

Amendments to the nomenclature of *Lippia* (Verbenaceae: Lantaneae): typification of names linked to the Brazilian flora

PEDRO HENRIQUE CARDOSO¹, PABLO MORONI², NATALY O'LEARY², AND FÁTIMA REGINA GONÇALVES SALIMENA³

¹ Departamento de Botânica, Universidade Federal do Rio de Janeiro, Museu Nacional, Quinta da Boa Vista, Rio de Janeiro, RJ CEP 20940-040, Brazil; e-mail: pedrocardoso@ufjf.br

² Instituto de Botánica Darwinion (ANCEFN-CONICET), Labardén 200, CC 22, B1642HYD, San Isidro, Buenos Aires, Argentina

³ Departamento de Botânica, Herbário Leopoldo Krieger, Universidade Federal de Juiz de Fora, Instituto de Ciências Biológicas, Juiz de Fora, MG 36036-900, Brazil

Abstract: During the preparation of the treatment of the genus *Lippia* for the *Flora do Brasil 2020 online* project, dozens of names were found in need of typification or typification clarifications. In this context, lectotypes are designated for 18 names (*L. asperrima*, *L. cordata*, *L. dracocephaloides*, *L. elliptica*, *L. florida*, *L. glabrescens*, *L. hederifolia*, *L. herbacea*, *L. hermannioides*, *L. hirta*, *L. iodophylla*, *L. maximiliani*, *L. microcephala*, *L. oxycnemis*, *L. primulina* var. *goyazensis*, *L. pseudothea*, *L. reticulata*, and *L. rhodocnemis*), and a second-step lectotypification is made for *L. aristata*. A neotype is proposed for *L. corymbosa*, whereas the erroneous application of the term “holotype” is corrected to lectotype for the names *L. pumila* and *L. turnerifolia*. Furthermore, supporting information for the holotype of *L. gardneriana* is provided.

Keywords: Brazil, lectotype, taxonomy.

Circumscribing taxa of Verbenaceae has been a challenge, especially for taxonomically complex and diverse genera such as *Lippia* L. With about 140 species, this genus represents one of the largest radiations within the family (Atkins, 2004; Marx et al., 2010; Cardoso et al., 2021) and is a notable element in tropical and subtropical zones of the New World. *Lippia* includes shrubs and subshrubs widely distributed from southern North America and the Caribbean to the Southern Cone in South America (Atkins, 2004), with most of the species richness found in Brazil (Salimena & Cardoso, 2020). Based on current ethnobotanical knowledge (Moroni, unpubl. data), about 22 species of *Lippia* are valued as sources of food and medicines. In particular, the fresh leaves of *L. alba* (Mill.) N.E.Br. ex Britton & P.Wilson have an intense anise aroma and are prized for flavoring soups, meats, and fish, and for making a pleasant tea. On the

other hand, the leaves of *L. graveolens* Kunth (Mexican oregano) have an intense oregano aroma and are often preferred over European oregano (Facciola, 1990).

Despite the economic importance of some species, the taxonomy of *Lippia* remains in a preliminary stage. Moldenke treated the genus in 11 short papers (Moldenke, 1965a, 1965b, 1965c, 1965d, 1965e, 1965f, 1965g, 1966a, 1966b, 1966c, 1966d) that he intended to form part of a larger monograph, which unfortunately was never published. Despite the work of subsequent authors (e.g.: Múlgura de Romero, 2000; Salimena, 2002; O'Leary et al., 2012; Salimena & Múlgura de Romero, 2015), it became obvious while preparing the taxonomic revision of *Lippia* for *Flora do Brasil 2020 online* that the nomenclature of numerous names required further work. The objective of this contribution is therefore to establish a well-founded nomenclatural treatment of *Lippia* in Brazil.

Materials and methods

In order to resolve typifications, the protologues of the treated taxa were studied and key literature (e. g.: Moldenke 1965a, 1965b, 1965c, 1965d, 1965e, 1965f, 1965g, 1966a, 1966b, 1966c, 1966d; Múlgura de Romero, 2000; Silva, 2001; Salimena, 2002; O'Leary et al., 2012; Salimena & Múlgura de Romero, 2015; Cardoso & Salimena, 2019; Cardoso et al., 2020a, 2020b) was consulted to identify possible prior typifications. Type specimens were analyzed during visits to B, BR, K, M, NY, P, RB, SI, SP and W (acronyms according to Thiers, 2021), as well as from digital images on the JSTOR Global Plants web (Ithaka, 2020) or from images obtained by personal communication with herbarium curators at LE and M.

Type material linked to each name was carefully analyzed to confirm if it agreed with the protologue. Furthermore, the handwriting on the labels was studied in order to ascertain if it belonged to the author of the species name. Concerning Friedrich Sellow and his collections, the Field Museum of Natural History (F) online database was checked since it has a vast collection of negatives of types once housed at B that were destroyed in the fire of 1943.

To proceed with the typifications, the rules of the ICN (Turland et al., 2018) and suggestions proposed by McNeill (2014) were followed. When selecting a lectotype from among syntypes (Art. 9.6 of the ICN), the specimen that showed the best quality of preservation of the important diagnostic features of the taxon was selected.

Results

Lectotypes are selected herein for 18 names, a second-step lectotypification is provided for *Lippia aristata* Schauer, and a neotype is selected for *L. corymbosa* Cham. Erroneous application of the term "holotype" is corrected to lectotype for *L. pumila* Cham. and *L. turnerifolia* Cham. Furthermore, supporting information related to the holotype of *L. gardneriana* Schauer is provided. Typifications are organized by accepted species names, for which we also provide full accounts of homotypic and heterotypic synonyms and discussion of the typification.

Lippia acutidens Mart. & Schauer, Prodr. [A. P. de Candolle] 11: 590 (1847). Type: Brazil,

Minas Gerais, "Habitat in campis ad Praed. Jä, in confin. Prov. Goyas. Provinciae M. Ger.", s.d., *C. F. P. von Martius* "(Mart. obs. 1734)" (holotype: M [bc] M0111625!).

Lippia reticulata Hayek, Repert. Spec. Nov. Regni Veg. 2: 87 (1906). Type: Brazil, Piauí, 1840, *G. Gardner 2940* (lectotype, here designated: W [bc] W0021577!; isolectotypes: P [bc] P00713726!, P [bc] P00713727!, SI [bc] SI003579!).

Discussion.—Hayek (1906) described *Lippia reticulata* based on two syntypes collected by G. Gardner with the same collection number (no. 2940), one from Piauí and the other from Pernambuco, Brazil, and kept at W. Four duplicates of the gathering from Piauí were located at P, SI and W, whereas one specimen linked to the collection from Pernambuco was found at W. All duplicates are in agreement with the diagnosis cited in the protologue: dentate leaves with prominent, reticulate veins on the abaxial surface, and flowers surpassing the length of the elliptical floral bracts. Salimena and Múlgura (2015: 192) lectotypified this name on a specimen currently housed at P. In this case, however, the sequence of choice provided for in Art. 9.12 of the ICN was not respected. Salimena and Múlgura (2015) selected an isosyntype from P when, in fact, they should have chosen one from among the syntypes at W. In this context, from among the material available for typification purposes, the Gardner syntype from Piauí is preferred over the Pernambuco material since it shows the best quality of preservation of the diagnostic features of the taxon. Thus, a sheet from among those held at W is selected as lectotype of the name. This selection maintains the current application of the name for a species endemic to Brazil (Moldenke 1965g; Ulloa et al., 2017; Salimena & Cardoso, 2020).

Additional specimen examined. BRAZIL. Pernambuco: Sine loco, *G. Gardner 2940* (W1889-0290221!).

Lippia aristata Schauer, Prodr. [A. P. de Candolle] 11: 581 (1847). Type: Brazil, Goiás, 1841, *G. Gardner 3403* (first-step lectotype, designated by Silva [2001: 1117]: K; **second-step lectotype, here designated:** K [bc] K000470915!; isolectotypes: BM [bc] BM000525904 image!, BR [bc] BR0000009816992!, K [bc] K000470914!).

Discussion.—Schauer (1847) described *Lippia aristata* based on two syntypes collected by J. B. E. Pohl (*s.n.*) and G. Gardner (no. 3403) in Brazil, stating that the material used to describe the species was studied at W and the Martius herbarium (“v. s. in h. caes. vindob. et Mart.”). Three specimens linked to the syntype collected by Pohl are kept at BR and W, whereas four duplicates of Gardner 3403 are housed at BM, BR and K. Silva (2001) cited a Gardner duplicate housed at K as the lectotype, although two sheets are actually lodged there. According to the Art. 9.17 (Turland et al., 2018) the choice of Silva (2001) is here interpreted as a first-step lectotypification. The material lodged at K is in agreement with the locality and the diagnosis cited in the protologue: distinctly 4-angled and strigillose stems, leaves lanceolate-ovate and flowers arranged in cylindrical or globose inflorescences. These specimens preserve the current application of the name for a species native to Argentina, Bolivia, Brazil and Paraguay (Rotman et al., 1999; Ulloa et al., 2017; Salimena & Cardoso, 2020). From among the material available for typification purposes, the sheet showing the best quality of preservation of the important diagnostic features mentioned above is selected as a second-step lectotype of the name.

Lippia asperrima Cham., *Linnaea* 7: 215 (1832).

Type: Brazil, sine loco, s.d., *F. Sellow* 3743 (lectotype, here designated: HAL [bc] HAL0098269!).

Discussion.—Chamisso (1832) described *Lippia asperrima* based on a F. Sellow collection made in Brazil with no further reference. According to Moldenke (1965b: 89) and Múlgura de Romero (2000: 248), the type was housed in B and is now destroyed. Unfortunately, there is no specimen recorded among the Field Museum’s type photographs. Múlgura de Romero (2000) indicated a specimen held at K as the isotype specifying “(holo-, B destruido; iso-, K aquí designado, SI fotografía)” without designating a lectotype. The duplicate at K is in agreement with the locality and the diagnosis cited in the protologue: stems 4-angled and viscid-hirtellous, leaves subsessile, oblong-lanceolate, coarsely serrate along the margins, and flowers arranged on globose inflorescences with short peduncles and involucrate floral bracts. The specimen concerned was distributed to K from B,

and even though it has a Berlin label it does not have an original label attributable to Chamisso. Thus, it is not certain that the author studied this specimen. Two additional sheets in agreement with the protologue were also found at HAL and P. The material at HAL bears a label annotated, in Chamisso’s hand, as “*Lippia asperrima*”. The sheet at P consists of a specimen from B that lacks an original label. The sheet at HAL is designated as lectotype, besides being well-preserved and displaying the important diagnostic features of the taxon, it ensures the application of the name to a species widely distributed in the Southern Cone of South America, i.e., Argentina, Bolivia, Brazil, Paraguay and Uruguay (Múlgura de Romero, 2000; Ulloa et al., 2017). Since the lectotype lacks a collection number, we cannot be completely sure whether the specimens at K and P are actual duplicates.

Additional specimens examined. BRAZIL. Sine loco, s.d., *Sellow s.n.* (K [bc] K000470912!); sine loco, s.d., *Sellow s.n.* (P [bc] P00713661!).

Lippia corymbosa Cham., *Linnaea* 7: 219 (1832).

Type: Brazil, sine loco, s.d., *F. Sellow* 1442 c499 (neotype, here designated: K [bc] K000470895!).

Discussion.—Chamisso (1832) described *Lippia corymbosa* based on a F. Sellow collection from Brazil with no further reference. Moldenke (1965c: 140) discussed this name and its original material, explicitly citing that the type had been kept at B and is now destroyed. No specimen linked to the name was recorded among the Field Museum’s type photographs. Three sheets in agreement with the diagnosis and the locality cited by Chamisso (1832), were located at K and P. These specimens match the protologue, they are densely leafy plants, hirsute throughout, with mostly ternate leaves, subpetiolate, ovate, revolute and crenate along the margins, and flowers arranged in ovoid, subpedunculate heads. In spite of this, the material lacks original labels by Chamisso and it is impossible to ascertain whether the author studied the specimens. Since all potential sources of original material have been checked, but nothing has been found, a neotype is designated (Art. 9.8 of the ICN, Turland et al., 2018). The selection of the Sellow sheet at K preserves the current application of the name for a species

endemic to Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020). Regarding the remaining specimen at K and the material from B at P, in the absence of collection numbers it is impossible to ascertain whether these specimens are duplicates of the neotype.

Additional specimens examined. BRAZIL. *Sine loco*, s.d., *Sellow s.n.* (K [bc] K000887913!); “S. de Moeva”, s.d., *Sellow s.n.* (P [bc] P00713670!).

Lippia elliptica Schauer, Prodr. [A. P. de Candolle] 11: 593 (1847). Type: Brazil, prov. Rio-Grande, “Inter Allegres & Trindade”, s.d., *J. B. E. Pohl 160* (**lectotype, here designated:** W [bc] W0005288!; isolectotypes: K [bc] K000470870!, K [bc] K000470871!, W [bc] W0005289!, W [bc] W0005290!).

Discussion.—Schauer (1847) described *Lippia elliptica* based on a J. B. E. Pohl collection from Brazil that he had studied at W (“v. s. in h. caes. vindob”). In the general collection at W there are three duplicates displaying the morphological features described in the protologue: stems glandular-hirtellous, leaves opposite or ternate, elliptic, sessile, obtuse and mucronate at the apex, crenate-serrate along the margins except at the base, subattenuate at the base, and flowers arranged in globose heads. Furthermore, all the specimens agree with the locality cited by Schauer (1847). Therefore, the sheet showing the best quality of preservation of the important diagnostic features of the taxon is selected as lectotype. This selection preserves the current application of the name for a species whose native distributional range is Brazil (Ulloa et al., 2017, Salimena & Cardoso, 2020). An additional Pohl sheet distributed to W from B, that was destroyed, was photographed by Macbride as photograph no. 17502. Moldenke (1965c: 153) referred to the sheet at B as the type of the name, likely unaware that the material studied by Schauer was explicitly stated to have been deposited at W.

Lippia eupatorium Schauer, Prodr. [A. P. de Candolle] 11: 592 (1847). Type: Brazil, Goiás, 1839, *G. Gardner 3408* (lectotype, designated by Salimena (2002: 122): K [bc] K000470873!; isolectotype: BR [bc] BR0000009817005!).

Lippia dracocephaloides Turcz., Bull. Soc. Imp. Naturalistes Moscou 36: 205 (1863). Type: Brazil, *sine loco*, s.d., *G. Gardner 4334* (**lectotype, here designated:** KW [bc] KW001001623 image!; isolectotypes: E [bc] E00373276 image!, K [bc] K000470875!, K [bc] K000470876!, NY [bc] NY00137753!, P [bc] P00713674!, P [bc] P00713675!, P [bc] P00713676!, SP [bc] SP003284!).

Discussion.—The protologue of *Lippia dracocephaloides* (Turczaninow, 1863) includes a direct reference to a collection made by G. Gardner (no. 4334) in Brazil, but no herbarium indication. According to Stafleu and Cowan (1986), Turczaninow’s herbarium and types are mainly at KW. In the general collection at KW there is one specimen annotated, in Turczaninow’s hand, as “*Lippia dracocephaloides* Turcz” in full agreement with the locality and the diagnosis cited in the protologue: stems sub-tetragonal and hirtous-tomentose, leaves lanceolate, acuminate at the apex, attenuate at the base, serrate along the margins, flower arranged in globose, axillary heads, and floral bracts ovate, briefly acute at the apex. Furthermore, eight duplicates of this gathering were found at E, K, NY, P and SP. Salimena (2002: 122) referred to a sheet lodged at LE as the holotype, whereas a duplicate at G was considered as an isotype. Salimena’s (2002) use of the term “holotype”, however, is an error that cannot be corrected to “lectotype” under Art. 9.10 (Turland et al., 2018) since it was published after 2001. Moreover, we were unable to locate such a specimen at LE (Vladimir Dorofeyev, pers. comm.). The material at KW is selected lectotype since it bears an original label annotated in Turczaninow’s hand.

Lippia florida Cham., Linnaea 7: 221. (1832). Type: Brazil, *sine loco*, s.d., *F. Sellow B1439 c495* (**lectotype, here designated:** K [bc] K000470878!).

Discussion.—In describing *Lippia florida*, Chamisso (1832) cited a collection made by F. Sellow in Brazil with no further reference. According to Moldenke (1965c: 160), the type was at B and it is now destroyed, although there is a photograph from Macbride’s series available at F (neg. F0BN17506). This source of evidence allows us to state that the specimen once housed at B belongs to a Sellow collection numbered

“B1439 c495”. Fortunately, a duplicate of this gathering was located at K. The material matches the protologue in having a plant with obsoletely angular and abundantly nodose stems, leaves opposite or ternate, sessile, subimbricate, obovate-cuneate, and flowers arranged in hemispheric, nutant heads. This specimen is selected as lectotype. Our selection preserves the current application of the name for a species endemic to Minas Gerais, Brazil (Moldenke, 1965c; Ulloa et al., 2017; Salimena & Cardoso, 2020). An additional Sellow collection from Brazil at K matches the protologue as referred to by Chamisso (1832). However, it is impossible to ascertain whether this specimen is a duplicate of the lectotype since no collection number is found on the sheet.

Additional specimen examined. BRAZIL. *Sine loco*, s.d., *Sellow s.n.* (K [bc] K000887970!).

Lippia gardneriana Schauer, Prodr. [A. P. de Candolle] 11: 592 (1847). Type: Brazil, “Piauhy et Goyaz” [Piauí to Goiás], 1834, *G. Gardner 3407* (holotype: BR [bc] BR0000009816985; isotypes: BM [bc] BM000992677 image!, BR [bc] BR0000009816985!, FI [bc] FI011025 image!, G [bc] G00366430!, K [bc] K000470880!, P [bc] P00713677!, W [bc] W0005292!).

Discussion.—In the protologue of *Lippia gardneriana*, Schauer (1847) cited a G. Gardner collection (no. 3407) from Brazil and clearly indicated that the material he used to describe the species was housed in the Martius herbarium (“v. s. in h. cl. de Mart.”), currently held at BR (Stafleu & Cowan, 1981). Seven duplicates of this collection in agreement with the protologue were found at BM, BR, FI, K, P, and W. All the sheets bear pilose-hirsute plants with branchlets obsoletely tetragonal, leaves opposite, sessile, ovate, acute at the apex, cordate and subaplexicaul at the base, coarsely dentate-serrate along the margins, venose-rugose, floral bracts thin-membranous, oblong, subacute at the apex, many-veined and eventually exceeding the flowers, and very hirsute calyces. From among the material found, however, there exists only one specimen from the Martius herbarium at BR that bears a label annotated, in Schauer’s hand, as “*Lippia gardneriana* Schauer”. Following McNeill (2014) we treat it as the holotype because Schauer explicitly cited a single gathering in a single herbarium. Moldenke

(1965c) stated that the “type” of *L. gardneriana* was housed at G and referred to the specimen at BR erroneously as an “isotype”.

Lippia hederifolia Mart. & Schauer, Prodr. [A. P. de Candolle] 11: 593 (1847). Type: Brazil, Minas Gerais, 1833, A.-C. Vauthier 196 (**lectotype, here designated**: G [bc] G00366431!; isolectotypes: MPU [bc] MPU012502 image!, P [bc] P00713682!, P [bc] P00713683!, P [bc] P00713684!, W [bc] W0021569!).

Discussion.—In the protologue of *Lippia hederifolia*, Martius and Schauer (1847) cited three gatherings from Minas Gerais, Brazil: C. F. P. von Martius (*s.n.*), J. B. E. Pohl (*s.n.*) and A.-C. Vauthier (no. 196). Additionally, the authors explicitly stated that the material they used to describe the species was studied in the herbaria of Martius (now at BR) and de Candolle (G-DC) (“v. s. h. Mart. et DC.”). One duplicate of the gathering collected by Martius (*s.n.*) is at M. This specimen is annotated, in Martius’ hand, as “*Lippia hederifolia* Mart”, and is in agreement with the locality cited in the protologue. Among the other gatherings, six duplicates of the collection made by Vauthier (no. 196) are housed at G, MPU, P and W. All duplicates are in agreement with the locality cited in the protologue, but the sheet at G is the only one annotated in Martius’ hand. There are duplicates of a gathering made by Pohl (no. 167) in agreement with the protologue at herbarium K. However, these sheets neither bear a label annotated in Schauer’s nor in Martius’ hand; hence, it is not certain that the sheets of *Pohl 167* are original material. An additional unnumbered Pohl collection was found at BR.

Moldenke (1965d: 200) discussed this name and its original material although he did not designate any type. He studied a Macbride negative (no. 17512) of a Pohl collection (no. 167) held at B and now destroyed, and referred to an unnumbered Pohl collection at BR as a “cotype”. In light of the above, the collections made by Martius and Vauthier are most suitable for typification purposes. All the specimens show the morphological features described in the protologue: branchlets tetragonal, angular, scabrous, leaves opposite, subpetiolate, blades ovate or subrotund, acute at the apex, incised-serrate and subrevolute along the margins, flowers arranged in corymbose heads, and floral

bracts ovate, acute at the apex, and ciliate margins. From among the specimens, the Vauthier gathering is preferred over the Martius gathering since duplicates of this collection are widespread in numerous herbaria. The specimen at G is selected as lectotype since it bears an original label annotated in Martius' hand, and shows better preservation of the diagnostic characters of the taxon. Our selection preserves the current application of the name *Lippia hederifolia* for a species endemic to Brazil (Moldenke, 1965d; Ulloa et al., 2017; Salimena & Cardoso, 2020).

Additional specimens examined. BRAZIL. Sine loco, s.d., *Pohl s.n.* (BR [bc] BR0000005623310!); s.d., *Pohl 167* (K [bc] K000470867!, K [bc] K000470868!). Minas Gerais: "Habitat in campis deserti Serro Frio", July 1818, *Martius s.n.* (M [bc] M0110866!).

***Lippia herbacea* Mart. ex Schauer, Prodr. [A. P. de Candolle] 11: 589 (1847).** Type: Brazil, Minas Gerais, s.d., *J. B. E. Pohl s.n.* (**lecto-type, here designated:** W [bc] W0005282!; isolectotypes: SI [bc] SI003536!, W [bc] W0005280!, W [bc] W0005281!).

Discussion.—In describing *Lippia herbacea*, Schauer (1847) cited two syntypes from Brazil. The first collection was made by C. F. P. von Martius (*s.n.*) and the other one by J. B. E. Pohl (*s.n.*). Additionally, Schauer (1847) explicitly stated that the material used to describe the species was studied at W and in the Martius herbarium ("v. s. in h. caes. vindob. et Mart."). Four duplicates from a gathering made by Pohl, in agreement with the protologue, were located at SI and W. From among this material, two specimens held at W bear labels annotated, in Schauer's hand, as "*Lippia herbacea* Mart.". Additionally, four duplicates of a Martius collection linked to the protologue were found at M and SI. In particular, the material at M was annotated by Martius as "*Lippia herbacea* Mart.", while the specimen at SI consists of fragments removed from one of the sheets at M.

All the specimens found are in agreement with the diagnosis in the protologue: stems herbaceous, erect, tetragonous, hirtellous, leaves opposite, sessile, ovate-lanceolate, acute at the apex, crenate-serrate along the margins, flowers arranged in wide panicles with opposite peduncles, hirtellous, and floral bracts herbaceous, ovate,

strigose-hirtellous, imbricate, and equaling the corolla tube length. The Pohl material is preferred over the other syntypes since it was certainly studied by Schauer when compiling his species account. Thus, the duplicate showing the best quality of preservation of the important diagnostic features of the taxon is selected as lectotype of the name. This designation preserves the current application of the name for a species endemic to Brazil (Moldenke, 1965d; Ulloa et al., 2017; Salimena & Cardoso, 2020).

Additional specimens examined. BRAZIL. Minas Gerais: "Habitat in humidis ad Mauritias viniferas in campis, ripae occid. fl. S. Franc. prope Salgado", s.d., *Martius 1705* (M [bc] M0110867!, M [bc] M0110868!, M [bc] M0110869!, SI [bc] SI003537!).

***Lippia hermannioides* Cham., Linnaea 7: 219 (1832).** Type: Brazil, sine loco, s.d., *F. Sellow 1443* (**lectotype, here designated:** B [bc] B 100279590 image!).

Lippia microcephala Cham., Linnaea 7: 220 (1832). Type: Brazil, sine loco, s.d., *F. Sellow s.n.* (**lectotype, here designated:** VT [bc] UVMVT026128 image!).

Discussion.—In the protologue of *Lippia hermannioides* Chamisso (1832) indicated that his diagnosis was based on material collected by F. Sellow in Brazil. According to Moldenke (1965e: 280), the type at B is no longer extant, but a photograph from Macbride's Berlin negatives (neg. 17513) is available at F with copies at NY and W. The photographs show that the specimen at B belonged to a Sellow collection numbered "1443". Fortunately, a duplicate of this collection was located at B. The specimen found matches the diagnosis in the protologue: it is a glandulous-subhirsute plant, profusely branched, branches tetragonal, leaves short-petiolate, cuneate-ovate or subrotund, dentate and revolute along the margins, flowers arranged in paucifloral heads with a brief peduncle equaling the leaf length, and floral bracts elliptical, subequaling the corolla tube length. Given that the photographed specimen at B no longer exists, the duplicate material at B, which is in agreement with the diagnosis, is selected as lectotype. This selection preserves the current application of the name for a species endemic to Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020).

Chamisso (1832) described *Lippia microcephala* based on a F. Sellow collection made in Brazil with no further reference. According to Moldenke (1965e: 280), the type of this species was at B and is now destroyed; only a photograph from Macbride's series is available (neg. F0BN017525). This photograph reveals that the sheet once held at B was annotated, in Chamisso's hand, as "*Lippia microcephala*". Therefore, it was certainly original material for the name. Two Sellow specimens in agreement with the protologue were found at VT. These come from B and were annotated by Chamisso as "*Lippia microcephala*". Both of them match the diagnosis: they are erect profusely branched plants, with scabrous-hirtellous pubescence, the leaves subpetiolate, elliptic to rather obovate, cuneate-acute at the base, with antrose dentate and revolute margins, the flowers arranged in paucifloral heads with a brief peduncle equaling the leaf length, and the floral bracts oblong with the apex obtuse, substrigose-hirtellous pubescence, and ciliate margins. UVMVT026127 is unnumbered, whereas UVMVT026128 bears a label that gives the collection number "889". UVMVT026128 is selected as lectotype since it shows the best quality of preservation of the important diagnostic features of the taxon. This choice allows us to undoubtedly identify the plant described by Chamisso in its current usage (i.e., a heterotypic synonym of *L. hermannioides*) as adopted by recent published taxonomic treatments (Bromley, 1984; Salimena & Cardoso, 2020). It is worth noting that in the absence of a collection number it is impossible to ascertain whether the specimen UVMVT026127 is a duplicate of the lectotype.

Additional specimen examined. BRAZIL. *Sine loco*: s.d., *Sellow s.n.* (UVMVT [bc] UVMVT026127 image!).

Lippia hirta (Cham.) Meisn. ex D. Dietr., Synop. Pl. 3: 599 (1843). *Dipterocalyx hirtus* Cham., Linnaea 7: 241 (1832) Type: Brazil, *sine loco*, s.d., *F. Sellow s.n.* (**lectotype, here designated**: K [bc] K000887764!).

Dipterocalyx glabrescens Cham., Linnaea 7: 241 (1832). *Lippia glabrescens* (Cham.) Meisn. ex D. Dietr., Synop. Pl. 3: 599 (1843). Type: Brazil, *sine loco*, s.d., *F. Sellow s.n.* (**lectotype, here designated**: K [bc] K000470918!).

Discussion. Chamisso (1832) described *Dipterocalyx hirtus* based on a F. Sellow collection from Brazil with no further reference. Moldenke (1965d: 210) discussed this name and its original material, explicitly stating that the type was kept at B and is now destroyed, but a photograph from Macbride's Berlin negatives (neg. 17515) is available at F with copies at NY and W. This negative shows a specimen in agreement with the protologue that was annotated by Chamisso as "*Dipretocalyx hirtus*". The plant mounted on the sheet bears a label that gives the collection number 4531. This allowed us to find a specimen filed as *Lippia hirta* at K with the number 4531. The plant mounted on the sheet preserves the important diagnostic features of the taxon as referred to by Chamisso (1832) in the protologue: leaves with thick blades, hirtellous on the venation beneath, flowers arranged in cylindrical heads and floral bracts obtuse at the apex. Thus, the specimen at K is chosen as the lectotype. This choice maintains the current application of the name for a species of *Lippia* endemic to Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020). Concerning three Sellow collections found at G, K and P, it is worth noting that even though this material matches the protologue, it is impossible to ascertain whether these specimens are duplicates of the lectotype given that they lack collection numbers.

In describing *Dipterocalyx glabrescens*, Chamisso (1832) cited a collection by F. Sellow in Brazil, but he did not include a reference to the provenance. Moldenke (1965d: 210) briefly mentioned this name with no reference to its original material. Unfortunately, there is no specimen recorded among the Field Museum's type photographs. A specimen in agreement with the protologue was located at K. This specimen lacks an original label but matches the protologue, it is a plant with flat leaves, glabrous on the abaxial surface, subglobose heads, and floral bracts acuminate at the apex. In spite of the lack of an original label, further reading of the protologue reveals that the material used by Chamisso to describe the species lacked flowers ("*specimina nostra jam deflorasta*"), which agrees with the specimen distributed to K from B. Since the material at K was studied by Chamisso when compiling the account of *D. glabrescens* and since it displays the morphological features described in the protologue, K000470918 is selected as lectotype. This selection allows us to undoubtedly

identify the plant described by Chamisso in its current usage (i.e., a heterotypic synonym of *L. hirta*) as adopted by recent published taxonomic treatments (Moldenke, 1965d; Salimena & Cardoso, 2020).

Additional specimens examined. BRAZIL. Sine loco: s.d., *Sellow s.n.* (P [bc] P00166267!); s.d., *Sellow s.n.* (G [bc] G00366425!); s.d., *Sellow s.n.* (K [bc] K000470919!).

Lippia lacunosa Mart. & Schauer, Prodr. [A. P. de Candolle] 11: 590 (1847). Type: Brazil, Minas Gerais, s.d., *J. B. E. Pohl 131* (lectotype, designated by Salimena [2015: 195]: K [bc] K000470891!; isolectotypes: SI [bc] SI003526!, W [bc] W0005299!, W [bc] W0073751!, W [bc] W0073752!).

Lippia cordata Turcz., Bull. Soc. Imp. Naturalistes Moscou 36: 205 (1863). Type: Brazil, "In prov. Goyaz [Goiás]", *G. Gardner 4330* (lectotype, here designated: KW [bc] KW001001626 image!; isolectotypes: KW [bc] KW001001625 image!, NY [bc] NY00137749!, NY [bc] NY00137750!, P [bc] P00713696!, P [bc] P00713697!, P [bc] P00713698!, P [bc] P00713699!).

Discussion.—In the protologue of *Lippia cordata*, Turczaninow (1863) cited a gathering made by G. Gardner (no. 4330) in Brazil, but did not indicate the herbarium where it was housed. According to Stafleu and Cowan (1986), Turczaninow's herbarium and types are mainly deposited at KW, and the material he used to describe the species should be located there. In the general collection at KW there is one specimen annotated, in Turczaninow's hand, as "*Lippia cordata* Turcz". Additionally, seven duplicates of this gathering were found at KW, NY and P. All the specimens show an adequate quality of preservation of the important diagnostic features of the taxon: stems tetragonus, leaves opposite, very subpetiolate, cordate-oblong, rugose beneath, and flowers arranged in axillary heads with peduncles shorter than the leaves. The material at KW that bears an original label annotated in Turczaninow's hand is preferred for typification purposes since it was definitely studied by the author. Therefore, it is selected as the lectotype. This selection preserves the current application of the name for a species found in Bolivia and Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020).

Lippia maximiliani (Schauer) T.R.S.Silva, Darwiniana 40: 58 (2002). *Lantana maximiliani* Schauer, Prodr. [A. P. de Candolle] 11: 595 (1847). *Camara maximiliani* (Schauer) Kuntze, Revis. Gen. Pl. 2: 504 (1891). Type: Brazil, Bahia, "In silvis caeduis prov. Bahiensis", s.d., *M. A. P. Neuwied s.n.* (lectotype, here designated: BR [bc] BR0000006587710!; isolectotypes: BR [bc] BR0000006588045!, NY [bc] NY00137661!).

Discussion.—In the protologue of *Lantana maximiliani*, Schauer (1847) cited a M. A. P. Neuwied collection from Bahia, Brazil, clearly indicating that the material he used to describe the species was studied in the Martius herbarium ("v. s. in h. cl. de Martius"). Two duplicates of a Neuwied collection in agreement with the protologue were found at BR, where a large number of Martius' specimens are currently housed (Stafleu & Cowan, 1981). Another specimen linked to the name is housed at NY, which consists of fragments removed from one of the syntypes at BR. Both sheets held at BR match the diagnosis, they are plants with tetragonus, villous branches, leaves membranaceous, opposite, oblong-lanceolate, acute at the apex, cuneate-attenuate at the base, crenate-serrate along the margins, flowers arranged in subglobose heads with brief peduncles, and floral bracts acuminate at the apex, strigose, and shorter than the corolla tubes. Furthermore, the material found bears labels annotated, in Schauer's hand, as "*Lantana Maximiliani*". Thus, they were certainly studied by the author of the species and constitute original material.

It is worth noting that Silva and Salimena (2002) mistakenly assumed that the "holotype" is an unnumbered specimen collected by Neuwied and currently held at BR. Silva and Salimena's (2002) use of the term "holotype" is an error that cannot be corrected to "lectotype" under Art. 9.10 (Turland et al., 2018) since their work was published after 2001; therefore, the requirements of Art. 7.11 are not met (Turland et al., 2018; McNeill, 2014). As such, the specimen at BR that shows the best quality of preservation of the important diagnostic features of the taxon is selected as lectotype. This selection is consistent with the usage of the name for a species endemic to Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020).

Lippia oxycnemis Schauer, Prodr. [A. P. de Candolle] 11: 589 (1847). Type: Brazil, “In campis editis prov. Minarum et Bahiensis” [Minas Gerais and Bahia], s.d., C. F. P. von Martius s.n. (**lectotype, here designated:** M [bc] M0110873!; isolectotypes: M [bc] M0110874!, SI [bc] SI003565!).

Discussion.—In describing *Lippia oxycnemis*, Schauer (1847) cited two syntypes from Brazil, but did not indicate the herbarium where the material was housed. The first collection was made by C. F. P. von Martius (s.n.) and the second by J. B. E. Pohl (s.n.). Moldenke (1965f: 334) discussed this name and its original material and mentioned that the syntype collected by Pohl had been deposited at B, but was subsequently destroyed. There is a photograph from Macbride’s series available at F (neg. F0BN017530). This photograph shows that the specimen once housed at B belonged to a Pohl collection numbered “137” and that it lacked an original label annotated by Schauer.

Three duplicates of a syntype collected by Martius (s.n.) are kept at M and SI. The specimens at M are annotated, in Schauer’s hand, as “*Lippia oxycnemis* Schauer”, and are in agreement with the locality cited in the protologue. The material at SI consists of fragments removed from one of the sheets at M. Concerning the other syntype, two duplicates of a collection made by Pohl (no. 137) are housed at BR and K. Both specimens are in agreement with the protologue, although they lack original labels in Schauer’s hand; hence, it is not certain that the gathering is original material. An additional unnumbered Pohl collection was found at M.

In light of the above, the collection made by Martius is the best element for typification purposes. All duplicates are in agreement with the diagnosis cited in the protologue: stems erect, tetragonal, hirsute, leaves opposite or ternate, petioles short, hirsute, leaves elliptic or oblong, acute at the apex, attenuate into the petiole, crenate-serrate along the margins except the base, penninerved, rugose, flowers arranged in terminal panicles, cymose, and floral bracts scale-like, ovate at the base, closely imbricate, equaling the corolla tube. Thus, the duplicate that shows the best quality of preservation of these diagnostic features is selected as lectotype. Our choice preserves the current application of the name *Lippia oxycnemis* for a species endemic to Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020).

Additional specimens examined. BRAZIL. *Sine loco:* s.d., Pohl 137 (BR [bc] BR0000013223069!, K [bc] K000470896!); s.d., Pohl s.n. (M [bc] M0110875!).

Lippia primulina S.Moore., Trans. Linn. Soc. London, Bot. ser. 2, 4: 436 (1895). Type: Brazil, Serra da Chapada, 1891–1892, S. Moore 189 (holotype: BM [bc] BM000582991!).

Lippia primulina var. *goyazensis* S.Moore, Trans. Linn. Soc. London, Bot. ser. 2, 4: 437 (1895). Type: Brazil, Goiás, 1839, G. Gardner 3406 (**lectotype, here designated:** K [bc] K000470847!; isolectotypes: BM [bc] BM000992684 image!, BR [bc] BR0000005505067!, G [bc] G00366531!, K [bc] K000470843!).

Discussion.—In describing *Lippia primulina* var. *goyazensis*, Moore (1895) cited a G. Gardner collection (no. 3406) housed at BM and K. Moldenke (1965f: 360) discussed this name and its original material, stating that an additional duplicate was deposited at G. In addition to these specimens, a duplicate was located at BR. All specimens are in agreement with the diagnosis cited in the protologue: floral bracts smaller than 6.5 mm long and 6.5 mm wide. Thus, the specimen which shows the best quality of preservation of this important diagnostic feature is selected as lectotype. This selection allows us to undoubtedly identify the plant described by Moore in its current usage (i.e., a heterotypic synonym of *L. primulina*) as adopted by recent published taxonomic treatments (Salimena & Cardoso, 2020).

Lippia pseudothea (A.St.-Hil.) Schauer, Prodr. [A. P. de Candolle] 11: 582 (1847). *Lantana pseudothea* A.St.-Hil., Pl. Us. Bras. t. 70. (1828). Type: Brazil, Minas Gerais, “In montosis saxosis prov. Minarum”, 1816–1821, A. Saint-Hilaire s.n. (**lectotype, here designated:** P [bc] P03607486!; isolectotypes: P [bc] P03607485!, P [bc] P03607489!).

Discussion.—In describing *Lantana pseudothea*, Saint-Hilaire (1824) cited a collection he made in Minas Gerais, Brazil. The protologue also includes an illustration that forms part of the original material. Three specimens in agreement with the protologue were located at P, where Saint-Hilaire worked (Stafleu & Cowan,

1983). This material matches the diagnosis; they are hirsute plants, with the leaves sessile with obovate-oblong blades, crenate along the margins, reticulate, and the flowers arranged in heads, with each flower in the axil of a sessile, cordiform floral bract. Concerning the illustration included in the protologue, it also matches the diagnosis in the protologue. Given that a specimen has precedence over an illustration in lectotype designation (Art. 9.12 of the ICN, Turland et al., 2018), the specimen duplicate that shows the best quality of preservation of the important diagnostic features of the taxon is selected as lectotype. Our selection preserves the current application of the name for a species endemic to Brazil (Ulloa et al., 2017; Salimena & Cardoso, 2020).

Lippia pumila Cham., *Linnaea* 7: 218 (1832).

Type: Brazil, sine loco, s.d., *F. Sellow s.n.* (lectotype, designated by Moldenke [1965g: 429]: W [bc] W1889–0290200 image!; isolectotypes: G [bc] G00366532!, HAL [bc] HAL0098264!).

Discussion.—Chamisso's (1832) description of *Lippia pumila* was based on material collected by F. Sellow in Brazil. Five sheets linked to the protologue were found at G, HAL, K, P and W. In particular, it is worth noting that the specimens kept at G, HAL and W have labels annotated, in Chamisso's hand, as "*Lippia pumila*". Thus, they were certainly studied by the author of the name and constitute original material. These specimens agree with the diagnosis coined by Chamisso (1832) since they consist of plants that are viscid-pubescent and softly villosulous-hirtellous throughout, leaves opposite or ternate, sessile, ovate or elliptical, sometimes serrate along the margins, peduncles filiform, erect, flowers arranged in globose heads, and floral bracts lanceolate, equaling the corolla tube. Moldenke (1965g: 429) discussed this name and referred to the sheet held at W as the "type". This was repeated by Múlgura de Romero (2000: 245). According to the current ICN (Art. 9.10, Turland et al., 2018) the citation by Moldenke (1965g) is here interpreted as an effective lectotypification. The material preserves the current application of the name for a plant endemic to Brazil (Salimena & Cardoso, 2020). Concerning the specimens found at K and P, in the absence of original labels annotated by Chamisso, it is impossible to

ascertain definitively whether these specimens are duplicates of the lectotype.

Additional specimens examined. BRAZIL. Sine loco: s.d., *Sellow 4728* (K [bc] K000470910!); s.d., *Sellow s.n.* (P [bc] P03607483!).

Lippia rhodocnemis Mart. & Schauer, *Prodr.* [A. P. de Candolle] 11: 592 (1847). Type: Brazil, Minas Gerais, "In campis editis prov. Minarum", s.d., *C. F. P. von Martius* (Mart. obs. 1471) (**lectotype, here designated:** M [bc] M0110881!; isolectotype: LL [bc] LL00031056 image!).

Discussion.—According to the protologue of *Lippia rhodocnemis*, Martius and Schauer (1847) based the description on two syntypes from Brazil: C. F. P. von Martius (*s.n.*) and J. B. E. Pohl (*s.n.*). The authors clearly indicated that the specimens they used to describe the species were studied at W and the Martius herbarium ("v. s. in h. caes. vindob. et Mart."). Two specimens linked to the Pohl gathering are kept at K and W. Among these, only the sheet at W is annotated, in Martius' hand, as "*Lippia rhodocnemis* Mart.". On the other hand, two duplicates of the collection made by Martius are housed at M and LL. The specimen held at M bears a label annotated by Martius as "*Lippia rhodocnemis* Mart.", whereas the sheet at LL consists of fragments removed from the syntype currently at M.

The material annotated by Martius is in agreement with the locality and the diagnosis in the protologue since it bears plants tomentose throughout with the leaves opposite, subpetiolate, ovate-elliptic or lanceolate, crenate along the margins, rugose-venose above, flowers arranged in axillary heads, and floral bracts ovate, subequaling the corollas, subacuminate at the apex, hirsute, and with reticulate venation. The specimens concerned preserve the current application of the name for a species endemic to Brazil (Salimena & Cardoso, 2020). From among the material available for typification purposes, the specimen collected by Martius found at M is preferred over the other syntype since it shows the best quality of preservation of the important diagnostic features mentioned above and, besides, it is well known that Martius's own collections from Brazil, including the types of most of his Brazilian species, are at M (Stafleu & Cowan,

1981). Thus, the specimen is selected as lectotype of the name.

Lippia triplinervis Gardner, London J. Bot. 4: 133 (1845). Type: Brazil, summit of Organ Mountains, March 1841, *G. Gardner 5829* (holotype: K [bc] K000470903!).

Lippia iodophylla Schauer, Prodr. [A. P. de Candolle] 11: 588 (1847). Type: Brazil, prov. Minas Gerais, s.d., *F. Sellow s.n.* (lectotype, here designated: P [bc] P00713694!).

Discussion.—Schauer (1847) described *Lippia iodophylla* based on a F. Sellow collection made in Brazil, explicitly indicating that the material he used was studied at B (“v. s. in h. r. berol.”). The specimen concerned, however, was destroyed in 1943. Only a photograph from Macbride’s series is available (neg. F0BN017519). Fortunately, a duplicate, annotated in Schauer’s hand, as “*Lippia iodophylla* Schauer”, was located at P. This specimen matches the protologue, has fastigiate-branched stems, strigose-hirtellous branchlets, leaves opposite, subsessile, cuneate-oblong, subacute at the apex, crenate-serrate toward the apex, entire at the base and attenuate into the petiole, flowers arranged in axillary, solitary heads with peduncle equaling the subtending leaves, and floral bracts strigose, submembranaceous, ovate to obovate-oblong, half as long as the corolla tube. Since the presumable holotype at B no longer exists, the material at P, which is in agreement with the in the protologue and annotated by Schauer, is selected as lectotype. This selection preserves the current application of the name and allows us to undoubtedly identify the plant described by Schauer in its current usage (i.e., a heterotypic synonym of *L. triplinervis*) as adopted by recent published taxonomic treatments (Bromley, 1984; Salimena & Cardoso, 2020).

Lippia turnerifolia Cham., Linnaea 7: 217 (1832). Type: Brazil, Rio Grande do Sul, September 1838, *F. Sellow s.n.* (lectotype, designated by Moldenke [1966b: 26]: W [bc] W0074832!).

Discussion.—Chamisso (1832) described *Lippia turnerifolia* based on a F. Sellow collection made in Brazil. Two sheets in agreement with the protologue as referred to by Chamisso (1832)

and annotated by him as “*Lippia turnerifolia*” were found at HAL and W. These specimens match the protologue, they are plants with hirsute, terete stems, leaves opposite, subpetiolate, blades lanceolate or oblong to obovate, acute at the apex, serrate along the margins, entire and cuneate at the base, narrowed into the petiole, strigose on the adaxial surface, hirsute on the venation on the abaxial surface, flowers arranged in round heads, and floral bracts ovate, imbricate, acuminate at the apex, and equaling the corolla tube.

In the words of Moldenke (1966b: 28), “the type of this rather puzzling species was collected by Friedrich Sellow in dry grassy places on dry hill-sides near the town of Sao Lucia, Rio Grande do Sul, Brazil, on September 17, 1828, and is deposited in the herbarium of the Naturhistorisches Museum at Vienna, where it was photographed by Macbride as his type photograph number 34333”. Following this, Múlgura de Romero (2000) stated that the holotype was housed at W. In the protologue of the species, however, there is no indication of a specific specimen. It is well documented that it is not possible to assert where Chamisso’s herbarium is preserved (Stafleu & Cowan, 1976). Thus, Moldenke’s (1966b) statement is here interpreted as an effective lectotype designation. The specimen preserves the current application of *L. turnerifolia* for a species found in Argentina, Bolivia, Brazil and Paraguay (Múlgura de Romero, 2000; Ulloa et al., 2017). Concerning the Sellow specimen at HAL and five additional sheets from B at E, K, P, and VT, even though this material matches the protologue, it is impossible to ascertain whether the specimens are duplicates of the lectotype, which lacks a collection number.

Additional specimens examined. BRAZIL. *Sine loco*: 17 Sep 1828, *Sellow s.n.* (UVMVT026137); s.d., *Sellow s.n.* (HAL0098266!); s.d., *Sellow s.n.* (E00373273 image!); s.d., *Sellow 3481* (K000470911!); s.d., *Sellow s.n.* (K000470930!). Paraná: S. Ignacio, s.d., *Sellow s.n.* (P00166266!).

Acknowledgments

The authors highly appreciate the assistance of Vladimir Dorofeyev (LE), Andreas Fleischmann (M) and Christian Bräuchler (W), who provided information about numerous type specimens. Special thanks to María E. Múlgura de Romero for her important contribution on an early version

of the manuscript. Jefferson Prado is also thanked for help and advice on nomenclatural issues. We are grateful to James Lendemer for significant editorial work and the anonymous reviewers for their constructive comments, which helped us to improve the manuscript. PHC thanks the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq, Brazil) for a doctoral scholarship (141837/2020-9). FRGS thanks CNPq (REFLORA/563560/2010-0) for financial support to review the Verbenaceae types in Europe. Support for this work to PM and NO by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET PIP 00537/13) is gratefully acknowledged. Finally, we thank the editors of the online databases that we use daily and often forget to mention: IPNI (International Plant Names Index), Tropicos, and the Biodiversity Heritage Library.

Literature cited

- Atkins, S. 2004. Verbenaceae. Pp. 449–468. In: K. Kubtzki (ed.) & J. W. Kadereit (vol. ed.), *The Families and Genera of Vascular Plants*, vol. 7. Springer-Verlag, Berlin and Heidelberg.
- Bromley, G. R. 1984. Notes on two Brazilian species of *Lippia* (Verbenaceae). *Kew Bulletin* 39: 805–806.
- Cardoso, P. H. & F. R. G. Salimena 2019. Notas taxonômicas em Verbenaceae da Flora do Brasil. *Hoechna* 46: 1–6.
- Cardoso, P. H., L. Meni Neto, M. Trovó & F. R. G. Salimena 2020a. Novelty on *Lippia* sect. *Goniostachyum* (Verbenaceae): a new variety from the Brazilian Cerrado and additional nomenclatural and taxonomic notes. *Phytotaxa* 447: 283–288.
- Cardoso, P. H., V. I. R. Valério, L. Meni Neto, M. Trovó & F. R. G. Salimena 2020b. Novelty in *Lippia* (Verbenaceae) from Minas Gerais State, Brazil. *Phytotaxa* 455: 47–52.
- Cardoso, P. H., N. O’Leary, R. Olmstead, P. Moroni & V. Thode. 2021. An update of the Verbenaceae genera and species numbers. *Plant Ecology and Evolution* 80–86.
- Chamisso, L. K. A. 1832. De plantis in expeditione rommanzoffiana et in herbariis regniis, Verbenaceae. *Linnaea* 7: 213–272.
- Facciola, S. 1990. *Cornucopia – A Source Book of Edible Plants* Kampong Publications, Vista, California.
- Hayek, A. 1906. Verbenaceae novae herbarii Vindobonensis. *Repertorium Specierum Novarum Regni Vegetabilis* 2: 86–88.
- Ithaka. 2020. JSTOR Global Plants. <http://plants.jstor.org/>.
- Marx, H., N. O’Leary, Y. Yuan, P. Lu-Irving, D. Tank, M. E. Múlgura & R. Olmstead. 2010. A molecular phylogeny and classification of Verbenaceae. *American Journal of Botany* 97: 1647–1663.
- McNeill, J. 2014. Holotype specimens and type citations: general issues. *Taxon* 63: 1112–1113.
- Moldenke, H. N. 1965a. Materials towards a monograph of the genus *Lippia* I. *Phytologia* 12: 6–72.
- Moldenke, H. N. 1965b. Materials towards a monograph of the genus *Lippia* II. *Phytologia* 12 (2): 73–120.
- Moldenke, H. N. 1965c. Materials towards a monograph of the genus *Lippia* III. *Phytologia* 12: 130–181.
- Moldenke, H. N. 1965d. Materials towards a monograph of the genus *Lippia* IV. *Phytologia* 12: 187–242.
- Moldenke, H. N. 1965e. Materials towards a monograph of the genus *Lippia* V. *Phytologia* 12: 252–311.
- Moldenke, H. N. 1965f. Materials towards a monograph of the genus *Lippia* VI. *Phytologia* 12: 331–367.
- Moldenke, H. N. 1965g. Materials towards a monograph of the genus *Lippia* VII. *Phytologia* 12: 429–464.
- Moldenke, H. N. 1966a. Materials towards a monograph of the genus *Lippia* VIII. *Phytologia* 12: 480–506.
- Moldenke, H. N. 1966b. Materials towards a monograph of the genus *Lippia* IX. *Phytologia* 13: 1–35.
- Moldenke, H. N. 1966c. Materials towards a monograph of the genus *Lippia* X. *Phytologia* 13: 162–167.
- Moldenke, H. N. 1966d. Materials towards a monograph of the genus *Lippia* XI. *Phytologia* 13: 169–179.
- Moore, S. L. M. 1895. The phanerogamic botany of the Matto Grosso Expedition, 1891–1892. *Transactions of the Linnean Society of London, Botany* 4: 265–516.
- Múlgura de Romero, M. E. 2000. Las especies de *Lippia* L. sect. *Dioicolippia* Tronc. (Verbenaceae). *Candollea* 55: 227–254.
- O’Leary, N., S. S. Denham, F. Salimena & M. E. Múlgura. 2012. Species delimitation in *Lippia* section *Goniostachyum* (Verbenaceae) using the phylogenetic species concept. *Botanical Journal of the Linnean Society* 170: 197–219.
- Rotman, A. D., M. E. Múlgura de Romero & Novara, L. 1999. Verbenaceae. *Aportes Botánicos de Salta-Serie Flora* 5: 1–83.
- Saint-Hilaire, A. F. C. P. de 1824. *Plantes usuelles des brasiiliens*. Grimbart, Paris.
- Salimena, F. R. G. 2002. Novos sinônimos e tipificações em *Lippia* sect. *Rhodolippia* (Verbenaceae). *Darwiniana* 40: 121–125.
- Salimena, F. R. G. & P. H. Cardoso. 2020. *Lippia* in Flora do Brasil 2020 em construção. Jardim Botânico do Rio de Janeiro. Available at: <http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB26153> (Accessed: 15 Jan 2021).
- Salimena, F. R. G. & M. E. Múlgura. 2015. Notas taxonômicas em Verbenaceae do Brasil. *Rodriguésia* 66: 191–197.
- Schauer, J. C. 1847. Verbenaceae. In: A.P. De Candolle (ed.), *Prodromus Systematis Naturalis Regni Vegetabilis* 11: 522–700. Treuttel & Würtz, Paris.
- Silva, T. R. S. 2001. Lectotypifications and neotypification in *Lantana* L. and *Lippia* L. (Verbenaceae). *Taxon* 50: 1115–1118.
- Silva, T. R. S. & F. R. G. Salimena. 2002. Novas combinações e novos sinônimos em *Lippia* e *Lantana* (Verbenaceae). *Darwiniana*, 40: 57–59.
- Staffleu, F. A. & R. S. Cowan. 1976–1988. *Taxonomic Literature, a Selective Guide to Botanical Publications and Collections with Dates, Commentaries and Types*, ed. 2. Bohn, Scheltema & Holkema, Utrecht.

- Thiers, B.** 2021. Index Herbariorum: A global directory of public herbaria and associated staff. The New York Botanical Garden, Bronx, New York. <http://sweetgum.nybg.org/ih>.
- Turczaninow, P. K. N. S.** 1863. Verbenaceae et Myoporaceae nonnullae hucusque indeductae. Bulletin de la Société impériale des naturalistes de Moscou 36: 193–227.
- Turland N. J. J. H. Wiersema, F. R. Barrie, W. Greuter, D.L. Hawksworth, P. S. Herendeen, S. Knapp, W.-H. Kusber, D.-Z. Li, K. Marhold, T. W. May, J. McNeill, A.M. Monro, J. Prado, M. J. Price & G. F. Smith.** 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code). Regnum Vegetabile 159. Koeltz Botanical Books, Glashütten.
- Ulloa C. U, P. Acevedo-Rodríguez, S. G. Beck, M. J. Belgrano, R. Bernal, P. E. Berry, L. Brako, M. Celis, G. Davidse, S. R. Gradstein, O. Hokche, B. León, S. León Yáñez, R. E. Magill, D. A. Neill, M. H. Nee, P. H. Raven, H. Stimmel, M. T. Strong, J. L. Villaseñor Ríos, J. L. Zarucchi, F. O. Zuloaga & P. M. Jørgensen.** 2017. An integrated assessment of vascular plants species of the Americas. Science 358: 1614–1617.