

# Origins of and key contributors to the economic botany collection of Meise Botanic Garden

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**Keywords.** — Economic botany; Ethnobotany; Herbarium Martii; World's fairs; Materia medica; Drug collections

**Summary.** — The economic botany collection housed at the Meise Botanic Garden herbarium (BR) comprises around 25,000 items, encompassing a wide array of materials such as wood samples, fibres, dyes, tanning agents, exudates (like gums, resins, waxes, latex, and manna), fats and oils, essential oils, and materia medica (pure and derived substances from plants, animals, and minerals used for medicinal purposes). Broadly, the collection can be categorized into three subcollections: the von Martius collection spanning 1821 to 1868, the State Botanic Garden collection in Brussels (post-von Martius) from 1856 to 1958, and the Van Heurck collection from the early 1800s to 1876. This article provides an extensive overview of the collection, delving into its key contributors, geographical origins, and historical context. We highlight exemplary specimens, elucidating the understanding of their economic use during that period. The collection serves as a testament to the intriguing history of collaborations and interactions between scientists, naturalists, explorers, and various other contributors involved in assembling economic botany collections. The combined knowledge and dedicated efforts of these contributors have resulted in a collection that vividly showcases the diverse applications of primarily plant-based resources during that historical era. Even today, this knowledge has the potential to contribute to the exploration of novel or rediscovered applications for plants and plant-derived products.

**Trefwoorden.** — Economische botanie; Etnobotanie; Herbarium Martii; Wereldtentoonstellingen; Materia medica; Drogerijenverzamelingen

**Samenvatting.** — De economische botaniecollectie in het herbarium van Plantentuin Meise (BR) omvat ongeveer 25.000 items, waaronder een brede waaier aan materialen zoals houtstalen, vezels, kleurstoffen, looistoffen, exsudaten (zoals gommen, harsen, wassen, latex en manna), vetten en oliën, etherische oliën en materia medica (zuivere en afgeleide stoffen van planten, dieren en mineralen die voor medicinale doeleinden worden gebruikt). In grote lijnen kan de collectie worden onderverdeeld in drie deelcollecties: de von Martius-collectie van 1821 tot 1868, de collectie van de Rijksplantentuin van Brussel (post-von Martius) van 1856 tot 1958 en de Van Heurck-collectie van begin 1800 tot 1876. Dit artikel geeft een uitgebreid overzicht van de collectie, waarbij we ingaan op de belangrijkste bijdragers, de geografische oorsprong en de historische context. We belichten typerende exemplaren en verduidelijken hun economisch gebruik in die periode. De collectie getuigt van de intrigerende geschiedenis van samenwerking en interactie tussen wetenschappers, naturalisten, ontdekkingsreizigers en verschillende andere personen die betrokken waren bij het samenstellen van economische botaniecollecties. De gecombineerde kennis en toegewijde inspanningen van deze personen hebben geresulteerd in een collectie die op levendige wijze de diverse toepassingen illustreert van voornamelijk plantaardige grondstoffen tijdens dat historische

tijdperk. Zelfs vandaag heeft deze kennis het potentieel om bij te dragen aan de verkenning van nieuwe of herontdekte toepassingen van planten en van planten afgeleide producten.

## 1. Introduction

The 19<sup>th</sup> century was a significant era for the exploration of natural products, driven by scientific curiosity, economic interests, and the search for new resources. Numerous explorers, scientists, and naturalists embarked on journeys to remote areas, including colonies, to collect a wide variety of unknown natural products with possible uses to humans (Cornish & Nesbitt 2014; Nesbitt & Cornish 2016). These collections comprise a wide range of raw materials of plant, animal or mineral origin, and their derivatives, as well as ethnographic artifacts, the latter sometimes ending up in natural history collections and herbaria, due to the historical overlap in the collection practices of botanists and ethnographers or due to practical considerations in the management of scientific and cultural collections (da Fonseca-Kruel et al. 2019).

National and international exhibitions served as a showcase for these newly discovered natural resources. The exhibited, previously unknown objects eventually found their place in commercial, industrial and scientific museums, as well as private collections, where they were examined, described, redistributed, and preserved (Crellin 1967; Widjaja & Kartawinata 2014; Cornish et al. 2017; Bahuchet et al. 2019; Cornish & Driver 2020; Svensson 2020). This endeavour was a collaborative effort involving scientists, curators, manufacturing and trading companies, diplomats, and independent collectors, many of whom were also naturalists. The variety of sources makes these collections particularly diverse, not only geographically but also in terms of content. As the 20<sup>th</sup> century unfolded, the interest in exotic species and ethnographic objects gradually waned, giving way to a focus on colonial agricultural products.

These collections have found their way into natural history museums, botanical gardens or other institutions through various routes, where they are now often conserved and curated as part of or alongside herbarium collections. Commonly known as economic botany collections, they are sometimes referred to as ethnobotanical collections as well. The history of economic botany collections actually dates back to the 16<sup>th</sup> and 17<sup>th</sup> centuries, with the establishment of *materia medica* cabinets that focused on plants for medicinal purposes (Peck 1953; Richards 2012). Economic botany collections emphasize the commercial and industrial importance of plants and their components, highlighting their economic value in agriculture, pharmaceuticals, and other industries. In contrast, ethnobotanical collections primarily focus on traditional knowledge and uses of plants by different cultures, including their medicinal, culinary, and ceremonial applications. While economic botany collections centre on the economic impact and commercial use of plants, ethnobotanical collections detail their cultural and traditional uses. Despite their distinct focuses, both types of collections overlap in their exploration of the human-plant relationship (Davis 1995; Cornish & Nesbitt 2014; Nesbitt & Cornish 2016).

Economic botany collections differ from herbarium collections in their broader content of specimen types, and more applied scientific focus. These collections include not only dried specimens but also plant-derived materials and sometimes cultural artifacts and have been gathered to document plant biodiversity in relation to their economic and industrial importance. Herbarium collections are often complementary to these collections and both collections share synergies in studying the diverse roles and significance of plants in human societies and ecosystems.

In the 19th century, economic botany and ethnobotanical collections were distinctly recognized by curators and users as unique types of collections (Cornish & Nesbitt 2014). Today, however, these collections—except for a few—are more neglected or less well-known compared to herbarium collections. Locating and linking these collections in institutions worldwide is challenging. Unlike Index Herbariorum (<https://sweetgum.nybg.org/science/ih/>), which offers a searchable list of herbarium collections globally, or the Global Registry of Scientific Collections (<https://scientific-collections.gbif.org/>), which aims to provide a worldwide catalogue of scientific collections, there is no comprehensive global overview of economic botany and ethnobotanical collections. Cornish & Nesbitt (2014) provide an overview table of 29 economic botany and ethnobotanical collections, some of which no longer exist. This list is supplemented here by 10 additional collections, including information on the nature of the collections and studies performed on them (Table 1).

## **2. The economic botany collection at Meise Botanic Garden**

The economic botany collection at Meise Botanic Garden predominantly dates back to the 19th century and beginning of the 20th century and comprises approximately 25,000 specimens of a very diverse nature, with specimens preserved in the original glass jars (fig. 1) or in cardboard boxes. Although some parts of the collection may initially appear to hold primarily taxonomical interest due to their close connection with the herbarium, it's important to recognise that every species within it has a use relevant to humans—whether obsolete, current or potential. Consequently, the entire collection was and still is considered to have economic value. Specimens include wood samples, fibres, dyes and tanning agents, exudates (such as gums, resins, waxes, latex and manna), fats and oils, essential oils, and materia medica (i.e. substances derived from plants, animals, and minerals used for medicinal purposes). Surprisingly, it also houses specimens of animal and mineral origin (Table 2), making the collection highly unusual compared to other collections within the Meise Botanic Garden herbarium.

Materia medica has had an important impact on the economic botany collection of Meise Botanic Garden. In his 1554 herbal, “Cruydeboeck”, which was initially largely derived from the herbal of Leonhart Fuchs, Rembert Dodoens, a physician and botanist, was one of the first to disseminate knowledge about useful plants in Dutch, referring to them as “profijtelicke cruyden” or profitable herbs (Anon. n.d. a). The use of plants by humans, whether for medicinal, dietary, textile, or other technical purposes, has since led to significant commercial and industrial activities.

Botany and pharmacology are intricately connected. Materia medica, encompassing both crude drugs (also called simples) and compound substances, plays a substantial role in economic botany collections (Leyman 2023). It is noteworthy that the words “drug” and “drogue” are derived from the Dutch terms “droge vaten, droge waren, droge kruiden, drogen, drogerijen” initially referring to substances stored in dry barrels or containers with dry substances (Philippa et al. 2003-2009).

Druggists and pharmacists collaborated closely in the 19th and early 20th centuries. Crude drugs and excipients, available at the druggist's, were processed by pharmacists into medicines. They monitored the authenticity of the raw materials and detected counterfeits, recognising that falsifying any ingredient could impair therapeutic efficacy. Consequently, they continually augmented their materia medica collections (“drogerijen” in Dutch, “droguiers” in French) with the latest substances on the market, whether of vegetable, animal or mineral origin. Excipients (inactive substances used as a carrier for the active ingredients of a medication, aiding in the drug's formulation and stability) were equally important and particularly diverse. Rather exceptionally, old naturalia emerge in collections, serving as silent witnesses to earlier cabinets of curiosities. Amber,

oyster pearls, “so-called” unicorn horn (fig. 2), red coral and Lapis judaicus, for example, appear unexpectedly in the economic botany collections of Meise Botanic Garden.

The economic botany collection of Meise Botanic Garden comprises three sub-collections: the collection of the former State Botanic Garden of Brussels (ca. 70%), which is subdivided into the von Martius collection, spanning 1821 to 1868 and the post-von Martius collection from 1856 to 1958 (hereafter referred to as the State Botanic Garden collection); and the Henri Van Heurck collection of the former Antwerp Herbarium (ca. 30%) dating from the early 1800s to 1876. Ethnographic artifacts only comprise a small portion of the collection.

The State Botanic Garden (the predecessor of Meise Botanic Garden) was founded in 1870 and this went hand in hand with the purchase of the Herbarium Martii, a pivotal move that positioned the garden alongside other renowned botanic gardens such as the Royal Botanic Gardens, Kew (Bommer 1871). Carl von Martius’s extensive herbarium of 300,000 specimens represented the first, largest and most important acquisition. Besides the classic herbarium of pressed and dried plant specimens, the Herbarium Martii also contains all kinds of plant parts (including woods) and plant-derived products. Towards the end of the 19<sup>th</sup> century, the garden was tasked with identifying all dried plant materials collected across the Congo Free State – and later in Belgian Congo – which soon resulted in the first important publications on the Flora of Congo (Arzel 2018). Most of this newly discovered material, such as wood, fruits, fibre and rubber, found its place within the economic botany collection. The expansion of this collection continued in the State Botanic Garden until the 1960s. Following the Garden’s relocation from Brussels to Meise, which took place from 1939 to the 1970s, and its renaming as the National Botanic Garden in 1958 (Diagre 2012), the economic botany collection was temporarily stored and neglected until its recent rediscovery in 2013.

Another 19<sup>th</sup> century collection that has enriched the Garden is the Henri van Heurck collection from Antwerp, and some post Van Heurck collections, originally housed in the Antwerp Herbarium. In 2006, this collection was lent to the National Botanic Garden. This collection contains, besides herbarium specimens, a substantial economic botany collection, which evolved from materia medica as its foundation and expanded into a botanical museum including industrial and commercial products. Several seed collections, exotic fruits, chemical products, two materia medica cabinets, a mycological collection and numerous, microscopic preparations of plants, animals and rocks also add to the whole. In 2014 this extensive and highly valuable collection became a permanent loan to Meise Botanic Garden.

Additionally, the economic botany collection was and is currently still occasionally supplemented through acquisitions made by botanists, private individuals and institutes.

The restoration of the economic botany collection at Meise Botanic Garden commenced in 2013. The vast majority of the specimens were well preserved after more than 100 years thanks to the right choice of receptacles that are still visually very attractive today. The specimens as such were limitedly documented but combining the data from the Library and Archives of Meise Botanic Garden, encompassing original publications, inventories, letters, and an array of on-line resources, led to the tracing of many series. One of the oldest series dates back to 1835 and consists of Brazilian wood samples collected by Samuel Blanchet, the Swiss consul of Bahia. Even older specimens can be traced to the Rigouts-Verbert collection from the early 1800s, in addition to a Venetian theriac<sup>1</sup> sample from 1603, a fragment of a wreath from an Egyptian coffin of the Greek-

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<sup>1</sup> Theriac is a historical medicinal concoction, originally formulated as an antidote to poisons and later used as a universal remedy for various ailments

Roman period, and last but not least Jurassic remains of fossilised sea-urchin radiolas of *Balanocidaris glandifera* Goldfuss, known as “Lapis judaicus” (fig. 3).

The chronological arrangement of these specimens acts as a material illustration of the history of Meise Botanic Garden, while also endowing the specimens themselves with enhanced context. The process of rehabilitation and restoration still goes on at present.

Within this publication, we delve into the economic botany collections of von Martius, the State Botanic Garden, and Van Heurck, offering an overview of their most important contributors. Fig. 4 summarizes the acquisition periods, main countries of origin, the economic use, and the known or estimated number of the specimens per contributor. Table 2 shows a selection of specimens discussed in this publication and their economic use.

The main aim of this article is to offer an overview of the economic botany collection housed at Meise Botanic Garden. It focuses on the collection's history and development, highlights the individuals and organizations that have contributed to its development, as well as significant events such as World Exhibitions that have shaped its history.

## Overview of the collection

### Von Martius collection

Carl Friedrich Philipp von Martius (Erlangen, 1794 – München, 1868)

Carl von Martius was a trained pharmacist, physician and botanist. Together with Johann Spix, a physician and zoologist, he embarked on an extensive exploration journey in Brazil from 1817 to 1820, covering a distance of c. 10,000 km (Helbig 1994). Their expedition extended beyond botany and zoology, delving into geology, anthropology, and linguistics. The plant specimens, objects and products they collected during this expedition found their destination in the Botanic State Collection in Munich.

Subsequently, von Martius assumed the position of director of the Munich botanic garden and a professorship at the University of Munich. He focused on the Herbarium Martii, his private collection, which he continued to expand until just two months before his death. In addition to his Herbarium Martii, he published two monumental works: the *Historia naturalis palmarum* and the *Flora Brasiliensis*. Both of these became enduring reference works in the fields of taxonomy and biodiversity.

In 1869, the Belgian State acquired the Herbarium Martii, just a year after the passing of von Martius (Diagre 2006). The collection of von Martius consists of five subsets: his fruit and seed collection, wood collection, plant product and drug collection and part of his palm collection, which currently form an integral part of the economic botany collection. The fifth subcollection is von Martius's herbarium (Eichler 1869).

Special mention should be made of von Martius's collection of palms, which is unique in the world. Von Martius is acclaimed as the ‘father of palms’ (fig. 5), and apart from the great significance of his palm collection for taxonomy, it also contains material with economic importance, including palm seeds, fibres and exudates (Leyman et al. 2016). For example, one of the palms that von Martius renamed and pictured in the “*Historia naturalis palmarum*” is *Copernicia prunifera* (Mill.) H.E.Moore, which yields the valuable carnauba wax (*Copernicia prunifera*) (fig. 6). Marcos Antonio de Macedo – Brazilian governor of Piauí – not only provided von Martius with wax in different forms (from

powder to processed candles); he also complemented the product with a detailed study in order to propose it for analysis to the Sorbonne in Paris (De Macedo 1867). At that time, he had already mentioned its quality as polish for parquet floors and introduced the wax at the World's Fair in Paris, 1867 (Seemann 2008). This highest quality natural wax, now also used as a glazing agent for fruits, illustrates how historical economic botany collections may still have economic potential today.

Carl von Martius built a worldwide network of more than 300 contacts (von Martius 1868). Among these, five emerged as principal contributors to the economic botany collection and are discussed below.

Theodor Wilhelm Christian Martius (Erlangen, 1796 - Erlangen, 1863)

Carl von Martius's brother, Theodor, followed in the footsteps of his father Ernst, court pharmacist in Erlangen. He became a pharmacologist and taught pharmacognosy at the University of Erlangen-Nürnberg. He meticulously assembled a collection of medicinal substances, consisting of six sets, designed to serve as didactic material for his students, who included aspiring doctors, pharmacists and chemists (Martius 1832). Duplicates of these collections were made in order to sell and expand the collection. In a transaction in March 1863, C. von Martius acquired one of these duplicates from T. Martius for his Herbarium Martii (von Martius 1868). These drugs, now in Meise Botanic Garden, are stored in glass jars with characteristic, recognizable labels and can be traced in a ten-part, handwritten manuscript by Theodor in 1857, and housed in the archives of Meise Botanic Garden.

As reflected in his drug collection and in his publication on pharmacognosy of the plant kingdom (Martius 1853), T. Martius maintained a classification based on the relevant plant part ("Radices, Cortices, Gemmae, Folia, Herbae, Flores, Fructus, Semina"). Technical products ("von Pflanzenauswüchse, Pflanzensatzmehle, Pflanzenpigmente, eingedickten Säfte, zuckerartigen Producte, Gummata, Resina, Gummi-Resina, Fetten und ätherischen Oelen, und von Web-, Faser- und Seilerstoffe") (plant exudates, starches, pigments, concentrates, sugary substances, gums, resins, fats and essential oils, and weaving, fibre and rope materials) complete the classification. His drug collection also contains Brazilian medicines, collected by his brother during the expedition with Spix. Notable among these is "Herba Tayuyae" (*Cayaponia tayuya*), named after the indigenous Caiapó tribe by António Luis Patrício da Silva Manso in 1836.

An especially remarkable series originates from the Great Exhibition of the Works of Industry of All Nations, the first international exhibition, held in London in 1851. The East Indian collection of raw materials from this exhibition was entrusted to T. Martius at the University of Erlangen-Nürnberg. T. Martius described the collection in great detail for the visitors (Martius 1853). Today, interested parties can view specimens of cotton fibre (fig. 7), both seed cotton and ginned cotton ("ungereinigte and gereinigte Baumwolle"), along with the beautiful, old handwritten manuscript for his publication. This manuscript is rendered comprehensible by consulting T. Martius's printed and corresponding numbered catalogue. His extensive tea collection is also well documented with data on provenance, denominations and prices in the associated manuscript.

In addition to T. Martius's drug collection at Meise Botanic Garden, the main and most complete collection is housed at the Friedrich-Alexander-Universität (FAU) in Erlangen-Nürnberg, bought by the university in 1862 (Thoma 2004), and a duplicate collection is present at the University of Vienna, bought in 1854 (<https://pharmakognosie.univie.ac.at/division/historic-collections/>). Of the ones in the universities of Berlin, Edinburgh and Halle little or nothing seem to remain.

Heinrich Rudolf Wilhelm Wullschlägel (Sarepta, 1805 – Berthelsdorf, 1865)

Heinrich Wullschlägel, a member of the Moravian Brotherhood, renowned for its international missionary work, embarked on a life of service. He was first dispatched to Antigua and later to Jamaica. Between 1849 and 1855 he resided in Suriname as head of the Evangelical Brotherhood in the capital, Paramaribo. He travelled along the east coast of Nicaragua before returning to Europe and being appointed as a bishop (Haarnack 2015).

Wullschlägel worked closely with von Martius between 1851 and 1863, collecting material in the districts of Paramaribo and Para (von Martius 1849, 1851, 1854). He provided von Martius with plants, wood and bark samples, fibres, fruits and seeds in exchange for books.

Wullschlägel documented the plant material with detailed information on his labels and manuscripts in his own, distinctive handwriting. He mentioned the common names of the plants in several languages, including German, lingua franca (“Neger-Englisch”), Arawakan and languages of the Caribbean. Furthermore, he detailed the properties and uses of the plants or plant parts. For example, he noted that the wood ashes of “kwepie” (*Couepia guianensis*) are used in firing pottery. A number of his wood samples refer to the tree plantation “Onverwacht” along the Para creek, including “pekrehoe/pegrekoe” (*Xylopia frutescens*), prized for its fine and elastic wood and the multifaceted use of its fruit as a spice and a medicine.

He also described a unique numbering system for collection numbers via incised label edges (fig. 8). Various specimens with these labels can be supplemented by the manuscript data. He recorded fascinating facts, such as the collection of germinating seeds of the water chestnut (*Pachira aquatica*) along the Marowijne River, the consumption of the “switiboontje” (*Inga* spp.) pod when green, and the popularity of “Caneelapfel” or custard apple (*Annona squamosa*) in Surinam due to its sweetness.

Theodor Peckolt (Pechern, 1822 - Rio de Janeiro, 1912)

Theodor Peckolt is considered today as the father of Brazilian ethnopharmacology (Paraense Dos Santos 2005). He studied pharmacy and practised his profession in several German cities. On the recommendation of Heinrich Gustav Reichenbach, he found employment at the Hamburg Botanic Garden. There he came into contact with von Martius - at the time director of the botanic garden in Munich - who was diligently working on the Flora Brasiliensis. In 1847, von Martius contracted Peckolt to study the tropical flora in Brazil and to furnish herbarium material.

Between 1848 and 1851, Peckolt crossed several states of Brazil. During his travels he dedicated substantial attention to the plants used in folk medicine and examined their therapeutic effects. In Cantagalo he established a pharmacy equipped with a laboratory, where he complemented the morphological research on herbaria with the results of his chemical analyses.

He emerged as a pioneering figure in the field of phytochemistry, analysing more than 6,000 useful Brazilian plant species. His correspondence and the dispatch of plant material to von Martius were facilitated through the imperial court of Pedro II and the German consular service in Rio de Janeiro. Between 1858 and 1867 he regularly sent wood samples, herbarium material, larger fruits preserved in liquid and plant products. The wood samples present in Peckolt’s collection can be retraced through the manuscript of von Martius (1858).

At the first Brazilian National Exhibition of 1861 held in Rio de Janeiro, Peckolt presented a collection featuring 146 products extracted from native plants. Subsequently, at the International Exhibition of 1862 (World Fair) in London, he exhibited 225 products including plants, roots and seeds, starches,

resins, gums, ethers, oils and dyes. Von Martius acquired part of these products in 1863 for his Herbarium Martii through his son Carl Alexander (von Martius 1863). The list of Brazilian products exhibited in 1862 by Peckolt (Anon. 1862) can be compared with von Martius's aforementioned manuscript (von Martius 1863) and the existing material. More details can be found in Peckolt's publication (Peckolt 1861) about his products exhibited in Rio de Janeiro in 1861. Among the noteworthy items are "orceilha do Brasil" or Brazilian orchil (*Spiloma roseum*), a red lichen dye. Amongst the starches is the purgative "batata de purga" (*Operculina macrocarpa*) and the edible cinnamon-leaf yam (*Dioscorea cinnamomifolia*). Some of the seed hair fibres represented (fig. 9) are from the floss silk tree (*Ceiba speciosa*), silk-cotton tree (*Bombax ceiba*) and bloodflower (*Asclepias curassavica*) which are used as stuffing material.

Charles Eugène Aubry-Lecomte (Paris, 1821 - 1898)

A number of French economic botany products exhibited during the International Exhibition of 1862 in London, in addition to those discussed earlier of Peckolt, reached von Martius in 1864 via Charles Aubry-Lecomte. These consist of two series originating from the French colonies: medicinal drugs from Réunion, French Guiana, Martinique, India, Senegal, Tahiti, New Caledonia, Gabon and Cochinchina (von Martius 1864), and wood samples from French Guiana (von Martius 1854-1868). Notable items include the root of "liane de boeuf" (*Danais fragrans*), listed as materia medica of Réunion and used to treat herpes. The wood samples of French Guiana (fig. 10), including "angélique, bagasse, cèdre noir, courbaril, grignon, sassafras and wacapou" (Table 2), are registered as timber for naval construction. They are part of the "Herbarium Martii" and the economic botany collection.

Von Martius's manuscripts also make reference to Chasseloup-Laubat. Justin Napoléon Samuel Prosper de Chasseloup-Laubat, a marquis, is the French Minister of Navy and Colonies between 1860 and 1867. It is on his orders that this series of products reached von Martius via Aubry-Lecomte.

Aubry-Lecomte, initially a marine officer stationed in Senegal, was a passionate collector of ethnographic objects. His journeys took him to Gabon, Oceania and the Indian Pondichéry territory. Upon returning to Paris in 1859, he looked after the collections and the influx of economic products from the colonies. He was appointed as the first curator of the "Exposition Permanente des Colonies", which later became the "Musée des Colonies françaises". Even after his retirement in 1879, he continued going on missions and teaching in the museum. His keen interest is also reflected in his publications (1865-1866) on the cultivation of tea, cocoa, coffee, cotton, tobacco, textile fibres and sugar cane in the French colonies (Piralla-Heng Vong 2012). In one of his publications, Aubry-Lecomte (1875) discussed the World Fair in Vienna in 1873, where the Belgian reporters Monsieur Bernardin and Gustave Delchevalerie were also present. Their contributions are discussed further in this article.

Johannes Elias Teijsmann (Arnhem, 1808 – Buitenzorg (Bogor), 1882)

Johannes Teijsmann travelled to Java in 1829 as the gardener of the governor-general resident in Buitenzorg. Adjacent to the palace garden, a botanic garden had been established, and named "'s Lands Plantentuin" (National Botanic Garden). Teijsmann's craftsmanship and special interest in botany quickly earned him the position of head gardener of the botanic garden, a role he assumed in 1830 and held until 1869. He doubled the area of the garden and enriched it with more than 9,000 species. 's Lands Plantentuin gained renown for its research on botany and acclimatization, . The

garden became a hub for the distribution of new crops. Teijsmann worked on the cultivation of vanilla, especially focussing on pollination techniques, and the ‘fever’ tree (*Cinchona* spp.). In the Dutch East Indies, he introduced important crops like cotton, camphor and Chinese cinnamon (Doornbos 2021). Even after his retirement, he continued travelling in the region, collecting a vast number of plants for the garden, and describing hundreds of species (Teijsmann 1863).

Teijsmann established a connection with von Martius, providing him with plant material from Java in 1866 (von Martius 1866). This included, apart from herbarium specimens, woods, (fig. 11a), fibres and paper samples. One sample of Manilla hemp fibre (*Musa textilis*) (fig. 11b) mentions “koffo” on the label, which appears to be the common name in Minahasa (northern region of Sulawesi), while “abaca” is its name in the Philippines (Wigman 1901). A beautiful series of Javanese wood samples includes the fever tree or quinine producing cinchona (*Cinchona* spp.), originating from the Andes and cultivated in the “Bergtuin” (mountain garden) of Tjibodas, founded by Teijsmann in 1825.

Not only von Martius but also the State Botanic Garden in Brussels was in contact, in 1885 and 1930, with the Buitenzorg Botanic Garden, as well as Edward Frison, the Antwerp micrographer, also around 1930.

### **State Botanic Garden Brussels collection – post-von Martius**

#### Royal Horticultural Society of Belgium

The economic botany collection of the State Botanic Garden in Brussels still comprises a number of specimens from its predecessor, the “Société Royale d’Horticulture de Belgique” (Royal Horticultural Society of Belgium). Archived letters from 1854 attest the intention to establish a botanic museum.

Some Algerian products which were exhibited in the first “Exposition Universelle” in Paris in 1855, came to the Society. In an archived letter of 1856, Edmond Bouvy, a French attaché of the Ministry of War for the commercial affairs of Algeria and in charge of the museum of Algeria (Piralla-Heng Vong 2012), pointed out that economic products, lacking in the Society’s horticultural museum, could be provided. As a result, several economic products such as processed flax, cochineal, safflower and seeds of rye were donated to the Society (Table 2). Bouvy also maintained contact with Carl von Martius.

Already before 1870, the Society also established connections with Vilmorin (later known as Vilmorin-Andrieux) (fig. 12), a Parisian seed company which was internationally renowned for its selection work (Diagre 2003), and obtained seed samples, including those from the bean family.

Monsieur Bernardin (discussed later in the article) too exchanged specimens with the Society. A letter from 1858 attests this along with specimens of Turkish gum arabic, ‘vegetable wool’ of pine needles, mate leaves and finely woven ramie fabrics (Table 2). He is discussed further in this article.

#### Jean-Édouard Bommer (Brussels, 1829 – Brussels, 1895)

Jean-Édouard Bommer (fig. 13), a key figure in the history of the Botanic Garden, joined the “Société Royale d’Horticulture de Belgique” (Royal Horticultural Society of Belgium) in 1855. During that year, the concept of establishing a botanic museum was first proposed. At the time of the sale of the Society to the State Botanic Garden in 1870 J.-E. Bommer was director of collections. In his work titled “Notice sur le jardin botanique de Bruxelles”, he described the complications of the transition and the purchase of the Herbarium Martii (Bommer 1871). Within the newly established botanic garden, Bommer was the driving force in the development of the scientific collections as curator of

both the herbarium and the living plant collections. His desiderata for the botanic museum are flagged in the successive catalogues of world's fairs. He held his position in the Botanic Garden from 1871 to 1895 (Lawalrée 2001).

J.-E. Bommer laid the foundations for the economic botany collection and highlighted the substantive and logistical facets inherent to such a collection in "Remarques sur l'arrangement et la conservation des collections de produits végétaux" (Bommer 1880). Remarkably, many of these aspects remain integral to the economic botany collection today, more than 140 years later, as described in the subsequent text. Plant products were to be stored in glass jars whose rims and those of the stopper are ground with emery to make them waterproof. J.-E. Bommer listed 25 sizes, the most common of which ranged in size from 11 cm in height and 3 cm in width to 33 cm in height and 18 cm in width. The monolingual, pre-printed labels of the garden were to be written with indelible "blue black" ink of the English brand Stephens. Preference was given to specimens representative of the species and the preferred species were economic crops. The amount of material held was related to the research potential; research on medicinal plants, for instance, required considerable supplies. Even detailed sizes for wood, bark and textile samples were specified. J.-E. Bommer proposed two possible classification systems: the scientific and the practical, expressing a preference for the latter, although it was not ultimately adopted, as evidenced by the current organization of the collection. Starting from 1888, the economic botany collection and the herbarium were rearranged according to Théophile Alexis Durand's *Index generum phanerogamorum* (fig. 14) which listed 8,349 genera of seed plants (Durand 1888).

Charles Bommer (Brussels, 1866 – Brussels, 1939)

J.-E. Bommer's son, Charles, had the same dynamism and became the founder of the Forest Museum at the State Botanic Garden in Brussels and of the Arboretum of Tervuren, both inaugurated in 1902 (Galoux 1969). They were both arranged according to the geographical distribution of the plant species.

Charles Bommer's great interests in mycology, dendrology, photography and botanical drawings are reflected in the economic botany collection.

At the Forest Museum, he established the very first Belgian wood collection, a considerable portion of which had been previously acquired by his father. He presented these wood samples both free-standing and in display cases and tables. The whole was completed with leafy branches, fruits, specimens showing plant diseases, pictures and botanical drawings, all essential in research. The xylarium of Meise Botanic Garden now includes the specimens of the former Forest Museum. Among these specimens is a section of a 324-year-old silver fir from the Carpathian Mountains. The original numbers are stamped into the samples (fig. 15) and refer to a card classification in use at that time. A selection of these specimens is currently displayed in the WOODlab of Meise Botanic Garden.

Hélène-Émilie Durand (Watermaal-Bosvoorde, 1883 – Ukkel, 1934)

Hélène-Émilie Durand was a distinguished expert in botanical drawings and watercolours, as evidenced on the glass plates at the Forest Museum and in several books published by Charles Bommer and stored as valuables in the Library of Meise Botanic Garden. Recognizing the crucial value of botanical illustrations in herbaria, Bommer emphasized that the botanical drawing adds undeniable value to the herbarium and stated: "Qui mieux qu'un artiste, en effet, peut alors -et

encore- rendre les délicats coloris et détails des plantes, que la conservation en herbier tend à rendre moins lisibles?” (Van Biervliet 2020).

For the Forest Museum, besides drawings and watercolours, Durand also made exceptional glass paintings to accompany a series of Japanese wood samples dating from the third World’s Fair in Paris in 1878 (Fig. 16a). The number on the back of the glass paintings by chance revealed the link with the wood samples. Among her delicate works were depictions of kaki or Japanese persimmon, Japanese pagoda tree, Japanese boxwood, keaki or Japanese elm and sugi or Japanese cedar (Table 2). A two-volume publication describes conifers and cycads cultivated in the Arboretum of Tervuren and the State Botanic Garden in Brussels (Bommer 1919-1930). Each species featured in the publication was accompanied by a full-page watercolour drawing (Fig. 16c). The plant part she was inspired by is in some cases still in the collection. For instance, a branch of the Japanese umbrella pine or kooyamaki (*Sciadopitys verticillata*), grown in the Arboretum and stored in liquid in a remarkable quadrangular jar (fig. 16b).

Monsieur Bernardin – Joannes Jacobus (Jean) de Waele (Brugge, 1817 – Melle, 1889)

In 1838 Joannes de Waele joined the Congregation of the Josephites in the Maison de Melle Lez-Gand, and changed his name to Monsieur Bernardin. In 1847 he started teaching in this private boarding school, focusing on literature, languages, mathematics, sciences, law, trade and industry. He took charge of the course on commerce and natural sciences. For his practical classes, he established and curated the Commercial-Industrial Museum, among other museums within the college. Through a series of annual reports titled “Notice sur les collections scientifiques et sur le Musée commercial-industriel”, Bernardin created publicity for the internationally renowned college. The museum continued to exhibit new materials and equipment in use by industry at that time. By 1866, his collection included over 13,000 specimens from the various continents. He also published several booklets in multiple languages—French, English, German, Dutch, and Spanish— about the classification of vegetable oils, fibres (fig 17a), tanning agents, rubber and gutta-perchas, animal oils, soaps, and starches, as well as studies of the commercial products of Central Africa, and the natural resources of the globe. The diverse products of Bernardin now in the economic botany collection at Meise Botanic Garden hold invaluable contextual information (Leyman 2022). For example, seeds of “lucrabau” (*Gynocardia odorata*) from Thailand, known from the extracted chaulmoogra oil which is efficient against leprosy, is linked with the journey of the frigate Novara from 1857 to 1859 which was the first German travel around the world by boat. Bernardin refers to the travel report of Karl von Scherrer who described these seeds collected in Siam. Bernardin, in the meantime, translates the preparation and use of the oil which can be read on the label of the specimen.

Bernardin visited the Vienna World Fair in 1873, with a particular interest on economic plants, and writes down his findings in a publication, providing detailed insights into dozens of natural products (Bernardin 1874). He gathered some of them from the oversupply of scattered novelties on display. This information, which is still valuable 150 years later in understanding the economic botany collection in Meise. For instance, he describes the two forms of Japanese isinglass (*Gelidium* spp.) or agar-agar (fig. 17b, c), exactly as they appeared in the collection in 2015. His information confirms the result of the recent search on the non-documented specimens. The publication is full of innovative ideas. A noteworthy novelty for the paper industry in 1873 was the 'sausage skin made of vegetable parchment' manufactured in Wurtemberg (species not mentioned). Bernardin concluded with a foresightful statement about the untapped potential of numerous products scattered across the globe, possibly leading to new industrial applications—a statement that remains pertinent even today.

Teaching for four decades, Bernardin gained international acclaim. His museums of ethnography and geography in particular are still famous today in what is now known as the College of Melle.

Gustave Delchevalerie (Vedrin, 1841 – Chaumes-en-Brie, 1899)

Gustave Delchevalerie, a Belgian horticulturist, initially gained recognition for his expertise in the parks and gardens of Paris before embarking on a journey to Egypt in 1868 (Wilkinson 2010). He entered the service of the Khedive of Egypt and Sudan, Isma'il Pasha, who modernised his country based on the European model. Delchevalerie provided his expertise in the start-up of an agricultural school and nurseries and reformed the acclimatisation garden.

Delchevalerie published mainly on garden architecture and horticulture. He collected and described agricultural and horticultural products and sent specimens to the State Botanic Garden in Brussels. These included wood samples from the banks of the Nile and different samples of dates, cotton (fig. 18) and tobacco, all listed in his unpublished manuscript and still present in the collection today.

At the World's Fair in Vienna in 1873, he was a member of the Egyptian Commission and international jury member. His report from the fair emphasised ornamental plants in particular (Delchevalerie 1873).

“Expositions Universelles” in Paris (1855, 1878, 1889)

The third World's Fair in Paris, held in 1878, held significant importance for the development of the economic botany collection of the State Botanic Garden in Brussels, which received an extensive collection of useful plants and products from the French colonies. This acquisition was made possible through the “Exposition permanente des Colonies” and its curator, Charles Aubry-Lecomte, who is discussed above.

The French overseas territories, which were widely dispersed geographically, comprised Cochinchina, Gabon, Guadeloupe, Guinea, French Guiana, India, Madagascar (Île Sainte-Marie), Martinique, Mayotte and Comoros, New Caledonia, Tahiti, Réunion, Saint Pierre and Miquelon, and Senegal.

The collection obtained was vast, covering a wide array of categories including wood, textiles (fig. 19a), tanning and dyeing agents, gums and resins, rubbers, perfumes, fats and oil products, waxes, spices and condiments, stimulants and narcotics, medicinal plants, fruits and seeds, cereals, starches, sugars and saponins. The uncovering of the collection is still ongoing. The handwritten, original lists of these acquisitions are subdivided by country and by category and include scientific and common names.

In the publication “Catalogue des Produits des Colonies Françaises à l'Exposition Universelle” of 1878 (Anon. 1878b), many species appearing in the economic botany collection were marked with a red pencil most likely by J.E. Bommer. These include, for example, around a hundred selected wood species of Sainte-Marie de Madagascar.

In addition to the products from the French colonies, there are acquisitions from other countries including Japan, the United States, Haiti, Peru, Egypt, Australia, Argentina and El Salvador. The Salvadoran products are ticked off, this time in blue, in “Catalogue des objets exposés par la République du Salvador” (Guzman 1878).

A limited number of specimens in the collection originate from the first (1855) and fourth (1889) World's Fairs of Paris. From the 1855 Fair, there are fibre specimens from British Guiana obtained via the Museo Herbario Parisiensis (fig. 19b); and from the 1889 World Fair, there are Argentine wood specimens originally destined for the former Forest Museum in Brussels

Products of the second World's Fair in Paris in 1867 only appear in the Henri Van Heurck collection, described later.

#### Government of Calcutta (1887-1888)

In 1888, the Revenue and Agricultural Department of the Government of India supplied a collection of Indian economic products to the Government of Belgium (Mukharji 1887). The corresponding printed archive list mentions 420 plant species comprising plant parts and products, and some minerals and silk. Among the examples are four specimens of munj sweetcane (*Triplidium bengalense*) represented by flower tops, straw, fibre and rope (fig. 20). Another example is bark of the yellow mangrove (*Ceriops decandra*), the sap of which yields a black, tannin rich dye used in the 'batik' industry and in preserving fishing nets.

Although the original labels of the specimens do not specify their provenance, their unique characteristics trace them back to Calcutta (now Kolkata). Some labels are printed, listing various Indian common names, while others are handwritten in elegant script on linen-coated paper, with details that correspond perfectly with the previously mentioned archive list.

#### Emil Holub (Bohemia, 1847 – Vienna, 1902)

Emil Holub studied medicine at the Charles-Ferdinand University of Prague. He became a physician but his interest in natural sciences and archaeology led him to South Africa in 1872 where he started his practice in Kimberley. He undertook three expeditions but eventually succumbed to malaria.

Holub's collections, housed in various institutions, including the Naturhistorisches Museum Wien (Mauthe 1997) and the National Museum (Prague) are among the earliest holdings from South Africa (Mauthe 1997; Jiroušková et al. 2011).

In 1876, the State Botanic Garden acquired Holub's herbaria and about a hundred economic botany specimens. He documented the latter thoroughly (with description, local use, location and common names) in a handwritten catalogue (fig. 21a). One of these specimens was a giant sorghum species "mobele" (*Sorghum bicolor*), commonly cultivated in South and South-central Africa for its use as a cereal and production of "butschuala" beer and the stronger "mo-timbo". Holub's material is stored in very distinctive glassware and some species are meticulously mounted on thin glass slides (fig. 21b).

#### Charles Lallemand (France, -1878-)

Charles Lallemand was a pharmacist. He moved to Algeria and opened a drugstore in l'Arba (later called Larbaâ) near Algiers. Lallemand studied the native flora and fauna (including vesicating beetles, molluscs and leeches) which provided an arsenal of therapeutic products (Bonnemain 2009).

A collection of Lallemand, consisting of medicinal and industrial products of Algeria and accompanied by a handwritten list (fig. 22a), eventually found its way to the State Botanic Garden in Brussels. An

example is medicinal “garou” bark (*Daphne gnidium*) (fig. 22b). This list dates from around 1878. Lallemand is also mentioned in the accompanying catalogue of the Algerian colony at the World’s Fair in Paris (Anon. 1878a). It enumerates agricultural and industrial products. He was one of the exhibitors in group 5 (extractive industries, raw and manufactured products), class 47 (chemical and pharmaceutical products).

Ambroise Delacre (Brussels, 1859 – Brussels, 1926)

Ambroise Delacre was the firstborn son of Charles Delacre, who opened a pharmacy (“Pharmacie anglaise”) in Brussels in 1853. Charles Delacre also sold chemical specialties, Chinese tea and cocoa, which led him to the manufacturing of chocolate and later the famous Belgian Delacre biscuits in Vilvoorde. Ambroise Delacre also studied pharmacy and in 1884 took over the business of his father situated at Coudenberg, previously known as Rue Montagne de la Cour (Lausberg S. 1999). Notable among his listed specialties were products like quinine toothpaste, tincture of myrrh and borax, castor oil pomatum and genuine American bay rum (Anon. n.d. b)

In 1881 and subsequent years, the State Botanic Garden in Brussels obtained his private “Collection Ambroise Delacre”, encompassing medicinal products, bark, and wood samples from various parts of the world. One document in the Meise archives lists an exchange of specimens with the Herbarium Martii. Other specimens originate from the collections of Bernardin. Ambroise also orders products from various companies such as: Fougere (Brooklyn), Gehe & Co (Dresden), Evans, Lescher & Webb (London), and Delvaille et Attias (Paris). Of the latter company, a revealing delivery receipt illustrates a series of cocoa bean cultivars, shipped by high-speed from Paris to Vilvoorde, and still part of the collection today. The cocoa bean jars of Delacre (fig. 23a) are distinctive for their stoppers containing a dehydrating powder (Fig 23b).

The second, stylish pharmacy of Delacre, also located at the “Coudenberg” in Brussels, is now a listed building. The inscription “Pharmacie anglaise – Ch. Delacre” can still be seen on the façade.

Albert-Louis Sapin (Charleroi, 1869 – 1914)

Albert Sapin graduated as a pharmacist from Ghent University in 1891 where he then started to work as a “preparationist” (laboratory assistant). By 1894 he became head of the laboratory at the A. Delacre pharmacy in Brussels. Three years later, in 1897, he set up his own pharmacy in the capital. In 1902, he joined the Congo Free State as attaché to the medical service in Boma. He collected many documents and data of a botanical, cultural and economic nature. He obtained his doctorate in 1905 and was sent on scientific and economic missions (Coosemans 1952). Labels from various herbaria mention, for example, “Mission scientifique de la Compagnie du Kasai”. It is from this last mission in Ubangi, in 1912 and 1913, that his economic botany specimens originate. Some of these include excellent plant fibres, and labels detailing the processing method: raw, processed and manufactured banana (*Musa* sp.) and pineapple (*Ananas sativus*) leaves (fig. 24), alongside n’kosa bast fibre (*Manniophyton fulvum*) and barkcloth (*Ficus* spp.). In 1914 he returned to Belgium for a brief stay but unfortunately died in 1914 after a trivial accident.

Museum Botanicum Horti Bogoriensis (1885, 1930)

A letter dated February 1885 from Melchior Treub (director of “’s Lands Plantentuin” in Buitenzorg from 1880 to 1910) to François Crépin (director of the State Botanic Garden from 1876 to 1901) emphasizes the collaboration between the two botanic gardens and describes a shipment of

Javanese plant objects packed in four boxes. These objects included herbarium specimens of economic plants, coffees and economic fruits preserved in liquid. Treub expressed the wish to exhibit some of these objects at the World's Fair in Antwerp that same year. The labelling of the jars containing fruits from the "Museum Botanicum Horti Bogoriensis" (fig. 25a) is house-styled and also mentions the Javanese popular name: e.g. "pisang, manga, advogado" (Table 2).

Later, in 1930, another shipment from "'s Lands Plantentuin" in Buitenzorg reached the State Botanic Garden in Brussels. This time, it consisted of a large series of well-documented, Javanese wood samples from the forestry research station "Boschbouwproefstation" that are shipped from Java to Amsterdam with the M.S. Christiaan Huygens. The information provided by the labels consists of scientific and common names, durability rating and use. For example, the label of Indian sandalwood (*Santalum album*) specifies its various applications for medicinal purposes, carving and its fragrant heartwood. Also four, less obvious mangrove wood samples -tandjang or black mangrove (*Bruguiera gymnorhiza*), tingi or spurred mangrove (*Ceriops tagal*), bakau or red mangrove (*Rhizophora mucronata*) and baropa or apple mangrove (*Sonneratia alba*)- are included (fig. 25b).

"Jardin Colonial de Laeken" (J.C.L.) (Brussels, 1900-1951) and "Jardin Botanique et jardin d'Essai à Eala" (near Mbandaka formerly Coquilhatville, 1900-to this day)

A decree from 3 February 1900 by Leopold II found in the library of the Meise Botanic Garden stipulates the creation of a botanic and a trial garden in Congo, and a colonial garden in Belgium. The latter was to provide the former with plants, chosen by the state, to be introduced as new crops in Congo (Anon. 1900)

The colonial garden in Laken, near Brussels, was dedicated to gathering suitable and economically important plant species aimed at developing agriculture in Central Africa. René Kinds, appointed director of the colonial garden, oversaw the cultivation of these plants and prepared them for shipment to Congo by boat. At the port of Antwerp, he provided final instructions for their successful transport (Comeliau 1952). Kinds published a list of these plants, cultivated in 1911 (Kinds 1912).

In addition to his horticultural skills, Kinds also excelled in applied agricultural research. For example, Kinds explored the "mabondo" nut (*Osmorhiza aristata*) as a potential African equivalent of the American palm nut, corozo (*Phytelephas macrocarpa*), the well-known vegetable ivory (Kinds 1924). Kinds had these nuts processed into buttons in the Brussels Gauthier factory. He arranged nuts and buttons in glass-fronted cases, still in the economic botany collection in Meise (fig. 26a). Some products, such as cassava flour (*Manihot esculenta*) and seeds of oil palm (*Elaeis guineensis*), were stored in decorative glass jars, all with distinctive labels, elegantly handwritten and with the letters 'J.C.L.'. Other examples include palm and palm kernel oil from the oil palm (fig. 26b) and an ample range of coffee bean samples.

The Botanic Garden in Eala grew tropical economic crops, including foods, feeds, fibres, oils, pharmaceutical, ornamental, and industrial crops. Seed and plants from the propagation nurseries were exchanged with similar institutions or bought by companies and individuals. The first list of cultivated plants published in 1908 includes around 820 species, varieties and cultivars. It mentions whether seeds or plants were available in addition to information about common names, use and origin (Anon. 1908).

From the Botanic Garden in Eala, mostly plant fibres appeared in the economic botany collection, apart from some fruit and seed specimens. A valuable report from around 1940 listed 36 fibre plant

species, detailing crucial information such as the weight of the crude fibre material, the retting period, the weight of the fibre output and the fibre percentage (fig. 27) (Dehon 1940). The Eala fibre samples still in the collection almost completely matches those on this list. Species that provide the highest fibre yields appear to be Queensland hemp, kenaf, devil's cotton and Congo jute (Table 2).

### Van Heurck collection

Henri Ferdinand van Heurck (Antwerp, 1838 – Antwerp, 1909)

Henri van Heurck's father and grandfather had been manufacturers of paints, oils, varnishes and saccharin (of which they were the only manufacturers in Belgium and the Netherlands) since 1787 (Van Heurck 2008). Van Heurck (fig. 28) initially taught natural sciences, chemistry and physics. He eventually directed his expertise towards horticulture, botany, plant anatomy and microscopy. His dedication and contributions to the field of microscopy and diatoms established him as an authoritative figure.

In 1877 he was appointed as director-professor of the Botanic Garden in Antwerp. Under his guidance, the garden was thoroughly renovated and a museum was added, known as the "Musée botanique du Dr. Henri van Heurck". In this way Van Heurck could offer a comprehensive educational package covering systematic, anatomical and medico-commercial botany to trainee pharmacists, teachers and professors, army officers, and enthusiasts. It was in the Botanic Garden of Antwerp -in 1893 and 1895, before the foundation of the Colonial Garden in Laken- that Van Heurck took care of the plants which were to be shipped to Congo. He invested a fortune in enriching his museum, investing significantly in expanding his herbarium, library and drug collection (Van Camp, Dorikens, Dorikens-Van Praet, Haustraete 2004). In his drug collection, which includes crude drugs, derivatives, excipients and forgeries, the famous materia medica collection of Verbert-Rigouts is the basis. This collection goes back to 1763 which means that the drogarium contains unique products that were no longer available in 1876 (Verleyen 1942). He classifies the specimens according to A.P. de Candolle's *Prodromus Systematis Naturalis Regni Vegetabilis* (Van Heurck 1876).

Separate specimens of larger, exotic fruits and products, in addition to the old collection of wood samples collected by Blanchet in Bahia in 1835, are also represented. A large seed collection from the company of Frans De Beucker is embellished with a range of decorative glass jars. It also features two materia medica cabinets (fig. 29a) and many microscopic preparations of plants, animals and stones.

The economic botany collection of Van Heurck also incorporates a representative number of products of animal and mineral origin, which illustrates natural history in a fuller scope.

An important publication by Van Heurck for this collection is "Notions succinctes sur l'origine et l'emploi des drogues simples de toutes les régions du globe" (Van Heurck 1876), being a "Catalogue systématique de la collection de matière médicale, commerciale et industrielle faisant partie du Musée Botanique de l'auteur". This catalogue provides a wealth of information in addition to that found on specimen labels.

Van Heurck also knew how to supplement his drug collection with exceptional specimens. For example, a Venetian theriac sample from 1603 in a small metal container -catalogued as pharmaceutical curiosity- with the inscription "Teriaca fina alla Testa d'Oro in Venet" (fig. 29b), is one of the oldest specimens in the economic botany collection of Meise Botanic Garden. Theriac is the legendary antidote to a broad spectrum of poisons.

Below are some of the important individuals and institutions which contributed to Van Heurck's economic botany collection. Pharmacy again plays an important role, as can be seen hereafter starting with three successive generations of pharmacologists-naturalists.

François Mathieu Verbert (Sint-Katelijne Waver, 1769 – Antwerp, 1854)

Mathieu Verbert commenced his professional career as an apprentice pharmacist before transitioning to manage a chemical products factory. Verbert opened his pharmacy office in Antwerp in 1797. In 1812, he obtained the exceptional title of pharmacist first class after an exam in Paris (Frison 1959). From the end of the 18th century, he started his collection of drugs -some from 1763-, which would continuously serve as demonstration material for the medico-botanical classes in Antwerp between 1819 and 1908, utilized in his own classes and later by F. Rigouts and Van Heurck (Aernouts & Frison 1959).

Verbert's distinct and authentic jars at Meise Botanic Garden are easily recognisable, characterized by teal-edged and handwritten labels and jars that are sealed with paper and string. His specimens represent the earliest economic botany collection of significant size of Meise Botanic Garden.

One of the ancient drugs, allegedly blood-purifying, is red coral (fig. 30a). Its classification as zoophyte was controversial and made it a luxury collectable in naturalia cabinets in the 17th century. Red coral was then shipped in Antwerp to trade for diamonds in India (Rijks 2019). "Conditura cadaverum" or Egyptian mummy powder is a rather unexpected specimen. Kaolin, "soude de varech" or sodium carbonate from burnt marine algae (mainly *Fucus* spp.) and "Succinum album, S. citrinum, S. rubrum, S. nigrum" being different coloured forms of amber from the Baltic sea, are some of Verbert's mineral products. Three varieties of ipecac or ipecacuanha (*Carapichea ipecacuanha*) from Brazil -a strong emetic used since ancient times- is especially worth mentioning since they originate from the collection of François Victor Mérat de Vaumartoise, who describes them extensively in his pharmacopeia (Mérat & De Lens 1837). South American copal resin from the Antilles piled up in gourd halves and tied with vegetable rope (fig. 30b), moreover illustrates the storage and transport method of this product.

François Joseph (Frans Jozef) Rigouts (Lier, 1796 – Antwerpen, 1867)

François Rigouts (aka Rigouts-Verbert) first went into training at the pharmacy of J. Van Eeckhoven in Lier. In 1821 he moved to Antwerp. In 1825 he married Verbert's daughter and took over her father's pharmacy, where he further expanded the materia medica collection. Rigouts became professor of botany, medical natural history and theoretical and practical pharmacy in 1829 (Broeckx 1868) and was appointed director of the botanic garden in Antwerp in 1856. This resulted in the creation of a botanical cabinet in which exotic and indigenous wood species were also included. Meanwhile, the young Van Heurck lived adjacent to the botanic garden; his father regularly consulted F. Rigouts, awakening the enthusiasm of Van Heurck (Aernouts & Frison 1959).

With regard to plants, F. Rigouts organised his materia medica collection, unlike T. Martius, according to Guibourt's new classification in his "Histoire naturelle des drogues simples" (Broeckx 1868). This implied that related plant genera and species (and no longer plant parts) went together.

F. Rigouts also collected every new drug on the market, as well as forgeries, bizarre and rare samples. The Rigouts-Verbert drug collection was a valuable completion of Van Heurck's collection.

The collection contains various vegetable samples, including chunks of opium (*Papaver somniferum*) as well as opium forged with clay, wax and starch. Nest pieces of the “salangane” or glossy swiftlet from Java and African lion claws are representatives of animal products (Table 2). Compounds of uranium and cobalt and tremolite – a form of asbestos – (fig. 31) are part of the mineral material.

F. Rigouts passed on his pharmacy and collection to his son Charles.

Charles Rigouts (Antwerp, 1828 – Antwerp, 1892)

Charles Rigouts, also a pharmacist, was passionate about botany, research into forgeries of medicines and foodstuffs and in the history of pharmacy. He sold his drug collection, commenced by his grandfather Verbert, to Van Heurck, laying the foundation for the "Musée botanique du Dr. Henri Van Heurck" (Aernouts & Frison 1959).

François Cools (Antwerp)

François Cools studied under F. Rigouts and gained years of theoretical and practical knowledge in his pharmacy. Cools's expertise was also often called upon in Van Heurck's botanical museum.

At the time, the type collection of the Cools's drugstore represented the Belgian materia medica and comprised more than 1,000 products. Today, the Van Heurck collection still contains a surprising number of specimens from plant, animal and mineral origin from this collection. The following specimens are an illustration of the diversity of this collection.

Carrageen moss or Irish moss (actually a red alga, *Chondrus crispus*) which contains a lot of polysaccharides is currently known as food additive E407. Petitgrain, bergamot, curacao and neroli oils are all essential oils from the bitter orange (*Citrus aurantium*). Spanish flies, ox gall extract and cod liver oil (Table 2) are animal remedies. Alkaloids like the stimulant caffeine (fig. 32a) – from coffee beans – and the toxic strychnine and brucine -from Saint Ignatius beans (*Strychnos ignatii*)- are chemical derivatives, and verdigris, “sel sédatif de Homberg” and epsom salt are among the mineral compounds (fig. 32b) in Cools's collection.

“École supérieure de Pharmacie de Paris” (Paris, -1876-) and François Gustave Planchon

Van Heurck received a considerable collection of rare and interesting products from the “École de Pharmacie de Paris” by Planchon. About half of the specimens were from Guibourt's collection, some bearing his handwritten labels.

Gustave Planchon (1833-1900) was director of this college. He supplemented the legacy of his predecessor, Guibourt. Nicolas Jean-Baptiste Gaston Guibourt (1790-1867) gained renown for his "Histoire naturelle des drogues simples", of which five editions were published between 1820 and 1851. Planchon complemented the sixth and seventh edition between 1869 and 1876, introducing a new classification system of the mineral, plant and animal kingdoms. For mineralogy, Guibourt adapted the basic elements of Ampère; for botany he followed the “Prodromus Systematis Naturalis Regni Vegetabilis” of A.P. de Candolle and for zoology the classification of Cuvier (Guibourt 1876).

The series of specimens of Guibourt is among the oldest in the economic botany collection in Meise Botanic Garden, though slightly younger than the Verbert collection.

It contains a high number of Guibourt's cinchona (also known as fever trees) bark samples (fig. 33) – yielding quinine – which are extensively described on 82 pages in Guibourt's "Histoire naturelle des

drogues simples" (Guibourt 1876). Guibourt refers to the initial research of Hipólito Ruiz (Ruiz 1792) and Hugh Algernon Weddell (Weddell 1849) from whom bark material is represented in the "Herbarium Martii".

Charles Jacques Édouard Morren (Gent, 1833 – Liège, 1886) and the World's Fair in Paris, 1867

Édouard Morren was a Belgian botanist with a special interest in bromeliads and horticulture. He became a professor at the University of Liège following in the footsteps of his father Charles Morren. He soon enriched the collections of the "Musée botanique" of the university with products of vegetable origin, diligently following international exhibitions, such as those in Paris in 1855 and 1867 (Morren 1856). In this way he offered Van Heurck a large number of valuable products from the second Paris World Fair in 1867 (Van Heurck 1876). These offerings encompassed not only novelties from the French colonies but also from diverse regions such as Cape Verde, Egypt, Syria, Niger, Angola, South Africa, Turkey, Iran, Timor, Thailand, Mauritius, Australia, Canada, Puerto Rico, the Antilles, Colombia, Brazil, Chile, Russia, Finland and Norway. Some examples of these products include Cape Verdean Canary orchil (*Roccella tinctoria*) used as dye, Australian acaroid resin or black boy 'gum' (*Xanthorrhoea arborea*) (fig. 34) -used as varnish and fragrance-, cashew tree gum (*Anacardium occidentale*) -used by bookbinders to repel insects- and Gabonese djave nut butter (*Baillonella toxisperma*) -used in the kitchen, in cosmetics, in traditional medicine and soap making.

Morren also maintained contacts with the State Botanic Garden as is shown in the archive inventory of April 1881, mentioning a series of mostly plant fibres.

Jacques Samuel Blanchet (Moudon, 1807 – Vevey, 1875)

Samuel Blanchet was a Swiss trader stationed in San Salvador de Bahia as consul of Switzerland from 1826 to 1856. Being an enthusiastic naturalist, he was one of the first to collect plant material (and terrestrial and freshwater molluscs) in Brazil's eastern states. The material was sent to Stéfano Moricand in Geneva for identification (Breure & Tardy 2020).

Dating from 1835, Blanchet's outstanding wood collection from Bahia became part of Van Heurck's Botanic Museum. It consists of uniform samples of branches, all c. 9 cm long and up to 7 cm diameter, each with a cut-out piece used for micrography (fig. 35).

Heinrich Carl Haussknecht (Bennungen, 1838 – Weimar, 1903)

Carl Haussknecht was a pharmacist who collected and studied alpine plants in his spare time. This passion introduced him to the Swiss botanist, Pierre Edmond Boissier, who was working on the Flora orientalis. Boissier invited Haussknecht to collect plants to complete his herbarium and flora. Haussknecht's first trip in 1865 was to Turkey and Syria, the second trip from 1866 to 1869 stretched from Lebanon to Persia. On site, he was also officially entrusted with tasks in his capacity as a pharmacist. As a result, he obtained a lot of information on medicinal plants from the local population who also led him to mountainous regions untrodden by botanists. He became a respected expert on oriental plants. His extensive travel diaries and collections were studied in-depth in Germany (Kämpfer & Victor 2020).

In his "Notions succinctes" Van Heurck mentioned the acquisition of Haussknecht's rare and interesting Persian products. One of these pharmaceutical curiosities was a sample of Persian bitumen mumiai, (fig. 36, Table 2) a mineral pitch which is called momiai in Persian and which was

once confused with powdered mummies. Outstanding too is a series of mannas, exuded by, for example, camelthorn, quince and Brant's oak (Table 2).

Adalbert Geheeb (Geisa, 1842 - Königsfelden, 1909)

Adalbert Geheeb was a pharmacist and carried on his father's pharmacy in Geisa. In addition, he was a botanist-bryologist. In his "Notions succinctes" Van Heurck (1876) mentioned that Geheeb had sent him the quasi-complete collection of medicines in use in Germany at that time. Some of them are of animal origin and are real curiosities in the collection, such as the following: Sturgeon glue or sturgeon isinglass prepared from the dried swim bladder, cut in different ways was complemented with its forgeries; Sandfish skink (fig. 37), preserved in lavender flowers, was listed as an aphrodisiac in pharmacopeia of the mid-19th century. Another noteworthy specimen of Geheeb is a defiant, dried common adder, once used in Venetian theriac or Venice treacle, an ancient broad-spectrum antidote. It contained 64 ingredients, including opium and agarics.

Part of Geheeb's pharmacy in Geisa has been transformed into a small museum dedicated to Geheeb, which can still be visited today (Anon n.d. c).

Julius von Wiesner (Tschechau, 1838 - Wien, 1916)

Julius Wiesner studied botany at the University of Vienna. His study trips focussed primarily on physiological aspects and took him to Java (Buitenzorg), Egypt, North America and Spitzbergen.

Van Heurck received some key products from Wiesner and stressed their value because they were the type products from two of Wiesner's publications, one about gums, resins and balms (Wiesner 1869), the other one about raw materials of plant origin (Wiesner 1927-1928). Among the examples in the economic botany collections are Chilean chagual gum and Australian kino, both used in folk medicine, and fruit of Cape jasmine, known as traditional, Chinese dye (Table 2). Of particular significance within these collections are Wiesner's essential oils (fig. 38) distilled from a variety of sources, including bay leaves, ylang-ylang, sandalwood, myrrh, ginger, wild cinnamon, wintergreen and lemon grass (Table 2), to name a few.

Other renowned contacts of Henri van Heurck

H. van Heurck also was in contact with Bernardin, whom he described as a distinguished naturalist and philologist. He also obtained (though only a very limited number) products from von Martius's collection. These included bark of *Esenbeckia febrifuga*, acting as quinine, and roots of *Smilax* species, known as "salsaparilla".

Post Van Heurck era

Following Van Heurck's passing in 1909, his extensive collection was transferred to the city of Antwerp for the mere sum of 125,000 Belgian francs (Aernouts & Frison 1959). Over the course of more than 50 years, these collections found temporary homes in various locations in Antwerp, sometimes being utilized and at other times remaining idle. Edward Frison greatly admired Van Heurck and comprehended the immense value of his collections. He dedicated decades of effort to ensure their conservation. After much wandering the city council gave the collections on long-term loan to the "Koninklijke Maatschappij voor Dierkunde van Antwerpen" (KMDA).

In 1985, the association for “Antwerps Wetenschappelijk en Industrieel Erfgoed (AWIE)” was founded under the chairmanship of Karel Van Camp with the aim of repurposing the patrimony of Van Heurck and Frison, among others. In 2004, transfers of books, microscopes and other equipment and microscopic wood preparations to the Central Library of Antwerp and the Museum of History of Sciences of Ghent University were arranged.

The important transfer of Van Heurck's herbarium, diatom collection and Botanical Museum, and of Frison's wood collection (all material from the Antwerp Herbarium, AWH) to the former National Botanic Garden in Meise was regulated in the 1990's. In 2014, this AWH material became a permanent loan to the newly structured Meise Botanic Garden. Subsequently, Frison's wood collection and microscopic sections, were transferred from Antwerp to Meise in 2020 and 2022.

Karel Edward Frison (Meerhout, 1888 – Antwerp, 1973)

Despite his limited acquaintance with Van Heurck, Edward Frison held him in high regard. He valued, studied and took care of his collections. He was particularly fascinated by microscopic research, first on algae, foodstuffs, drugs (from the Van Heurck collection), paper, fibres, and later wood (Frison 1944). He became an expert in microscopy and microphotography, essential to the identification of commercial wood species. His personal collection reached up to about 30,000 microscopic specimens, mostly wood sections, c. 1,800 wood samples, various microscopes and a library. It was sold to the city of Antwerp for 600,000 Belgian francs in 1977 (Van Camp, Dorikens, Dorikens-Van Praet, Haustraete 2004).

A substantial number of wood samples of Frison are housed in Meise Botanic Garden. Some of these have a corner removed that served for micrographic research. Frison's wood samples with "Terv" numbers are among the earliest “TW”-numbers in the xylarium of the Africa Museum in Tervuren. Examples include African rosewood (*Guibourtia demeusei*) (Terv31=Tw31) and tchitola (*Prioria oxyphylla*) (Terv47=Tw47) from expeditions in Congo dating back to 1910 and 1912.

Apart from the collections of 1866 and 1930, discussed earlier, Frison's collection also contains wood samples from Bogor. The wooden case is now labelled with: “Collectie van houtmonsters uit Ned. Oost- en West-Indië. Afdeling Handelsmuseum van het Koloniaal Instituut.” and contains wood samples with the original (and informative) label and stamp of the “Boschbouwproefstation Buitenzorg”. The Macassar ebony (*Diospyros* sp.) stands out as the darkest coloured specimen in this series (fig. 39).

The provenances of Frison's wood samples also outline the collectors, institutions, companies and societies at that time. For instance, Incense cedar (*Calocedrus decurrens*) is a sample from the only Belgian and no longer existing pencil factory “Crayons Gilbert” in Hastière.

## Epilogue

In 1873, the “Société Botanique de France” planned an extraordinary session with several excursions in Belgium. The members visited botanic gardens, museums and nurseries. Planchon reported enthusiastically and was full of praise for the visit to the State Botanic Garden in Brussels and to the Commercial-Industrial Museum in Melle as well as to the Botanical Museum of Van Heurck in Antwerp (Planchon 1873). Overlooking the three collections in Meise Botanic Garden 150 years later, we find ourselves sharing the same opinion. The combined knowledge and dedicated efforts of all the contributors have led to a collection that testifies to every possible use of (mainly) plants at the time. Interestingly, the search for resources then runs a parallel with today's technologies and

ongoing searches for diverse applications, while historic collections like the Meise Botanic Garden economic botany collection still serve as a source of innovation (Stauffer & Roguet 2012, Decq et al. 2019, 2021, De Paepe et al. 2023).

The economic botany collection at Meise Botanic Garden remains largely hidden from public view, with the exception of a selection of wood specimens displayed in the WOODlab (including touch-screens including background information on the specimens), and a number of specimens in jars on display in a permanent exhibition on the history of Meise Botanic Garden in the Bouchout Castle. Additional portions of the collection can be seen in the herbarium rooms, but only through guided tours. As part of the planned renovations of the collection building, scheduled for 2028-2030, a permanent exhibit will be created to showcase the rich collections from the herbarium, library, and archives, and to highlight the related research activities. This exhibit will guide visitors along the paths of historical botanists during their explorations of remote regions around the world, unveiling the rich history, current endeavours, and future directions of research and collections at the Botanic Garden.

Understanding the content, as well as the historical, political and cultural context of the economic botany collection at Meise Botanic Garden is a crucial first step. Specimen data from this collection are already present in the collection management system of Meise Botanic Garden, and basic information can be accessed through our institutional portal (<https://www.botanicalcollections.be>) and the Global Biodiversity Information Facility (GBIF) (Meise Botanic Garden 2024). The next step will be to include high-resolution images of the specimens, include data on their uses, conduct provenance research for specimens that have not yet been re-examined, and recognize traditional knowledge wherever possible.

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**Table 1.** Selection of economic botany collections in European institutions, including information on the nature of the collections and studies performed on them. The list complements the overview of 29 economic botany and ethnobotanical collections published by Cornish & Nesbitt (2014).

<b>Institution</b>	<b>Collection with date and estimated number of specimens, and notes.</b>	<b>Reference</b>
Botanischer Garten Berlin	Spezialsammlungen, 1819-, unknown number of specimens.	Botanischer Garten Berlin (2024)
Université de Reims	Droguier Menier, 1816-1838, c. 755 specimens.	Demouy (2010, 2011)
Faculdade de Farmácia da Universidade de Lisboa	Materia Medica via Gehe & Co, 1910-1920, c. 400 specimens	Perdigão (2014)
Faculté de Pharmacie de Montpellier	Droguier de la Faculté de médecine, 1633-, c. 15,000 specimens.	Motte-Florac (2012)
Faculté de pharmacie de Paris, Université Paris Cité	Droguier du Musée de Matière médicale de la Faculté de Pharmacie, 1763-, c. 8000 specimens, plus c. 1300 specimens from the collection Guibourt.	Paris (1975)
Faculté de pharmacie, Nantes Université	Droguier de la Faculté de Pharmacie, 19 <sup>th</sup> century, unknown number of specimens.	Laurence (1993)
Friedrich-Alexander-Universität Erlangen-Nürnberg	Pharmakognostisches Kabinet von Theodor Martius, 1841, c. 2400 specimens. Smaller duplicate of the collection present in Meise Botanic Garden.	Thoma (2004)
Maison de Melle Lez-Gand	Musée commercial, 1847-1889, number of specimens unknown. Collection in decay.	Planchon (1873)
Queens' College, Cambridge	Vigani's Cabinet, 1703-1704, c. 700 specimens.	Wagner (2007), Steigenberger (2013)
Universität Wien	Pharmakognostische und Pharmaziehistorische Sammlung der Uni, 1854-, c. 18,000 specimens of which 2,812 from Theodor Martius.	Kletter (2012)

**Table 2.** Selection of specimens in the economic botany collection of Meise Botanic Garden, indicating common and scientific taxon names (and nature of the material if not plant-based), their economic use, and specimen barcode number(s). Specimen data is available on the herbarium collection portal of Meise Botanic Garden, [www.botanicalcollections.be](http://www.botanicalcollections.be).

Common name	Scientific name	Economic use	Specimen
Acaroid resin / black boy 'gum'	<i>Xanthorrhoea arborea</i>	Exudate	AWH10027158
Advogado / avocado	<i>Persea gratissima</i>	Food	BR4010005693462
African rosewood	<i>Guibourtia demeusei</i>	Wood	AWH10095782
Agave fibres	<i>Agave vivipara</i> var. <i>deweyana</i> (syn. <i>A. deweyana</i> , <i>Agave vera-cruz</i> (syn. <i>A. mexicana</i> ))	Fibre	BR4010004633391, BR4010004634428
Angélique	<i>Dicorynia paraensis</i>	Wood	BRW14100338, BRW14100345
Bagasse	<i>Bagassa guianensis</i>	Wood	BRW14100369, BRW14100352
Bakau / red mangrove	<i>Rhizophora mucronata</i>	Wood	BRW14115622
Banana fibre / plantain fibre	<i>Musa × paradisiaca</i> , <i>Musa</i> sp.	Leaf fibre	BR4010004560307, BR4010002728549
Barkcloth from fig tree	<i>Ficus</i> spp.	Bark fibre	BR4010002742385, BR4010002743412
Baropa/ apple mangrove	<i>Sonneratia alba</i>	Wood	BRW14115646
Batata de purga	<i>Operculina macrocarpa</i> (syn. <i>Ipomoea operculata</i> )	Materia medica	BR4010005508490, BR4010004108363
Bay leaves	<i>Laurus nobilis</i>	Essential oil	AWH10021590
Bitter orange	<i>Citrus aurantium</i> (syn. <i>C. bigaradia</i> )	Essential oil	AWH10004821, AWH10004838, AWH10004845, AWH10004852, AWH10004869
Bitumen mumiai	Dead sea bitumen (seep petroleum)	Materia medica	AWH10031636
Bloodflower	<i>Asclepias curassavica</i>	Seed hair fibre	BR4010005516440
Brant's oak manna	<i>Quercus brantii</i> (syn. <i>Q. persica</i> )	Exudate	AWH10023914, AWH10023907
Brazilian orchil	<i>Spiloma roseum</i> (lichen)	Dye	BR4010002272264
Camelthorn manna	<i>Alhagi maurorum</i>	Exudate	AWH100008003
Canary orchil	<i>Roccella tinctoria</i> (lichen)	Dye	AWH10029206, AWH10029213
Caneelapfel / custard apple	<i>Annona squamosa</i>	Food	BR4010000153220

Cape jasmine	<i>Gardenia jasminoides</i> (syn. <i>G. grandiflora</i> )	Dye	AWH10015667
Carnauba wax	<i>Copernicia prunifera</i> (syn. <i>C. cerifera</i> )	Exudate	BR4010003192264
Carrageen moss / Irish moss	<i>Chondrus crispus</i> (red algae)	Materia medica	AWH10029411, AWH10029428
Cashew tree gum	<i>Anacardium occidentale</i> (syn. <i>Cassuvium pommiferum</i> )	Exudate	AWH10006900
Cassava	<i>Manihot esculenta</i>	Starch	BR4010004834484
Cèdre noir	<i>Laurus surinamensis</i>	Wood	BRW14100765, BRW14100758, BRW14100772
Chagual gum	<i>Puya coarctata</i>	Exudate	AWH10026670
Cinnamon-leaf yam	<i>Dioscorea cinnamomifolia</i> (syn. <i>D. tuberosa</i> )	Starch	BR4010005503341
Cobalt	Co (mineral)	Materia medica	AWH10031209
Cochineal	<i>Dactylopius coccus</i> (scale insect)	Dye	BR4010002245329, BR4010002246357
Cocoa	<i>Theobroma cacao</i>	Materia medica / stimulant	Several accessions, including BR4010001143220
Cod liver oil	<i>Gadus morhua</i> (fish)	Oil	AWH10029848, AWH10029855, AWH10029862, AWH10029879, AWH10029886, AWH10029893, AWH10029929
Coffee / caffeine	<i>Coffea</i> spp.	Materia medica / stimulant	AWH10013946, AWH10013953
Common adder	<i>Vipera berus</i> (syn. <i>Pelias berus</i> ) (snake)	Materia medica	AWH10029824
Conditura cadaverum / mummy	<i>Homo sapiens</i>	Materia medica	AWH10029442
Congo jute	<i>Urena lobata</i>	Bast fibre	BR4010000822379
Corozo	<i>Phytelephas macrocarpa</i>	Vegetable ivory	BR4010003557490
Cotton	<i>Gossypium</i> spp.	Seed hair fibre	BR4010002330193
Courbaril, South American copal resin	<i>Hymenaea courbaril</i>	Wood, exudate	BRW14100567, AWH10009192
Date	<i>Phoenix dactylifera</i>	Food	BR4010003142214, BR4010003143242, BR4010003144270, BR4010003145307
Devil's cotton	<i>Abroma augusta</i>	Bast fibre	BR4010001109363

Djave nut butter	<i>Baillonella toxisperma</i>	Fat, food, medicinal	AWH10017494
Epsom salt / magnesium sulphate	MgSO <sub>4</sub> (mineral)	Materia medica	AWH10030769
Fever tree	<i>Cinchona</i> spp.	Materia medica	AWH10015544
Flax	<i>Linum usitatissimum</i>	Bast fibre	BR4010001243258
Floss silk tree	<i>Ceiba speciosa</i> (syn. <i>Chorisia speciosa</i> )	Seed hair fibre	BR4010001030094
Garou	<i>Daphne gnidium</i>	Materia medica	BR4010005354363
Ginger	<i>Zingiber officinale</i>	Essential oil	AWH10025802
Goat's rue	<i>Galega officinalis</i>	Materia medica	BR4010002082214
Grignon	<i>Bucida buceras</i>	Wood	BRW14100819, BRW14100826, BRW14100833
Gum arabic	<i>Acacia nilotica</i>	Exudate	BR4010003950406
Herba Tayuyae	<i>Cayaponia tayuya</i>	Materia medica	BR4010002296406
Incense cedar	<i>Calocedrus decurrens</i> (syn. <i>Libocedrus decurrens</i> )	Wood	AWH10094389
Ipecac / ipecacuanha	<i>Carapichea ipecacuanha</i> (syn. <i>Cephaelis ipecacuanha</i> )	Materia medica	AWH10013434, AWH10013441, AWH10013465, AWH10013489
Japanese boxwood	<i>Buxus japonica</i>	Wood	BRW14109751, BR4010004801363 (glass painting)
Japanese isinglass	<i>Gelidium</i> spp. (red algae)	Food	BR4010002920363, BR4010002921391
Japanese pagoda tree	<i>Styphnolobium japonicum</i> (syn. <i>Sophora japonica</i> )	Wood	BRW14109713, BR4010004798632 (glass painting)
Japanese umbrella pine / kooyamaki	<i>Sciadopitys verticillata</i>	Wood	BRW14109782, BR4010004803428 (glass painting), BR4010005623391 (jar with liquid)
Kaki / Japanese persimmon	<i>Diospyros kaki</i>	Wood	BRW14109522, BR4010004781412 (glass painting)
Kaolin / China clay	Al-compound (mineral)	Materia medica	AWH10031032
Keaki / Japanese elm	<i>Zelkova serrata</i> (syn. <i>Z. keaki</i> , <i>Z. acuminata</i> )	Wood	BRW14109829, BRW14109874, BR4010004809604 (glass painting)
Kenaf	<i>Hibiscus cannabinus</i>	Bast fibre	BR4010000833412

Kino (tannic) gum	<i>Eucalyptus citriodora</i>	Exudate	AWH10011508
Kwepie	<i>Couepia guianensis</i>	Wood for pottery firing	BRW14103773, BRW14103780
Lapis judaicus	<i>Balanocidaris glandifera</i> (sea urchin)	Materia medica	AWH10031674
Lemon grass	<i>Cymbopogon citratus</i>	Essential oil	AWH10028704
Liane de boeuf	<i>Danais fragrans</i>	Materia medica	BR4010004994577
Lion claws	<i>Panthera leo</i> (syn. <i>Felis leo</i> ) (cat)	Materia medica	AWH10029459
Mabondo nut	<i>Osmorhiza aristata</i> (syn. <i>Sclerosperma mannii</i> )	Vegetable ivory	BR4010002843440
Macassar ebony	<i>Diospyros</i> sp.	Wood	AWH10090213
Manga / mango	<i>Mangifera indica</i>	Food	BR4010005692434
Manilla hemp / koffo / abaca	<i>Musa textilis</i>	Leaf fibre	BR4010004573406
Mate	<i>Ilex paraguariensis</i>	Materia medica / stimulant	BR4010001606428
Milkweed	<i>Asclepias</i> sp.	Fibre	BR4010004229440
Munj sweetcane	<i>Triplidium bengalense</i> (syn. <i>Saccharum bengalense</i> , <i>S. munja</i> )	Fibre	BR4010004744462
Myrrh	<i>Commiphora gileadensis</i> (syn. <i>Balsamodendrum ehrenbergianum</i> )	Essential oil	AWH10007068
N'kosa	<i>Manniophyton fulvum</i>	Bast fibre	BR4010002720307, BR4010005474412
Oil palm	<i>Elaeis guineensis</i>	Oil	BR4010003449511, BR4010003434357
Opium	<i>Papaver somniferum</i>	Medicinal	AWH10002445
Ox gall extract	<i>Bos taurus</i> (bovine)	Materia medica	AWH10029695
Pappus from Apocynaceae	<i>Stipecoma peltigera</i> , <i>Echites</i> sp., <i>Prestonia denticulata</i> (syn. <i>E. suberosus</i> ), <i>Araujia sericifera</i> (syn. <i>Physianthus albens</i> )	Seed hair fibre	BR4010004759626, BR4010004761391, BR4010004762428, BR4010004764484
Pearls	<i>Pinctada margaritifera</i> (syn. <i>Avicula margaritifera</i> ) (pearl oyster)	Materia medica	AWH10030189

Pekrehoe / pegrekoe	<i>Xylopi frutescens</i>	Wood, medicinal, spice	BRW14104077
Pineapple	<i>Ananas sativus</i>	Fibre	BR4010002748561, BR4010002749599
Pisang Radja sereh / plantain	<i>Musa x paradisiaca</i> L. (AAB Group) 'Latundan' (syn. <i>Musa sapientum</i> var.)	Food	BR4010005269490
Queensland hemp	<i>Sida rhombifolia</i>	Bast fibre	BR4010005475440
Quince manna	<i>Pyrus glabra</i>	Exudate	AWH10010956, AWH10010969
Ramie	<i>Boehmeria nivea</i>	Bast fibre	BR4010004538511, BR4010004539549, BR4010004540286, BR4010004541313, BR4010004542341, BR4010004543379, BR4010004544406
Red coral	<i>Isis nobilis</i> (polyp)	Materia medica	AWH10030202
Rosary pea	<i>Abrus precatorius</i>	Jewelry	BR4010004226357
Rye	<i>Secale cereale</i>	Food	BR4010005340236
Safflower	<i>Carthamus tinctorius</i>	Dye	BR4010004854505
Saint Ignatius bean	<i>Strychnos ignatii</i>	Materia medica	AWH10018484, AWH10018491
Salangane / glossy swiftlet	<i>Collocalia esculenta</i> (syn. <i>Hirundo esculenta</i> ) (swift)	Materia medica	AWH10029787, AWH10029794
Sandalwood / Indian sandalwood	<i>Santalum album</i>	Essential oil, wood	AWH10022115, BRW14115639
Sandfish skink	<i>Scincus scincus</i> (syn. <i>S.</i> <i>officinalis</i> ) (lizard)	Materia medica	AWH10029817
Sassafras	<i>Licaria guianensis</i>	Wood	BRW14101366, BRW14101342, BRW14101359
Sel sédatif de Homberg/ boric acid	B(OH) <sub>3</sub> (mineral)	Materia medica	AWH10030943
Silk-cotton tree	<i>Bombax</i> spp.	Seed hair fibre	BR4010000960385
Sorghum	<i>Sorghum bicolor</i>	Food	BR4010004246379
Soude de varech/ sodium carbonate	Burnt brown algae ( <i>Fucus</i> spp.)	Various	AWH10030493
Spanish fly	<i>Lytta vesicatoria</i> (syn. <i>Cantharis vesicatoria</i> ) (blister beetle)	Materia medica	AWH10030011
Sturgeon glue/ sturgeon isinglass	<i>Huso huso</i> (syn. <i>Acipenser</i> <i>huso</i> ) (fish)	Glue	AWH10029930

Sugi/ Japanese cedar	<i>Cryptomeria japonica</i>	Wood	BRW14109799, BRW14109461, BRW14109836, BR4010004775527 (glass painting)
Switiboontje	<i>Inga sp.</i>	Food	BR4010005365406
Tandjang/ black mangrove	<i>Bruguiera gymnorhiza</i>	Wood	BRW14115608
Tchitola	<i>Prioria oxyphylla</i> (syn. <i>Oxystigma mortehanii</i> )	Wood	AWH10095591
Tea	<i>Camellia sinensis</i>	Materia medica	BR4010000694440- BR4010000744428
Tingi/ spurred mangrove	<i>Ceriops tagal</i> (syn. <i>C. candolleana</i> Arn.)	Wood	BRW14115615
Tobacco	<i>Nicotiana tabacum</i>	Materia medica	BR4010003759610, BR4010003760357, BR4010003761385, BR4010003762412, BR4010003763440, BR4010003764478
Tomalayota	<i>Cucurbita sp.</i>	Food	BR4010002444357
Tremolite	Ca-compound (mineral)	Materia medica	AWH10030622
Unicorn horn / narwhal ivory	<i>Monodon monoceros</i> (whale)	Materia medica	AWH10029770
Uranium	U (mineral)	Materia medica	AWH10031223
Vegetable wool of pine needles	<i>Pinus sylvestris</i>	Leaf fibre / materia medica	BR4010004691391
Venetian theriac	Natural concoction	Materia medica	AWH10031599
Verdigris/ copper acetate	$\text{Cu}(\text{CH}_3\text{COO})_2$ (mineral)	Materia medica	AWH10031407
Wacapou	<i>Vouacapoua americana</i>	Wood	BRW14101441, BRW14101434
Water chestnut	<i>Pachira aquatica</i> (syn. <i>Carolinea princeps</i> )	Food	BR4010000931385
Wild cinnamon	<i>Cinnamomum malabathrum</i>	Essential oil	AWH10021293
Wintergreen	<i>Gaultheria procumbens</i>	Essential oil	AWH10017180
Yellow mangrove	<i>Ceriops decandra</i> (syn. <i>C. roxburghiana</i> )	Dye	BR4010005046329
Ylang-ylang	<i>Cananga odorata</i>	Essential oil	AWH10001943

## Figure legends

Fig. 1. Variety within glass jars preserving palm specimens.

Fig. 2. Fragments of “unicorn horn” also called narwhal ivory, AWH10029770.

Fig. 3. Lapis judaicus: fossilized radiolas of a sea urchin depicted on a black-and-white photo. AWH10031674

Fig. 4: Summary of the period -collecting period or arrival of material in the contributor’s collection-, the main countries of origin, the economic use and the known or presumed number of the specimens per contributor and collection subset. SRH: Société Royale d’Horticulture de Belgique; ESPh Paris Planchon: Ecole Supérieure de Pharmacie de Paris, Planchon.

Fig. 5. Carl von Martius, father of palms: detail from a -winning- poster (Berlin, 2016, SPNHC congress).

Fig. 6. Carnauba wax specimens from Marcos Antonio de Macedo, BR4010003192264.

Fig. 7. Cotton seed fibre specimens from the collection of Theodor Martius.

Fig. 8. Remarkable labeling of a “switiboontje” by Heinrich Wullschlägel showing the number 51, BR4010005365406.

Fig. 9. “Pappus” or seed hair from various Apocynaceae specimens from Theodor Peckolt’s collection, BR4010004759626, BR4010004761391, BR4010004762428, BR4010004764484.

Fig. 10. Specimens obtained via Charles Aubry-Lecomte including “angélique”, mentioning the wood plantation St. Louis, BRW14100338, BRW14100345.

Fig. 11. Representative specimens from the collection of Johannes Teijsmann: (a) Wood specimens, (b) Koffo fibres also called abaca on the right side, BR4010004573406.

Fig. 12. Authentic labels on specimens -goat’s rue and tomalayota- from the Royal Horticultural Society of Belgium; seeds from Vilmorin on the left, BR4010002082214, BR4010002444357.

Fig. 13. Portrait and signature of Jean-Édouard Bommer.

Fig. 14. Label showing the corresponding number (5454) of the genus *Pithecoctenium* in Théophile Durand’s Index Alphabeticus Generum Phanerogamorum, BR4010005563406.

Fig. 15. Classification system of Charles Bommer’s wood collection using stamped numbers.

Fig. 16. Representative specimens of Japanese umbrella tree drawn by Hélène Durand: (a) Glass painting BR4010004803428 and corresponding wood sample BRW14109782 on the left, (b) Branch, preserved in liquid BR4010005623391, which was depicted, (c) Watercolour drawing.

Fig. 17. Representative specimens from the collection of Monsieur Bernardin. (a) Specimens of ramie fibre BR4010004538511, BR4010004539549, BR4010004540286, BR4010004541313, BR4010004542341, BR4010004543379, BR4010004544406, (b) Square Japanese isinglass BR4010002921391, (c) Lined Japanese isinglass, BR4010002920363.

Fig. 18. Old, more explicit label of a cotton specimen from the Egyptian collection of Gustave Delchevalerie, BR4010002330193.

Fig. 19. Items regarding the third and the first World Fair of Paris: (a) Manuscript list from 1878 matching with the fibre specimens of Martinique, (b) Specimen of banana -plantain- leaf fibre from 1855 originating from British Guiana, BR4010004560307.

Fig. 20. Specimen from the Indian economic product collection: fibres and rope of munj sweetcane, BR4010004744462.

Fig. 21. Representative items from the collection of Emil Holub: (a) Detail of manuscript, (b) Specimens of rosary pea and milkweed mounted on glass slides, BR4010004226357, BR4010004229440.

Fig. 22. Representative specimens (a.o. nr 39) from the collection of Charles Lallemand: (a) Detail of manuscript, (b) Medicinal "garou" bark, BR4010005354363.

Fig. 23. Representative specimens from the collection of Ambroise Delacre: (a) cocoa bean specimens, (b) Distinctive jar stopper.

Fig. 24. Representative specimens with well-documented labels from the collection of Albert-Louis Sapin: (a) Braided pineapple fibres, BR4010002748561, BR4010002749599, (b) Pooled banana fibres, BR4010002728549.

Fig. 25. Representative items from the collection of Bogor Botanical Garden: (a) Label of the garden's museum on plantain specimen, BR4010005269490, (b) Mangrove wood samples, BRW14115608, BRW14115622, BRW14115615, BRW14115646.

Fig. 26. Representative specimens from the collection of the Colonial Garden in Laken: (a) Vegetable ivory from mabondo nuts manufactured into buttons BR4010002843440, (b) Oil palm nuts BR4010003449511 and palm oil BR4010003434357 (two jars at the left).

Fig. 27. Agave fibres from the Botanical Garden in Eala with yield data per plant species, BR4010004633391, BR4010004634428.

Fig. 28. Portrait and signature of Henri Van Heurck.

Fig. 29. Representative specimens from the materia medica collection of Henri Van Heurck: (a) Cabinet drawer with vials, (b) Venetian theriac sample, AWH10031599.

Fig. 30. Representative specimens from the collection of Mathieu Verbert: (a) Red coral, AWH10030202, (b) South American copal resin, AWH10009192.

Fig. 31. Tremolite or "lin fossile" from Charles Rigout's mineral collection, AWH10030622.

Fig. 32. Representative specimens from the collection of François Cools: (a) Caffeine specimens, AWH10013946, AWH10013953 (b) Mineral compounds, AWH10030981, AWH10031407, AWH10030943.

Fig. 33. Part of Guibourt's fever tree bark specimens from the collection of the "Ecole de Pharmacie" in Paris, AWH10015544.

Fig. 34. Australian acaroid resin from the collection of Charles Morren, AWH10027158.

Fig. 35. Selection of Brazilian wood samples from Samuel Blanchet (the entire collection includes specimens AWH10034590-AWH10036372).

Fig. 36. Bitumen mumiai from the Persian collection of Carl Haussknecht, AWH10031636.

Fig. 37. Sandfish skink in lavender flowers from the materia medica collection of Adalbert Geheeb, AWH10029817.

Fig. 38. Essential oil specimens -ylang-ylang and ginger- from the collection of Julius von Wiesner, AWH10001943, AWH10025802.

Fig. 39. Macassar ebony and other wood samples from the collection of Edward Frison, AWH10090213.