towards a Cultural History of a Renaissance Naturalist,* Amsterdam, Koninklijke Nederlandse Academie van Wetenschappen, pp. 221-246.

Lasso de la Vega y Cortez, O. J. (1988), *Biografia y estudio critico de las obras del médico Nicolás Monarde*s, Sevilla, Padilla Libros.

López Piñero, J. M. (1990), "Las nuevas medicinas americanas en la obra (1565-1574) de Nicolás Monardes", *Asclepio. Revista de Historia de la Medicina y de la Ciencia*, 42, pp. 3-68.

López Piñero, J. M. (1992), "Nicolas Monardes: el estudio de la materia medica americana desde Sevilla". En: Lopez Piñero, J. M. (ed.), *Medicinas, drogas y alimentos vegetales del nuevo mundo: textos e imagines espanholas que los introdujeron en Europa*, Madrid, Ministerio de Sanidad y Consumo, pp. 111-197.

López Piñero, J. M.; López Terrada, M. L. (1997), "El tratado de Monardes: acogida y primeras traducciones". En: *La influencia espaniola en la introducción en Europa de las plantas americanas (1493-1623)*, Universitat de Valencia, CSIC, pp. 55-66.

Loureiro, R. M. (2008), "Garcia de Orta e os Colóquios dos Simples: Observações de um viajante sedentário". En: Mendes, A.; Fragoso, G. (eds.), *Garcia de Orta e Alexander von Humboldt: Errâncias, Investigações e Diálogo entre Culturas*, Lisboa, Universidade Católica Editora, pp.135-146.

Macleod, R. (ed.), (2000), *Nature and Empire: Science and the Colonial Enterprise, Osiris,*volume *XV.*

Mathew, K. S. (1997), "The Portuguese and the study of medicinal plants in India in the sixteenth century", *Indian Journal of History of Science*, 32, pp. 369-376.

Matos, M. C. (1987), "Humanismo e evangelização no Oriente no século XVI", *Revista Icalp*, 7-8, pp. 41-72.

Mendes, A. y Fragoso, G. (eds.), (2008), "Garcia de Orta e Alexander von Humboldt: Errâncias, Investigações e Diálogo entre Culturas*", Actas do Colóquio Internacional e Interdisciplinar*, Lisboa, Universidade Católica Editora.

Mendes, A. (ed.) (2009*), "*Garcia de Orta and Alexander von Humboldt across the east and the West", *Proceedings of the international and transdisciplinary conference*, Lisboa, Universidade Católica Editora.

Nobre-Carvalho, T. (2008), "Colóquios dos Simples de Garcia de Orta: Conversas no interior da Índia". En: Mendes, A.; Fragoso, G. (eds.), (2008) *Garcia de Orta e Alexander von Humboldt: Errâncias, Investigações e Diálogo entre Culturas*. Actas do Colóquio Internacional e Interdisciplinar, Lisboa, Universidade Católica Editora, pp. 165-175.

Nobre-Carvalho, T. (2010), "Invisible travelers and virtual tracks: knowledge construction in *Colóquios dos Simples e Drogas da India* of Garcia de Orta (Goa, 1563)", *Proceedings of the 4th ESHS Conference*, Barcelona, pp. 288-293.

Orta, G. de (1563), *Coloquios dos simples, e drogas he cousas mediçinais da India…*, Goa, Ioannes de Endem.

Orta, G. de [1563] (1891, 1895), *Colóquios dos Simples e drogas da Índia*, edited by Ficalho, C., Lisboa, Imprensa Nacional.

Orta, G. de [1563] (1913), *Colloquies on the Simples and* drugs of India [1563], translated by Markham, C, Delhi, Sri Satguru Publications.

Orta, G. de [1563] (2004), *Colloques des Simples et des Drogues de l'Inde*, translated by Ramos, S. M.; Ramos, A.; Marchand-Sauvagnargues, F., Lisboa, Fundação Oriente, Paris, Fundação Calouste Gulbenkian.

Parasher-Sen, A. (2006), "Difference and interaction. 15th and 16th century Portuguese contact with Indian Medicine". En: Varajadaran, L. (ed.), *Indo-Portuguese Encounters: Journeys in Science, Technology and Culture*, Goa, Lisbon, Indian National Science Academy, Centro de História e Além Mar, vol. 1, pp. 88-112.

Pardo Tomás, J.; López Terrada, M. L. (1993), *Las primeras noticias sobre plantas americanas en las relaciones de viajes y crónicas*

de Indias, 1493-1553, Valencia, Instituto de Estudios Documentales e Históricos sobre la Ciencia.

Pardo Tomás, J. (2007), "Two glimpses of America from a distance: Carolus Clusius and Nicolás Monardes". En: Egmond, F., Hoftizer, P.; Visser, R. (eds.), *Carolus Clusius, Towards a Cultural History of a Renaissance Naturalist,* Amsterdam, Koninklijke Nederlandse Academie van Wetenschappen, pp. 173-194.

Pearson, M.N. (2001), "Hindu medical practice in the sixteenth-century Western India: evidence from Portuguese sources", *Portuguese Studies*, 17, pp. 100-113.

Pereira, D. P. [c. 1505-1508] (1752), *Esmeraldo de Situ Orbis*, translated by Gibbs, J., London.

Pina, L, (1945), *As ciências na história do Império Colonial Português (séculos XV a XIX),* Porto, Anais da Faculdade de Ciências do Porto.

Pina, L. (1963), "Garcia de Orta no magistério universitário da Filosofia Natural em Lisboa", *O Médico*, 636, pp. 3-26.

Ramusio, G. B. (1550), *Delle navigationi et viaggi…*, Venetia, Gli Heredi di Lucantonio.

Revah, I. S. (1960), "La famille de Garcia de Orta", *Revista da Universidade de Coimbra*, 19, pp. 1-16.

Schiebinger, L. (2004), *Plants and Empire: Colonial Bioprospecting in the Atlantic World*, Cambridge, MA, Harvard University Press.

Schiebinger, L.; Swan, C. (eds.) (2004), *Colonial Botany: Science, Commerce, and Politics in the Early Modern World,* Philadelphia: University of Pensilvania Press.

Shapin, S. (1984), «Pump and Circumstance: Robert Boyle's Literary Technology», *Social Studies of Science,* 14, pp. 481-520.

Siepmann, H. (2008), "O diálogo-discurso científico entre tradição e inovação". En: *Garcia de Orta e Alexander von Humboldt: Errâncias, Investigações e Diálogo entre Culturas*. Actas do Colóquio Internacional e Interdisciplinar, Lisboa, Universidade Católica Editora, pp. 157-164.

Silva Carvalho, A. (1934), **"**Garcia de Orta", *Revista da Universidade de Coimbra*, 13, 61-246*.*

Soler, I. (2003), "La permeabilidad del saber en el siglo XVI", *Humanitas: Humanidades Médicas*, 1, pp. 49-60.

Swan, C. (2006), "The Uses of Realism in Early Modern Botany". En: Givens, K., Reeds, M.; Touwaide, A. (eds.), *Visualizing Medieval Medicine and Natural History, 1200-1550*. London, Ashgate, pp. 239-249.

Varadarajan, L. (ed.) (2006), *Indo-Portuguese Encounters: Journeys in Science, Technology and Culture*, Goa, Indian National Science Academy; Lisbon, Centro de História e Além Mar, vol. 1 and 2.

Walker, T. (2009), "Acquisition and circulation of medical knowledge within the Early Modern Portuguese Colonial Empire", En: Bleichmar, D.; de Vos, P.; Huffine, K.; Sheehan, K. (eds.), *Science, Power and the Order of Nature in the Spanish and Portuguese Empires*, Stanford, Stanford University Press, pp. 247-270.

Walter, J. (1962), "Simão Álvares e o seu rol de drogas da Índia", *Studia*, 10, pp. 117-149.

Walter, (1963), "Dimas Bosque, físico-mor da Índia e as sereias", *Studia*, 12, pp. 261–271.

Wille, H. (1993), *Botany in the Low Countries: Catalogue of the exhibition*, Antwerp.

Zupanov, I. (2002), "Drugs, health, bodies and souls in the tropics: Medical experiments in sixteenth-century Portuguese India", *The Indian Economic and Science History Review*, 39, 1-43.