Tracing plant histories: linking botanical collections, peoples, and illustrations in seventeenth century Dutch Brazil

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Chapter 5

Looking into the flora of Dutch Brazil: botanical identifications of seventeenth century plant illustrations in the *Libri Picturati*

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Abstract

The *Libri Picturati* includes a collection of plant illustrations from seventeenth century Dutch Brazil kept in the Jagiellonian Library in Krakow since World War II. While many studies focused on these images' artistic details and history, we identified the flora depicted and checked their geographic origins. Using contemporary textual sources (e.g., *Historia Naturalis Brasiliae*), monographs, and taxonomist assessments, we obtained 198 taxa. These mainly were wild and native rainforest trees and 35 introduced species. In addition, we retrieved the life forms, domestication and conservation status, and the represented plant parts of these species. Fertile branches are the most represented, although some loose dry fruits and sterile material were also painted, which sheds light on the collection methods by naturalists in Dutch Brazil. Since colonialism, several species are no longer abundant or have become invasive due to anthropogenic influences. Through this botanical iconography, we traced the first records of the sunflower and the Ethiopian pepper in Brazil and the dispersion and assimilation of the flora encountered in the colony by Indigenous, African and European peoples. We emphasized the relevance of combining visual and textual sources when

studying natural history collections, and we highlighted how digitalization makes these artistic and scientific collections more accessible.

5.1 Introduction

> 'We are also told that the nature of the foreign was understood through its natural objects. What this nature was, we are often left to wonder' (Pugliano, 2009: 324).

In 1977, in the Jagiellonian library of Krakow (Poland), zoologist Peter Whitehead found a treasure that most scholars had already considered lost: a collection of Brazilian illustrations in the *Libri Picturati* (Whitehead & Boeseman, 1989). The *Libri Picturati* consists of thousands of drawings and paintings of flora, fauna, and people from several ethnical backgrounds, which were bound together in the nineteenth century (Albertin, 1985). It contains—inter alia—sixteenth century plant watercolors attributed to the circle of correspondents around Carolus Clusius and Charles de Saint-Omer (Egmond, 2008) and a collection of Brazilian Natural History illustrations made during the Dutch occupation of northeast Brazil. The latter was created under the patronage of count Johan Maurits of Nassau-Siegen (governor-general of Dutch Brazil from 1636 to 1644) by artists and naturalists who aimed to represent the natural elements that surrounded them in the colony. The Brazilian collection includes the oil paintings known as the *Theatrum Rerum Naturalium Brasiliae* (from now on *Theatrum*), the watercolor drawings known as Handbooks, *Manuais* or the *Libri Principis* (LP), and the crayon/pencil sketches and oil paintings bound in the *Miscellanea Cleyeri* (MC) (Albertin, 1985).

Other contemporary materials to these visual sources of Brazilian nature include an account of Johan Maurits' endeavors in Brazil written by polymath Caspar Barlaeus (1647); the encyclopedia *Historia Naturalis Brasiliae* (from now on HNB) authored by the naturalist

Marcgrave and the physician Piso and published by Johannes de Laet in 1648; and the *India Utriesque re Naturali et Medica* (IURNM), a modified and doubtful version of the HNB (Piso, 1658). Both the HNB and IURNM contained descriptions and woodcut images of animals, plants, people, and tropical diseases of Dutch Brazil. These textual sources were published in the Netherlands and circulated widely among European naturalists and other inquiring minds interested in the 'exotic' nature of the Americas, while the Brazilian images were exchanged as diplomatic gifs (Whitehead & Boeseman, 1989). In 1652, Johan Maurits sent these images to Frederick William, Elector of Brandenburg (1620-1680), who passed them to his court physician Christian Mentzel (Albertin, 1985). Also interested in the natural world, Mentzel devoted himself to assembling all the illustrations from 1660 to 1664. His work resulted in a fairly organized art collection of Brazilian nature that was kept in the Elector's library (presently part of the *Staatsbibliothek zu Berlin*), available for study to humanists and intellectuals alike. Almost 300 years later, this collection was evacuated during World War II to protect it from the bombings. The *Libri Picturati* went through several transfers, and ultimately, the Brazilian iconography was found in Poland, which opened new possibilities for research (Albertin, 1985; Whitehead & Boeseman, 1989).

5.1.1 Previous research and our role

When the paintings were still in Berlin, Lichtenstein (1819, 1961) studied the fish and other animals depicted, while Schneider (1938) identified the birds and matched them with the HNB woodcuts. Martius (1853) used the *Theatrum* to compare its plant images to the HNB and IURNM and elaborated further on Brazilian botany in his commentaries on Marcgrave's plants. However, he previously described this endeavor as 'such a laborious task' (Martius, 1843: XI). Albertin (1985) focused on the content of the *Theatrum* from an art historical perspective with a special focus on the authorship of the images. Whitehead and Boeseman

(1989) provided a thorough overview of the visual and textual sources produced in or about Dutch Brazil, considering the *Theatrum* images as the basis for the HNB woodcuts. Brienen (2006, 2007) focused on the relationship between visual information and scientific enterprise in the early modern period and advanced hypotheses about the authorship of the images. Ferrão and Soares (1993, 1995) historically contextualized and reproduced the images of the *Libri Picturati* while commenting on some of the illustrations. Recently, Scharf (2019) analyzed the different pictorial techniques behind the composition of the LP. The images were made by different artists using various techniques, but the authorship is still uncertain. Scholars have attributed them to Dutch painters Albert Eckhout (Brienen, 2006; Teixeira, 1992, 1995) or Frans Post (Schneider, 1938). Others suggested that they were made by Marcgrave, who had taken artistic training and produced several drawings that served as the basis for some of the woodcuts depicted in the HNB (Whitehead & Boeseman, 1989). Scharf (2019) suggested that count Johan Maurits was the artistic hand behind some watercolors. Hence, these illustrations have been mainly studied from an (art) historical approach. We chose to identify the species depicted in the paintings, thereby revealing their domestication status, geographic origin, and the natural vegetation type in which they occur, to suggest where they were made and how close naturalists and artists collaborated in Dutch Brazil.

A team of art historians and botanists that studied the sixteenth century illustrations of the *Libri Picturati* have identified the plants depicted (Koning et al., 2008), but this has not been the case for the Brazilian collection. In the *Theatrum*, some taxonomic notes are written above the plant illustrations—of dubious authorship, which Albertin (1985) attributed to Lichtenstein. Nevertheless, these are often incomplete, outdated, or erroneous. The recent digitization of all plant illustrations by the Jagiellonian library has enormously facilitated research on these valuable historical images. Here we present the first botanical revision and systematic identifications of the plants depicted in the Brazilian collection of the *Libri*

Picturati: the *Theatrum Rerum Naturalium Brasiliae*, the *Libri Principis,* and the *Miscellanea Cleyeri*. We posed the following research questions: (1) What plant taxa are illustrated in the *Libri Picturati*? (2) What taxa were intended to be added to the original collection by Mentzel but lack illustrations in this collection? (3) What insights can we infer from the illustrations on the methods of plant collection and collaboration between naturalists and artists in the colony? (4) What are the differences and similarities in botanical content between visual and written sources?

Brienen (2006) and Ferrão and Soares (1993) attested that the flora represented in the *Libri Picturati* mainly came from the surroundings of Recife, the colony's capital. Due to Marcgrave's multiple expeditions to the interior of Brazil (Van den Boogaart & Brienen, 2002), we expected to find plant species from a wide variety of ecosystems in northeastern Brazil: the semi-arid *sertão* or *caatinga* and the Atlantic rainforest, which includes savannas, mangroves, and dry shrub land (Martinelli & Moraes, 2013: 1070). Following Whitehead and Boeseman (1989) and Teixeira (1992), we expected to find similar plant taxa in the *Libri Picturati* as in Marcgrave and Piso's natural history treatises because both visual and textual representations were made in the same area around the same time in Dutch Brazil.

5.2 Methods

Due to Covid-19 travel restrictions, we could not study the original material in Poland. Jagiellonian library curator Izabela Korczyńska provided the scanned images of the *Theatrum*, while the LP (https://jbc.bj.uj.edu.pl/dlibra/publication/193892/edition/183824/content) and MC (https://jbc.bj.uj.edu.pl/dlibra/doccontent?id= 197455) were retrieved from the Jagiellonian Digital Library. We systematized all information on the botanical images in a spreadsheet organized by page number, vernacular plant names, and reference annotations to the HNB

and IURNM on the folios. Next, we included our taxonomical identifications (to species level whenever possible) and indicated whether these taxa were present in Marcgrave and Piso's books (1648, 1658) or Marcgrave's herbarium (1638-1643/4) (available at https://samlinger.snm.ku.dk/en/dry-and-wet-collections/botany/general-herbarium/ the-marcgrave-herbarium/). We identified the illustrated plant taxa by using our previous identifications of the species present in the HNB, the IURNM, and Marcgrave's herbarium (Alcantara-Rodriguez et al., 2019), and prior research of the Brazilian botanists Pickel (2008) on the species described in Marcgrave and Piso's textual sources and Andrade-Lima et al. (1977) on Marcgrave's herbarium. We compared the illustrations with related seventeenth century Brazilian images (Wagener, c.1641, in Teixeira, 1997). In addition, we used literature on the Brazilian flora (Lorenzi, 2002; Lorenzi & Matos, 2008), monographs (e.g., García-Mendoza, 2001; Johnson & Murray, 2018; Taylor, 1980), online herbarium databases, such as the Global Biodiversity Information Facility (https://gbif.org/), Tropicos (https://tropicos.org/), Naturalis Biodiversity Center (https://bioportal.naturalis.nl/). We also consulted expert taxonomists in Brazil, the Netherlands, Mexico, and the United States. Information on the native or introduced status and life form of the depicted taxa was retrieved from the online Flora do Brazil 2020 (http://floradobrasil.jbrj.gov.br/). We checked the exotic species' origin using the database Pl@ntUse (https://uses.plantnet-project.org/en/Main_Page). We also reviewed other sources on introducing specific taxa to Brazil (e.g., Burle et al., 2010; Lentz et al., 2008; Maia et al., 2015; Roullier et al., 2013). We noted the plant parts represented in the illustration, as these give an idea of the collection methods in the mid-seventeenth century. We verified the domestication status of each depicted taxon from the descriptions by Marcgrave and Piso (1648, 1658), who sometimes alluded to cultivation methods or plant provenance. We also reviewed archaeobotanical and historical studies on pre-Columbian plant domesticates (Clement, 1999; Levis et al., 2017, 2018). Lastly, we

looked into the research on Johan Maurits' palace gardens in Recife (Silva & Alcides, 2002) based on Barlaeus (1647). Although the varying degrees in the level of domestication of certain species fit better in a continuum (Clement, 1999), for this paper, we distinguish three categories: wild, cultivated, and domesticated. Following Levis et al. (2017), we considered domesticated species that show substantial morphological and genetic changes and depend on human management for long-term survival. We included as cultivated species those that are managed to some extent by humans, albeit they can survive and reproduce in the wild without them (Levis et al., 2017: 6). We retrieved the conservation and endemic status from the Brazilian database on Flora Conservation (CNC-Flora: https://cncflora.jbrj.gov.br/portal/) and the IUCN Red List (https://iucnredlist. org/). We also referred to the CITES list to check which species are currently protected to avoid over-exploitation by international trade (https://cites.org/). To reconstruct the floristic content of the *Theatrum* if Mentzel had been able to add all plant illustrations he aimed, we verified reference annotations (vernacular names and page numbers) on the empty folios to Marcgrave and Piso's books (1648, 1658) and identified the taxa that were meant to be represented on those folios. To update the taxonomical nomenclature, we used the Flora do Brazil 2020 (https://floradobrasil.jbrj.gov.br/) and the Plants of the World Online (https://plantsofheworldonline.org/).

5.3 Results

5.3.1 Botanical content of the *Libri Picturati* Brazilian collection

We listed our identifications of all plant illustrations with their vernacular names, page numbers, and associated information on growth form, geographical origin, conservation, and domestication status in Supplementary Dataset S1. From the entire collection of Brazilian

plant illustrations in the *Libri Picturati*, we identified 198 taxa organized in the *Theatrum*, LP, and MC, as indicated in Supplementary Table S1. Between folios 729 and 731 of the *Theatrum*, an illustration of a tea plant (*Camellia sinensis* (L.) Kuntze) is glued, which was sent by Cleyer from Batavia (currently Jakarta, Indonesia), the headquarters of the Dutch East Indian Company (VOC). As it was inserted later in the *Theatrum* and not depicted in Brazil, we did not include it in our analysis. A few plants remained unidentified due to a lack of morphological characters, the limited quality of the drawing, and/or the lack of references to written sources by Marcgrave or Piso (1648, 1658).

Among the LP botanical watercolors, we identified 34 vascular plant species (38 images), with the Passifloraceae as the most represented family (five species, six images), followed by the Fabaceae (five species, five images). Among the MC plant drawings, we identified 26 vascular plant species (34 images), and the most represented families were the Cucurbitaceae (three species, seven images) and the Myrtaceae (three species, three images). Among the illustrated content of the *Theatrum*, we identified 162 vascular plant species (175 images) and one basidiomycete fungus (*Copelandia cyanescens* (Sacc.) Singer, Bolbitiaceae). Fungi were commonly placed within the plant kingdom until the mid-twentieth century. The most represented families among the illustrated content are the Fabaceae (22 species, 22 images), followed by the Solanaceae (10 species, 11 images), Lamiaceae (six species, six images), and Myrtaceae (six species, eight images). The Fabaceae is the most diverse plant family in the world (Gomes et al., 2018), while the Myrtaceae is one of the most rich-species woody plant families in the Atlantic Forest in Brazil (Giaretta et al., 2015).

5.3.2 Mentzel's unfinished task: the intended botanical content of the *Theatrum*

The *Theatrum* also includes 206 empty folios, interleaved between 160 folios with plant illustrations (see example in Fig 5.1). On most folios, vernacular names and references to the pages of the HNB and IURNM are written on the top center, often relating to one taxon but sometimes referring to two taxa.

The blank folios occur predominantly at the end of the collection, as if the maker had little space and somehow had to squeeze them in. Among these unillustrated folios, the vernacular plant names and references to Marcgrave and Piso's sources allowed us to identify 196 vascular plant species (218 records), including five ferns from the families Drypteriaceae (one species), Polypodiaceae (one species) and Pteridaceae (three species); one algae (*Sargassum tenuissimum* (Endlicher & Diesling) Grunow, Phaeophyceae) and a marine sponge (*Clathria* cf. *nicoleae* Vieira de Barros, Santos & Pinheiro, Microcioniadae) (Supplementary Dataset S1). Since the study of spongiology (Porifera) did not develop until the mid-nineteenth century, these animal colonies must have been considered aquatic plants because of the tree-like shape and the fact of living attached to the seabed. The most represented family that would correspond to the blank folios was the Fabaceae (29 unillustrated species, 33 records), followed by the Arecaceae (nine species, ten records), Solanaceae (nine species, nine records), and Asteraceae (seven species, seven records). Estimates of the intended botanical content (i.e., empty folios with references and illustrated folios) are shown in Table 5.1.

Table 5.1 Estimations of the botanical content of the *Theatrum Rerum Naturalium*, including empty and illustrated folios.

Theatrum	*Unfinished plant content*	*Illustrated plant content*	*Total (intended) botanical content*
Folios	206	160	366
Illustrations	0	172	172
Vernaculars/plants	220	176	396
Taxa	205	163	335
Species	197	150	313
Genera	5	8	13
Unidentified taxa	3	5	8
Families	74	68	95

* The sums of taxa, species, and families exclude the repeated records in both empty and illustrated folios.

On f. 139 of the *Theatrum*, the vernacular name *Ambaibuna* is written on an empty page without reference to Marcgrave's or Piso's books (Fig 5.1a). Moreover, the page with *Ambaibuna* is located between *Ambaiba*, which corresponds to the illustration of *Cecropia pachystachya* Trécul (Fig 5.1b), and a blank page with only the vernacular name *Ambaitinga*, which corresponds to *C. hololeuca* Miq. (Fig 5.1c). The Brazilian *Cecropia* species are known in Tupi-related languages as *Ambauba*, *Ambauva,* or *Umbaúba* (https://dataplamt.org.br/). These terms are phonetically and morphologically similar to *Ambaibuna*. For those reasons, we initially assumed that *Ambaibuna* referred to a *Cecropia* species. Still, the same name *Ambaibuna* is later repeated with the name Iito (Fig 5.1d) next to an illustration representing a completely different tree species: *Guarea guidonia* (L.)

Sleumer. Furthermore, *Ambaibuna* is written above the illustration of a grapevine, Vitis vinifera L., unrelated to *Cecropia* (Fig 5.1e).

Fig 5.1 **Similar vernacular names for different taxa in the *Theatrum* collection** (a) Empty folio, except for the vernacular name written above (f. 139) (b) oil painting of *Cecropia pachystachya* Trécul in f. 137 (b) (c) empty folio that would correspond to *Cecropia hololeuca* Miq. according to the reference to the IURNM (d) illustration of *Guarea guidonia* (L.) Sleumer in f. 227 (e) illustration of *Vitis vinifera* L.

Whether *Ambaibuna* was a generic name to designate several non-related species or represents a mistake by the author who wrote the names on the illustrations remains

unknown. On the other hand, neither Marcgrave nor Piso mentioned *Ambaibuna* in their descriptions of the Brazilian flora. Aside from Marcgrave and Piso's books (1648, 1658), it is yet to be determined which source(s) Mentzel relied on when arranging the botanical content of the *Theatrum*. It is nonetheless clear that he must have been confused by the similarity of some of the Tupi-related plant names. Unfortunately, Marcgrave was no longer present to help him match the illustrations, names, and descriptions because he died about 16 years before Mentzel started organizing the Brazilian plant illustrations.

5.3.3 Origin of the exotic species in the *Libri Picturati*

Predominantly, the *Libri Picturati* collection depicts native Brazilian plants. Most of the species represented in the *Theatrum* are native to Brazil. Still, the proportion of native species is much lower in the MC and lowest in the LP, in which almost half of the illustrations represent introduced species (Fig 5.2).

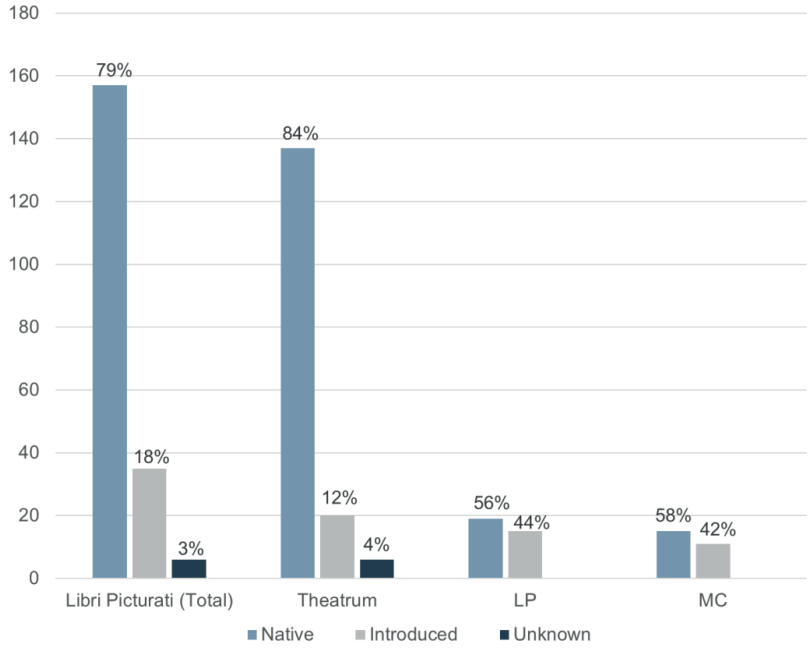

Fig 5.2 **Proportion of native and introduced species in the Brazilian collection of the *Libri Picturati*.** Percentages and numbers correspond to the ratio of native/introduced plant species depicted in the whole collection and the three separate works: *Theatrum Rerum Naturalium* (Theatrum), *Libri Principis* (LP), and *Miscellanea Cleyeri* (MC).

There are 35 species of exotic origin in the complete Brazilian collection of the *Libri Picturati* (Supplementary Table S2). These introduced species now occur in (sub-) tropical areas worldwide. Most of the exotic plants originally came from other parts of the Americas, especially Mexico, the Caribbean, and the Andes region (14 species), followed by those that originated in the African continent (10 species) and tropical Asia (nine species) (Supplementary Table S2). Long before the European colonization, Indigenous groups domesticated, traded, and introduced to Brazil most of the exotic American plants we found

in these collections. Examples are the papaya (*Carica papaya* L.), cotton (*Gossypium barbadense* L.), sweet potato (*Ipomoea batatas* (L.) Lam.), beans (*Phaseolus vulgaris* L.), guava (*Psidium guajava* L.) and maize (*Zea mays* L.) (Clement, 1999). Most of the species of Asiatic origin were already naturalized or cultivated in Africa and introduced to Brazil through the Trans-Atlantic slave trade before the Dutch arrived. Examples are yams (*Dioscorea alata* L.), plantains (*Musa* × *paradisiaca* L.), and weeds like *Abrus precatorius* L. and *Plumbago zeylanica* L. (Carney & Rosomof, 2009; Voeks, 2013). Others were introduced from Europe by merchants and settlers, such as the Portuguese Jesuits, who incorporated them as remedies into their *boticas* (Jesuit pharmacies in the colonies). For instance, *Citrus* and pomegranate fruits were planted as fruits but also used medicinally. Lemons expelled roundworms, and pomegranates could combat cold fevers (Leite, 2013: 88). Portuguese and Dutch must have been familiar with some African plants before their arrival to Brazil, such as *Aloe vera* (L.) Burm.f., *Ricinus communis* L. and *Tamarindus indica* L. These useful plants were already known in Europe through Arabic and Greek medical texts, whose knowledge was boosted by their translations into Latin during the High Renaissance (Leite, 2013; Reeds, 1976). *Punica granatum* L. was introduced into the Iberian Peninsula via ancient merchant routes in the Mediterranean (Chandra et al., 2010) and brought to Brazil by the Portuguese (Leite, 2013). Portuguese started cultivating grapes (*Vitis vinifera* L.) in Pernambuco around 1542 (Sousa, 1969). Along the Atlantic coast, lemons, pomegranates, and grape vines adapted to the new environmental conditions and thrived in the vicinities of Johan Maurits' residence, as evidenced by the illustrations in the *Theatrum* and textual accounts (Marcgrave & Piso, 1648; Piso, 1658a; Silva & Alcides, 2002).

These globally commodified plants are common today in Brazil as in many regions worldwide. Other species seem to have lost their popularity over time. The so-called Ethiopian, Guinean, or Negro pepper, *Xylopia aethiopica* (Dunal) A.Rich., was present

around the 1640s in northeast Brazil, as evidenced in the *Libri Picturati* by a painting with a fruiting branch with leaves named *Piperis aethiopici spés* (Fig 5.3a). The first iconography of this aromatic tree in Europe is found in Matthioli's commentaries on Dioscorides under the name of *Piper aethiopicum* (Matthioli, 1565: 575), and its fruits were previously cited by the Persian polymath Avicenna (980–1037) (Johnson & Murray, 2018). This African pepper was commonly used in Europe until southeast Asian spices gained popularity in the sixteenth century (Halikowski Smith, 2008). In the plantation societies of tropical America, *X. aethiopica* constituted a food crop for enslaved Africans in the early colonial period (Carney & Rosomof, 2009: 135). Today, its fruits are used in aphrodisiac tonics (Volpato et al., 2009) and special dishes prepared for African deities (Orishas) in Cuba (Carney & Rosomof, 2009: 90). Still, it is unclear whether the species grows in Brazil. Its current distribution range encompasses west, central, and southern Africa (https://gbif.org/occurrence/map?taxon_key=3157151). The dry fruits are used in tropical Africa as a condiment, in rituals, and as medicine to treat cough, bronchitis, rheumatism, malaria, amenorrhea, and uterine fibroids (Burkill, 1985; Erhirhie & Moke, 2014; Kofie et al., 2016). There is an herbarium record in Brazil made by photographer and anthropologist Pierre Verger. The label on the specimen mentions 'Brazil' and 'Plantas de Candomblé' and it indicates that the voucher was deposited at the Herbarium Alexandre Real Costa (ALCB, according to *Index Herbariorum*: http://sweetgum.nybg.org/science/ih/, accessed 23 August 2021) in Bahia (Verger s/n, ALCB012478, available at ALCB, via Species Link: https://specieslink.net/search/, accessed 23 August 2021). Verger presumably collected this specimen in Bahia in 1967 while researching ritual and medicinal plants used in Candomblé (http://inct.florabrasil.net/alcb-resgate/, accessed 2 June 2021) (Verger, 1995). However, it seems to be a mixed collection, as the leaves are oppositely arranged and with long petioles, which is uncommon for Annonaceae (Johnson & Murray, 2018). In Brazil, the fruits of the Brazilian relative *Xylopia*

aromatica (Lam.) Mart. have probably served as a good substitute for *X. aethiopica*, as they have a similar peppery taste and stomachic properties (Dias, 1988: 3), and are more easily gathered from the *cerrado* savannahs or the Amazon rainforest. Voeks (1990) documented *X. aethiopica* seed powder as used in Candomblé rituals by Yoruba practitioners in Bahia. Nevertheless, there is no clear information on whether *X. aethiopica* is cultivated in the Neotropics or imported; thus, the origin of the fruits, seeds, or powder in Brazil remains uncertain.

Fig 5.3 **Exotic species in Dutch Brazil depicted in the *Theatrum*** (a) illustration of the African spice-producing tree *Xylopia aethiopica* (Dunal) A.Rich. in f. 321 (b) oil painting of the first record of the sunflower (*Helianthus annuus* L.) in Brazil (f. 555).

The first reference to the sunflower (*Helianthus annuus* L.) in Brazil dates to the twentieth century when European immigrants introduced it due to its economic value as an oil-producing crop (Feoli & Ingaramo, 2015). Sunflowers are of North American and/or Mexican origin (Janick, 2020; Salgado, 2009) and were introduced to Europe in the sixteenth century by the Spanish as part of the Columbian exchange (Crosby, 2003). Merchants observed how native Americans benefited from this plant and exported the sunflower to Europe, where it was primarily valued as ornamental and later as a food crop, propelled by genetic improvement by the Russians in the 1800s (Salgado, 2009). Before the sunflower became a popular and well-established crop in the twentieth century, this plant was already encountered in northeast Brazil, as evidenced by the illustration in the *Theatrum* (Fig 5.3b). Portuguese sailors may have played a role in its introduction to Brazilian territories, or it could have been intentionally brought by merchants or Jesuits, although the latter paid more attention to medicinal plants (Leite, 2013; Walker, 2013). We may also consider the Dutch as active agents in its introduction to their colonies in the northeast. Egmond (1016) indicated that a relevant female agent in disseminating the sunflower in the Netherlands was Christine Bertolf (1525-1590), who was acquainted with the Spanish court and keened on the rare plants that thrived in the Royal Botanical Garden in Madrid. She spread textual and visual information about the sunflower and possibly its seeds among her network of naturalists and collectors, including the Flemish botanists Dodoens and Clusius (Egmond, 2016). After Dodoens (1568: 295) depicted the first European sunflower in his herbal in 1568, images and descriptions of this species began to circulate in manuscripts of other naturalists and physicians in Europe (e.g., Matthioli, 1568: preface, Fragoso, 1572: title page, Monardes, 1574: 109v, and Clusius, 1590: 14-15). Thus, by the seventeenth century, Dutch scholars and collectors of exotic naturalia were familiar with sunflowers, which possibly promoted their cultivation at Johan Maurits' gardens for ornamental purposes.

Interestingly, the sunflower is referenced as *Camará-guaçú,* an Indigenous term from the macrolinguistic Tupi family. *Camará*, *Kamará* or *Cambará* is a generic name given to several unrelated species, such as *Lantana camara* L. (Verbenaceae) and *Ageratum conyzoides* L. (Asteraceae) (http://www.dataplamt.org.br/, accessed 2 June 2021), both found in the *Theatrum* (p. 341 and 343 respectively). According to Tibiriçá (1984), Tupi *caa* means plant, and *mbaraá* means illness, and according to Cherini (2007), *Cambará* means 'leaf of rough bark.' Hence, *Camara* also refers to medicinal plants with rough leaves in general. *Guaçú* means big and *miri* small (Navarro, 2015), which matches with the larger inflorescence of *H. annuus* in contrast to the African weed *Sida rhombifolia* L. (Malvaceae), documented as *Camara-miri* in the HNB and 'used by black people as a broom to sweep the houses of their masters' (Piso, 1648: 110). According to the Tupi-based nomenclature associated with *H. annuus* in the *Theatrum*, Tupi Indigenous groups were already familiar with the sunflower in Brazil around the 1640s.

5.3.4 Life forms and domestication status of the *Libri Picturati* plants

Most of the species in the *Theatrum* are tropical trees, followed by shrubs, herbs, and lianas (Fig 5.4). Several consisted of rainforest trees, such as *Andira fraxinifolia* Benth., *Garcinia brasiliensis* Mart. and *Syagrus coronata* (Mart.) Becc. The same trend was observed for the illustrations in the MC, with trees as the most often represented life forms, followed by shrubs, lianas, and herbs. Typically, the LP contains much fewer trees but more small herbs, shrubs, and vines that were probably found in and around Mauritsstad (i.e., the former capital of Dutch Brazil, currently a part of the Brazilian city of Recife). Examples are *Commelina erecta* L. and *Turnera subulata* Sm., which commonly grow in disturbed landscapes.

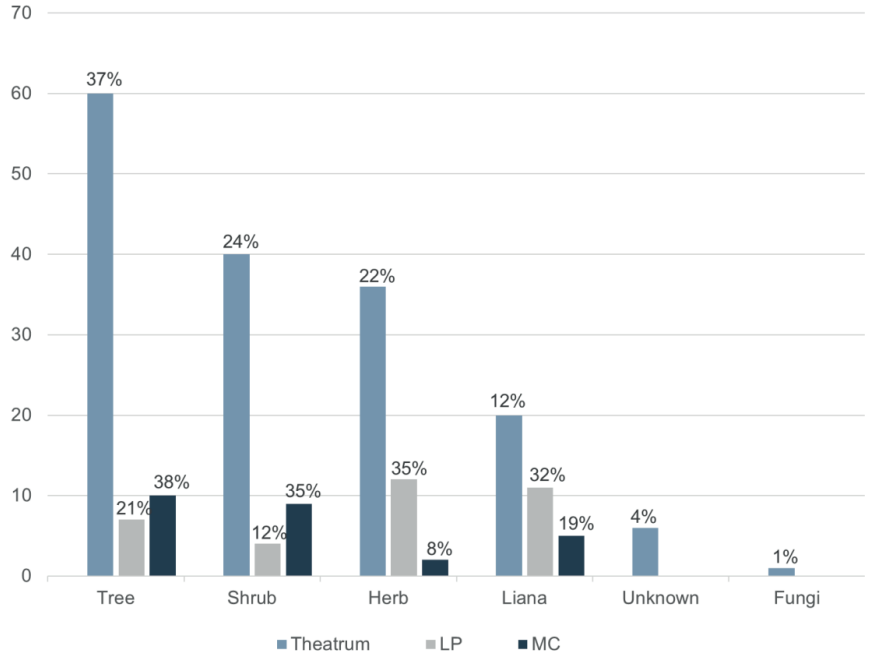

Fig 5.4 **Proportion and number of life forms of the species depicted in the *Libri Picturati***.

Although the majority of the species depicted in the *Theatrum* and the MC are wild forest trees, some species are found both in the wild and cultivated, such as *Psidium guineense* Sw., which was part of the pre-Columbian anthropogenic forests or 'Indigenous landscape' in Brazil (Balée, 1994; Clement, 1999; Levis et al., 2017). Some trees were planted in or around Recife. *Hancornia speciosa* Gomes, known by its Tupi-based name *Mangabiba* or *Mangaiba* [*Mangabeira*] (Marcgrave, 1648: 121), was cultivated in Mauritsstad (Barlaeus, 1647: 242; Silva & Alcides, 2002). The fruit of *H. speciosa* (*Mangaba*) was harvested in large amounts as it was a highly appreciated food (Marcgrave, 1648: 122). Seeds were collected to plant the tree, and Marcgrave gave details about the specific locations of varieties in different northeastern locations (Salvador, Sergipe, and Olinda). *H. speciosa* was already selected and

managed by Indigenous groups before colonization (Clement, 1999), yet wild populations of this tree exist today in the Brazilian rainforest and savannah (http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB15558, accessed 4 June 2021). Domesticated plants are represented in higher proportions within the LP and the MC (Fig 5.5), mainly accounting for introduced fruit species (Supplementary Dataset S1). Examples are *Citrus* spp., *Musa* x *paradisiaca,* and *Cocos nucifera* L. cultivated in Maurits' gardens in Recife (Silva & Alcides, 2002). The influence of the European colonization of Brazil is also visible in the presence of weeds from Asia and Africa among the illustrations in the *Theatrum* and the LP, such as *Abrus precatorius* L., *Argemone mexicana* L., *Boerhavia coccinea* Mill. and *Plumbago zeylanica* L. Some plants were introduced from Africa via slave ships, while others may have dispersed naturally (Voeks, 2013). *Guilandina bonduc* L., an African scrambling shrub depicted as *Inimboi* in the *Theatrum,* was described by Piso (1648: 95) as 'growing in abundance in sandy and dry forests of the coasts.' We categorized *G. bonduc* as a wild plant: its round seeds could have been brought by oceanic currents from West African shores and germinated in the coastal vegetation of Pernambuco and other South American areas (Murray, 1986). However, *G. bonduc* may have reached Brazil during the Trans-Atlantic slave trade, as the hard, grey seeds are used in the African game *Oware* and bead ornaments (Heilbron, 2012).

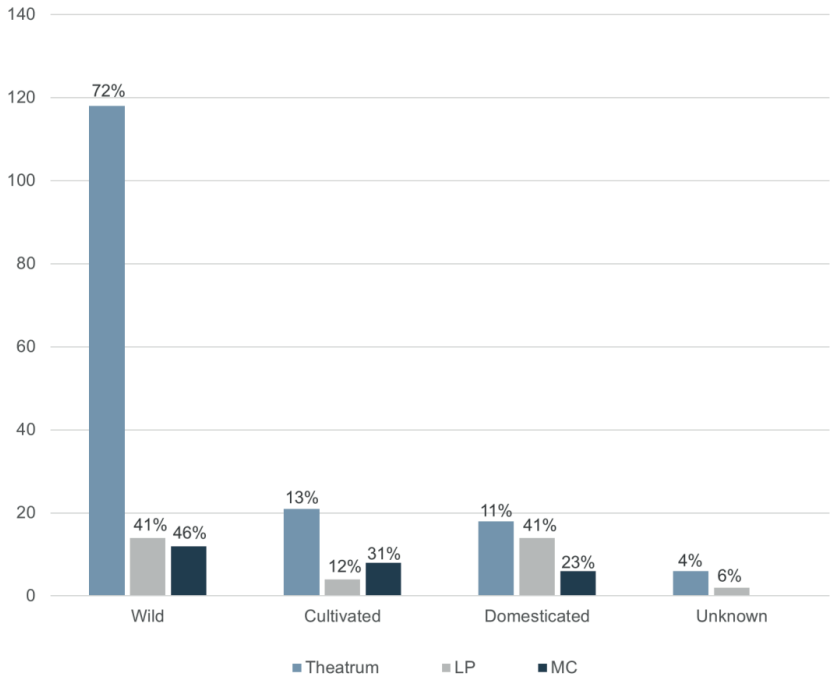

Fig 5.5 **Domestication status of the species in the Brazilian collection of the *Libri Picturati*.**

5.3.5 Plant parts represented in the *Libri Picturati*

The way plants are depicted in the *Libri Picturati* provides information about the artists' level of botanical skills and how closely they worked together with the naturalists in the Dutch colony. For instance, some plants are represented by only loose parts or depicted as sterile, while others show us different organs and reproductive stages, which greatly facilitated their taxonomic identification (Table 5.2).

Table 5.2 Plant parts represented in the botanical illustrations of the *Libri Picturati*.

Plant parts represented	*N° of plants in the Theatrum*	*N° of plants in the LP*	*N° of plants in the MC*
Stem [(a)] + (Leaves) + Fruits + (Seeds)	73 (41%)	6 (16%)	10 (29%)
Stem + (Leaves) + Flowers + Fruits + (Seeds) + (Underground organs) [(b)]	38 (22%)	4 (11%)	2 (6%)
Stem + (Leaves) + Flowers	33 (19%)	16 (42%)	6 (18%)
Fruit + (Seeds) only	12 (7%)	7 (18%)	8 (23%)
Flowers only	4 (2%)	3 (8%)	3 (9%)
Sterile branches/leaves/underground organs only	15 (9%)	2 (5%)	5 (15%)

[(a)] Stems, including branches and trunks.

[(b)] Including roots, rhizomes, tubers, and bulbs.

Most illustrations depict fertile plant species with flowers and fruits, often cut in half to show the seeds, which reveals a high level of botanical knowledge. Fertile plants are more common in the *Theatrum*, on a few occasions also showing their tubers, such as *Spondias tuberosa* Arruda, known as *Umbi* [*Iva Umbu*], of which the prominent tuber in the bottom front captures the attention of the observer (Fig 5.6a). Likely associated with a scientific purpose, drawing some plant parts out of proportion corresponds to a visual style also observed in other iconographies. This selective painting method is also the case in the *Icones Plantarum Malabaricarum*, which depicts plants from Ceylon (modern Sri Lanka) in the eighteenth century and often accentuates valuable fruits, flowers, or roots (Van Andel et al., 2018).

Fig 5.6 **Examples of plant parts represented in the *Libri Picturati*** (a) tuber of *Spondias tuberosa* Arruda painted in the front and branch with leaves, tiny white flowers, and fruits in the back (*Theatrum* f. 261) (b) Infertile individual of *Hippeastrum psittacinum* (Ker Gawl.) Herb. (*Theatrum* f. 389) (c) leaf of *Ficus gomelleira* Kunth & C.D.Bouché (*Theatrum* f. 157) (d) Flowering vine of *Centrosema brasilianum* (L.) Benth. (*Libri Principis* f. 2) (e) dry open fruit without seeds of *Amphilophium crucigerum* (L.) L.G.Lohmann (*Theatrum* f. 387).

Piso (1648: 78) indicated that roots [tubers] of *S. tuberosa* deserved special attention because of the way they developed underground and their use as a refreshment [water reservoir] for feverish patients and exhausted travelers, as he experimented by himself. He and Marcgrave

(1648: 108) also described how the local population valued its fruits as food. This example provides textual and visual evidence of these naturalists' field trips to the interior and their first-hand experiments. Furthermore, it adds insights into the connectedness between artistic and scientific practices in seventeenth century Dutch Brazil. Currently, *S. tuberosa*, known as *Umbu* or *Umbuzeiro* (https://dataplamt.org.br/), is an essential economic and subsistence food resource for rural communities in semiarid regions of northeast Brazil (Cavalcanti et al., 2000; Neto et al., 2010). Its specialized root system (xylopodia) bears tubers that store liquids, sugars, and other nutrients and allow the tree's survival during the dry seasons of the *caatinga* and central Brazilian savanna, where this species is endemic (Cavalcanti & Resende, 2006). The water or sweet juice of the xylopodia is still used as an emergency thirst quencher in extremely arid areas of the Brazilian sertão (Batista et al., 2015); also see https://www.youtube.com/watch?v=NyGNl rljAww, accessed 25 August 2012].

In the *Theatrum*, a small proportion of plants are illustrated in their sterile stage, such as *Hippeastrum psittacinum* (Ker Gawl.) Herb. (Fig 5.6b) or *Ficus gomelleira* Kunth & C.D.Bouché (Fig 5.6c). As noticed by Pickel (2008: 59), Marcgrave must not have seen the impressive flower of *H. psittacinum* as any description of the fertile parts is lacking in his observations (Marcgrave, 1648: 32). The *Theatrum* painting was likely made in the wet season in the interior of Pernambuco when Marcgrave and the painter(s) encountered the lily with only leaves, which occurs before the leaves fall off and the mesmerizing flower appear (Pickel, 2008: 59). *Ficus gomelleira*, depicted by a single oblong leaf with its characteristic pinnate venation (Fig 5.6c), is a large tree, up to 40 m tall (https://portal.cybertaxonomy.org/flora-guianas/node/3041, accessed 4 June 2021). It can be challenging to collect a branch, so the painter(s) or local assistants may have picked a leaf from the ground.

The LP contains mainly flowering plants (e.g., *Ruellia* cf. *elegans* Poir.), tendrillate vines (e.g., *Centrosema brasilianum* (L.) Benth. in Fig 5.6d) and cultivated crops, such as peanuts (*Arachis hypogaea* L.), pumpkins (*Cucurbita pepo* L.) or guava (*Psidium guajava* L.) (Supplementary Dataset S1). Compared to the MC and the LP, a smaller proportion of the illustrations display only flowers or fruits in the *Theatrum*. Yet, these deserve special attention as the reasons for only painting the reproductive organs in the three collections may differ. While in the MC and LP, flowers or fruits represent domesticated species or are more likely to be found in urban areas, such as *Capsicum baccatum* L. or *Hancornia speciosa*, the *Theatrum* contains more loose parts of native plants found in the rainforest. *Amphilophium crucigerum* (L.) L.G.Lohmann is a liana referenced by the Tupi-related name *Iaruparicuraba* and today known in Brazil as *pente-de-macaco* (https://dataplamt.org.br/), meaning monkey's comb. This term refers to its sizeable dehiscent fruit (c.17 cm long) that opens in two valves covered with soft spines (Fig 5.6e). Its winged seeds are not present in the drawing, possibly one empty valve was gathered from the ground, and the wind already dispersed the seeds.
In the MC, we also find some drawings of infertile structures, but these mostly belonged to species depicted on several folios. When assembling those folios, we observed the whole plant represented in its fertile stage: the watermelon (*Citrullus lanatus* (Tunb.) Matsum. & Nakai) is depicted with its leaves and fruit on folio 63 (verso) and its leaves on folio 64 (recto). In the case of *Furcraea foetida* (L.) Haw., whoever bounded the drawings in the MC collection, did not realize that three of its folios formed together one entire plant (Fig 5.7).

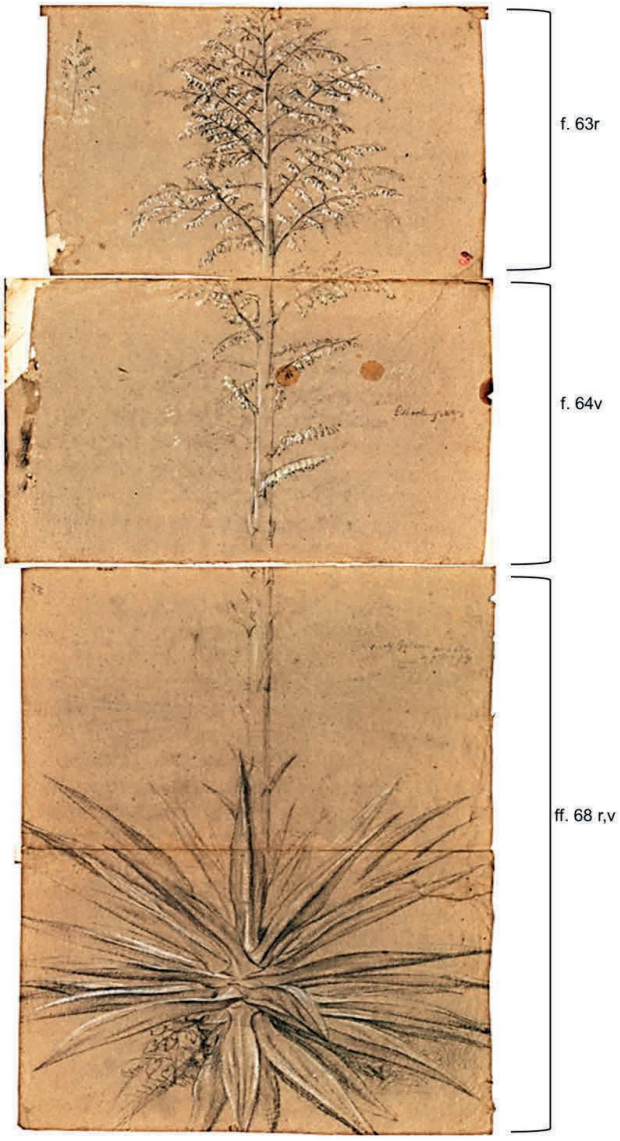

Fig 5.7 **Seventeenth century botanical puzzle.** *Miscellanea Cleyeri*'s folios 63 (recto), 64 (verso), and 68 (double folio) assembled to reveal the flowering *Furcraea foetida* (L.) Haw.

On other occasions, the painters focused on painting the plant parts that were valuable to humans. Several rainforest trees were highly valued for their edible fruits or seeds, such as *Hymenaea courbaril* L. (Marcgrave & Piso, 1648: 101) or *Lecythis pisonis* L., of which 'the seeds (also called chestnuts) were eaten raw or roasted' (Marcgrave & Piso, 1648: 128) and 'were considered aphrodisiacs' (Marcgrave & Piso, 1648: 65). The fruit of *Macoubea guianensis* Aubl. was 'appreciated for its sweetness by the Indigenous peoples to eat during their travels, while Europeans used it to treat chest affections' (Piso, 1658: 242). The fruit of *Swartzia pickelii* Killip ex Ducke was 'not eaten unless it was cooked, from which the inhabitants made a wholesome delicacy for the stomach called Manipoy' (Piso, 1658: 165). The same applies to the tomato-like fruits of the African eggplant *Solanum aethiopicum* L. These fruits were 'eaten cooked, after seasoning with oil and pepper; they have lemon taste' (Marcgrave & Piso, 1648: 24). While these plants are represented in the *Theatrum* only by their fruits (Supplementary Dataset S1), the tree branches or the whole plant are depicted in the written sources. Marcgrave most likely made the drawings displayed in the books, as he aimed to describe and show as many plant parts as possible, although compromising in aesthetic aspects. On the other hand, the painters focused on the edible parts without sacrificing their aesthetics. Nonetheless, the *Theatrum* illustrations and the woodcuts and descriptions of the written sources (HNB, IURNM) often complemented each other and thus facilitated our identifications.

5.3.6 Current conservation status of the Brazilian species in the *Libri Picturati*

In the past centuries, the Atlantic Forest and savannah regions of northeast Brazil have been severely affected by habitat loss and degradation due to the expansion of urbanization, intensive agriculture, farming, and logging (Rogers, 2010; Silva & Casteleti, 2003). As a

result, several plant species that were abundant enough to be noted by European artists around 1640 are not common anymore today. According to the IUCN Red List, eight species in the *Libri Picturati*, seven in the *Theatrum,* and one in the LP are currently experiencing population decline or are at risk of extinction (Supplementary Table S3). The illustrations show several endemic plants from the northeast Atlantic rainforest and caatinga biomes. Four species in the *Libri Picturati* are currently CITES-listed and restricted to trade: the cacti *Brasiliopuntia brasiliensis* (Willd.) A.Berger, *Cereus fernambucensis* Lem., *Epiphyllum phyllanthus* (L.) Haw. and *Melocactus violaceus* subsp. *margaritaceus* N.P.Taylor. The latter is an endemic cactus of the coastal dunes in the Atlantic rainforest known as *restinga*, an ecoregion severely threatened by agricultural expansion and urbanization (Hughes, 2017). Some endemic species are classified as Least Concern by the IUCN or the CNC Flora (12 species), while others (13 species) have not been evaluated yet (Supplementary Dataset S1). The MC does not contain threatened species but includes two endemic trees: *Attalea compta* Mart. and *Eugenia* cf. *brasiliensis* Lam., which are only found in the biodiversity hotspots of the Atlantic rainforest and the *cerrado*, both greatly affected by habitat loss (Martinelli & Moraes, 2013). The mangrove vegetation along the Brazilian coast has been severely affected by urbanization, pollution by industrial and domestic waste, and climate change (Magris & Barreto, 2010; Pelage et al., 2019), threatening the populations of the mangrove trees *Avicennia schaueriana* Stapf & Leechm. ex Moldenke and *Laguncularia racemosa* (L.) C.F.Gaertn. The occurrence of anthropogenic impacts and the lack of available data call for the implementation of more in-depth and continuous studies on the conservation status of these vulnerable populations.

5.3.7 Linking the plant illustrations to the published works and Marcgrave's herbarium

A total of 357 different plant species are described in the HNB and IURNM (Supplementary Dataset S2). Because the *Theatrum* includes more illustrations, we found more taxa from the books and the herbarium represented in this source (102 out of 163 taxa, 63%). However, the largest overlap occurred between the HNB and the MC (21 out of 26, 81%). A smaller overlap exists between the LP and the HNB/IURNM (18 out of 34, 53%). We counted 143 taxa at the species level in Marcgrave's herbarium (Supplementary Dataset S3), and we observed some of these preserved species in all three pictorial works, with the greatest percentage of taxa in common with the MC (seven out of 26, 27%), probably because of its smaller number of images. Strikingly, a third of the species illustrated in the whole Brazilian collection of the *Libri Picturati* could not be ascribed to the species described by Marcgrave or Piso (61 out of 180, 34%).

5.4 Discussion

Mentzel intended to include much more botanical illustrations in the *Theatrum*, as is shown by the empty folios with the Tupi vernaculars and the references to plants described by Marcgrave and Piso. The combination of the plant illustrations in the *Libri Picturati* and the written sources provide a complete overview of the flora as perceived by naturalists and painters in the Dutch colony than the published works alone. In addition, the links provided between the published and unpublished images allow for more in-depth studies by (art) historians, botanists, and other scholars interested in the floristic landscape of Dutch Brazil. As Whitehead and Boeseman (1989) highlighted, studying these plant images allows us to trace humans' introduction of exotic species. These human groups were highly diverse:

Portuguese or Dutch colonists growing popular fruits or ornamentals, Jesuits bringing their plant-based remedies from Europe, enslaved Africans planting crops from their homeland, Indigenous groups trading and domesticating several species before and during colonization, etc. The iconographic identifications provide evidence for the first records of some introduced species in Brazil. For example, the presence of *Xylopia aethiopica* in the *Libri Picturati* reveals its existence for the first time in the Neotropics, adding new insights into the corpus of literature on plant exchange related to the African diaspora in the Americas and the preservation of its botanical legacy by African descendants (Carney & Rosomof, 2009; Ferrão, 2013; Van Andel et al., 2014; Voeks, 2013). The sunflower in the *Theatrum* proves that it was introduced to Brazil at least 300 years earlier than previously thought (Feoli & Ingaramo, 2015). The Tupi-related names for this exotic plant show how Indigenous peoples incorporated the foreign flora and revealed the role the Dutch played in introducing plants to Brazil, sometimes promoted by the early plant exchange between Spain and the Netherlands. The differences in plant habit, domestication status, and plant parts represented between the *Theatrum*, LP, and MC reveal the selection and collection methods by the naturalists and artists that collaborated in the three visual collections. The MC shares characteristics with the *Theatrum* (many wild trees with fruiting branches) and the LP (multiple small weeds and loose fruits of domesticated crops). Most of these plant parts also figure in the artworks that were possibly made after them, such as Eckhout's still-life paintings and the series of tapestries of the Old Indies (Brienen, 2006; Thomsen, 1938; Whitehead & Boeseman, 1989). The plants represented in these paintings could have been found in Recife's surroundings and close to the court painters in Mauritsstad (Brienen, 2006; Teixeira, 1992). The same may apply to the makers of the LP illustrations, who probably stayed in open, anthropogenic vegetation, as evidenced by the many herbs and weeds depicted. The large number of rainforest trees in the *Theatrum* show that the artist(s) either accompanied Marcgrave during

his botanical expeditions, went into the hinterland themselves, or obtained the plant material from locals.

Many of the *Theatrum* illustrations not only represent species described and/or depicted in the HNB and IURNM, but they resemble, sometimes almost identical, the woodcuts in Marcgrave and Piso's published sources. Whitehead and Boeseman (1989) and Brienen (2006) discussed the potential function of the *Theatrum* illustrations as sources for the engravings. Still, the reasons for leaving out some of these botanical images in the written sources have been overlooked. Editor De Laet must have had difficulties linking some of these images to the descriptions, as parts of Marcgrave's notes were presumably missing, and his sudden and mysterious death prevented him from discussing the arrangement of the HNB content with De Laet. Marcgrave was a skilled botanist who aimed for full descriptions of plants, capturing the morphology, life stages, phenology, and other characters as much as possible. He likely excluded some of the specimens known only by loose parts, such as the fruits of *Amphilophium crucigerum* or the flower of *Neomarica* cf. *northiana* (Schneev.) Sprague (Supplementary Dataset S1). These loose flowers and fruits were either found by him during his expeditions or brought to him by local people or artists but never observed in situ by himself in their complete form. Hence, he did not include them in his descriptions, as Marcgrave himself stated: 'I will not write anything down that I have not seen or observed myself' (Marcgrave & Piso, 1648: 139). Unsurprisingly, most of the MC plants are found in the HNB and IURNM, as the MC mainly consisted of plants that grew in Maurits' palace gardens or surroundings and also figured in Eckhout's paintings; these paintings aimed to represent the territory in the colony as seen by the European settlers (Brienen, 2006). The LP contains many common weeds from roadsides and gardens, likely admired by the artist who depicted them for the beauty of their flowers or fruits, which fulfilled its contemplative purposes (Ferrão & Soares, 1995) but probably dismissed by scientists like Marcgrave and

Piso. In our forthcoming paper, we will use the correlations between the *Libri Picturati* and Marcgrave and Piso's books and herbarium to shed light on the origin of the woodcuts and the multiple connections between visual and textual sources as scientific and artistic entities in the early modern period.

The joint study of all associated materials has facilitated our identifications of the flora represented in both visual and textual sources. In the MC, *Citrus* x *aurantiifolia* (Christm.) Swingle, of Asian origin, was first mistaken for a native Brazilian fruit due to the lack of coloration and other key characters. We found a plant drawing in Wagener (Teixeira, 1997: 5) that bears a remarkable resemblance to the sketch in the MC. This *Citrus* is colored dark green and includes a brief description and the vernacular name *Sweet lemon*, which dissipated doubts about this taxon. Attempts to reveal the species behind the three separate folios that depict *Furcraea foetida* were made before, but the pieces were not assembled correctly, or the plant was mistakenly considered a Bromeliad (Teixeira, 1995). In the seventeenth century, *F. foetida* was already familiar to the Spaniards. They encountered it in their colonies in the Caribbean and presumably brought it in 1648 from Spain to the Netherlands (Trelease, 1910). However, as the MC painting reveals, the Dutch already knew about this plant around 1640 and cultivated it in northeast Brazil to obtain its fibers (García-Mendoza, 2001). *Furcraea* species have been used as fiber sources by multiple Indigenous groups, a traditional use appropriated by Europeans and now in disuse in the Western world (Barbosa, 2017). However, the ecological footprint of its introduction is still present, as *F. foetida* is today an invasive species along the Atlantic Brazilian coast (Barbosa, 2017). These new botanical findings provide new insights into vegetation distribution and dispersion and reveal baseline conditions where the environment was altered by intensive Western agriculture and other high-profit enterprises of early capitalist societies. These plant illustrations act as a repository of historical distributional data that allows us to trace the origins of ecological

disturbance (Shaffer et al., 1998), in this case, in northeastern Brazil since the seventeenth century. Moreover, with these findings, we add valuable information to the existing literature on these taxa (e.g., for *Furcraea* spp.: Barbosa, 2011; Drummond, 1907; García-Mendoza, 2001).

One of the most relevant new fields in ethnobotany is plants & art research (Pieroni, 2020). The digitalization of the Brazilian collection of the *Libri Picturati* enabled us to take this innovative approach and perform an in-depth botanical study of its beautiful plant images. Through this study, we draw attention to the relevance of digitizing and studying historical collections and facilitating their access to a more extensive and diverse community (Soltis et al., 2018). Furthermore, as proven throughout this paper, these valuable but sometimes forgotten collections are excellent data sources for cultural and biodiversity research (Stork et al., 2019).

In summary, through access to these digital natural history collections and their scientific study, we disclosed a valuable data source that we can research from several perspectives. By identifying the depicted plants, we revealed their various habits, geographical origin, and domestication status. By analyzing the plant parts illustrated and comparing all visual and textual sources, we discussed the methods of collection and collaboration between botanists and artists in Dutch Brazil. Finally, we detected plants no longer abundant in northeast Brazil due to deforestation, urbanization, and large-scale agriculture and drew attention to their urgent conservation needs. We hope that the *Libri Picturati*—as a botanical and cultural treasure—will reach the inhabitants of the country where these illustrations were made and that the Brazilian vegetation will continue to reflect the beauty and rich diversity captured by artists and naturalists almost 380 years ago.