

A Clockwork Orange: Citrus Fruits in Early Modern Philosophy, Science, and Medicine, 1564–1668

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Abstract:

In the early modern time citrus fruits unpredictably drew enormous attention, not only in mythology or artistic knowledge, but also in natural philosophy and medicine. Embedded within two lesser-known texts belonging to the sciences, in this article I analyse diverse sources to appraise the richness and plurality of approaches to citrus fruits that pool different ways of constructing a complex knowledge of plants. First, I explore the classificatory attempts of Renaissance botanists. Second, I discuss the experimental investigation in the enchantment for monstrosities and teratologies in Della Porta's natural magic and Aldrovandi's naturalism. Then, I present the more structured obsession displayed by Giovanni Battista Ferrari. Finally, I investigate the natural philosophical systematization of citrus in Gassendi's corpuscularianism and Descartes' mechanics. In outlining a combination of frameworks, the study of citrus fruits surfaces as a suitable case study to assess the complex knowledge of plants in early modern Europe.

Keywords: Renaissance catalogues; vegetal monstrosities and teratologies; *Hesperides*.

It is Air also which Tinges and Colours
the Golden Apples
in the Garden of the Hesperides.

[Michael Maier, *Atalanta fugiens* (1618), emb. XXII]

1. Introduction

In the century that goes from the third edition of Nicolas Monardes' (1508–1588) *De secunda vena in pleuriti ... de rosa et partibus ejus ... de malis citrijs, aurantijs, ac limonij libelli* (1564) and Hermann Grube's (1637–1698) *Analysis Mali citrei compendiosa* (1668), the interest in citrus fruits peaked and acquired a more disciplinary status. Besides mythological knowledge, alchemic wisdom, art, luxury, and folklore, which characterized a relevant section of European culture of citrus,¹ this fruit arises as a meaningful subject for botanical and natural philosophical investigations, therefore attracting a broad and unparalleled attention in early modern botanical knowledge. This new interest moved around two aspects. The first is related to a few curious cases of citrus fruits, which could be labelled as vegetal monstrosities. The second is the astonishing number of diverse kinds of citrus that scholars found difficult to order and catalogue. In a 1631 letter to Cassiano dal Pozzo (1588–1657), French antiquarian Nicolas Claude Fabri de Peiresc (1580–1637) thanked his correspondent for the botanical treatises by Filippo Magalotti (1588–?), but also claimed to have difficulties in “grasping either the differences between the citrus fruits or between their names,” therefore listing a few problematic cases related to the knowledge of citrus fruits.² Somehow in response to these issues, Jesuit Giovanni Battista Ferrari (1584–1655)

¹ For example, discussions on oranges intertwined the religious belief of Adam's pome, the mythology of the golden fruit growing in the Garden of Hesperides—supposedly located in Portugal, whose name (*portokali* or *portocale*) is still used in a few European languages and Italian dialects to refer to oranges—and so on. I am not dealing with these aspects in this article. See Giovanni Dugo and Angelo Di Giacomo, eds., *Citrus: The Genus Citrus* (London and New York: Taylor & Francis, 2002). Douglas Cazaux Sackman, *Orange Empire: California and the Fruits of Eden* (Berkeley: University of California Press, 2005). Pierre Laszlo, *Citrus: A History* (Chicago and London: The University of Chicago Press, 2007). Toby Sonneman, *Lemon. A Global History* (London: Reaktion Books, 2012). Helena Attlee, *The Land Where Lemons Grow: The Story of Italy and Its Citrus Fruits* (New York: The Countryman Press, 2015); Fabien Montcher, "Bonds of sweetness: A political and intellectual history of citrus circulating across the Western Mediterranean during the Late Renaissance," *Pedralbes* 40 (2020): 143-165.

² Peiresc to Cassiano dal Pozzo, in David Freedberg, "Cassiano, Ferrari and their Drawings of Citrus Fruit," in *The Paper Museum of Cassiano dal Pozzo: A Catalogue raisonné...*, ed. David Freedberg and Enrico Baldini (London:

published the *Hesperides, sive de malorum aureorum cultura et usu libri quatuor* (Rome, 1646), a monumental attempt to name, gather, and catalogue citrus. In five hundred pages, Ferrari tentatively reduces the varieties of citrus to three main *genera*, producing an unlimited source of botanical knowledge and ultimately revealing how much Renaissance and early modern scholars draw a large, growing attention to citrus from botanic perspectives.

A few decades earlier, Sevillian physician Nicolas Monardes published a short text on citrus, pointing out the hybrid character of citrus fruits from a medical perspective. Firstly published in 1540 as a short appendix to a pharmacological treatise on roses, the little treatise was published again in 1551 and in 1564.³ Through a number of historical sources, from Theophrastus to Ruel, Monardes presented a few issues related to the cultivation and acclimatization of citrus fruits, as he claimed that grafting made possible having oranges and sweet citrus from citrus medica, but also for the medical uses of citrus, as he claimed that physicians recommend oranges for many treatments.⁴ Yet, although he referred to several kinds of citrus and the importance of hybridization, Monardes claimed since the beginning that he expressed his opinions as a foreteller [*divinator*],⁵ meaning that he knows little of citrus in general. Despite its brevity and shortcomings, the text reveals a few important botanical issues on the aspects of hybridization as system to produce different varieties. In sum, the text bears significance to the early modern attraction to citrus fruits, and also specifies that a more precise knowledge of citrus is suitable but still to be achieved. Carolus Clusius (1526–1619) found it important to include this text in *Exoticorum libri decem* (1605), along with other texts of Monardes.⁶

Moving from this text, in this article I engage the early modern attraction to citrus fruits, leaving aside the questions of acclimatization, accommodation, circulation, cultivation, and the

Harvey Miller, 1997), 45–6.

³ See Florentino Fernández González and Luis Ramón-Laca Menéndes de Lúcar, “El tratado sobre los cítricos de Nicolás Monardes,” *Asclepio* 54, no. 2 (2002): 149–64.

⁴ Nicolas Monardes, *De malis Citrijs, Aurantijs, ac Limonijs Libelli*, in *De secunda vena in Pleuriti, Inter Grecos & Arabes concordia* (Antwerp, 1564), 36v, 38v.

⁵ *Ibid.*, 36v.

⁶ See José Pardo-Tomás, “Two Glimpses of America from a Distance: Carolus Clusius and Nicolás Monardes,” in *Carolus Clusius: Towards a Cultural History of Renaissance Naturalist*, ed. Florike Egmond, Paul Hoftijzer, and R.P.W. Visser (Amsterdam: Akademie van Wetenschappen, 2007), 173–93.

presence of citrus trees in early modern garden landscape, as scholars have already discussed these aspects.⁷ In section 2, I explore Monardes' context, namely Renaissance naturalism and botany. While scholars such as Pietro Andrea Mattioli (1501–1577) tried to classify citrus fruits within the family of *malus*, following Ancient Greek glossaries that recognized citrus as Persian sour apples, I unearth the limitations of this flourishing system, as scholars mostly reduced citrus varieties to a categorization of general cases. In section 3, I uncover the experimental attention given to particular or monstrous cases of citrus fruits in Giambattista Della Porta's (1535–1615) natural magic and in the naturalistic work of Ulysses Aldrovandi (1522–1605). In section 4, I focus on the boundless study of the diversity of citrus in the work of Ferrari, who tried to gather and classify all citrus, by methodologically observing all varieties. In section 5, I explore the natural philosophical interpretation of citrus, as an attempt to embed this knowledge within a more precise theoretical framework surfaces in Andrea Cesalpino's (1519–1603) Aristotelian botany, in the mechanical or atomistic description of citrus of Pierre Gassendi (1592–1655) and René Descartes (1596–1650), and finally in the short work of Grube, whose summary of previous interpretations results in an Aristotelian framework to encompass citrus fruits and botanical knowledge.

Following these various cases, I show how much the study of citrus fruits exemplifies the construction of a modern knowledge of plants. This latter results from the incorporation of diverse frameworks: the natural historical efforts of cataloguing (section 2), the observation of peculiar and monstrous cases (section 3), the knowledge of all outward diversities (section 4), and the investigation of plant physiology encompassed within a theoretical framework (section 5). A botanical discipline therefore results from the combination of sixteenth century natural history or

⁷ See, for example, Alessandro Tagliolini and Margherita Azzi Visentini, eds., *Il giardino delle Esperidi. Gli agrumi nella storia, nella letteratura e nell'arte* (Florence: Edifir, 1996). Enrico Baldini, "Agrumi, frutta, e uve alla corte dei Granduchi di Toscana," in *Le Belle forme della natura. La pittura di Bartolomeo Bimbi (1648-1730) tra scienza e meraviglia*, ed. Daniela Savoia and Maria Letizia Strocchi (Bologna: Abacus, 2001), 20–32. Ana Duarte Rodrigues, "The Role of Portuguese Gardens in the Development of Horticultural and Botanical Expertise on Oranges," *Journal of Early Modern Studies* 6, no. 1 (2017): 69–91. Wolfgang Wüst, "Citronen, Pomeranzen, Spargel, Tabak: Exotik im Archer und Garten – Anbau und Konsum in frühen Quellen," *Mitteilungen des Vereins für Geschichte der Stadt Nürnberg* 104 (2017): 165–202.

*natural science*⁸ and the investigation of the secrets of nature with seventeenth century natural philosophical exploration of botanical physiology aiming at embedding diversities to common (either mechanical, corpuscular, or humoral) patterns, as the studies of citrus uncover.

2. Citrus or *Malae* in Renaissance Natural Science: A General Classification

Renaissance botanists discussed citrus fruits in their botanical catalogues and comments on Dioscorides' *materia medica*. They presented it in a broad way, following a broad distinction and mostly dealing with unspecified cases that provided a general description of citrus. By the end of the century, a change of focus slowly developed, as scholars provided a clearer division of citrus genres and descriptions acquired a more epistemological state and were increasingly connected to classification and causal explanation.⁹ Let us investigate a few examples of sixteenth-century natural historical description of citrus.

In the first book of *De natura stirpium* (Paris, 1536), Jean Ruel (or Ioannes Ruellius, 1474–1537) devoted a few pages to citrus, especially in chapters 68 and 69. Several chapters earlier, he discussed Cedrus, which scholars such as Monardes generally associated with citrus and that Ruel separated from citrus altogether. The text is without illustrations and was intended to elucidate the writings of ancient scholars. Ruel's other important work consists of emending Dioscorides' *materia medica*.¹⁰ Despite starting his description of its medical uses, Ruel generally discussed the presence of citrus in ancient texts, and the cultivation of the plant in different regions, such as in Media, Persia, or Assyria. He described the plant, the branches, and the leaves, and then the fruit, which he defined as a *malus*, that is a *pomum* "round in shape, gold in colour, pleasing at smell, and

⁸ Florike Egmond suggests that sixteenth-century experimentation and natural historical approach specifies a 'natural science' at the time. In this article, I follow her. See Florike Egmond, "Experimenting with Living Nature: Documented Practices of Sixteenth-Century Naturalists and Naturalia Collectors," *Journal of Early Modern Studies* 6, no. 1 (2017): 21–45.

⁹ I am not dealing with description, on this see Brian Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago and London: The University of Chicago Press, 2006), ch. 3; Florike Egmond, *Eye for Detail: Images of Plants and Animals in Art and Science, 1500–1630* (London: Reaktion Books, 2017).

¹⁰ Cf. Agnes Arber, *Herbals: Their Origin and Evolution a Chapter in the History of Botany 1470–1670* (Cambridge: Cambridge University Press, 1912), 98.

bitter at taste.”¹¹ He then listed a few vernacular names for citrus fruits, such as *aurengia*, *citreola*, *citrulea*, *citrangula*, *limones*, *ponceria*,¹² and detailed how ancient scholars named citrus. Finally, he described how to use citrus as therapeutics, for example to ease digestion.¹³ What is interesting to note is that neither a distinction between *genera* nor a study of particular cases, such as the *Pomi Adami*, surfaces. At this early stage, the attention to citrus appears restricted to a few common cases.

A growing focus on citrus emerged in later works by Pietro Andrea Mattioli and Rembert Dodoens (1517–1585), but also Jacques Dalechamps (1513–1588), Carolus Clusius (1526–1619), Matthias de l’Obel (or Lobel, 1538–1616) and Gaspard Bauhin (1560–1624), among others.

In *Plantarum seu Stirpium historia* (1576), Matthias de l’Obel deals with *Malus medica*,¹⁴ providing four drawings and a short reference to Dioscorides’ uses of *malus medica* as therapeutics. The first drawing is *malus medica* or Citron, the second is a drawing of lemons [*Limones*], the third is of oranges [*Arantia*], and the fourth is what he calls the pomum Assyrium or *Poncirus*, today known as the Japanese or Chinese bitter orange. Although l’Obel avoids any description of the citrus fruits, he presents a division in four genres that seems significant. A more important text is Mattioli’s *De Plantis epitome utilissima* (1586), in which he gathered all *mala* plants: apples, quinces [*Cotonea mala* and *Cotonea maiora*], peaches [*Persica* and *Persica rubra*], apricots [*Mala Armeniaca maiora* and *minora*], and citrus. He presents four cases or genres of citrus¹⁵ and for each of them presents the genre, the shape, the origin [*Locus*], qualities, and the therapeutics strength [*Vires*]. The first is *Citria mala sive Mala medica*. In this case, Mattioli devotes attention to the description of the plant and leaves and reveals the bitter taste of the juices.¹⁶ The second is lemon

¹¹ Jean Ruel, *De Natura stirpium libri tres* (Paris: Colinaei, 1536), I, ch. 19, 190: “Pomi effigies caperata rugis [...] interdu rotundior: aureus colos, gratus odor, acidus sapor, amara intus pyri grana.” [Translation is mine.]

¹² *Ibid.*, 191.

¹³ *Ibid.*, 193–4.

¹⁴ Matthias de l’Obel, *Plantarum seu Stirpium historia* (Antwerp, 1576), 572: “Medica Malus. Malum Persicum sorte Theoph. Malum Assyriacum Plin. Malum Hespericum, Citreum & Chrysomela, Athenaei. Ital. Cedri, & Citroni. Angl. Citrontre. Ger. & Gall. Citron. Hisp. Cidras. Belg. Citroenen.”

¹⁵ A similar distinction in Pietro Andrea Mattioli, *Commentarii in libro Sex Pedacii Dioscoridis...*, *De Medica materia* (Venice, 1554).

¹⁶ Pietro Andrea Mattioli, *De Plantis Epitome utilissima* (Franckfurt, 1586), 148.

[*Limonia mala*], whose qualities are the same of *citria mala*. He gives special attention to the places where lemons grow, and to its therapeutics strengths. The third is orange [*Aurantia mala*], whose juice cools and dries [*refrigerant & exiccant*] according to Mattioli's Galenic framework. Then he describes its therapeutic uses against fevers and especially in reinvigorating the heart and vivifying the spirit [*Cor corroborat, & spiritus vivificat*].¹⁷ The fourth is the *Pomi Adami* or Lumia, a bigger kind of lemon (see Fig. 1).

¹⁷ Ibid., 150.

POMA Adami. Italis, *Lomie & Pomi d' Adamo*. Germ. *Adams Deyffel*.

POMA ADAMI.

FORMA.



Arbor quę hæc edit poma, *Matth.*
 folio est Limonię Arboris
 maiore, patientioreq; ramis
 etiam similibus: floribus Ci-
 trei mali æmulis, fructu Au-
 rantijs duplo, triplove maio-
 re rotũdo: Cortice haud cras-
 so, pallido, crispo, & inæqua-
 li fixuris quibusdam apparen-
 tibus, perinde ac dẽtibus de-
 morso, succosa, acidaq; ma-
 det pulpa, sapore limonum
 haud lögẽ absimili, inspidio-
 re tamen, in qua semina lati-
 tant citrei mali, aut limonij
 æmula. Hęc poma, quidam
 putant limonia esse fẽmini-
 ni generis.

LOCVS.

Seruntur cum Citrijs, li- *Idem.*
 monijs, aurantijsq; malis, &
 ijsdem, vt illa proueniunt lo-
 cis.

QUALITATES.

Idem.

Refrigerant, exiccant, & adstringunt.

VIRES.

Præstat eorum succus ad ea omnia ad quę limonia præstare diximus: minore *Idem.*
 tamen efficacia: Peculiariter autem valent poma ad scabiem, si per medium
 secta: & tenuissimo sulfuris puluere aspersa, & deinde feruentibus cineribus
 calefacta, scabiosis corporis partibus infricentur.

K 4

PYRA,

FIGURE 1 *Poma Adami. Italis, Lomie & Pomi d' Adamo...*, in Mattioli, *De plantis*, 151. Courtesy of Bayerische Staatsbibliothek Regensburg, 999/Med.37, 151, url:nbn:de:bvb:12-bsb11105704-1.

A similar division of citrus in four genres (i.e., citrus malus, lemons, oranges, and the Assyrian pome or Adam pome) is in Dodoens' *Des Cruydboeks* (1554), translated into French by Clusius in 1557 with the title *Histoire des plantes*, and into Latin in 1583 with the title *Stirpium historiae pemptades sex, sive libri XXX*.¹⁸ Something similar is in Dalechamps' *Historia generalis plantarum* (1586),¹⁹ in Castore Durante's (1529–1590) *Herbario nuovo* (1585), although in this case the four genres are separated. Similarities also occur in Joachim Camerarius the Younger's (1534–1598) *Kreutterbuch* (1590),²⁰ a translation and implementation of Mattioli's *De plantis*, and later in Bauhin's *Pinax Theatri botanici* (1623) or in John Parkinson's (1567–1650) *Theatrum Botanicum: The Threater of Plants. Or, an Herball of a Large Extent* (1640). Yet, Bauhin divides citrus into two bigger genres: (1) *malus citria*, under which he also includes *malus limonia*, and (2) *malus arantia*, under which he includes oranges and the Pome of Adam. While Bauhin's text just collects the references to citrus in ancient and modern scholars, the previous texts also present the nature of these plants and fruits, eventually discussing their therapeutic uses. Parkinson follows the same division of his predecessors, but provides a more detailed description of singular cases for each genre.²¹ In all these cases, both the description of plants, the virtues of fruits, and the drawings of the four genres are consistent with Mattioli's text, and make a significant classification of citrus as an attempt to describe all its varieties.

Still, in all these texts, scholars present citrus in a very general way. Despite providing a framework to encompass citrus within 4 genres, they fail to describe citrus in all their complexities and fail to provide an explanation to all curious cases. This results in (1) undervaluing the varieties of citrus, (2) under-representing peculiar and singular cases, and (3) using unclear methodologies for classification. Notwithstanding their description of the shape of plants, and the characteristics, shape, taste, and smell of citrus fruits and their therapeutic virtues, these interpretations reveal

¹⁸ Remberd Dodoens, *Stirpium historiae pemptades sex libri III* (Antwerp, 1616), III, ch. 2, 790–3.

¹⁹ Jacques Dalechamps, *Historia generalis plantarum*, 2 vols. (Lyon, 1586), I, bk. 3, ch. 5, 298–303.

²⁰ See also Joachim Camerarius, *Hortus medicus et philosophicus: in quo plurimarum stirpium breves descriptiones* (Frankfurt, 1588), 47.

²¹ John Parkinson, *Theatrum Botanicum: The Threater of Plants. Or, an Herball of a Large Extent* (London: 1640), 1505-9.

problems, disregards, and confusions. Difficulties in differentiating between citrus and representing their varieties raise significant shortcomings that Peiresc voiced in the 1631 letter quoted earlier. In the next section I highlight an attempt to deal with point (2), in section four with point (1), while in the last section I deal with the attempt to embed this knowledge within a theoretical framework.

3. Observing Monstrosity, Particular Cases, and Teratologies: Della Porta and Aldrovandi

Questions concerning the nature of citrus emerges as scholars drew attention to several very peculiar cases. While Renaissance botanists mostly dealt with citrus in general, providing important depictions of citrus per se, they under-represent peculiar cases that put general study at stake. These cases were investigated in the sixteenth and early seventeenth century in relation to natural magic and monstrosity. A significant example is Neapolitan eclectic and erudite, but also alchemist, naturalist, and botanist, Giambattista Della Porta, who observed citrus by means of his natural magic and revealed the secrets of citrus fruits.²² In *Pomarium* (1583), he devotes a few chapters to citrus: chapter 5 concerns *malo medica*, chapter 6 lemons [*de limonibus malis*], chapter 7 oranges [*de malo aureo*], chapter 8 lemons [*de limone*], chapter 9 Poncirus [*de poncerius*], and chapter 10 the Adam pome.²³ For the first three cases, Della Porta follows the division of citrus of Renaissance botanists, while the last three describe three singular cases that naturalists generally gathered together. For example, chapter 8 presents a Neapolitan lemon, which resembles the *malo limonio* but produces a bigger fruit,²⁴ while chapter 9 discusses a fruit he found in the littoral area south of Naples. Also noteworthy is that, while these latter have no subheadings, the first three chapters are more detailed. They include subheadings on names, shapes, genres, and a description of the plant, but also aspects concerning their cultivation, such as the weather conditions and the best characteristic of soil (which he names *Coelum, et solum*), the planting (*Satio*), in which he describes

²² On Della Porta's secrets, see William Eamon, "Science and Popular Culture in Sixteenth Century Italy: The 'Professors of Secrets' and Their Books," *Sixteenth Century Journal* 16, no. 4 (1985): 471–85.

²³ One should note that *Pomarium* was later included as book 5 in Della Porta's agricultural treatise, *Villae libri xii* (Frankfurt, 1592).

²⁴ Giambattista Della Porta, *Pomarium* (Naples, 1583), 43.

the seed and the water needed and then the techniques of cultivation and grafting. Besides the questions of names and cataloguing, in *Pomarium* Della Porta importantly describes the ways of cultivating fruits, especially highlighting how much the right place and soil, weather conditions, quantity of water, and useful proximities with other plants influence the nature and powers of a plant. In this perspective, his narration of the fable of Hesperides seems to fit a description of the agricultural conditions to cultivate citrus. Moreover, Della Porta importantly grounds his investigation on the observation, and dissection of plants, seeds, and fruits, by which means he has been able to describe the diversities and varieties of citrus fruits together with their characteristics and qualities.

Some of this work resurfaces in both in the 1589 edition of *Magia naturalis* (firstly published in 1558) and in *Phytognomonica octo libris* (1588). In the first text, Della Porta examines the mutation of plants, which he claims are not reliant on miracles but on the difference in the soil, weather, place of cultivation,²⁵ and in agricultural activities, such as grafting. By combining different plants, one may compose diverse fruits.²⁶ The case of citrus is important, given the great variety of fruits one may produce by the means of husbandry.²⁷ For example, he names the case of *citromala*, which according to him is “a mixture of different genres, lemon, and *medica semiacida*, and *semidulcia* [half bitter and half sweet],”²⁸ or of an orange [*malum aureum*] with the one half sweet and the other half sour, which he himself made by grafting two branches together.²⁹ In another case, he claims to have observed in a garden in Naples how much continuing irrigation helped a citrus plant [*malus medica*] to be more luxuriant and produce soft fruits.³⁰ Similarly, one may produce new plants such as red citrus,³¹ produce fruits with different flavours, or produce

²⁵ Giambattista Della Porta, *Magiae naturalis libri XX* (Frankfurt, 1591), bk. 3, ch. 2, 102.

²⁶ *Ibid.*, ch. 3, 105.

²⁷ *Ibid.*, ch. 3, 113: “Citriij arbor diversa poma ferat, diversorumque saporum” [Citrus plant produces different fruits, with different tastes]. Cf. *Ibid.*, ch. 7, 132: “*Citria crassoria producere.*” [Italics in the text.]

²⁸ *Ibid.*, ch. 3, 108. Cf. *Ibid.*, ch. 7, 119: “*Diophanes fecit Citromala ex mala & citrio composita...*” [Italics in the text.]

²⁹ *Ibid.*, ch. 3, 111-12.

³⁰ *Ibid.*, ch. 3, 113.

³¹ *Ibid.*, 143.

sweet citrus.³² These few cases reveal Della Porta's experimentation with citrus fruits, as he aimed to produce new fruits by grafting different branches or by combining different plants. While referring to agricultural treatises, Della Porta embeds a few agricultural practices within his natural magic, according to which it is possible to make plants copulate and produce new types of plants. As a result of performing experiments and observations on plants, Della Porta explores the secrets of nature, i.e., the inner aspects of citrus plants and fruits, and ultimately transforms nature.

In *Phytognomonica*, Della Porta unearths a secret correspondence between citrus fruits and the hearts of animals. Grounded on the doctrine of signatures, which claimed an analogical resemblance between a part of a plant and a part of the body as a sign revealing the healing power of that plant in relation to the diseases affecting the corresponding organ. He claims citrus represent the image of the heart and, consequently, share its virtues and could effectively heal it.³³ As seen earlier, Della Porta was not the first claiming citrus would heal the heart. A similar connection is also in Monardes, as he refers back to Avicenna's (980–1037) *De viribus cordis* and to Mesué (ca. 777–857). Yet, the external resemblance of citrus and heart enables him to infer inherent properties and apply them to treat cardiac diseases, which satisfies Della Porta's understanding of nature, as he writes, “the image [*effigie*] of citrus fruits represents the heart.”³⁴ In order to reveal the similarities, he also adds an image of several plants and fruits that help healing the heart, together with a heart (see Fig. 2).

³² Ibid., 154.

³³ Giambattista Della Porta, *Phytognomonica octo libris contenta* (Naples, 1608), bk. I, ch. 12, 22. See Lucia Tongiorgi Tomasi and Tony Willis, *An Oak Spring Herbaria: Herbs and Herbals from the Fourteenth to the Nineteenth Centuries* (New Haven: Yale University Press, 2009), 299ff.

³⁴ Della Porta, *Phytognomonica*, bk. III, ch. 46, 222: “Citrium sui fructus efficie cor repraesentat”. [Translation mine.]

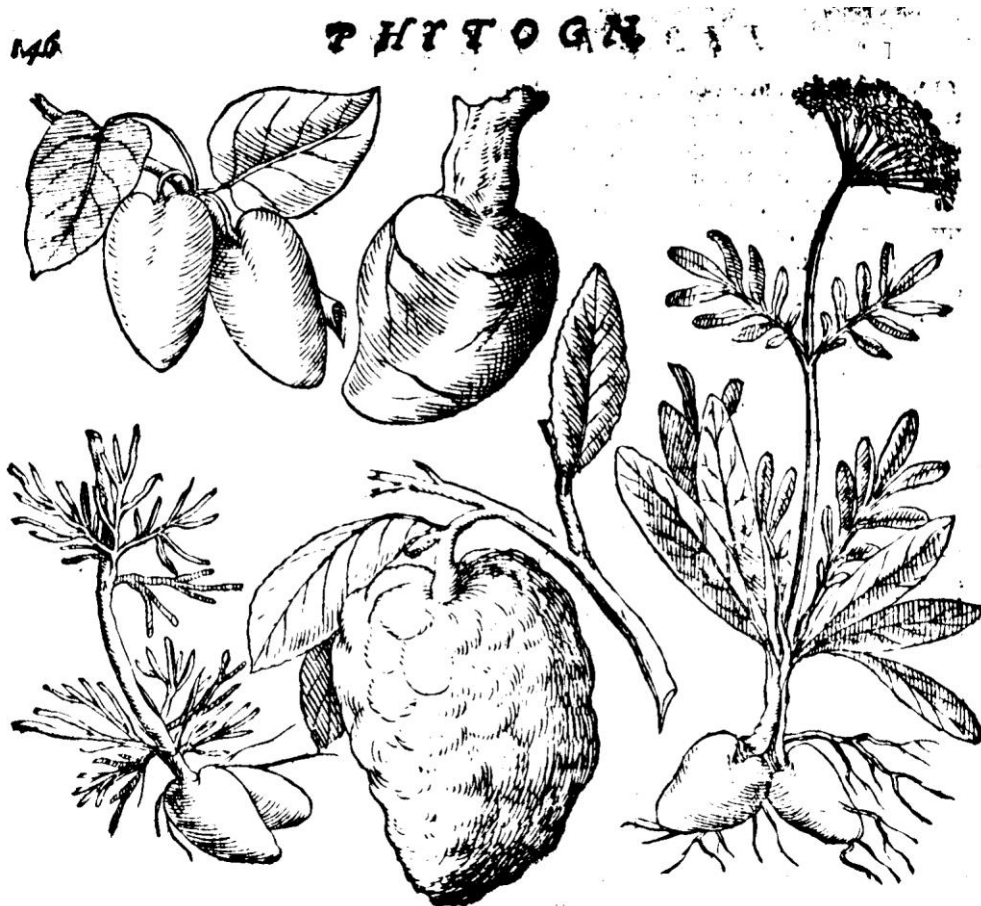


FIGURE 2 Citrus fruit and other plants that help treating the heart, in Della Porta, *Phytognomonica octo libris contenta* (Naples, 1588), 146. Source www.gallica.bnf.fr / BnF

Other references to citrus surface in this text. In a previous section, Della Porta claimed that mixing the juices of citrus (likely lemons) and oranges helps control the yellow bile.³⁵ In book 4, he then explores other similarities between plants and animal bodies—an important section of early modern study of plants³⁶—and presents the case of pregnant lemons, which he claims to be a case of superfetation [*superfoetationes*].³⁷ Through observations and experimentation, Della Porta unearths a few common patterns in nature, claiming that these strange cases reveal a continuity between different reigns of beings, ultimately reducing unnatural to natural by means of his natural magic.

Even in the field of plants, scholars and learned noticed Della Porta's sharp investigation of

³⁵ *Ibid.*, bk. III, ch. 5, 150.

³⁶ On the similitudes between plants and animal organs, see Dominique Brancher, *Quand l'esprit vient aux plantes. Botanique sensible et subversion libertine (XVIe-XVIIe siècles)* (Geneva: Droz, 2015).

³⁷ Della Porta, *Phytognomonica*, bk. IV, ch. 26, 293.

the secrets of nature. In 1610 Federico Cesi (1585–1630) met Della Porta and then asked him to join the Accademia dei Lincei.³⁸ Additionally, Francis Bacon (1561–1626) used Della Porta’s experimental reports to develop a study of vegetables and uncover the transformations of nature.³⁹

Contemporary to Della Porta, the Bolognese antiquarian and naturalist Ulysses Aldrovandi assembled a boundless body of drawings of nature, whose museum spans from the more common cases to curiosities and monstrosities of any sort.⁴⁰ His monumental herbal, the *Iconographia Plantarum*, contains several scattered images that compose a pomological survey and include several beautiful watercolours of citrus fruits. It is to be noted that a few of these images will later complement the second book, chapter four of *Dendrologiae naturalis scilicet arborum historiae libri duo* (posthumously published in 1668 by Ovidio Montalbani), which is the text devoted to botany.⁴¹ Three images collected in the manuscripts represent interesting cases of pomes similar to citrus, the *Pomo Ade congener* (*Icon.Plant.* III: 161), the *Pomum Ade figura melopeponis Citrij species* (*Icon.Plant.* V: 312), the *Pomum aliud Limonis simile* (*Icon.Plant.* V: 313), and the *Pomum Ade aliud Citrio simile* (*Icon.Plant.* V: 314). These are three borderline cases of plants in between different species. Another image depicts the *citrium oblungum* and *citrium rotundum* (*Icon.Plant.* I: 16; cf. *Dendrologiae*, 526), which is a case of polymorphism, a genotypic variability within the botanical species, as two different citrus fruits grow out of the same branch. The other images depict: the *medica mala* (or *citria mala* or *citromala* or *mala assyriaca*, *Icon.Plant.* VIII: 62), the

³⁸ See Paula Findlen, *Possessing Nature: Museum, Collecting, and Scientific Culture* (Berkeley: University of California Press, 1990), 317–18. David Freedberg, *The Eye of the Lynx: Galileo, his Friends, and the Beginnings of Modern Natural History* (Chicago and London: The University of Chicago Press, 2002), 72–3. Alfonso Paoletta, “La presenza di Giovan Battista della Porta nel ‘Carteggio Linceo,’” *Bruniana & Campanelliana* 8, no. 2 (2002): 509–21. Paolo Galluzzi, *The Lynx and the Telescope: The Parallel Worlds of Cesi and Galileo* (Leiden: Brill, 2017).

³⁹ On the relation between Bacon and Della Porta, see Dana Jalobeanu, “Bacon’s Apples: A Case Study in Baconian Experimentation,” in *Francis Bacon on Motion and Power*, ed. Guido Giglioni et al. (Cham: Springer, 2016), 83–113. Doina-Cristina Rusu, “Rethinking *Sylva sylvarum*: Francis Bacon’s Use of Giambattista Della Porta’s *Magia naturalis*,” *Perspectives on Science* 25, no. 1 (2017): 1–35. See the recent special issue on *Centaurus*, “Giovan Battista Della Porta and Francis Bacon on the creative power of experimentation,” and especially Doina-Cristina Rusu, “Using Instruments in the Study of Animate Beings: Della Porta’s and Bacon’s Experiments with Plants,” *Centaurus* 62 (2020): 393–405; Dana Jalobeanu, “Enacting Recipes: Giovan Battista Della Porta and Francis Bacon on Technologies, Experiments, and Processes of Nature,” *Centaurus* 62 (2020): 425–46. On Francis Bacon’s experimentation with vegetal bodies, see Dana Jalobeanu and Oana Matei’s contribution to this issue.

⁴⁰ On Aldrovandi, see Giuseppe Olmi and Fulvio Simoni, eds., *Ulisse Aldrovandi. Libri e immagini di storia naturale nella prima età moderna* (Bologna: Bononia University Press, 2017).

⁴¹ See Enrico Baldini, “Fruits and Fruit Trees in Aldrovandi’s ‘Iconographia Plantarum,’” *Advances in Horticultural Science* 4, no. 1 (1990): 61–73.

citrum pyriforme (*Icon.Plant.* III: 166; cf. *Dendrologiae*, 528 – see Fig. 3), the *Limonia mala* (*Icon.Plant.* VIII: 64), the *Mala aurantia* from China (*Icon.Plant.* VII: 68; cf. *Dendrologiae*, 489), the *Mala aurancia seu narantia Figura melopeponis* (*Icon.Plant.* VIII: 61) that is similar to the *Aurantia Mala Segmentata* (*Dendrologiae*, 487; see Fig. 4), the *Malum Hespericum* (*Icon.Plant.* VIII: 63), and the *Poma Adami* (*Icon.Plant.* VIII: 65; cf. *Dendrologiae*). In general, these images reveal the remarkable attention to details and objectivity in Aldrovandi's observation of fruits, sometimes suggesting the three-dimensional shape of fruit, as in the case of the *Citrium pyriforme*.



FIGURE 3 *Citrium pyriforme* in Aldrovandi. On the left, Aldrovandi, *Icon.Plant.* III, 166, in *Tavole acquarellate di Ulisse Aldrovandi*, vol. III – Piante fiori frutti c. 166. Courtesy of Alma Mater Studiorum Università di Bologna – Biblioteca Universitaria di Bologna, any reproduction is forbidden. On the right, Aldrovandi, *Dendrologiae*, 528; Source MémoNum – MCEZ de Montpellier.

Aldrovandi's methodology of observing fruits is especially important for teratologic cases, such as the deformity of the horned citrus of the *Mala aurantia* (see Fig. 4), or the *Pomum paradiseum*

monstricum,⁴² which is a case of Siamese citrus fruit, collected in posthumous *Monstrorum historia* (1642, edited by Nicolò Tebaldini), in the section on vegetal monstrosities. Indeed, Aldrovandi's interest in rare or borderline case, namely in monsters, appears meaningful in the light of the attempt to reduce wondrous freak to an order of nature.⁴³



FIGURE 4 Horned citrus. On the left Aldrovandi, *Icon.Plant. VIII*: 61 in *Tavole acquarellate di Ulisse Aldrovandi*, vol. VIII – Piante fiori frutti c. 61. Courtesy of Alma Mater Studiorum Università di Bologna – Biblioteca Universitaria di Bologna, any reproduction is forbidden. On the right, Aldrovandi, *Dendrologiae*, 487; Source Source MémoNum – MCEZ de Montpellier.

Within this aim, a more ordered study of citrus is in Aldrovandi's *Dendrologiae*, in a chapter

⁴² Ulisse Aldrovandi, *Monstrorum historia* (Bologna, 1642), 711.

⁴³ On monsters in early modern period, see Katharine Park and Lorraine J. Daston, "Unnatural Conceptions: The Study of Monsters in Sixteenth- and Seventeenth-Century France and England," *Past & Present* 92 (1981): 20–54. Paula Findlen, "Jokes of Nature and Jokes of Knowledge: The Playfulness of Scientific Discourse in Early Modern Europe," *Renaissance Quarterly* 43, no. 2 (1990): 292–331. Lorraine J. Daston and Katharine Park, *Wonders and the Order of Nature, 1150–1750* (New York: Zone Books, 2001). Sandra Cheng, "The Cult of the Monstrous: Caricature, Physiognomy, and Monsters in Early Modern Italy," *Preternature* 1, no. 2 (2012): 197–231. Serina Patterson, "Reading the Medieval in Early Modern Monster Culture," *Studies in Philology* 111, no. 2 (2014): 282–311.

devoted to *De Malis aureis, sive Medicis*. Although Montalbani significantly edited the text, the *Dendrologiae* contains several important aspects, as it provides a long list of names for citrus, a description of various genres, and particular cases of citrus. The text is in a sharp contrast to the frugal classification of Renaissance botanists, who, with the exception of Della Porta, rarely exceeded four types of citrus fruits and never discussed vegetal monstrosity. In *Dendrologiae*, Aldrovandi collects the cases of horned citrus, oranges without seeds, citrus of different shapes, and the citrate orange (i.e., a case of a combination of citrus and orange).⁴⁴ He first deals with equivocal cases, enigmas, and monsters or *mirabilia*;⁴⁵ such as the case of cylinder lemon, a lemon with the shape of a hand, a lemon with the shape of testicles,⁴⁶ a lemon with an external head, or a lemon

with the shape of a beak of an eagle (see Fig. 5.) He next addresses fabulous and *ludicra*, both ludicrous and playful, or jokes of nature,⁴⁷ and mystique and symbolic cases, such as the citrus representing a crocodile jaws.⁴⁸

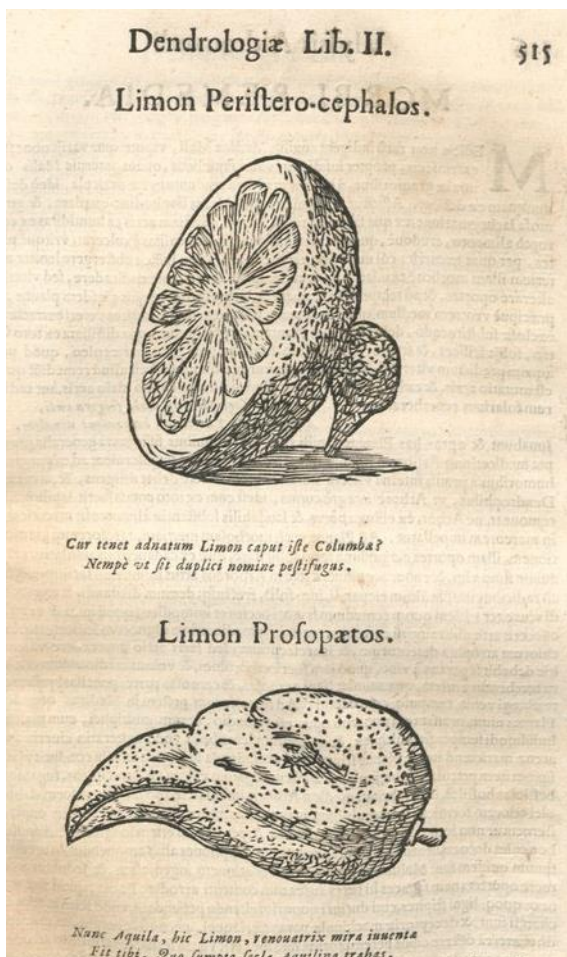


FIGURE 5 On the top, citrus with external head, on the bottom eagle head citrus, in Aldrovandi, *Dendrologiae*, 515. Source MémoNum – MCEZ de Montpellier.

⁴⁴ Aldrovandi, *Dendrologiae*, 497.

⁴⁵ *Ibid.*, 511ff.

⁴⁶ *Ibid.*, 514.

⁴⁷ *Ibid.*, 519–23.

⁴⁸ *Ibid.*, 534.

While these teratologic cases reveal the ample uses of imagination, Aldrovandi and Della Porta attempted to reduce deformations and monstrosities to the order of nature by means of a direct observation of details, accurately depicted and therefore elucidating, describing, and identifying the varieties of citrus fruits. In this sense, both their attention to teratologic cases and their interest in all diversities reveal the early modern attempt to collect and observe every singular phenomenon of nature as a way to produce a more precise and correct knowledge of plants, going thus beyond Aristotelian and scholastic traditions.⁴⁹

4. Ferrari's *Citrusmania*: Observing and Collecting all Citrus

The Jesuit Giovanni Battista Ferrari tried to overcome the shortcomings of Renaissance botanists discussed in section 2, as he dealt with all varieties of citrus and included the investigations of vegetal monstrosities presented in section 3 in his grandiose book, *Hesperides*, in which he collected 150 kinds of citrus.⁵⁰ Indeed, Ferrari went far beyond his predecessors and devoted much more attention to citrus, gathering all cases and visualizing all details and small aspects, ultimately developing a methodology to catalogue all citrus fruits.

Since 1619, Ferrari had been professor of Hebrew, Syriac, and rhetoric at the Jesuit College in Rome, but his career suddenly changed direction as he became gardener and acted as chief horticultural consultant to the Barberini family.⁵¹ Yet he applied his rhetoric background in his work with plants, as he was attentive to particulars and tiny details, which he claimed to be important to classify and encapsulate every different fruit. Within this line, Ferrari published *De florum cultura libri IV* in 1633, a book on the cultivation of flowers in gardens (dealing with manuring, irrigating, protecting), on using flowers (for example to make perfumes), and on the problems of nomenclature and taxonomy. While eschewing the aspects of herbal and medicinal

⁴⁹ Cf. Sandra Tugnoli-Pattaro, *Metodo e Sistema delle scienze nel pensiero di Ulisse Aldrovandi* (Bologna: Clueb, 1981).

⁵⁰ See Peter Davidson, "The Jesuit Garden," in *The Jesuit II: Cultures, Sciences, and the Arts 1540-1773*, ed. John W. O'Malley et al. (Toronto: Toronto University Press, 2006), 86–107.

⁵¹ Cf. David Freedberg, *The Eye of the Lynx: Galileo, His Friends, and the Beginning of Modern Natural History* (Chicago and London: The University of Chicago Press, 2002), 38ff.

uses, which were paramount at the time, Ferrari's book was useful for young noblemen willing to know more about flower arranging.⁵² Yet this was more than just a representation of flowers or gardens, as Ferrari addressed the difficulties of historical classifications and identification, its modes of growth and cultivation, and the uses of flowers. In this sense, the text is the first modern treatise on the cultivation of flowers.⁵³ *De florum cultura* prefaces the work Ferrari undertook for the *Hesperides*, the former of which is entirely devoted to one species alone in all its possible variation. The latter text is a brave attempt to encompass (and classify) the whole citrological world.

Indeed, the *Hesperides* reveals the enthusiasm for any curious, rare, or singular notion concerning citrus as Ferrari packed every bit of information in an encyclopaedic manner. The text is not just a catalogue for a cabinet of curiosity or an allegorical reconstruction, but it reveals a system and order—a principle of classification. A general classification first appears in the division of books: the second book concerns citrus [*De malo citreo*], the third lemons [*De malo limonio*], the fourth oranges [*De malo aurantio*]. The first book provides a more general framework, dealing with the fable of Hesperides and its allegory, an etymology of citrus, and a historical and archaeological reconstruction of the knowledge of citrus. In chapter 7 of this book, Ferrari presents the various names under which the tree in the Garden of Hesperides has been called. In Ferrari's view, this was made to establish terminology, bringing forward the description of earlier writers (from Varro to Pliny, and from Pontano⁵⁴ to Clusius) and making clear his attempt to gather information from different sources.⁵⁵ Moving from this ground, Ferrari develops the firm determination to classify all citrus fruits under three *genera*. Although this was a traditional division, he successfully applied it to every type of citrus fruit.

In the *Hesperides*, Ferrari balances between three main aspects. The first is the natural

⁵² See David Freedberg, "From Hebrew and Gardens to Oranges and Lemons: Giovanni Battista Ferrari and Cassiano dal Pozzo," in *Cassiano dal Pozzo: Atti del Seminario Internazionale di Studi*, ed. Francesco Solinas (Rome: De Luca, 1989), 37–72.

⁵³ Cf. Cristina Serafini, "Arte, scienza e diletto nella Roma di Urbano VIII: il trattato *De florum cultura* di Giovanni Battista Ferrari S.I. (1583-1655). Una fonte per il giardino italiano" (PhD, Sapienza Università di Roma, 2004).

⁵⁴ See Giovanni Pontano, *De hortis Hesperidum sive de cultu citrorum* (Venice: Aldus Manuntius, 1501).

⁵⁵ Giovanni Battista Ferrari, *Hesperides, sive de malorum aureorum cultura et usu libri quatuor* (Rome, 1646), I, ch. 7, 36–7.

historical reconstruction. The second is the attempt to divide the varieties and gather them under the three *genera*. The third is the observation and examination of all tiny details, which he achieved through an obsessive attention to all kinds of texture, leathery, lump, and protuberance. In this sense, the uses of microscopes helped him deal with tiny details and was related to his attempt to ground taxonomic distinctions on a thoroughgoing concentration on direct observation.⁵⁶ Moreover, while Ferrari worried less about on borderline cases than his predecessors did, in their delight for monstrosity, he was nevertheless able to solve these problematic cases, naming and gathering them in the manner of modern botanists.

Let us take two cases. The first concerns the cases of fruits that showed the characteristics of both lemon and citron, and the second of orange and citron. For the first, Ferrari speaks of citrated lemon [*Limon citratus*], which is a lemon united with a citron and having the smell and the nature of a citron. Ferrari recognized two kinds of these, one with a smooth rind and one with a rough rind.⁵⁷ Then, he presented other cases of citrate lemon, the one from Amalfi, the one from Rome, the pseudo-citrate lemon cultivated in the Quirinal garden by the Barberini family, and a rural one.⁵⁸ The second is the citrated orange.⁵⁹ For each of these, he reduced their varieties to a specific order and gathered them according to the similarities they had with the three *genera*. He solved this issue by proceeding as he did for every case. He described the leaves and acknowledged the similarities with other plants, the shape and structure of the plant itself (for example, the number of branches), the shape of fruit and the similarities or dissimilarities with lemon or oranges, and then its qualities such as smell, taste, touch, and colour.

Another example of how his application of a methodology in classifying citrus surfaces in the attempt to deal with strange cases. For example, Ferrari described the *pomum paradisi* and the

⁵⁶ Ferrari was one of the first who made uses of a microscope for botanical illustrations. On the uses of microscopes, see Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope* (Princeton: Princeton University Press, 1995).

⁵⁷ Ferrari, *Hesperides*, III, ch. 19, 263–4.

⁵⁸ *Ibid.*, III, ch. 20, 280–7.

⁵⁹ *Ibid.*, IV, ch. 12, 422.

pomum Adami, which were borderline cases at the time.⁶⁰ While his contemporaries had great delight in discussing monstrosity, Ferrari tried to reduce the variety of cases and integrate them within his system of classification. This is especially evident in the case of the *Lima citrata oblonga sive scabiosa et monstrosa* (see Fig. 6). Despite naming it “monster,” he considered this fruit a case of lemon, therefore reducing its monstrosity to an order.⁶¹

⁶⁰ *Ibid.*, III, chs. 23-24, 305–15.

⁶¹ *Ibid.*, III, ch. 26, 332.

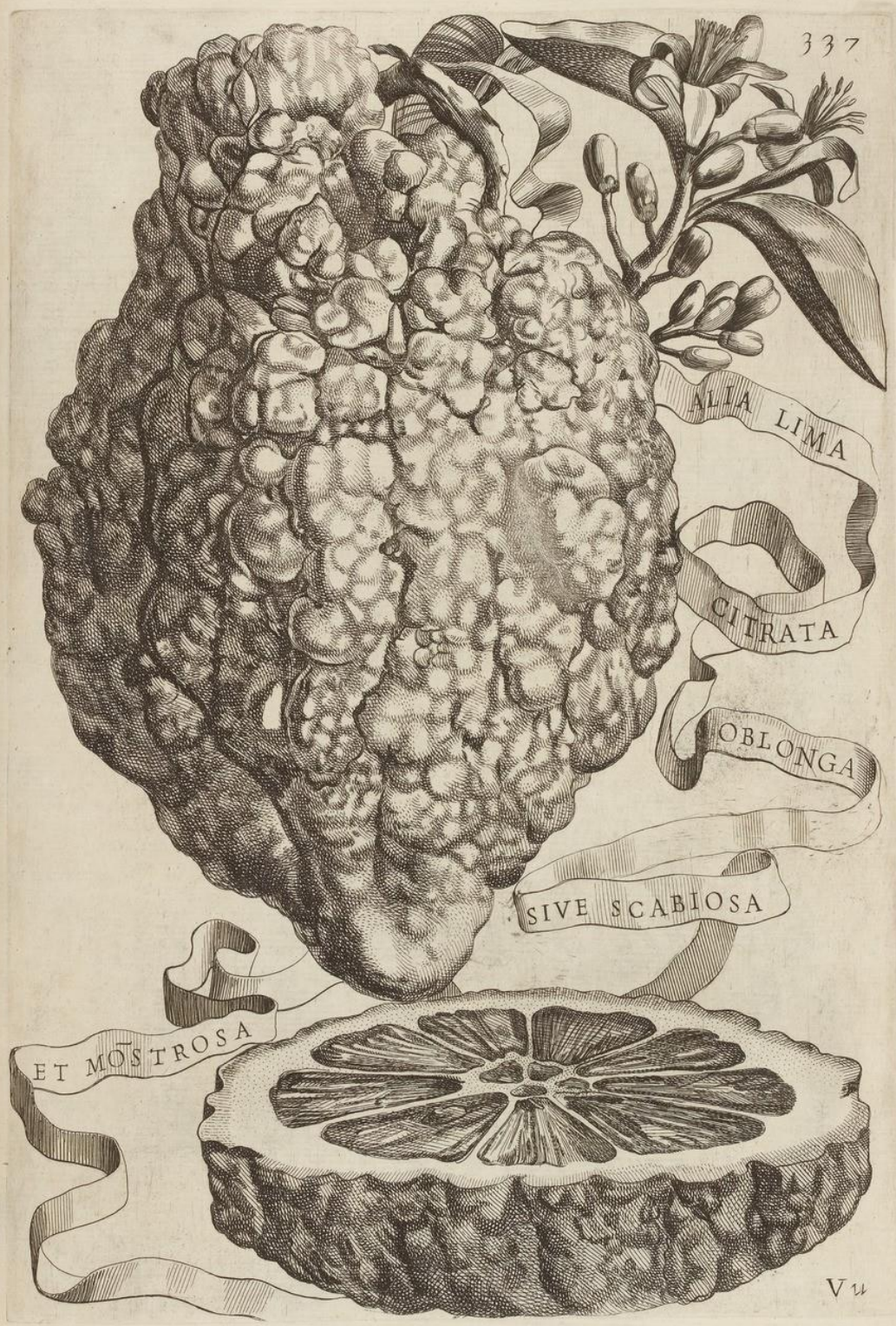


FIGURE 6 *Alia lima citrata oblonga sive scabiosa et monstrosa*, in Ferrari, *Hesperides*, 337. Source: www.gallica.bnf.fr / BnF.

Ferrari dealt with cases in which one fruit is included within another, such as the citrate lemon and the pregnant lemons from Pietrasanta⁶² or the *aurantium foetiferum*.⁶³ He also dealt with cases of deformed citrus, such as the more famous case of the *malum citreum digitatum seu multiforme*,⁶⁴ the *aurantium hermaphroditum, sive corniculatum* and the *aurantium callosum*,⁶⁵ or the *aurantium distortum*, of which he wrote: “we dread abortion & monsters in the larger part of animate beings, we love in fruits [*pomi*].”⁶⁶ In all these cases, Ferrari enumerated the varieties and malformation by describing its features, and finally seeking an explanation that would help him reduce any fruit to a natural order. When shortcomings arose in accounting for a specific case,⁶⁷ Ferrari devised stories or poems to supplement natural philosophy and provide an explanation to it. Both poetic imagination and rhetoric surface as “a heuristic tool to supplement empirical logic and the limited evidence of the eyes,”⁶⁸ as David Freedberg writes. *Hesperides* is not only a description of all varieties of citrus fruit, as one may count more than 150 species that made the text an extensive and unparalleled work. But rather, it is also a gathering of several botanical, cultural, and erudite means to describe and order citrus within nature. Besides the microscopic observation, detailed representation of citrus, scientific description, and intense investigation of the varieties, Ferrari’s uses of histories, imagination, and poetry reveal how much he obsessively delved into citrus with all the devices available to him.

The work of Ferrari grew out of his collaboration with Cassiano dal Pozzo. As Freedberg

⁶² *Ibid.*, III, ch. 19, 269, 71.

⁶³ *Ibid.*, IV, ch. 8, 403–5.

⁶⁴ *Ibid.*, II, ch. 5, 75–92.

⁶⁵ *Ibid.*, IV, chs. 9–10, 407–11.

⁶⁶ *Ibid.*, IV, ch. 11, 413.

⁶⁷ In the case of the lemons from Pietrasanta, Ferrari claims this was due to the cold temperatures and the winds blowing from the sea, see Ferrari, *Hesperides*, III, ch. 19, 263.

⁶⁸ David Freedberg, “On the Classification of Oranges and Lemons,” in *Documentary Culture. Florence and Rome from Grand-Duke Ferdinand I to Pope Alexander VII*, ed. Elizabeth Cropper, Giovanna Perini, and Francesco Solinas (Bologna: il Mulino 1992), 305.

has pointed out, Cassiano dal Pozzo “seems to have played a crucial role not only in the funding of the *Hesperides*, but also in the gathering of the information for it.”⁶⁹ For example, Cassiano crucially helped with assembling the drawings of citrus. Several images contained in Ferrari’s *Hesperides* were indeed among the papers of Cassiano dal Pozzo, which are now collected in the magnificent volume on citrus edited by David Freedberg and Enrico Baldini.⁷⁰ These images in colour played a key role in Ferrari’s attempt to identify, name and classify citrus fruits. Besides the economic help, Cassiano dal Pozzo himself collected information and material about citrus from a large number of correspondents, following Ferrari’s requests and attempt to order the variety of citrus.⁷¹ Although it is difficult to fully describe the extent of Cassiano dal Pozzo’s contribution to the *Hesperides*, given the randomness of his reflections, the importance of them cannot be overestimated. This was both methodological insofar as the attention to the relation between visual description and taxonomic order in the *Hesperides* likely came from Cassiano and Cesi, and substantial, given Cassiano’s extraordinary intensity in discussing the subject and in disseminating natural history information. In the end, building on the collaboration with Cassiano, Ferrari achieved his monumental attempt to encompass the knowledge of citrus.

In the history of botany, the *Hesperides* represents an apogee. The text combines Baroque iconography and natural historical investigations and depictions of citrus, which was essentially the taxonomic attempt to reduce curious objects to a natural order and assembly of every kind of information. Neither earlier nor later publications could match the obsessive attention Ferrari devoted to citrus, not even Johannes Commelin’s *Nederlantze Hesperides* (1676) and Johann

⁶⁹ David Freedberg, “Ferrari and the Pregnant Lemons of Pietrasanta,” in *Il Giardino delle Esperidi. Gli agrumi nella storia, nella letteratura e nell’arte*, ed. Alessandro Tagliolini and Margherita Azzi Visentini (Florence: Edifir, 1996), 45.

⁷⁰ See David Freedberg and Enrico Baldini, eds., “Citrus Fruits,” in *The Paper Museum of Cassiano dal Pozzo: A Catalogue raisonné...* (London: Harvey Miller, 1997). Cf. Francesco Solinas, ed., *Cassiano dal Pozzo: Atti del Seminario Internazionale di Studi* (Rome: De Luca, 1989). Jennifer Montagu, ed., *Cassiano dal Pozzo’s Paper Museum* (Milano: Olivetti, 1992). Francesco Solinas, ed., *I segreti di un collezionista. Le straordinarie raccolte di Cassiano dal Pozzo 1588-1657* (Roma: 2000).

⁷¹ David Freedberg, “Cassiano dal Pozzo’s Drawings of Citrus Fruits,” in *Il Museo Cartaceo di Cassiano dal Pozzo. Cassiano naturalista, Quaderni Puteani 1* (1989): 16–36.

Christoph Volkamer's *Nürnbergische Hesperides* (1708–1709).⁷² Ferrari's text developed as a crucial source of knowledge of citrus fruits in the early modern period, as scholars continued to refer to his work while trying to make order within the varieties of citrus from a botanical perspective. In combining a descriptive approach with a methodological attempt to classify citrus variety based on the observation of all cases, this text reveals the combination of several components of early modern botanical science in its making, as Ferrari maniacally observed any little aspect of citrus as a way to know and classify them.

5. Citrus in Early Modern Natural Philosophy: Theoretically Framing Knowledge

The attempt to specify the methodology to study plants more clearly surfaces in early modern natural philosophical studies. In dealing with the nature of citrus fruits, philosophers tried to provide a theoretical framework to systematize the knowledge of vegetal bodies within a universally valid system. This attempt follows different lines, spanning from an experimental to a more theoretical approach, and from Aristotelianism to mechanical or corpuscular programmes. For example, in *Sylva Sylvarum* (1626), Bacon describes a few experimentations with oranges, likely following Della Porta's observation, yet a description of its varieties is nowhere to be found. Several decades earlier, Andrea Cesalpino devoted a chapter of his philosophical botany, *De plantis libri XVI* (1583), to citrus.⁷³ He begins describing the pulp of citrus, oranges, lemons, and the presence of seeds, and then moves to describing the shape of bark, leaves, flowers, and fruits. While he focuses on the qualities of citrus, its colour, smell, taste, and the flavour of its juice, he especially specifies the morphological structure of citrus plants and the characteristics of the vegetal organs devoted to reproduction, i.e., the seeds, the flowers, and the fruits. In this sense, he differentiates between lemons and citrus by means of dissimilarities, which concern the cortex, the juice, and the pulp of

⁷² See Iris Lauterbach, "Johann Christoph Volkamers Hesperidenwerk," in *Die Frucht der Verheißung – Zitrusfrüchte in Kunst and Kultur*, ed. Y. Doosry, Ch. Lauterbach, and J. Pommeranz (Nuremberg: Germanisches Nationalmuseum, 2011), 237–63. Cf. the new edition of this text, in Johann Christoph Volkamer, *The Book of Citrus*, ed. Iris Lauterbach (Berlin: Taschen, 2020).

⁷³ Andrea Cesalpino, *De plantis libri XVI* (Florence: Marescottom, 1583), bk. 3, ch. 59, 139–41.

fruits. He describes specific cases, such as the citrus in Gaieta and Spain, the *melangula*, *citrangula*, and Poncirus, which stands between lemon and orange. In these few pages, Cesalpino's methodology for classification surfaces: first, the rejection of *accidentia*, or pharmaceutical grouping or purely artificial alphabetic arrangement; second, the attention to botanical characters related to the morphology of plants and to the organs of growth and nutrition; and third, his effort to compare the qualities of fruits, such as texture, colour, and flavour, in corresponding parts.⁷⁴ Grounded in Aristotelian botany, Cesalpino's theoretical classification framed the study of citrus within a philosophical system. This theoretical attention was absent in earlier studies and laid the table to a shift in botanical knowledge.

Within this line, a completely different example surfaces in book four of *Syntagma Philosophicum* (1658), where Pierre Gassendi presents a meaningful description of plants as inanimate bodies.⁷⁵ Indeed, his anti-animistic (and anti-Aristotelian) definition of vegetal life is consistent with a mechanistic, corpuscularian, and atomistic interpretation of plants that innovatively introduces a *historia plantarum*. While rejecting Aristotelianism and Renaissance botany, Gassendi's simple division of plants in herbs or trees [*herbas, arbores*] coherently reduces the qualities of plants to the internal activity of particles or corpuscles that constructs the differences of each vegetal body.⁷⁶ Yet, as he comes to speak of trees bearing fruits, he describes *malus* [pomes fruits] in a very traditional way. For the case of citrus fruits, he divides them in (1) *Malus Medica, seu Assyria*, whose virtues, pleasing smell, flavour, and gold colour of fruits are well known; (2) oranges or *Malus Aurea*, that is when the fruit is more round; (3) *Citrea, & Citronia*, which is oblong or egg-shaped; and (4) *Malus Adamea*, which gather lemons and Poncerius.⁷⁷ Gassendi's hugely innovative philosophical interpretation of vegetation, according to which the vegetal

⁷⁴ On Cesalpino's theoretical approach to botany, see Alain G. Morton, *History of Botanical Science* (London: Academic Press, 1981), 128–41.

⁷⁵ See Luigi Guerrini, "Animazione, sensibilità, facoltà. Le premesse allo studio del mondo vegetale nel *Syntagma Philosophicum* di Pierre Gassendi," *Rivista di storia della filosofia* 59, no. 4 (2004): 853–76. Antonia Lolordo, *Pierre Gassendi and the Birth of Early Modern Philosophy* (Cambridge: Cambridge University Press, 2007), ch. 8, 183–207.

⁷⁶ See Hiro Hirai, *Le concept de semence dans les théories de la matière à la Renaissance. De Marsile Ficin à Pierre Gassendi* (Turnhout: Brépols, 2005), 480–3.

⁷⁷ Pierre Gassendi, *Syntagma Philosophicum*, Partis 2, Sect. 3, I *De rebus Terrenis Inanimis*, lib. 4, in *Opera Omnia* (Lyon: 1658), 149a.

activities and the variations between plants depend on the motion of particles, does not result in an alternative division of citrus fruits as compared to naturalistic tradition. Still, within his atomistic, corpuscularian hypothesis, Gassendi explains the differences between citrus fruits, making this a relevant subject of early modern natural philosophy.

A further case is in a note of René Descartes' *Excerpta anatomica*, a biomedical manuscript that collects the extent of his botanical study.⁷⁸ In these notes, Descartes mechanizes the nature of plants, specifying the movement of particles in composing plants and trees and producing flowers and fruits. While he provides a general, mechanistic framework in which particles move rectilinearly within channels in the trunk and arrange at the top and ultimately forming fruits, Descartes also describes three specific cases. This is the note:

Several fruits are bitter, in particular those growing in hot regions, like the shells of nuts, citrus [*malorum aureorum*], and so on. Bitter things usually purge quite violently and dry up, and even irritate and sever the extremities of veins. From this I deduce that heat initially stirs up several particles of smoky vapour that are shaded and black (as in the shell of nuts), so that afterwards these particles are gradually secreted by the rapid movements of fluid particles in the tree, and simultaneously pressed together: thus, the more olives ripen, the more bitter they are. As a result, these particles compose a very thick and wet body, which with respect to human flesh is dry, and so this body purges our limbs; for in fact, what is very thick clings to the humours, and this thick body carries everything with itself with the exception of the most fluid parts that are left to heat up and dry [the human body].⁷⁹

The note has nothing to share with the attempt to classify the variety of fruits of Descartes'

⁷⁸ For a reconstruction of Descartes' study of plants, see Fabrizio Baldassarri, "The Mechanical Life of Plants: Descartes on Botany," *British Journal for the History of Science* 52, no. 1 (2019): 41–63.

⁷⁹ René Descartes, *Excerpta anatomica*, in *Œuvres de Descartes*, ed. Charles Adam and Paul Tannery, 11 vols. (Paris: Vrin, 1964–1974), vol. XI 622-623: "Amari sunt plerique fructus, ii praecipue qui in calidiusculis regionibus nascuntur, ut nucum putamina, malorum aureorum, etc. Abstergunt autem amara omnia vehementissime et exsiccant; imo etiam exulcerant, et venarum extremitates resecant. Ideo concludo esse partes in fumum quidem ab initio a calore excitatas, ideoque opacas et nigras (ut in nucis cortice), postea vero in arbore a partibus fluidis celeriter motis paulatim secretas et simul constipatas (unde olivae, quo maturiores, eo magis amarae), ac proinde quae faciunt corpus humidum crassissimum, quod se toto respectu carnis nostrae est siccum, ideoque abstergit; illi enim quod crassissimum est, in humoribus adhaeret, et sic omnia secum vehit, fluidissimis exceptis, quae relictas calefaciunt et siccant." [Translation is mine.]

contemporaries, nor with the attempt to define fruits through their therapeutic (or noxious) virtues, their flavours, or the weather condition and ground to make them grow. In contrast, Descartes explores the ways sour fruits are formed in hot regions, tracing the movement of particles and the interaction between particles and smoky vapours, therefore attributing a role to heat, vapours, and hazes in the production of fruit bitterness and purgative virtues. In this sense, he grounds the qualities of fruits such as nuts, olives, and citrus to the mechanics of particles, through which he explains vegetation at large. In this sense, his reference to citrus remains general, as he calls them *malorum aureorum*, but meaningful, insofar as he describes the formation of citrus, whose pulp is made of fluid particles, and whose bitter taste results from the presence of smoky vapours within the plant. Within Cartesian physics, the movement and change of particles and vapours arising through the trunk and mixing together results in a mechanization of fruits such as citrus, whose varieties is thus unimportant as it would depend on a variation in the motion of particles or in the presence of vapours. In Descartes' natural philosophy, citrus develops as a mechanical fruit, whose qualities stem out of the mechanical activity of plants, i.e., a clockwork orange.

A final case within this line is from a lesser-known German physician, Hermann Grube, who had studied at Leiden with Sylvius and had been practiced medicine in Denmark and befriended Thomas Bartholin (1616–1680), and who in 1668 published a medico-philosophical treatises on citrus, the *Analysis Mali Citrei compendiosa, ad Botanices, Philosophicae iuxta ac Medicae*. This text opens with a commendable letter by Bartholin himself, who inserts this text within the tradition of Bauhin and Ferrari, therefore praising Grube's investigation of plants. Indeed, this text brings to completion Grube's botanical study begun with a *Disputatio de Vita et Sanitate Plantarum* (1664) in which he presents a medico-philosophical interpretation of plants consistent with Aristotelian philosophy. In *Disputatio*, while discussing the properties and characteristics of plants, Grube rejects the opinions endowing plants with sensitive and cognitive powers and promotes an orthodox Aristotelianism in botany, mainly relying on Giovanni Costeo's (or Johannes Costaeus, 1528–1603) *De Universali Stirpium Natura libri duo* (1573).

Grube's aim to produce a philosophical botany that embeds the medical and physiological knowledge within a philosophical system of nature finds in citrus fruits a suitable subject matter, as one could develop grammatical, philosophical, and medical investigations of botany.⁸⁰ The text consists of three main chapters or parts; the first is a philosophical study of citrus, the second is a medical approach, and the third concerns the therapeutic uses of citrus to prepare remedies. As it is, the book is an important assemblage of the early modern knowledge of citrus fruits.

Let us deal with the first part. First, Grube describes the characteristics of the citrus plant; second, he describes the locations it grew and how an exotic plant had been transplanted in European gardens; and third, he presents three genres of citrus. This is interesting, as Grube lists three *differentiae*: “Limonium, Citreum, [...] & Poncerium,”⁸¹ while oranges as such disappear from his catalogue. Then, he describes the smell and taste of citrus fruits, especially discussing the ways to investigate these issues by means of anatomical or chymical studies of citrus. Indeed, the sourness of citrus depends on the combination of heat, cold, and humidity and not on the shape of atoms, as Epicurean philosophers claim.⁸² In this sense, Grube's interpretation is Aristotelian and Galenic.⁸³ Discussing the external shape and colour of citrus, Grube then rejects Della Porta's theory of signatures (later followed by Oswald Crollius, ca. 1560–1608), which he considered an utter imagination, and the Cartesian interpretation of the role of particles (or atoms—he mixes Cartesian physics with atomism) composing the fruit.⁸⁴ Accordingly, the figures composed by particles do not produce a certain virtue in fruits, therefore making it impossible to infer its characteristics from the signs or figures of citrus. While he considers both Della Porta's and the mechanistic and atomistic interpretations ungrounded, Grube claims that the balance of humours produces the qualities of citrus. In reviving an Aristotelian and Galenic botanical interpretation,

⁸⁰ Hermann Grube, *Analysis Mali Citrei compendiosa, ad Botanices, Philosophicae iuxta ac Medicae* (Kopenhagen, 1668), 2–8.

⁸¹ *Ibid.*, 16.

⁸² *Ibid.*, 27.

⁸³ On Galen in the seventeenth century knowledge, see Matteo Favaretti Camposampiero and Emanuela Scribano, eds., *Galen and the Early Moderns* (Cham: Springer, 2022).

⁸⁴ Grube, *Mali Citrei*, 29–33. On Crollius, see Hirai, *Le concept de sémence*, 295–323.

Grube appraises the claims of his predecessors and provides us with an important commentary of the knowledge of citrus fruits in early modern culture that is in line with the attempt to explore the internal structure of vegetal bodies. Indeed, his effort to reduce the qualities of citrus to humours clearly reveals a theoretical framework embedding botanical knowledge. This framework is Aristotelian and contrasts mechanical and corpuscular theories.

In all these cases, the interest in citrus combined the attention to outward varieties and the study of rare cases with the knowledge of the internal structure of the fruit, namely a physiology of plants, which natural philosophers claimed help specify the properties of citrus, define its natures, and ultimately provide a theoretical framework for the botanical knowledge in general. In providing a methodology to explore citrus fruits, early modern natural philosophers reduced the varieties of citrus either to the texture and arrangement of particles or corpuscles, or to the balance of humours, unearthing the importance of theoretical assumptions and experimental knowledge to frame botanical studies.

6. Conclusions

As I disclosed in this article, citrus fruits exemplifies how botanical studies unveils a combination of diverse frameworks. In the early modern period, citrus fruits attracted the attention of a wide array of scholars, such as naturalists, experimenters, natural philosophers, and physicians, ultimately emerging as subject of natural magic, natural history, catalogues, and so on. Yet, it especially lays bare a case study to investigate the early modern construction of botany as a discipline of knowledge, combining Renaissance natural science, systematization and classification, and early modern natural philosophy. Two texts by two physicians, namely Monardes' *de malis citrijs, aurantijs, ac limonij libelli* and Grube's *Analysis Mali citrei*, embed a century of study, if not even obsession, for citrus fruits, whose peak is represented by Ferrari's *Hesperides* at a middle point between the former two. While Monardes acknowledged the restriction of his approach, as he failed to observe all specific cases, a common trait in Renaissance botany, 1646 Ferrari's

masterpiece contains a direct observation of all specimens as a crucial methodological tool to know all varieties. Finally, early modern natural philosophers, whose positions are summarized by Grube, show how much a study of citrus necessarily requires a focus on the internal structure of bodies, and thus paves the way to the knowledge of vegetal physiology as a crucial feature of botanical science.

In section 2 I have discussed how much Renaissance botanists provided a general division of its species into 4 genres, generally avoiding the discussion of problematic cases, but focusing on the description and depiction of broad classes of fruits. In contrast, peculiar cases are the ideal subjects of Della Porta's and Aldrovandi's work, whose botanical observations made citrus fruits a subject for natural magic and teratology. Besides their peculiarities, these works provide a meaningful attempt to observe and interpret vegetal monstrosities within a modern system of knowledge, which in the case of Aldrovandi also results in a few lavish images, as I have detailed in section 3. In section 4, I have explored the famous text of Ferrari, which represents the apex of this obsession and lays bare an original combination of the Renaissance efforts to classify and describe, the study of teratologic cases and the combination of figurative knowledge and attention to details. Without any doubt, this text outlines the innovative ways to achieve botanical knowledge in the seventeenth century. Yet, Ferrari's observation focuses on outward varieties. A theoretical instance finally emerges in the work of natural philosophers, which I have briefly discussed in the last section of this article. Starting from the botanical philosophy of Cesalpino and then dealing with Gassendi's atomistic and Descartes' mechanistic interpretation of citrus fruits, these texts reveal the meaningful attempt to consider the varieties of citrus developing from the internal arrangement of particles. In these cases, the explanation of the nature of citrus develops from the knowledge of their internal structure, grounded on a few theoretical assumptions. In his medico-philosophical botany, Grube presents a summary of the previous interpretations of citrus, rejecting both the imaginations of Della Porta (and alchemists) and the mechanic-atomistic reduction of Descartes and Gassendi, ultimately reassessing a botanical discipline within Aristotelian theoretical framework.

Yet, this is not the end of the story. Strange citrus fruits such as a "crowned-orange" or a

“hermaphrodite-limon” that are some of the vegetal rarities collected in the museum of the Royal Society and described by Nehemiah Grew (1641–1712) in 1685, continued to be collected, described, and investigated.⁸⁵ However, a change surfaces in the systematization of the knowledge of such cases. For example, while claiming that monstrosities help shedding light on a body’s normal operations, “as if by erring she reveals her secrets,”⁸⁶ Marcello Malpighi (1628–1694) tried to solve the questions of a monstrous egg enclosing three smaller eggs by relying on the case of citrus growing one inside the other, the *limon citratus* discussed by previous scholars as a teratology case. In Malpighi, this monstrous citrus fruit is thus a fitting example to explain the complexity of nature and buttress medical knowledge, as he grounded the observation of diverse and peculiar varieties of citrus with the study of their internal structure, that is, the physiology and anatomy of plants blossoming in the second half of the seventeenth century.

In sum while a shift of theoretical approaches to plants surfaces in the early modern period, as the study of vegetal physiology surfaces, botanical knowledge appears not a mere refusal of previous studies. As the case of citrus importantly highlights, the study of plants in early modern Europe appears as a combination of the Renaissance focus on outward qualities with a study of internal structure grounded on philosophical system. In the end, besides the attraction to citrus per se, this fruit fascinatingly arises as a suitable case study to explore the features and mysteries of nature in early modern knowledge.

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⁸⁵ Nehemiah Grew, *Musaeum Regalis Societatis or, A Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society...* (London, 1685), 186. On Nehemiah Grew, see Pamela MacKenzie in this issue.

⁸⁶ Domenico Bertoloni Meli, *Mechanism: A Visual, Lexical, and Conceptual History* (Pittsburgh: University of Pittsburgh Press, 2019), 128. Cf. Id., “Blood, Monsters, and Necessity in Malpighi’s *De Polypo Cordis*,” *Medical History* 45 (2001): 511–22.

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Captions: