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Bodies of the plant and Animal Kingdom: An illustrated manuscript on *materia medica* in the Netherlands (ca. 1800)



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ABSTRACT

Ethnopharmacological relevance: Around 1800, Amsterdam was a global trade hub for *materia medica* of Dutch, European and exotic origin. Contemporary knowledge on medicinal plants in academic circles has been well documented in local pharmacopoeia, illustrated herbals and catalogues of botanic gardens. Until the end of the ancient regime, physicians, surgeons and apothecaries were trained how to use plants in their specific guild or *Collegium Medicum*. Little is known, however, on how the plant collectors and merchants that provided the pharmaceutical substances to apothecaries learnt to recognise the variety of medicinal products.

Aim of the study: To analyse the content, origin, purpose and scientific importance of an anonymous, undated, hand-written Dutch manuscript on *materia medica*, entitled *Corpora ex Regno Vegetabili/Animali* (Bodies of the Plant/Animal kingdom) kept by the Artis Library of the University of Amsterdam, the Netherlands.

Materials and methods: We digitised the entire manuscript and dated the paper by means of its watermark. We identified the plant and animal species using the historic Dutch and Latin names, the illustrations and historic literature. We compared the plant properties and uses to contemporary literature to check whether the information in the manuscript was original or copied from another source.

Results: The paper was produced between 1759 and 1816 in Zaandam, the Netherlands. The manuscript contains 19 substances of animal origin, one mineral and 273 plants and plant-derived products, which belong to ca. 260 species. While most plants are native or cultivated in the Netherlands, 111 plant entries (105 spp.) represent exotic products, imported from as far as Madagascar and Australia. A total of 134 illustrations were cut out from a 1549 Dutch edition of the New Herbal by Leonhard Fuchs (1543), but only 69% correspond to the correct species. The manuscript contains detailed descriptions on growth locations, field characteristics, flowering season, provenance and quality of the medicinal products, including methods to detect forgery. The author mostly described humoral properties of the plants rather than listing medicinal recipes. We did not find evidence that he copied his texts from other sources, but the Dutch and Latin names correspond largely with the Amsterdam pharmacopoeia from 1795.

Conclusions: The author's extensive knowledge on trade names, quality and origin of *materia medica* and his refrain from using literature suggests he could have been a merchant, an intermediary between herb cultivators, overseas traders and apothecaries. This manuscript offers a unique insight in the global trade in medicinal products and the circulation of knowledge in non-academic circles around 1800.

1. Introduction

Between the late 16th and the late 18th century, European trade networks had seen increasing volumes in colonial commodities like

sugar, coffee, tobacco, spices and medical substances, harvested in overseas territories like the East Indies, Africa and the Americas (Cook and Walter, 2013; Wallis, 2011). The city of Amsterdam harbored the headquarters of the Dutch East and West India Company and was a

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major trading hub for the wholesale of spices and drugs of both exotic and European origin (Israel, 1989). The global trade in *materia medica* prompted the simultaneous rise of specialist brokers in drugs who handled medicinal commerce (Klein, 2018). Because of the enormous variety of substances and uses, expertise was needed to identify the goods and to know their virtues (Cook and Walter, 2013). In the 17th century, apothecaries and doctors received practical training in herbal medicine in the botanical gardens in Amsterdam and Leiden. These gardens also played an important role in harboring exotic plants from faraway colonies, for scientific purposes, as status symbol and to attract visitors (Baljet and Bouman, 2015; Van Uffelen, 2012; Wijnands, 1983).

Pharmacopoeia were kept up to date by issuing updated editions every few years, independently, and in different cities, such as Amsterdam, Leiden, Groningen and Dordrecht. They generally consist of lists of crude medicinal substances that apothecaries were required to have in stock, but provide little information on the sources of these ingredients for medicinal recipes. It was unlikely that botanic gardens provided the main stock of plant material to apothecaries. Fresh herbs were probably harvested from private gardens and dried material was purchased from merchants (Klein, 2018), but little published information exists on the commercial sources of herbal medicine in the early modern period. It is also unclear how knowledge on *materia medica* was transferred in the circles of herb collectors and merchants, as they did not receive the training that was provided to doctors and apothecaries in their respective guild or *Collegium Medicum* (Baljet and Bouman, 2015). Since traders in herbal medicine had to acquaint themselves with dozens of products, including the many fraudulent products that must have circulated, it is likely that they learned their craft in practice (Klein, 2018).

A detailed source of information on herbal medicine in the Netherlands and surrounding countries was the work of the Groningen doctor and botanist Abraham Munting (1626–1683). His book '*Naauwkeurige beschrijving der aardgewassen*' (Detailed description of plants, Munting, 1696) contains elaborate descriptions of medicinal plants, their properties, cultivation, harvesting methods and uses. Although Munting considered his own horticultural experience as the main source of knowledge for his book, he also mentioned to have learned from healers and vendors of herbal mixtures. He regularly cited famous 16th century herbals such as *De Historia Stirpium Commentarii Insignes*, written by the German physician and botanist Leonhard Fuchs (1542), the *Cruydtboeck* by Matthias de Lobel (1581), and Pietro Andrea Mattioli's comments (1554) on the classical Greek herbal *De materia medica* by Dioscorides (c. 65). These large herbals were compiled by renowned scientists, and contained extensive scientific knowledge on plant properties, uses and recipes that could be applied in medical practice. It is unlikely, however, that herb growers, merchants and wholesalers, people who generally lacked higher education, were aware of or had access to these herbals, pharmacopoeia or garden catalogues. Most of their plant knowledge must have passed on orally, but little is known how they were trained within their families or guilds to recognise the many medicinal plant species.

A rare example of a non-scholarly work on *materia medica* in the Netherlands is currently in the possession of the Artis Library, as part of the Special Collections of the University of Amsterdam. The manuscript consists of a chapter on products of plant origin and one on products of animal origin. The first part (AB Legkast 294 (1), <http://permalink.opc.uva.nl/item/003425973>) is entitled *Corpora ex Regno Vegetabili* (with the Dutch translation *Ligchaamen uijt het Planten Rijk* (Bodies of the Plant Kingdom, Fig. 1A). The second part (AB Legkast 294 (2), <http://permalink.opc.uva.nl/item/003425929>) is entitled *Corpora ex Regno Animalii*, with the Dutch translation *Ligchaamen uijt het Dieren Rijk* (Bodies of the Animal Kingdom, Fig. 1B). The entire manuscript is now made available online (<https://plantenrijk.wordpress.com>).

The bound manuscript contains handwritten, Dutch descriptions of ca. 300 *materia medica* products, the majority of vegetal origin. Next to the entries on plant products, 136 hand-coloured illustrations have

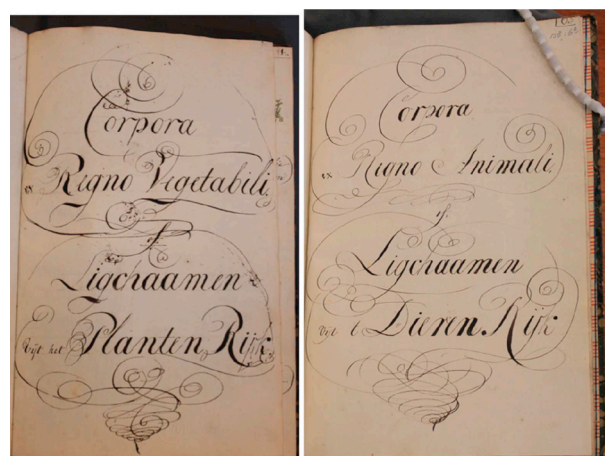


Fig. 1. Frontispieces of the two chapters of the manuscript, with the titles in Latin and Dutch. A. Bodies of the Plant Kingdom. B. Bodies of the Animal Kingdom.

been glued or stitched, all but one cut out from a Dutch edition of Fuchs' original Latin herbal from 1542, entitled: '*Den nieuwen herbarius, dat is, d'boeck vanden cruyden*' (The new herbal, which is a book of herbs) and published in 1549 in Basel. This Dutch edition is smaller than Fuchs' first herbal, and contains 517 black-and-white woodcut illustrations. Stübler (1928) estimated the publishing date of this edition to be 1545 or later, but he probably missed the Dutch text next to the portrait of Fuchs that refers to his age (48). We estimate this Dutch edition to be published in 1549, as Fuchs was born in 1501.

No information exists on the author of the manuscript, as there is no mention of a name, initials or any personal information on the pages. The Artis Library received the manuscript in 1860, as a gift by a certain J.F. Steenberg, a member of the Royal Zoological Society *Natura Artis Magistra* from 1856 to 1875. The manuscript has never been subjected to scientific research and the plants and animals remained unidentified, but the entry from the library catalogue of 1860 stated that the manuscript was probably produced towards the end of the 18th century (*Natura Artis Magistra*, 1860: 111).

The aim of this study was to disclose the identity of the author of the manuscript by analysing the paper, the medicinal species and products, their origins and uses. Therefore, we posed the following research questions:

1. Which plant and animal species are mentioned in the manuscript?
2. Which exotic *materia medica* products are described?
3. What types of medicinal properties or uses are listed?
4. To what extent is the information original or copied from other sources?
5. Who has composed the manuscript and when?
6. What could have been the purpose of this manuscript?

We hope that this study draws attention to possible other examples of contemporary, non-scholarly manuscripts on *materia medica* in libraries in and outside the Netherlands and provides guidelines for their scientific analysis.

2. Methods and materials

As the fragile manuscript could not be handled too much without damaging it, we photographed all pages of the manuscript at the beginning of our research. We took pictures of the watermarks while shining a light through the pages and compared them to similar images in the online database *Memory of Paper* (Bernstein, 2017) and literature on Dutch paper makers and their windmills around 1800 (Voorn, 1960; ZaanWiki, 2017). From the pictures, we transcribed all

handwritten Dutch texts and copied the Dutch and pre-Linnaean Latin names, including old grammar and spelling mistakes. We entered these data in a Microsoft Excel database and translated the original text into modern Dutch and English. We identified the plant species by using historic herbals, both original copies (Munting, 1682, 1696), digital versions online (Besler, 1613; Dodonaeus, 1618; Fuchs, 1549; Rumphius 1741–1755) and recently edited volumes (Fuchs, 1543 [2001]; Snippendaal, 1646 [2007]) as well as modern floristic literature (Kleijn and Brouwer, 1980; Van der Meijden, 2005) and online resources on the native Dutch flora (Dijkstra, 2017; Floron, 2017). For the accurate nomenclature of scientific names, we followed The Plant List (www.theplantlist.org). We compared the species descriptions, pre-Linnaean and local names and images in the manuscript with those of Fuchs, using an original copy of the Dutch edition (Fuchs, 1549) kept by the Special Collections of the University of Amsterdam and its online version from the University of Cologne (<http://caliban.mpiz-koeln.mpg.de/fuchs/herbarius/index.html>), and the recently edited, full-colour German edition with modern plant identifications (Fuchs, 2001 [1543]). We also checked Dutch plant names in various dialects in the PLAND database of folk names for plants in the Dutch-speaking area (<http://www.meertens.knaw.nl/pland/>).

We traced the historic names for drug components of plant, animal and mineral origin and their potential provenance in historic medical handbooks (e.g., De Vriese, 1838) and on the Time Capsule website (<http://timecapsule.science.uu.nl>), an online search tool designed to trace the trajectories of exotic drug components to the Netherlands as documented in historic sources from the 1400s onwards (Klein et al., 2017). To find possible sources of information used by the author for his plant and animal descriptions and common Dutch names, we compared the manuscript text with the historic pharmacopoeia of Groningen (Croeser, 1729), Amsterdam (Anonymous, 1636, 1643, 1723, 1795), Alkmaar (Anonymous, 1726) and Dordrecht (Anonymous, 1766), all accessible via the website of the Dutch Foundation for Pharmaceutical Heritage (<https://www.stichtingfarmaceutischergoed.nl/projecten/gedigitaliseerde-farmacopees>). To analyse the most frequently mentioned diseases and medicinal properties of the *materia medica* described in the manuscript, we calculated their number of citations in the entries of plant, animal and mineral products.

We consulted the city archive of Amsterdam (Gemeente Amsterdam Stadsarchief) to search for more information on J.F. Steenberg, the person who donated the manuscript to the Artis library. We also created a website (<https://plantenrijk.wordpress.com>), on which we uploaded all pages of the manuscript as a gallery assembly of pictures. For each entry a digital image of the manuscript page is included, with the original text, the English translation, the pre-Linnaean Latin and historic Dutch names, modern scientific names and English names. On the website, we ordered the plant products alphabetically according to their modern scientific name, and the animal and other products by their original name.

3. Results

3.1. Dating the paper

The first library catalogue that reports the manuscript after donation, the 1860 yearbook of the Amsterdam Zoological Garden, estimated it to originate from ‘the latter half of the previous century’, referring to the late 18th century (Natura Artis Magistra, 1860: 111). The manuscript itself, however, does not contain any reference to an author, a location or a date. Each page in the manuscript has a watermark: either one with a Dutch coat of arms (Fig. 2 A), or one with the name ‘Adriaan Rogge’ below an image of a whale (Fig. 2 B).

Adriaan Jansz. Rogge (1732–1816) was a notable citizen of Zaandam, who worked as a whaler and a trader in tobacco, coffee, sugar, cocoa, indigo and Russian hemp. He owned a paper mill named

‘de Zwarte Walvis’ (the Black Whale), which operated between 1660 and 1817 (Voorn, 1960). The paper used for this manuscript was produced between 1759 and 1816 in Zaandam, as in this period Adriaan Rogge was running the mill and the paper carries his name (ZaanWiki, 2017). This period coincides with the date estimated by the Artis library in 1860.

3.2. Content of the manuscript

The manuscript consists of a frontispiece and 130 pages (65 double pages), of which five blank pages and 125 with written text: 112 are dedicated to plants and plant-derived products and 13 to animal products and substances of mixed biological or mineral origin. The double pages numbered 1 to 9, which may have contained an index or references to minerals, are missing. The pages of the manuscript are numbered from 10 to 72 on the upper part of the right-hand page (‘recto’), but not on the left-hand page (‘verso’). Number 51 and 55 are erroneously used twice. The ‘Bodies of the Plant Kingdom’ section (Fig. 1A) starts on page 11, with the first plant product entry (‘Abrotanum’, *Artemisia abrotanum* L.) and ends on page 64 with the last plant entry (‘Zingiber’, *Zingiber officinale* Roscoe) and the elegantly written sentence ‘End of the Plant Kingdom’. The section on ‘Bodies of the Animal Kingdom’ starts at page 65 with the frontispiece (Fig. 1B) and continues on page 66 with amber. The author was not aware that amber is a fossilized pine resin; he doubted whether it was an ‘earth resin’ or originated from wasp nests. The animal chapter ends on the backside (‘verso’) of page 71 with marine sponges and the sentence ‘*Finis Coronat Opus*’. This proverb is attributed to the classic Roman poet Ovid (2 AD) and is translated as ‘the end crowns the work’ or ‘a major part of a work is properly finishing it’ ([https://en.wikipedia.org/wiki/List_of_Latin_phrases_\(F\)](https://en.wikipedia.org/wiki/List_of_Latin_phrases_(F))). The title page of the manuscript (Fig. 3) contains a watercolour illustration of *Acanthus mollis* L., drawn after (but not an exact copy of) the original image of *Acanthus mollis* L. in capitulum XV in the Dutch edition of Fuchs’ herbal (Fuchs, 1549) and the Dutch name Beeren klaauw (bear’s claw).

It also bears the Latin text ‘*Utendum est aetate*’, which is part of a larger expression ‘*Utendum est aetate, cito pede labitur aetas*’, originating from verse 65 of the third book on the Art of Love, also by Ovid (2 AD), and translated as ‘You must employ your time: time glides on with speedy foot’.

The pages are bound in a hard, cardboard cover, measuring 31 × 21 cm, probably after the manuscript was donated to the Artis Library. During the binding process, the pages were cut to size (30.4 × 20 cm), slicing off part of the images on eight pages. The images are attached to the pages using both glue and thin, white yarn to stitch them into place (Figs. 4 and 5). The illustrations are never larger than 13 × 9 cm, and are meticulously cut out from hand-coloured woodcut prints of the 1549 Dutch version of Fuchs’ herbal, in which the woodcut illustrations are mirrored images of the 1543 edition. Many of the images are slightly damaged or trimmed, missing a few branches, and sometimes the broken twigs are glued on crooked. In the case *Colchicum autumnale* L. (p. 25 verso), two originally separate images were artfully combined into one.

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The manuscript contains 292 separate descriptions of *materia medica* products: 264 entries on products of (higher) plant origin, two on fungi, one lichen, 19 substances of animal origin and six products of mineral or mixed biological origin. With every entry, the author meant to describe a distinct entity and did not intend for any doubles to occur. However, he sometimes described separate plant parts or various products made from the same species under separate headings. He also combined various medicinal products into one entry, such as the roots and inflorescences of one plant species or the glands of various species of musk deer. There is no index included (although it may have been written on the missing pages 1 to 9) nor any reference to literature, not



Fig. 2. Watermarks in the manuscript. A. The Dutch coat of arms. B. The name of the papermaker ‘Adriaan Rogge’ and the whale.



Fig. 3. Title page with a watercolour drawing after Fuchs's woodcut image of *Acanthus mollis* and a pencil note (upper left page) by the Artis library on the person who donated the manuscript (J.F. Steenberg).

even to Fuchs. An overview of all plant, animal and mineral entries with short English translations, historic and current Dutch and scientific names and geographic origins mentioned in the manuscript, is provided in Supplementary File 1. A pdf of the entire manuscript is available as

Supplementary file 2.

3.3. Medicinal plant descriptions

The first part of the manuscript is the largest and deals with *materia medica* of plant origin (Fig. 4). For most of the 273 plant entries, the author has written two pre-Linnaean Latin names. Each manuscript page usually features two or more entries, and next to 135 descriptions, the author left a blank space for an illustration (Figs. 5 and 6). The entries all follow a more or less similar structure that starts with the local Dutch name, a morphological description of the plant itself, its uses or properties, two pre-Linnaean Latin names and when available, an image taken from Fuchs' Dutch herbal attached to the entry (Fig. 5).

The manuscript provides descriptions of ca. 251 plant species, belonging to 83 plant families. There are more plant or plant-based entries (273) than species, as some plants are included twice or more with different parts or products, like the nutmeg tree (*Myristica fragrans* Houtt.), with separate entries for nutmeg seeds and oil, and the grape (*Vitis vinifera* L.) and its many derived products, such as wine, raisins, currants, cream of tartaric, etc. For 17 entries (e.g., frankincense resin, *Boswellia* spp.), more than one species could be involved in the product. For eight entries, we could only identify the plant on the genus level and for two species only the family. Most of the 83 plant families are represented in the manuscript with one or two species. The five most

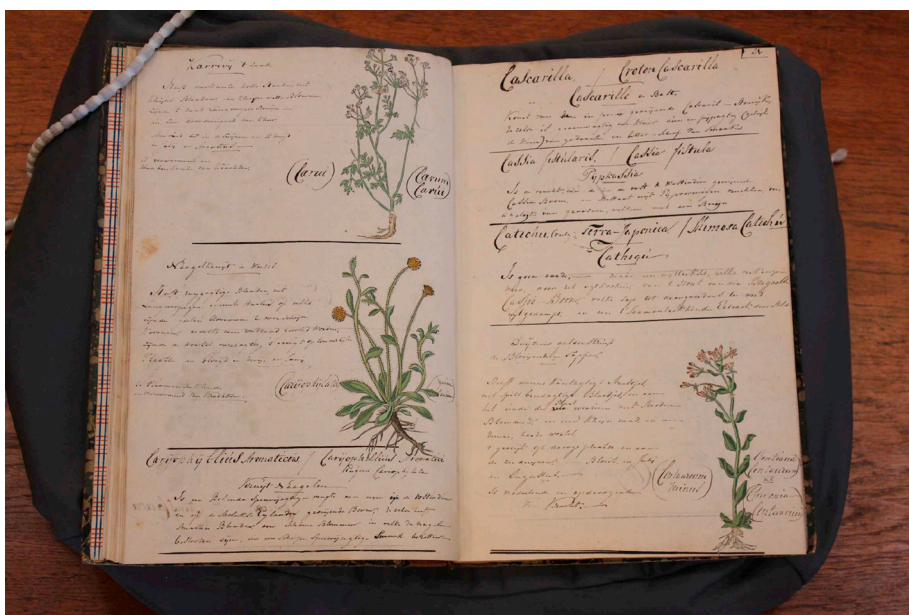


Fig. 4. Overview of two pages with five entries of *materia medica* descriptions. The exotic products (cloves, black cutch, cascarilla and *Cassia fistula*) were not illustrated by Fuchs (1549) so they lack an image.

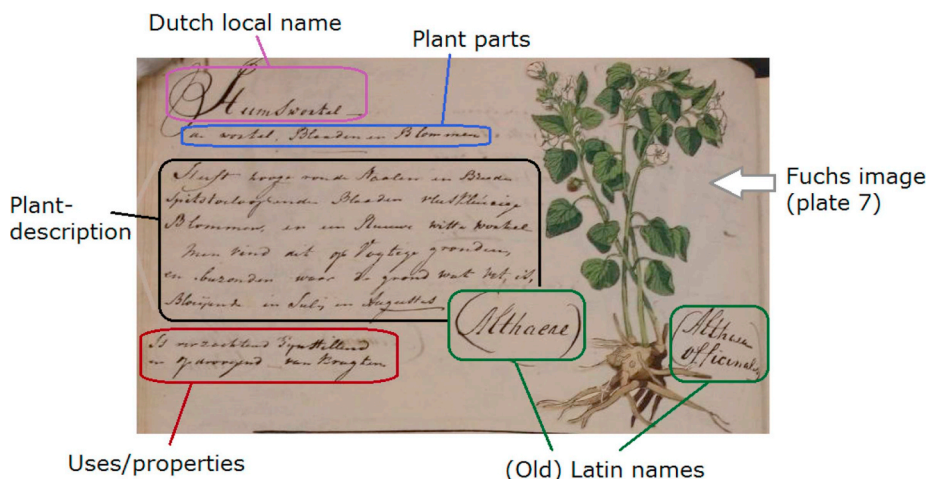


Fig. 5. Detail of the structure of a typical entry of a plant product in the manuscript.

represented families are Apiaceae (21 spp.), Lamiaceae (20), Leguminosae (17), Compositae (17) and Rosaceae (10). These families are still highly prevalent in current herbal medicine use worldwide (Gurib-Fakim, 2006; Weckerle et al., 2011).

3.4. Source of origin of the herbal medicine

Most of the plants described in the manuscript (167 of the ca. 251 species) are native to the flora of the Netherlands (Floron, 2017). For 76 plants, the author mentioned that they could be found in gardens, sometimes specifying between herb, vegetable or flower gardens. Several domesticated vegetables are listed (e.g., onions, fennel, parsnip), while plants such as garden angelica (*Angelica archangelica* L.) and blessed thistle (*Centaurea benedicta* L.) have a wild origin outside the Netherlands, but were apparently commonly grown in gardens around 1800. A total of 56 species were harvested from the wild, and specific habitats are mentioned, such as roadsides, swamps, field edges, forests and watersides. A few species (e.g., *Artemisia vulgaris* L.) were indicated as wild, ‘but sometimes also found in gardens’, although it was not always clear whether it occurred there as a weed or was deliberately planted for herbal medicine.

While most of the local plants are accompanied by an image from Fuchs, most of the non-native species that were recently introduced at the time the manuscript was written, were still unknown at the time when Fuchs published his famous herbal. Tropical products like cinnamon, bay laurel and tobacco lack an image in the manuscript and

cannot be found in Fuchs (1549), but had already become integrated in Dutch medicine halfway through the 17th century, as they were listed in the Amsterdam pharmacopoeia of 1636 (bay laurel) and 1643 (tobacco, cinnamon). For tobacco (*Nicotiana tabacum* L.), the author even mentioned: ‘its fatherland is America, but it is nowadays also cultivated here’. Cinnamon bark and oil (*Cinnamomum* spp.) are mentioned in the manuscript, but although the spice was introduced in Western Europe the course of the 16th century (Wijesekera, 1977), it was not included in Fuchs' herbal.

In total 111 entries (ca. 105 species) concerned exotic plants that were imported from elsewhere. Most lack an image, but for 11 introduced species (e.g., *Ficus carica* L., *Capsicum annum* L.), a corresponding illustration was included from Fuchs' herbal (Supplementary File 1). The manuscript mentions a wide variety of geographical origins, not only from the Dutch colonies in the East Indies (Ceylon, Malabar, Sumatra, Java) and the West Indies (Suriname, Guyana, Curacao), but also from the Mediterranean, China, Persia and Peru. Most exotic plant material came from the Near East (mentioned 28 times, Syria in particular), Indonesia (25), the US (10, in particular Carolina), the Caribbean (10), Spain (10), Mexico (6) and Italy (6). The accounts of where products were shipped from are surprisingly accurate and coincide with the places of origin mentioned in the modern floristic literature. An example of the author's knowledge on product provenance is a type of resin known by the name of Tacamahac, which can refer either to *Bursera* spp. or *Calophyllum* spp., depending on its provenance. The author seemed to be confused on the geographical origin of the

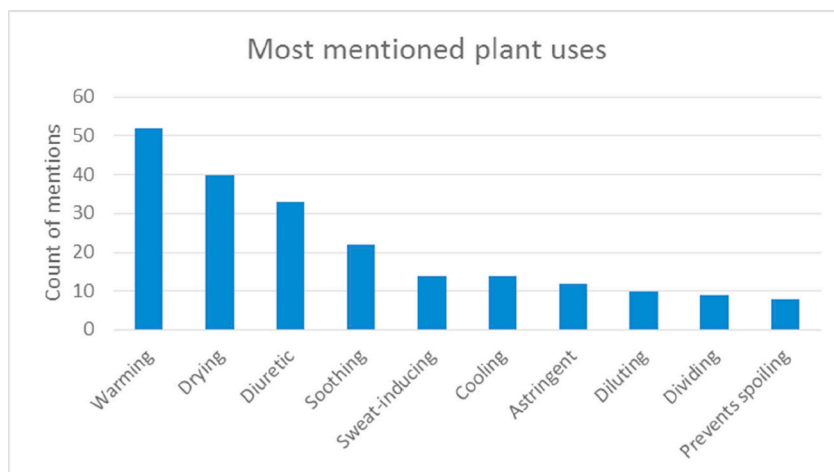


Fig. 6. Most frequently mentioned plant properties in the manuscript.

resin when he wrote: ‘comes from America, and particularly Madagascar’. However, several types of Tacamahac resin were traded at that time: the one from *Bursera* species from the Americas (Anagnostou, 2005; Sterling Yard, 1924) and the one from *Calophyllum* from Madagascar (Stevens, 1980).

The author also showed comprehensive knowledge of the differences in product quality, even if several types were sold under the same name. For the root of *Curcuma zedoaria* (Christm.) Roscoe for instance, he stated that although it was imported from Madagascar and the East Indies, the best quality was obtained from Ceylon, as these roots were sharp, spicy and grey-brown of colour. Despite his knowledge on the place of origin and quality of most exotic products, the author often did not know the source plant and its habitus. For example, Melegueta pepper seeds (*Aframomum melegueta* K. Schum.) are clearly described in the manuscript, while the Calomba root (*Jateorhiza palmata* (Lam.) Miers) was only referred to as ‘the root of an insufficiently known plant cultivated near Colombo, Ceylon’.

3.5. The role of Fuchs

Apart from the image for *Digitalis purpurea* L., which comes from an unknown source, a total of 134 images were inserted in the manuscript that originate from a 1549 Dutch edition of Fuchs' herbal (Supplementary File 1). The illustrations are mirror images of the original Latin herbal and the colours also differ from the (recently printed facsimile of the) coloured version of the German edition (Fuchs, 1543 [2001]). It seems that the author of the manuscript used a black-and-white copy that was hand-coloured afterwards. The coloured prints were all carefully cut out and attached to the pages, but not all images match the described species. In the case of *Satureja hortensis* L., for example, the author added the image of *Lepidium ruderales* L. from Fuchs (1549, capitulum 115), even though the book contains an illustration of *S. hortensis* with accompanying text in the previous capitulum (114). In his description of the male fern, *Dryopteris filix-mas* (L.) Schott, the author wrote the correct names and included the right image from Fuchs, but his description did not match the species. Instead of describing a fern, he mentioned a plant with yellow flowers, broad leaves and hand-shaped seeds, which we were unable to identify. In total, 42 inserted images taken from Fuchs' herbal do not match the species description in the manuscript. In 14 of those cases, the images represent another species in the same genus, while in 19 cases, the image of the correct species was present in Fuchs (1549) but apparently overlooked by the author. For 17 plant entries that have no image attached (including several products made out of grapes, *Vitis vinifera* L.), there is a matching image present in Fuchs's herbal. For example, *Ricinus communis* L. is depicted in Fuchs (1549: cap. 128), but although the author described the seeds and the oil as the trade products, ‘imported from the East Indies, but also cultivated here in gardens’, he probably did not know what the plant itself looked like.

In his search for matching illustrations, it seems that the author checked whether the common Dutch plant name had an equivalent in Fuchs' herbal, which did not always lead to a correct identification. His entry on *Geum urbanum* L. (Rosaceae), known by him as ‘Naagelkruijt’ in Dutch, was matched with an image of the botanically unrelated species *Hieracium pilosella* L. (Compositae), which is listed as ‘Nagelkruyt’ in the Dutch translation of Fuchs (1549). This is probably a direct translation of the German name ‘Nagelkraut’ from Fuchs' German herbal (1543 [2001]). Although Fuchs' Dutch version included a woodcut illustration of *G. urbanum* (cap. 144), its ‘Dutch’ name is ‘Benedictenwortel’, which seems a direct translation of the German ‘Benedictenwurz’ (Fuchs 1543: 215) and was not used in the Netherlands (PLAND, 2018). The same probably happened when the author searched for an image of the wild carrot (*Daucus carota* L.), then named ‘Voogel-nest’ (Birdnest) in Dutch. He added the image of *Ammi visnaga* (L.) Lam. (Fuchs, 1549: cap. 306), which carried the ‘Dutch’ name ‘Vogelnest’, which is a direct translation of the German term ‘Vogelnest’

for *A. visnaga* (Fuchs, 1543: 452), while an image of *D. carota* was available in cap. 263 under the (correct) Dutch name ‘Peen’.

On other occasions, he must have tried to match his pre-Linnaean Latin name with an image of Fuchs, which did not always result in a correct identification either. In the description of *Glechoma hederacea* L., he clearly described its purple flowers, but added an image of *Hedera helix* L. (Fuchs, 1549: cap. 160) that clearly lacks such flowers, and missed Fuchs's image of *G. hederacea* in cap. 337. In this case, the pre-Linnaean names ‘*Hedera terrestris*’ and ‘*Gleichoma Hederacea*’ resemble more the ‘*Hedera*’ of Fuchs for common ivy than the ‘Dutch’ names ‘Onderhave’ and ‘Eerdveijl’ for *G. hederacea* in Fuchs (1549) resemble the Dutch name ‘Aardsveijl’. In spite of the author's mismatches and misidentifications, resulting from his somewhat inadequate knowledge of botany, he inserted the vast majority of Fuchs's images (for 93 entries) with the correct plant names and descriptions.

3.6. Animal, mineral and other products

While some of the 19 entries of animal origin represent common household products like honey, beeswax, unsalted butter and bath sponges, the manuscript also lists several exotic *materia medica* products. Examples are isinglass (sturgeon swim bladders imported from Russia and used in beer and wine production), Mexican cochineal (a scale insect valued for its source of carmine dye) and Spanish fly (*Lytta vesicatoria* L.). While no information is given on the preparation, the pharmaceutical properties or the (medical) application of these animal products, much attention is paid on the distinctive characters of the products, like colour, smell and taste, and how to detect forgery and adulteration. In his description of musk (the scented glands of male musk deer), the author specified that the best quality was imported from ‘China, Tunquin (Vietnam) and Benghal’, of which ‘the purses are beset with brown hairs’. The ones imported from Russia are cheaper, but of lesser quality and distinguished by their white hairs. The author warned his readers to only buy musk when it came in closed pouches without seams, otherwise the glands had been opened and mixed with wood and sand.

The manuscript also lists one true mineral (phosphorus) and other chemical substances like sodium carbonate, vinegar, potash and cream of tartar, most of which are plant-derived products or of mixed biological-mineral origin. The Spanish soap, for example, was prepared in Alicante from olive oil and sodium carbonate, which in turn was produced by burning plants that grew along the beach. Products of biological origin that the author could not easily classify into plant or animal categories, like oak galls, sugar, amber, mushrooms and lichens, are mentioned in this section as well. Just like the animal products, the quality and visible characters of ‘minerals’ are meticulously described, but little is said about their applications in medicine, perfumes or pigments.

3.7. Medicinal properties of plant products

For 167 of the 264 higher plant entries, some medicinal properties were mentioned in the manuscript, mostly general characteristics like a bitter taste or a warming effect, rather than specific medicinal applications (Fig. 6). The few detailed medicinal recipes in the entire manuscript include a syrup prepared from the flowers of fennel (*Foeniculum vulgare* Mill.), a cooling syrup made from the flowers of *Viola odorata* L., the application of *Agrimonia eupatoria* L. leaves on old wounds, cooking China root (*Smilax china* L.) with guaiac wood (*Guaiacum officinale* L.) against skin problems and to promote sweating, and cooking laurel berries (*Laurus nobilis* L.) in oil to apply to skin rashes.

For the remaining 97 plant products, mostly derived from exotic species, no details on therapeutic applications were included at all. The lack of medicinal recipes suggests that the author was probably not a physician or an apothecary and the manuscript was not written as a

handbook for the preparation of herbal medicine. With only the information on plant properties like ‘drying’, ‘warming’ or ‘bitter tasting’, a layperson would not know how to apply the particular plants or products. To a physician or apothecary, however, these properties gave an indication of the possible applications of herbal products. In the 16th and 17th centuries, European medicine was still very heavily influenced by the ideas of humoralism (Klerk, 2015). This concept was based on the belief that human health depended on the balance of the four bodily fluids (humours): yellow bile, black bile, blood and phlegm. If one of these fluids was in excess or deficient, the best remedy was to counter the effects with plants that had the opposite characteristics (Nutton, 2005; Sternberg, 1997). Each humour had its property: either hot and wet (blood), cold and wet (phlegm), hot and dry (yellow bile) or cold and dry (black bile). Someone who was suffering from a fever and sweating was considered to have an excess of hot and wet humours and thus have too much blood. Apart from bloodletting, a possible remedy would include a ‘cooling’ plant, such as cucumber (*Cucumis sativus* L.). Throughout the manuscript, the author referred to the humoral qualities of particular plant products as if he understood how a doctor or apothecary would know how to use them. Most plant species mentioned in the manuscript were considered to have warming and drying properties (Fig. 6).

3.8. Information sources of the author

Remarkably, the author of the manuscript did not copy Fuchs' descriptions of the plant species or their uses, although these contain details such as all flower colour variations in single species and clear recipes for distinct medicinal treatments. In his description of dill (*Anethum graveolens* L.), Fuchs (1549: cap. 9) described that by putting the upper stems in water, a fluid was obtained that increased breast milk production, released wind from the stomach and helped digestion. He also explained how the plant eased pain and induced sleep when steeped in oil. The author of the manuscript included Fuchs' image, but only mentioned that dill helped to reduce pain and break the winds. Fuchs (1549: cap. 22) gave an elaborate description of how the powdered leaves of *Arum maculatum* L. were used for the healing of inflamed skin sores, while the author of the manuscript only characterized the plant as ‘loosening and dividing’.

The author did not refer to any literature sources, not even to Fuchs and it remains unclear whether he has used other sources of printed information. He sometimes used phrases like ‘it is said’ or ‘people say’, but it is uncertain whether his information comes from persons knowledgeable of herbal medicine, published texts or his own personal experience. Still, most *materia medica* products in the manuscript were well documented by 1800. Apart from Fuchs (1549), standard works on European medicinal plants were available in the Dutch language (Dodonaeus 1618; Munting 1696). Many exotic medicinal products from Asia had been described elaborately in the *Herbarium Amboinense* (Rumphius, 1741–1755) and the *Hortus Malabaricus* (Van Reede tot Drakestein, 1678–1692). The author did not copy texts from these well-known works on herbal medicine, but he was familiar with the Latin names of the crude drug substances. Outside the academic circles, Latin terms for exotic *materia medica* were known among traders and brokers (Klein, 2018). The majority of the products described in the manuscript are listed in the contemporary Amsterdam pharmacopoeia (Anonymous, 1795), although there are some spelling differences. While the author wrote that the true origin of the product “*Saga-peengom, sagapenum*” (*Ferula szowitziana* DC.) was unknown, Munting (1682: 417–418) gives a clear description on the species providing this product. Either the author did not have access to botanical reference books or he did not know of their existence. This practically rules out the possibility that he was a scholar or that he received higher education.

3.9. Elaborate product descriptions

The descriptions of the Dutch plants in the manuscript may not be of a scholarly level and not up-to-date with regard to the contemporary botanical standards, they are still quite detailed. Instead of focusing on the number of petals, sepals or anthers, the author wrote that a plant had flowers that were large and blue, or small and yellow, where it could be found and when it flowered. Possibly, the author wanted to produce a reference work for *materia medica*, either for himself or for someone else to learn the skill. The author described fresh plants only when he had seen them alive. For each imported product, he described the material that was brought in by the ships, and incidentally mentioned a source plant. The lack of botanical descriptions for exotic plants, of which only the derived products were imported, indicates that the author did not search for or harvest exotic plants in faraway places himself. It is therefore unlikely that he was an explorer or overseas merchant.

From the Amsterdam city archives, we learnt that Jan Theodorus Florentius Steenberg (1812–1890) was a bookseller and shopkeeper in Amsterdam. He was not only a member of the Zoological Society *Natura Artis Magistra* from 1856 to 1875, but also of a society to promote the arts. He was interested in science and technology and published on engines and natural rubber (Steenbergen, 1879, 1885). Since he was a bookseller, he could have obtained the manuscript via different channels, so his personal relation to the author of the manuscript remains unknown.

4. Discussion and conclusions

4.1. Identity of the author

Linnaeus published his influential works on binomial nomenclature halfway the 18th century (Linnaeus, 1756), but this new system of classifying plants was only slowly adopted by the scholarly community (Cain, 1959). This may be an explanation why the author of the manuscript did not use the Linnaean nomenclature for his Latin names. As he did not quote or copy any of the scientific resources on (medicinal) plants that were available around 1800, it is likely that he either had no access to, could not read or did not know this literature. He ‘recycled’ a valuable copy of Fuchs' herbal by cutting out the images, so a lack of money did not keep him away from libraries or other information sources. The cut-out images in the manuscript have printed text on their backside, so the author had access to the texts of Fuchs on medicinal recipes. The fact that he classified several exotic medicines as ‘little known’, while they had been elaborately described by famous botanists like Rumphius and Van Reede tot Drakestein, suggests he was not aware of what information was available. A lay-person interested in documenting the variety of *materia medica* would probably have consulted more published information.

His extensive details on the places of origin of many plant products, however, indicate that he was well informed about trade routes. This leads us to our conclusion that the author must be searched in the circles of traders or brokers in herbal medicine. He clearly knew where products were collected or traded, their morphological traits that were essential in recognising the species, the variety in quality, and methods to test this quality. In the cases where different products from the same species were described in separate entries in the manuscript, such as the oil and seeds of nutmeg (*Myristica fragrans*), those products were often shipped through different routes. The Time Capsule databases indicate that nutmeg oil was shipped from Batavia (and probably produced there), while the seeds were imported from other places in the Dutch East Indies, like Banda, now Eastern Indonesia. Although the author acknowledged that oil and seeds came from the same tree by using the same Dutch and Latin names, he chose to treat them separately. This supports our theory that he saw the plant products as trade items. A

botanist would group products derived from the same plant species together, while a doctor would categorise them by disease or medicinal property. The manuscript looks as though the author intended to make a catalogue of traded medicinal products. Although he was no scholar, he knew how to identify *materia medica*, so it is likely that he had seen Dutch plants in their natural habitat and observed the imported products regularly. We therefore think that he was involved in the trade in medicines of herbal and animal origin, probably located in the vicinity of Amsterdam and engaged in the import of exotic plants.

Only five plant products and none of the animal products described in the manuscript are absent from the pharmacopoeia of Amsterdam (Anonymous, 1795) that was published around the time this manuscript was produced (Supplementary file 1). However, the ‘pinxternakel’ (*Pastinaca sativa* L.) and ‘Spaanse peper’ (*Capsicum annum* L.) were listed in the Amsterdam pharmacopoeia of 1723, and the ‘Wormbast’ from Jamaica (*Andira inermis* (Wright) DC.) was discussed by Murray (1790). The seed of ‘Waterfenkel’ (*Oenanthe aquatica* (L.) Poir.) was mentioned in the Dutch pharmacopoeia (Anonymous, 1805) as a medicinal plant (‘Phellandrium aquaticum’). Only the sago starch, harvested from the Asian palm *Metroxylon sagu* Rottb., and mentioned in the manuscript as a granular starch used by the natives of the Moluccas and Siam to prepare bread, and having ‘softening’ properties when dissolved in water, we could not trace in the literature on herbal medicine around 1800. As the author of the manuscript uses similar names as those listed in pharmacopoeias in the same period (apart from some spelling differences), he could have been involved in supplying the stock to apothecaries.

By writing the manuscript, the author intended to document his extensive knowledge on *materia medica*. If he had used his manuscript to show off his knowledge and gain fame, he would probably have published it or included his name somewhere. It is likely that he documented the information for someone else, an intended successor perhaps. Whoever this person was, he did not use the manuscript often, as there are hardly any traces of use on the pages or the cover of the book.

4.2. Scientific relevance of the manuscript

Between 1500 and 1700, the global commerce in exotic medicinal substances, which formed a subcategory of the profitable spice trade, transformed the European pharmacopoeia as well as others (Cook and Walter, 2013). This manuscript offers a unique insight in this worldwide trade in and knowledge on *materia medica* in non-academic circles around 1800. The medicinal plants described by the anonymous author reflect the extensive cultivation and wild-collection of medicinal herbs in the Netherlands, but also show how new medicines and practices from faraway countries had entered the medical repertoires of the Dutch citizens. The results of our study are also relevant to recent digital humanities initiatives tracing the trading routes of exotic *materia medica*, as they illustrate how traders recognized these foreign substances by their morphological and organoleptic features and how they tested their quality and detected forgery. The Galenic framework used to indicate the healing properties in the manuscript was already obsolete at the end of the 18th century, but plant properties like ‘drying or ‘warming’ would still be indicative for doctors and apothecaries on the use of *materia medica*. The manuscript contains medicines that were well known and widely available in apothecary shops at that time, even when they were imported from faraway places. However, the fact that this author, possibly a drug merchant, an intermediary between herb cultivators, overseas traders and apothecaries, documented his own knowledge, outside the academic tradition and without using obvious published sources except printed images, makes this manuscript truly unique.

Author contributions

IS conducted the research, made the website and drafted a first version of the paper; WK conducted archival research, MB studied the Fuchs herbals; TvA designed the study and wrote the final version of the paper. All authors revised and approved the final version of the paper.

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Appendix A. Supplementary data

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