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#### Publication date

2022

#### Published in

Maria Sibylla Merian

[Link to publication](#)

#### Citation for published version (APA):

Dunaeva, Y., & van de Roemer, B. (2022). How to Crack Such Shells? Maria Sibylla Merian and Catalogues of Zoological Specimens. In B. van de Roemer, F. Pieters, H. Mulder, K. Etheridge, & M. van Delft (Eds.), *Maria Sibylla Merian: Changing the Nature of Art and Science* (pp. 252-264, 278). Lannoo.

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# How to Crack Such Shells?

## Maria Sibylla Merian and Catalogues of Zoological Specimens

Yulia Dunaeva & Bert van de Roemer

In the early modern period, collecting was an omnipresent pastime in Europe among different social strata of society.<sup>1</sup> Many collectors were involved in the exchange and trade of *naturalia*. A significant problem in the communication between these collectors, naturalists, and traders was the correct nomenclature of the specimens they were corresponding about, as names were not yet standardized. Books with illustrations of plants and animals played an important role in the identification of specimens and were often used to be more precise. Historian of science Dániel Margócsy coined this communicational mode with the phrase “refer to folio and number”, as authors always needed to name the publication, the page number, and the number of the illustration in order to acknowledge that they were talking about the same thing.<sup>2</sup> The published images of Maria Sibylla Merian were of essential importance in

this process. We will describe how her works were employed for this method of “referring to folio and number” by discussing five catalogues of zoological specimens, concluding with the celebrated publication by the famous Swedish naturalist Carl Linnaeus (1707–1778), the tenth edition of *Systema Naturae* (1758), which is usually seen as a threshold constituting the starting point of modern scientific zoological nomenclature.

After the publication of the *Systema Naturae*, the standardization of the identification of animals started to develop.<sup>3</sup> Before this seminal publication, there was a proliferation of names and different taxonomic systems.<sup>4</sup> Naturalists used vernacular names or diagnostic phrase names containing morphological or biological features. Consistency seemed not to be their aim, as a naming of one species might change within the same publication of one author.<sup>5</sup> Many scholars

considered this abundance of names and systems a troublesome problem. Botanist John Tradescant the Younger (1608–1662) wrote about the difficulties he encountered with naming zoological specimens when he compiled the catalogue of his father’s collection. When trying to explain why he composed the list partly in Latin and partly in English, he added an expressive phrase: “Encroachers upon that faculty, may try how they can crack such shells.”<sup>6</sup> Likewise, the German naturalist Georg Everhard Rumphius (1627–1702) mentioned that one of the reasons for his publication about crustaceans, shells, and minerals on the Indonesian island of Ambon was because enthusiasts of *naturalia* (“*Liefhebbers*”) could not understand each other due to the many names given to various species.<sup>7</sup> Merian was also aware of the complexities concerning nomenclature, stating in the preface of *Metamorphosis Insectorum Surinamensium* (1705) that she only employed plant names used by indigenous people and inhabitants, and that she relied on Caspar Commelin (1668–1731), the professor of botany in Amsterdam, for the Latin names. Did she foresee the role her work would play in the exchange of information about specimens? Certainly she published her work with an eye to the *Liefhebber*, as she dedicated her work to these enthusiasts, many of whom tried to make their identifications more precise by referring to her published images of similar organisms.<sup>8</sup>

The quality of these images made by Merian was very high. When composing the plates for her books, Merian used her

detailed watercolors of insects that she had previously made in her *Studienbuch*. She etched most of the plates in her books herself, and for others she closely supervised the artisans who cut the plates. She was very concerned with color accuracy (see also the chapter by Schmidt-Loske and Etheridge in this volume).<sup>9</sup> Every image contained many fine visual details of an animal that could help identifying a specimen and make it recognizable as a specific type.<sup>10</sup> No wonder that her illustrations did not escape the attention of compilers of scholarly and commercial catalogues.

### **The Pharmacist with a Network of Agents: James Petiver**

An example of a naturalist and collector who refined the descriptions of his insect specimens with references to Merian’s books was James Petiver (ca. 1663–1718). Petiver was the proprietor of an apothecary shop in London and had a passion for *naturalia*. He managed to arrange one of the largest and most varied collections of specimens of natural history that existed in England during the early eighteenth century.<sup>11</sup> To enrich his collection with exotic specimens, Petiver organized a network of persons who sailed over the Atlantic or lived in different places, from Moscow to the British colonies in the so-called New World, and from the Cape of Good Hope to the Spanish settlements in the Philippines. A few dozen correspondents and contributors—shipmasters, ship’s surgeons, missionaries, physicians, servants of trading companies, etc.—sent

or brought him natural objects from all over the world.<sup>12</sup>

Petiver owned Merian's publications and corresponded with her about the exchange of specimens, finding clientele in England for her Suriname book and translating her work into English.<sup>13</sup> In 1695, he published the first part of his catalogue entitled *Musei Petiveriani Centuria Prima Rariora Naturae Continens*. Five more parts followed: *Centuria secunda & tertia* (1698), *Centuria quarta & quinta* and *Centuria sexta & septima* (1699), *Centuria octava* (1700), and the last issue, *Centuria nona & decima* (1703). The pagination in these issues was continuous.<sup>14</sup> In total he described one thousand specimens of *naturalia* in batches of a hundred, called *Centuriae*. The larger part concerned plants, but he also included many animals. All issues of the catalogue except the second one (1698) contained descriptions of insects. These were partly in Latin and partly in English.

As a rule, each of Petiver's descriptions of insects begins with a Latin diagnostic phrase name. The first word in such a phrase often indicates a higher taxonomical group that a specimen can be grouped under: butterflies (*Papilio*), moths (*Phalaena*), dragonflies (*Libella*), beetles (*Scarabaeus*), flies (*Musca*), and so on. This is followed by one, two, or more morphological features of a specimen that usually concern the size, form, and colors of an insect. He also includes Latinized geographic names indicating the countries of origin. These phrase names were followed by references to

published sources with information about the insect. After the references, Petiver gave also an English name, if one existed. At the end of each description he usually reported very briefly some biological traits of an insect. When specimens were received from abroad, Petiver added the name of the donor.

As was the custom in those days, Petiver presented the published references in an abbreviated form. As a rule, they contain no more than three or four letters of the last name of an author and the number of the page or plate. He presented a list of abbreviations with the first *Centuria*, so it is clear which authors he meant. Most common were "Aldr." (Aldrovandi), "Mof." (Moffet), and "Johnst." (Jonston). In many descriptions of insects, he mentions "Graf. v. 1" and "Graf. v. 2." The list of abbreviations explains it refers to "Graf. v. 1: Mar. Sibyll. Graffin, of Insects. Dutch. Nürnberg. 1679. 4<sup>o</sup>" and "Graf. v. 2: Her 2nd vol. in Dutch. Franc. ad Moen. 1683. 4<sup>o</sup>".<sup>15</sup> With these references he meant the first and second volume of *Der Raupen wunderbare Verwandlung*, which Merian published under her husband's last name, "Graffin". He mentions the first part seven times and the second three times, in descriptions of six butterflies, two moths, one caterpillar, and one pupa. Obviously, all these descriptions concern European insects.

In the first *Centuria*, Petiver referred three times to plate 29 from the first *Raupenbuch* (Fig. 1). This plate illustrates the developmental stages of the common magpie moth (*Abraxas*



Fig. 1 M.S. Merian, The development stages of the common magpie moth (*Abraxas grossulariata*) on a white currant (*Ribes rubrum*), in M.S. Merian, *Der Rupsen Begin, Voedzel en Wonderbaare Verandering*, part I, Amsterdam 1712, plate 29, hand-colored etching, counterproof, 18.6 x 14 cm (plate). Artis Library, Allard Pierson, University of Amsterdam, AB Legkast 019.02. Same image (reversed) as in *Der Raupen wunderbare Verwandlung*, Nuremberg 1679.

*grossulariata*) on a white currant (*Ribes rubrum*).<sup>16</sup> Petiver listed the imago, the caterpillar, and the pupa as three different specimens in his collection, and he placed the description of the imago on another page.<sup>17</sup> From his notes on the caterpillar and the pupa it is clear that he was aware that these were stages of the metamorphosis of the moth described on the previous page. Apparently, he felt no need to combine the three

descriptions and to stress their temporal coherence. Did it seem more logical for him to describe the dried imago apart from the caterpillar and the pupa preserved in alcohol? In any case, he added to all three descriptions references to the same plate in Merian's book, emphasizing the connection between the three stages and so giving additional indication of the moth's metamorphosis.

### The Curious Preserver: Levinus Vincent

At the end of his catalogue, Petiver added an "acknowledgment": a list of persons he was obliged to for sending specimens. Among these persons, he mentioned the "curious preserver of all natural and artificial rarities, 'myn heer' Levinus Vincent at Amsterdam", who had sent to Petiver "divers admirable insects".<sup>18</sup> Merian, Petiver, and Vincent belonged to the same international network of exchanging specimens, information, and documentation. The letters from both Merian and Vincent to Petiver, preserved in the British Library, show there was some conflict between the two concerning who would be Petiver's contact person in the Dutch Republic.<sup>19</sup>

Levinus Vincent (1658–1727) was a Dutch designer, producer, and seller of luxurious cloth, and together with his wife, Joanna van Breda (1653?–1715), he owned and curated a "Wonder Theatre of Nature". Their collection was considered one of the finest in the Dutch Republic around 1700. Vincent published four catalogues of his collection





Fig. 2 R. de Hooghe (design), J. van Vianen (etching), Allegorical representation of the collection of Levinus Vincent and Joanna van Breda. Frontispiece of L. Vincent, *Wondertooneel der Nature*, Amsterdam 1706. Allard Pierson, University of Amsterdam.

between 1706 and 1726. In the catalogue of 1719, which also lists the contents of his library, he mentions Merian's *Metamorphosis*, but not her European Caterpillar Books. In 1726, Vincent published his most extensive bilingual catalogue in Latin and French, titled *Catalogue et description des animaux [...]*. This is an inventory of a part of his zoological collection listing primarily the specimens kept in alcohol and some ethnographical objects.<sup>20</sup> It was published *in quarto* without illustrations, but included an earlier etched frontispiece by Romeyn de Hooghe (1645–

1708), giving an allegorical impression of the collection (Fig. 2).

Just like Petiver, Vincent organized his list of specimens in hundreds. There are six of these, which describe six hundred glass jars with specimens. These are followed by a list of 45 items concerning toads and frogs, a special interest of Vincent's. The catalogue ends with a list of one hundred ethnographical objects. In the first group of a hundred specimens, Vincent listed both vertebrate and invertebrate animals. Insects are absent from this publication, because he preserved them in separate boxes and drawers. However, he does mention some caterpillars, for which he occasionally used Merian's *Metamorphosis* as source of reference. The descriptions in this catalogue are less informative than those of Petiver, because Vincent used the diagnostic phrase names without the notes on biological traits of the animals. Moreover, he rarely added references to other sources of information and, when he did, he almost never clarified a reference with the number of the page or plate. However, there are few exceptions. He supplemented twelve descriptions in the catalogue with references to Merian's *Metamorphosis*; in eleven of these, he specified the numbers of the relevant plates.<sup>21</sup> All of these particular descriptions concerned the larvae of South American insects: eleven moths or butterflies and one beetle. Just like Petiver, Vincent ignored the association between the larvae and some imagoes of insects, though the references to Merian's plates supplied this information.

## The Pharmacist's Treasures: Albertus Seba

Rich collections like those of Levinus Vincent could evoke admiration or lead to competition by other Dutch collectors, such as Albertus Seba (1665–1736). This German-born pharmacist curated another famous and highly esteemed collection of *naturalia* in Amsterdam at the beginning of the eighteenth century.<sup>22</sup> In 1715, Seba offered his extensive collection for sale to the Russian Tsar Peter the Great (1672–1725). In a letter of 4 October 1715, Seba wrote to Peter's agent that his collection was more complete than that of Vincent.<sup>23</sup> Soon after successfully completing the bargain, Seba acquired a new collection that was even richer than the previous one. He decided to publish an illustrated catalogue of his *naturalia* and invited qualified artists to produce the plates by which all of his specimens should be displayed. The result was the appearance of *Locupletissimi Rerum Naturalium Thesauri* (1734–1765), one of the most impressive works of eighteenth-century natural history.<sup>24</sup> Seba's *Thesaurus*, as it is mostly called, comprises four large volumes *in folio* with 449 plates. Only the first and second volumes of this extensive work were published during Seba's lifetime. By the time of his death in 1736, the etchings for the third and the fourth volumes were nearly all ready, but the text was not yet finished.<sup>25</sup> Seba wrote the text in Dutch, which was translated into Latin and in French. There were two bilingual editions: Latin and French or Latin and Dutch. After Seba's death, Arnout Vosmaer (1720–1799) supplemen-

ted and revised the text of the third volume with the participation of other naturalists and wrote the text of the fourth volume. These were published in 1759 and 1765.<sup>26</sup> The content of the first volume is a mixture of plates showing various specimens of plants and vertebrate and invertebrate animals; the second volume concerns snakes, the third is devoted to fishes and other aquatic animals, and the fourth to the insects and minerals.

Like Vincent, Seba did not add many references to the descriptions of his specimens. However, Merian's Suriname book was also among those few sources of information to which he repeatedly referred. There are four references to Merian in the first volume and no less than sixteen in the fourth. Seba and Vosmaer formulated their references in a different mode than Petiver and Vincent. In all cases, they mention the author, either "D. Merian" or "Mad. Merian" or "Meriana". Most of the references in the fourth volume by Vosmaer were clarified with the plate numbers. Only few of these were supplied with inaccurate titles of the book, such as *Historia insectorum Surinamensium* or *Description insectorum Surinamensium*, or *Insectorum Surinamensium*.

In the first volume of the catalogue, Seba added references to Merian in the descriptions of animals other than insects: an opossum ("Muris, sylvestris, Americani, foemella"), a giant lizard ("Lacerta Tejuguacu, Americana, maxima, Sauvegarde dicta..."), and a caiman ("Crocodilus, Americanus, amphibius").<sup>27</sup>



Fig. 3 Two depictions of a female opossum with young on its back. Above: in A. Seba, *Locupletissimi rerum naturalium thesauri*, volume 1, Amsterdam 1734, plate 31, figure 5, etching. Below: in M.S. Merian, *Dissertatio de Generatione et Metamorphosibus Insectorum Surinamensium*, Amsterdam 1719, plate 66 (detail), etching. Both: Library of the Russian Academy of Sciences at the Zoological Institute, Saint Petersburg.

This shows that Seba relied on the second edition of the *Metamorphosis* from 1719 (or one of the later editions), because the publisher of this posthumous edition added twelve extra plates to the sixty originals of the 1705 edition. All the abovementioned animals are represented on these twelve extra plates.<sup>28</sup> This was also the case in the fourth volume of Seba's *Thesaurus*, where there is one reference to plate 65.<sup>29</sup>

The image of the mouse opossum (*Marmosa murina*) on plate 31 of the first volume in Seba's *Thesaurus* shows a strong resemblance with the animal on plate 66 of the *Metamorphosis* of 1719, which could hardly be accidental (Fig. 3). Both images show a female opossum with young on her back. Their number and placement are identical on both plates, and the positions of the heads, legs, and bodies are the same. However, Merian's opossum is rendered with greater awareness of the three-dimensionality of the forms (for instance, in the treatment of shadows), and with more understanding of the anatomy of the animal (for instance, in the structure of the head and ears). It seems unlikely that the illustrations were drawn from the same preserved specimens, because there are also some remarkable differences. Obviously, the stretched tail was turned upright in the Seba version, which might be caused by the smaller size of the copperplate used by Seba's etcher. In nature, young opossums do not curl their tail like that around the mother's tail, whether stretched or upright.<sup>30</sup> Another remarkable difference is that in Merian's plate the hind legs of the adult opossum were depicted incorrectly, with one toe pointed backward. This was corrected on the plate for the Seba catalogue. In any case, as all postures of the animals are similar, it is safe to assume that Seba's etcher followed Merian's image and was instructed by Seba to make a small correction. In the text, Seba comments on Merian's images and that the specimen he owned did not have claws



like a bird, as in Merian's picture, but hands like a monkey, with four fingers and a thumb with short claws. This example poses interesting questions about how Merian's work was used as a source of reference for illustrators as well as the more general practice of copying natural history illustrations.

### The *Kunstkamera* of Saint Petersburg and Merian

In 1714, Tsar Peter the Great founded the first Russian public museum, the *Kunstkamera*, in Saint Petersburg. The tsar considered such an institute to be essential for enhancing the scientific prestige of Russia in Europe and to develop the educational system in his empire. He made many efforts to improve and replenish the museum. Several large collections were bought abroad, including the abovementioned collection of Albertus Seba and the famous anatomical cabinet of Frederik Ruysch (1638–1731).<sup>31</sup> The tsar decreed that all unusual and curious things found in Russia should be sent to Saint Petersburg to be preserved in the *Kunstkamera*. Moreover, the Russian government organized several expeditions to Siberia in the first half of the eighteenth century. Many specimens were collected during these voyages, and they enriched the *Kunstkamera* as well. As the museum's holdings increased rapidly, the need for systematization and cataloguing was felt in due course.

Between 1741 and 1745 the first extensive printed catalogue of the *Kunstkamera*, titled *Musei Imperialis Petropolitani*, was published in two octavo volumes in

Latin and without illustrations. The first volume listed the *naturalia* and the second the *artificialia*. Seven thousand zoological specimens are described in the first part of the first volume.<sup>32</sup> The descriptions are brief and usually include the name of the animal, a brief account of its external features, the place of origin, and—like the examples discussed above—references to other publications with illustrations or information on the animal. The catalogue lists about 1,400 references to 49 sources by 42 authors. Among these references the works by Merian are mentioned 169 times. We can discern three groups here. First, there are 41 references to her Suriname book, formulated as “Mad. Merian. Metamorph. Insect. Surinamens.” or “Mad. Mer. Insect. Surinam. Metamorph.” or “M. Merian. Insect. Surinam.” In addition to the shortened title of the book, each reference contains the number of a plate. The second group of references, 64 in all, leads us to different parts of the Caterpillar Books, formulated as “*Raupen-Verwandlung* Part I” (34 references), “*Raupen-Verwandlung* Part II” (23 references), and “*Raupen-Verwandlung* Part III” (seven references). These references in the catalogue are printed in a different Gothic font. Apparently, the compilers made no distinction in the linguistic differences between the first two German parts from 1679 and 1683 and the third part of 1717, which was in Dutch.

Remarkably, researchers in Saint Petersburg had one special and unique source by Merian at their disposal that remained unknown to other researchers

in Europe. In all, 64 references mention the manuscript journal of Merian, the so-called *Studienbuch*. This is a unique document containing her handwritten observations on metamorphosis, insect behavior, relationships with parasites, and other biological traits, accompanied by detailed watercolors on small pieces of vellum (see also the Introduction as well as the chapter by Schmidt-Loske and Etheridge in this volume).<sup>33</sup> Tsar Peter the Great's chief physician and adviser, Robert Areskin (1677–1718), bought this *Studienbuch*, among many other watercolors on larger sheets of vellum, in 1717 in Amsterdam and brought it to Russia. After Areskin's death, the manuscript entered the first Russian public library, which was closely related to the *Kunstkamera*.<sup>34</sup> The references to this manuscript are usually formulated as “Mad. Merian Journal” with added numbers of pages and figures. Importantly, the compilers of the Russian catalogue had access to these first-hand observations by Merian and used them for their cataloguing work. It is intriguing that they considered it an important reference source, even though it was not accessible for readers abroad. Therefore they frequently added a reference to a corresponding image in Merian's published work, as many of the *Studienbuch* images were also reprinted in her books.

### Two Butterflies

The references to Merian images in the catalogue of the *Kunstkamera* can help to interpret the data much better, as the following example will show. One but-

terfly is described as: “*Papilio Surinamensis nigra, ochroleucis maculis varia, alis inferioribus rufa macula insignitis: depicta a Mad. Merian. Metamorph. Insect. Surinam. Tab. XXXI*” (A black butterfly from Suriname with various pale yellow spots and with distinctive red spots on hind wings: pictured by Madame Merian in the *Metamorphosis* on plate 31).<sup>35</sup> A colored copy of plate XXXI of the *Metamorphosis* shows two butterfly imagoes with different coloration (Fig. 4). The coloration of the lower butterfly partly corresponds with the description in the *Kunstkamera* catalogue. The wings are dark with various pale yellow spots, but there are no distinctive red spots on the underside of the hind wings. On the contrary, the upper butterfly has red spots, but the upper sides of the wings are dark green. At present, the identity of all insect species depicted by Merian in her *Metamorphosis* has been determined. The stages of lepidopteran development presented on plate XXXI represent the subspecies of the butterfly *Papilio (Heraclides) androgeus androgeus* (Cramer, 1775), which is found in Suriname.<sup>36</sup> The adults of this subspecies are known for their sexual dimorphism; males and females have different coloration, and that is what Merian depicted here. The upper sides of male wings are dark with pale yellow spots, whereas the wings of females are dark green. There are small red spots on the undersides of the hind wings of both sexes.<sup>37</sup> The extremely concise description of the butterfly in the catalogue of the *Kunstkamera* tells us very little



Fig. 4 M.S. Merian, Metamorphosis of *Heraclides androgeus* on *Hibiscus mutabilis*, in M.S. Merian, *Over de Voortteeling en wonderbaerlyke Veranderingen der Surinaemsche Insecten*, Amsterdam 1719, plate 31, hand-colored etching, counterproof. Artis Library, Allard Pierson, University of Amsterdam, AB Legkast 019.01.

about the specimen, but the added reference to Merian's plate led us to the name of the subspecies and even the gender of the insect that was preserved in the collection. Thanks to the links to Merian's books, we can get a visual representation of the zoological specimens of the *Kunstkamera*.

### Linnaeus and Merian

Another example of the importance of Merian's illustrations for zoological identification in early modern natural history can be found in the work of no less a person than the famous Swedish naturalist Carl Linnaeus. He also used Merian's publications to "refer to folio and number", and we will illustrate this by discussing two works. Between 1751 and 1754 he worked for the King of Sweden, Adolf Fredrik (1710–1771), who maintained a natural history cabinet in the royal castle of Ulriksdal, located near Stockholm. Linnaeus, then professor in Uppsala, spent several weeks at the palace to prepare a catalogue of the *naturalia* collection, titled *Museum Regis Adolphi Friderici*. The catalogue was published in Stockholm in two volumes, in 1754 and 1764. The first volume is a luxury edition *in folio* with numerous engravings.<sup>38</sup>

Linnaeus used in this catalogue for the first time his binominal nomenclature for zoological specimens. The catalogue refers seven times to plates in Merian's *Metamorphosis*: four beetles, a peacock katydid (*Gryllus ocellatus*), a cicada (*Cicada mannifera*), and a tarantula (*Aranea avicularia*).<sup>39</sup> For the beetles, Linnaeus used the following names:

*Scarabaeus elongatus*, *Cerambyx longimanus*, *Cerambyx cervinus*, and *Buprestis maxima*.<sup>40</sup> These species were later included in the tenth edition of his *Systema Naturae* (1758), which will be discussed below. Linnaeus changed the names in three cases: *Scarabaeus elongatus* became *Scarabaeus interruptus*, *Cerambyx cervinus* became *Cerambyx cervicornis*, and *Buprestis maxima* became *Buprestis gigantea*.<sup>41</sup> As he was referring in both publications to the same images by Merian, we are certain he was talking about the same species. It also shows that the beetles in the Swedish royal collection can be considered as the type specimens for the respective species described in the *Systema Naturae*.

The famous tenth edition of Linnaeus's *Systema Naturae* did not describe the holdings of an actual collection; it was instead an attempt to systematize the whole natural world in order to solve the problem of the proliferations of names, mentioned earlier. Even though the tenth edition lists general species instead of specific specimens, it was organized in a way comparable to a catalogue of a collection. In the beginning of the chapter on "Insecta", Linnaeus enumerates Merian among those entomologists who made a considerable contribution through her outstanding images of the metamorphosis of insects.<sup>42</sup> Following this praise, he refers to her work 136 times. Botanist William T. Stearn published the first extensive discussion of Linnaeus's use of Merian's work in 1982, but this was restricted to the *Metamorphosis*, whereas we will discuss refer-

ences to all of her works.<sup>43</sup> The significant total number of 136 references shows that Merian's images were of great value for Linnaeus. This is especially notable in the section of *Systema Naturae* on butterflies, which has 99 references to Merian. Additionally, there are references to images of nineteen beetles, four cicadas, and several other insects, such as flies, mayflies, true bugs, and even aphids. There is also a reference to the famous image of the bird-eating spider (see Fig. 1 on p. 14 in the chapter by MacGregor in this volume), a frog, a lizard, and a bird.

The references to Merian's works in *Systema Naturae* can be divided in three groups. The first contains 46 references that concern organisms in the Suriname book. They are indicated with "Merian surin.", "Merian sur.", or "Mer. surin.", followed by a number of the page or plate, which always coincide (e.g., "Merian sur. 17 t. 17."). As these numbers run from 2 to 71, it is certain that Linnaeus used the posthumous publications of the *Metamorphosis* from 1719, 1726, or 1730, which contained twelve extra plates, as we have seen above.

The second group consists of 77 references to the different parts of the European Caterpillar Books and are indicated with "Merian europ.", "Merian eur.", or "Mer. eur.". They are also followed by plate numbers. Among this group, 44 have another number ("1", "2", or "3") indicating the different parts of the Caterpillar Books. For instance, "Merian eur. 2. t. 35." indicates plate 35 (*tabula*) of the second part of the Caterpillar Book.

A third group of thirteen references is less specific and leaves some doubts as to the specific work Linnaeus means. These ambiguous references are formulated as "Merian ins." or "Mer. ins.", indicating only that it was a work about insects. As four of them are followed by the number "2", it probably is safe to assume that Linnaeus was in these cases referring to the second part of the Caterpillar Book. The other nine cases remain unclear.

A comparison between the insect names in the *Systema Naturae* and the images of the Merian plates indicates that Linnaeus likely used at least two different editions of the Caterpillar Books. In 42 instances, plate numbers between 2 and 181 are given.<sup>44</sup> The Dutch and French editions of 1730 numbered the original plates of the three Caterpillar Books consecutively and added some extra plates, like the title plates and plates originating from Merian's *Blumenbuch*; this resulted in a total of 184 numbered plates in these combined volumes that were published after her death (see also the chapter by Van de Plas in this volume). The separate parts of the earlier editions of the Caterpillar Books each contained plate numbers from 1 to 50. On the contrary, the 48 references in Linnaeus's work with the numbers "1", "2", or "3" added to them never mention plate numbers higher than 50, so we can conclude that Linnaeus used the 1730 edition as well as the three separate volumes on European caterpillars in naming these type specimens; these volumes were published between 1679 and 1718 in German, Dutch, and Latin.



The six catalogues of zoological specimens discussed above show the important role Merian's publications played in the process of the identification of species and establishing a standardized nomenclature. First, her work was used as sources of reference by private collectors to help them with the identification of objects in their own collections and as an aid for the communication with others through the method of "referring to folio and number". Gradually, her body of work was increasingly employed in a steadily growing modern scientific context, as it was used for the institutional collection of the Kunstkamera and in the foundation of modern taxonomic

order by Linnaeus. In a way, Linnaeus increased the scientific importance of Merian's work. Her high-quality depictions of insects were so precise and detailed that later collectors and researchers were able to identify species or even subspecies of an insect. For present-day research, her work has proven especially valuable in comparison with non-illustrated catalogues compiled before Linnaeus's standardization. Through consultation of Merian's artful and accurate images, species in historic collections can be identified that otherwise would have remained unknown, thus giving insight in early modern taxonomical procedures.