

On holotypes and isotypes

by Gea Zijlstra

In this talk, I will sketch several stories, on plants who found peculiar paths to the herbaria in which they nowadays can be found. Each story will end with the question: which specimen is the holotype and which are the isotypes? At the end, there are some concluding remarks.

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•	several cases to be discussed
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fig. 1

I. Introduction

This will be a story on types. **Types** are the elements to which names of plants are permanently attached, to make it clear forever what is meant by a certain name. The Code recognizes a number of type categories, they are listed in fig. 2. If not designated by the original author, the holotype is the specimen or illustration **used** by the author who described and named a species. Isotypes are duplicates of the holotype.

specimens and illustrations	specimens
holotype	isotype
lectotype	isolectotype
neotype	syntype
epitype	isosyntype
	paratype

fig. 2

The Code section on typification is rather big; I made a small selection, including some important definitions. This is presented in a **handout** that you may get it at the end, I will not discuss them.

To avoid misunderstandings, a few preliminary comments:

- 1) This talk is restricted to species described from one gathering (that often had duplicates).
- 2) My talk concerns **old** holotypes and isotypes, those that were not designated as such by the original author (as is required nowadays).
- 3) Two categories of elements can be types: specimens and illustrations. This talk only concerns holotypes that **can have** duplicates, thus specimens; I will not discuss holotypes that are illustrations.

II. Rudge

The first case is **Rudge**, see fig. 3 for the topics to be discussed. Rudge's book is written in Latin, and the collector is not mentioned anywhere.

Rudge

Plantarum Guianae rariorum icones et descriptiones 1805

- how the specimens of its new species regularly are cited in literature
- the wandering of the plants
- TL-2 and Stearn & Williams
- correct citation of holotypes

fig. 3

In fig. 4 is an example of a citation from Judziewicz (1990, the grasses volume of the Flora of the Guianas), including two species names that are synonyms of *Paspalum repens* Berg. Note that for the first one, *Paspalum gracile* Rudge, no collector is mentioned, apparently his name is not clear from the specimen in the BM. Moreover, as the country, Guyana is mentioned (and this is wrong, as I will explain). It can be done still worse, see below: the same country, and as collector "Rudge s.n.". Rudge, however, has never been in the Guianas.

***Paspalum gracile* Rudge, Pl. Guian. 20, pl. 26. 1805. Type: Guyana (holotype BM!, fragment US!).**

***Paspalum bistipulatum* Hochst. ex Steud., Syn. Pl. Glumac. 1: 29. 1853. Type: Surinam, Hostmann 707a (holotype P!, fragment US!, isotype LE not seen, fragment US!).**

fig. 4

Some essential information on the specimens is found in Stafleu & Cowan, Taxonomic Literature, ed. 2 (1983: 971-972) (the series of 7 volumes is abbreviated as TL-2). This book is not only very important to find the publication dates of books; in many cases, it also gives information on the herbaria of the taxonomists whose books are treated. Moreover, there are a lot of references to more literature on taxonomists, their books and / or their herbaria. In this case, Stafleu & Cowan refer to Stearn & Williams (1957). The Rudge case is quite extraordinary in illustrating the peculiar wanderings that plant specimens may have undertaken.

As explained by Stearn & Williams, it concerns plants, collected by Joseph Martin in French Guiana. Martin was from Paris, and his plants were shipped for Paris. In May 1803, however, Great Britain and France were in war, and the ship with Martin's dried plants (and living plants) was captured and brought into the river Thames. The natural history specimens were declared war-booty and sold.

Two rich English countryman, Edward Rudge and Aylmer Bourke Lambert, both amateur botanists, bought the herbarium specimens, in partnership with several more, less known persons. They paid an enormous sum of money, but, as Lambert wrote, Martin's collection was "one of the finest collections of specimens that ever came into this country"; "three thousand specimens both in flower and fruit and generally four duplicates", thus Lambert wrote. Rudge determined his specimens in the Banks Herbarium, that nowadays is incorporated in the BM, dept. of Botany.

The TL-2 info is almost correct, except that it mentions Guyana - after having read more than six pages of the pirate story, Stafleu apparently had already forgotten what is at the end of the first page of Stearn & Williams (fig. 5):

comme prise de guerre. Il conviendrait donc de les citer comme provenant de « Guiana gallica, Martin » et non pas, comme le font Miquel et les autres, « Guiana anglica, Rudge ».

fig. 5

Translated: (...) The convenient way to cite them would thus be as originating from « Guiana gallica, Martin », and not, like Miquel and others have done it, « Guiana anglica, Rudge ».

As for that fragment of the holotype that is stored elsewhere (see fig. 4: “fragment US!”; informally such fragments are called kleptotypes), upon removal from the original herbarium and insertion in another herbarium, this has become an isotype (see Art. 8, Ex. 5).

So, this is how the type of *Paspalum gracile* should have been cited:

Type: French Guiana, J. Martin s.n. (holotype BM, isotype US).

In general: the BM plants described by Rudge are the **holotypes**; and the duplicates in other herbaria are **isotypes**.

III. Kunth in HBK

Next we will consider the plants underlying **Kunth** in Humboldt, Bonpland & Kunth, *Nova Genera and Species Plantarum*. (fig. 6)

Kunth in HBK

- Nova Genera and Species Plantarum, seven volumes, published 1816-1825
 - Humboldt: German, naturalist, especially geographer, 1769-1859
 - Bonpland: French, botanist, 1773-1858
 - Kunth: German, botanist, 1788-1850
- expedition to S America: Humboldt & Bonpland 1799-1804, ca. 6000 specimens

fig. 6

Humboldt & Bonpland took ca. 6000 specimens back to Paris, along with a diary of Humboldt, and many field notes of Bonpland, later on named *Journal Botanique*, including (for tropical America) six volumes with numbered descriptions, some drawings, and comments, most of them in the hand of Bonpland, but there are occasional entries by Humboldt (Lack 2004, with photo's of 2 pp. of these field notes). Lack concluded that not all herbarium specimens were numbered (only the rare or new ones got a field note), and that there was never a complete set of dried plants documenting all entries in the *Journal Botanique*.

Much information on the *Nova Genera* and the underlying plants is given by Stearn (1956, 1968), and originally for my talk I drafted a picture that was fully based upon Stearn, who gives the impression (especially in 1956: 156) that Humboldt sent a set of duplicates to Berlin **because** Bonpland had failed to publish the new genera and species. After the talk, I got some recent Berlin reprints, and from these I got a (hopefully more balanced) picture that I am presenting now for this on-line version of my lecture.

Originally, there have been four sets of duplicates that were not fully identical.

In 1801 already, when they were in Cuba, Humboldt sent a number of duplicates to Willdenow, a shipment comprising ca. 1600 plants from Venezuela. Citing from correspondence between Humboldt and Willdenow, Rankin Rodríguez & Greuter (2001) explain the situation. When sending their plants, Humboldt asked Willdenow not yet to incorporate them in his own (Willdenow's) herbarium, but to keep them separate until they would be described by himself and Bonpland. Humboldt (who considered himself a pupil of Willdenow) nevertheless put the duplicates available to Willdenow: “If however, (...) you should discover new species that particularly attract your attention, you may of course, at your will, insert **a few of them, but not many or all**, in your excellent edition of the *Species*.” (bold from me, G.Z.) This is cited from Rankin Rodríguez & Greuter (p. 1234), who added Humboldt's reason for this restriction: “His dislike of the prospect that his novelties be published with the poor descriptions one could draw up from dried specimens, when Bonpland and he had prepared ‘very, very exact diagnoses’ from fresh material.” Rankin Rodríguez & Greuter suppose that the duplicates of the later collections (from Colombia, Ecuador, Peru and Mexico) were given to Willdenow soon after return to Europe, very probably no later than Humboldt's visit to Berlin in 1805.

At a certain moment, Willdenow entered the duplicates in his own herbarium. When in 1818 (6 years after Willdenow's death) this herbarium was purchased by B, this was the start of the Berlin herbarium. Nowadays the Willdenow Herbarium still is kept there separately (it even survived the 1943 fires) as B-W. This Willdenow Herbarium is issued on microfiches, and some of its specimens can be found on the website of B. In fig. 7, there is an example, with two details enlarged in the right hand column:

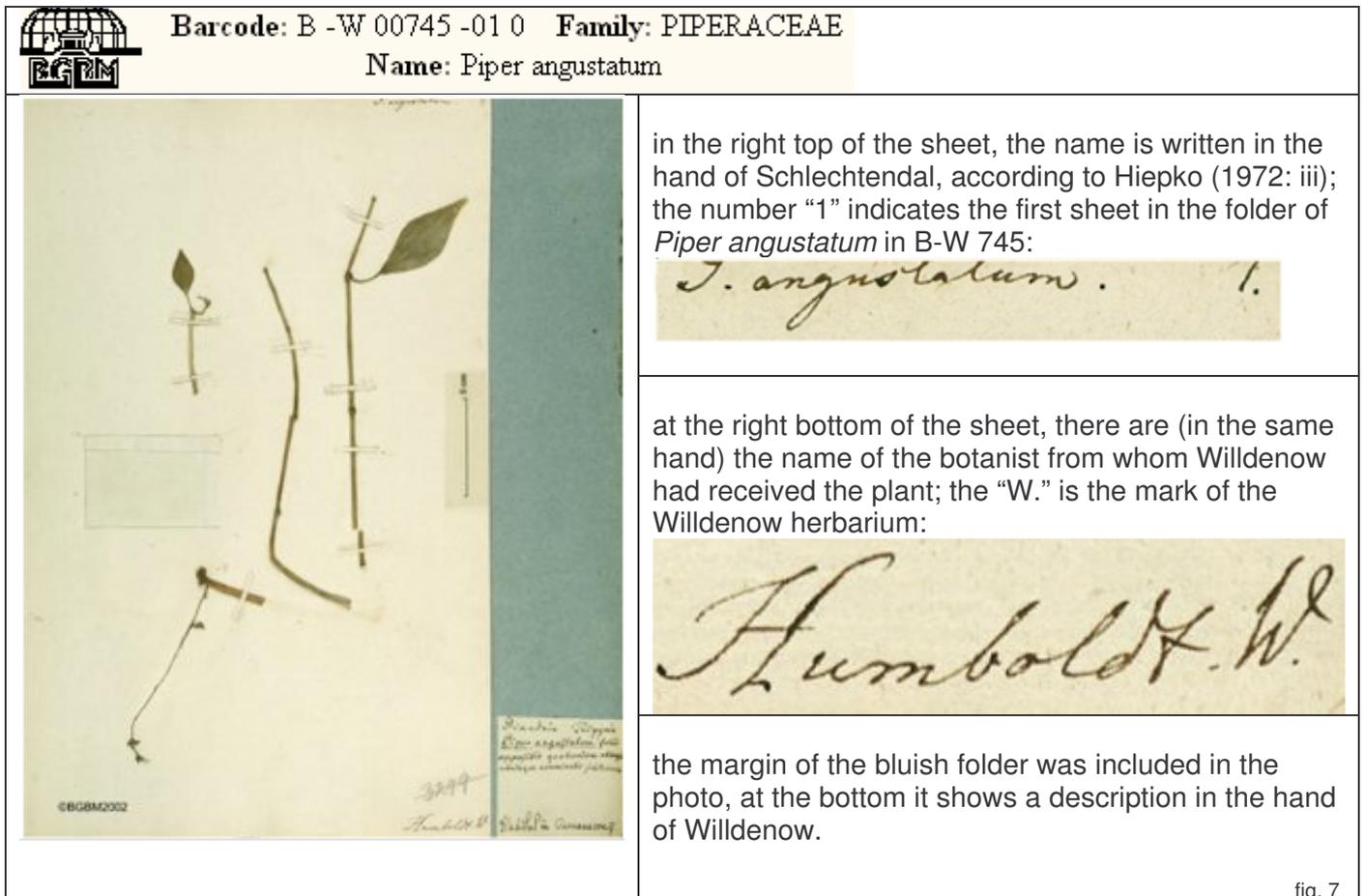


fig. 7

As for the plants that were kept in Paris, these specimens Bonpland set in order. A few of the plants of the South American expedition were described in the *Plantae Aequinoctiales* (Humboldt & Bonpland 1805-1817) and the *Monographiae Melastomacearum* (Humboldt & Bonpland 1806-1823). **Bonpland**, however, did not at all like herbarium work. From 1808 on, he became more and more absorbed in managing an estate, as the chief gardener of the empress Joséphine (who had a deep interest in flowers and horticulture). In 1816 Bonpland emigrated to Argentina, and he took with him a set of the Humboldt & Bonpland duplicates. This second set was returned to Paris in 1832 (Krapovickas 1970: 234-235), in P it is now stored in the general herbarium.

Humboldt was a scientific traveller, biologist, a founder of plant geography, and also a geologist and meteorologist. He wished the plants to be described, therefore in 1810, he asked **Willdenow** to continue the work, and in 1810-1811 Willdenow worked for some months in Paris, in a number of cases writing down new names on specimens of new species. Willdenow died in 1812, leaving behind only some fragmentary manuscripts on those plants (Hiepko 2006: 511). At last Humboldt obtained the services of **Kunth**, a young German botanist, a pupil of Willdenow, who in 1813 came to him in Paris. Kunth was the right person to do this job: he described the plants. In a number of cases, he accepted such a Willdenow name, but he never mentioned the fact that he used a name coined by Willdenow (Hiepko 2006: 511).

Besides the sets of duplicates in B-W (ca. 3360 specimens, not available to Kunth as long as he worked in Paris) and the set that Bonpland owned (number of specimens unknown; according to

Hiepko (2006: 512-513), some of these specimens have been used by Kunth), there were two more sets of Humboldt & Bonpland plants, and these sets were used by Kunth:

- a) an original Humboldt set including ca. 3560 specimens, nowadays stored in P-Bonpl.;
- b) a set in Kunth's private herbarium, received from Humboldt before 1829; this included ca. 3000 types of taxa described in the *Nova Genera*. When in 1829 Kunth went to Berlin (see below), this set thus went to B. In the 1943 fires, however, much of these specimens were lost; specimens still exist in the pteridophytes and in a few families of spermatophytes.

The figures mentioned above for numbers of specimens in the four sets are taken from Hiepko (2006: 512-513). What can be said on holotypes and isotypes in these four sets of dried plants?

- 1) the set that was sent to Willdenow, nowadays in **B-W** (with their own B-W numbering): specimens that never have been seen by Kunth when he worked in Paris: these are **isotypes**.
- 2) the set owned by Bonpland, that has been in Argentina and nowadays is part of **P**: in most cases, these also are **isotypes**.
- 3) If there is nothing in the B set (ex herbario Kunth), the set in **P-Bonpl.** usually includes the **holotypes** of the plants described in the *Nova Genera*;
- 4) If there is nothing in P-Bonpl., while there is a specimen still existing in **B** (not B-W), the latter may be the **holotype**.

If there is a specimen in P-Bonpl. **and** in B (not B-W), thus two duplicates studied by Kunth still are existing, then there is no holotype, because the holotype must be one specimen. Then (even if one original gathering only was studied by Kunth) a **lectotype** must be chosen from among these two duplicates; *Phytolacca bogotensis* provides an example (Greuter 2002: 8).

The fact that the four sets were not fully identical, was illustrated by several authors who made study of a small group of taxa (e.g. Leuenberger 2002). In the Cactaceae, there even is no Humboldt & Bonpland specimen at all for five of Kunth's fifteen 1823 new species. For the remaining ten new species, there is no P and/or no B-W duplicate. (Moreover, there are Humboldt & Bonpland Cactaceae specimens in P and/or B-W that do not occur in P-Bonpl. - then of course not species described by Kunth in the *Nova Genera*).

In the literature and in Flora of the Guianas manuscripts, I find those holotypes occasionally mentioned as Humboldt, s.n. or with a number; Bonpland with a number, or occasionally as Humboldt & Bonpland, s.n. or with a number. It is clear now that those specimens should always be cited as gathered by Humboldt & Bonpland, and that they have a number only when they were described in Bonpland's *Journal Botanique*. In other words, originally it were field note numbers, and secondary only these can be used as collection numbers.

Moreover, in many cases the numbers have been lost when the specimens were relabelled - then apparently the original, scrappy field labels were discarded.

In 1829, Kunth became a professor of botany in Berlin. **His** private herbarium was **also** one of the basic herbaria of the Berlin general herbarium.

When Kunth was working in Paris, he was not allowed to see the duplicates in Berlin. In that period, however, two different German botanists have extensively used the Willdenow Herbarium: Roemer & Schultes (McVaugh 1955). Much to the disgust and annoyance of Kunth and the inconvenience of later systematists, they burdened a considerable number of those B-W plants with synonymy by publishing them under different names about the same time as Kunth. For these names, the B-W specimens are holotypes, and isotypes may be present in P-Bonpl. and/or P and/or B (ex herbario Kunth)!!

From 1829 on, the B-W specimens were thus available to Kunth, and this explains that in some cases, B-W specimens do have annotations in Kunth's hand (thus written after his finishing the *Nova Genera*).

Hiepko (2006: 515) gives an explanation for the fact that Kunth during his Paris period could not get permission to see the specimens in the Willdenow herbarium. For conservative circles in Berlin, at that time Paris was the capital of the enemy. Moreover, there were personal resentments against Kunth because the latter never referred to Willdenow when he accepted a name written down during Willdenow's visit to Paris, 1810-1811.

IV. Aublet

The next book to be considered, is very important for the Guianas: **Aublet's** *Histoire des plantes de la Guiane Française*, 1775, short title *Histoire*. There are two sources who give a survey on the fate of Aublet's herbarium: TL-2 (Stafleu & Cowan 1976: 79-80) and Howard (1983) on Aublet's plates. It is my feeling that both sources lay a different stress on the available data.

At first the oldest, I cite from TL-2: "Aublet's herbarium was divided after his death and put up for sale. The main fragments are at BM (through Sir Joseph Banks) and at Paris (in the Denaiffe collection, in the Tristan herbarium, and the herbaria of Lamarck and Jussieu). Other sets of some size are at S in the herbarium of the younger Linnaeus, and at C in the Vahl herbarium. Isolated specimens are encountered in various herbaria (BR, F, LIV, MO, UPS, W). - The original drawings are for the greater part at BM (through Banks)."

Now a citation from Howard (yes, he does mention TL-2): "Aublet's herbarium was purchased by Sir Joseph Banks, along with his drawings and notes. These are now all in the British Museum (Natural History); the notes and drawings have been bound separately and are housed in the library. Banks apparently shared the specimens with Linnaeus filius, whose collections are in the J. E. Smith herbarium at the Linnean Society. Additional collections are in several herbaria in Paris (Adanson, Jussieu, Rousseau) as well as at Stockholm, Copenhagen, and Vienna, with fewer specimens at Brussels, the Field Museum, Liverpool, Missouri, Uppsala, and possibly Geneva."

It is not my aim to decide which of the two sources might be more correct, only to illustrate the different accents. A summary is in fig. 8.

Aublet, Histoire 1775, 4 vols	
TL-2, vol. 1, 1976: <ul style="list-style-type: none"> • BM • P: <ul style="list-style-type: none"> – Denaiffe (Rousseau) – Tristan – Lamarck – Jussieu • S, C • BR, F, LIV, MO, UPS, W 	Howard 1983: <ul style="list-style-type: none"> • BM • LINN-SM • P: <ul style="list-style-type: none"> – Adanson – Jussieu – Rousseau • S, C, W • BR, F, LIV, MO, UPS, ?G

fig. 8

Howard lists the herbaria in which he has studied Aublet collections, almost all of the above mentioned herbaria, except that for the Adanson herbarium in P, he said that he was able to examine only a few bundles in this herbarium (a Paris herbarium that TL-2 did not mention). Howard added: "The last often contained the most complete specimens, occasionally with extensive holographic notes"; and further on he states that "Aublet's notes obtained by Joseph Banks are not complete, the missing ones should be sought in the Adanson herbarium." To sum up, for Howard two herbaria seem to be most important: BM and P-Ad. (=P-Adanson).

For the rest of his article, Howard lists the Aublet plates, and mentions the types, listing what he found in the literature as well as annotated on the specimens. In many cases he only lists the indication **that it is a type**, without the addition of holo- or iso- (or lecto-, or isolecto-). A few examples from Howard's list are in fig. 9; his abbreviations "NG" indicates 'new genus' and "TS" means 'type species'.

I chose these three examples, because they are also reported in an article of Lanjouw & Uittien (1940) (one of the sources that TL-2 used).

A small note (in the *Chronica Botanica* of 1939) on a Rousseau herbarium with Aublet plants, put Lanjouw on the track of a herbarium in the possession of Denaiffe. Lanjouw & Uittien travelled to Denaiffe (who lived in the N of France), stayed there for a couple of days, and studied this herbarium.

AMANOA GUIANENSIS (1: 256. t. 101 (*guyannensis*))—NG, TS—Euphorbiaceae = **Amanoa guianensis** Aublet. BM, P-R 6: 229.

AMBELANIA ACIDA (1: 266. t. 104)—NG, TS—Apocynaceae = **Ambelania acida** Aublet. Specimen at BM marked “holotype”; LINN-SM 440/1; P-R 7: 242.

AROUNA GUIANENSIS (1: 16. t. 5 (*guyannensis*))—NG, TS—Leguminosae = **Dialium guianensis** (Aublet) Sandw. Specimen at BM labeled “type specimen”; LINN-SM 69.1; P-R 1: 33.

fig. 9

They confirmed the opinion of a retired physician (given already in that Chronica Botanica note), that the labels of this Rousseau herbarium were written by Aublet.

They concluded that it must have been a part of Aublet's private herbarium, and using data of that retired doctor, they gave a survey of the wandering of this herbarium, from Aublet to Rousseau and further to six later owners before it became in the possession of Denaiffe. Lanjouw & Uittien state that **this is the only set of Aublet plants that have labels written by Aublet himself** - this in contrast to the specimens in the BM that until then were considered as the types. In their 1940 publication, Lanjouw & Uittien list 118 species names with their types.

Because those specimens have the notation “*h. g. fr.*” (*histoire guiane française*) and the page and plate numbers from the *Histoire*, Aublet must have written these labels between 1775 and his death in 1778. It concerns the species described in p. 1-300 of the *Histoire*.

In 1953, Denaiffe sold this herbarium to P, where it is stored as a part of the Rousseau herbarium (indicated by the P-R in fig. 9). Where the rest of this private herbarium may be - Lanjouw & Uittien have no idea, nor have I.

For a while I thought that the specimens in this Herbarium Denaiffe thus could be considered as the holotypes, and its duplicates as isotypes, and I already wondered why Howard did not fully use the information that he reports to have read.

Alas, it is not so simple. Let us have a look at what Lanjouw & Uittien report on those three cases of Howard, given above in fig. 9 (see fig. 10):

1. **Amanoa** Aubl. vol. I, p. 256 (Euph.).
guianensis Aubl. vol. I, p. 256, tab. 101.
 Fl. of Suriname vol. II, part 1, p. 10.
 Hb. Denaiffe vol. VI, no. 229: une branche avec feuilles et fleurs, plus belle que la planche.
2. **Ambelania** Aubl. vol. I, p. 265 (Apoc.).
acida Aubl. vol. I, p. 266, tab. 104.
 Fl. of Suriname vol. IV, part 1, p. 6.
 Hb. Denaiffe vol. VII, no. 242: une branche avec feuilles.
3. **Arouna** Aubl. vol. I, p. 16 (Papil.).
guianensis Aubl. vol. I, p. 16, tab. 5.
 = *Dialium guianense* (Aubl.) Steudel.
 Fl. of Suriname vol. II, part 2, p. 53.
 Hb. Denaiffe vol. I, no. 33: une branche avec feuilles et fleurs, ressemblant beaucoup à la planche.

fig. 10

In the third case, Lanjouw & Uittien wrote “a twig with leaves and flowers, strongly resembling the plate”, thus for the third case, my supposition looked fine.

In the first case, however, Lanjouw & Uittien wrote “a twig with leaves and flowers, more beautiful than the plate”, thus Aublet must have used another specimen for the original drawing. The same

can be said of the second case, here Lanjouw & Uittien only mention this: "a twig with leaves", whereas in the *Histoire* there are flowers described and figured.

I can draw one conclusion only: For these Aublet plants described so long ago, it may be very difficult to establish which of the duplicates is the **holotype**, and which ones are **isotypes**. Even for several cases of names, published in p. 1-300 (and thus with a specimen in the herbarium Denaiffe), it looks like it cannot simply be said that the specimens that Aublet annotated and left behind, are the (only) specimens that he **used**. Let alone that a clear conclusion can be drawn on the plants, described in the rest of the *Histoire*.

In this context, still something should be said on Aublet's descriptions, and especially on his **plates**. Howard (1983: 255) reports that in some cases, the descriptions are composites of discordant elements. Many of the drawings published by Aublet are mixtures, not only because elements of different species were put together. It also looks like drawings of fruits, flowers and dissections originally were on separate sheets of paper, and that errors may have been made when these drawings were put together for one engraved plate (Howard 1983: 258).

V. Martius

At the Flora of the Guianas meeting in Berlin, there was no time left to tell the Martius part of the talk. When several colleagues afterwards understood that a text on Martius had been prepared as well, they encouraged me to include it in this internet version.

The last botanist to be treated is **Carl Friedrich Philipp von Martius**, see fig. 11:

Martius, founder of Fl. Bras.

born 1794 in Erlangen, Germany
 1810 to university in Erlangen / starts collecting
 1812 got the herbarium of his father (a pharmacist)
 1814 degree in Erlangen / post in München (Munich)
 1817-1820 with Spix (zoölogist) to Brazil
 1854 retired in München
 1868 died in München

fig. 11

He was born in Erlangen, went to the university when he was 16, and got his degree when he was almost 20, on a 210 pp. dissertation that comprized a list of the plants in the Botanical Garden in Erlangen, arranged according to the system of Linnaeus. At that moment (March 1814), he had just taken up a post at the Botanic Garden of München (Munich).

From 1817-1820, he travelled in Brazil, together with the zoologist Spix, and in 1819 also, using the Amazon River and its confluents, on the Rio Japurá, later on Río Caqueta, into Colombia up to Araracuara ('Arara-Coara', see Spix & Martius 1823-1831: 1256-1257). He returned to München, and became a curator of the Botanic Garden. He retired in 1854 and died in 1868. In geographical respect, a simple life, with one long expedition to the Neotropics.

What about his plants? Some information can be found in the Index Herbariorum (Vegter 1976: 509-510) and in TL-2 (Stafleu & Cowan 1981: 325-327; 333-337), and also on the website of the Martius' Flora Brasiliensis project, set up by the herbaria of Brussels, München and Leyden, in collaboration with several more institutions: <http://projects.bebif.be/enbi/martius/>. Much more information can be found in Förther 1994 (in Sendtnera, a München journal).

There are two groups of specimens:

1) The **gatherings of his trip to Brazil** are housed in München; originally they went to the Bayer. Akad. der Wissenschaften, from where they were brought to the Botanische Staatssammlung

München (M). It concerns ca. 20.000-25.000 specimens (estimate H.-J. Esser, M), representing ca. 8000 species (Förther 1994: 10). Some duplicates exist in BR, K, LE, P and W (Förther 1994: 9).

2) Much bigger is the so-called “**Herbarium Martii**”, this included Martius’ private collection. After his return from Brazil, Martius’ own gathering activities were neglectible.

He was very talented, however, to build and keep up good relations with all great botanists of those days, so he got many specimens as a gift or inheritance, in exchange and by buying them. So his herbarium grew steadily, and when Martius died, it contained ca. 300,000 specimens (Fl. Bras. website; Förther 1994: 8), representing ca. 65.000 species (Fl. Bras. website), approximately one third of them from the Amazon Basin. From 1851 on, Martius tried to sell his herbarium to the state of Bayern: it would be much easier for him, if both collections in München could be merged. These efforts had no success. The Herbarium Martii was acquired by the Belgian government in 1870, and formed the beginning of the collection of the National Botanic Garden of Belgium (i.e. Meise, abbrev. BR); it is nowadays included there in the General Herbarium.

What about holotypes and isotypes? Martius published many new genera and species in his *Nova Genera and Species Plantarum* (1823-1832), in the journal *Flora* (among others, Martius 1837-1841), and in older issues of the *Flora Brasiliensis*.

With respect to the species that Martius described there, using the plants that he himself had collected: the holotypes (or lectotypes, if there is more than one gathering) usually are in M, and isotypes (or isolectotypes) may exist elsewhere. Of what he described from specimens in his private herbarium, a holotype (or lectotype) is likely to be found in BR (and isotypes / isolectotypes may exist in many other herbaria). There are a few families, however, where BR and M ‘changed’ the collections (pers. comm. H.-J. Esser).

Much more complicated, however, is the situation for the many specimens that other collaborators of (among others) the *Flora Brasiliensis* used. Did they use a specimen from that so-called Herbarium Martii, or a duplicate?

Förther explains that duplicates often were exchanged without original collection numbers; and also often without any species name and without locality. Förther (1994: 21) mentions the example of **Fresenius** who did the Boraginaceae for the *Flora Brasiliensis*: in Fresenius’ own herbarium (in FR = Frankfurt), there is not any brazilian specimen that could be a type specimen of the dozens of new species; from his correspondence with Martius, however, it is clear that he studied specimens from the Herbarium Martii (thus BR), B, LE, G, P and W.

To conclude, for later *Flora Brasiliensis* authors who used specimens from the Herbarium Martii, the situation often is utmost complicated.

VI. Conclusions

The conclusions are arranged in two groups:

on the four cases that are discussed;

some general comments, one could call them recommendations.

- **Rudge**: clear: holotype of the Martin specimens in BM, isotypes elsewhere.
- **Kunth** in HBK: rather clear:
 - in P-Bonpl., not in B (ex herbario Kunth): holotype.
 - in B (ex herbario Kunth), not in P-Bonpl.: holotype.
 - in P-Bonpl. and in B (ex herbario Kunth): a lectotype to be chosen.
 - in the general P herbarium: usually isotypes (unless if annotated by Kunth, and not present in P-Bonpl.).
 - in B-W: isotypes.
- **Aublet**: a holotype may exist in P-xxx or BM; isotypes may exist in many herbaria; compare with plates; and possible Aublet annotation.

- **Martius** himself: often clear:
 1. Brazil-expedition: holotype usually in M, isotypes may be elsewhere
 2. 'Herb. Martii': holotype usually in BR, isotypes may be elsewhere.

More general conclusions:

- try to find specimens annotated by the describing author.
- if you have a problem, have a look in TL-2, it often includes info with reference to further literature.
- in doubtful cases, for the sake of stability, be careful before you reject somebody else's holotype conclusion.

VII. Literature

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