

Epitypification of *Heliotropium arborescens* L. (*Heliotropiaceae*)

Federico Luebert,^{1,2} Maximilian Weigend¹ & Hartmut H. Hilger¹

¹ Freie Universität Berlin, Institut für Biologie – Botanik, Altensteinstraße 6, 14195 Berlin, Germany

² Departamento de Silvicultura, Facultad de Ciencias Forestales, Universidad de Chile, Santiago, Chile

Author for correspondence: Federico Luebert, fluebert@zedat.fu-berlin.de

Abstract The plate designated as lectotype of the name *Heliotropium arborescens* L. (1759) does not permit a precise application of the name. The herbarium material associated with that illustration was examined in order to clarify the identity of the type material and an epitype was selected. The epitype corresponds in morphology to the taxon called *Heliotropium urbanianum* K. Krause (1906) in the recent literature, which is here lectotypified and synonymized with *H. arborescens*. The name *Heliotropium arborescens* has been misapplied to a predominantly Peruvian species, which should now be correctly called *Heliotropium corymbosum* Ruiz & Pav. (1799). The epitypification here proposed will ensure nomenclatural stability for most material from cultivation, where the name *Heliotropium arborescens* is widely used.

Keywords *Boraginaceae*; Ecuador; *Heliotropiaceae*; Joseph De Jussieu; Peru; Philip Miller

■ INTRODUCTION

The most commonly cultivated species of the widespread genus *Heliotropium* L. is a shrubby species from South America that belongs to the Andean *Heliotropium* sect. *Heliothamnus* I.M. Johnston, and is usually known under the name *Heliotropium arborescens* L. (Linnaeus, 1759) or under its homotypic synonym *Heliotropium peruvianum* L. (Linnaeus, 1762; see Jarvis, 2007). The name *Heliotropium arborescens* L. was established on the basis of a plate by Miller (1757: pl. 144, erroneously cited by Linnaeus as plate 143, see McClintock & Fryxell, 1979). The plate (available on-line from the Digital Library of the Real Jardín Botánico of Madrid, http://bibdigital.rjb.csic.es/Imágenes/Of_MIL_Fig_Pl_1/MIL_Fig_Pl_1_247.pdf, accessed 11 Dec. 2009) was based on a plant cultivated at that time in the Chelsea Physic Garden, where Miller worked as gardener from 1722 to 1772 (Underwood, 1963). This plate was designated as lectotype for *H. arborescens* L. by Riedl (1997: 102; see Jarvis, 2007). Johnston (1928) indicated the presence of a herbarium specimen at BM, and considered it as the type of “Miller’s plant from the Chelsea Gardens”. However, the latter cannot be considered as a valid lectotypification, because in the description of *H. arborescens* by Linnaeus (1759) only the plate of Miller (1757: pl. 144) is cited, and there is no evidence that Linnaeus ever saw any of Miller’s specimens, to which Johnston (1928) refers. These specimens are thus not part of the original material. In consequence, the lectotypification by Riedl (1997) can not be superseded in spite of the presence of the herbarium specimens.

Heliotropium arborescens is the type of *Heliotropium* sect. *Heliothamnus*, a group of ca. eleven Andean and Central American species (Johnston, 1928; Förther, 1998) with a particularly complex taxonomy and difficult species delimitation. According to Johnston (1928), the morphology of the style stigma complex, as well as the presence of glandular trichomes on the surface of the ovary are the most important characters to key out the species within *Heliotropium* sect. *Heliothamnus*.

Unfortunately, the morphology of the gynoeceum is not depicted in the lectotype plate of Miller (1757: pl. 144), nor is it mentioned in the accompanying description. It therefore cannot be identified for the purposes of precise application of the name *Heliotropium arborescens*. It seems hence evident that the name *Heliotropium arborescens* needs to be unambiguously applied through the designation of an epitype. A suitable epitypification would be both nomenclaturally stabilizing and taxonomically clarifying. In this note, we establish the connection between Miller’s (1757) plate, and the specimens housed at BM mentioned by Johnston (1928) and select one of them as the epitype of *Heliotropium arborescens*.

■ MILLER’S SPECIMENS AND EPITYPIFICATION

There are three main sources of herbarium material of Miller’s plants (Britten, 1913; Stearn, 1972, 1974): (1) the Sloane Herbarium, (2) the Miller Herbarium, acquired by Joseph Banks after Miller’s death and (3) the specimens sent from the Chelsea Physic Garden to the Royal Society of London. All of them can now be found in the herbarium of the Natural History Museum in London (BM). Some additional specimens of Miller are also held at the Linnaean Herbarium, LINN (Stafleu & Cowan, 1981).

Since the first reference to *Heliotropium arborescens* in Miller’s works dates to 1757, it is not possible that any of Miller’s herbarium specimen of the species under study is found in the Sloane Herbarium, because it only contains plants given by Miller to Sloane between 1727 and 1739 (Dandy, 1958). Two specimens deposited in the general collection of BM correspond to the other two sources of Miller’s material: (1) One of them consists of a single fragment of a flowering branch and is labelled as sent to the Royal Society of London with the number 1770; according to Wilmer (1758), this number corresponds to a specimen that, holding the same name Miller gave to the plate

(Miller, 1757: pl. 144), was sent to the Royal Society of London in 1757, which is the same year Miller first published the plate. It is very likely that this specimen had been taken directly from the plant cultivated at Chelsea from which the plate was drawn. (2) The other material, doubtlessly conspecific with the latter, consists of several flowering branches; it probably was part of Miller's herbarium as it is labelled as "Hort. Chels." on the reverse side (Britten, 1913); it also has the annotations "Stylus breviformis" and "Mill. Dict. 6", which is the number of the species in subsequent editions of the *Gardeners Dictionary* (Miller, 1759, 1768). In the Linnaean Herbarium there is one specimen labelled as *Heliotropium peruvianum* (LINN 179.1; original not seen, digital photograph!); whether this specimen was obtained from Miller is not possible to ascertain, at least not from the letters from Miller in the Linnaean correspondence. In any case, Linnaeus published the name *Heliotropium peruvianum* only in 1762, so that this specimen should not be treated as original material of *Heliotropium arborescens*.

The two specimens deposited in the general collection of BM can be directly linked to Miller's plate. We have therefore chosen the better of them as the epitype of *Heliotropium arborescens*.

■ APPLICATION OF THE NAME *HELIOTROPIUM ARBORESCENS*

Kunth (1818), De Candolle (1845) and Bentham (1846: 233–240) explicitly considered *Heliotropium arborescens* (under the name *H. peruvianum*) to be a species from the Andes of Ecuador. However, Johnston (1928: 40) applied the name *Heliotropium arborescens* var. *arborescens* [as var. "genuinum"] to a species "from the region about Lima", Peru. Upon examination of Miller's specimens at BM, it becomes clear that they do not correspond to the plants "known only from the Department of Lima, Peru", as suggested by Johnston (1928: 40). They belong to a different species of *Heliotropium* sect. *Heliothamnus*, native to the Andes of southern Ecuador and northern Peru, as previous authors correctly assumed. Johnston (1928) referred the specimens corresponding to that taxon to *Heliotropium urbanianum* K. Krause, which should therefore be placed under the synonymy of *H. arborescens*. This latter taxon differs from the species from Lima in having a style shorter than or equal to the stigmatic head, calyx lobes acute, not long acuminate (Fig. 1A–B), leaves generally smaller and with the surface more rugose and with more deeply impressed veins, as well as a different geographic range (Johnston, 1928) and perfectly agrees with the Miller specimens in BM. Conversely, the taxon that is common in the area around Lima is characterized by having the style twice as long as the stigmatic head and by its acute and long acuminate sepals, especially in the fruiting stage (Fig. 1C–D). These characters coincide with the geographical origin, the description and the type material (B!, MA!) of *Heliotropium corymbosum* Ruiz & Pav. (Ruiz & Pavón, 1799), which is the oldest name available for this Peruvian species.

■ FORMAL NOMENCLATURE

Heliotropium arborescens L., Syst. Nat., ed. 10, 2: 913. 1759
= *Heliotropium peruvianum* L., Sp. Pl., ed. 2, 1: 187. 1762, nom. illeg. – Lectotype (designated by Riedl 1997: 102): [icon] "*Heliotropium, foliis ovato lanceolatis, spicis plurimis confertis caule fruticoso*" in Miller, Fig. Pl. Gard. Dict. 1: 96, t. 144. 1957. Epitype (designated here): Hort. Chels. N°1 [ex Herb. Miller] (BM [barcode N° BM000953070]).
= *Heliotropium urbanianum* K. Krause in Bot. Jahrb. Syst. 37: 633. 1906 – Holotype: Ecuador, in lichten Buschwerken um Pulilio [Pelileo] und Cuero [Quero], int[...?] Thal von Amboto [Ambato] 2300–2800 m, F.C. Lehmann 5779 (B, destroyed [photo F. neg nr. 17349!]) – Lectotype (designated here): Ecuador, Pelileo and Quero, valley of the Ambato, 2300–2800 m, F.C. Lehmann 5779 (K!; duplicates of the lectotype: F!, US!).

■ *HELIOTROPIUM ARBORESCENS* IN HORTICULTURE

In cultivation the application of the name *Heliotropium arborescens* is considerably more complex than in the wild, partly because of the history of its cultivation, partly because characters such as leaf size and pubescence are variable in cultivation (e.g., Anonymous, 1884) and because of the existence of both interspecific hybrids and horticultural varieties (Anonymous, 1849; Morren, 1852; Bailey, 1909; Randhawa & Mukhopadhyay, 1986). The publication of the Miller's (1757) plate is the first mention of the species in cultivation in Europe. From this, and the fact that Miller did not mention this species in previous editions of the *Gardeners Dictionary* (Miller 1752, 1754), it must be assumed that the plant was introduced into Europe sometime during the first half of the 1750s (see Stearn, 1974). The species was rapidly propagated and distributed to other gardens across Europe (e.g., Curtis, 1790; Trattinnick, 1816; see Appendix for selected specimens from cultivation).

The introduction of *Heliotropium corymbosum* took place in 1808 (Donn, 1811; Redouté, 1833; Morren, 1852) and it was also soon propagated in the gardens of Europe. Donn (1811), Bonpland (1813), Sims (1814), Loiseleur-Deslongchamps (1817), Schrank (1817), Redouté (1833), Morren (1852) and Bailey (1909) report the cultivation of *Heliotropium corymbosum* (or its synonym *Heliotropium grandiflorum* Donn ex Schrank; fide De Candolle, 1845; Johnston, 1928; Förther, 1998). However, *H. corymbosum* was apparently not cultivated as widely as *H. arborescens* and may have soon been lost again from cultivation (see Appendix for selected specimens from cultivation)—we have not seen modern material of *H. corymbosum* from horticulture. However, artificial crossings to obtain hybrids between *Heliotropium arborescens* and *Heliotropium corymbosum* were undertaken as early as 1815 ("*Heliotropium* × *hybridum*" = *H. arborescens* × *H. corymbosum*; Morren, 1852), and some plants later cultivated may go back to hybrid stock. Moreover, Anonymous (1849) and

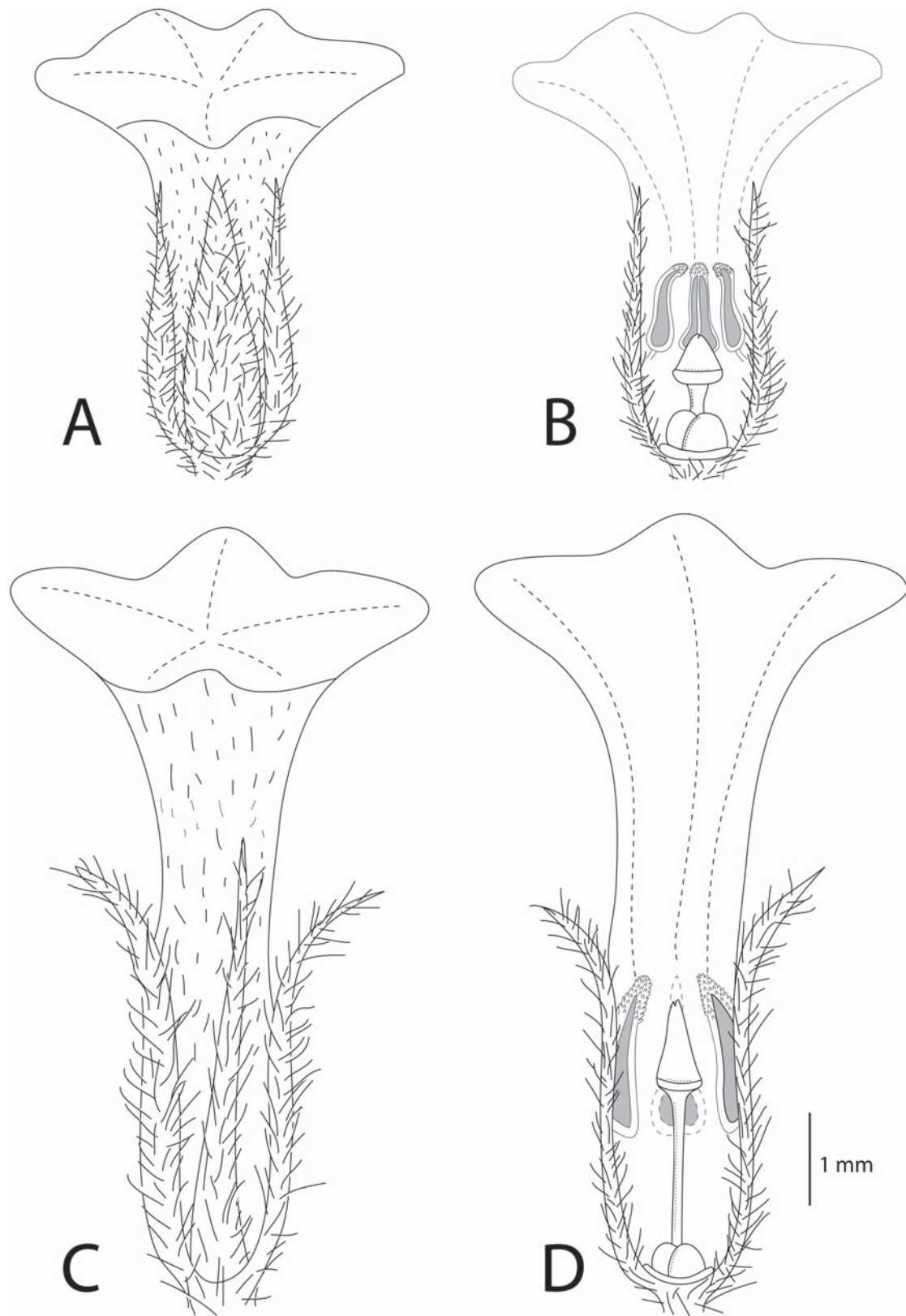


Fig. 1. Flower morphology of *Heliotropium arborescens* L. and *Heliotropium corymbosum* Ruiz & Pav. **A–B**, *H. arborescens*, from the Andes of southern Ecuador (Prov. Tungurahua, Ambato and Baños); = *Heliotropium urbanianum* K. Krause sensu Johnston (1928); it corresponds to Miller's material at BM; from *Lehmann 362a* (G). **C–D**, *H. corymbosum*, from the region about Lima (Depto. Lima, Pachacamac); = *Heliotropium arborescens* L. sensu Johnston (1928); from *Weigend & Förther 97/550* (BSB).

Morren (1852) provide evidence of the existence of horticultural varieties that were circulated in the horticulture at least as early as 1850, but it remains unclear whether these are of hybrid origin, or represent selections based on morphologically aberrant seedlings or newly introduced wild accessions. The situation is further complicated by the introduction of additional species of *Heliotropium* sect. *Heliothamnus* into Europe during the second half of the nineteenth century; for instance, *Heliotropium submolle* Klotzsch (1852) and *H. argenteum* Lehm. (Anonymous, 1884), which may have also been used to generate hybrids.

During the twentieth century the cultivation of the garden heliotrope became common around the world. Most regional taxonomic revisions mention it as *Heliotropium arborescens* or *Heliotropium peruvianum* (e.g., Johnston, 1951; Frohlich, 1982; Verdcourt, 1991; Riedl, 1997, but see Britton & Wilson, 1930). Consequently, all herbarium material from cultivated plants is generally referred to *Heliotropium arborescens* (or *H. peruvianum*), regardless of flower morphology. In order to clarify this aspect and to illustrate the historical application of the names *Heliotropium arborescens* (*peruvianum*) and *H. corymbosum* (*grandiflorum*) we provide some examples from herbarium specimens taken from plants in cultivation with their original determinations (Appendix). From the examples given in the Appendix, it seems that both names, *Heliotropium arborescens* and *H. corymbosum*, were quite consistently applied during the nineteenth century. Most modern material from horticulture agrees with the type of *Heliotropium arborescens*, but we can not discard the possibility that some cultivated strains ultimately go back to artificial hybrids/backcrosses. Johnston's (1928) definition of *Heliotropium arborescens* (as identical to *H. corymbosum* from Peru) would necessitate a name change for the (majority of the) cultivated material, which would then have to be called *H. urbanianum*. Since the name *H. arborescens* is widely (and in our view correctly) used for the domesticated species in horticulture this would be contrary to Art. 57.1. of the ICBN (McNeill & al., 2006). The epitypification and re-definition of *H. arborescens* here proposed based on morphological evidence thus also contributes to the stabilization of a widely used and commonly known taxon name.

■ ACKNOWLEDGEMENTS

Federico Luebert thanks the support of a visiting scholar award at Smithsonian Institution and the German Academic Exchange Service (DAAD). This research received support from the Synthesys project <http://www.synthesys.info> which is financed by European Community Research Infrastructure Action under the FP6 "Structuring the European Research Area" Programme (grant GB-TAF 4514) and the FP7 "Capacities" Programme (grant ES-TAF 136). We are grateful to Maarten Christenhusz who suggested the publication of this note, the valuable help of Charlie Jarvis, Sandra Knapp, Armando Mendez (BM), Carlos Aedo, Félix Muñoz-Garmendia, Charo Noya (MA), and the curators of A, AAU, B, BM, BSB, F, G, GH, K, M, MA, MO, MSB, QCA and US. The valuable suggestions of Federico Selvi, John McNeill and two anonymous reviewers are gratefully acknowledged.

■ LITERATURE CITED

- Anonymous. 1849. *Heliotropium peruvianum voltaireanum*. *Praxt. Bot. Mag.* 16: 99.
- Anonymous. 1884. A new heliotrope. *Gard. Chron.* 22: 808–809.
- Bailey, L.H. 1909. *Cyclopedia of American horticulture*, vol. 2. New York: Macmillan.
- Bentham, G. 1846. *Plantas hartwegianas*. London: Pamplin.
- Bonpland, A. 1813. *Description des plantes rares cultivees a Malmaison et a Navarre*. Paris: De l'Imprimerie de P. Didot l'aîné.
- Britten, J. 1913. Philip Miller's plants. *J. Bot.* 51: 132–135.
- Britton, N.L. & Wilson, P. 1930. *Scientific survey of Porto Rico and the Virgin Islands*, vol. 6. New York: New York Academy of Sciences.
- Curtis, W. 1790. *Heliotropium peruvianum*. *Bot. Mag.* 4: 141.
- Dandy, J.E. 1958. *The Sloane Herbarium*. London: British Museum (Natural History).
- De Candolle, A.P. 1845. *Prodromus systematis naturalis regni vegetabilis*, vol. 9. Paris: Treuttel & Würtz.
- Donn, J. 1811. *Hortus cantabrigiensis*, 6th ed. Cambridge: White.
- Förther, H. 1998. Die infragenerische Gliederung der Gattung *Heliotropium* L. und ihre Stellung innerhalb der subfam. *Heliotropioideae* (Schröd.) Arn. (*Boraginaceae*). *Sendtnera* 5: 35–241.
- Frohlich, M.W. 1981. *Heliotropium*. Pp. 70–104 in: Gómez-Pompa, A. (ed.), *Flora de Veracruz*, vol. 18. Xalapa: Instituto Nacional de Investigaciones sobre Recursos Bióticos.
- Jarvis, C. 2007. *Order out of chaos: Linnaean plant names and their types*. London: The Linnean Society of London and Natural History Museum.
- Johnston, I.M. 1928. Studies in the *Boraginaceae* VII. The South American species of *Heliotropium*. *Contr. Gray Herb.* 81: 3–73.
- Johnston, I.M. 1951. Studies in the *Boraginaceae* XX. Representatives of three subfamilies in eastern Asia. *J. Arnold Arbor.* 32: 1–26, 99–122.
- Klotzsch, F. 1852. *Heliotropium submolle*, eine neue Art aus dem Freistaate Ecuador. *Allg. Gartenzeitung (Otto & Dietrich)* 20: 89–91.
- Kunth, K.S. 1818. *Nova genera et species plantarum*, vol. 3. Paris.
- Linnaeus, C. 1759. *Systema naturae*, 10th ed., vol. 2. Stockholm: Laurentius Salvius.
- Linnaeus, C. 1762. *Species plantarum*, 2nd ed., vol. 1. Stockholm: Laurentius Salvius.
- Loiseleur-Deslongchamps, J.L.A. 1817. *Herbier général de l'amateur*, vol. 2. Paris: Audot.
- McClintock, E.M. & Fryxell, P.A. 1979. The rare third edition (1809) of Philip Miller's *Figures ... Huntia* 3: 127–148.
- Miller, P. 1752. *The gardeners dictionary*, 6th ed. London: printed for the author.
- Miller, P. 1754. *The gardeners dictionary: Abridged from the folio edition*, 4th ed. London: printed for the author.
- Miller, P. 1757. *Figures of the most beautiful, useful, and uncommon plants described in the Gardeners Dictionary*. London: printed for the author.
- Miller, P. 1759. *The gardeners dictionary*, 7th ed. London: printed for the author.
- Miller, P. 1768. *The gardeners dictionary*, 8th ed. London: printed for the author.
- Morren, M.C. 1852. L'Heliotrope Princesse Charlotte. *Belgique Hort.* 2: 37–40.
- Randhawa, G.S. & Mukhopadhyay, A. 1986. *Floriculture in India*. New Delhi: Allied Publishers.
- Redouté, P.J. 1833. *Choix de plus belles fleurs et des plus beaux fruits*. Paris: Panckoucke.
- Riedl, H. 1997. *Boraginaceae*. Pp. 43–144 in: Kalkman, C., Kirkup, D.W., Nooteboom, H.P., Stevens, P.F. & de Wilde, W.J.J.O. (eds.), *Flora malesiana, Series I—Seed plants*, vol. 13. Leiden: Rijksherbarium/Hortus Botanicus.
- Ruiz, H. & Pavón, J. 1799. *Flora peruviana, et chilensis*, vol. 2. Madrid: Typis Gabrielis de Sancha.

"Praxt" ??? - please spell out

- Schrank, F.v.P.** 1817. *Plantae rariores horti academici monacensis*, vol. 1. Munich: Venditur in Instituto lithographico Scholae festivalis.
- Sims, J.** 1814. *Heliotropium corymbosum*. *Bot. Mag.* 39: 1609.
- Stafleu, F.A. & Cowan, R.S.** 1981. *Taxonomic literature*, 2nd ed., vol. 3. The Hague: Junk.
- Stearn, W.T.** 1972. Philip Miller and the plants from Chelsea Physic Garden presented to the Royal Society of London, 1723–1796. *Trans. Bot. Soc. Edinburgh* 41: 293–307.
- Stearn, W.T.** 1974. Miller's *Gardeners Dictionary* and its abridgement. *J. Soc. Bibliogr. Nat. Hist.* 7: 125–141.
- Trattinnick, L.** 1816. *Freye Auswahl einzelner Pflanzenabbildungen in schwarzen Kupfern*, vol. 4. Vienna: Arrebmam.
- Underwood, E.A.** 1963. *A history of the Worshipful Society of Apothecaries*. London: Oxford Univ. Press.
- Verdcourt, B.** 1991. *Boraginaceae*. Pp. 1–124 in: Polhill, R.M. (ed.), *Flora of tropical East Africa*. Kew: Royal Botanic Gardens.
- Wilmer, J.** 1758. A catalogue of the fifty plants from Chelsea Garden, presented to the Royal Society by the Worshipful Company of Apothecaries, for the year 1757, pursuant to the direction of Sir Hans Sloane, Baronet, Med. Reg. & Soc. Reg. Nuper Praeses. *Philos. Trans., Ser. B.* 50: 648–651.

Appendix. Specimens from cultivation of *H. arborescens*, *H. corymbosum* and putative interspecific hybrids; “o.d.” indicates original determination.

***Heliotropium arborescens* L.** (style shorter than or equal to the stigmatic heads; agreeing with Miller's specimens): cultivated in Madrid, Spain, 1800 (MA [o.d. *H. peruvianum*]); cultivated in Madrid, Spain, 1805 (MA [o.d. *H. peruvianum*]); cultivated in Madrid, Spain, 1808 (MA [o.d. *H. peruvianum*]); cultivated in Lausanne, Switzerland, 1811 (K [o.d. *H. peruvianum*]); cultivated in Toulon, France, 1819 (K [o.d. *H. grandiflorum*]); cultivated in England, 1819 (K [o.d. *H. peruvianum*]); cultivated in Bonn, Germany, 1821 (B [o.d. *H. corymbosum*]); cultivated in Bonn, Germany, 1830 (B [det. as *H. voltairianum* Hort.]); cultivated in Bonn, Germany, 1841 (B [o.d. *Heliotropium*]); cultivated in Nantes, France, 1842 (BM [det. as *H. peruvianum* var. *voltairianum*]); cultivated in Berlin, Germany, 1898 (B [o.d. *H. peruvianum*]); cultivated in Kenya, 1953 (K [o.d. *H. corymbosum*]); cultivated in Berlin, Germany, 1975 (B [o.d. *H. arborescens*]); cultivated in Berlin, Germany, 1988 (B [o.d. *H. arborescens*]); cultivated in Buenos Aires, Argentina, 1993 (BSB [o.d. *H. peruvianum*]); cultivated in Asturias, Spain, 2001 (MA [o.d. *H. arborescens*]); cultivated in Kew, England, 2003 (K [o.d. *H. arborescens*]); cultivated in Malaga, Spain, 2004 (MA [o.d. *H. arborescens*]); cultivated in South Carolina, U.S.A., 2006 (BSB [o.d. *Heliotropium*]).

***Heliotropium corymbosum* Ruiz & Pav.** (style longer than the stigmatic heads): cultivated in Nantes, France, 1816 (K [o.d. *H. corymbosum*]); cultivated in Lisbon, Portugal, 1840 (BM [o.d. *H. peruvianum*]); cultivated in Paris, France, 1841 (MA o.d. *H. grandiflorum*); cultivated in Munich, Germany, 1841 (M [o.d. *H. grandiflorum*]).

Putative interspecific hybrids: cultivated (Herb. Déséglise), 1817 (BM [o.d. *H. peruvianum*]); cultivated in Saxony, Germany, 1896 (B [o.d. *H. peruvianum*]).