

A tale of traded specimens, or what to know when selecting types from Ernst Ule's collections

Leonardo M. Borges,¹ Matthias Schultz,² Hans-Helmut Poppendieck,² Jacquelyn A. Kallunki³ & Marcelo Trovó⁴

¹ Universidade Federal de São Carlos, Departamento de Botânica, Rodovia Washington Luís, Km 235, São Carlos, SP, 13565-905, Brazil

² Herbarium Hamburgense, Biocenter Klein Flottbek, University of Hamburg, Ohnhorststr. 18, 22609 Hamburg, Germany

³ The New York Botanical Garden, Bronx, New York 10458-5126, U.S.A.

⁴ Departamento de Botânica, Instituto de Biologia, Universidade Federal do Rio de Janeiro, CCS, Bloco A1, Cidade Universitária, Rio de Janeiro, RJ, 21941-590, Brazil

Author for correspondence: Leonardo M. Borges, aquitemcaqui@gmail.com

DOI <https://doi.org/10.12705/673.10>

Abstract Many Brazilian plant names are based on specimens gathered by European naturalists working in the 19th and early 20th centuries. Among these explorers is Ernst Ule, a German naturalist who collected profusely in Brazil. Ule's specimens were largely used to publish names before the need to indicate types for valid publication and, hence, many of those names need to be typified. Because typification is not always a straightforward process, we use examples from *Mimosa* and *Paepalanthus* to show how an understanding of the historical background of these collections is necessary to support nomenclatural work with names based on specimens he gathered. We present a set of guidelines for typification of names based on his collections and, as examples, we provide lectotypifications for 35 species of Mimosoid legumes.

Keywords Eriocaulaceae; herbarium; Herbarium Berolinense; Herbarium Hamburgense; Leguminosae

■ INTRODUCTION

One of the principles of the *International Code for Nomenclature for algae, fungi, and plants (ICN)* is that “the application of names of taxonomic groups is determined by means of nomenclatural types” (McNeill & al., 2012: 23). This concept was officially established in 1935, with inclusion of the “type-method” in the Cambridge Rules (Harms, 1935; Rijkvevorse, 2014). Hence, most new species descriptions made before that date do not include explicit type designations. Nonetheless, sometimes it is possible to consider a particular specimen belonging to a certain herbarium as the holotype, especially when the author clearly stated that it was the only one studied (Prado & al., 2015; but see McNeill, 2014). For other situations, it is possible to select a lectotype based on original material studied and used to describe the species (McNeill & al., 2012).

Between the time of publication of *Species plantarum* (Linnaeus, 1753) and the establishment of the Cambridge Rules (Harms, 1935), a great number of plant names were published without explicit designation of types. Therefore, many names must be typified. Among these are a multitude of Brazilian species, many of which were collected and described only after the opening of the country to foreign botanists with the arrival of the Portuguese royal family in the beginning of the 19th century (Pires-O'Brien, 1993). Specimens from Brazil were collected by many explorers, for example Ludwig Riedel, Carl F.P. von Martius, Friedrich Sellow, William J. Burchell, and Auguste F.M. Glaziou, to name only a few (Urban, 1906). Among later botanical explorers was Ernst Ule, who collected in Brazil

between 1883 and 1912 (Harms, 1915). During his lifetime as a collector, Ule made about 17,000 collections, that represented different groups of embryophytes, fungi, and lichens. Most of these collections were made in Brazil, but some were collected in Peru or in areas that at the time belonged to Bolivia (chiefly the Brazilian state of Acre) (Harms, 1915).

Ule's collections were subsequently used as the basis for the descriptions of a large number of taxa. We estimate that about 1200 collections are types of vascular plants, 600 are types of bryophytes (Walther & Martienssen, 1976) and 750 are types of fungi (Friedrichsen, 1973). The descriptions of many of these taxa, however, were published before the establishment of the type-method, thus the names frequently require typification.

Here we present historical data that sheds light on issues pertaining to the distribution and deposition of Ule's collections. We also provide a set of guidelines to aid in the typification of names based on these collections, mostly based on study of Mimosoids (Leguminosae), particularly *Mimosa* L. (Linnaeus 1753), and *Paepalanthus* Mart. (Martius, 1834) (Eriocaulaceae). We also present, as examples for the application of the Guidelines, lectotypifications for 35 species of Mimosoids.

■ ERNST ULE: A BRIEF HISTORY

Ernst Heinrich Georg Ule (Fig. 1) was a botanist and explorer who became one of the most prominent plant collectors in Brazil and Amazonian Peru. His life, particularly his professional life, has been portrayed by several authors (Taubert,

Article history: Received: 5 May 2017 | returned for (first) revision: 10 Aug 2017 | (last) revision received: 3 Apr 2018 | accepted: 3 Apr 2018 | published: online fast track, 4 Jun 2018; in print and online issues, 6 Jul 2018 || **Associate Editor:** James C. Lendemer || © International Association for Plant Taxonomy (IAPT) 2018, all rights reserved

1896; Urban, 1906; Harms, 1915; Stafleu & Cowan, 1986), and detailed information about his collecting expeditions has been provided by Harms (1915). Here we present a brief biographical sketch in order to provide a historical context for our work.

Ule was born on 12 March 1854 in Halle an der Saale, Germany (Urban, 1906). From 1874 to 1876 he attended the pomology school at Proskau (now Poland) after abandoning horticulture due to health problems (Urban, 1906). In 1879, Ule joined the Halle Botanical Garden, where he was a gardener and a student of professors G. Kraus and J. Kühn (Urban, 1906; Stafleu & Cowan, 1986). Later, in 1879, he continued his studies while working as a temporary staff member (“Adjunct”) at the Berlin Botanical Garden (Urban, 1906; Harms, 1915). Being ill again, Ule immigrated to Brazil in 1883 and settled in Santa Catarina State (Urban, 1906; Harms, 1915). There he worked as a private teacher and began to collect specimens of Brazilian plants, fungi, and lichens (Harms, 1915). In 1891, he moved to Rio de Janeiro to work in the administration of the *Museu Nacional*, where in 1895 he became assistant-director (Harms, 1915; Stafleu & Cowan, 1986). During this time he also worked as a travelling naturalist (Urban, 1906).

Among other activities, Ule was in charge of surveying the vegetation of central Brazil as part of an expedition in search of

a place to establish a new capital for the country (Taubert, 1896; Harms, 1915; Stafleu & Cowan, 1986). After leaving the *Museu Nacional* in 1900, with the encouragement of K. Schumann, chairman of the Botanical Society of Berlin and Brandenburg, and the help of Senator Dr. H. Traun, from Hamburg, and N.H. Witt, a businessman working in Manaus, Ule started to collect in the Amazon basin (Urban, 1906; Harms, 1915). In 1906 and early 1907, he also collected in Bahia and Piauí states, and from 1908 to 1912, on his last expedition, he again collected in the Amazon forest (Harms, 1915). In March of 1912, Ule left Brazil and by April he had settled in Berlin (Harms, 1915; Stafleu & Cowan, 1986). There he regularly went to the Berlin Botanical Museum to work on his collections until his death on 15 July 1915 (Harms, 1915).

Ule’s interests ran broad and deep. Besides being a prolific collector, he also devoted himself to the publication of a long list of works in taxonomy (including description of new genera and species), regional Floras, plant morphology, plant-insect interactions, floral biology, ethnobotany, vegetation formations, and more (e.g., Ule, 1878, 1895, 1896; see Harms, 1915 for a complete list of publications). The specimens collected by Ule can now be found in many herbaria (Stafleu & Cowan, 1986; Vegter, 1988), but the main sets are (or were) housed in German herbaria—not necessarily because he was a German citizen, but in part because he was hired by those institutions to collect botanical specimens.



Ernst Ule.

Fig. 1. Ernst Ule. Reproduced from Harms (1915).

■ ULE’S COLLECTIONS

Although Ule made about 17,000 collections, we focus here on those of vascular plants—about 10,000 numbers (Harms, 1915), mostly of angiosperms. As we show below, Ule had a special relationship with the Herbarium Hamburgense (HBG) and the Herbarium Berolinense (B), where the largest sets of his specimens are found today. Duplicates of the same collection sometimes are found in both herbaria (see below). A survey of HBG during the type registration and digitization efforts begun at that institution in 2006, showed that it houses about 8100 specimens of spermatophytes collected by Ule. These specimens consist of numbered sheets from 1 to 7575 and circa 600 unnumbered sheets, collected between June 1883 and February 1907. Of the aforementioned specimens, about 1000 are types or original material.

In 1913, B housed 8022 specimens of vascular plants collected by Ule (Urban, 1917), and after Ule’s death in 1915, this number increased by the integration of his personal herbarium, which included 3800 specimens of phanerogams (1300 from Europe and 2500 from Brazil and Peru) and 800 specimens of cryptogams (Hiepko, 1987). Most collections at B were destroyed during World War II (WW II), but about 500 specimens collected by Ule and belonging to various taxonomic groups have survived (Curators Herbarium B, 2016). Before WW II, J.F. Macbride photographed 1003 of Ule’s specimens deposited at B. The photographs are available in the Berlin Negatives held by the Field Museum (http://emuweb.fieldmuseum.org/botany/search_berlin.php). Most of these images are of type specimens

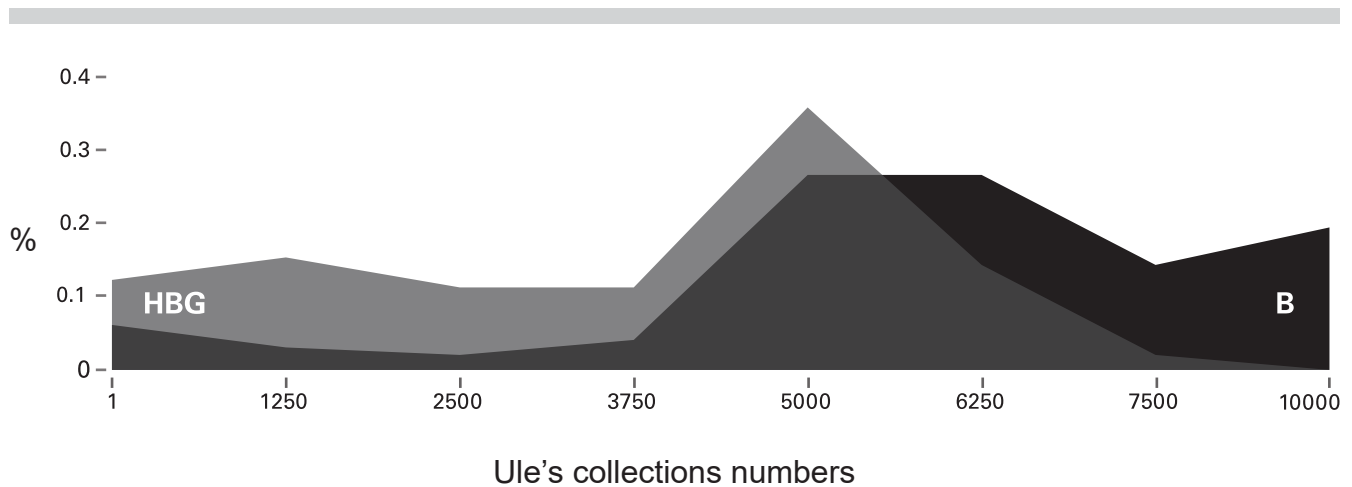


Fig. 2. Lines showing the relative numbers of types of spermatophytes based on Ule's collections at HBG (light grey) and B (black) by sets of collection numbers. Specimens numbered from 1 to 5000 are more common at HBG, while those numbered above 6250 are more common at B. Specimens with collection numbers between 5001 and 6250 are housed at HBG and B in relatively equal numbers.

that correspond to some of Ule's collections numbered from 16 to 9909, whereas about 46 have numbers that do not follow Ule's numbering sequence or are unnumbered.

It is clear from the above that names based on Ule's specimens numbered above 7575 are (or were) present at B, but lacking at HBG. Close inspection of Fig. 2 shows that collections numbered below 5000 are better represented at HBG than B. Collections numbered above 5000 are apparently equally distributed between the two herbaria, but those above 6250 are more common at B.

Perusal of unpublished documents and letters preserved at HBG revealed that this discrepancy in the distribution of Ule's specimens at B and HBG is related to changes in the contracts regarding the purchase of his collections. These documents indicate that among earlier subscribers to Ule's collections were The Geneva Botanical Garden; Georg H.E.W. Hieronymus (1846–1921), a German botanist and plant collector whose herbarium was acquired by the Berlin Museum (Urban, 1917); and the Hamburg Botanical Museum (at that time the institutional keeper of HBG).

Between 1891 and 1915, Ernst Ule and the Hamburg Botanical Museum maintained a long-lasting, mutually fruitful relationship. This is evident not only from the large number of his chiefly Brazilian specimens purchased by the museum for its herbarium, but also from various other items that he collected, and in part donated, for the museum's exhibitions and special collections. These included seeds, fruits, rubber, fibers, galls, various ethnographical items, photographs of Brazilian plants, and landscapes, as well as seeds and living plants for what is now the Hamburg Botanical Garden. Perhaps because Ule and the founding director of the Museum, Prof. Richard Sadebeck, had a shared interest in mycology, the museum also obtained Ule's large collection of fungi.

Acquisitions of botanical materials collected by Ule were regularly reported in the *Jahrbuch der Hamburger Wissenschaftlichen Anstalten*. The earliest acquisition, documented by Sadebeck (1892), was a purchase in 1891 of 424 phanerogams and 44 lichens collected by Ule in Brazil, as well as his

Bryotheca brasiliensis. Further acquisitions, including occasional gifts, were reported by Sadebeck (1892, 1899, 1900) and Zacharias (1899, 1901, 1904, 1905, 1906). These sources make clear that the Hamburg Botanical Museum had already acquired a substantial number of Ule's plant collections before he began to negotiate, in September 1903, the sale of the large collection of Brazilian plants (including living specimens) he had assembled by that time.

The terms and conditions for this sale were fixed in a contract between Ule and the Hamburg Botanical Museum dated 29 June 1906. Drafts and an original of the contract are preserved in the HBG archive. In the contract, the museum committed to store the Ule collection properly in the rooms of the Hamburg Botanical Museum and to keep the phanerogams separate from the general herbarium in order to allow easy access to the specimens and quick fulfillment of loans for study and identification by Ule and other specialists in Berlin. The financial part of the contract was settled with considerable delay because the Museum had to request extra funding from the Hamburg state to cover the costs. Eventually, Ule was paid a sum of 6000 Reichsmark on 13 February 1908. As a result of this contract, the Hamburg Botanical Museum received 6938 phanerogams, 3320 fungi, 2393 bryophytes, and 240 liverworts, plus a few lichens not listed by Zacharias (1908). These collections constituted Ule's personal herbarium, which included all specimens collected between June 1883 and February 1907 (Ule 1–7575). Because the museum had already purchased a substantial number of duplicates, many collections are now represented by more than one replicate at HBG. Study of HBG revealed that duplicates of the phanerogamic collections with numbers 1–4999 are common, whereas those with numbers 5000–7575 are few. When the contract was signed, Ule also agreed to provide duplicates of his future Amazonian collections (i.e.; those made after 1907), which were to be acquired and stored by the Museum under conditions similar to those specified in the 1906 contract for collections 1–7575.

Correspondence archived at HBG between Ule and W. Heering, curator of the herbarium, and reports in several

volumes of the *Jahrbuch* indicate that Ule regularly requested loans of HBG specimens to B and that he identified and returned them to Hamburg. This loan activity indicates that Ule was willing and prepared to fulfill his identification duties and that, in order to do so, he had to request loans from Hamburg because many collections were not represented by duplicates at Berlin.

On 1 November 1912, the *Botanische Staatsinstitute* in Hamburg was divided into two independent institutions, the *Institut für Allgemeine Botanik* (Institute of General Botany) and the *Institut für Angewandte Botanik* (Institute of Applied Botany) (Winkler, 1913). The HBG collections became the responsibility of the *Institut für Allgemeine Botanik*, of which Prof. H.K.A. Winkler became director after the former curator, W. Heering, was drafted into military service. In 1915, Ule started to correspond with Winkler, who was unwilling to accept several of the special conditions regarding storage and treatment of Ule's collections. Winkler also expressed in his letters concern with the removal of parts of the herbarium specimens from HBG required for specialist identification, since he expected such samples to be taken from the Berlin duplicates only. He was either unaware that Berlin simply did not possess a complete set of the Ule collections, or he was unwilling to accept Ule's explanations that some sampling—of flowers, for example—was usually unavoidable when identifying specimens, especially of undescribed species. Ule repeatedly claimed that the value of the collection would be enhanced if studied in detail by specialists, but Winkler ultimately refused to purchase any further specimens from him (letter to Ule, 14 May 1915). A few weeks later, on 15 July, Ule died. As a consequence, HBG holds no Ule collections with numbers above 7575 (i.e., those collected in Amazonia between 1908 and 1912). These were eventually all deposited at B, where he was working at that time.

As we have noted above, Ule worked also at the *Museu Nacional* in Rio de Janeiro from 1891 until 1900 (Harms, 1915), and many of his collections from that period are found in its herbarium (R). Ule intended to sell one set of his early collections to the *Museu Paraense* herbarium (MG), but eventually did not do so (letters by Ule to A. Voigt, 2 August and 30 August 1903). Other herbaria, such as G, K, and P, also have considerable numbers of specimens collected by Ule. Duplicates were also widely, though sometimes sparsely, disseminated among other European and North American herbaria (Vegter, 1988). In these cases, it is not known whether the specimens were obtained through purchase, exchange, or gifts for identification by specialists. Nonetheless, the main herbaria holding Ule's collections are HBG and B. The unequal distribution of specimens between these two collections, however, has nomenclatural implications, which are explored in detail below.

■ GUIDELINES FOR TYPIIFICATION OF NAMES BASED ON ULE'S SPECIMENS

In most cases, specimens collected by Ule and used to support the description of new taxa are to be treated as syntypes or original material because many taxa described on

the basis of his collections were published not only before the introduction of the type method in 1935, but also before citation of a type became mandatory for valid publication in 1958 (McNeill, 2014). However, extra care is needed when selecting lectotypes from Ule's collections because the specimen histories, combined with potentially misleading label features on some specimens, may result in inaccurate typifications. After evaluation of most of Ule's vascular plants collections stored at HBG, selected specimens still extant at B, the Berlin Negatives, and specimens of some taxa belonging to *Mimosa* and *Paepalanthus*, we created the guidelines presented below to aid in the typification of names based on Ule's collections.

(1) Locating syntypes and original material of names based on Ule's collections. — All collections of Mimosoids and *Paepalanthus* collected by Ule that we have studied were found either at both B (including as images the Berlin Negatives) and HBG, or at one of those two herbaria. Collections not located at either of those herbaria may have been deposited only at B and destroyed during WW II (but see guideline 3). We suggest that when a given collection cannot be located at B and HBG, or when additional material of a given collection may be needed for examination, the next herbaria to search would be G, K, P or R because Ule is known to have sent material to those institutions. Smaller numbers of duplicates are expected at many other herbaria (Vegter, 1988), and thus it is important to take into account where duplicates that may have been sent to contemporary experts for identifications may now be located. Herbaria we found to house a small number of duplicates of Leguminosae collected by Ule included CORD, L, M, MG, NY, U, and US.

It should be noted that fragments of specimens are also sometimes located in F, often accompanied by images of the specimens from B photographed by Macbride (e.g., *Mimosa pseudosepiaria* Harms below). Macbride likely removed these fragments from the B specimens at the time he photographed the collection. Hence, the fragments are to be considered duplicates, from which lectotypes could be selected in the absence of other specimens.

(2) Understanding variation in label design and inconsistent specimen numbering. — The labels on specimens collected by Ule are of various designs (Figs. 3, 4). Those for his earliest collections were produced completely by hand (Fig. 3A), while later labels also included different amounts of pre-printed information (Fig. 3B, C). In rare cases, labels with a pre-printed heading of *Museu Nacional* were also used (Fig. 4C).

Of particular relevance to the present study, is the frequent presence of two different collection numbers on the same label, both handwritten by Ule. Our comparison of such collections at B and HBG, together with protologues of the names, revealed that the number written in the upper left corner was provisional, while the one in the upper right corner (probably added later) follows Ule's official numbering sequence (Fig. 3A). Many duplicates, however, were labeled and distributed with only provisional numbers. For instance, at P there is a single specimen identified as *Mimosa speciosissima* Taub. (Taubert, 1896) collected by Ule. The label bears the provisional number "5" and the collection locality and date are given as "Serra de Balisa"

and “Setembro de 1892” (Fig. 3B). Taubert (1896) indicated the same locality and date of collection in the protologue, but instead of “Ule 5”, he cited the specimen he examined as “Ule 2828”. This inconsistency was resolved by a specimen at HBG, which was annotated with both numbers as well as the locality data (Fig. 3A). See also guideline 5 below that addresses Ule’s specimens without label information.

(3) Determining whether specimens not found at B were ever deposited there. — Many of Ule’s collections originally housed at B and destroyed during WW II are now available only as photographs. The common practice in selecting a lectotype for names based on such collections is to select from among other extant specimens using the criteria stated in guideline 4 below. The current absence of some types from B may not be the result, however, of their destruction during WW II. As we have shown, Ule’s extant collections at B mainly correspond to numbers above 5000 and particularly those above 7575. Hence, in the absence of evidence to the contrary, it is reasonable to assume that numbers below 5000 currently absent both from B and the Berlin Negatives were likely never deposited in B, but kept at HBG. Nonetheless, a number of authors have cited the types of names based on Ule collections to be “holotypes” that were destroyed at B without any evidence these were ever deposited there (e.g., Hopkins, 1986; Barneby, 1991; Pennington 1997; Barneby, 1998).

For instance, Barneby (1991) indicated that the holotypes of names in *Mimosa* described by Taubert (1896) had been deposited at B, that they were destroyed during WW II, and that the specimens at HBG were isotypes (see Borges & Pirani, 2014). However, there are no photographs of such materials among the Berlin Negatives and all of them are numbered below 7575. This is supported by Taubert’s (1896: 403) statement “[...] E. Ule made his collections available to me [...]” (our emphasis), which indicates that Ule granted Taubert access to his collections, but did not necessarily deposit them in B. That a set of these early collections was not sent to B may explain why some of Ule’s early collections are still represented by more than one duplicate at HBG, the institution that purchased Ule’s collections numbered below 7575, including what would likely be considered his “personal set”. While the specimens at HBG can be considered holotypes if it can be demonstrated that they were the only material used by the authors to prepare the description, they nonetheless are logical choices to select as lectotypes in many cases.

(4) Typifying a name when duplicates of the same collection are present at both B and HBG. — When duplicates of a Ule collection are found at both B and HBG, selection of a lectotype should be based on criteria such as adequacy of the match to the original description, the presence of annotations made by the author of the name, and the quality of the material (see Art. 9 of the ICN; McNeill & al., 2012). It is important to take into account that duplicates may be differently numbered (see guideline 1 above).

Likewise, although Ule promoted specimen exchange between HBG and B, authors working at B may not have always had access to full sets of duplicates. For instance, Harms (1922) did not describe the fruits of *Mimosa ernestii*, which were

absent from the sheet at B and present on the sheet at HBG, the latter of which he must not have been examined. In that case, the specimen at B would be the best choice for a lectotype (or considered the holotype), given the strong evidence that Harms examined and may have used it exclusively to prepare the description. Pontes & al. (2016) provided a clear example in which annotations on labels of the specimens collected by Ule were essential for typification of *Anthurium petrophilum* K.Krause.

(5) Dealing with the absence of collection information on some specimens at B. — Some of Ule’s specimens housed at B lack collection numbers, without which it could be impossible to establish a clear connection with numbered specimens at HBG or other herbaria. However, to not attempt to reconstruct such

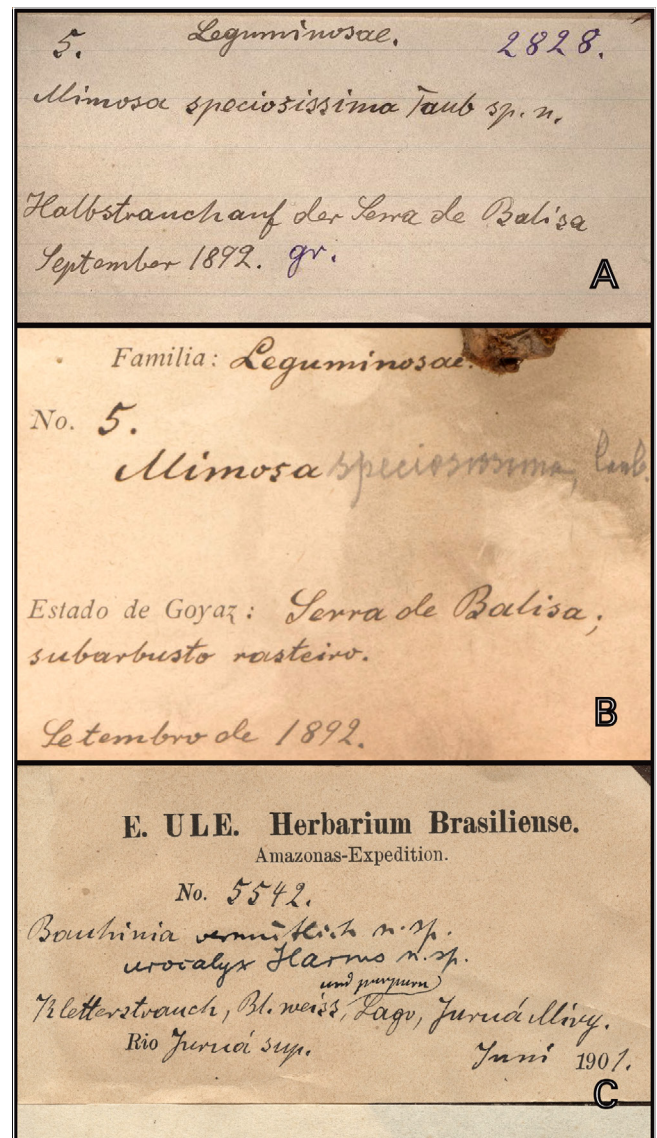


Fig. 3. Ule’s labels. **A**, Label from a collection of *Mimosa speciosissima* Taub. from HBG bearing Ule’s provisional number “5” in black ink in the upper left corner and his official sequenced number “2828” written in blue ink in the upper right corner; **B**, Label of a duplicate housed at P and bearing only the provisional number “5”; **C**, Label with pre-printed information annotated only with Ule’s official number.

connections is to ignore historical evidence about the distribution of Ule's specimens.

For example, one specimen of *Paepalanthus itatiaiensis* Ruhland (1903) collected by Ule, is not numbered, but includes information pertaining to the collection site and date, all written in Ruhland's hand (Fig. 4A), plus his original drawings and descriptions. In the protologue, Ruhland (1903) gave such information, but cited the examined specimen as "Ule s.n.?" In contrast, at HBG, there is a specimen of *P. itatiaiensis* numbered *Ule 3507*, which also has the same dates and site descriptions as the specimens at B, all written by Ule, and the species name annotated by Ruhland (Fig. 4B). There is a duplicate of this collection at R, not seen by Ruhland, on which Ule wrote complete collection information, but used only his provisional number (Fig. 4C). All these specimens of *P. itatiaiensis* at B, HBG, and R also are morphologically quite similar, even though the specimen at B is a fragment, presumably removed from the HBG specimen. Thus, in the case of *P. itatiaiensis*, the three specimens of each held in B, HBG, and R can be unambiguously

considered as duplicates of the same collection, and as original material, from which a lectotype could be selected. Given that Ule's specimens at HBG usually bear complete collection information (i.e., collection number, site, and date), we suggest that they be selected as lectotypes when there is no clear evidence to do otherwise (see Rec. 9A.1 in the *ICN*).

(6) Specimens extant at B that are absent from the Berlin Negatives. — Of the 22 taxa of Eriocaulaceae described by Ruhland on the basis of Ule's specimens, of which all are at B, only 9 appear in the Berlin Negatives. Given that the names were published in 1903 (Ruhland, 1903), they should have been deposited at B in 1929 when Macbride first visited to photograph types. One possible explanation is that, because many Eriocaulaceae types at B are fragments, Ruhland may have kept them apart from the main collection, where they were not seen by Macbride. Similar situations may occur for other taxonomic groups, particularly those known to have been on loan by the time Macbride was at B, or during the war (Hiepko, 1987; Arroyo-Leuenberger & Leuenberger, 1996; Gebauer, 2011)

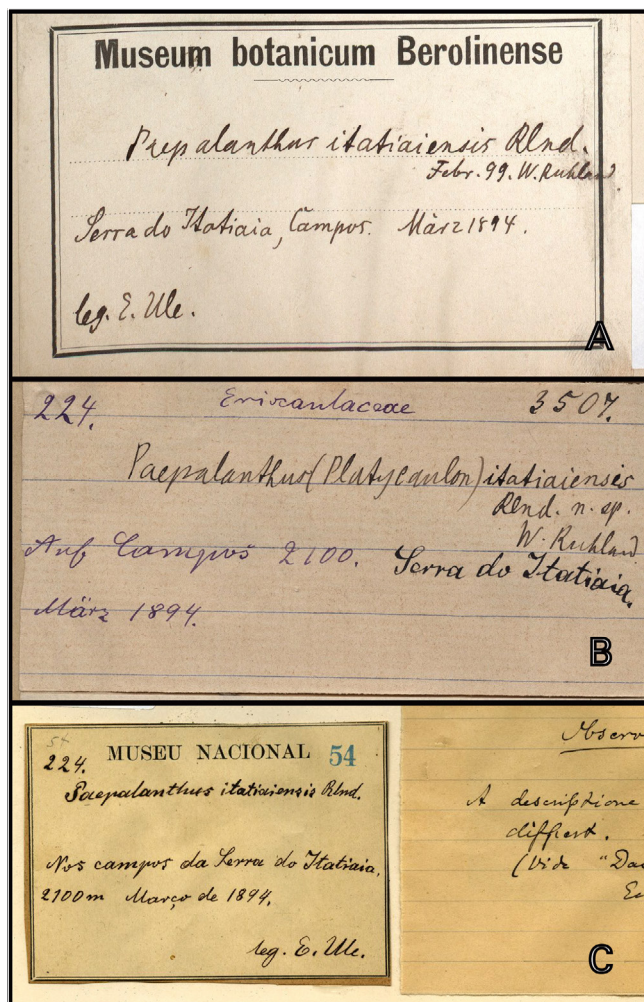


Fig. 4. Labels of different duplicates of a collection of *Paepalanthus itatiaiensis*. **A**, Unnumbered sheet at B; **B**, The HBG specimen with both the provisional and the official number; **C**, Only the provisional number is annotated on the sheet at R.

LECTOTYPIFICATION OF SELECTED SPECIES IN MIMOSOIDS (LEGUMINOSAE)

Names of new species based on Ule's collections were published by himself and by many other botanists. For example, species of Leguminosae were named by Taubert, who studied Ule's earlier collections with lower numbers, and by Harms, who focused on his later collections with higher numbers. Taubert (1896), Ule (1907, 1908), Pilger (1915), and Harms (1922) published collectively 47 new species of Mimosoid legumes based on Ule's collections, all of which required typification. Of these, 12 have already been typified by Pennington (1997) and Borges & Pirani (2014), the latter correcting errors made by Barneby (1991). Here we lectotypify the remaining 35 names to illustrate the guidelines presented above and comment on the lectotypifications made by Pennington (1997) and Borges & Pirani (2014).

We examined specimens in B, HBG, and R, images in JSTOR Global Plants (<http://plants.jstor.org>), and the Berlin Negatives (<http://fieldmuseum.org/explore/our-collections/berlin-negatives>). Each of the 35 specimens that we selected as lectotypes had been annotated with current taxonomic identities by Hopkins (1986), Barneby (1991, 1998), Barneby & Grimes (1996, 1997), Pennington (1997), and Hughes (1998). Information given within quotation marks in the type citations is derived from the original labels, not from the protologues. Homotypic synonyms, when existent, are presented, and heterotypic synonyms are indicated for names not currently accepted. All currently accepted names are given in bold italics.

Affonsea hirsuta Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 297. 1915 – **Lectotype (designated here)**: Brazil, Santa Catarina, "Itajahy, nach Barra de Rios zu", Nov 1885, fl., *E. Ule 449* (HBG barcode HBG-520816!; isolectotype: F No. 609615 [fragment, image!]) = ***Inga edwallii*** (Harms) T.D.Penn., Gen. Inga, Bot.: 687. 1997.

Ule 449 is represented by a specimen at HBG. A specimen was also deposited at B, however it was destroyed, as is indicated by the Berlin Negatives. An unidentified individual other than Ule wrote the collection information on the B sheet and Harms annotated it with the species name. On the other hand, Ule wrote the collection information on the label of the specimen at HBG, but Harms did not annotate it. The fragment at F comprises one leaflet and a single flower accompanied on by a photograph of the specimen that was at B. Given that the B specimen was destroyed and the duplicate at F is highly fragmentary, the logical choice of lectotype of *Affonsea hirsuta* is the specimen at HBG.

It is interesting to note that a liverwort specimen at G, annotated in 1973 as *Lophocolea trapezoides* Mont. by M. Fulford, bears a handwritten “*Ule 449*”. Because the label is not one of Ule’s originals and the number was not written in Ule’s hand, the conflict in numbering likely occurred when the specimen was deposited at G.

Calliandra catingae Harms in Bot. Jahrb. Syst. 42(2–3): 202–203. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Catinga bei Remanso”, Jan 1907, fl., fr., *E. Ule 7573* (HBG barcode HBG-520260!).

= *Calliandra squarrosa* Benth. in London J. Bot. 3: 104. 1844 (Renvoize, 1981).

Harms described the fruits of *Calliandra catingae* in the original description (Ule, 1908). The Berlin Negatives indicate that a specimen matching the description of *C. catingae*, but lacking a collection label, was present at B and had both flowers and fruits. The labeled duplicate of *Ule 7573* we located at HBG lacks fruits. Thus, Harms most likely based the species description on the specimen at B. Nonetheless, we select the specimen at HBG as lectotype because the specimen at B was destroyed.

Calliandra exsudans Harms in Bot. Jahrb. Syst. 42(2–3): 203. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Serra da Vendinha, Sincorá”, Nov 1906, fl., *E. Ule 7133* (HBG barcode HBG-520261!; isolectotypes: F No. 609685 [fragment, image!], G barcode G00191164 [image!], K barcode K000205803 [image!]).

= *Calliandra sincorana* Harms in Bot. Jahrb. Syst. 42(2–3): 204. 1908 (Barneby, 1998).

Currently, duplicates of *Ule 7133* are found at G, HBG, and K, and a fragment at F. The latter comprises one leaf and a few flowers mounted with a photograph of the specimen previously at B. Of all the extant specimens, the one at HBG has an original collection label that includes detailed locality data not present on the other duplicates. Because these data were cited by Harms (Ule, 1908), who also annotated the specimen at HBG, we select this specimen as lectotype of *Calliandra exsudans*.

Calliandra hirsuticaulis Harms in Bot. Jahrb. Syst. 42(2–3): 203. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Serra do Sincorá, 1400 m”, Nov 1906, fl., *E. Ule 7312* (HBG barcode HBG-520267!; isolectotypes: K barcode K000205777 [image!]).

The Berlin Negatives indicate that a duplicate of *Calliandra hirsuticaulis* with no collection label, but accompanied by a copy of Harms’s published protologue (Ule, 1908), was present at B but was destroyed. On the other hand, both duplicates of *Ule 7312* at HBG and K are well preserved specimens that match the original description and have original labels with concordant information. Hence, either of these specimens would equally well serve as lectotype. Because HBG houses the most complete set of Ule’s collections below 7575, we select the specimen there as lectotype.

Calliandra macrocalyx Harms in Bot. Jahrb. Syst. 42(2–3): 203. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Campo der Serra do São Ignacio”, Feb 1907, fl., *E. Ule 7203* (HBG barcode HBG-520264!; isolectotype: NY barcode 01492202! [fragment]).

Calliandra macrocalyx was represented at B by a duplicate of *Ule 7203*, a flowering specimen with an original label prepared by Ule (see Berlin Negatives), which was later destroyed. Barneby (1998) mistakenly cited *Ule 7586*, collected in December 1906, as the type collection. In the protologue (Ule, 1908), Harms, however, cited only *Ule 7203*, collected in February 1907. Renvoize (1981) cited the correct collection number and stated that an “isotype” of *C. macrocalyx* was in HBG. To the best of our knowledge, HBG holds the only extant duplicate of *Ule 7203*, which we select as lectotype. The fragment at NY was probably removed by Barneby from a specimen in an European herbarium, very likely HBG.

Calliandra pilgeriana Harms in Bot. Jahrb. Syst. 42(2–3): 204. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Serra do São Ignacio”, Feb 1907, fl., *E. Ule 7530* (HBG barcode HBG-520263!; isolectotypes: F No. 609619 [fragment, image!]).

As with some other *Calliandra* specimens collected by Ule, *C. pilgeriana* was represented at B by a specimen without a collection label but with a copy of the published protologue. Currently, F holds a fragment and photograph of the specimen that was at B, and HBG a duplicate numbered *Ule 7530* bearing an original collection label annotated by Harms. Thus, we select the HBG specimen as lectotype.

Calliandra silvicola Taub. in Bot. Jahrb. Syst. 21(4): 429. 1896 – **Lectotype (designated here)**: Brazil, Goiás, “habitat in ditone fluminis Maranhão superioris in silva ad Morro do Salto”, Sep 1892, fl., *E. Ule 2834* (HBG barcode HBG-506636! [also annotated as “11”]; isolectotypes: P, R barcodes R 000003197! & R 000003197a! [all sheets from P and R annotated only as “11”]).

Not present in the Berlin Negatives, *Ule 2834*, the type of *Calliandra silvicola*, is one of Ule’s earlier collections that would not have been sent to B. Despite that, Barneby (1998) mistakenly considered the holotype to have been deposited at B and subsequently lost. Here we select the specimen at HBG, which has complete collection information, both provisional (i.e., “11”) and official collection numbers, and Taubert’s annotation, as lectotype. All other duplicates have only Ule’s provisional number, which was not cited in the protologue.

Calliandra sincorana Harms in Bot. Jahrb. Syst. 42(2–3): 204. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Serra do Sincorá, 1400 m”, Nov 1906, fl., *E. Ule 7310* (HBG barcode HBG-520262!).

Ule 7310 was represented at B by a specimen that was subsequently destroyed. We designate the only extant duplicate, which is housed at HBG and annotated to species by Harms, as the lectotype.

Calliandra ulei Harms in Bot. Jahrb. Syst. 42(2–3): 204. 1908 – **Lectotype (designated here)**: Brazil, Piauí, “Catinga der Serra Branca”, Jan 1907, fl., *E. Ule 7440* (HBG barcode HBG-520259!; isolectotypes: G barcode G00020216 [image!], K barcode K000205547 [image!]).

Three duplicates of *Ule 7440* are currently housed at G, HBG, and K. A fourth was at B, but although it bore a copy of Harms’s species description (Ule, 1908), it lacked a collection label. All the extant syntypes are flowering specimens with Ule’s original collection labels and concordant information as described by Harms (Ule, 1908). Nonetheless, only the specimen at HBG includes information about habitat (“Catinga”), which was mentioned in the original description (Ule, 1908). We select this specimen, annotated by Harms, as lectotype.

Calliandra villosiflora Harms in Bot. Jahrb. Syst. 42(2–3): 205. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Catinga bei Remanso”, Dec 1906, fl., *E. Ule 7386* (HBG barcode HBG-520265!; isolectotypes: K barcode K000205530 [image!]).

= *Calliandra macrocalyx* Harms in Bot. Jahrb. Syst. 42(2–3): 203–204. 1908 (Renvoize, 1981).

Calliandra villosiflora was represented at B by a duplicate of *Ule 7386* that was later destroyed. Both extant duplicates of this collection have original collection labels with identical information and the specimens agree with the original description of the species. Because the specimen at HBG is the only one annotated by Harms, we select it as lectotype.

Inga acreana Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 298. 1915 – **Lectotype (designated here)**: Brazil, “Gebiet des Alto Acre, Seringal S. Francisco”, Jun 1911, fl., *E. Ule 9425* (K barcode K000328505 [image!]; isolectotypes: F Nos. 609663 [fragment, image!] & 1540250 [fragment, image!], G barcode G00365926 [image!], MG).

Because the duplicate of *Ule 9425* at B was lost and because duplicates of collections numbered above 7575 were not sent to HBG, this collection is not currently represented in any German herbaria, to our knowledge. The two specimens at F, one of which bears a photograph of the specimen at B, are fragmentary and lack original collection labels. Although the specimens at G and K are well preserved, match the original description of the species, and have original labels, neither was annotated by Harms. Because K is a major herbarium for botanists working on Brazilian Leguminosae taxonomy, we designate the specimen at K as lectotype. Readers should refer to the entry for *I. calophylla* for a discussion of the location of Seringal S. Francisco, where the type specimens of *I. acreana* also were collected.

Inga auristellae Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 298. 1915 – **Lectotype (designated here)**: Peru, “Alto Acre, Seringal Auristella”, Apr 1911, fl., *E. Ule 9426* (G [photo!]; isolectotypes: F Nos. 609662 [fragment, image!] & 1023071 [fragment, image!], K barcode K000328492 [image!], L barcode L.1948073 [image!], MG, U barcode U 0008099 [image!], US barcode 00000016 [image!]).

Similar to other collections numbered above 7575, *Ule 9426* was represented by a specimen at B, but not at HBG. Among all the representatives of *Ule 9426* examined by us, the specimen at B that is now lost, was the only one annotated by Harms and probably the sole specimen studied by him. Except for the fragments at F, all other extant duplicates have original collection labels with concordant information and fit the original description. The specimen at K lacks intact stamens, the one at US bears only a few flower buds, and those at F are fragmentary. Of the specimens at G, L and U, the first has flowers in different stages of development and for that reason, we select it as lectotype.

Inga brachyrhachis Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 159. 1907 – **Lectotype (designated here)**: Peru, Loreto, “Pongo de Cainarachi”, Sep 1902, fl., *E. Ule 6361* (HBG barcode HBG-519651!; isolectotypes: F No. 609661 [fragment, image!], G barcode G00365958 [image!], K barcode K000328490 [image!]).

Prior to WW II, there was a duplicate (now destroyed) of *Ule 6361* annotated by Harms at B. Pennington (1997) cited the specimens at G and K as isotypes but did not provide a lectotypification. There is also a specimen at F (fragmentary and lacking an original label) and at HBG. None of the specimens, other than the one that was housed at B, were annotated by Harms. All the extant representatives of *Ule 6361* have similar information on the original labels, are well preserved, and match the original description of the species. Because the specimen at HBG has many flowers and belongs to Ule’s main set of specimens, we select it as lectotype of *Inga brachyrhachis*.

Inga calophylla Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 298. 1915 – Lectotype (designated by Pennington, Genus Inga, Bot.: 413. 1997): Brazil, “Gebiet des Alto Acre, Seringal S. Francisco”, Jul 1911, fl., *E. Ule 9427* (K barcode K000328381 [image!]; isolectotypes: F Nos. 609657 [fragment, image!] & 1540259 [fragment, image!], G barcode G00365848 [image!], MG, US).

= *Inga chartacea* Poepp. & Endl., Nov. Gen. Sp. Pl. 3: 79. 1845 (Pennington, 1997).

In the original description of *Inga calophylla*, Harms (Pilger, 1915) cited two specimens (*Ule 9427*, *Ule 9428*) that were deposited at B, however both were destroyed and are now lost. Pennington (1997) selected *Ule 9427* at K as lectotype and cited duplicates at MG and US as isolectotypes. Additionally, we have seen an image of a third isolectotype at G. Although we have not seen the specimens at MG and US cited by Pennington (1997), we agree with Pennington’s choice of the specimen at K as lectotype.

Pennington also cited Seringal S. Francisco, the collection site of *Ule 9427*, to be in “Peru, Madre de Dios”, not in Brazil as indicated on Ule’s original labels. Ule’s designation is correct; Seringal São Francisco is located at the left side of the Acre River (10° 57’ S, 69° 37’ W), and hence, is in Acre State, Brazil (Douglas Daly, pers. comm.).

Inga chaetophora Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 299. 1915 – **Lectotype** (first-step designated by Macbride in Publ. Field Mus. Nat. Hist., Ser. Bot. 13(3): 42. 1943; **second-step designated here**): Brazil, “Gebiet des Alto Acre, Seringal S. Francisco”, Mar 1911, fl., *E. Ule 9418* (G barcode G00388529 [image!]; isolectotypes: F Nos. 609658 [fragment, image!] & 1540222 [fragment, image!], K barcodes K000328445 [image!] & K000328446 [image!]). = *Inga stipulacea* G. Don, Gen. Hist. 2: 391. 1832 (Macbride, 1943; Pennington, 1997).

In the original description of *Inga chaetophora* (Pilger, 1915), Harms cited two collections *Ule 5821* and *Ule 9418*. The second, *Ule 9418*, was cited by Macbride (1943) as the “type” of *I. chaetophora*. Pennington (1997) expanded on that and cited duplicates of *Ule 9418* at G, K, and MG as “isolectotypes”, but neither Pennington nor Macbride indicated a single specimen as the type (i.e., a lectotype). Because the specimens at B were destroyed and the extant duplicates do not differ significantly in collection information, are in good condition (except for the fragments at F), and were not annotated by Harms, we narrow the earlier typification and designate *Ule 9418* at G as lectotype. Readers should refer to the note under *I. calophylla* for a comment regarding the location of Seringal S. Francisco, where the type specimens of *I. chaetophora* were collected.

Inga cynometrifolia Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 159–160. 1907 – **Lectotype (designated here)**: Peru, Loreto, “Juan Guerra”, Oct 1902, fl., *E. Ule 6452* (G barcode G00365900 [image!]; isolectotypes: F Nos. 602037 [fragment, image!], 609666 [fragment, image!] & 1540228 [fragment, image!], HBG barcode HBG-519648!, K barcode K000328498 [image!]).

Ule 6452 is an example of the collections of which duplicates were sent both to B and HBG. Harms probably studied only the specimen at B which was destroyed and is now lost. As is evidenced by the Berlin Negatives, he annotated that specimen, but not the other extant specimens. Pennington (1997) cited only specimens at G and K as “isotypes”. Were we to follow our Guidelines, we would select the sheet at HBG as lectotype, but because most flowers of that specimen lack stamens, we instead select the duplicate at G because the flowers are better preserved.

Inga mendoncaeii Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 300. 1915 – **Lectotype (designated here)**: Brazil, Rio de Janeiro, “Serra do Macahè, 900 m”, Feb 1900, fl., *E. Ule 4886* (HBG barcode HBG-520825!).

In the original description of *Inga mendoncaeii*, Harms cited four collections, all of which are syntypes (Pilger, 1915): *Mendonça 50*, *Glaziou 3935*, *Ule 4822*, and *Ule 4886*.

Pennington (1997) cited only the fragment of *Mendonça 50* at F as an “isosytype”. Indeed, *Mendonça 50* would be an obvious choice for a lectotype of the species named in honor of Mendonça, a Brazilian physician with botanical interests and whose collections were deposited at B, with duplicates sent to HBG (Urban, 1906). Today, however, the specimen held at B has been destroyed, the fragment at F consists of a single incomplete leaflet, and we were not able to locate duplicates in any other herbaria, including HBG. We also did not find any duplicates of *Glaziou 3935* at P or R. The Ule collection of *I. mendoncaeii* at R (R 000067365!), which is unnumbered and was collected at the same site on the same date, is probably (but not certainly) a duplicate of *Ule 4822*. Because *I. mendoncaeii* has not been lectotypified, we select *Ule 4886*, collected at the same site as *Mendonça 50*, as lectotype.

Inga microcoma Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 301. 1915 – **Lectotype (designated here)**: Brazil, “Alto Acre, Seringal S. Francisco, Monte Alegre”, Sep 1911, fl., *E. Ule 9431* (G barcode G00371284 [image!]; isolectotypes: F Nos. 609664 [fragment, image!] & 1540220 [fragment, image!], K barcode K000328320 [image!], MG, US barcode 00000131 [image!]).

Among the German herbaria we examined, only B is known to have housed a specimen of *Ule 9431*, which was destroyed and is now lost. None of the representatives that we examined in other herbaria were annotated by Harms, nor do they (except for the fragmentary specimens at F) differ from each other significantly enough to make any one an obvious choice of lectotype. Here we select the specimen at G as lectotype. Refer to the entry for *I. calophylla* for a note regarding the location of Seringal S. Francisco, where the type specimens of *I. microcoma* were collected.

Inga ochroclada Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 302. 1915 – **Lectotype (designated here)**: Brazil, “Alto Acre, Seringal S. Francisco”, Aug 1911, fl., *E. Ule 9419* (K barcode K000328582 [image!]; isolectotypes: F No. 609659 [fragment, image!]).

= *Inga sapindoides* Willd., Sp. Pl. 4: 1012. 1806 (Pennington, 1997).

As was the case for other collections numbered above 7575, *Ule 9419* was represented by a specimen at B before WW II, but the specimen is now lost. At F, the photograph of this specimen is associated with a fragmentary specimen comprising one leaflet and a single flower. Currently and to the best of our knowledge, the duplicate at K is the only complete specimen of *Ule 9419*, and we select it as lectotype. Refer to the entry of *I. calophylla* for a note about the location of Seringal S. Francisco, where the type specimens of *I. ochroclada* were collected.

Inga pachyphylla Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 303. 1915 – **Lectotype (designated here)**: Brazil, Acre, “Rio Branco, Surumu, Abhang der Serra de Mirary, 600 m”, Nov 1909, fl., *E. Ule 8395* (K barcode K000328360 [image!]; isolectotypes: F No. 609604 [fragment, image!]).

The specimen of *Ule 8395* at B, which was evidently unlabeled, was destroyed and is now lost. At F the photograph of this specimen is associated with a fragment comprising one leaflet and a single flower. We select the duplicate of *Ule 8395* at K as the lectotype because it is more complete and better preserved.

Inga peltadenia Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 160. 1907 ≡ *Inga thibaudiana* subsp. *peltadenia* (Harms) T.D.Penn., Gen. Inga, Bot.: 489. 1997 – **Lectotype (designated here)**: Peru, Loreto, “Tarapoto”, Oct 1902, fl., *E. Ule 6451* (HBG barcode HBG-519640!; isolectotypes: F No. 609660 [fragment, image!], G barcode G00388522 [image!, two sheets], K barcode K000328528 [image!]).

Ule 6451 is among the collections that were distributed to both B and HBG, but only the specimen at HBG is extant because the specimen at B was destroyed. The specimen at F is fragmentary and the duplicate at K has few intact flowers. The specimens at HBG and G were not annotated by Harms, but both match the original description of the species and are well preserved. We follow our guidelines and select the specimen at HBG as the lectotype of *Inga peltadenia*.

Inga ulei Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 161. 1907 – **Lectotype (designated here)**: Brazil, [Amazonas:], “Amazonas-Gebiet, Cachoeiras des Marmellos”, Mar 1902, fl., *E. Ule 6088* (HBG barcode HBG-519637!; isolectotype: F Nos. 602792 [fragment, image!] & 609602 [fragment, image!], G barcode G00388512 [image!], K barcode K000328337 [image!]).

The duplicate of *Ule 6088* previously deposited at B was destroyed and is now lost. All extant duplicates of this collection, except for the fragments at F, are equally reasonable options to serve as a lectotype. Hence, using the same criteria applied in the case of *Inga peltadenia*, we select the specimen at HBG as lectotype.

Inga wittiana Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 161. 1907 – **Lectotype (designated here)**: Brazil, Amazonas, Juruá, “im Walde bei Marary”, Sep 1900, fl., *E. Ule 5057* (HBG barcode HBG-519636!; isolectotype: F Nos. 609603 [fragment, image!] & 1540258 [fragment, image!], G barcode G00371266 [image!]).

= *Inga nobilis* subsp. *quaternata* (Poepp. & Endl.) T.D.Penn., Gen. Inga, Bot.: 383. 1997 (Pennington, 1997)

Extant duplicates of *Ule 5057* are housed at HBG and G. Of the fragmentary specimens at F, one is mounted with a photograph of the lost specimen at B taken by Macbride. The specimens at HBG and G are similar to each other, but the first has more flowers and leaves and was part of Ule’s main set of specimens. Hence, we designate the specimen at HBG as lectotype.

Leucaena ulei Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 162. 1907 ≡ *Parkia ulei* (Harms) Kuhlm. in Arch. Jard. Bot. Rio de Janeiro 4: 34, 356. 1925 – **Lectotype (designated here)**: Brazil, [Amazonas:], “[Rio Madeira], Cachoeira des Marmellos”, Mar 1902, fl., *E. Ule 6085*

(HBG barcode HBG-519570!; isolectotypes: F No. 609686 [fragment, image!], G barcode G00370511 [image!], K barcode K000504600 [image!], L barcode L 0019050 [image!], MG, S).

As is evidenced by the Berlin Negatives, the specimen of *Ule 6085* that was originally deposited at B had no collection label. Nonetheless, all extant specimens seen by us carry labels that indicate the location Cachoeira des Marmellos [Marmellos Waterfall] to be on the Madeira River. Like other authors, Hopkins (1986) treated the “presumably destroyed” specimen at B as the “holotype” of *Leucaena ulei*. We select the specimen at HBG as the lectotype because it is the only extant specimen that was annotated by Harms.

Mimosa acanthophora Harms in Bot. Jahrb. Syst. 42(2–3): 206. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Tableiro bei Remanso”, Dec 1906, fl., fr., *E. Ule 7384* (HBG barcode HBG-519403!; isolectotype: F No. 609626 [fragment, image!]).

= *Mimosa hexandra* Micheli in Mém. Soc. Phys. Genève 30 (2/7): 91, t. 27. 1889 (Lewis, 1987).

Given that the duplicate of *Ule 7384* at B was destroyed during WW II and that the specimen at F is a fragment, we select the specimen at HBG as the lectotype of *Mimosa acanthophora*. This particular sheet also has Harms’s annotation of the species name.

Mimosa albolanata Taub. in Bot. Jahrb. Syst. 21(4): 433–434. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 217. 2014): Brazil, Goiás, “Serra Dourada”, Jan 1893, fl., *E. Ule 2872* (HBG barcode HBG-506647!; isolectotypes: R barcodes R 000003358! & R 000003358a!).

The specimen at HBG was selected as lectotype because it is the only one that carries Ule’s official collection number.

Mimosa brevispica Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 303. 1915 – **Lectotype (designated here)**: Brazil, Acre, Rio Branco, “Serra de Carauma”, Nov 1908, fl., fr., *E. Ule 7726* (K barcode K000532503 [image!]; isolectotype: F No. 609627 [fragment, image!]).

Of the two collections, *Ule 7726* and *Ule 8478*, cited by Harms (Pilger, 1915) in the description of *Mimosa brevispica*, we were able to locate only *Ule 7726*, which is represented by the photograph of the labeled specimen once at B and by extant specimens at F and K. The specimen at B included both flowers and fruits. The absence of collections from HBG is logical as both have numbers greater than 7575. Since the specimen at F is a fragment, we designate the sheet at K as lectotype, even though it lacks mature fruits, which were described in the protologue.

Mimosa campicola Harms in Bot. Jahrb. Syst. 42(2–3): 206. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Campo der Serra do São Ignacio”, Feb 1907, fl. fr., *E. Ule 7528* (HBG barcode HBG-519422!; isolectotypes: F No. 609628 [fragment, image!], K barcode K000090854 [image!], NY barcode 01345161! [fragment]).

The specimen of *Ule 7528* that had been deposited at B was destroyed and is now lost. Both HBG and K hold intact and complete specimens of *Ule 7528*. Since Harms annotated the specimen at HBG, we select it as lectotype.

Mimosa cyclophylla Taub. in Bot. Jahrb. Syst. 21(4): 429. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 208. 2014): Brazil, Goiás, “habitat in ditone Tocantini superioris in campis ad Paraizo”, Sep 1892, fl., fr., *E. Ule 2825* (HBG barcode HBG-506638!; isolectotypes: R barcodes R 000003352! & R 000003352a!).

Given that the specimen at HBG is the only representative of *Ule 2825* that carries Ule’s official collection number, Borges & Pirani (2014) selected it as lectotype.

Mimosa ernestii Harms in Repert. Spec. Nov. Regni Veg. 18: 232. 1922 – **Lectotype (designated here)**: Brazil, Rio de Janeiro, “im Hochwalde der Serra dos Orgãos, um 2000 m”, Dec 1896, fl., fr., *E. Ule 4204* (HBG barcode HBG-519412!; isolectotypes: F No. 609629 [fragment, image!], R barcode R 000064079!).

Harms did not describe the fruits of *Mimosa ernestii*, which were not present on the specimen he studied at B and which is lost. Fruits are, however, present on the duplicate at HBG, and the absence of these from the protologue strongly suggests that Harms did not review this specimen. The unnumbered specimen at R is probably a duplicate of *Ule 4204* because it was collected at the same site on the same date. Although neither Ule nor Harms wrote the species name on the specimen at HBG, we select it as lectotype of *M. ernestii*.

Mimosa formosana Taub. in Bot. Jahrb. Syst. 21(4): 433. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 216. 2014): Brazil, Goiás [Formosa], “prope Formosa”, Sep 1894, fl., *E. Ule 2827* (HBG barcode HBG-506642!).

= *Mimosa setosa* Benth. in J. Bot. (Hooker) 4(32): 404. 1842 (Barneby, 1991).

HBG holds the single known specimen of *Ule 2827*, which was selected by Borges & Pirani (2014) as lectotype of *Mimosa formosana*.

Mimosa hirsuticaulis Harms in Bot. Jahrb. Syst. 4(2–3): 206. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Taboleiro bei Remanso”, Jan 1907, fl., fr., *E. Ule 7389* (HBG barcode HBG-519402!; isolectotypes: F No. 609619 [fragment, image!], G, K barcode K000090824 [image!], L barcode L 0019118 [image!], M[?], NY barcode 01345818! [fragment]).

The extant specimens of *Ule 7389* at HBG, K, and L are complete, intact, and match the original description. None of these, however, has fruits, which were described by Harms (Ule, 1908) based on the specimen at B that is now lost. There is doubt about the origin of the specimen at L because it has no Ule label and was annotated as an Ule collection from Brazil in an unknown hand. Barneby later added the locality and collection number to that specimen. The specimens at F and NY

are fragments, and those at G and M cited by Barneby (1991) were not available to us. According to A. Fleischmann (pers. comm.), there is not a duplicate of this collection at M. Since there are no major differences between the specimens at HBG and K, we select the former as lectotype.

Mimosa longepedunculata Taub. in Bot. Jahrb. Syst. 21: 432. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 214. 2014): Brazil, Goiás, “Habitat in valle fluvii Passa Tempo in ditone Maranhao superioris”, Sep 1892, fl., fr., *E. Ule 2830* (HBG barcode HBG-506643!; isolectotypes: P barcode P03150238!; R barcodes R 000003324! & R 000003324a!).

Borges & Pirani (2014) selected the specimen of *Ule 2830* at HBG as lectotype of *Mimosa longepedunculata* because it is the only one bearing Ule’s official collection number.

Mimosa paraizensis Taub. in Bot. Jahrb. Syst. 21(4): 430. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 208. 2014): Brazil, Goiás, “habitat in ditone Tocantini superioris in campis ad Paraizo”, Sep 1892, fl., [fr. imm.], *E. Ule 2824* (HBG barcode HBG-506640!; isolectotypes: CORD barcode CORD 00002927 [image!], P barcodes P03151832 [image!] & P03151833 [image!], R barcodes R 000003382! & R 000003382a!).

= *Mimosa radula* var. *imbricata* (Benth.) Barneby in Mem. New York Bot. Gard. 65: 674. 1991 (Barneby, 1991)

Only two specimens of *Ule 2824* bear Ule’s official collection number, the criterion used by Borges & Pirani (2014) to select lectotypes. One is at HBG and the other at CORD. The duplicate at HBG was arbitrarily selected by these authors as lectotype of *Mimosa paraizensis*.

Mimosa pseudosepiaria Harms in Bot. Jahrb. Syst. 42: 207. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Sumpfige Niederungen bei Remanso”, Jan 1907, fl., fr., *E. Ule 7383* (HBG barcode HBG-519387!; isolectotypes: F Nos. 609623 [fragment, image!] & 1546185 [fragment, image!], G barcode G00371517 [image!, 2 sheets], K barcode K000090738 [image!], NY barcode 01346669! [fragment]).

Given that the duplicate of *Ule 7383* at B was destroyed, we designate the specimen at HBG as lectotype because it bears Harms’s annotation and both flowers and fruits as described in the protologue. Other extant duplicates lack at least one of these features.

Mimosa pyreneae Taub. in Bot. Jahrb. Syst. 21(4): 430. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 208. 2014): Brazil, Goiás, “habitat in montibus Serra dos Pyreneos”, Aug 1892, fl., *E. Ule 2854* (HBG barcode HBG-506639!; isolectotypes: P barcode P03151915 [image!], R barcodes R 000003383! & R 000003383a!).

Borges & Pirani (2014) selected the duplicate of *Ule 2854* deposited at HBG, the only one bearing Ule’s official collection number, as lectotype of *Mimosa pyreneae*.

Mimosa remansoana Harms in Bot. Jahrb. Syst. 42(2–3): 207. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Taboleiro bei Remanso”, Jan 1907, fl., fr., *E. Ule 7390* (L barcode L 0019120 [image!]; isolectotypes: F No. 609622 [fragment, image!], HBG barcode HBG-519385!, K barcode K000090810 [image!]).

= *Mimosa misera* Benth. var. *misera* in J. Bot. (Hooker) 4(32): 411. 1842 (Barneby, 1991).

To the best of our knowledge, *Ule 7390* is represented by five specimens, of which one was destroyed (B) and one is fragmentary (F). Each of the three remaining specimens has an original label and includes flowers and fruits, both of which were described by Harms (Ule, 1908). The protologue described leaves with 1–3 pairs of pinnae, 2–6 pairs of leaflets, and fruits with 6–8 articles. Among the extant and intact specimens, that at L is the best match for the description and we select it as lectotype, even though Harms annotated only the duplicate at HBG.

Mimosa setosissima Taub. in Bot. Jahrb. Syst. 21(4): 434. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 218. 2014): Brazil, Goiás, “habitat in montibus Serra dos Pyreneos”, Aug 1892, fl., *E. Ule 2853* (HBG barcode HBG-506645!; isolectotypes: P barcode P03151933!, R barcodes R 000003315! & R 000003315a!).

All duplicates of *Ule 2853*, but the one at HBG bear only Ule’s provisional collection number. Because of that, Borges & Pirani (2014) selected the specimen at HBG as lectotype of *Mimosa setosissima*.

Mimosa setuligera Harms in Bot. Jahrb. Syst. 42(2–3): 208. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Taboleiro bei Remanso”, Jan 1907, fl., fr., *E. Ule 7388* (HBG barcode HBG-519380!; isolectotypes: F No. 609621 [fragment, image!], G barcode G00371533 [image!], K barcode K000090825 [image!]).

Except for the fragment at F, all extant specimens of *Ule 7388* match the original description and have original labels. Thus, each would be an equally reasonable choice for selection as lectotype. On the other hand, because only the specimen at HBG was annotated by Harms, we select it as lectotype. The photograph of the unlabeled specimen at B that is now destroyed is particularly puzzling. Although this specimen was supposedly available to Harms, it bore fruits that were not included in the original description

Mimosa speciosissima Taub. in Bot. Jahrb. Syst. 21(4): 431. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 212. 2014): Brazil, Goiás, “Habitat in montibus Serra da Baliza”, Sep 1892, fl., *E. Ule 2828* (HBG barcode HBG-506641!; isolectotypes: P!, R barcodes R 000003314! & R 000003314a!).

Using the presence of Ule’s collection number on specimen’s labels, Borges & Pirani (2014) selected the duplicate of *Ule 2828* at HBG as lectotype of *Mimosa speciosissima*.

Mimosa surumuensis Harms in Notizbl. Königl. Bot. Gart. Berlin 6: 304. 1915 – **Lectotype (designated here)**: Brazil,

Acre, Rio Branco, “Gebiet des Surumu, auf Felsen bei der Serra do Mel”, Jul 1909, fl., fr., *E. Ule 8131* (K barcode K000532651 [image!]; isolectotypes: F No. 609620 [fragment, image!], G barcode G00371538 [image!], NY barcode 00003084!, US barcode 00000942 [image!]).

Extant specimens of *Ule 8131* are not present in German herbaria to our knowledge and the specimen at B was destroyed. The other specimens were not annotated by Harms, and do not differ significantly from each other or the original description. We select the specimen at K, an important collection of Leguminosae, as lectotype.

Mimosa tocantina Taub. in Bot. Jahrb. Syst. 21(4): 431. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 212. 2014): Brazil, Goiás, “Habitat in ditone Tocantini superioris in montosis ad Vargem Grande”, Sep 1892, fl., *E. Ule 2826* (HBG barcode HBG-506644!; isolectotypes: P barcode P00756072!, R barcode R 000003365!). Borges & Pirani (2014) selected the only duplicate of *Ule 2826* bearing Ule’s official collection number as lectotype of *Mimosa tocantina*.

Mimosa tomentosa Taub. in Bot. Jahrb. Syst. 21(4): 434. 1896, nom. illeg., non *M. tomentosa* Humb. & Bonpl. ex Willd., Sp. Pl. 2: 1033. 1806, nec *M. tomentosa* Rottler in Neue Schriften Ges. Naturf. Freunde Berlin 4: 208. 1803 ≡ *Mimosa laniceps* Barneby in Mem. New York Bot. Gard. 65: 412. 1991 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 220. 2014): Brazil, Goiás, “Valle rivi Vargem Grande”, Sep 1892, fl., *E. Ule 2832* (HBG barcode HBG-506646!; isolectotypes: P barcodes P03150245! [fragment] & P03150246!, R barcode R 000003357!).

Among the duplicates of *Ule 2832*, that at HBG is the only one bearing Ule’s official collection number. Given that, Borges & Pirani (2014) selected it as lectotype of *Mimosa laniceps*, the name used by Barneby to replace the illegitimate *M. tomentosa* Taub.

Mimosa ulbrichiana Harms in Bot. Jahrb. Syst. 42(2–3): 208. 1908 – **Lectotype (designated here)**: Brazil, Bahia, “Campo der Serra do São Ignacio”, Feb 1907, fl., fr., *E. Ule 7529* (HBG barcode HBG-519376!; isolectotypes: F Nos. 609625 [fragment, image!] & 1546191 [fragment, image!], G barcode G00371531 [image!], K barcode K000090821 [image!]).

The specimen of *Ule 7529* previously deposited at B was destroyed, and the two sheets at F are fragments. Of the extant and intact duplicates at G, HBG, and K, the one at HBG was annotated by Harms and fits better the original description because it has mature fruits with 6–8 articles. The specimen at K has fruits with 4 articles, and the one at G has only immature pods. Based on the above, we select the specimen at HBG as lectotype.

Mimosa ulei Taub. in Bot. Jahrb. Syst. 21(4): 432. 1896 – Lectotype (designated by Borges & Pirani in Phytotaxa 177(4): 216. 2014): Brazil, Goiás, “Habitat in campis ad

fluvium Rio Preto in ditone Maranhão [Tocantins, not Maranhão] superioris”, Sep 1892, fl., fr., *E. Ule 2829* (HBG barcode HBG-506637!; isolectotypes: CORD barcode CORD 00002931 [image!], P barcodes P02768751! [inflorescence] & 02768752! [leaf], R barcodes R 000003326!, R 000003326a! & R 000003326b!)

Among the duplicates of *Ule 2829* bearing Ule’s official collection number, Borges & Pirani (2014) selected the specimen at HBG as lectotype of *Mimosa ulei*.

Pithecellobium juruanum Harms in Verh. Bot. Vereins Prov. Brandenburg 48: 162. 1907 ≡ *Zygia juruana* (Harms) L.Rico in Kew Bull. 46(3): 501. 1991 – **Lectotype (designated here)**: Brazil [Amazonas:], “Amazonas-Gebiet, im Walde bei Marary, Jurua”, Sep 1900, fl., *E. Ule 5062* (G barcode G00364034 [image!]; isolectotypes: HBG barcode HBG-519290!, K barcode K000528136 [image!]).

Rico-Arce (1991), when transferring *Pithecellobium juruanum* to *Zygia*, cited the specimen that was originally deposited at B as the holotype and the specimen at K as an isotype. This was followed by Barneby & Grimes (1997). Given that the type cited by those authors was already destroyed, a lectotype must be selected from among the extant duplicates at G, HBG and K. The specimen at K has only fragmentary inflorescences with a few flowers and flower buds. The duplicates at G and HBG have original collection labels with similar information and are equally good matches to the original description. Even though the sheet at HBG was annotated by Harms and belonged to one of Ule’s main sets of specimens, we designate the specimen at G as lectotype because it has more flowers that can be studied in the future.

Stryphnodendron goyazense Taub. in Bot. Jahrb. Syst. 21(4): 434. 1896 – **Lectotype (designated here)**: Brazil, Goiás, “habitat in locis Cerrados dictis prope Meiaponte”, Oct 1892, fl., *E. Ule 2836* (HBG barcode HBG-506635! [also annotated as “13”; isolectotype: R barcode R 000003076! [only annotated as “13”]).

Ule 2836 is among the collections that were never sent to Berlin. The specimen at R has only the provisional collection number, while the specimen at HBG as both official and provisional numbers. We select the specimen at HBG as lectotype because it has Ule’s official number and was most likely the specimen studied by Taubert.

■ CONCLUSION

Here we have shown that knowledge of the patterns of distribution of Ule’s collections is helpful when selecting lectotypes from among the replicates of specimens he collected that have been distributed to various herbaria. Such knowledge may prevent errors such as those made by Barneby (1991) when typifying some species of *Mimosa*. Similar situations, are known from Welwitsch’s African collections, which have been in the hands of different institutions over time (Albuquerque

& al. 2009), and Fritz Kraenzlin’s orchid collections, which were assumed to have been destroyed, but are extant at HBG (Christenson, 1994).

The guidelines and typifications presented here were arrived at after study of historical documents and specimens—the latter a small sample of the diversity encompassed by Ule’s collections. It would be interesting to determine whether our guidelines would remain useful for Ule’s collections of other organisms, such as fungi, lichens, and bryophytes and other groups of vascular plants—especially those not destroyed in Berlin during WW II, e.g., Amaryllidaceae (Arroyo-Leuenberger & Leuenberger, 1996), Begoniaceae (Hiepko, 1987), and Loranthaceae (Gebauer, 2011). Of course it would be difficult to determine whether specimens belonging to families not photographed by Macbride, such as Cactaceae (Eggli & Leuenberger, 2008), were deposited at B and then destroyed, or were never there in the first place. We focused on species described by Taubert and Harms, two German botanists employed at B with convenient access to Ule’s specimens. Hence, it would also be worthwhile to determine how applicable our guidelines are to cases in which Ule’s specimens were treated by non-German botanists, such as Cogniaux who worked with Brazilian Orchidaceae (e.g., Cogniaux, 1893) at the herbarium in Meise, Belgium (BR).

The history and guidelines presented here can help to resolve most problems encountered when selecting lectotypes from Ule collections. These guidelines should not be followed blindly, however, because the use of mechanical methods are not encouraged by the *Code* (McNeill & al., 2012; Rec. 9A.2). Detailed examination of each case and careful adherence to the principles of botanical nomenclature are always necessary.

Our work on the history of Ule’s collections is part of the effort taxonomists have made for a long time to document collectors’ journeys in search of plants (e.g., Urban, 1906; Moraes, 2008; Delprete, 2015). While this used to be a time-consuming task, gathering such knowledge has become easier than ever given the increasing number of online databases and the overall proliferation of the internet. However, full understanding of the distribution of Ule’s collections required study of documents in the HBG archives that were not already accessible online. Both electronic resources and manual examination of herbaria, as well as archival materials, should be used to gather knowledge about people and collections in the past, and to synthesize them into a compelling narrative and useful tool.

■ AUTHOR CONTRIBUTION

LMB and MS designed the research with contributions by MT. MS and HHP contributed historical data on Ule and his collections. LMB provided lectotypifications and taxonomic comments. LMB wrote the text with contributions by MS, MT and JAK. LMB revised the final version of the text. — LMB, <https://orcid.org/0000-0001-9269-7316>; MT: <https://orcid.org/0000-0002-0478-2332>; MS <https://orcid.org/0000-0001-6202-8939>

■ ACKNOWLEDGMENTS

We thank Renato Mello-Silva for fine translation of references in Latin, Douglas Daly for help with localities in Acre, Scott Heald for revision of English grammar and style of an earlier draft, Matheus F. Santos, three anonymous reviewers and the editors Jefferson Prado, and James Lendemer for comments on earlier versions of this work. L.M. Borges's research was sponsored by FAPESP (2010/11093-1) and FAPESP (2013/13709-8). Financial support to M. Trovó was provided by the Alexander von Humboldt Foundation, FAPERJ (E-26/111010.001.392/2014-BIOTA, E-26/203.269/2016-JCNE) and CNPq (proc. 470349/2013-1-Universal, proc. 301832/2016-1-Pq2).

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