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NOMENCLATURE ARTICLE

Piperaceae Raddianae: A taxonomic and nomenclatural study of Giuseppe Raddi's Brazilian Piperaceae

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Abstract Giuseppe Raddi collected in the state of Rio de Janeiro, Brazil, from November 1817 to June 1818. He published 12 new names in the family Piperaceae in an article that appeared in 1828. Raddi's article has not been cited in specialized literature and these names were never properly studied. In the present study, these names are typified, and their identity is clarified. Five new combinations are here presented, namely *Peperomia callitrichoides*, *P. catesbaeifolia*, *P. cylindrica*, *P. gracillima*, and *P. plantaginifolia*. The new name *Piper raddianum* is published, honoring him and his botanical accomplishments. In addition, the names *Piper scutatatum*, *Piper scolopendrifolium*, *Piper truncatum*, *Piper fluminense*, *Steffensia ampla* (\equiv *Piper amplum*), *Piper variabile*, *Piper catesbaeifolium*, *Piper cylindricum*, *Piper pumilum*, *Peperomia martiana*, and *Piper gracillimum* are here lectotypified.

Keywords Neotropics; *Peperomia*; *Piper*; Rio de Janeiro; South America; typification

■ INTRODUCTION

Giuseppe Raddi was born in Florence, Italy, on 9 July 1770 (Baldini & Pignotti, 2018a). Since his youth he was interested in the study of plants, especially their medicinal virtues as he worked in a pharmacy. His talents were appreciated by Ottaviano Targioni Tozzetti (1755–1826), who became his mentor and sponsor (Pichi Sermolli & Bizzarri, 2005; Baldini & Pignotti, 2018a). Raddi worked for many years at the Museum of Natural History in Florence, and made two important collecting expeditions, one in the surroundings of Rio de Janeiro, Brazil, and the other in Egypt. He died on 6 September 1829 on the island of Rhodes, near Greece, returning from the Egypt expedition.

Raddi: the first Italian naturalist to collect in Brazil. —

Domenico Agostino Vandelli (1735–1816) was the first Italian to study the flora of Brazil, although only from herbarium specimens collected by other botanists. He was based in Portugal, and never set foot in Brazil. After receiving his doctorate in Natural Philosophy and Medicine at the University of Padua (Italy) in 1764, he was appointed lecturer in Chemistry and Natural Sciences at the University of Coimbra, and in 1793 he became the first director of the Botanical Garden at the Palácio da Ajuda, in Lisbon.

Raddi was the first Italian naturalist to collect the flora of Brazil, in 1817–1818. He was followed by Giovanni Casaretto (1810–1879), who collected plant specimens in the states of São Paulo, Santa Catarina, Rio de Janeiro, Bahia, and Pernambuco from May to December 1839 (Delprete, 2016; Baldini & Pignotti, 2018b; Delprete & al., 2019).

Raddi took part in the expedition to Brazil organized by the Habsburg family on the occasion of the wedding of Archduchess Maria Leopoldina Habsburg-Lorraine with Dom Pedro de Bragança, Crown Prince of Brazil and Portugal. At that time, the Grand Duchy of Tuscany was under the rule of the Habsburgs (Parrini, 2008; Baldini & Pignotti, 2018a). Several European naturalists participated in this expedition, including the German botanist Karl Martius (1794–1868), who is well-known for his work on the Brazilian flora. For additional details about this expedition, see the travel diary of Spix & Martius (1976) and Diener & Costa (2018).

Raddi arrived in Rio de Janeiro on 5 November 1817, and remained there for about seven months; he departed on 1 June 1818 and arrived in Genoa, Italy, on 19 August 1818. Although his primary interest was the study of cryptogams and ferns, he also collected and studied numerous families of flowering plants, as well as minerals and animals, in the city of Rio de Janeiro and several nearby localities. These localities

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included Corcovado, Serra da Tijuca, Serra da Estrela, Gávea, Fazenda Mandiocca, and Serra dos Órgãos (Baldini & Pignotti, 2018a). During his stay in Rio de Janeiro he had very little economic support, so he collected on his own. Nevertheless, he was able to gather a considerable number of botanical specimens (Baldini & Pignotti, 2018a).

Raddi's botanical collections. — Raddi's botanical collections from Brazil were distributed to various European herbaria. His personal herbarium represents the main set of his botanical collections, which is kept at PI. Raddi sent specimens to several botanists at various herbaria, and after his death in 1829, Filippo Parlatore (1816–1877) labeled the duplicates present at FI and distributed them to other European herbaria (see Goldenberg & Baldini, 2002; Pichi Sermolli & Bizzarri, 2005). As a result of the complex distribution of Raddi's collections (Savelli, 1918; Goldenberg & Baldini, 2002; Baldini & Guglielmone, 2012; Baldini & Pignotti, 2017, 2018a), incomplete sets are at BM, BOLO, FI, K, and W (Stalfu & Cowan, 1983).

Raddi's specimens have been studied by specialists for the following angiosperm families: Begoniaceae (Irmscher, 1957), Cyperaceae (Longhi Wagner & al., 2010), Lecythidaceae (Prance & Mori, 1979; Delprete & al., 2019), Melastomataceae (Goldenberg & Baldini, 2002), Orchidaceae (Romero González & al., 2008), and Poaceae (Chase, 1923; Baldini & Longhi Wagner, 2006; Longhi Wagner & Baldini, 2007). The cryptogams were studied by Pinheiro da Costa (2009), and the pteridophytes by Pichi Sermolli & Bizzarri (2005). A list of the plant names published by Raddi is available in Baldini & Pignotti (2018b).

Raddi's publications. — Raddi's scientific publications have been poorly known until now, probably due to the obscure venues with limited distribution. It should also be mentioned that Raddi experienced operational difficulties in Florence and had problematic relations with the local academic and museum world, as reported in Parrini (2008) and Baldini & Pignotti (2018a). For example, the Cyperaceae published by Raddi (1823) were not studied until almost 200 years later by Longhi Wagner & al. (2010). For the Cyperaceae, it was possible to trace the distribution of original specimens in Italian and European herbaria.

Raddi published an article on the Piperaceae that he collected in the state of Rio de Janeiro. In this article he described several new species, but also included species previously published by other authors. The article was published in volume 17 of the *Nuovo Giornale de' Letterati*. The portion dedicated to Sciences bears the date July–August 1828, which is here retained as the date of publication as we do not have any additional information to provide a more precise date. At that time, Raddi was about to leave Italy to participate in a multi-disciplinary expedition to Egypt. Parrini (2008: 270–273) reported that he left Pisa for Genoa on 15 July 1828, Genoa for Toulon (France) on 22 July, and the port of Toulon for Egypt on 31 July, arriving on 18 August 1828. About one year later, he was forced to leave Egypt before the planned date of return due to a grave sickness, and while attempting his return to Italy he eventually died on the

island of Rhodes on 6 September 1829. From this information, we can reach three conclusions: (1) he submitted the Piperaceae manuscript before his departure from Italy; (2) he did not have the time to properly distribute his Piperaceae specimens to other herbaria due to his imminent departure; and (3) he did not see his Piperaceae article published. A confirmation of his inability to distribute the Piperaceae to other herbaria is the lack of duplicates in the *Hortus Siccus Exoticus* in BOLO, where his privileged correspondent Antonio Bertoloni (1775–1869) was based (Managlia & Ranalli, 2018).

■ MATERIALS AND METHODS

The Piperaceae names published by Raddi and their corresponding original specimens are here studied for the first time. For this study, we analyzed primarily the specimens in the FI and PI herbaria. To complete our study, we also searched for possible duplicates in B, BM, BOLO, BP, BR, CE, E, FH, FP, G, GZU, H, K, LINN, M, P, SBT, and W. We also studied the digital images of specimens in the CRIA (<https://specieslink.net/>) and ReFlora (<http://reflora.jbrj.gov.br/reflora/PrincipalUC/PrincipalUC.do>) virtual herbaria.

The specimens in FI were re-labeled by Filippo Parlatore, after Raddi's death, with the annotation “In Brasilia legit Cl. Raddi”.

The main objectives of the present paper are to review the existing typifications of the Piperaceae names published by Raddi, provide any necessary corrections, and present formal lectotypifications of the names not yet typified. We also aim to clarify the identity of the names cited by Raddi and published by previous authors. In his publications, Raddi cited only the locality of the gatherings, and did not cite either a collection number or date. Therefore, following Art. 40.3 Note 2 of the *Code* (Turland & al., 2018), Raddi's specimens should be treated as original material from which lectotypes and isolectotypes can be selected. As explained above, Raddi did not distribute his Piperaceae specimens to other herbaria before embarking on his final expedition and he died on his return journey. After exhaustive searches in the herbaria listed above, we are sure that the Piperaceae specimens collected by Raddi are present only in PI (his personal herbarium), and in FI (with Parlatore's annotation). Therefore, in cases where the only known specimen associated with a given name is present in PI, we treat it as the holotype.

Herbarium specimens were studied either by visiting and/or through loans from the herbaria listed above. Specimens were examined using a dissecting microscope. For accurate citation of herbarium specimens, after the herbarium code we cite the barcode number; when no barcode number was available on the specimen, we cite the accession number preceded by “No.” All specimens cited have been examined, unless the herbarium code is followed by “n.v.” (not seen).

High-resolution digital images of Piperaceae original specimens collected by Raddi in Rio de Janeiro are available from the authors (e-mails: georgeazevedo08@gmail.com, piero.delprete@ird.fr, riccardomaria.baldini@unifi.it).

In his descriptions, Raddi provided the measurements of various plant parts in feet, inches, and lines. The metric system was adopted only after the unification of Italy, with the law of 28 July 1861. For conversion of Raddi's units to the metric system we used the following values: 1 foot = 30.48 cm, 1 inch = 2.54 cm, and 1 line = 2.116 mm.

■ NOMENCLATURAL TREATMENT

In his article, Raddi (1828) divided the Piperaceae that he collected in the state of Rio de Janeiro into three groups: A. Fruticosi [Fruticose]; B. Caule carnosio eretto, oppure ascendente [Stem fleshy, erect or ascendent]; C. Caule carnosio repente [Stem fleshy, creeping]. The first group consists of woody plants and corresponds to the genus *Piper* L., while the other two groups are herbaceous plants, with ascending or repent stems, and correspond to the genus *Peperomia* Ruiz & Pav. Here, the names of new species and those of other authors cited by Raddi are sequenced following his publication. A few Piperaceae specimens were found at PI annotated by Raddi, but not cited in his publication; these names are discussed at the end of the present treatment. In the following treatment, accepted names are in bold.

A. Fruticosi [Fruticose]

1. ***Piper obliquum*** Ruiz & Pav., Fl. Peruv. 1: 37–38, t. 63. 1798 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 3. 1828].

Collection locality and habit. – “Ritrovato nei folti Boschi delle Montagne d’Estrella, dove il suo tronco perviene fino all’altezza di quindici a venti piedi [...]” (Found in the dense forests of the Serra da Estrela, where its trunk reaches the height of 15 to 20 feet [4.5–6 m tall]).

Notes. – Specimens of *Piper obliquum* Ruiz & Pav. collected by Raddi are at PI and FI, and were correctly determined by him. The specimen at PI is mounted on two sheets, numbered “1” and “2”. Sheet 1 (Acc. No. 043381) has a long infructescence and Raddi's handwritten label “*Piper obliquum* Ruiz et P.: - Roem: Syst. I. 304”, while sheet 2 (Acc. No. 043380) has a large leaf and no label. The FI specimen is mounted on four sheets, kept together in the same folder, with the single barcode FI055271, affixed on the first sheet. The first sheet has the label “In Brasilia legit Cl. Raddi” handwritten by Parlatore, but does not have Raddi's identification. The other three sheets of this specimen have no labels.

Under *Piper obliquum*, Raddi (1828: 3) cited *P. macrophyllum* Sw. in synonymy, which is a synonym of *P. arboreum* Aubl. var. *arboreum* (Yuncker, 1973).

2. ***Piper scutatium*** Raddi in Nuovo Giorn. Lett., Sci. 17(40): 3. 1828 [non *Piper scutatium* Willd. in Dietrich, Sp. Pl. 1: 143. 1831, nom. illeg.] – Type [protologue]: Brazil: Rio de Janeiro: “Trovasi nelle ombrose Foreste delle Montagne sopra mentovate [sic! menzionate]. Il suo tronco perviene all’altezza di due fino a tre piedi circa [...]” (Found in the

shaded forests of the above-cited mountains [Serra da Estrela]. Its trunk reaches the height of about 2 or 3 feet [60–90 cm]). **Lectotype (designated here):** “*Piper* (scutatium), foliis peltatis ovatis vel ovato-oblongis acutis subcoriaceis, spica terminalis elongata gracilis”, s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI No. 043384; isolectotypes: FI barcodes FI055262, FI055263).

= *Piper scutifolium* Yunck. in Bol. Inst. Bot. (São Paulo) 3: 123–124, fig. 107. 1966, **syn. nov.** – Holotype: Brazil. Rio de Janeiro: Terezopolis, Fazenda da Boa Fé, 11 Sep 1942, *Luiz Emygdio* 80 [*L.E. Mello Filho* 80] (R barcode R 000038599; isotype NY barcode 00251759).

Notes. – Original specimens of *Piper scutatium* Raddi are found in PI (No. 043384) and FI (barcodes FI055262, FI055263). Raddi (1828: 3) described this species as “foliis peltatis, ovatis vel ovato-oblongis acutis subcoriaceis, spadici-bus terminalibus solitariis elongatis gracilis. *Nob.*”, which is similar to the annotation on the label of the PI specimen. The specimens at FI only have the annotation “In Brasilia legit Cl. Raddi” handwritten by Parlatore. Because Raddi's personal herbarium is preserved at PI, the single specimen therein is here designated the lectotype of this name.

The morphological characters described in the protologue and the features of the specimens clearly show that this name is synonymous with *Piper scutifolium* Yunck. In addition, the illegitimate later homonym *Piper scutatium* Willd. was placed in synonymy under *Pothomorphe peltata* (L.) Miq. (now recognized as *Piper peltatum* L.) by Yuncker (1973: 145).

3. ***Piper scolopendrifolium*** Raddi in Nuovo Giorn. Lett., Sci. 17(40): 4. 1828 – Type [protologue]: Brazil. Rio de Janeiro: “Cresce sulle Montagne suddette, ove perviene all’altezza di circa quattro piedi [...]” (It grows in the above-cited mountains [Serra da Estrela], where it reaches the height of about 4 feet [ca. 1.22 m]). **Lectotype (designated here):** s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI Nos. 043386 & 043387 [specimen on 2 sheets]; isolectotype: FI barcode FI055272).

= *Piper truncatum* Vell., Fl. Flumin.: 25. 1829 (“1825”), **syn. nov.** – Type [protologue]: Brazil. [Rio de Janeiro: Rio Pirai]: “*ad ripas fluvii dicti Pirahy ad mediterranea offendi; postea silvis maritimis iterum mihi fuit obvia*”. **Lectotype (designated here):** [illustration] Original parchment plate “*Piper truncatum*” in the Manuscript Section of the Biblioteca Nacional, Rio de Janeiro [cat. no.: mss1095062_061] (later published in *Flora Fluminensis icones*).

Notes. – Because Raddi's personal herbarium is preserved at PI, the only original specimen there, mounted on two sheets with accession numbers 043386 and 043387, is here designated the lectotype of this name. Raddi (1828: 4) described *Piper scolopendrifolium* Raddi as a plant with obliquely cordate-lanceolate, very long, glabrous leaves. The original specimens at FI and PI and Raddi's description correspond to *P. truncatum* Vell. (Vellozo, 1829: 25), which is a common species in the state of Rio de Janeiro. As *P. scolopendrifolium* was published in 1828, it has priority over *P. truncatum*.

Therefore, *P. scolopendrifolium* is the name to be used for this species.

José Mariano da Conceição Vellozo (1742–1811) worked on the flora of the state of Rio de Janeiro and surrounding areas, and commissioned the drawings of the species to be published in his publication. His great work was published posthumously, about two decades after his death. According to Borgmeier (1937) and Carauta (1973), the text of *Flora Fluminensis* was printed in 1825 and distributed in 1829; and the illustrations in *Flora Fluminensis icones* were edited in 1827 and distributed 1831. As plate 57 of Vellozo's (1831) *Icones* was published two years after the publication of *Piper truncatum*, it cannot be treated as original material. An original drawing with the name “*Piper truncatum*” is kept in the Manuscript Section of the National Library in Rio de Janeiro, Catalogue No. mss1095062_061, which is here designated the lectotype of this name.

4. *Piper fluminense* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 4. 1828 [non *Piper fluminense* C.DC. in Candolle, Prodr. 16(1): 308. 1869, nom. illeg.] – Type [protologue]: Brazil. Rio de Janeiro: “Comunissimo nei Contorni di Rio-Janeiro, dove l’altezza ordinaria del suo tronco è di sei a sette piedi circa. [...]” (Very common in the surroundings of Rio de Janeiro, where its trunk is commonly 6 to 7 feet [1.8–2.1 m] tall). **Lectotype (designated here):** s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI Nos. 043382 & 043383 [specimen on 2 sheets]; isoelectotypes: FI barcodes FI055169, FI055270). (Part of lectotype is shown in Fig. 1.) = *Steffensia ampla* Kunth in Linnaea 13: 618. 1840 (“1839”) ≡ *Piper amplum* Kunth in Linnaea 13: 618. 1840 (“1839”), **syn. nov.** ≡ *Artanthe ampla* (Kunth) Miq., Syst. Piperac.: 501. 1844 – **Lectotype (designated here):** Brazil. Rio de Janeiro, s.d., *Sellow s.n.* (K barcode K000324051).

Notes. – At PI is preserved an original specimen of *Piper fluminense* Raddi, mounted on two sheets, with accession numbers 043382 and 043383, numbered “2” and “1”, respectively, in pencil. On sheet number 1 (Fig. 1), with accession number 043383, is affixed a label handwritten by Raddi “*Piper* (fluminense), foliis ovato-oblongis acuminatis utrinque glaberrimis basi subaequalibus, petiolis subpollicaribus canaliculatis basi vaginatibus, spadiciis oppositifoliis erectis foliis dimidio brevioribus. nob.” This is the same description that was published by Raddi. Sheet number 2 (Acc. No. 043382) is without label, and kept together with sheet number 1. This specimen, mounted on two sheets, is here designated the lectotype of *Piper fluminense* Raddi. In FI there are two specimens of *Piper fluminense* Raddi, with barcodes FI055169 and FI055270. On each of them is a branch with a few leaves, and the label handwritten by Parlatore “In Brasilia legit Cl. Raddi.” These specimens are isoelectotypes.

As a result of the analysis of the specimens kept in PI and FI and Raddi's description, we concluded that *Piper fluminense* Raddi is synonymous with *P. amplum* Kunth.

Kunth (1840: 618) along with the description of *Steffensia ampla* Kunth (≡ *Piper amplum* Kunth) cited three

syntypes from southern Brazil as “Rio Janeiro Gaudich. [Charles Gaudichaud-Beaupré], Corcovado Luschnath. [Bernard Luschnath], Guidowald Sellow. [Friedrich Sellow]”. Below the species description, Kunth reported that he studied material collected by Luschnath on Macaé (state of Rio de Janeiro), present in the “herbario Lucaeano”. Lucae's herbarium at KIEL was destroyed (Stafleu & Cowan, 1981: 179). Kunth, after staying in Paris from 1813 to 1819, returned to Germany, where he was appointed Professor of Botany at the University of Berlin in 1820. The original material of *Steffensia ampla* at B was destroyed during WWII. In our search for extant original material associated with this name, we found a specimen at K, with barcode K000324051. The label of this specimen has the heading “Herb. Reg. Berolinense”, the printed footnote “Brasilia. Sellow legit”, and the handwritten annotation “*Steffensia ampla* Kunth. | *Artanthe ampla* Miq.” Specimen K000324051 is here designated the lectotype of *Steffensia ampla* (≡ *Piper amplum*).

The illegitimate later homonym *Piper fluminense* C.DC. is a synonym of *Manekia obtusa* (Miq.) T.Arias & al. (Arias & al., 2006).



Fig. 1. Lectotype of *Piper fluminense* Raddi at PI (sheet no. 1, Acc. No. 043383). The label is handwritten by Raddi.

5. *Piper variabile* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 4. 1828, **syn. nov.** [non *Piper variabile* C.DC. in Bot. Gaz. 19(7): 259. 1894, nom. illeg.] – Type [protologue]: Brazil. Rio de Janeiro: “Trovasi come la precedente specie nelle vicinanze di Rio-Janeiro, e perviene alla medesima altezza. [...]” (As the previous species [*P. fluminense* Raddi], it is found in the surroundings of Rio de Janeiro, and reaches the same height [6 to 7 feet; 1.8–2.1 m]). **Lectotype (designated here):** “*Piper variabile* nob.”, s.d. [Nov 1817–May 1818], Raddi s.n. (PI Nos. 043372 & 043373 [specimen on 2 sheets]; isolectotypes: FI [4 sheets] barcodes FI055276, FI055277, FI055278, FI055279).

= *Piper arboreum* Aubl. var. *arboreum*, Hist. Pl. Guiane 1: 23. 1775.

Notes. – At PI is preserved an original specimen, mounted on two sheets, with accession numbers 043372 and 043373, numbered 1 and 2 in pencil, respectively. On sheet number 1 is affixed a small label handwritten by Raddi “*Piper variabile*. nob.” Sheet number 2 is without a label, and kept together with sheet number 1. On those two sheets are present small portions of stem with a few leaves, and two of them, on sheet number 2, have a small inflorescence. This specimen, mounted on two sheets, is here designated the lectotype of *Piper variabile* Raddi. In FI there are four specimens, with barcodes FI055276, FI055277, FI055278 and FI055279. On each of them there is a branch with a few leaves, and a label handwritten by Parlatore “In Brasilia legit Cl. Raddi.” These specimens are isolectotypes.

Raddi (1828: 4–5) described *Piper variabile* as a glabrous plant with asymmetrical leaf bases and erect spikes. As a result of a detailed analysis of the original specimens at PI and FI, we concluded that this name is synonymous with *P. arboreum* Aubl., which is a very common species in the state of Rio de Janeiro (and throughout the Neotropics). More specifically, Raddi's plant is glabrous, and is synonymous with *P. arboreum* var. *arboreum*.

The other varieties of *Piper arboreum* can be distinguished from the typical variety as follows: var. *falcifolium* (Trel.) Yunck. is a glabrous plant with falcate leaves, and var. *hirtellum* Yunck. has pubescent vegetative parts (stems, petioles, and leaf lamina, especially on the abaxial surface).

6. *Piper impunctatum* Hoffmanns. in Schultes, Mant. 1: 242. 1822 [nom. illeg., non *Piper impunctatum* Link in Jahrb. Gewächsk. 1(3): 62. 1820] [both cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 5. 1828].

= *Piper divaricatum* G.Mey., Prim. Fl. Esseq.: 15–16. 1818.

Collection locality and habit. – “Questa, e la seguente specie sono state da me ritrovate nelle vicinanze di Mandioca. Il tronco in ambedue le specie non oltrepassava l'altezza di sei piedi” (This and the following species [*Piper hirtellum* Raddi] were found by me in the vicinity of Mandioca [Fazenda Mandioca]. The trunk of both species did not exceed the height of 6 feet [2 m]).

Notes. – Raddi (1828: 5) used the illegitimate name *Piper impunctatum* Hoffmanns. for this species. He characterized it

as a plant with glabrous stems, petiolate, lanceolate, acuminate, abaxially ferruginous leaves, and leaf-opposed, shortly pedunculate spikes. We did not find any specimens collected by Raddi with this name in the FI or PI herbaria, or in the other herbaria studied. Raddi's description is sufficient to conclude that this name is synonymous with *Piper divaricatum* G.Mey. According to both Yuncker (1972) and Tebbs (1990), *Piper impunctatum* Link (holotype: *Hoffmannsegg* s.n. [B-W barcode B -W 00645 -01 0]) is also a synonym of *Piper divaricatum*.

7. *Piper hirtellum* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 5. 1828 [non *Piper hirtellum* C.DC. in J. Bot. 4: 218. 1866, nom. illeg.] – Type [protologue]: Brazil. Rio de Janeiro: “vicinanze di Mandioca” (near Fazenda Mandioca). Holotype: s.d. [Nov 1817–May 1818], Raddi s.n. (PI No. 043375).

Collection locality and habit. – “[V]icinanze di Mandioca [from previous species]” (near Fazenda Mandioca), “Similissimo alla specie antecedente, dalla quale differisce soltanto per la presenza di una quantità di peli morbidi, che si trovano sparsi sulla pagina inferiore delle foglie, e sul loro peziolo” (Very similar to the previous species [*Piper impunctatum* Hoffmanns., nom. illeg. = *P. divaricatum* G.Mey., see above], from which it differs only by the presence of soft hairs on the leaf abaxial side and on the petioles).

Notes. – For this taxon, Raddi (1828: 5) provided the following description “foliis lanceolato-acuminatis, integerrimis, supra glabris, subtus petiolisque villosus-hirtis, basi subaequalibus; spadicibus oppositifoliis, gracilibus.” After an exhaustive search in all herbaria studied, we were able to find only one specimen in PI, accession number 043375, without label, and constituted by just one leaf. The leaf is lanceolate and acuminate, and corresponds with Raddi's description. By these characters, *Piper hirtellum* Raddi closely resembles *P. anisum* (Spreng.) Angely, a very common species in the state of Rio de Janeiro. The two species are similar in that the adaxial leaf surface is glabrous and the abaxial leaf surface and petioles are hirtellous (especially on the veins). His description indicated that the spikes are slender (“gracilibus”), whereas in *P. anisum* the inflorescences are racemose. At the initial stage of development, the spike and the raceme of these two species are similar, which might have led Raddi to an incorrect interpretation. However, as the original specimen of *P. hirtellum* Raddi is only represented by one leaf, it is here maintained with this name and as a distinct species.

Raddi collected the original material near Fazenda Mandioca, and in the protologue he commented that it is similar to *Piper impunctatum* (= *P. divaricatum* G.Mey.), from which it can be distinguished by the presence of trichomes on the leaf abaxial surface, while *P. divaricatum* is completely glabrous.

8. *Piper cornifolium* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 5. 1828, nom. illeg. [non *Piper cornifolium* Kunth in Humboldt & al., Nov. Gen. Sp., qu. ed., 1: 52. 1816 (“1815”)] = *Piper raddianum* E.F.Guim., G.A.Queiroz & Delprete, **nom. nov.** – Type [protologue]: Brazil. Rio de Janeiro:

“Ritrovato sulle Montagne d’Estrella, dove è piuttosto [sic! piuttosto] raro” (found on the Serra da Estrela, where it is quite rare). Holotype: “*Piper cornifolium*”, s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI No. 043379).

Notes. – Raddi (1828: 5) called this species *Piper cornifolium*, citing “*An Piper cornifolium. Humb: et Bonpl: N. Gen.?*” in synonymy. Therefore *P. cornifolium* Raddi is an illegitimate later homonym of *P. cornifolium* Kunth, which Raddi cited as a doubtful synonym.

Raddi described this species as having leaves short-petiole, broadly lanceolate, symmetrical at base, acuminate, glabrous (above), with veins below and petioles sub-pubescent; spikes leaf-opposed, cylindrical, slightly curved.

We found only one original specimen in PI (Acc. No. 043379), which is the holotype of *Piper cornifolium* Raddi. After detailed analysis, we concluded that the PI specimen has a certain resemblance to *P. gaudichaudianum* Kunth, which also occurs on the Serra da Estrela. The latter can be distinguished by the leaf blades scabrous-pubescent below, while in Raddi’s specimen the lamina is glabrous with sub-pubescent veins below. As we concluded that this is a distinct species deserving a new name, we dedicate the specific epithet to Raddi, who collected the original material.

9. *Piper hoffmannseggianum* Schult., Mant. 1: 242. 1822 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 6. 1828].

Collection locality and habit. – “Trovasi nelle vicinanze di *Rio-Janeiro*, ma non frequentemente. Vi cresce all’altezza di circa otto piedi: egli è ramosissimo, e i suoi rami sono eretti” (It is found in the surroundings of Rio de Janeiro, but not frequently. There, it grows to the height of about 8 feet [2.4 m]: it is much-branched, and its branches are erect).

Notes. – Raddi (1828: 6) copied word for word the original description of *Piper hoffmannseggianum* Schult. Raddi characterized this species as a plant about 2.4 m tall, with glabrous stems, lanceolate, acuminate, concolorous leaves, and shortly pedunculate, leaf-opposed spikes. In synonymy, he included the illegitimate name *P. citrifolium* Link (Jahrb. Gewächsk. 1(3): 63. 1820; non *P. citrifolium* Lam. 1791).

Specimens of this gathering are in PI and FI. At PI there is a specimen, mounted on two sheets, with accession numbers 043369 and 043370, numbered “1” and “2”. Sheet no. 1 bears a label handwritten by Raddi of “*Piper Hoffmannseggianum* Roem et Sch: Mant: p: 242? – *P. citrifolium* Link Jahrb: I. 3. p: 63?”. In FI there are two specimens, both of them with the annotation “In Brasilia legit Cl. Raddi” handwritten by Parlatore. The specimen with barcode FI055275 has the annotation “Piper” handwritten by Raddi, while that with barcode FI055255 does not have any annotation by Raddi.

Yuncker (1972) treated *Piper divaricatum* G.Mey. and *P. hoffmannseggianum* as distinct species, and we concur with his decision. Raddi’s description and our analysis of the PI and FI specimens confirm that this is a gathering of *P. hoffmannseggianum*.

10. *Piper aduncum* L., Sp. Pl. 1: 29. 1753 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 6. 1828].

Collection locality and habit. – “Comunissimo nei contorni di *Rio-Janeiro*, dove perviene non più che all’altezza di cinque a sei piedi circa” (Very common in the surroundings of Rio de Janeiro, where it can reach a height of about 5–6 feet [1.5–1.8 m]).

Notes. – Raddi (1828: 6) correctly identified his collection as *Piper aduncum* L., and characterized this species as having oblong-ovate to elliptic, asymmetrical at base, abaxially scabrous leaves, and axillary, uncinat spikes. He also correctly cited the synonym *Piper scabrum* Lam. (confirmed by Yuncker, 1972). We could find only one specimen of this species collected by Raddi in FI, with barcode FI055261. Raddi’s description and the analysis of this specimen permits us to agree with his identification.

11. *Piper tuberculatum* Jacq., Icon. Pl. Rar. 2: 2, t. 211. 1795 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 6. 1828].

Collection locality and habit. – “Questo Pepe è ancor più comune del precedente, trovandosi dappertutto in vicinanza di *Rio-Janeiro*, specialmente attorno le siepi” (This pepper is even more common than the preceding one [*Piper aduncum*], and is found everywhere in Rio de Janeiro, especially near hedges).

Notes. – Raddi (1828: 6) characterized *Piper tuberculatum* Jacq. as having ovate, basally asymmetrical leaves, and verrucose stems. We found four sheets of this species collected by him in FI (barcodes FI055256, FI055257, FI055258, FI055259). No specimen was found in PI. The FI specimens have the labels “In Brasilia Legit Cl. Raddi” handwritten by Parlatore and do not have Raddi’s identification. The verrucose petioles of these specimens confirm Raddi’s citation of this species in his publication.

12. *Piper amalago* L., Sp. Pl. 1: 29. 1753 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 6. 1828].

Collection locality and habit. – “Questo pure è comune nei contorni di *Rio-Janeiro*, meno però dei due precedenti. L’altezza alla quale vi giunge è ordinariamente di circa tre piedi, raramente quattro” (Also this one is common in the vicinity of Rio de Janeiro, but less so than the preceding two [*P. aduncum*, *P. tuberculatum*]. It usually reaches the height of 3 feet, rarely 4 feet [1(–1.2) m]).

Notes. – Under *Piper amalago* L., Raddi (1828: 6) cited the polynomial *Piper longum arboreum altius* (Sloane, 1707: 134) in synonymy. Specimens identified by Raddi with this name are at PI (Acc. No. 043367) and FI (barcode FI055265). The PI specimen consists of several loose leaves and a loose inflorescence, and has a label handwritten by Raddi: “*Piper amalago* Vahl, Enum: I. 328. Roem: Syst: I. 306.” However, an analysis of the publications by Vahl (1805: 328) and by Roemer & Schultes (1817: 306) demonstrated that Raddi incorrectly cited the authority of this name. The specimen at FI (barcode FI055265) has the label “In Brasilia Legit

Cl. Raddi" handwritten by Parlatore and does not have Raddi's identification.

13. *Piper sidifolium* Link & Otto, Icon. Pl. Select.: 15, t. 6. 1820 ('*sidaefolium*') [cited by Raddi as '*sidaefolium*' in Nuovo Giorn. Lett., Sci. 17(40): 7. 1828]. = *Piper umbellatum* L., Sp. Pl. 1: 30. 1753.

Collection locality and habit. – "Trovati nei contorni di Rio-Janeiro. Tre in quattro piedi circa è l'altezza alla quale vi perviene" (It is found in the surroundings of Rio de Janeiro. It reaches 3 to 4 feet [1–1.2 m] in height).

Notes. – Raddi identified his collection as *Piper sidifolium* Link & Otto and cited *P. peltatum* L. and *P. umbellatum* L. in synonymy. We were unable to find any specimen collected by Raddi with the name *P. sidifolium* (as '*sidaefolium*') in the FI and PI herbaria, or in the other herbaria studied. *Piper sidifolium* was treated as a synonym of *Pothomorphe umbellata* (L.) Miq. (now recognized as *Piper umbellatum*) by Yuncker (1973: 146) and we agree with this synonymy.

14. *Piper nigrum* L., Sp. Pl. 1: 28. 1753 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 7. 1828].

Collection locality and habit. – "Questo vi è stato trasportato dall'Indie orientali, ed ora si coltiva in tutte le Provincie presso la Costa Brasiliana, dalla Guiana Portoghese fino a Rio-Janeiro" (This one was transported from the East Indies, and now is cultivated in all the Provinces of the Brazilian coast, from Portuguese Guiana [now state of Amapá] to Rio de Janeiro).

Notes. – Specimens collected by Raddi with the name *Piper nigrum* are deposited in PI and FI and were correctly identified by him (Raddi, 1828: 7). The specimen at PI (Acc. No. 043364) consists of a small branch with three leaves and an inflorescence, and a loose leaf, and has Raddi's label "Piper nigrum". The specimen in FI (barcode FI055253) has several loose leaves, one of them on a distal node, with a small portion of stem and a pendulous inflorescence. This specimen has a label with the heading "Herbarium I. et R. Musaei Florentini" and the annotation "In Brasilia legit Cl. Raddi" handwritten by Parlatore. Both specimens have been correctly identified by Raddi.

15. *Piper caudatum* Vahl, Eclog. Amer. 1: 3. 1797 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 7. 1828]. = *Piper marginatum* Jacq., Collectanea 4: 128. 1791.

Collection locality and habit. – "Cresce nelle ombrosissime Foreste della Serra degli Organi. Il suo caule è più grosso d'una penna da scrivere; egli è in principio repente, gettando ad ogni internodo delle radici, con le quali si fissa al terreno su cui giace, quindi si alza obliquamente per guadagnare le piante ad esso vicine, sulle quali si arrampica e si sostiene. [...]" (It grows in the very shady forests of the Serra dos Orgãos. Its stem is wider than a writing quill; the basal portion is repent, with roots at each internode, which fix the stem on the soil, the distal portion raises obliquely to find the nearby plants, on which it climbs and holds itself).

Notes. – Raddi characterized this species as a plant with the basal portion lying on the ground and the distal portion climbing on surrounding vegetation, with terete, glabrous stems, sub-rotund-ovate, basally cordate, apically acuminate, 9-veined, pellucid-punctate, subcoriaceous, glabrous leaves, and leaf-opposed spikes.

Three sheets of *Piper marginatum* Jacq. are present at PI, which should be treated as two separate specimens. The first specimen is mounted on two sheets, with accession numbers 043363 (numbered "1"), and 043362 (numbered "2"). On the first sheet is attached a small label, handwritten by Raddi, indicating "Piper marginatum ex H: Cors:", while the second sheet does not have any label. On the second specimen at PI, accession number 043360, there is a label handwritten by Raddi "*Piper caudatum* Vahl?", which is a synonym of *P. marginatum* Jacq. (Yuncker, 1972: 61). On the lower portion of the sheet is mounted a leaf and two stem portions of *Peperomia arifolia* Miq., a species quite frequent in the mountains surrounding Rio de Janeiro. It is worth noting the differences between the two species mounted on this sheet. On the upper portion of the sheet are the specimens of *Piper marginatum*, which is a species characterized by shrubby habit, leaf blades with palmate venation with all veins reaching the apex, densely ciliate margins, and leaf base not peltate. On the lower portion of the sheet is mounted *Peperomia arifolia*, a fleshy herb, with peltate leaves, palmate veins reaching only to the median portion of the blades, and glabrous margins.

B. Caule carnosu eretto, oppure ascendente [Stem fleshy, erect, or ascendent]

16. *Piper rubricaulis* Nees, Horae Phys. Berol.: 48. 1820 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 8. 1828] ≡ *Peperomia rubricaulis* (Nees) A. Dietr., Sp. Pl. 1: 182. 1831.

Collection locality and habit. – "Ritrovato sulle Montagne che costituiscono la così detta Serra degli Organi (*Serra dos Organos*). Cresce all'altezza di circa un piede. Il suo caule è eretto, oppure semieretto, pochissimo o punto ramoso, carnosu, e articolato, i di cui articoli o rigonfiamenti sono assai distanti fra loro, gl'inferiori dei quali muniti di poche e brevi radicele, e circondati da cinque foglie simili, nella loro figura, a quelle del *Ruscus Hyppoglossum* Lin." (Found on the mountains that compose the Serra dos Orgãos. It grows to about one foot tall. Its stem is erect, or semi-erect, sparsely or not branched, fleshy, and articulate; its articles or swellings [at nodes] are quite distant from each other, the basal ones have a few thin adventitious roots, and are surrounded by five leaves that resemble, in outline, those of *Ruscus Hyppoglossum* Lin. [sic! *Ruscus hypoglossum* L.]).

Notes. – A sole specimen collected by Raddi with the name *Piper rubricaulis* Nees was found in PI (Acc. No. 043359). It is annotated with a label handwritten by Raddi as "Piper rubricaulis, Nees H. Berol: p. 48. t. 8. – Roem. et Sch. Mant: 246." The description provided by Raddi (1828: 8) and the specimen at PI completely agree with the identity

of this species, which belongs to *Peperomia*, and the combination *Peperomia rubricaulis* (Nees) A.Dietr. already exists.

17. *Piper catesbaeaeifolium* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 8. 1828 ≡ *Peperomia catesbaeifolia* (Raddi) G.A. Queiroz, E.F.Guim. & Delprete, **comb. nov.** – Type [protologue]: Brazil. Rio de Janeiro: “Trovasi sulle Montagne suddette” (found on the above-cited mountains [Serra dos Órgãos]). **Lectotype (designated here):** “*Piper catesbaeaeifolium* nob.”, s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI No. 043376; isolectotype: FI barcodes 055250 & 055251 [specimen on 2 sheets]).

= *Peperomia arbuscula* Yunck. in Bol. Inst. Bot. (São Paulo) 3: 154, fig. 138. 1966, **syn. nov.** – Holotype: Brazil. Rio de Janeiro: Serra dos Órgãos, s.d., *J.T. Moura s.n.* (R barcode R 000039058; isotype: NY barcode 00222664).

Collection locality and habit. – “Trovasi sulle Montagne suddette; Cresce all’altezza di sette in otto pollici, e le sue foglie sono lunghe circa cinque linee e larghe quattro” (It is found on the above-cited mountains [Serra dos Órgãos]; it grows to the height of 7 to 8 inches [17.8–20.3 cm], and the leaves are about 5 lines long and 4 lines wide [10.5 × 8.5 mm]).

Notes. – Original specimens of *Piper catesbaeaeifolium* Raddi are at PI and FI. At PI there is a single specimen (Acc. No. 043376) with the label “*Piper catesbaeaeifolium* nob.” handwritten by Raddi, which is here designated as the lectotype of this name. The specimen at FI is mounted on two sheets (barcodes FI055250 and FI055251), both with the label “In Brasilia legit Cl. Raddi” handwritten by Parlatore, and represents the isolectotype of *P. catesbaeaeifolium*.

Raddi (1828: 8) described this species as a fleshy, glabrous, erect herb, densely and dichotomously branching, with 4 leaves per node, sessile or shortly petiolate blades, and terminal, thin spikes. This species belongs to the genus *Peperomia*, for which a new combination is here provided. In its general morphology, it is identical to *Peperomia arbuscula* Yunck., which is here treated as a new synonym.

18. *Piper cylindricum* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 8. 1828 ≡ *Peperomia cylindrica* (Raddi) G.A. Queiroz, E.F.Guim. & Delprete, **comb. nov.** – Type [protologue]: Brazil. Rio de Janeiro: “Trovasi sulle Montagne suddette” (found on the above-cited mountains [Serra dos Órgãos]). **Lectotype (designated here):** “In Brasilia legit Cl. Raddi” (handwritten by Parlatore), s.d. [Nov 1817–May 1818], *Raddi s.n.* (FI barcode 055260; isolectotype: PI No. 043385 [“*Piper cylindricum* nob.” handwritten by Raddi]).

Collection locality and habit. – “Ritrovato sulle Montagne suddette, ove però è rarissimo. L’altezza del suo caule è di circa otto pollici. Le sue foglie, di un verde giallognolo, sono lunghe poco più di due pollici sopra un pollice di larghezza, e sostenute da un peziolo di quattro linee di larghezza. Lo spadice è circa due pollici lungo” (It is found in

the above-cited mountains [Serra dos Órgãos], where it is very rare. The stems are about 8 inches [20.3 cm] tall. Its leaf blades are yellowish green, 2 inches long and 1 inch wide [5 × 2.5 cm], sustained by a petiole 4 lines [8.5 mm] long. The spike is about 2 inches [5 cm] long).

Notes. – Original specimens of *Piper cylindricum* Raddi are in PI and FI. The specimen at PI (Acc. No. 043385) is represented by only one leaf, while the specimen at FI is a complete branch. Therefore, we here designate the FI specimen (Fig. 2), with barcode FI055260, as the lectotype of this name. Based on Raddi’s description and the examination of the original specimens, we can characterize this species as an erect herb, ca. 20 cm tall, dichotomously branched, with striated stems, leaves with petioles 8.5 mm long, blades ovate-elliptic, 5 × 2.5 cm, symmetrical at base, obtuse or rarely acute, apex acuminate, spike terminal, solitary, filiform, ca. 5 cm long, and fruits narrowly cylindrical. These characters demonstrate that this species belongs to *Peperomia*. It resembles *Peperomia nitida* Dahlst., from which it differs by being completely glabrous, while in *Peperomia nitida* the leaf blade margins are ciliate towards the apex.



Fig. 2. Lectotype of *Piper cylindricum* Raddi at FI (barcode 055260) (= *Peperomia cylindrica* (Raddi) G.A. Queiroz, E.F.Guim. & Delprete). Lower right corner: magnified specimen label, with “In Brasilia legit Cl. Raddi” handwritten by Parlatore.

19. *Piper plantaginifolium* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 9. 1828 ≡ *Peperomia plantaginifolia* (Raddi) E.F. Guim., G.A. Queiroz & Delprete, **comb. nov.** – Type [protologue]: Brazil. Rio de Janeiro: “Ritrovato come sopra” (found in the locality of the previous species [Serra dos Orgãos]), s.d. [Nov 1817–May 1818], *Raddi s.n.* (not traced). *Collection locality and habit.* – “Ritrovato come sopra. Le sue foglie sono lunghe circa tre pollici, e larghe otto in nove linee” (Found in the locality [Serra dos Orgãos] of the previous species [*P. cylindricum* Raddi]). Its leaf blades are about 3 inches long, and about 8–9 lines wide [7.6×1.7 – 1.9 cm].
- Notes.* – Raddi (1828: 9) collected *Piper plantaginifolium* Raddi on the Serra dos Orgãos and described it as “foliis lanceolatis tri- vel quinquenerviis, glaberrimis; spadicibus oppositifoliis; caule radicante adscendente” (leaves lanceolate, 3- or 5-veined, glabrous, spike leaf-opposed, stem rooting, ascending). We were unable to find any species similar to *P. plantaginifolium* in the state of Rio de Janeiro. As this taxon was described by Raddi as having an ascending stem with adventitious roots, we conclude that it belongs to the genus *Peperomia*. The first two authors of the present paper have a profound knowledge of the Piperaceae of southern Brazil, and we are quite confident that this is a distinct species of *Peperomia*, probably endemic to the state of Rio de Janeiro. Therefore, the new combination *Peperomia plantaginifolia* (Raddi) E.F. Guim., G.A. Queiroz & Delprete is here provided.

20. *Piper mandioccanum* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 9. 1828, **syn. nov.** – Type [protologue]: Brazil. Rio de Janeiro: “Boschi di Mandioca, piccola Valle a piè di una delle Montagne d’Estrella” (in the forests of [Fazenda] Mandioca, in a small valley at the base of the Serra da Estrela). Holotype: “*Piper mandioccanum* nob.”, s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI No. 043355). = *Piper obtusifolium* L., Sp. Pl. 1: 30. 1753 ≡ *Peperomia obtusifolia* (L.) A. Dietr., Sp. Pl. 1: 154. 1831.

Collection locality, habit, and description. – “Cresce nei Boschi di Mandioca, piccola Valle a piè di una delle Montagne d’Estrella. Le sue foglie sono rotondate alla loro estremità, attenuate verso la base, lunghe due pollici fino a due pollici e mezzo, larghe circa un pollice e sostenute da un peziolo lungo otto fino a dieci linee. La lunghezza del peduncolo che sostiene lo spadice è dal pollice fin quasi a due pollici e mezzo” (It grows in the forests of [Fazenda] Mandioca, in a small valley at the base of the Serra da Estrela. Its leaf blades are round at apex, attenuate at base, 2–2.5 inches long, about 1 inch wide [5 – 6.3×2.5 cm], with a petiole 8–10 lines [17–21 mm] long. The peduncle of the spike is 1–2.5 inches [2.5–6.5 cm] long).

Notes. – We could find only one original specimen collected by Raddi at PI (Acc. No. 043355), comprised of several loose leaves, one loose inflorescence, and a root portion. It has the label “*Piper mandioccanum* Nob.” handwritten by Raddi, and is the holotype of this name.

In the description, Raddi (1828: 9) wrote that the stem is ascending, rooting at basal nodes, the leaves are round at apex

and attenuate at base, and the spike is terminal. These features indicate that this species is a *Peperomia*. A detailed analysis of the PI specimen and Raddi’s description allow us to conclude that this name is synonymous with *Peperomia obtusifolia* (L.) A. Dietr., a species very common in the state of Rio de Janeiro and other states of southeastern Brazil (and throughout the Neotropics).

21. *Piper pumilum* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 9. [Jul–Aug] 1828, **syn. nov.** [non *Peperomia pumila* Opiz in Presl, Reliq. Haenk. 1(3): 163, t. 30, fig. 3. 1828; non *Peperomia pumila* Sessé & Moc., Naturaleza (Mexico City), ser. 2, 2, app. 11. 1893, nom. illeg.] – Type [protologue]: Brazil. Rio de Janeiro: “scoscese Rupi delle Montagne d’Estrella” (steep slopes of the Serra da Estrela). **Lectotype (designated here):** “*Piper* (*Peperomia*) *pumilum*, nob.”, s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI No. 043374; isolectotype: FI barcode FI055273 pro parte [only the branch overlapping the specimen label; see *Piper serpens*, below]).
- = *Peperomia martiana* Miq., Syst. Piperac. 1: 189. 1843 – Holotype: Brazil: “Habitat em Brasília”, s.d., *Sellow s.n.* (B, destroyed). **Lectotype (designated here):** Brasília, *Sellow s.n.* (K barcode K000324691; isolectotype: U barcode U 0068762).

Collection locality, habit, description. – “Trovasi nelle scoscese Rupi delle Montagne d’Estrella. Il suo caule serpeggia sul terreno, fissandovisi per delle sottili radicele, delle quali di tratto in tratto egli è provvisto, da cui s’inlzano pochi rametti semplici, dritti, dell’altezza di circa due pollici, nudi verso la base, ornati di foglie ovali o quasi rotonde alla loro sommità, non più lunghe di sette linee, e sostenute da dei pezioli di due fino a tre linee di lunghezza” (It is found on the steep slopes of Serra da Estrela. Its stem is creeping on the ground and is anchored by the thin radicles, which are sparsely present, with a few simple erect branchlets about 2 inches [5 cm] long, glabrous at base, with ovate or almost round leaf blades up to 7 lines [15 mm] long, and petioles 2–3 lines [4.2–6.4 mm] long).

Notes. – Original specimens of *Piper pumilum* Raddi are present at PI and FI. At PI there is a specimen, with accession number 043374, consisting of a decumbent plant with running stems with numerous thin roots, obovate leaves shallowly notched, and one inflorescence. It also has the label “*Piper* (*Peperomia*) *pumilum*, nob.” handwritten by Raddi. This specimen is here designated as the lectotype of *P. pumilum*. At FI there is a sheet, barcode FI055273, on which several small branches belonging to two different species are mounted. Most branches on the sheet are *Piper serpens* Sw. (= *Peperomia serpens* (Sw.) Loudon, see below under this name), and are easily recognizable by the broadly ovate leaves obtuse at apex. The branch with one leaf overlapping the specimen label is easily distinguished from the other branches on the same sheet by the obovate leaves, round and shallowly notched at apex. This branch is *Piper pumilum* (= *Peperomia martiana* Miq.) and is the isolectotype of this name.

Raddi (1828: 9) described *Piper pumilum* as a glabrous herb with creeping stems, ovate or almost round leaf blades, and terminal spikes. These characters indicate that this taxon belongs to *Peperomia*. An analysis of the original specimens at PI and FI showed that they have shallowly notched leaf blades. These features allow us to conclude that *Piper pumilum* is synonymous with *Peperomia martiana* Miq., a species found in the mountains surrounding Rio de Janeiro.

According to our analysis, *Piper pumilum* should be transferred to *Peperomia*. However, the binomial *Peperomia pumila* is not available, and the correct name for this species is *Peperomia martiana* Miq.

Miquel (1843: 189–190) described *Peperomia martiana* and cited the material studied as “Habitat in Brasilia (Sellow! in Herb. reg. berol.)”. The B holotype was destroyed during World War II. Yuncker (1974: 193–194), among the numerous specimens cited for this species, wrote “without date, Sellow s.n. (K, sketch; U, isotype)” probably assuming that the holotype was at B. For this taxon, Guimarães & al. (1984: 164–165) wrote “Tipo – Brasil, Sellow s/n°. U= isótipo.” Article 9.10 of the *Code* states that “The use of a term defined in the *Code* (Art. 9.1, 9.3 and 9.5–9.9) as denoting a type, in a sense other than that in which it is so defined, is treated as an error to be corrected.” Thus, in their citations Yuncker and Guimarães used the term isotype correctly, so these are not inadvertent lectotypifications. Hence, according to Art. 9.12, Yuncker and Guimarães did not lectotypify *P. martiana*, and a lectotype needs to be designated.

Searching for potential original material of *Peperomia martiana*, we were able to find the following entities:

(1) A sheet at G-DC with a pencil sketch of a plant and the penciled text “Peperomia Martiana Miq., Sellow legit, h. Berlin”. As explained in the handwritten text, this sketch is based on the holotype that was at B. Most likely this sketch was made after Miquel’s publication, so it cannot be treated as original material.

(2) A sheet at K with numerous different collections, each of them with a different barcode. One of these specimens (barcode K000324691, upper left-hand area) has the label “Herb. Reg. Berolinense. | Peperomia Martiana Miq. | Brasilia Sellow legit.” This specimen is original material and is here designated the lectotype of *Peperomia martiana*.

(3) A sheet at U (barcode U 0068762), which is a small, sterile specimen with several notched leaves. This sheet has the stamp “! T.G. Yuncker”, the handwritten (author unknown) label “Peperomia Martiana Miq. | Brasilia | Sellow” and another label (author unknown), handwritten with a ballpoint pen, “Peperomia martiana Miq. cited as isotypus, maybe holotypus. Fl. S. Cat. Pip. II: 104. 1984”. This specimen is original material and is an isolectotype.

C. Caule carnosus repente [Stem fleshy, creeping]

22. *Piper serpens* Sw., Prodr.: 16. 1788 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 10. 1828] ≡ *Peperomia serpens* (Sw.) Loudon, Hort. Brit.: 13. 1830.

Collection locality and habit. – “Ritrovato come sopra. Egli ha molta somiglianza, nella grandezza e figura delle sue foglie, con il seguente” (Found in the same locality of the previous species [steep slopes of the Serra da Estrela]. It is very similar, in height and leaf shape, to the following species [*Piper bracteatum*]).

Notes. – We were able to find three specimens of *Piper serpens* Sw. collected by Raddi, two in PI and one in FI. One specimen in PI (Acc. No. 043368) is annotated by Raddi as “*Piper bracteatum* Thom. in Lin. Transact: IX. p. 203. tab. 21. f. 2. – Roem. et Sch: I. p: 583.” The other specimen at PI (Acc. No. 043361) is annotated by Raddi as “*Piper serpens* Roem. et Schult: p. 323. n: 154. – *Peperomia scandens* Ruiz et Pav.?” In fact, Raddi (1828: 10) cited *Piper scandens* Ruiz & Pav. as a dubious synonym of *Piper serpens*.

The sheet at FI, barcode FI055273, has been discussed above under *Piper pumilum* Raddi. Most branches on this sheet are *Piper serpens* Sw. [≡ *Peperomia serpens* (Sw.) Loudon], while the branch with one leaf overlapping the specimen label is the isolectotype of *Piper pumilum* Raddi (= *Peperomia martiana* Miq.).

Yuncker (1974: 228) stated that *Peperomia serpens* (Sw.) Loudon is the name to be used for this species, and listed *Piper bracteatum* as one of the synonyms. We concur with him that these two names are synonymous, and the correct name for this species is *Peperomia serpens*.

23. *Piper bracteatum* Thomps. in Trans. Linn. Soc. London 9: 203, t. 21. 1808 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 10. 1828].

= *Peperomia serpens* (Sw.) Loudon.

Collection locality and habit. – “Comunissimo sopra i vecchi muri nelle vicinanze di *Rio-Janeiro*” (Very common on old walls in the vicinity of Rio de Janeiro).

Notes. – The specimen at PI, No. 043368, identified by Raddi as *Piper bracteatum* has been discussed under *Piper serpens* Sw. (≡ *Peperomia serpens* (Sw.) Loudon, see above).

24. *Piper molle* Poir. in Lamarck, Encycl., Suppl. 4: 467. 14 Dec 1816 [cited by Raddi in Nuovo Giorn. Lett., Sci. 17(40): 10. 1828] ≡ *Peperomia mollis* Kunth in Humboldt & al., Nov. Gen. Sp., qu. ed., 1: 65. Jan 1816 (“1815”).

Collection locality, habit, and description. – “Sui tronchi degli alberi presso la famosa Cascata di *Tijuca*, a due leghe circa da *Rio-Janeiro*. Il suo serpeggiante caule è pochissimo ramoso. Le sue foglie negl’individui da noi osservati, sono lunghe dalle cinque fino alle otto linee, larghe dalle tre e mezzo alle cinque” (On the trunks of the trees near the famous Waterfall of Tijuca, at about two leagues from Rio de Janeiro. Its meandering thin stem is very little branched. Its leaves, in the individuals observed, are 5–8 lines long and 3.5–5 lines wide [10.6–17 × 7.4–10.6 mm]).

Notes. – Raddi (1828: 10) cited both *Piper molle* Poir. and *Peperomia mollis* Kunth for this taxon. Kunth (in Humboldt & al., 1816: 65) described *Peperomia mollis* citing a gathering

collected in Colombia by Humboldt & Bonpland (holotype P-Bonpl., barcode P00669297). Poiret (1816: 467) published the name *Piper molle* with the citation “Kunth, l.c. p. 65. Sub peperomia Kunth” and listed the same specimen indicated by Kunth.

We found only one specimen annotated by Raddi with these names, which is deposited at PI. The specimen, with accession number 043358, only has two loose, small leaves, and has two labels handwritten by Raddi. The label written in pencil has the annotation “solitariis Roem. 326. Folia 4–6 lin; petioli lineam longi; spadices pollicares erecti rubri.” The label in ink has the annotation “Piper molle Roem. et Sch: I. 326. Peperomia mollis Humb. et B: N. Gen: I. p. 65.” Raddi (1828: 10) described this plant as having filiform, repent, much-branched stems, ovate, sub-fleshy, softly pubescent leaves, and leaf-opposed spikes. The name to be used for this species is *Peperomia mollis*.

25. *Piper gracillimum* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 10. 1828 [non *Piper gracillimum* Trel. in Publ. Field Mus. Nat. Hist., Bot. Ser. 10: 159. 1931, nom. illeg.] ≡ *Peperomia gracillima* (Raddi) E.F.Guim., G.A.Queiroz & Delprete, **comb. nov.** – Type [protologue]: Brazil. Rio de Janeiro: “Foreste delle Montagne d’Estrella” (forests of the Serra da Estrela). **Lectotype (designated here):** “Piper (Peperomia) gracillimum, nob.”, s.d. [Nov 1817–May 1818], *Raddi s.n.* (PI No. 043378; isoelectotype: FI barcode FI055252).

= *Peperomia pseudoestrellensis* C.DC. in Annuaire Conserv. Jard. Bot. Genève 2: 277. 1898 (*pseudo-Estrellensis*), **syn. nov.** – Lectotype (designated by Yuncker in Hoehnea 4: 144. 1974): Brazil: Rio de Janeiro, “Estrella” [Serra da Estrela], 1844, *Weddell 763* (P barcodes P00468101 & P00468102 [specimen on 2 sheets]).

Collection locality and habit. – The collection locality of this species was described by Raddi under *Piper callitrichoides* Raddi as “among the moss on the trunk of the trees growing in the very shaded forests of Serra da Estrela”. He described *Piper gracillimum* Raddi as “Le sue foglie hanno circa cinque linee di lunghezza sopra 3 1/2 di larghezza, e sono sostenute da un peziolo lungo una linea fino a 1 1/2” (Its leaves are about 5 lines long and 3 1/2 lines wide [ca. 10 × 7 mm], and are sustained by a petiole 1 to 1 1/2 lines long [2–3 mm long]).

Notes. – Original specimens of *Piper gracillimum* Raddi are at PI and FI. The specimen at PI, accession number 043378, bears Raddi’s handwritten annotation “Piper (Peperomia) gracillimum nob.” and is here designated as the lectotype. The specimen at FI, barcode FI055252, has the annotation “In Brasilia legit Cl. Raddi” handwritten by Parlato, and is the isoelectotype of this name.

Raddi’s specimens represent a species fairly common in the mountains surrounding Rio de Janeiro traditionally known as *Peperomia pseudoestrellensis* C.DC., which is here treated as a synonym of *Piper gracillimum*. As this species belongs to *Peperomia*, the new combination *Peperomia gracillima* (Raddi) E.F.Guim., G.A.Queiroz & Delprete is here provided.

Casimir de Candolle (1898: 277), along with the original description of *Peperomia pseudoestrellensis* C.DC., cited two collections: “Estrella [Serra da Estrela] (Weddell n. 763 in h. Mus. Par.)” and “prov. Espiritu-Santo (A. de Saint-Hilaire, catal. B², 2^{me} part. n. 364 ibid)”. Yuncker (1974: 144–145), among the specimens studied, included the following citation “Estrella, without date, *Weddell 763* (P, holotype)”. In P there are two sheets of *Weddell 763*, barcodes P00468101 and P00468102. These two sheets are kept together, and are here treated as one specimen with multiple preparations. We interpret Yuncker’s citation as an inadvertent lectotypification.

26. *Piper callitrichoides* Raddi in Nuovo Giorn. Lett., Sci. 17(40): 11. 1828 ≡ *Peperomia callitrichoides* (Raddi) E.F.Guim., G.A.Queiroz & Delprete, **comb. nov.** – Type [protologue]: “Foreste delle Montagne d’Estrella” (forests of the Serra da Estrela). Holotype: Brazil. Rio de Janeiro: “Piper (Peperomia) callitricoides, nob.”, s.d., *Raddi s.n.* (PI No. 043377).

Collection locality, habit, and description. – “Questa, e la precedente specie sono state da noi trovate, fra il musco sopra i tronchi degli alberi nelle ombrosissime Foreste delle Montagne d’Estrella. Le foglie inferiori hanno 3–4 linee di lunghezza su 2–3 di larghezza; le superiori 6–8 linee di lunghezza su due circa di larghezza” (This and the previous species [*Piper gracillimum*] were found among the moss on the trunk of the trees growing in the very shaded forests of the Serra da Estrela. The basal leaves are 3–4 lines long and 2–3 lines wide [6.3–8.5 × 4.2–6.3 mm]; and the distal ones are 6–8 lines long and about 2 lines wide [12.7–17 × 4.2 mm]).

Notes. – We could find only one original specimen of *Piper callitrichoides* Raddi, at PI (Acc. No. 043377), which is the holotype. This specimen was annotated by Raddi as “Piper (Peperomia) callitrichoides, nob.” The specific epithet refers to the genus *Callitriche* L. (Plantaginaceae), with which it bears a certain resemblance. This species is a crawling herb, with filiform stems, sparsely branched; very thin adventitious roots; sessile, alternate leaves, the basal ones (6–) 8–10 × 4–6 mm, obovate, acute at base, truncate at apex, the distal ones 12–16 × 2–6 mm, lanceolate, acute at base, obtuse to round at apex, the margins and abaxial side glandular.

D. Piperaceae specimens collected by Raddi of species not cited in Raddi (1828)

Several Piperaceae specimens present in the PI and FI herbaria belong to species not cited by Raddi in his article. These specimens are discussed below.

1. *Piper lepturum* Kunth var. *lepturum* in Linnaea 13: 679. 1840 (“1839”) – Type: Brazil. “Crescit prope Rio de Janeiro. (Gaudichaud legit.)” (P).

Notes. – There are three original sheets in P, two sheets of *Gaudichaud 1117* and one sheet of *Gaudichaud 1112*. A lectotype will need to be selected for this name.

A gathering of this taxon, collected by Raddi and housed in FI is mounted on three sheets (barcodes FI055266, FI055267 and FI055268), each bearing a label with the annotation “In Brasilia Legit Cl. Raddi” handwritten by Parlatore, and no annotation by Raddi.

2. “*Piper nigrum* ex H. Mus. Fl. 1826.”

Piper marginatum Jacq.

Notes. – The specimen at PI with accession number 043365 (with “2” written in pencil) has three branches with several leaves and spikes, and a label with the annotation “*Piper nigrum*, ex H. Mus. Fl. 1826” handwritten by Raddi. This specimen has been incorrectly identified by Raddi, as the leaf blades of this specimen are cordate at base and thus characteristic of *Piper marginatum* (vs. blades round or obtuse at base in *P. nigrum* L.).

3. *Peperomia polystachyoides* Dahlst. in Kongl. Svenska Vetensk. Acad. Handl. 33(2): 136, t. 11, fig. 5. 1900 – Lectotype (designated by Yuncker in Hoehnea 4: 198. 1974): Brazil. Rio de Janeiro: Without locality, 1876, *Glaziou 7839* (C barcode C10016485).

Notes. – In PI there is a specimen, accession number 043357, with three labels. One label has the annotation “*Piper polystachyon*, 203” written in ink by an unknown author. A second label, handwritten by Raddi, has the annotations “*Piper trifolium?* ex H. Mus. Flor.” in pencil, and “*Piper polystachyon*” in ink. In the attached envelope, there are several branch portions, and a third label with the annotation “*Piper polystachyon* Roem. et Sch.” handwritten by Raddi in ink. All the branches contained in the envelope bear spikes, which facilitate the identification of the species. We disagree with Raddi’s determination, and we are confident that this specimen is *Peperomia polystachyoides* Dahlst.

Dahlstedt (1900: 136–137) along with the protologue of *Peperomia polystachyoides* cited the collections studied as “*Brasilia* (Glaziou n:o 7839 in Hb. Warming et in Hb. Berol.), Rio de Janeiro Corcovado, Paineiras ad rupes madidas umbrosas (Mosén n:o 2574 in Hb. Stockholm. et Ups.); Corcovado (R. Mendonça n:o 731 in Hb. Berol.); Corcovado ad aquaeductum in rupibus madidis (H. Schenk, Herb. brasil. n:o 1817 in Hb. proprio).”

Yuncker (1974: 198) cited the material examined of *Peperomia polystachyoides* as follows: “Rio de Janeiro & Guanabara: without loc., 1876, *Glaziou 7839* (C, holotype; P), this number in G and LE is *P. trinervis*; Corcovado, Paineiras, 15-IX-1874, *Mosen 2574* (S).” Therefore, according to Art. 7.11 and 9.10 of the *Code*, Yuncker’s citation is an inadvertent lectotypification of the name on the C specimen. At C there is a specimen, barcode C10016485, with a label with the heading “Ex herbario Eug. Warming” and the handwritten text “*Peperomia variabilis* C. DC. Mus.” and “*Glaziou 7839*”. A second label has the typewritten annotation “*Peperomia polystachyoides* Dahlst. Det. T.G. Yuncker 1960.” This specimen is the lectotype of this name.

4. “*Piper quinquefolium* Raddi” (in herb.).

= *Peperomia galioides* Kunth in Humboldt & al., Nov. Gen. Sp., qu. ed., 1: 71, t. 17. 1816 (“1815”) – Holotype: Colombia, “crescit in montanis Regni Novogranatensis, juxta cataractam Tequendamae [Tequendama Falls], s.d., A.J.A. Bonpland & F.W.H.A. Humboldt s.n. (P-Bonpl. barcode P00669318; isotype: B-W barcode B -W 00762 -01 0).

Notes. – Kunth described *Peperomia galioides* Kunth using a specimen in Paris, which is now in P-Bonpl. (Bonpland Herbarium) and has the barcode P00669318. That specimen is the holotype of this name.

Another original specimen associated with *Peperomia galioides* Kunth is in B-W, with barcode B -W 00762 -01 0. That specimen has two labels, one with the handwritten annotation “*Peperomia galioides* Humb. & Kth. | Kth scripsit”, and the other with the annotation “Willd. hb. n. 762 | *Peperomia galioides* H. B. K. | ex C. DC.” The B-W specimen is an isotype.

Saralegui Boza (2004: 12) designated the specimen at P-Bonpl. as the lectotype of *Peperomia galioides*. However, the specimen in P-Bonpl. is the sole specimen studied by Kunth before the publication of this name, and is the holotype of *Peperomia galioides*.

There is a specimen in PI, with accession No. 043356, bearing the following label handwritten by Raddi: “*Piper quinquefolium*, nob: an *Peperomia portulacaefolia* Humb. et Bonpl., *Piper verticillatum*, ex Hort. Schoënbrun.” The name “*Piper quinquefolium*” has never been published. The two other names, “*Peperomia portulacaefolia* Kunth” (*Peperomia portulacifolia* Kunth) and “*Piper verticillatum* ex Hort. Schoënbrun” (= *Peperomia verticillata* L.) pertain to two other species. On the sheet are present several branches with verticillate leaves (mostly 4 per node, rarely 5 per node), some of them with spikes, and a loose, long spike. After careful examination, we concluded that this specimen corresponds to *Peperomia galioides* Kunth, a species relatively common in the mountains surrounding Rio de Janeiro.

It is worth noting that the other two names indicated by Raddi on the label of the PI specimen correspond to two species that differ from *Peperomia galioides* by several characters. *Peperomia galioides* and *Peperomia verticillata* are similar in having leaves in whorls disposed at regular intervals along the stem, and blades that are lightly scabrous or pubescent; the leaves of the former are elliptic-lanceolate and ciliate at the apex, while those of the latter are elliptic and non-ciliate at the apex. In *Peperomia portulacifolia* the leaves are condensed at the distal portion of the branches, and the blades are glabrous, obovate, and with an emarginate, glabrous apex.

5. “*Piper siriboa* L., Sp. Pl. 1: 29. 1753” [incorrectly identified with this name by Raddi].

Manekia obtusa (Miq.) T.Arias, Callejas & Bornst. in Novon 16(2): 206. 2006.

Notes. – One specimen in PI, with accession number 043366, was identified by Raddi as *Piper siriboa* L., a species

native to tropical Asia. No information regarding the collection locality is present on the specimen. Raddi misidentified this specimen, which is represented by only three loose leaves, cordate at base, and with a long-vaginate petiole that ends at the junction with the blade. This latter feature is diagnostic for *Manekia obtusa* (Miq.) T. Arias & al., the only species of this genus known to occur in Brazil (specifically southeastern portions of the country).

■ AUTHOR CONTRIBUTIONS

RMB, PGD, EFG, and GAQ initiated the study, conceptualized the paper, and wrote the manuscript. All authors contributed equally to the work. RMB selected Piperaceae specimens collected by Raddi at FI and PI, and searched for possible specimens in B, BM, BOLO, BP, BR, CE, E, FH, FP, G, GZU, H, K, LINN, M, P, SBT, and W. All authors commented on, contributed to, and approved the final version. – EFG, <https://orcid.org/0000-0002-8586-462X>; GAQ, <https://orcid.org/0000-0001-7823-4075>; PGD, <https://orcid.org/0000-0001-5844-3945>; RMB, <https://orcid.org/0000-0003-2181-3441>

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