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Taxonomic revision of Bromeliaceae subfam. Tillandsioideae based on a multi-locus DNA sequence phylogeny and morphology

MICHAEL H.J. BARFUSS[1,*], WALTER TILL[1], ELTON M.C. LEME[2], JUAN P. PINZÓN[3], JOSÉ M. MANZANARES[4], HEIDEMARIE HALBRITTER[1], ROSABELLE SAMUEL[1] & GREGORY K. BROWN[5]

[1]*Department of Botany and Biodiversity Research, Faculty of Life Sciences, University of Vienna, Rennweg 14, 1030 Vienna, Austria; michael.h.j.barfuss@univie.ac.at; walter.till@univie.ac.at; heidemarie.halbritter@univie.ac.at; mary.rosabella.samuel@univie.ac.at*

[2]*Herbarium Bradeanum (HB), Rio de Janeiro, Brazil; leme@tjrj.jus.br*

[3]*Departamento de Botánica, Campus de Ciencias Biológicas y Agropecuarias, Universidad Autónoma de Yucatán, Carretera Mérida-Xmatkuil Km. 15.5, Apdo. Postal: 4-116 Itzimná, C.P: 97100, Mérida, Yucatán, México; juan.pinzone@uady.mx*

[4]*Herbario Nacional (QCNE), Sección Botánica del Museo Ecuatoriano de Ciencias Naturales del Instituto Nacional de Biodiversidad, Quito, Ecuador, Casilla Postal 17-09-7518, Quito, Ecuador; jose_manzanares@hotmail.com*

[5]*Department of Botany 3165, University of Wyoming, 1000 E. University Ave., Laramie, WY 82071-3165, USA; GKBrown@uwyo.edu*

**Corresponding author: michael.h.j.barfuss@univie.ac.at*

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MICHAEL H.J. BARFUSS, WALTER TILL, ELTON M.C. LEME, JUAN P. PINZÓN, JOSÉ M. MANZANARES, HEIDEMARIE HALBRITTER, ROSABELLE SAMUEL & GREGORY K. BROWN
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Abstract

A taxonomic revision of Bromeliaceae subfam. Tillandsioideae is presented based on a multi-locus DNA sequence phylogeny (viz., plastid DNA loci *rpoB-trnC-petN*, *trnK-matK-trnK*, and *ycf1*, and the nuclear DNA gene *PHYC*) and new or re-evaluated morphology (e.g., leaf, inflorescence, sepal, petal, ovary, stigma, stamen, pollen, ovule, and seed morphology). This enables the circumscription of monophyletic units using synapomorphic combinations of diagnostic morphological characters. Stigma morphology has proven to be indicative for super-specific taxa in Tillandsioideae. One new stigma type and several subtypes of previously described stigmas were found. The four tribes proposed earlier are mostly confirmed, but Catopsideae replaces the formerly used name Pogospermeae for the monotypic tribe of *Catopsis*. In addition, the two new subtribes Cipuropsidinae and Vrieseinae are proposed within tribe Vrieseeae. Several new genera are established to render taxonomic units monophyletic and morphologically well circumscribed. They represent segregates of either *Mezobromelia* (*Gregbrownia*: 4 spp.), *Tillandsia* (viz., *Barfussia*: 3 spp., *Josemania*: 5 spp., *Lemeltonia*: 7 spp., *Pseudalcantarea*: 3 spp., and *Wallisia*: 4 spp. and 1 hybrid), or *Vriesea* (viz., *Goudaea*: 2 spp., *Jagrantia*: 1 sp., *Lutheria*: 4 spp., *Stigmatodon*: 18 spp., and *Zizkaea*: 1 spp.). The new subgenera *Tillandsia* subg. *Pseudovriesea* and *T.* subg. *Viridantha* are established, and *T.* subg. Aerobia is resurrected. An identification key to all accepted genera of Bromeliaceae subfam. Tillandsioideae is provided. Furthermore, to clarify nomenclatural uncertainties, typifications are proposed for *Catopsis* subg. *Tridynandra*, *Thecophyllum* [unranked] *Biflorae*, *Tillandsia* subg. *Aerobia*, *T.* sect. *Caricifoliae*, *T.* sect. *Conostachys*, *T.* sect. *Cyathophora*, *T.* sect. *Eriophyllum*, *T.* sect. *Macrocyathus*, *T.* sect. *Platystachys* Baker *auct. non al.*, *Tillandsia* sect. *Strepsia, Vriesea* subg. *Conostachys* Mez *auct. non al., T. lindenii* K. Koch *auct. non al.*, and *T. macropetala*.

Key words: Synapomorphic combination of diagnostic morphological characters; *trnK-matK-trnK*; Nomenclature; *PHYC*; *rpoB-trnC-petN*; Taxonomy; *Tillandsia*; Typification; *Vriesea*; *ycf1*

Introduction

Bromeliaceae subfam. Tillandsioideae Harms is the largest of the eight currently established subfamilies (Givnish *et al.* 2007, 2011) and comprises *c*. 1403 species in nine genera (e.g., Gouda *et al*. cont. updated, Grant & Zijlstra 1998, Luther 2008, 2010, 2012, 2014, Till 2000a, Smith & Till 1998). While its monophyly is confirmed in all published DNA sequence phylogenies (e.g., Barfuss 2006, 2012, Barfuss *et al.* 2004, 2005a, Crayn *et al.* 2004, 2015, Escobedo-Sarti *et al.* 2013, Givnish *et al.* 2007, 2011, 2014, Horres *et al.* 2000, Schulte *et al.* 2005, Terry *et al.* 1997a, b), the generic, subgeneric and/or sectional classification has remained controversial. For example, in the latest monograph (Smith & Downs 1977) six genera are accepted: *Catopsis* Griseb., *Glomeropitcairnia* (Mez) Mez, *Guzmania* Ruiz & Pav., *Mezobromelia* L.B. Sm., *Tillandsia* L., and *Vriesea* Lindl. The diagnostic morphological characters used in certain combinations to differentiate among these genera include ovary position, development and mature form of seed appendages, flower disposition, degree of petal connation/conglutination, and the presence/absence of petal appendages, exactly as they had been used in the monographs of Mez (1896, 1935). Their application as synapomorphic combinations of diagnostic characters to delimit monophyletic ('natural') units was soon questioned in the subsequent literature (e.g., Brown & Gilmartin 1984, 1988, 1989, Brown & Terry 1992, Gardner 1982, 1986), but with no taxonomic consequences. Only later did new or re-evaluated morphological evidence lead to the description or resurrection of four additional genera, all segregates from either *Tillandsia* [i.e., *Racinaea* M.A. Spencer & L.B. Sm., Spencer & Smith 1993, and *Viridantha* Espejo, Espejo-Serna 2002] or *Vriesea* [i.e., *Alcantarea* (E. Morren ex Mez) Harms, and *Werauhia* J.R. Grant, Grant 1995a]. However, an inclusive re-evaluation of the remaining species in the still very heterogeneous and species-rich genera *Tillandsia* and *Vriesea* has never been conducted. *Alcantarea*, *Racinaea*, and *Werauhia* became generally accepted (Smith & Till 1998, Till 2000a), whereas *Viridantha* was only rarely considered to be distinct from *Tillandsia* (Espejo-Serna *et al.* 2007, López-Ferrari & Espejo-Serna 2009). The attempt of Betancur & Miranda-Esquivel (1999) to resurrect *Sodiroa* André from *Guzmania*, also was not accepted. Recently, Gomes-da-Silva & Costa (2013) published an overview of the taxonomy and phylogenetic history of Tillandsioideae genera.
A number of DNA sequence phylogenetic studies have included members of Tillandsioideae aiming to address their relationships (e.g., Crayn *et al.* 2004, Givnish *et al.* 2004, 2007, 2011, 2014, Horres *et al.* 2000, Ranker *et al.* 1990, Terry & Brown 1996, Terry *et al.* 1997a, b). These showed the incongruences between DNA sequence data

and taxonomy, but included a limited number of species and suffered from an extremely low number of informative DNA sequence characters. Each mostly concludes that other DNA loci with higher variability, and a greater number of species are needed to draw well-supported taxonomic conclusions. Other phylogenetic DNA studies focused on understanding the evolution of specific species complexes and contributed to the circumscription of these, but do not include a greater sample of other Tillandsioideae (e.g., Castello *et al.* 2016, Chew *et al.* 2010, Granados-Mendoza 2008, Pinzón *et al.* 2016, Versieux *et al.* 2012).

Our earliest phylogenetic investigations of Bromeliaceae subfam. Tillandsioideae, based solely on plastid DNA sequence data (Barfuss *et al.* 2001, 2003, 2004), have already resulted in a new tribal classification (Barfuss *et al.* 2005a, Barfuss 2006). The monophyly, and thus concepts of *Catopsis*, *Glomeropitcairnia*, and *Guzmania sensu* Smith & Downs (1977) are supported. However, *Mezobromelia*, *Tillandsia* and *Vriesea* are para- and polyphyletic, and the concepts of four proposed genera (*Alcantarea*, *Racinaea*, *Viridantha* and *Werauhia*) are problematic, when the remaining species within *Tillandsia* and *Vriesea* are taken into account. New taxonomic circumscriptions and morphological descriptions would have been necessary, but no taxonomic rearrangements were proposed in Barfuss *et al.* (2005a) due to a limited taxon sampling, unclear morphological evidence, low sequence divergence in the investigated plastid DNA loci, and the lack of nuclear DNA sequences, like in the previous studies. Subsequent studies tried to overcome these drawbacks (Barfuss *et al.* 2005b, 2008a, b, Till & Barfuss 2006). The preliminary results were presented at international conferences (Barfuss *et al.* 2011, 2013, 2015, Barfuss & Till 2011) and in the dissertation thesis of Barfuss (2012) including a preliminary phylogeny largely based on the two nuclear DNA genes Phytochrome C (*PHYC*) and Phosphoribulokinase (*PRK*), which is shown in Fig. 9 (see supplementary data).

We are here proposing a taxonomic revision at the tribal, subtribal, generic and partly subgeneric levels based on new or re-evaluated morphological and more variable DNA sequence data. Morphologically well-defined and monophyletic lineages in the tribes Vrieseeae and Tillandsieae are formally recognised. The main goals are to provide a stable classification based on monophyletic established genera, and new taxa (genera and subgenera) using new synapomorphic combinations of diagnostic morphological characters, provide a key for generic identification, and a comprehensive nomenclature for the accepted genera, including full synonymy. This should facilitate future studies of the phylogeny in evolutionary, biogeographic, and other biological aspects, as well as encourage detailed studies of individual groups.

Material and methods

Taxon sampling

Plant material for the phylogenetic investigations was selected based on the results of Barfuss *et al.* (2005a) and Barfuss (2012). The latter included 447 terminals (representing 356 species and infraspecific taxa), where a preliminary phylogenetic tree is shown in Fig. 9 (see supplementary data). The current study includes a subset of these, plus several new samples (totalling 210 terminals that cover 195 species and infraspecific taxa). Sample selection was done by selecting at least three accessions per major subclade including species of earlier and more recent nodes and eliminating species with an evident phylogenetic placement, by including taxa with critical geographic distributions, species with a crucial morphology, and new taxa of uncertain placement. We also tried to include all relevant type species for ranks above the species level, but lack the taxonomically important *Cipuropsis subandina* Ule [type and only species of *Cipuropsis* Ule, syn. *Vriesea subandina* (Ule) L.B. Sm. & Pittendr.]. This species is not known in cultivation and was not recently found in its natural habitat. Furthermore, we sometimes had to rely on plants of unknown origin, but had been correctly identified and vouchered, because no recent collections were known, or because of conservation concerns in their natural environments. For the latter reason detailed information of the exact locality for field-collected material was omitted. Appendix 1 lists all used DNA accessions with details (source, collector, specimen voucher information, location), including taxon authorities and GenBank accession numbers (NCBI). It should be noted that the sample *Mezobromelia pleiosticha* (Griseb.) Utley & H. Luther (DNA № B15 = MB-15) that was nested in *Guzmania* in Barfuss *et al.* (2005a) turned out to be *G. variegata* L.B. Sm., most probably due to a labelling confusion in the botanical garden (see Fig. 9, supplementary data).

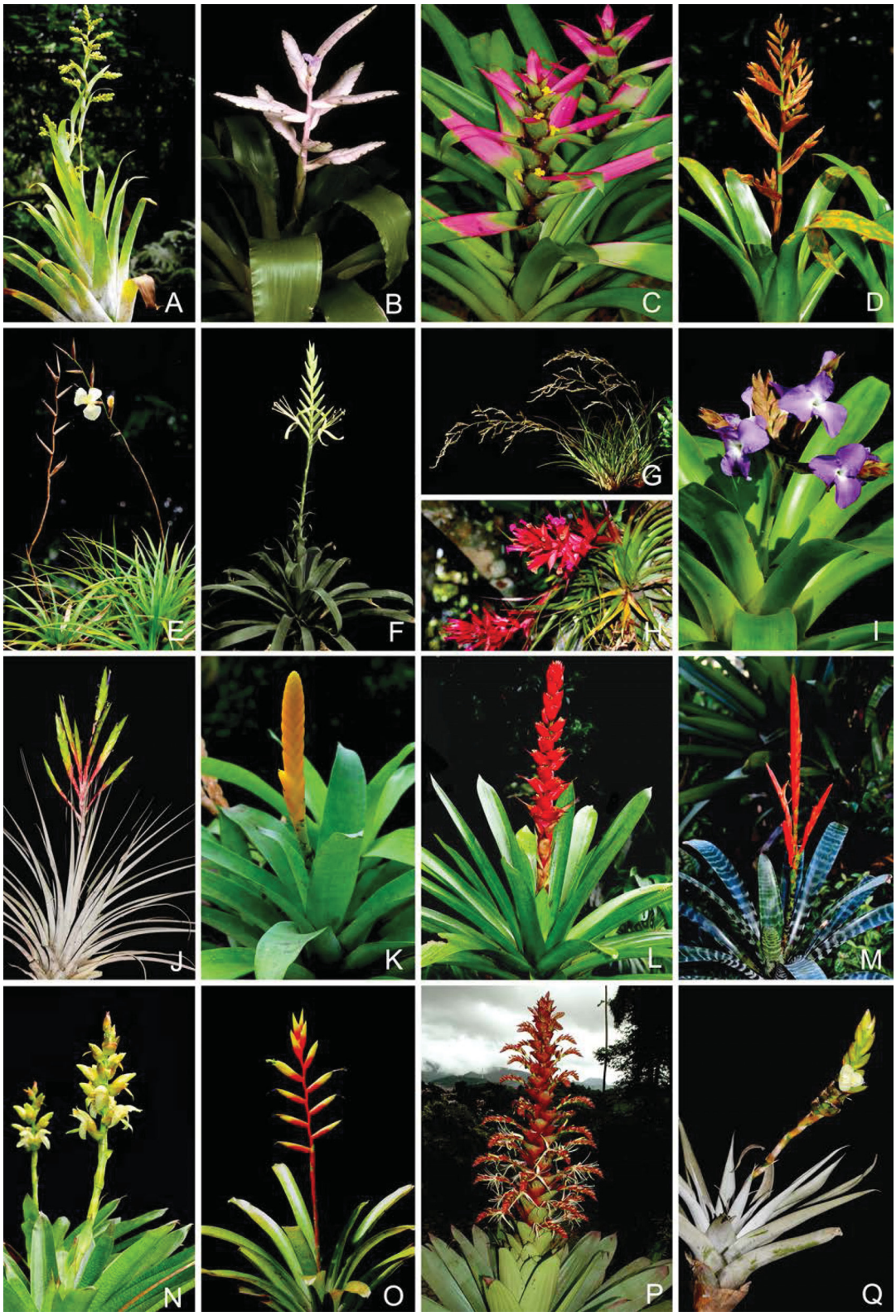

FIGURE 1. Habit of selected Tillandsioideae. **Habit (adult)**: m = mesomorphic, sx = semi-xeromorphic, x = xeromorphic. **Central tank (adult)**: a = absent, p = present. **A.** *Catopsis hahnii* (*Leme 2482*; m, p). **B.** *Barfussia wagneriana* (*Takizawa s.n.*; m, p). **C.** *Guzmania kareniae* (*Leme 3439*; m, p). **D.** *Josemania singularis* (*Leme 2838*; m, p). **E.** *Lemeltonia dodsonii* (*Leme 2523*; sx, a). **F.** *Pseudalcantarea viridiflora* (*Takizawa s.n.*; m, p). **G.** *Racinaea pugiformis* (*Leme 5180*; m, a). **H.** *Tillandsia geminiflora* (*Leme s.n.*; sx, a). **I.** *Racinaea hamaleana* (*Leme 7319*; m, p). **J.** *Tillandsia fasciculata* s.l. (*Leme 4833*; x, a). **K.** *Goudaea chrysostachys* (*Leme 2509*; m, p). **L.** *Mezobromelia capituligera* (*Leme 5111*; m, p). **M.** *Lutheria glutinosa* (*Leme 2525*; m, p). **N.** *Werauhia nephrolepis* (*Leme 3955*; m, p). **O.** *Vriesea psittacina* (*Leme 7075*; m, p). **P.** *Alcantarea imperialis* (*Leme 304*; m, p). **Q.** *Stigmatodon euclidianus* (*Leme 5712* sx, p).

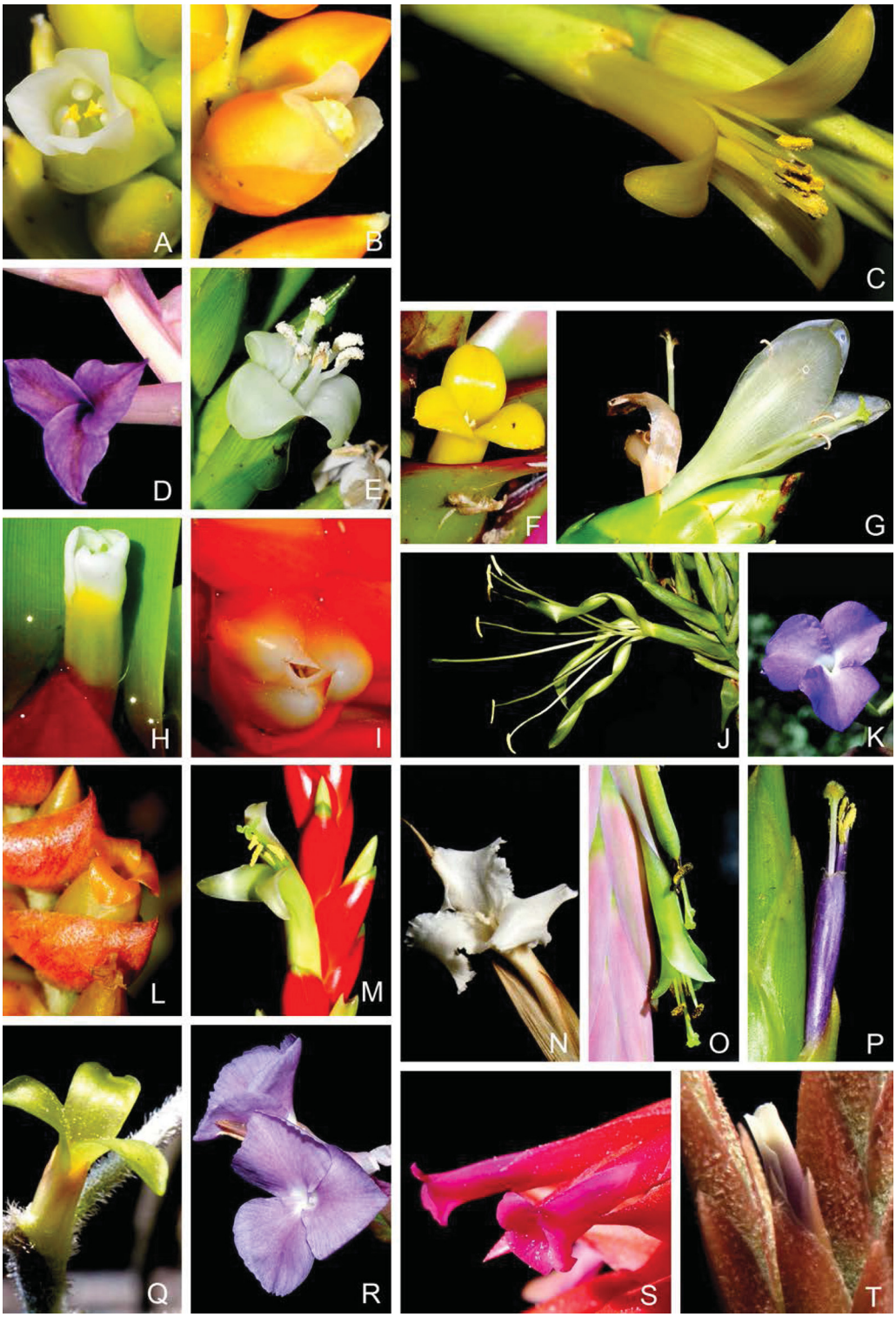

FIGURE 2. Corolla types in Tillandsioideae. **A.** *Catopsis hahnii* (*Leme 2482*; urceolate). **B.** *Catopsis pisiformis* (*Leme 2410*; urceolate); **C.** *Gregbrownia lyman-smithii* (*Leme 4655*; tubular with spreading petal blades); **D.** *Barfussia laxissima* (*Takizawa s.n.*; salverform); **E.** *Guzmania patula* (*Leme 4062*; tubular with recurved petal blades); **F.** *Guzmania kareniae* (*Leme 3439*; tubular with spreading petal blades); **G.** *Guzmania cylindrica* (*Leme 4586*; tubular with enlarged, erect, slightly divergent petal blades); **H.** *Guzmania sanguinea* var. *comosa* (*Leme 3253*; tubular with cucullate petal tips); **I.** *Guzmania musaica* (*Leme 3538*; tubular with cucullate petal tips). **J.** *Pseudalcantarea viridiflora* (*Takizawa s.n.*; tubular with spreading, helicoiform petal blades). **K.** *Racinaea hamaleana* (*Leme 7319*; salverform); **L.** *Racinaea crispa* (*Leme 2437*; urceolate). **M.** *Tillandsia malzinei* (*Leme 361*; tubular with recurved petal blades). **N.** *Tillandsia xiphioides* (*Takizawa s.n.*; salverform). **O.** *Tillandsia incurva* (*Leme 7299*; tubular with divergent petal tips). **P.** *Tillandsia fasciculata* s.l. (*Leme 4833*; tubular). **Q.** *Tillandsia usneoides* (*Leme 306*; tubular with spreading petal blades). **R.** *Tillandsia graomogulensis* (*Leme 1489*; salverform). **S.** *Tillandsia geminiflora* (*Leme s.n.*; tubular with spreading petal tips). **T.** *Tillandsia tectorum* (*Takizawa s.n.*; tubular).

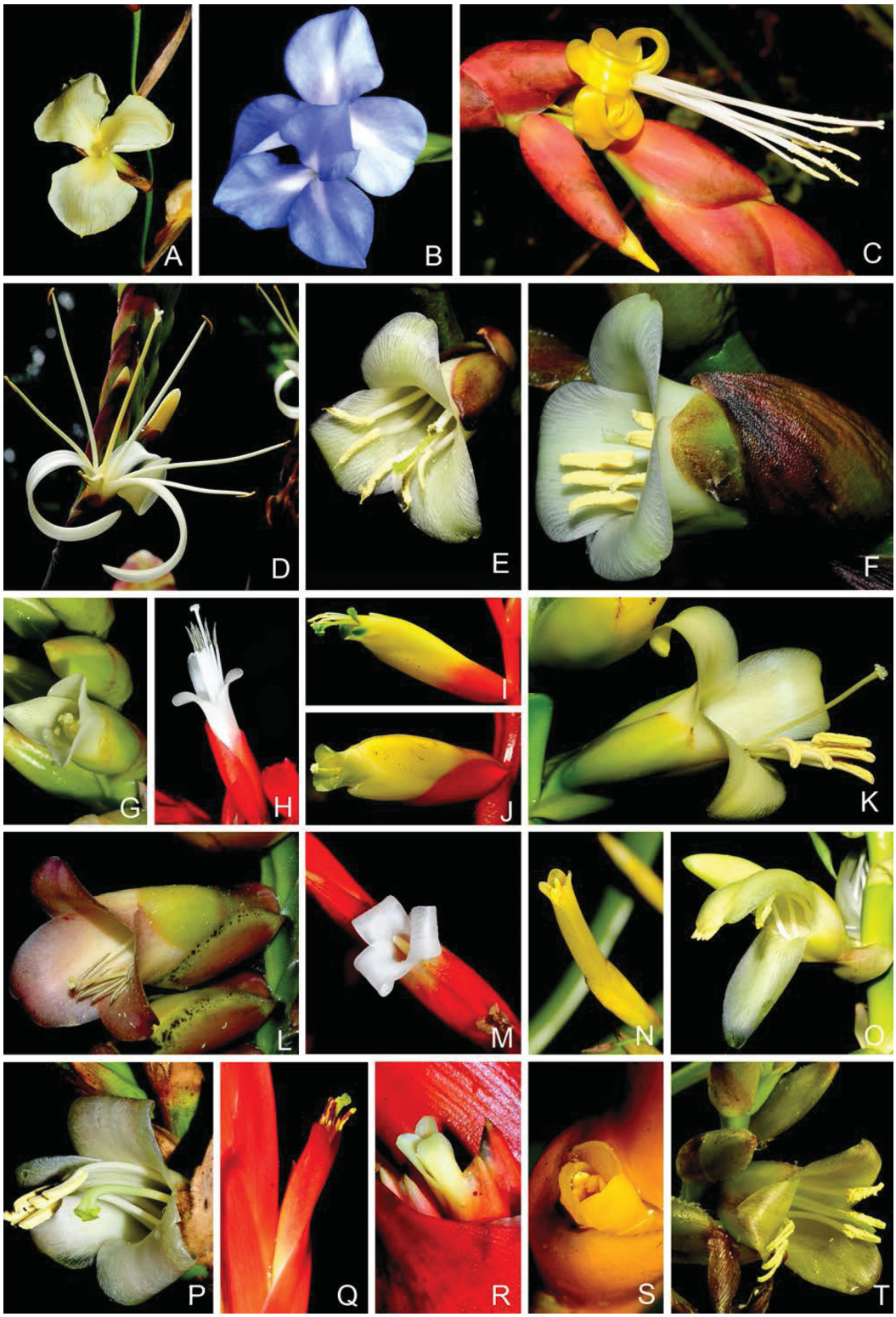

FIGURE 3. Corolla types in Tillandsioideae (continued). **A.** *Lemeltonia dodsonii* (*Leme 2523*; salverform). **B.** *Wallisia lindeniana* (*Barfuss s.n.*; salverform). **C.** *Alcantarea farneyi* (*Leme 1910*; tubular with strongly recurved petal blades). **D.** *Alcantarea roberto-kautskyi* (*Leme 3866*; tubular with strongly recurved petal blades). **E.** *Stigmatodon plurifolius* (*Leme 6997*; campanulate). **F.** *Stigmatodon apparicianus* (*Leme 7379*; campanulate). **G.** *Stigmatodon amadoi* (*Leme 5953*; campanulate). **H.** *Vriesea flammea* (*Leme 5471*; tubular with spreading petal tips). **I.** *Vriesea psittacina* (*Leme 7075*; tubular). **J.** *Vriesea platynema* (*Leme 1670*; tubular). **K.** *Vriesea saxicola* (*Leme 5236*; campanulate). **L.** *Vriesea pseudoatra* (*Leme 3917*; campanulate). **M.** *Vriesea* (‘*Cipuropsis*’) *elata* (*Leme 743*; tubular with recurved petal blades). **N.** *Vriesea breviscapa* (*Leme 8235*; tubular). **O.** *Werauhia nephrolepis* (*Leme 3955*; cup-shaped base and one petal blade spreading, the other two forming a hood). **P.** *Werauhia gladioliflora* (*Leme 3967*; campanulate). **Q.** *Lutheria glutinosa* (*Leme 2525*; tubular). **R.** *Mezobromelia capituligera* (*Leme 5111*; tubular). **S.** *Goudaea chrysostachys* (*Leme 2509*; tubular with cucullate petal tips). **T.** *Zizkaea tuerckheimii* (*Gouda s.n.*; campanulate).

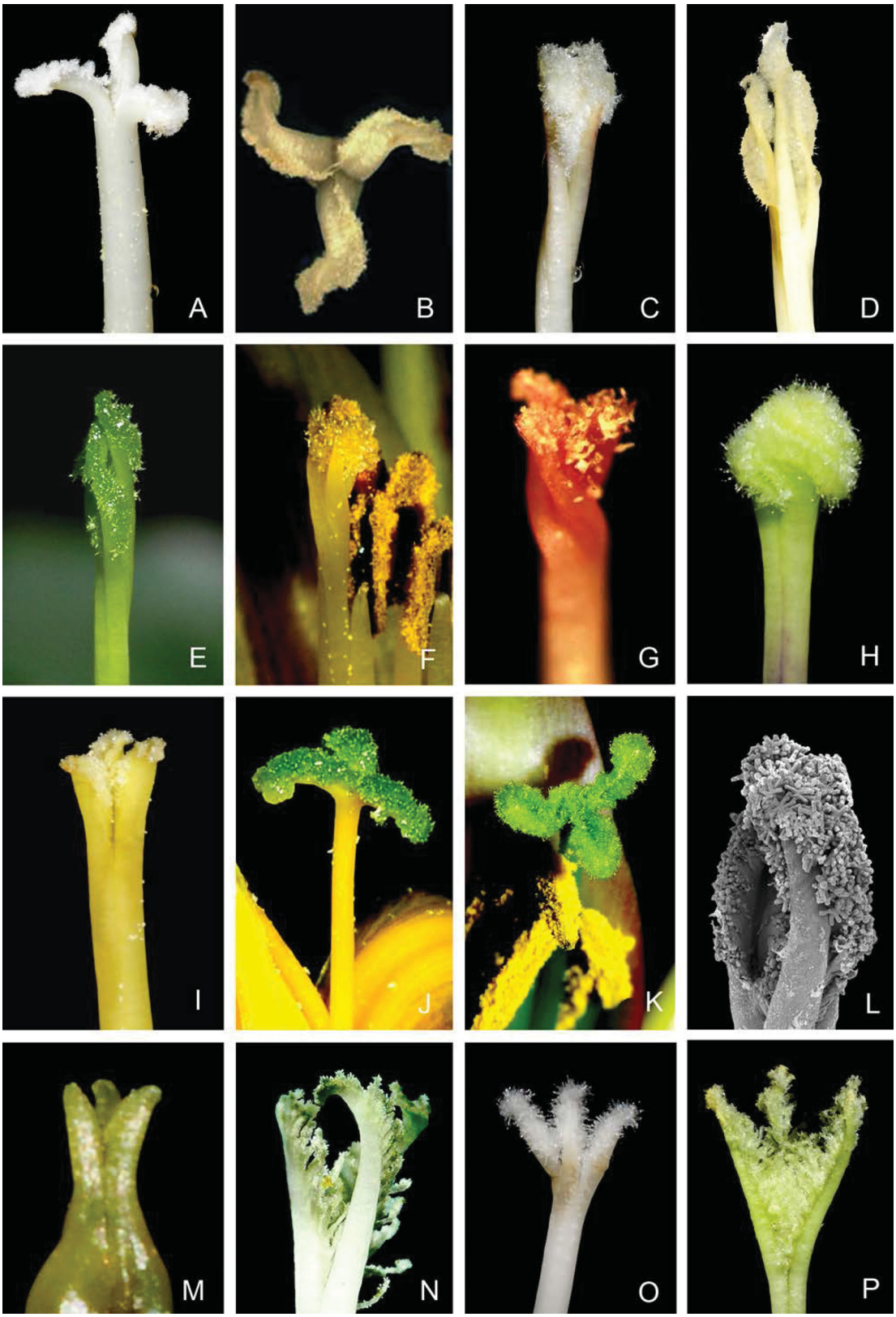

FIGURE 4. Stigma types in Tillandsioideae. Conduplicate and simple types (Table 5). **A.** *Alcantarea heloisae* (*Leme 8055*; cp, lateral view). **B.** *Alcantarea heloisae* (*Leme 8055*; cp, top view). **C.** *Alcantarea extensa* (*Leme 1942*; ce, early anthesis). **D.** *Alcantarea cerosa* (*Leme 8551*; ce, late anthesis). **E.** *Pseudalcantarea viridiflora* (*Leme 2835*; ce). **F.** *Gregbrownia lyman-smithii* (*Leme 4655*; cs). **G.** *Tillandsia gardneri* (*Leme s.n.*; cs). **H.** *Tillandsia fasciculata* s.l. (*Leme 4833*; cs). **I.** *Goudaea chrysostachys* (*Leme 2509*; se). **J.** *Guzmania sprucei* (*Leme 3551*; sp). **K.** *Tillandsia malzinei* (*Leme 361*; sp). **L.** *Guzmania musaica* (spi). **M.** *Catopsis floribunda* (*Leme 8101*; se). **N.** *Wallisia anceps* (*Till et al. 15046*; cpi). **O.** *Guzmania wittmackii* (*Leme 2520*; spi). **P.** *Wallisia lindeniana* (*Leme 2406*; cpi).

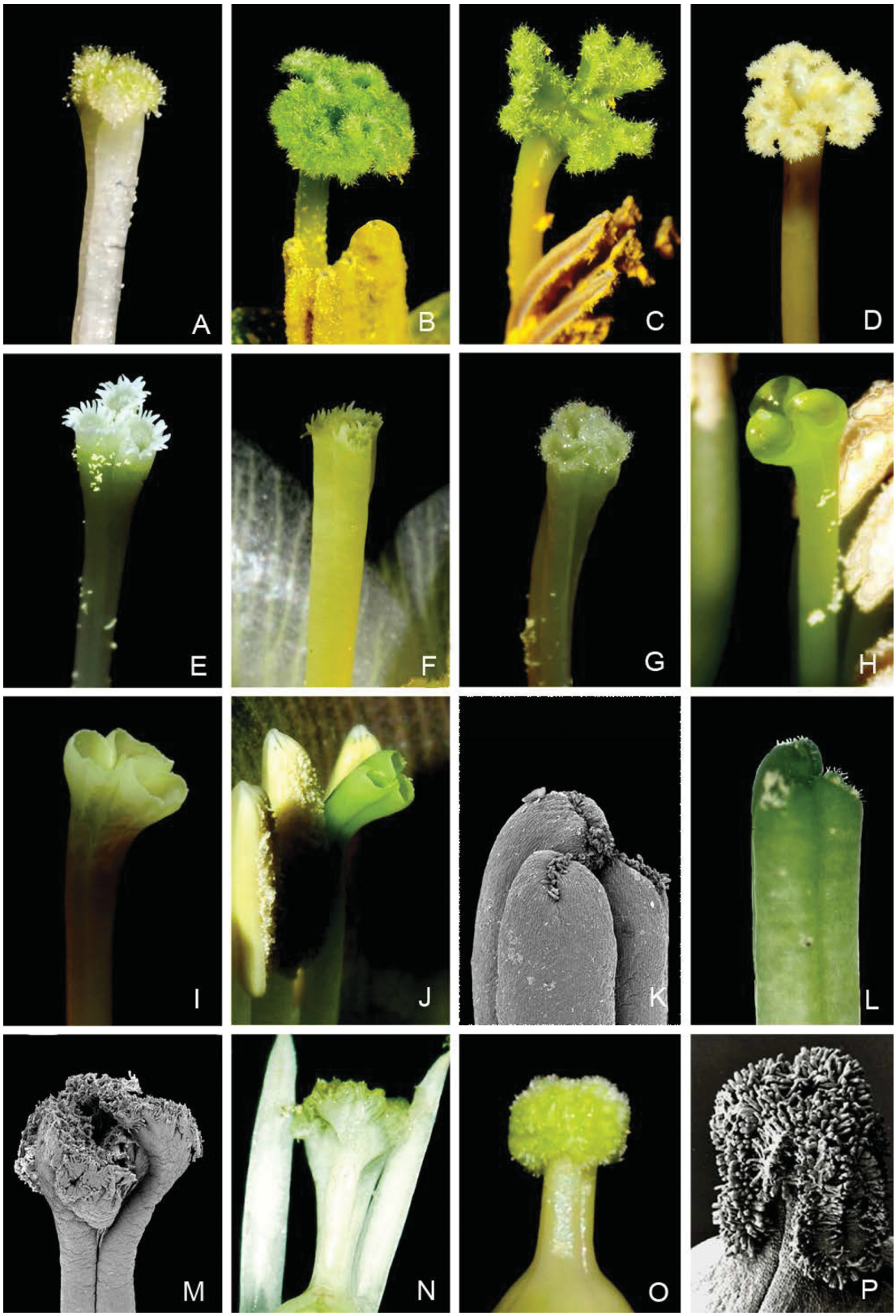

FIGURE 5. Stigma types in Tillandsioideae (continued). Convolute, coralliform, cupulate, tubo-laciniate and urceolate types (Table 5). **A.** *Guzmania patula* (*Leme 4062*; cbI). **B.** *Vriesea gradata* (*Leme 5738*; cbII). **C.** *Vriesea psittacina* (*Leme 7075*; cbII). **D.** *Vriesea jonghei* (*Leme 2189*; cbII). **E.** *Stigmatodon bifidus* (*Leme 7368*; tl). **F.** *Stigmatodon funebris* (*Leme 7976*; tl). **G.** *Stigmatodon rosulatulus* (*Leme 8621*; tl with papillae). **H.** *Werauhia pedicellata* (*Leme 7320*; cup). **I.** *Werauhia subsecunda* (*Leme 2561*; cup). **J.** *Werauhia sp*. (*Leme 3987*; cup). **K.** *Zizkaea tuerckheimii* (*W. Till 17055 & Hromadnik 25033*; urc). **L.** *Zizkaea tuerckheimii* (*W. Till 17055 & Hromadnik 25033*; urc). **M.** *Barfussia platyrhachis* (*Belvedere s.n.*; co). **N.** *Barfussia platyrhachis* (*Belvedere s.n.*; co). **O.** *Racinaea venusta* (*Leme 2590*; cf). **P.** *Lemeltonia dodsonii* (*MSBG 1981-0055*; cf).

For the morphological investigations and descriptions, all available information for species of Bromeliaceae subfam. Tillandsioideae from the literature, and our own observations, were used. Appendix 2 provides details (taxon authorities, photographers, and accession numbers) for all morphological accessions, which are shown in Figs. 1–5.

Taxon authorities for investigated material are listed in the Appendix 1 and 2 and in the taxonomy section, and are given in the other chapters only for taxa that appear there.

Phylogenetic DNA sequence data

Total genomic DNA was extracted from silica gel dried leaf tissue, or rarely from seeds present in herbarium specimens following a modified sorbitol/CTAB-based protocol for difficult plant tissue (Tel-Zur *et al.* 1999, Russell *et al.* 2010a) in combination with the silica-membrane-binding DNeasy Plant Mini Kit (QIAGEN, #69104). Using each extraction protocol alone either yielded low amounts of DNA (DNeasy Plant Mini Kit) or often contaminated extracts (sorbitol/CTAB-based protocol; most probably due to polyphenols/tannins). DNA stocks are kept at -80°C and usually 1:10 working dilutions with water were used for PCR.

In addition to the plastid DNA (ptDNA) loci used by Barfuss *et al.* (2005a: *atpB-rbcL*, *rbcL*, *rps16* intron, *trnK-matK-trnK*, *trnL* intron and *trnL-trnF*), several new loci were sequenced and compared for a small subset of taxa (M.H.J. Barfuss, unpublished data): *atpH-atpI*, *ndhC-trnV*, *ndhF-rpl32-trnL*, *petA-psbJ*, *rpl16* intron, *rpoB-trnC-petN*, *trnD-trnY-trnE-trnT-psbD*, *trnH-rps12-psbA*, *trnK-rps16-trnQ*, *trnT-trnL* (Shaw *et al.* 2005, 2007, 2014), and the new *ycf1*. The three most informative from both the large (LSC) and small single-copy (SSC) regions were selected for the total sample set (Table 1). The plastid loci used in this study include: (1) *rpoB-trnC-petN* (LSC; e.g., Barkalov & Kozyrenko 2014, Demesure *et al.* 1995, Versieux *et al.* 2012) amplified in one or two fragments; (2) *trnK-matK-trnK* (LSC; e.g., Barfuss *et al.* 2005a, Crayn *et al.* 2004, Givnish *et al.* 2011, 2014, Schulte *et al.* 2005) amplified in one or two fragments; and (3) *ycf1* (SSC; e.g., Castello *et al.* 2016; Dong *et al.* 2015, Neubig *et al.* 2009) amplified in three or six fragments. In addition, the nuclear DNA (nDNA) gene *Phytochrome C* (*PHYC*; e.g., Barfuss 2012, Castello *et al.* 2016, Jabaily & Sytsma 2010, Krapp *et al.* 2014, Louzada *et al.* 2014, Russell *et al.* 2010b, Schütz *et al.* 2016) was chosen from other nDNA loci (Barfuss 2012: ITS 1-5.8S-ITS 2, *NIA*, *PRK*, *XDH*), and partial exon 1 was amplified in one or two fragments, or sometimes re-amplified using nested primers (Table 1). Eighty-three DNA sequences of *trnK-matK-trnK* were taken from Barfuss *et al.* (2005a), and data for *PHYC* mostly came from Barfuss (2012). All other sequences were generated specifically for this study.

TABLE 1. Primers used in this study. Grey letters indicate alternative primers that were occasionally used, with primers labelled by an asterisk (*) often giving better results than standard primers. Bp = base pairs, ptDNA = plastid DNA, nDNA = nuclear DNA, LSC = large single-copy region, SSC = small single-copy region, IR = inverted repeat. The fragment length is given including primer sequences. **Primer names**: numbers within primer names indicate the base position of the 3' end within the investigated locus based on the reference sequences of *Typha latifolia* (NC_013823) [or *Ananas comosus* (NC_026220)] for ptDNA loci and *Oryza sativa* (NC_008396) [or *Ananas comosus* (Ming *et al.* 2015, *Ananas comosus v3*, Phytozome v11.0)] for the nDNA gene *Phytochrome C* (*PHYC*); br = Bromeliaceae specific; dp = *Diaphoranthema* specific; mo = Monocot specific; po = Poales specific. Alternative primer names are given in brackets. **Usage**: italic capital letters in brackets indicate standard primer combinations for the first (*A–C*), and italic small letters for second (*a–f*) amplification protocols (see Table 2); Seq = Sequencing; nPCR = nested PCR. **Source**: the primary reference and a bromeliad specific reference, where possible, is given.

Primer names	Sequence (5'–3')	Directions	Bp	Usage	Source
rpoB-trnC-petN (ptDNA, LSC; total length in *Ananas*: 5801 bp; fragment length in *Ananas*: 2603 bp; observed fragment length: 2125–2628 bp)					
rpob-3165f-br [3165]	TTAATGAACCTACAAAATCCC TCAAATTG	forward	29	PCR/Seq (*A*/*a*)	Castello *et al.* (2016)
rpob-3165f [3165]	TYAATGAACCTACAAAATCCY TCAAATTG	forward	29	PCR/Seq	This study
rpob-3176f-mo [3176]	CAAAATCCCTCAAATTGGATC TGACTAA	forward	28	Seq	This study
rpob-3950f-br [3946]	ATTCAATACAATGAAAGATTA AAGCACG	forward	28	PCR/Seq (*b*)	Castello *et al.* (2016)

...Continued on next page

TABLE 1. (Continued)

Primer names	Sequence (5'–3')	Directions	Bp	Usage	Source
trnC (trnc-4289f) [4673] (trnc-67f)	CCAGTTCAAATCTGGGTGTC	forward	20	Seq	Demesure *et al.* (1995), Versieux *et al*. (2012)
rpob-4127r-br [4143]	CGGTTCTTCTATTTTGTATTTAATCTCAATG	reverse	31	Seq	This study
rbob-4127r-dp [4143]	CGGTTCTTCTATTTTGTATTTAATATCAATG	reverse	31	Seq	Castello *et al.* (2016)
trnc-4258r-mo [4642] (trnc-36r-mo)	CCAGATTTGAACTGGGGATAAAGGATT	reverse	27	Seq	This study
trnc-4271r-mo [4655] (trnc-49r-mo)	CAGGCGACACCCAGATTTGAACTG	reverse	23	PCR/Seq (*a*)	This study
petn-5337r-br [5713] (petn-2r-br)	CAGCCCAAGCGAGACTTACTATATCCA	reverse	27	PCR/Seq (*A*/*b*)	Castello *et al.* (2016)
petn-5337r [5713] (petn-2r)	CAGCCCAAGCRAGACTTACTATATCCA	reverse	27	PCR/Seq	This study
petN1R (petn-5338r) [5714]	CCCAAGCAAGACTTACTATATCC	reverse	23	PCR/Seq	Lee & Wen (2004), Versieux *et al.* (2012)
trnK-matK-trnK (ptDNA, LSC; total length in *Ananas*: 2684 bp; fragment length in *Ananas*: 1900 bp; observed fragment length: 1891–1919 bp)					
trnk-799f-br [799]	CCCTGTTCTGACCATATTGCACTATGTAT	forward	29	PCR/Seq (*A*/*a*)	Castello *et al.* (2016)
trnk-799f [799]	CCYTGTTYTRACYRTATYGCACTATGTAT	forward	29	PCR/Seq	This study
-19F (trnk-796f) [796]	CGTTCTGACCATATTGCACTATG	forward	23	PCR/Seq	Molvray *et al.* (2000), Barfuss *et al.* (2005a), Pinzón *et al.* (2016)
390F (matk-1279f) [1273]	CGATCTATTCATTCAATATTTC	forward	22	PCR/Seq	Sun *et al.* (2001), Barfuss *et al.* (2005a)
matK-413f-2 (matk-1280f) [1274]	TAATTTACGATCYATTCATTCAATATTTCC	forward	30	PCR/Seq	Heckenhauer *et al.* (2016)
matk-1383f-br [1377]	TGGTTCAAATCCTTCAATGYCGGATC	forward	26	PCR/Seq	This study
matk-1610f-br [1604] (matK808fBRO)	AACATCTTCTGGAACCTTTCTTGAGCG	forward	27	PCR/Seq (*b*)	Castello *et al.* (2016), Pinzón *et al.* (2016)
matk-2051f-br [2045]	GTATCGGGACATCCTATTAGTAAGCC	forward	26	Seq	This study
matk-1333r-br [1327]	CCAAGATTTCCAAATGGATAGGATAGGG	reverse	28	Seq	This study
matk-1594r-br[1588] *	CTGTATTCGCTCAAGAAAGGTTCC	reverse	24	Seq	This study
matk-1769r-br [1763] (matK966rBRO)	GCCAGAGATTGACAAGGTAACATTTCC	reverse	27	PCR/Seq (*a*)	Castello *et al.* (2016), Pinzón *et al.* (2016)
matK-1227r-1 (matk-2109r) [2103]	GARGAYCCRCTRTRATAATGAGAAAGATTT	reverse	30	PCR/Seq	Heckenhauer *et al.* (2016)
1300R (matk-2153r) [2147]	CGAAGTATATAYTTYATTCGATACA	reverse	25	PCR/Seq	Samuel *et al.* (2005)
1326R (matk-2172r) [2166]	TCTAGCACACGAAAGTCGAAGT	reverse	22	PCR/Seq	Sun *et al.* (2001), Barfuss *et al.* (2005a)
1710R (trnk-2581r) [2569]	GCTTGCATTTTTCATTGCACACG	reverse	23	PCR/Seq	Samuel *et al.* (2005), Barfuss *et al.* (2005a)
trnk-2662r [2650]	CTCGAACCCGGAACTAGTCGG	reverse	21	PCR/Seq (*A*/*b*)	Castello *et al.* (2016)

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TABLE 1. (Continued)

Primer names	Sequence (5'–3')	Directions	Bp	Usage	Source
trnk-2653r [2641] * (trnK2R*)	CCCGGAACTAGTCGGATGGAG TAG	reverse	24	PCR/Seq	Pinzón *et al.* (2016)
ycf1 (ptDNA, IR-SSC; total length in *Ananas*: 5601 bp; fragment length of the SSC in *Ananas*: 4472 bp; observed fragment length: 4325–4514 bp)					
ycf1-1109f [1109]	ACWYTTCTTTTYRATTMKAAA MRATGGAATCG	forward	32	PCR/Seq	This study
ycf1-1113f-br [1113]	TTTYGATTATAAAMGATGGAA TCGYCCA	forward	28	PCR/Seq (*A*/*a*)	Castello *et al.* (2016)
ycf1-1910f-br [1916]	CTATTGGAATAGAAGAAATCC RTAAAAGGGT	forward	31	PCR/Seq (*b*)	This study
ycf1-1922f-br [1928]	AATCCRTAAAAGGGTTCCTCG RTGGTC	forward	27	PCR/Seq	This study
ycf1-2564f-br [2570]	GCCGTATGTTATTATTCCAATT CCC	forward	25	PCR/Seq	This study
ycf1-2567f-br [2573]	CGTATGTTATTATTCCAATTCC CCGA	forward	26	PCR/Seq (*B*/*c*)	Castello *et al.* (2016)
ycf1-3210f-br [3210]	GAACAATCACAATCARGAATC AAATAGAA	forward	29	PCR/Seq	This study
ycf1-3212f-br [3212]	AACAATCACAATCAGGAATCA AATAGAACG	forward	30	PCR/Seq (*d*)	This study
ycf1-3872f-br [3878]	AARTGGCGAAATAGAATCAAT CAACG	forward	26	PCR/Seq (*C*/*e*)	Castello *et al.* (2016)
ycf1-3965f-br [3871]	AATTCATTACGTGAAACAAAA TTACTATGC	forward	30	PCR/Seq	This study
ycf1-4492f-br [4549] *	TTGATGCATATAAGATTAAAC CATGGATTA	forward	30	PCR/Seq	This study
ycf1-4643f-br [4730]	GCAASAGGACCAAGTAAATCT TGTATCAGA	forward	30	PCR/Seq	This study
ycf1-4702f-br [4789]	TTGAAGAGAATTAYGYGARAT CAGACATTA	forward	30	PCR/Seq (*f*)	This study
ycf1-1990r-br [1996] *	GTTTGGCTTTTCTTGAACGAA TTTC	reverse	25	Seq	This study
ycf1-2103r-br [2103]	TGCGAGTAACGTATCAAAGCC ACCTCT	reverse	27	PCR/Seq (*a*)	This study
ycf1-2660r-br [2666]	TCTTTATCTGAATACCGTCTG YTAACCAAT	reverse	30	PCR/Seq (*A*/*b*)	Castello *et al.* (2016)
ycf1-3372r-br [3372]	CCTGTGAATGGTAATCATACA TAGCAAG	reverse	26	PCR/Seq (*c*)	This study
ycf1-4104r-br [4161]	CTTCTTCTAGATAATCACTAA TAGCTGTACTTACC	reverse	35	PCR/Seq (*B*/*d*)	Castello *et al.* (2016)
ycf1-4625r-br [4712] *	TTTCTTTTCGTAKATCTGATAC AAGATTTACTT	reverse	33	PCR/Seq	This study
ycf1-4795r-br [4888]	ATCATTCTTTGGTTCAAGGAG TCATC	reverse	26	PCR/Seq (*e*)	This study
ycf1-5440r-br [5533]	TGAAACGACTGCCATTATTGG TATC	reverse	25	PCR/Seq (*C*/*f*)	Castello *et al.* (2016)

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TABLE 1. (Continued)

Primer names	Sequence (5'–3')	Directions	Bp	Usage	Source
PHYC					
(nDNA; total length of exon 1 in *Ananas*: 2092 bp; fragment length in *Ananas*: 1229 bp; observed fragment length: 1211–1244 bp)					
phyc-515f-br [554]	AAGCCCTTYTACGCTATCCTG CACCG	forward	26	PCR/Seq (*A*/*a*)	Barfuss (2012), Louzada *et al.* (2014), Castello *et al.* (2016)
phyc-515f-po [554] *	AAGCCCTTCTACGCYATHNTG CACCG	forward	26	PCR/Seq	This study
phyc-524f-br [563]	GCTATCCTGCACCGGATCGAY GT	forward	23	nPCR/ Seq	Barfuss (2012), Castello *et al.* (2016), Schütz *et al.* (2016)
phyc-974f-br [1013]	GCTCCTCACGGCTGCCACGCT CA	forward	23	PCR/Seq (*b*)	Barfuss (2012), Louzada *et al.* (2014), Schütz *et al.* (2016)
phyc-977f-po [1016] *	CCBCAYGGYTGYCAYGCDCA GTA	forward	23	PCR/Seq	This study
phyc-991f-mo [1030]	CCAYGCTCARTAYATGGCTAA TATGG	forward	26	PCR/Seq	Barfuss (2012)
phyc-1145r-mo [1178]	CCTGMARCARGAACTCACAA GCATATC	reverse	27	PCR/Seq (*a*)	Russell *et al.* (2010b), Barfuss (2012), Louzada *et al.* (2014)
phyc-1145r2-mo [1178]	CAACAGGAACTCACAAGCAT ATC	reverse	23	PCR/Seq	Barfuss (2012)
phyc-1147r-po [1180] *	ACYTGCAWSAGRAAYTCRCA AGCATA	reverse	26	PCR/Seq	This study
phyc-1210r-mo [1243]	GGATATGCTTCTCCTTTGYTTG AGC	reverse	25	PCR/Seq	Barfuss (2012)
phyc-1690r-br [1723]	TCAACATCTTCCCAYGGGAGG CT	reverse	23	nPCR/ Seq	Barfuss (2012), Castello *et al.* (2016), Schütz *et al.* (2016)
phyc-1699r-br [1732]	ATWGCATCCATTTCAACATCT TCCCA	reverse	26	PCR/Seq (*A*/*b*)	Barfuss (2012), Louzada *et al.* (2014), Castello *et al.* (2016)
phyc-1699r-po [1732] *	ATWGCATCCATTTCAACATCY TCCCA	reverse	26	PCR/Seq	This study

The PCR reactions were performed in an Eppendorf Mastercycler using either the ThermoPrime 2× ReddyMix PCR Master Mix with 1.5 mM $MgCl_2$ (Thermo Scientific, TS, #AB-0575/DC/LD/A) or 2× Phusion Green Hot Start II High-Fidelity PCR Master Mix (TS, #F-566S) according to manufacturer's instructions, sometimes with slight modifications (Su *et. al.* 1996) of recommended cycling conditions (Table 2). The Phusion DNA polymerase was used to reduce polymerase slippage (stuttering peaks in DNA electropherograms) when A/T stretches of more than eight base pairs where encountered.

TABLE 2. PCR conditions of each investigated DNA locus using first amplification protocols (primer combinations *A–C*): *rpoB-trnC-petN*: one fragment (*A*); *trnK-matK-trnK*: one fragment (*A*); *ycf1*: three fragments (*A–C*); *PHYC*: one fragment (*A*). If the second amplification protocols (primer combinations *a–f*) for shorter fragments are applied, the extension times have to be halved: *rpoB-trnC-petN*: two fragments (*a*, *b*); *trnK-matK-trnK*: two fragments (*a*, *b*); *ycf1*: six fragments (*a–f*); *PHYC*: two fragments (*a*, *b*). Primer combinations can be found in Table 1. A lower extension temperature (68°C) was used with ThermoPrime 2× ReddyMix PCR Master Mix with 1.5 mM $MgCl_2$ for *rpoB-trnC-petN* and *ycf1* due to a high A/T content of the amplified DNA sequences (Su *et al.* 1996). Different annealing temperatures were sometimes used for fragment *C* and *e* of *ycf1* (given in brackets) due to amplification of unspecific products in several cases when using lower temperatures. Alternatively, the two specific primers ycf1-4625r-br (instead of ycf1-4795r-br) and ycf1-4492f-br (instead of ycf1-4702f-br) were used for fragments *e* and *f*, respectively.

DNA locus	ThermoPrime 2× ReddyMix PCR Master Mix with 1.5 mM $MgCl_2$	2× Phusion Green Hot Start II High-Fidelity PCR Master Mix
rpoB-trnC-petN	1× 2 min @ 95°C; 5× 25 s @ 95°C, 35 s @ 65°C – 1°C/cycle, 3 min @ 68°C; 22× 25 s @ 95°C, 35 s @ 60°C, 3 min @ 68°C; 13× 25 s @ 95°C, 35 s @ 60°C, 3 min + 5 s/cycle @ 68°C; 1× 5 min @ 72°C; hold @ 15°C	1× 30 s @ 98°C; 5× 10 s @ 98°C, 30 s @ 70°C – 1°C/cycle, 1 min 30 s @ 72°C; 22× 10 s @ 98°C, 30 s @ 65°C, 1 min 30 s @ 72°C; 13× 10 s @ 98°C, 30 s @ 65°C, 1 min 30 s + 5 s/cycle @ 72°C; 1× 5 min @ 72°C; hold @ 15°C
trnK-matK-trnK	1× 2 min @ 95°C; 5× 25 s @ 95°C, 35 s @ 67°C – 1°C/cycle, 2 min @ 72°C; 22× 25 s @ 95°C, 35 s @ 62°C, 2 min @ 72°C; 13× 25 s @ 95°C, 35 s @ 62°C, 2 min + 5 s/cycle @ 72°C; 1× 5 min @ 72°C; hold @ 15°C	1× 30 s @ 98°C; 5× 10 s @ 98°C, 30 s @ 72°C – 1°C/cycle, 1 min @ 72°C; 22× 10 s @ 98°C, 30 s @ 67°C, 1 min @ 72°C; 13× 10 s @ 98°C, 30 s @ 67°C, 1 min + 5 s/cycle @ 72°C; 1× 5 min @ 72°C; hold @ 15°C
ycf1	1× 2 min @ 95°C; 5× 25 s @ 95°C, 35 s @ 65°C (68°C) – 1°C/cycle, 2 min @ 68°C; 22× 25 s @ 95°C, 35 s @ 60°C (63°C), 2 min @ 68°C; 13× 25 s @ 95°C, 35 s @ 60°C (63°C), 2 min + 5 s/cycle @ 68°C; 1× 5 min @ 72°C; hold @ 15°C	1× 30 s @ 98°C; 5× 10 s @ 98°C, 30 s @ 70°C (72°C) – 1°C/cycle, 1 min @ 72°C; 22× 10 s @ 98°C, 30 s @ 65°C (68°C), 1 min @ 72°C; 13× 10 s @ 98°C, 30 s @ 65°C (68°C), 1 min + 5 s/cycle @ 72°C; 1× 5 min @ 72°C; hold @ 15°C
PHYC	1× 2 min @ 95°C; 5× 25 s @ 95°C, 35 s @ 65°C – 1°C/cycle, 1 min 30 s @ 72°C; 22× 25 s @ 95°C, 35 s @ 60°C, 1 min 30 s @ 72°C; 13× 25 s @ 95°C, 35 s @ 60°C, 1 min 30 s + 5 s/cycle @ 72°C; 1× 5 min @ 72°C; hold @ 15°C	1× 30 s @ 98°C; 5× 10 s @ 98°C, 30 s @ 70°C – 1°C/cycle, 45 s @ 72°C; 22× 10 s @ 98°C, 30 s @ 65°C, 45 s @ 72°C; 13× 10 s @ 98°C, 30 s @ 65°C, 45 s + 5 s/cycle @ 72°C; 1× 5 min @ 72°C; hold @ 15°C

PCR components for a 1× reaction were: (1) for (a) #AB-0575/DC/LD/A: 1× ReddyMix PCR Master Mix including 0.025 U/µl ThermoPrime *Taq* DNA polymerase, 75 mM Tris-HCl (pH 8.8 at 25°C), 20mM $(NH_4)_2SO_4$, 1.5 mM $MgCl_2$, 0.01% (v/v) Tween 20, and 0.2 mM of each dNTP; for (b) #F-566S: 1× Phusion Green Hot Start II High-Fidelity PCR Master Mix including 0.025 U/µl Phusion DNA polymerase, 1.5 mM $MgCl_2$, and 0.2 mM of each dNTP; (2) primers (Sigma-Aldrich, SA) were used in a final concentration of 0.32 µM (1 µl of each 3.2 µM primer per 10 µl PCR reaction); (3) to facilitate PCR we added 0.2 µg/µl BSA (20 µg/µl; TS, #B14; 0.1 µl per 10 µl PCR reaction) and 0.2 M Trehalose (1 M; SA, #T9531; 2 µl per 10 µl PCR reaction) for all loci and 3% (v/v) DMSO (100%; SA, #D8418; 0.3 µl per 10 µl PCR reaction) for the nDNA gene *PHYC*; and (4) usually 1 µl of diluted DNA template was used and PCR grade water was added. The smallest final reaction volume was 10 µl, but volumes were scaled up proportionally when more PCR product was necessary to perform additional sequencing reactions. PCR products were purified with a 1:2 mixture of Exonuclease I (20 U/µl; TS, #EN0581) and FastAP Thermosensitive Alkaline Phosphatase (1 U/µl; TS, #EF0654) according to Werle *et al.* (1994). We used a slightly

modified protocol by adding 1 µl of the enzyme mixture to each 10 µl PCR reaction (scaled up proportionally for higher volumes) and incubated at 37°C for 45 min, followed by a deactivation of the enzymes at 85°C for 15 min.

Cycle sequencing reactions were performed on a 96-Well GeneAmp PCR System 9700 (Life Technologies, LT) according to the BigDye Terminator v3.1 Cycle Sequencing Kit (LT, #4337455). We used slightly modified PCR conditions: 1× 1 min @ 96°C; 35× 10 s @ 96°C, 5 s @ 50°C, 3 min @ 60°C; and a final hold @ 4°C. Reaction components were: 0.4 µl of BigDye Terminator v3.1, 1 µl of 3.2 µM primer, 1.8 µl of 5× sequencing buffer (LT), 2 µl of 1 M Trehalose, 2(–4) µl of purified PCR product, and (0.8–)2.8 µl of PCR-grade water. Cycle sequencing products were purified by gel filtration using MultiScreen filter plates (Millipore, #MAHVN4550) and Sephadex G-50 Fine or Superfine (GE Healthcare, #17-0042-02 and #17-0041-01, respectively) according to manufacturer's instructions (previously known as Millipore protocol Tech Note TN053). Clean products were run on a 3130*xL* Genetic Analyzer (LT) or 3730 DNA Analyzer (LT) following manufacturer's instructions. We usually sequenced forward and reverse strands using PCR primers, but in several cases, we used additional internal sequencing primers (Table 1) to obtain bi-directional, clean reads for most parts of the assembled consensus sequences.

Sequences were assembled and edited using SeqMan Pro (Lasergene v8.1, DNASTAR), and the consensus was exported in fasta format and deposited in GenBank (www.ncbi.nlm.nih.gov/). Alignments without missing data were generated manually in the program BioEdit v7.2.5 (Hall, 1999, 2013) for four DNA sequence matrices corresponding to each investigated genomic locus. For phylogenetic analyses, DNA sequence matrices were analysed individually and concatenated (six datasets: individual ptDNA loci *rpoB-trnC-petN*, *trnK-matK-trnK*, and *ycf1*; concatenated ptDNA loci; the individual nDNA gene *PHYC*; and a matrix of all loci concatenated).

Phylogenetic reconstructions were obtained using maximum parsimony (MP), maximum likelihood (ML) and Bayesian inference (BI). Prior to final phylogenetic analyses, the approach of Wiens (1998) was applied to test for significant levels of localised incongruence among the ptDNA and the nDNA datasets, using the level of bootstrap support. For this, the 75% MP bootstrap trees calculated for each individual matrix (not shown; parameters see below) were compared (Hillis & Bull 1993). No topological conflicts were observed between these bootstrap trees, indicating the absence of significant incongruence and combinability of ptDNA and nDNA loci (Wiens 1998).

The MP analyses were performed for all six datasets with PAUP* version 4.0a149 (Swofford 2002, 2016) using 1000 replicates of heuristic search with random addition of sequences (five trees held at each step) and subsequent TBR branch swapping (steepest descent option not in effect, MULTREES option in effect, branches collapsed if maximum branch length is zero, and saving no more than 50 trees in each replicate). All analyses were performed with DNA sequence characters treated as independent, unordered and equally weighted (Fitch parsimony; Fitch 1971) and gaps treated as missing data.

Parsimony branch support was calculated with the bootstrap (Felsenstein 1985) using 1000 pseudo-replicates, which were performed in the same way as the MP analyses, but using 10 replicates of heuristic search with random sequence addition and subsequent TBR branch swapping (saving no more than 10 trees in each replicate). Support limits were: <50 % (not supported), 50–74% (weakly supported), 75–89% (moderately supported), and 90–100% (strongly supported) (Buerki *et al.* 2009, Calvente *et al.* 2011).

The ML analysis was performed for the matrix of all loci concatenated with RAxML (Stamatakis 2006) through raxmlGUI v1.3 (Silvestro & Michalak 2012) using the GTRGAMMAI substitution model, which efficiently approximates the well-known general time-reversible model (GTR; Rodríguez *et al.* 1990) with gamma-distributed substitution rates. Substitution model parameters were calculated separately for non-coding and each codon position of coding loci, to allow different model parameters to be estimated separately for each partition. The following twelve partitions were set: (1) *rpoB-trnC-petN*, (2) 5' *trnK*, (3) *matK* 1st codon position, (4) *matK* 2nd codon position, (5) *matK* 3rd codon position, (6) 3' *trnK*, (7) *ycf1* 1st codon position, (8) *ycf1* 2nd codon position, (9) *ycf1* 3rd codon position, (10) *PHYC* 1st codon position, (11) *PHYC* 2nd codon position, and (12) *PHYC* 3rd codon position. Analyses were run by selecting the 'ML + rapid bootstrap' option with 1000 rounds of random addition of sequences and 1000 fast bootstrap replicates for assessing likelihood branch support.

The BI analysis was conducted using MrBayes 3.2.6 (Huelsenbeck & Ronquist 2001, Ronquist *et al.* 2012) for the matrix of all loci concatenated with four partitions, one set for each locus, with model parameters allowed to vary among them. Two independent runs with 10,000,000 generations were initiated, sampling every 1000th generation and saving the branch length. Each run consisted of one cold and three heated chains. A 50% majority-rule consensus tree was constructed in PAUP* after discarding the initial 25% of the trees as a burn-in.

All resulting phylogenetic trees were drawn with the program FigTree v1.4.2 (Rambaut 2014) and the exported vector graphics were edited in Adobe Illustrator CS6 v16.0.0 (Adobe Systems).

Morphological data

Morphological data were recorded from observations of living material cultivated in the botanical garden at the University of Vienna (HBV) and the private plant collections of H. & L. Hromadnik and E.M.C. Leme, with herbarium specimens deposited (see Appendix 1), from other herbarium specimens, pickled plant material, and from microphotographs (W. Till, unpublished data). Additional information was collected and carefully reviewed from previous literature, such as monographic works of Bromeliaceae (e.g., Baker 1889, Harms 1930, Mez 1896, 1935), the monograph of Tillandsioideae (Smith & Downs 1977), the monograph of *Alcantarea* (Versieux & Wanderley 2015), incomplete familial treatments (e.g., André 1889, Beer 1856), subfamilial treatments (e.g., Till 2000a), generic treatments (e.g., Costa *et al.* 2014, 2015, Espejo-Serna 2002, 2003, Grant 1995a, Palací 1997, Spencer & Smith 1993, Till 2000b), species complex treatments (e.g., Castello 2010, Castello & Galetto 2013, Castello *et al.* 2016, Costa 2002, Donadío 2012, Donadío *et al.* 2015, Ehlers 1997, 2009, Gardner 1982, 1986, Gomes-da-Silva *et al.* 2012, Granados-Mendoza 2008, Hromadnik 2005, Krömer *et al.* 2012, Pinzón-Esquivel 2012, Pinzón *et al.* 2016, Tardivo 2002, Terreros-Olivares 2012, Till 1984, 1992), species descriptions, morphological works (e.g., petal appendages: Brown & Terry 1992; filament plication: Evans & Brown 1989; ovary position: Böhme 1988, Sajo *et al.* 2004; stigma types: Brown & Gilmartin 1984, 1988, 1989, Gilmartin *et al.* 1989, Gortan 1990, 1991, Leme 2007, 2009, Leme & Brown 2004, Schill *et al.* 1988, Till 2000a, Till *et al.* 1997; ovule appendages: Kuhn *et al.* 2016; seed micromorphology: Groß 1988, Magalhães & Mariath 2012; pollen micromorphology: Halbritter 1988, 1992) and general bromeliad literature (e.g., Benzing 2000).

For the morphological circumscription of the monophyletic groups obtained from phylogenetic analyses, we tested the traditional, as well as potential new characters for their diagnostic value by mapping their distribution for each classified species over the phylogenetic trees. Relevant morphological characters finally used for genera were checked for their diagnostic value (see Table 4 and key to the genera) and the diagnostic characters exhibiting synapomorphic combinations were selected to circumscribe genera (i.e., have to be present in the classified species; see key to genera of the Tillandsioideae and taxonomy section). Taking into account the high levels of homoplasy in other morphological data of Bromeliaceae, in general, and the difficulty in assessing several of these characters for many species of Tillandsioideae, no phylogenetic analyses of coded morphological characters were conducted in the current study.

TABLE 3. Attributes of analysed matrices using PAUP*, RAxML and MrBayes, and parsimony scores of equally most-parsimonious trees. Variable characters were also optimised onto the maximum likelihood (ML) and tree scores calculated for comparison. № = number, C = characters, const. = constant, var. = variable, PUC = parsimony uninformative character, PIC = parsimony informative character, CI = consistency index, RI = retention index, RC = rescaled consistency index.

DNA locus	№ of C	№ of const. C	№ of var. C	№ of PUCs	№ of PICs	№ of trees	Tree length	CI	RI	RC
rpoB-trnC-petN	3,225	2,516 (78.0%)	709 (22%)	341 (10.6%)	368 (11.4%)	>10,000	1,199	0.676	0.867	0.587
trnK-matK-trnK	1,887	1,458 (77.3%)	429 (22.7%)	174 (9.2%)	255 (13.5%)	>10,000	767	0.639	0.864	0.552
ycf1	4,731	3,536 (74.7%)	1,195 (25.3%)	459 (9.7%)	736 (15.6%)	>10,000	2,437	0.575	0.819	0.471
PHYC	1,237	755 (61.0%)	482 (39%)	145 (11.7%)	337 (27.3%)	>10,000	1,236	0.515	0.795	0.410
ptDNA loci concatenated	9,843	7,510 (76.3%)	2,333 (23.7%)	974 (9.9%)	1,359 (13.8%)	>10,000	4,426	0.611	0.839	0.512
All loci concatenated	11,080	8,265 (74.6 %)	2815 (25.4 %)	1,119 (10.1%)	1,696 (15.3%)	>10,000	5,749	0.581	0.823	0.478
All loci concatenated (ML)	11,080	8,265 (74.6 %)	2815 (25.4 %)			1	5,754	0.580	0.822	0.477

Results

Phylogenetic DNA sequence analyses

Attributes of individually analysed matrices are summarized in Table 3. The matrix of concatenated ptDNA and nDNA sequences included 11,080 characters, 1696 of which were phylogenetically informative. The strict consensus tree obtained from 37,200 most parsimonious trees (length = 5749; CI = 0.581 and RI = 0.823) from MP analyses is shown in Fig. 6. The phylogram from ML analyses, which is topologically identical to the 50% majority-rule consensus tree from BI analyses (not shown), is displayed in Fig. 7. For comparison of how well the ML phylogram matches the MP trees, we optimized the variable DNA sequence characters onto the ML phylogram, and this resulted in a tree only five steps larger than the MP trees (length = 5754; CI = 0.580 and RI = 0.822). The 50% majority-rule consensus tree from MP analyses (Fig. 8) shows the only three conflicting clades (indicated with §) when compared to the ML and BI tree. All trees are labelled with support values from both ML and MP bootstrapping (likelihood bootstrap support = LBS/parsimony bootstrap support = PBS) and BI analyses (Bayesian posterior probabilities = BPP). Trees obtained from MP analyses of individual loci (not shown) differed mainly in the degree of resolution, with the conflicting topologies having low branch support, most likely due to a lack of informative characters for certain groups in loci-specific matrices.

TABLE 4. States, terminology and description of morphological-ecological and morphological traits used to characterise Tillandsioideae taxa.

Trait	States & terminology	Description
Lifestyle	**epiphytic** (**ep**)	growing and rooting on a plant surface, primarily without additional substrate (although debris might accumulate gradually and used as substrate later)
	terrestrial (**tr**)	growing on the ground and rooting into the substrate
	saxicolous (subtype of tr) = rupestral, rupicolous	growing on the ground and rooting into the shallow substrate accumulated between rocks or in crevices
	epilithic (**el**) = lithophytic	growing and rooting on a bare rock surface, primarily without additional substrate (although debris might accumulate gradually and used as substrate later)
Habit (adult)	**mesomorphic** (**m**)	leaves flat in cross section, usually green and sparsely lepidote, but sometimes covered by epicuticular waxes, without water storing tissue
	semi-xeromorphic (**sx**)	leaves flat to trigonous in cross section, variously but usually sparsely lepidote, little water storing tissue
	xeromorphic (**x**)	leaves flat to trigonous in cross section, usually densely lepidote and appearing grey, with conspicuous water storing tissue
Central tank (adult)	**present** (**p**)	strongly to inconspicuously impounding (tank-forming, phytotelma-forming)
	absent (**a**)	non-impounding
Petal appendages	= nectar scales, petal scales, ligules	a pair of usually membranaceous or sometimes thicker structures partially adnate to the petals, with different shapes and distal ornamentations (e.g., entire, crenulate, laciniate, lacerate, bifid) located at the basal portion of the petals, but sometimes highly adnate, without connection between the appendages, but sometimes associated with lateral callosities (lateral folds) extending over their length
	present (**p**)	petals bearing two basal appendages (as defined above)
	absent (**a**)	petals without basal appendages (but callosities may rarely be present)
Ovary position	**1/2–2/3 inf**	1/2–2/3 inferior (*Glomeropitcairnia*)
	sup–1/8 inf	superior–1/8 inferior (*Catopsis*)
	1/8–1/3 inf	about 1/8–1/3 inferior (most core Tillandsioideae)
	1/3–1/2 inf	about 1/3–1/2 inferior (*Alcantarea*, *Pseudalcantarea*, *Tillandsia* p.p.)

...Continued on next page

TABLE 4. (Continued)

Trait	States & terminology	Description
Stigma (terminology) (types see Table 5)	**broadened**	at least two times broader than long
	capitate	head-shaped
	conduplicate	folded together lengthwise; forming a functionally single stigmatic surfaces of paired margins
	contort	oblique in shape and twisted together spirally
	convolute	rolled up longitudinally
	coralliform	coral-like in shape; irregular proliferated
	crenulate	finely round-toothed or scalloped
	cupulate	cup-shaped
	curtate	shortened, short
	denticulate	finely toothed or notched
	elongate	at least three times longer than broad
	infundibuliform	funnel-shaped
	laciniate	divided into narrow fringes with taper-pointed incisions; fringed
	navicular	boat-shaped; U- or V-shaped
	obconic	inverted cone-shaped
	pinnatisect	pinnately and deeply incised
	truncate	ending very abruptly as if cut straight across
	urceolate	urn-shaped
Ovule appendage		a multifilametous outgrowth (*Catopsis*) or an undivided multicellular outgrowth (remaining Tillandsioideae) at the chalaza (but the latter may split in ripe seeds; see seed appendages); the relative length of the appendage to the ovule proper can be used as character
	absent (**a**)	ovule appendage lacking or nearly so (ovule obtuse or subobtuse)
	ap ≤ ov	ovule appendage shorter than or about as long as the ovule proper
	ap > ov	ovule appendage longer than the ovule proper
Pollen (Halbritter 1992)	**inaperturate**	no aperture (sulcus) visible; exine reticulate
	sulcate, simple type (type A)	sulcus with gradual or ± clear-cut aperture margins; no exine elements covering the aperture; exine reticulate
	***Puya* type** (subtype a)	sulcus with gradual aperture margins
	***Catopsis* type** (subtype b)	sulcus with ± clear-cut aperture margins
	sulcate, complex type (type B)	sulcus with ± distinct or indistinct aperture margins; ± coherent or isolated exine elements covering the aperture; exine reticulate or rarely non-reticulate
	diffuse type (subtype c)	sulcus with indistinct aperture margins; ± coherent, loose (diffuse) exine elements covering the aperture
	insulae type (subtype d)	sulcus with ± distinct aperture margins; ± isolated (island-like), compact exine elements covering the aperture
	operculum type (subtype e)	sulcus with ± distinct aperture margins; ± coherent, compact exine elements at the aperture centre (operculum)
	***Alcantarea* type** (subtype f) = *Vriesea imperialis* type	sulcus with ± distinct aperture margins; ± coherent, compact exine elements at the aperture borders

...Continued on next page

TABLE 4. (Continued)

Trait	States & terminology	Description
Seed appendages	**flight apparatus** = coma, pseudopappus	a plumose seed appendage for wind dispersal anchored at the apical end (chalazal end of ovules) of the seed (*Catopsis*) or the basal end (micropylar end of ovules) of the seed (Glomeropitcairnia, core Tillandsioideae); the way of seed appendage formation can be used as character
	***Catopsis* type**	plumose flight apparatus formed at the apical end by multicellular hairs folded at maturity; multicellular, undivided plume at the basal end
	***Glomeropitcairnia* type**	plumose flight apparatus formed at the basal end by a multifilamentous outgrowths of the outer integument, extending off the basal end, innermost cell layer of the outer integument remaining fixed proximally, all cell layers of the outer integument split into cell rows, these bent in the middle for 180° but not forming an exostoma; undivided plume formed at the apical end, filiform, about twice the length of the seed proper
	Core Tillandsioideae type	plumose flight apparatus formed at the basal end by a multifilamentous outgrowths of the outer integument, extending off the basal end, innermost cell layer of the outer integument remaining fixed proximally, distally fused to an exostoma with the central and outer cell layers of the outer integument, the latter two layers split into cell rows and spreading at maturity, forming an parachute-like architecture; ± straight plume at the apical end, usually short and undivided, occasionally long and somewhat divided (*Alcantarea*), or lacking

Figure 6 displays the widely accepted taxonomic concepts applied by Grant & Zijlstra (1998) and Smith & Till (1998), with the exception of transferred xeromorphic, grey-leaved '*Vriesea*' species (Grant 1993, 1995b, Jul 2005), which was not generally accepted. To show the incompatibility of the traditional classification with the results of our phylogenetic analyses, the generic, subgeneric or sectional treatment of the latest monograph (Smith & Downs 1977) is also included. Figures 7 and 8 show the revised classification proposed in this study. Bromeliaceae subfam. Tillandsioideae is monophyletic and strongly supported (LBS 100/PBS 100/BPP 1). The two non-core Tillandsioideae genera *Glomeropitcairnia* (Glomeropitcairnieae) and *Catopsis* (Catopsideae) are strongly supported (both LBS 100/PBS 100/BPP 1), are sister groups (LBS 96/PBS 98/BPP 1), and together are sister to a strongly supported core Tillandsioideae clade (LBS 100/PBS 100/BPP 1). Core Tillandsioideae splits into two subclades, both strongly supported (LBS 100/PBS 100/BPP 1) and mostly corresponding to the tribes Vrieseeae and Tillandsieae. The two tribes are not monophyletic when previous taxonomic concepts are applied, as members of *Vriesea* are nested within the Tillandsieae, and *Tillandsia* species are nested in Vrieseeae.

The clade containing most Vrieseeae species is divided into two main lineages. The first (LBS 100/PBS 98/BPP 1) contains a monophyletic genus *Alcantarea* (LBS 100/PBS 100/BPP 1) in sister position to a clade composed of *Vriesea* species (LBS 100/PBS 98/BPP 1). The latter, nearly exclusive eastern Brazilian *Vriesea* clade, branches into two subclades (LBS 100/PBS 100/BPP 1; LBS 100/PBS 99/BPP 1), corresponding to two distinct lineages of *Vriesea* (e.g., *V. psittacina* and *V. harrylutheri*, respectively). The second lineage (LBS 100/PBS 100/BPP 1) includes mesomorphic Andean/northern South American/Central American/Caribbean *Vriesea* and *Werauhia* species, four *Tillandsia* species, and some *Mezobromelia* species. This second lineage is grouped into several distinct monophyletic lineages with a mostly well-resolved backbone: (1) *V. monstrum*, (2) *V. splendens* and *V. glutinosa* (LBS 100/PBS 100/BPP 1), (3) *Werauhia* (e.g., *W. gladioliflora*; LBS 100/PBS 100/BPP 1), (4) *V. chrysostachys* and *V. ospinae* (LBS 87/PBS 83/BPP 1), (5) *V. tuerckheimii*, (6) *Tillandsia singularis* and *T. asplundii* (LBS 100/PBS 100/BPP 1), and (7) several *Mezobromelia* species (e.g., *M. bicolor*) together with mesomorphic northern Andean *Vriesea* species (e.g., *V. dubia*), *T. amicorum*, and *T. schimperiana* (LBS 100/PBS 100/BPP 1).

The first non-core Tillandsieae clade that branches at the earliest node within the clade containing most Tillandsieae species consists of *Mezobromelia hutchisonii* and *M. fulgens* (LBS 100/PBS 100/BPP 1). The second clade (LBS 92/PBS 95/BPP 1) splits into two lineages, one being exclusively composed of *Guzmania* species (e.g., *G. monostachia*; LBS 100/PBS 100/BPP 1) and the other displaying mostly the species-rich genus *Tillandsia* in the sense of Smith & Downs (1977; LBS 100/PBS 100/BPP 1), but containing also the genus *Racinaea* and all xeromorphic Andean and two mesomorphic Central American/Mexican *Vriesea* species.

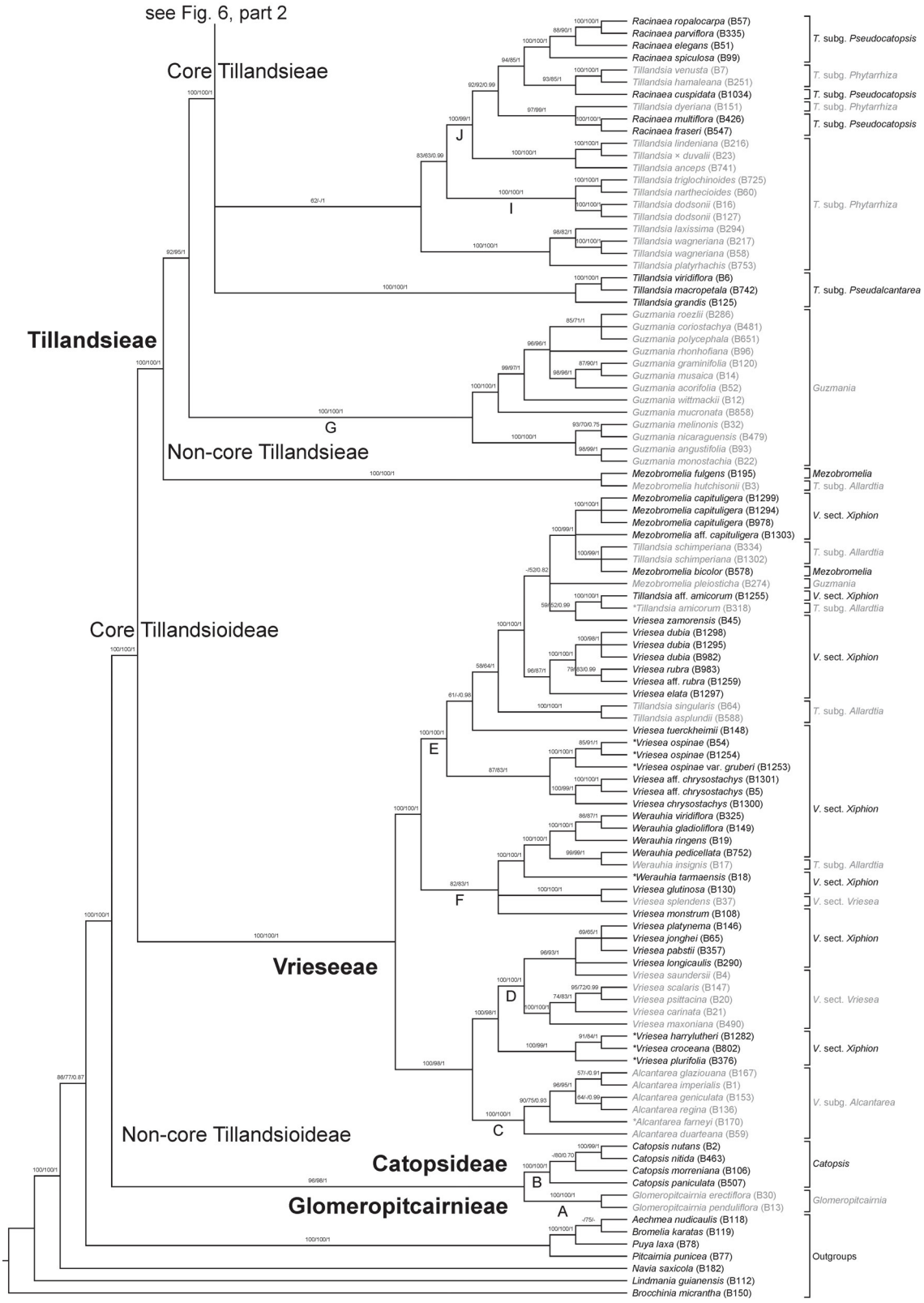
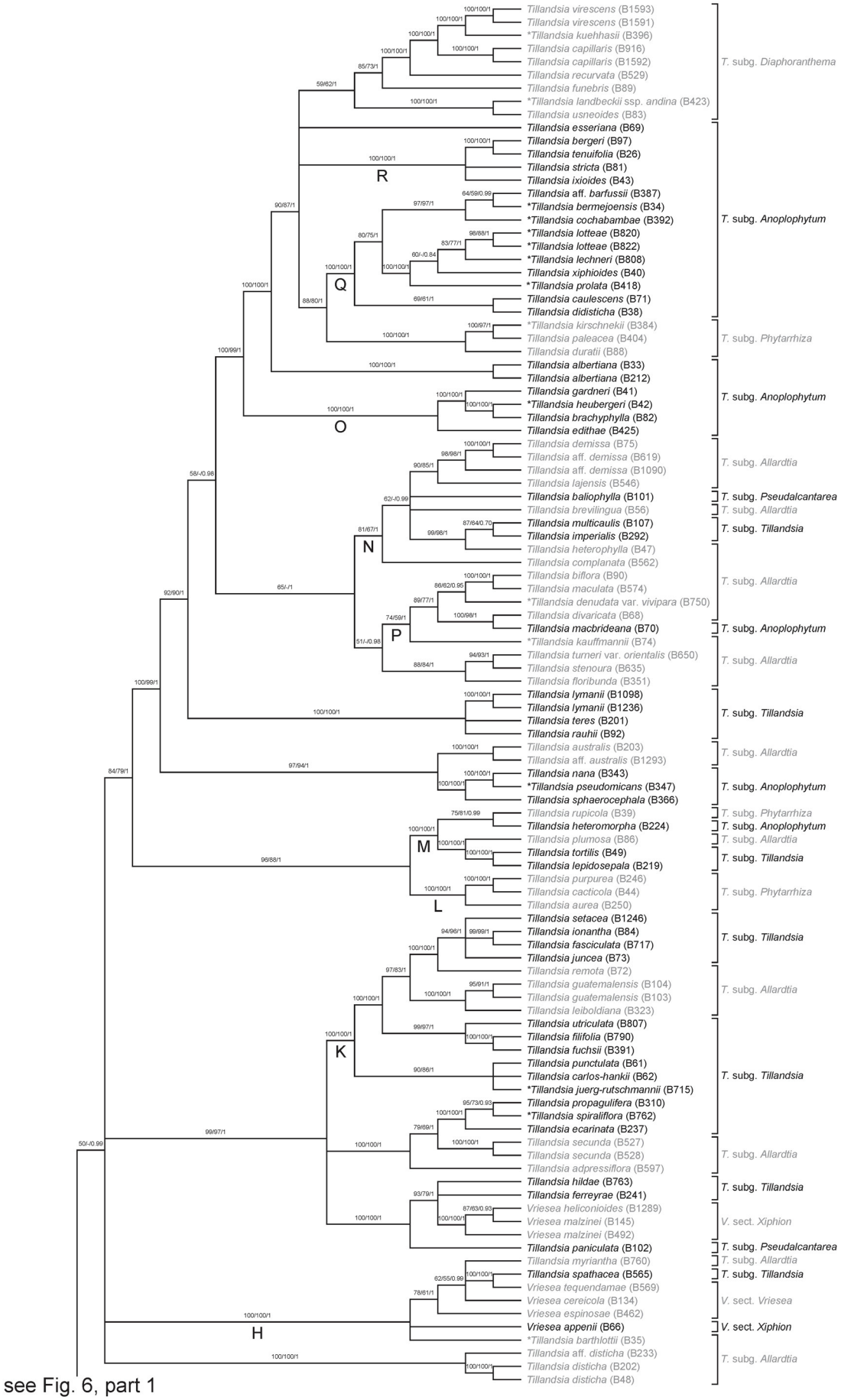


FIGURE 6. The traditional classification of Tillandsioideae. Maximum parsimony (MP) strict consensus tree based on ptDNA *rpoB-trnC-petN*, *trnK-matK-trnK*, *ycf1*, and nDNA *PHYC* sequence data (tree length = 5749 steps; CI = 0.581 and RI = 0.823). Numbers above branches are bootstrap support (BS) values of maximum likelihood (ML) and MP bootstrapping and Bayesian inference (BI) posterior probabiltities (LBS/PBS/BPP); missing values (-/-/-) indicate values less than 50% BS or 0.50 BPP, respectively. Letters below branches indicate clades already published in Barfuss *et al.* (2005a) and discussed in the subsequent literature. Taxa are labelled with their commonly accepted names in comparison to the classification according to Smith & Downs (1977). An asterisk before species names indicates taxa, which were described after the monograph was published, but classified here according to the circumscription of Smith & Downs (1977). Black and grey letters are used to indicate different taxonomic groups. **(Continued on next page)**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Tillandsia virescens (B1591)
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Tillandsia capillaris (B916)
Tillandsia capillaris (B1592)
Tillandsia recurvata (B529)
Tillandsia funebris (B89)
*Tillandsia landbeckii ssp. andina (B423)
Tillandsia usneoides (B83)
T. subg. Diaphoranthema
Tillandsia esseriana (B69)
Tillandsia bergeri (B97)
Tillandsia tenuifolia (B26)
Tillandsia stricta (B81)
Tillandsia ixioides (B43)
Tillandsia aff. barfussii (B387)
*Tillandsia bermejoensis (B34)
*Tillandsia cochabambae (B392)
*Tillandsia lotteae (B820)
*Tillandsia lotteae (B822)
*Tillandsia lechneri (B808)
Tillandsia xiphioides (B40)
*Tillandsia prolata (B418)
Tillandsia caulescens (B71)
Tillandsia didisticha (B38)
T. subg. Anoplophytum
*Tillandsia kirschnekii (B384)
Tillandsia paleacea (B404)
Tillandsia duratii (B88)
T. subg. Phytarrhiza
Tillandsia albertiana (B33)
Tillandsia albertiana (B212)
Tillandsia gardneri (B41)
*Tillandsia heubergeri (B42)
Tillandsia brachyphylla (B82)
Tillandsia edithae (B425)
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Tillandsia aff. demissa (B619)
Tillandsia aff. demissa (B1090)
Tillandsia lajensis (B546)
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Tillandsia baliophylla (B101)
T. subg. Pseudalcantarea
Tillandsia brevilingua (B56)
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Tillandsia multicaulis (B107)
Tillandsia imperialis (B292)
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Tillandsia complanata (B562)
Tillandsia biflora (B90)
Tillandsia maculata (B574)
*Tillandsia denudata var. vivipara (B750)
Tillandsia divaricata (B68)
Tillandsia macbrideana (B70)
*Tillandsia kauffmannii (B74)
Tillandsia turneri var. orientalis (B650)
Tillandsia stenoura (B635)
Tillandsia floribunda (B351)
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T. subg. Anoplophytum
T. subg. Allardtia
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Tillandsia lymanii (B1236)
Tillandsia teres (B201)
Tillandsia rauhii (B92)
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*Tillandsia pseudomicans (B347)
Tillandsia sphaerocephala (B366)
T. subg. Anoplophytum
Tillandsia rupicola (B39)
T. subg. Phytarrhiza
Tillandsia heteromorpha (B224)
T. subg. Anoplophytum
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Tillandsia tortilis (B49)
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Tillandsia cacticola (B44)
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Tillandsia hildae (B763)
Tillandsia ferreyrae (B241)
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Vriesea malzinei (B145)
Vriesea malzinei (B492)
V. sect. Xiphion
Tillandsia paniculata (B102)
T. subg. Pseudalcantarea
Tillandsia myriantha (B760)
T. subg. Allardtia
Tillandsia spathacea (B565)
T. subg. Tillandsia
Vriesea tequendamae (B569)
Vriesea cereicola (B134)
Vriesea espinosae (B462)
V. sect. Vriesea
Vriesea appenii (B66)
*Tillandsia barthlottii (B35)
V. sect. Xiphion
Tillandsia aff. disticha (B233)
Tillandsia disticha (B202)
Tillandsia disticha (B48)
T. subg. Allardtia
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see Fig. 6, part 1

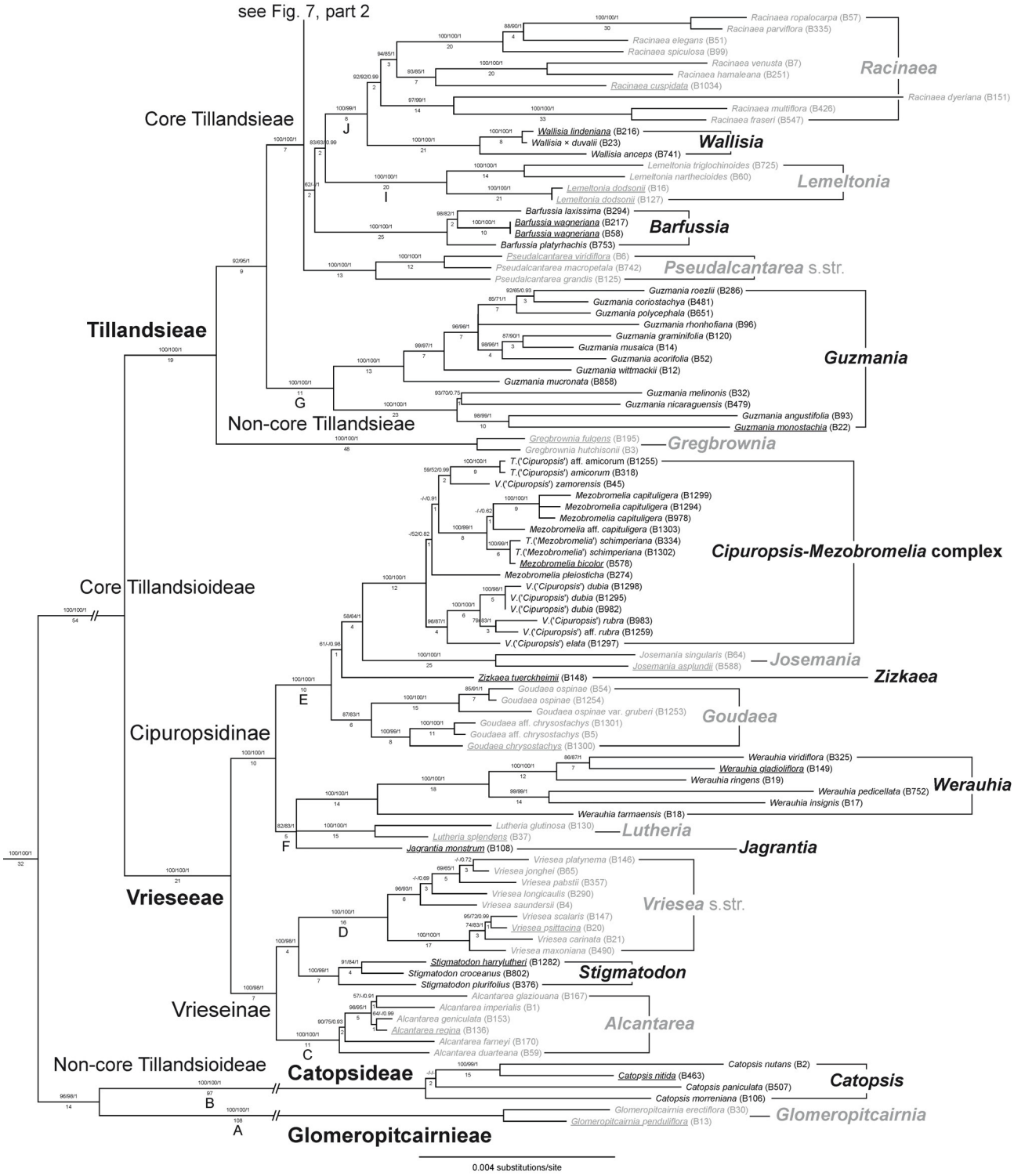
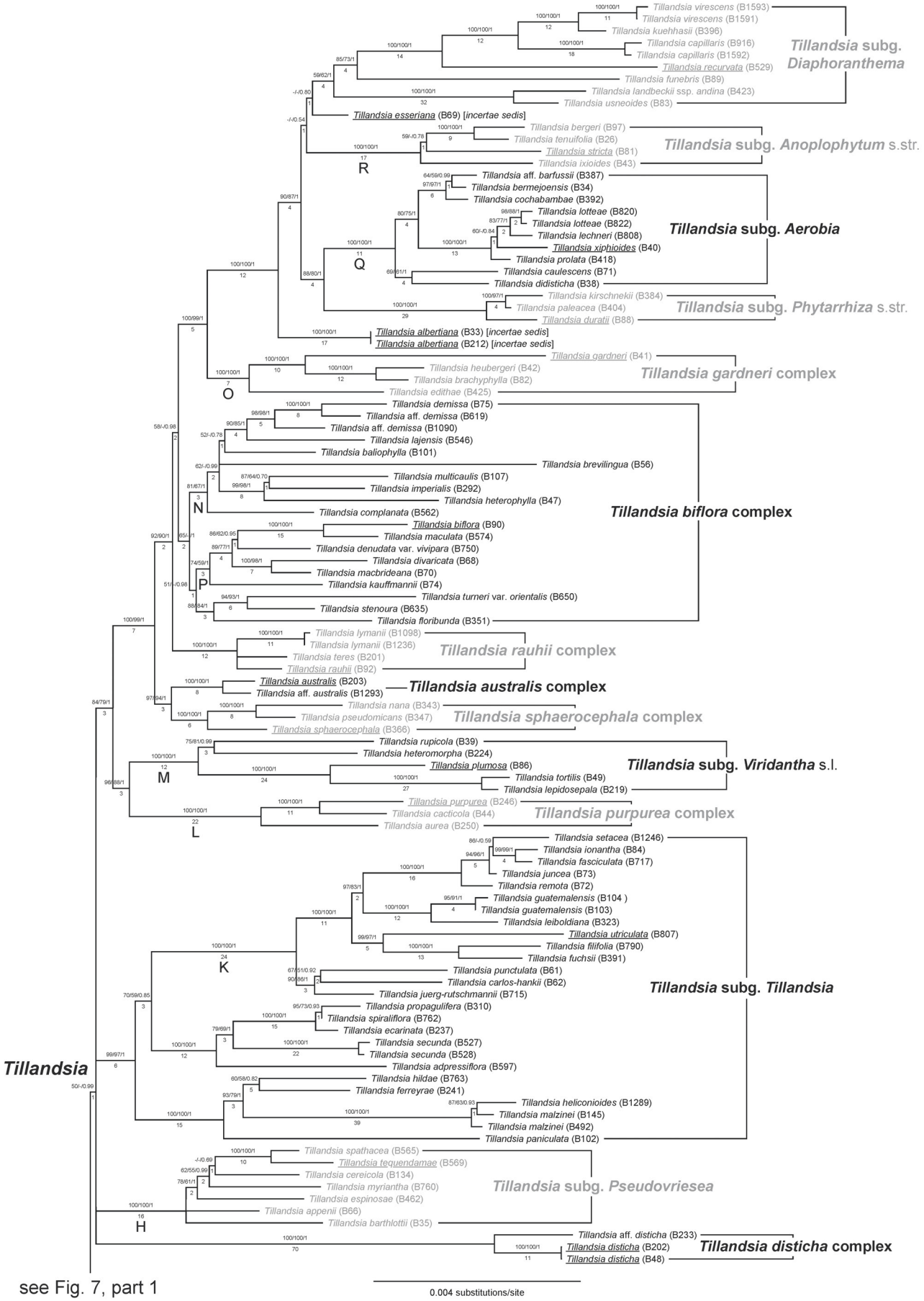


FIGURE 7. The revised classification of Tillandsioideae. Maximum likelihood phylogram (ML) based on ptDNA *rpoB-trnC-petN*, *trnK-matK-trnK*, *ycf1*, and nDNA *PHYC* sequence data. Branch lengths are proportional to the inferred number of nucleotide changes along each branch; numbers below branches are branch lengths of variable DNA characters optimised onto the ML phylogram (tree length = 5754 steps; CI = 0.580 and RI = 0.822). Numbers above branches are bootstrap support (BS) values of maximum likelihood (ML) and MP bootstrapping and Bayesian inference (BI) posterior probabiltities (LBS/PBS/BPP); missing values (-/-/-) indicate values less than 50% BS or 0.50 BPP, respectively. Letters below branches indicate clades already published in Barfuss *et al.* (2005a) and discussed in the subsequent literature. Taxa are labelled with their newly proposed names according to the revised classification. Generic and subgeneric type species, key taxa for species complexes and unclassified taxa are underlined. Black and grey letters are used to indicate different taxonomic groups. **(Continued on next page)**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Tillandsia barthlottii (B35)
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Tillandsia subg. Pseudovriesea
Tillandsia aff. disticha (B233)
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Tillandsia disticha complex
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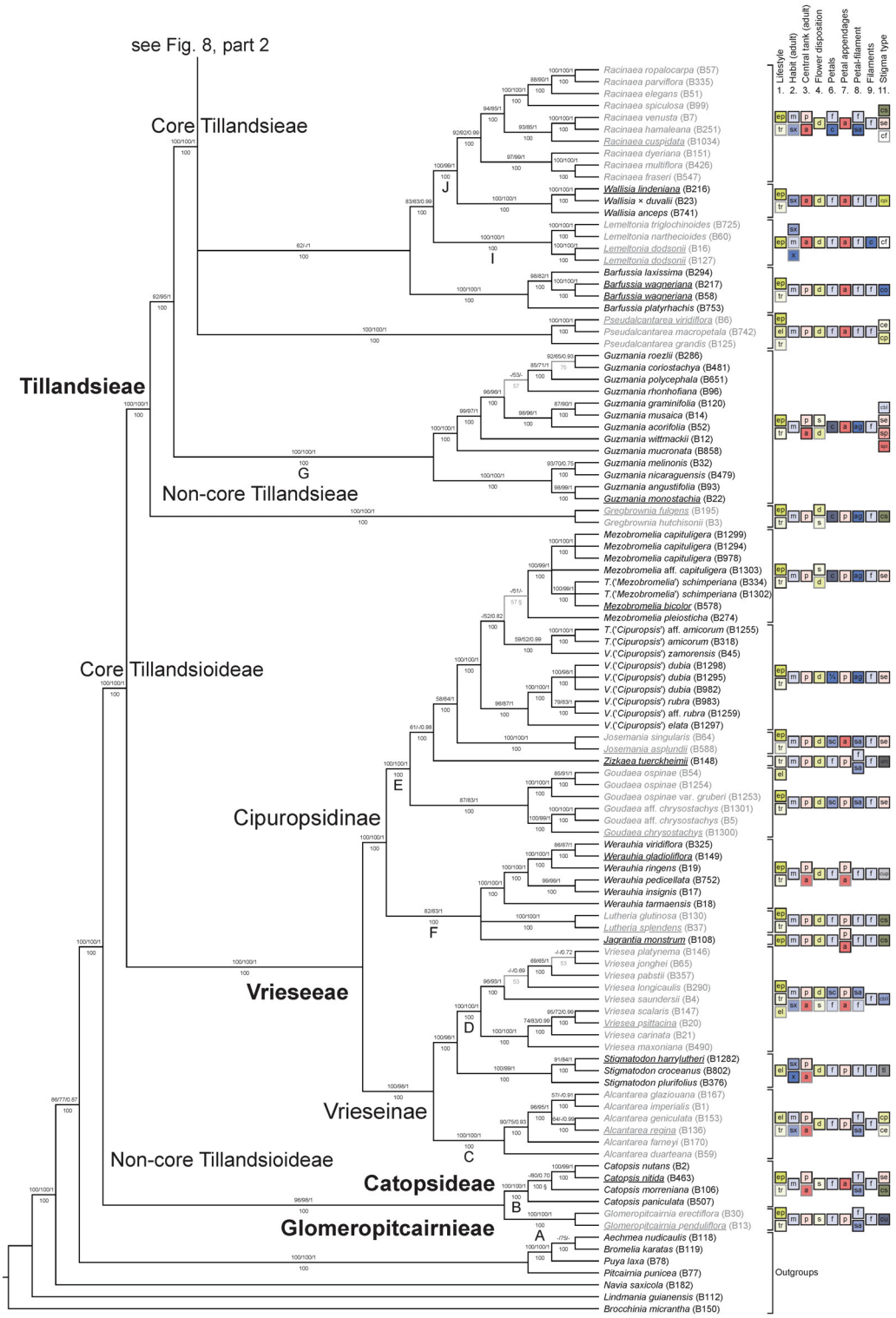
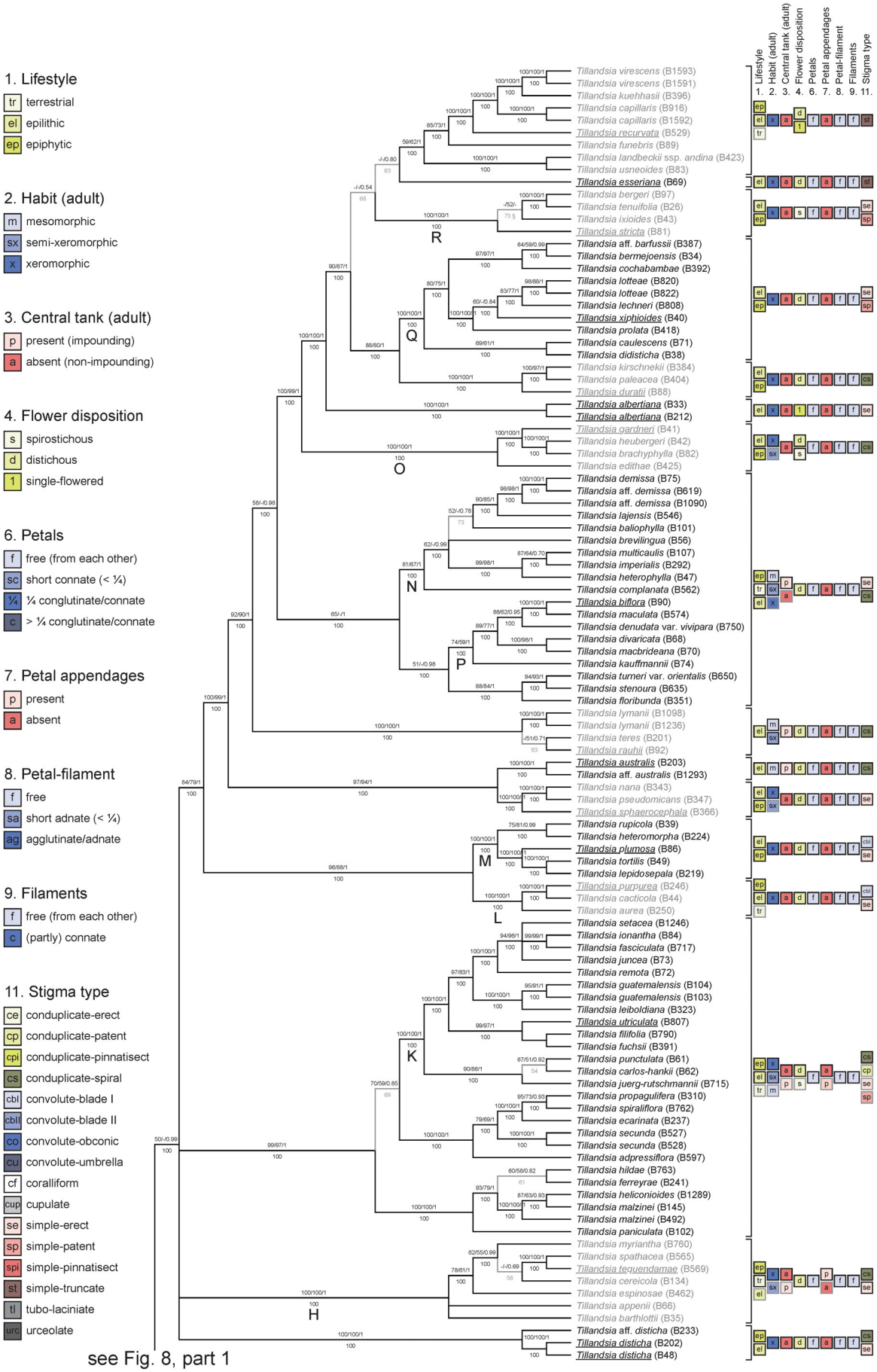


FIGURE 8. The revised classification of Tillandsioideae and ecological adaptations and morphological characters. Maximum parsimony (MP) majority-rule consensus tree based on ptDNA *rpoB-trnC-petN*, *trnK-matK-trnK*, *ycf1*, and nDNA *PHYC* sequence data; the figure also shows the MP strict consensus tree, in which the grey branches collapse (tree length = 5749 steps; CI = 0.581 and RI = 0.823). Numbers above branches are bootstrap support (BS) values of maximum likelihood (ML) and MP bootstrapping and Bayesian inference (BI) posterior probabiltities (LBS/PBS/BPP); missing values (-/-/-) indicate values less than 50% BS or 0.50 BPP, respectively; numbers below branches indicate the percentage of MP phylograms showing that branch; an § indicates branches not compatible with the ML phylogram. Letters below branches indicate clades already published in Barfuss *et al.* (2005a) and discussed in the subsequent literature. Taxa are labelled with their newly proposed names according to the revised classification. Generic and subgeneric type species, key taxa for species complexes and unclassified taxa are underlined. Black and grey letters are used to indicate different taxonomic groups. Abbreviations for morphological-ecological adaptations and morphological characters are explained in Tables 4–6. Grey symbols indicate states, which are rarely present in that lineage. **(Continued on next page)**


1. Lifestyle
tr terrestrial
el epilithic
ep epiphytic
2. Habit (adult)
m mesomorphic
sx semi-xeromorphic
x xeromorphic
3. Central tank (adult)
p present (impounding)
a absent (non-impounding)
4. Flower disposition
s spirostichous
d distichous
1 single-flowered
6. Petals
f free (from each other)
sc short connate (< ¼)
¼ ¼ conglutinate/connate
c > ¼ conglutinate/connate
7. Petal appendages
p present
a absent
8. Petal-filament
f free
sa short adnate (< ¼)
ag agglutinate/adnate
9. Filaments
f free (from each other)
c (partly) connate
11. Stigma type
ce conduplicate-erect
cp conduplicate-patent
cpi conduplicate-pinnatisect
cs conduplicate-spiral
cbl convolute-blade I
cbll convolute-blade II
co convolute-obconic
cu convolute-umbrella
cf coralliform
cup cupulate
se simple-erect
sp simple-patent
spi simple-pinnatisect
st simple-truncate
tl tubo-laciniate
urc urceolate
Lifestyle
Habit (adult)
Central tank (adult)
Flower disposition
Petals
Petal appendages
Petal-filament
Filaments
Stigma type
1. 2. 3. 4. 6. 7. 8. 9. 11.
Tillandsia virescens (B1593)
Tillandsia virescens (B1591)
Tillandsia kuehhasii (B396)
Tillandsia capillaris (B916)
Tillandsia capillaris (B1592)
Tillandsia recurvata (B529)
Tillandsia funebris (B89)
Tillandsia landbeckii ssp. andina (B423)
Tillandsia usneoides (B83)
Tillandsia esseriana (B69)
Tillandsia bergeri (B97)
Tillandsia tenuifolia (B26)
Tillandsia ixioides (B43)
Tillandsia stricta (B81)
R
Tillandsia aff. barfussii (B387)
Tillandsia bermejoensis (B34)
Tillandsia cochabambae (B392)
Tillandsia lotteae (B820)
Tillandsia lotteae (B822)
Tillandsia lechneri (B808)
Tillandsia xiphioides (B40)
Tillandsia prolata (B418)
Tillandsia caulescens (B71)
Tillandsia didisticha (B38)
Tillandsia kirschnekii (B384)
Tillandsia paleacea (B404)
Tillandsia duratii (B88)
Tillandsia albertiana (B33)
Tillandsia albertiana (B212)
Q
Tillandsia gardneri (B41)
Tillandsia heubergeri (B42)
Tillandsia brachyphylla (B82)
Tillandsia edithae (B425)
O
Tillandsia demissa (B75)
Tillandsia aff. demissa (B619)
Tillandsia aff. demissa (B1090)
Tillandsia lajensis (B546)
Tillandsia baliophylla (B101)
Tillandsia brevilingua (B56)
Tillandsia multicaulis (B107)
Tillandsia imperialis (B292)
Tillandsia heterophylla (B47)
Tillandsia complanata (B562)
Tillandsia biflora (B90)
N
Tillandsia maculata (B574)
Tillandsia denudata var. vivipara (B750)
Tillandsia divaricata (B68)
Tillandsia macbrideana (B70)
Tillandsia kauffmannii (B74)
Tillandsia turneri var. orientalis (B650)
Tillandsia stenoura (B635)
Tillandsia floribunda (B351)
P
Tillandsia lymanii (B1098)
Tillandsia lymanii (B1236)
Tillandsia teres (B201)
Tillandsia rauhii (B92)
Tillandsia australis (B203)
Tillandsia aff. australis (B1293)
Tillandsia nana (B343)
Tillandsia pseudomicans (B347)
Tillandsia sphaerocephala (B366)
Tillandsia rupicola (B39)
Tillandsia heteromorpha (B224)
Tillandsia plumosa (B86)
Tillandsia tortilis (B49)
Tillandsia lepidosepala (B219)
M
Tillandsia purpurea (B246)
Tillandsia cacticola (B44)
Tillandsia aurea (B250)
L
Tillandsia setacea (B1246)
Tillandsia ionantha (B84)
Tillandsia fasciculata (B717)
Tillandsia juncea (B73)
Tillandsia remota (B72)
Tillandsia guatemalensis (B104)
Tillandsia guatemalensis (B103)
Tillandsia leiboldiana (B323)
Tillandsia utriculata (B807)
Tillandsia filifolia (B790)
Tillandsia fuchsii (B391)
Tillandsia punctulata (B61)
Tillandsia carlos-hankii (B62)
Tillandsia juerg-rutschmannii (B715)
K
Tillandsia propagulifera (B310)
Tillandsia spiraliflora (B762)
Tillandsia ecarinata (B237)
Tillandsia secunda (B527)
Tillandsia secunda (B528)
Tillandsia adpressiflora (B597)
Tillandsia hildae (B763)
Tillandsia ferreyrae (B241)
Tillandsia heliconioides (B1289)
Tillandsia malzinei (B145)
Tillandsia malzinei (B492)
Tillandsia paniculata (B102)
Tillandsia myriantha (B760)
Tillandsia spathacea (B565)
Tillandsia tequendamae (B569)
Tillandsia cereicola (B134)
Tillandsia espinosae (B462)
Tillandsia appenii (B66)
Tillandsia barthlottii (B35)
H
Tillandsia aff. disticha (B233)
Tillandsia disticha (B202)
Tillandsia disticha (B48)
see Fig. 8, part 1

Within this latter core Tillandsieae clade, three lineages can be recognized on a trichotomy. The first (LBS 100/PBS 100/BPP 1) is formed by *Tillandsia* subg. *Pseudalcantarea* s.str. composed of *T. grandis*, *T. macropetala*, and *T. viridiflora*. The second (LBS 62/PBS -/BPP 1) is composed of mesomorphic and semi-xeromorphic species of *T.* subg. *Phytarrhiza* s.l. which are forming a grade with species of genus *Racinaea*: (1) the *T. wagneriana* complex including *T. laxissima* and *T. platyrhachis* (LBS 100/PBS 100/BPP 1); (2) the *T. dodsonii* complex including *T. narthecioides* and *T. triglochinoides* (LBS 100/PBS 100/BPP 1); (3) the *T. lindenii* complex including *T. anceps* and *T.* × *duvalii* (LBS 100/PBS 100/BPP 1); and (4) *Racinaea* (e.g., *R. cuspidata*) together with *T. dyeriana*, *T. hamaleana*, and *T. venusta* (LBS 92/PBS 92/BPP 0.99).

The weakly supported third lineage (LBS 50/PBS -/BPP 0.99) containing the vast majority of *Tillandsia* species from diverse subgenera, also has a basal polytomy of four distinct clades: (1) the *T. disticha* complex (LBS 100/PBS 100/BPP 1); (2) xeromorphic Andean *Vriesea* species (e.g., *V. tequendamae*) together with *T. barthlottii*, *T. myriantha*, and *T. spathacea* (LBS 100/PBS 100/BPP 1); (3) most species of *T.* subg. *Tillandsia* (e.g., *T. utriculata*), including some Central American species from *T.* subg. *Allardtia* (e.g., *T. guatemalensis*), Caribbean *T. paniculata*, Mexican *V. malzinei*, and Central/northern South American *V. heliconioides* (LBS 99/PBS 97/BPP 1); and (4) a clade of a predominantly South American radiation (e.g., *T. aurea*; LBS 84/PBS 79/BPP 1).

The latter is divided into two subclades: (1) a clade (LBS 96/PBS 88/BPP 1) consisting of the *Tillandsia purpurea* complex (LBS 100/PBS 100/BPP 1) in sister position to a clade (LBS 100/PBS 100/BPP 1) consisting of the Mexican *T. plumosa* complex (*Viridantha*) (LBS 100/PBS 100/BPP 1) and the northern Andean *T. tectorum* complex (e.g., *T. rupicola*; LBS 75/PBS 81/BPP 0.99), and (2) a strongly supported clade of predominantly Andean *Tillandsia* species (LBS 100/PBS 99/BPP 1; e.g., *T. stenoura*).

The second clade is further divided and forming a grade: (1) the *Tillandsia sphaerocephala* complex (LBS 100/PBS 100/BPP 1), including *T. nana* and *T. pseudomicans*, in a clade (LBS 97/PBS 94/BPP 1) together with the *T. australis* complex (LBS 100/PBS 100/BPP 1); (2) the *T. rauhii* complex (LBS 100/PBS 100/BPP 1) including *T. lymanii* and *T. teres*; (3) the polymorphic *T. biflora* complex (e.g., *T. demissa*) including Caribbean *T. baliophylla* and Mexican *T. heterophylla*, *T. imperialis* and *T. multicaulis* (LBS 65/PBS -/BPP 1); (4) the *T. gardneri* complex (LBS 100/PBS 100/BPP 1) with *T. brachyphylla* and *T. heubergeri* together with *T. edithae* (LBS 100/PBS 100/BPP 1); (5) *T. albertiana* (LBS 100/PBS 100/BPP 1); and (6) a last clade (LBS 90/PBS 87/BPP 1) displaying a basal polytomy with (1) *T. esseriana*, (2) *T.* subg. *Anoplophytum* s.str. (e.g., *T. stricta*; LBS 100/PBS 100/BPP 1), (3) a clade (LBS 88/PBS 80/BPP 1) consisting of *T.* subg. *Phytarrhiza* s.str. (e.g., *T. duratii*; LBS 100/PBS 100/BPP 1) in sister position to the *T. xiphioides* complex (LBS 100/PBS 100/BPP 1), and (4) *T.* subg. *Diaphoranthema* (e.g., *T. recurvata*; LBS 59/PBS 62/BPP 1).

Morphological analyses

Morphological characters studied and subsequently used for taxonomic circumscriptions and morphological descriptions are presented in the taxonomy section, with the most important characters receiving a detailed explanation in Table 4. Stigma types thus far found in Tillandsioideae are presented in Table 5. Table 6 summarises 14 traits, both traditionally used, and new ones, for each major phylogenetic lineage (genera). Nine of these traits are mapped onto the 50% majority-rule tree of the MP analysis (Fig. 8) to show the distribution and taxonomic value of these characters.

Lifestyle (Table 6), habit and central tank formation (Fig. 1; Table 6), and corolla types (Figs. 2, 3), in general, support the groups obtained in the phylogenetic DNA sequence analysis, but need more detailed investigation as important traits used to characterize taxa (see taxonomy section).

At generic level, only the following diagnostic characters used by Mez (1896, 1935) and Smith & Downs (1977) are still used here in the old sense to diagnose Tillandsioideae genera: ovary position (*Glomeropitcairnia*), the formation of seed appendages (*Catopsis*), and the degree of the petal connation/conglutination (*Guzmania*, *Mezobromelia*). Ovary position has traditionally been considered as semi-inferior (perigynous) in *Glomeropitcairnia*, and superior (hypogynous) in remaining Tillandsioideae. However, while this is correct for *Catopsis* p.p., and for the placenta position in the remaining Tillandsioideae, studies of septal nectaries, which are part of the carpels, suggest that ovary position is actually semi-inferior in most Tillandsioideae (e.g., Bernardello *et al.* 1991, Böhme 1988, Sajo *et al.* 2004). This semi-inferior part containing nectary tissue is often called the "obconic pedicel" or "enlarged receptacle", and can be quite substantial (*Alcantarea*, *Pseudalcantarea*, *Tillandsia* p.p.; e.g., Beaman 1989, Beaman & Judd 1996, Versieux 2009). The distribution of the characters 'flower

disposition' and the 'presence/absence of petal appendages' over the phylogenetic trees shows that these characters are not suitable as applied previously (i.e., diagnostic for the genera in Smith & Downs 1977), as they are homoplasious and/or plesiomorphic (Table 6; Fig. 8). However, these characters are sometimes useful in combination with other characters, to differentiate genera by synapomorphic combinations of diagnostic morphological characters.

TABLE 5. Stigma types in Tillandsioideae. Determination of stigma types is a synthesis of own observations and from literature (Brown & Gilmartin 1984, 1988, 1989, Gilmartin et al. 1989, Gortan, 1990, 1991, Leme 2007, 2009, Leme & Brown 2004, Schill *et al.* 1988, Till 2000a, Till *et al.* 1997). The morphological descriptions are based on the occurrence in subfamily Tillandsioideae. In Bromeliaceae as a whole, the stigma type is not necessarily associated to presence/absence of papillae or margin ornamentation, e.g., the basic conduplicate-spiral or simple-erect types can have entire, laciniate, dentate, crenulate, or scalloped margins, either papillate or non-papillate. Recognition of further (sub)types needs a careful investigation of the concerned species and might help narrowing generic circumscriptions. Some of the newly proposed types can be also applied to species of the remaining subfamilies with few adaptations.

Stigma type	Abbr.	Figs.	Description	Genus	Reference
conduplicate-erect	ce	4C–E	lobes free, erect, elongate, conduplicate, ± spirally twisted; margins densely papillate	*Alcantarea* p.p., *Pseudalcantarea* p.p.	Leme (2009)
conduplicate-patent (= conduplicate-spreading)	cp	4A, B	lobes free, spreading, elongate, conduplicate, ± spirally twisted; margins densely papillate	*Alcantarea* p.p., *Pseudalcantarea* p.p., *Tillandsia* p.p.	Leme (2007)
conduplicate-pinnatisect	cpi	4N, P	lobes free, erect, elongate, conduplicate, ± spirally twisted; margins pinnatisect, pinnae elongate, straight, papillate	*Wallisia*	This study
conduplicate-spiral	cs	4F–H	lobes free, erect to subspreading, ± broadened, conduplicate, spirally twisted, tightly to ± openly contort; margins papillate	*Gregbrownia*, *Jagrantia*, *Lutheria*, *Racinaea* p.p., *Tillandsia* p.p.	Brown & Gilmartin (1984, 1989)
convolute-blade I (guzmanioid)	cbI	5A	lobes free, erect to subspreading, ± broadened, slightly convolute; margins undulate, densely papillate; stigma capitate to narrowly infundibuliform	*Guzmania* p.p., *Tillandsia* p.p.	Brown & Gilmartin (1984, 1989)
convolute-blade II (vrieseoid)	cbII	5B–D	lobes ± fused, spreading, strongly broadened, convolute; margins undulate, densely papillate; stigma infundibuliform to umbrella-shaped	*Vriesea*	Brown & Gilmartin (1984, 1989)
convolute-obconic	co	5M, N	lobes free, erect, broadened, slightly convolute, ± slightly twisted; margins undulate, papillate; stigma obconic	*Barfussia*	This study
convolute-umbrella	cu	Till *et al.* (1997)	lobes fused, spreading, membranaceous, distinctly broadened, convolute; margins undulate, papillate; stigma umbrella-shaped	*Glomeropitcairnia*	Brown & Gilmartin (1989), Gilmartin *et al.* (1989)
coralliform	cf	5O, P	lobes free, curtate, coralliform, erect; margins undulate, densely papillate; stigma capitate	*Lemeltonia*, *Racinaea* p.p.	Brown & Gilmartin (1989)
cupulate	cup	5H–J	lobes ± fused, erect, truncate; margins entire, not papillate; stigma shallow cupulate with increased diameter from base to apex	*Werauhia*	Brown & Gilmartin (1989)

...Continued on next page

TABLE 5. (Continued)

Stigma type	Abbr.	Figs.	Description	Genus	Reference
simple-erect	se	4I, M	lobes free, erect to subspreading, flat to navicular; margins entire to crenulate, straight to slightly undulate, papillate	*Catopsis*, *Cipuropsis*, *Goudaea*, *Guzmania* p.p., *Josemania*, *Mezobromelia*, *Racinaea* p.p., *Tillandsia* p.p.	Brown & Gilmartin (1984, 1989)
simple-patent	sp	4J, K	lobes free, spreading, elongate, flat to navicular; margins entire to crenulate, straight to slightly undulate, papillate	*Guzmania* p.p., *Tillandsia* p.p.	This study
simple-pinnatisect	spi	4L, O	lobes free, erect to subspreading, elongate, navicular; margins pinnately incised, pinnae oblong, spreading, papillate	*Guzmania* p.p.	This study
simple-truncate	st	Gortan (1991), Till (2000a)	lobes free, ± erect, curtate, ± horizontally truncate, U-shaped; margins entire, densely papillate	*Tillandsia* p.p.	This study
tubo-laciniate	tl	5E–G	lobes ± fused, erect, tubular; margins denticulate to laciniate, mostly not, rarely sparsely papillate; stigma deeply cupulate, ± with similar diameter from base to apex	*Stigmatodon*	Leme & Brown (2004)
urceolate	urc	5K, L	lobes ± fused, erect, truncate; margins entire, papillate; stigma ± closed urceolate	*Zizkaea*	This study

The most powerful super-specific new diagnostic character for taxonomy in Bromeliaceae subfam. Tillandsioideae (and most probably for the whole family) is stigma morphology (initially emphasized by Brown & Gilmartin 1984) that is described in Table 5, their distribution among genera shown in Table 6 and Figs. 3 and 4. One new stigma type (urceolate) and several subtypes of the basic conduplicate-spiral type (conduplicate-pinnatisect type), convolute-blade type (convolute-obconic type) and simple-erect type (simple-patent type, simple-pinnatisect type and simple-truncate type) are now known (Table 5). Other important characters used to circumscribe genera are e.g., leaf, sepal, petal and stamen morphology, inflorescence architecture and micromorphology of ovules, pollen and seeds.

Tillandsioideae pollen usually is sulcate and reticulate, rarely non-reticulate (*Tillandsia* p.p.) or occasionally inaperturate (*Guzmania* p.p.), as already shown by Halbritter (1988, 1992). Differences between the taxa are observable in pollen size, and sulcus features and ornamentation (Table 4). The sulcus is either of the simple type (type A) or the complex type (type B). The simple type is divided into two subtypes, but occurs within Tillandsioideae only in *Catopsis*: sulcus of the *Catopsis* type (subtype b; subtype a or *Puya* type occurs in Hechtioideae, Navioideae, Pitcairnioideae and Puyoideae). The complex type is divided into four subtypes, which are all present in Tillandsioideae: sulcus of the diffuse type (subtype c), sulcus of the insulae type (subtype d), sulcus of the operculum type (subtype e), or sulcus of the *Alcantarea* type (subtype f, former *Vriesea imperialis* type). Between these types, there are continuous transitions and variations, which need further detailed investigations.

Pollen and other micromorphological characters (endostome type of the seed, embryo type; Groß 1988) are omitted from the taxonomic key, and partly from the taxonomy section, because these are unknown for many taxa and are quite impractical as field characters.

TABLE 6. Morphological-ecological adaptations and morphological characters used to differentiate among genera of Tillandsioideae. Taxa are arranged according to the taxonomy chapter. Data in brackets indicate states, which are rarely present in that genus. **Lifestyle**: ep = epiphytic, el = epilithic, tr = terrestrial/saxicolous. **Habit (adult)**: m = mesomorphic, sx = semi-xeromorphic, x = xeromorphic. **Central tank (adult)**: a = absent, p = present. **Flower disposition**: d = distichous, s = spiral, 1 = single-flowered. **Sepals**: asym = (distinctly) asymmetric, sym = (sub)symmetric. **Petals**: c = connate/conglutinate, f = free (from each other), sc = short connate. **Petal appendages**: a = absent, p = present. **Petal-filament**: ag = agglutinate, ap = antepetalous, as = antesepalous, f = free, sa = short adnate. **Filaments**: c = connate/conglutinate, f = free (from each other). **Stigma type**: cbI = convolute-blade I (guzmanioid), cbII = convolute-blade II (vrieseoid), ce = conduplicate-erect, cf = coralliform, co = convolute-obconic, cp = conduplicate-patent, cpi = conduplicate-pinnatisect, cs = conduplicate-spiral, cu = convolute-umbrella, cup = cupulate, se = simple-erect, sp = simple-patent, spi = simple-pinnatisect, st = simple-truncate, tl = tubo-laciniate, urc = urceolate. **Ovary position**: inf = inferior, sup = superior. **Ovule appendage**: a = absent, ap = appendage, ov = ovule. **Capsule**: sept = septicidal. **Seed appendages**: *C.* type = *Catopsis* type, *Gl.* type = *Glomeropitcairnia* type, Core Ti. type = Core Tillandsioideae type.

Genus	1. Lifestyle	2. Habit (adult)	3. Central tank (adult)	4. Flower disposition	5. Sepals	6. Petals	7. Petal appendages	8. Petal-filament agglutination/ adnation	9. Filaments	10. Ovary position	11. Stigma type	12. Ovule appendage	13. Capsule	14. Seed appendages
Catopsideae														
Catopsis	ep/(tr)	m	p/(a)	s	asym	f	a	f/as f/ap sa	f	sup–1/8 inf	se/cs	ap > ov	sept	*C.* type
Glomeropitcairnieae														
Glomeropitcairnia	ep/tr	m	p	s	sym	f	p	as f/ap sa	f	1/2–2/3 inf	cu	ap > ov	partly sept	*Gl.* type
Tillandsieae														
Barfussia	ep/(tr)	m	p	d	sym	f	a	f	f	1/8–1/3 inf	co	a	sept	Core Ti. type
Gregbrownia	ep/tr	m	p	d/(s)	sym	> 1/2 c	p	ag	f	1/8–1/3 inf	cs	a	sept	Core Ti. type
Guzmania	ep/tr	m	p/a	s/(d)	sym	> 1/4 c	a	ag	f	1/8–1/3 inf	cbI/se/sp/spi	a	sept	Core Ti. type
Lemeltonia	ep	sx/(m)/(x)	a	d	sym	f	a	f	(partly) c	1/8–1/3 inf	cf	a	sept	Core Ti. type
Pseudalcantarea	ep/el/(tr)	m	p	d	sym	f	a	f	f	1/3–1/2 inf	ce/cp	ap ≤ ov	sept	Core Ti. type
Racinaea	ep/(tr)	m/(sx)	p/a	d	asym/(sym)	f/sc	a	f/sa	f	1/8–1/3 inf	se/cs/(cf)	a	sept	Core Ti. type

...Continued on next page

TABLE 6. (Continued)

Genus	1. Lifestyle	2. Habit (adult)	3. Central tank (adult)	4. Flower disposition	5. Sepals	6. Petals	7. Petal appendages	8. Petal-filament agglutination/ adnation	9. Filaments	10. Ovary position	11. Stigma type	12. Ovule appendage	13. Capsule	14. Seed appendages
Tillandsia	ep/el/(tr)	x/m/sx	a/p	d/(s)/(1)	sym	f	a/(p)	f	f	1/8–1/2 inf	cs/se/sp/st/(cp)/(cbI)	ap ≤ ov/(> ov)/(a)	sept	Core Ti. type
Wallisia	ep/(tr)	sx	a	d	sym	f	a	f	f	1/8–1/3 inf	cpi	a	sept	Core Ti. type
Cipuropsidinae														
Cipuropsis	ep/tr	m	p	d	sym	1/4 c	p	ag	f	1/8–1/3 inf	se	a	sept	Core Ti. type
Goudaea	ep/tr	m	p	d	sym	sc	p	sa	f	1/8–1/3 inf	se	a	sept	Core Ti. type
Jagrantia	ep	m	p	d	sym	f	p/a	f	f	1/8–1/3 inf	cs	a	sept	Core Ti. type
Josemania	ep/(tr)	m	p	d	sym	sc	a	sa	f	1/8–1/3 inf	se	a	sept	Core Ti. type
Lutheria	ep/tr	m	p	d	sym	f	p	f	f	1/8–1/3 inf	cs	a	sept	Core Ti. type
Mezobromelia	ep/tr	m	p	s/(d)	sym	1/3–1/2 c	p	ag	f	1/8–1/3 inf	se	a	sept	Core Ti. type
Werauhia	ep/tr	m	p/(a)	d	sym	f	p/(a)	f	f	1/8–1/3 inf	cup	a	sept	Core Ti. type
Zizkaea	tr/el	m	p	d	sym	f	p	as f/ap sa	f	1/8–1/3 inf	urc	ap ≤ ov	sept	Core Ti. type
Vrieseinae														
Alcantarea	el/(tr)	m/(sx)	p/(a)	d	sym	f	p	f/as f/ap sa	f	1/3–1/2 inf	cp/(ce)	ap > ov	sept	Core Ti. type
Stigmatodon	el	sx/x	p/(a)	d	sym	f	p	f	f	1/8–1/3 inf	tl	ap ≤ ov	sept	Core Ti. type
Vriesea	ep/tr/(el)	m/(sx)	p/(a)	d/(s)	sym	sc/(f)	p/(a)	sa/(f)	f	1/8–1/3 inf	cbII	ap ≤ ov/(> ov)/(a)	sept	Core Ti. type

Discussion

Both phylogenetic and morphological results show that a taxonomic revision for Bromeliaceae subfam. Tillandsioideae is required. The monophyly and morphological circumscriptions according to Smith & Downs (1977) of only *Catopsis* (Palací 1997), *Glomeropitcairnia* and *Guzmania* are supported. The remaining three genera *Mezobromelia*, *Tillandsia*, and *Vriesea* are not monophyletic and are in conflict with the classification based on the traditional morphological characters used by Smith & Downs (1977), i.e., petal appendages present/absent, flower arrangement (distichous/spiral). The same applies to characters Smith & Downs used to determine subgeneric categories (subgenera, sections), i.e., stamens included/exserted, filaments straight/plicate, petal blades broad/narrow and conspicuous/inconspicuous. However, most of these characters still have important taxonomic value for defining species groups using synapomorphic combinations of diagnostic morphological characters, which are of relevance in the current study for characterizing some new genera.

Mezobromelia and the two largest genera *Tillandsia* and *Vriesea* are polyphyletic. The two distinct lineages of *Mezobromelia* are placed in either Tillandsieae (species with laxly flowered spikes) or Vrieseeae (species with dense spikes). The xeromorphic, grey-leaved *Vriesea* species (as already proposed by Grant 1993, 1995b, Jul 2005) as well as *V. heliconioides* and *V. malzinei* are found within Tillandsieae, and several *Tillandsia* species within Vrieseeae. The segregated genera *Alcantarea* and *Werauhia* (Grant 1995a) are both monophyletic and morphologically distinct, but in a nested position within remaining species of *Vriesea*. Studied species of *Guzmania* form a strongly supported group and the segregations of *Sodiroa* (as proposed by Betancur & Miranda-Esquivel 1999) and *Massangea* are currently not corroborated, at least not using the traditional generic circumscriptions. *Racinaea* (Spencer & Smith 1993) is paraphyletic and nested within three clades of former mesomorphic species of *T.* subg. *Phytarrhiza* s.l. *Viridantha* (Espejo-Serna 2002, 2003, Ehlers 2009) shows great morphological and phylogenetical affinities to the *T. tectorum* complex (Hromadnik 2005). However, the resulting strongly supported clade is nested within other lineages of *Tillandsia*.

In our opinion, a stable classification of Bromeliaceae subfam. Tillandsioideae has (1) to be based on phylogenetic relationships (i.e., monophyletic units) and (2) should have predictable morphological determinability by synapomorphic combinations of characters, when at least flowering material is available. We therefore evaluated the two most realistic approaches: (1) recognizing three small genera (*Catopsis*, *Glomeropitcairnia*, and a new genus segregated from *Mezobromelia*), one medium size genus (*Guzmania*), and lumping remaining species into two large genera (*Vriesea*, and *Tillandsia*) by sinking four well-established and morphologically mostly well-defined genera into synonymy (into *Tillandsia*: *Racinaea*; into *Vriesea*: *Alcantarea*, *Mezobromelia* s.str., and *Werauhia*); or (2) recognizing the six already widely accepted genera (*Alcantarea*, *Catopsis*, *Glomeropitcairnia*, *Guzmania*, *Racinaea*, and *Werauhia*) and splitting three existing genera (*Mezobromelia*, *Tillandsia*, and *Vriesea*) into smaller groups. The first scenario would primarily create the two morphologically very heterogeneous and ill-defined genera *Vriesea* and *Tillandsia*, both with no predictive value, meaning that synapomorphic combinations of diagnostic morphological characters are absent to define these genera for all species that would have to be included. The second scenario allows the recognition of several smaller genera, which are well circumscribed morphologically and are monophyletic, and an emended narrower circumscription of established genera. We therefore implemented the second splitting approach since also previous investigations have clearly shown that only smaller groups can be morphologically well characterized (e.g., Costa *et al.* 2014, Grant 1995a, Krömer *et al.*, 2012, Leme 2007, Spencer & Smith, 1993, Versieux & Wanderley 2015).

Conclusion

Our current understanding of the phylogeny and taxonomy of Bromeliaceae subfam. Tillandsioideae is shown in Figs. 7 and 8, and is explained in the taxonomy section in detail. The general topology and clades (A–R) are essentially the same as already shown by Barfuss *et al.* (2005a), but much better resolved with a denser taxon sampling. The preliminary Fig. 9 (supplementary data) modified from Barfuss (2012) is even more inclusive for Tillandsioideae species and shows the same clades, but needs further improvement. Table 7 shows the accepted tribal, subtribal and generic concepts and informal super-generic lineages of Tillandsioideae in comparison to earlier classification systems (based on the placement of the nomenclatural types). Table 8 summarizes the generic names relevant to Tillandsioideae and their approximate species numbers.

TABLE 7. Accepted tribal, subtribal and generic concepts and informal super-generic lineages of Tillandsioideae in comparison to earlier classification systems (based on the placement of the nomenclatural types).

Smith & Downs (1977)	**Grant & Zijlstra (1998), Smith & Till (1998)**	**Barfuss *et al.* (2005a)**		**This study**			
Catopsis	*Catopsis*	*Catopsis*		*Catopsis*	Catopsideae		Non-core
Glomeropitcairnia	*Glomeropitcairnia*	*Glomeropitcairnia*		*Glomeropitcairnia*	Glomeropitcairnieae		
Tillandsia	*Racinaea*	*Racinaea*	Tillandsieae	*Racinaea*	Tillandsieae	Core Tillandsieae	Core Tillandsioideae
	Tillandsia	?*Viridantha*		*Tillandsia*			
		Tillandsia		*Barfussia*			
				Lemeltonia			
				Pseudalcantarea			
				Wallisia			
Guzmania	*Guzmania*	*Guzmania*		*Guzmania*		Non-core	
Mezobromelia	*Mezobromelia*	*Mezobromelia*		*Gregbrownia*			
				Mezobromelia	Vrieseeae	Cipuropsidinae	
Tillandsia	*Tillandsia*	*Tillandsia*		*Josemania*			
Vriesea	*Werauhia*	*Werauhia*	Vrieseeae	*Werauhia*			
	Vriesea	*Vriesea*		*Cipuropsis*			
				Goudaea			
				Jagrantia			
				Lutheria			
				Zizkaea			
				Stigmatodon		Vrieseinae	
				Vriesea			
	Alcantarea	*Alcantarea*		*Alcantarea*			

Non-core Tillandsioideae constitute the two monotypic tribes Glomeropitcairnieae Harms (*Glomeropitcairnia*) and Catopsideae Harms (*Catopsis*) that are well circumscribed. Tribe Vrieseeae splits into an eastern Brazilian lineage, subtribe Vrieseinae, and an Andean/Central American/Caribbean lineage, subtribe Cipuropsidinae. Vrieseinae currently comprises the morphologically well-defined genera *Alcantarea* and *Vriesea* s.str., and the new genus *Stigmatodon*. Tribe Cipuropsidinae is more diverse and comprises seven distinct clades in our phylogeny: *Werauhia*, the new genera *Goudaea*, *Jagrantia*, *Lutheria*, and *Zizkaea*, and the *Cipuropsis*-*Mezobromelia* complex. The latter alliance includes the difficult mesomorphic northern Andean '*Vriesea*' (*Cipuropsis*) species, together with northern Andean/Caribbean *Mezobromelia* (*sensu typo*). The *Cipuropsis*-*Mezobromelia* complex is now correctly placed in tribe Vrieseeae (see Barfuss *et al.* 2005a), but is not yet treated taxonomically. This is mostly

due to the uncertain application of *Cipuropsis*, because its type could not be investigated phylogenetically, and because of uncertain interspecific relationships within the *Cipuropsis-Mezobromelia* complex.

TABLE 8. Generic names relevant to Tillandsioideae including authors, nomenclatural status and dates of valid publication. The accepted genus for non-accepted names is listed. Accepted generic names are in boldface and their approximate species numbers are given in brackets.

Genus	Dates of valid publication	Accepted genus
Acanthospora Spreng., *nom. illeg.*	20 Apr 1817	***Tillandsia*** L.
Alcantarea (E. Morren ex Mez) Harms (> 40 spp.)	30 Dec 1929	
Allardtia A. Dietr.	31 Jul 1852	***Tillandsia*** L.
Anoplophytum Beer	14 Jun 1854	***Tillandsia*** L.
Barfussia Manzan. & W. Till (3 spp.)	this study	
Bonapartea Ruiz & Pav.	Aug 1802	***Tillandsia*** L.
Caraguata Plum. ex Lindl*., nom. illeg.*	1827	***Guzmania*** Ruiz & Pav.
Caraguata Plum. ex Adans., *nom. illeg.*	Jul–Aug 1763	***Tillandsia*** L.
Catopsis Griseb. (18 spp.)	13 Jan 1864	
Chiripoa Suess.	30 Jan 1942	***Guzmania*** Ruiz & Pav.
Cipuropsis Ule (1sp., ?8 spp.)	1907	
Dendropogon Raf.	1825	***Tillandsia*** L.
Diaphoranthema Beer	14 Jun 1854	***Tillandsia*** L.
Glomeropitcairnia (Mez) Mez (2 spp.)	28 Feb 1905	
Goudaea W. Till & Barfuss (2 spp.)	this study	
Gregbrownia W. Till & Barfuss (4 spp.)	this study	
Guzmania Ruiz & Pav. (> 210 spp.)	Aug 1802	
Hexalepis Raf., *nom. rej.*	1838	***Vriesea*** Lindl.
Jagrantia Barfuss & W. Till (1 sp.)	this study	
Josemania W. Till & Barfuss (5 spp.)	this study	
Lemeltonia Barfuss & W. Till (7 spp.)	this study	
Lutheria Barfuss & W. Till (4 spp.)	this study	
Massangea E. Morren	1877	***Guzmania*** Ruiz & Pav.
Mezobromelia L.B. Sm. (3 spp., ?6 spp.)	1935	
Misandra F. Dietr., *nom. illeg.*	1819	***Tillandsia*** L.
Neovriesea Britton ex Britton & P. Wilson, *nom. illeg.*	10 Aug 1923	***Vriesea*** Lindl.
Phytarrhiza Vis.	1854	***Tillandsia*** L.
Pitcairnia L'Hér.	7 Jan 1789	
Pityrophyllum Beer	Sep–Oct 1856, '1857'	***Tillandsia*** L.
Platystachys K. Koch, *nom. illeg.*	1855	***Tillandsia*** L.
Pogospermum Brongn., *nom. illeg.*	Jul 1854	***Catopsis*** Griseb.
Pseudalcantarea (Mez) Pinzón & Barfuss (3 spp.)	this study	
Racinaea M.A. Spencer & L.B. Sm. (> 70 spp.)	1993	
Renealmia L., *nom. rej.*	1 May 1753, 1754	***Tillandsia*** L.
Schlumbergeria E. Morren, *nom. illeg.*	1878	***Guzmania*** Ruiz & Pav.
Sodiroa André	1878	***Guzmania*** Ruiz & Pav.
Stigmatodon Leme, G.K. Br. & Barfuss (18 spp.)	this study	
Thecophyllum André	24 Aug–Dec 1889	***Guzmania*** Ruiz & Pav.
Tillandsia L. (> 650 spp.)	1 May 1753, 1754	
Tussacia Willd. ex Beer, *nom. illeg.*	Sep–Oct 1856, '1857'	***Catopsis*** Griseb.
Viridantha Espejo	2002	***Tillandsia*** L.
Vriesea Lindl., *nom. cons.* (> 210 spp.)	7 Feb 1843	
Wallisia (Regel) E. Morren (4 spp.)	Apr–Dec 1870	
Werauhia J.R. Grant (> 90 spp.)	1995	
Zizkaea W. Till & Barfuss (1 sp.)	this study	

Non-core lineages of tribe Tillandsieae are well circumscribed. *Gregbrownia fulgens* and *Gr. hutchisonii* are phylogenetically well separate from *Mezobromelia* (*sensu typo*) and form a distinct genus. *Guzmania* remains in the generic limits according to Smith & Downs (1977).

Although the backbone of core Tillandsieae only partially resolved, species are grouped in distinct, morphologically well-defined lineages. Former *Tillandsia* subg. *Phytarrhiza* s.l. has proven to be highly polyphyletic. The mesomorphic species together with *Racinaea* belong to four different clades splitting at an

earlier node, which were identified consistently in previous phylogenetic DNA sequence (Barfuss 2005a, Barfuss 2012) and partly in morphological analyses (Gilmartin & Brown 1986). The recognition of the three new genera *Barfussia*, *Lemeltonia*, and *Wallisia*, and the emendation of *Racinaea* also to include *R. dyeriana*, *R. hamaleana*, and *R. venusta*, creates monophyletic taxa. Rauh (1990: 179) already realized the morphological distinctiveness of *Lemeltonia* species and provided a key for all taxa. The xeromorphic taxa of *T.* subg. *Phytarrhiza* s.l. are placed in two distinct lineages, one (*T.* subg. *Phytarrhiza* s.str.) is closely related to *T.* subg. *Aerobia*, *T.* subg. *Diaphoranthema* and *T.* subg. *Anoplophytum*, and the other (*T. purpurea* complex) is in sister position to *T.* subg. *Viridantha*.

Pseudalcantarea s.str. is elevated to generic rank and narrowed in its circumscription to include only *P. grandis*, *P. macropetala*, and *P. viridiflora*. Krömer *et al.* (2012) revised the Mexican species of *Tillandsia* subg. *Pseudalcantarea* and therefore already the genus in its limits according to the revised classification. The taxonomic conclusions of Beaman & Judd (1996) are only partly supported; the transfer of *T. paniculata* to *T.* subg. *Tillandsia* is confirmed, while the exclusion of *T. grandis* and the inclusion of *T. baliophylla* are contradicting our results.

Remaining species of *Tillandsia* are grouped into 14 mostly well-supported clades (subgenera and species complexes) with two unclassified species (*T. albertiana*, *T. esseriana*). These clades are generally not treated taxonomically in the current study and are the subject of a separate publication with an expanded sampling and additional DNA loci (for preliminary data see Fig. 9, supplementary data). The exceptions are two new subgenera, because these species complexes were treated within another (*Vriesea*) or as a separate genus (*Viridantha*). The inclusion of xeromorphic *Vriesea* species into *Tillandsia* as proposed by Grant (1993, 1995b, Jul 2005) is confirmed while the segregation of *Viridantha* (Espejo-Serna 2002, 2003) will only be corroborated if further splitting of *Tillandsia* is undertaken. We therefore propose the status of subgenera (without necessary generic transfers) for both entities (*T.* subg. *Pseudovriesea*, *T.* subg. *Viridantha*) and the emendation of *T.* subg. *Viridantha* s.l. also to include the *T. tectorum* complex (Ehlers 2009, Hromadnik 2005). The other already published subgenera and species complexes are listed in the taxonomy section for completion. Some of these were already the subject of previous publications (e.g. Donadío 2012, Donadío *et al.* 2015, Gardner 1982, 1986, Tardivo 2002, Till 1984, 1992)

The current study clarifies relationships and long-lasting discussions about the correct phylogenetic and taxonomic placement of certain species. However, since plant material is sometimes inaccessible for many groups, several species-rich lineages (e.g., *Guzmania*, *Tillandsia* s.str., and *Vriesea* s.str.) and underrepresented clades (e.g., *Racinaea*, *Werauhia*) remain to be studied in more detail using an expanded sampling. The two most crucial lineages are the *Cipuropsis*-*Mezobromelia* complex and the genus *Tillandsia*.

Key to the genera of Tillandsioideae

Note:—For determination, flowering plants are indispensable; fruiting material is helpful in some cases. Stigma types and other floral characters are best studied in fresh material just before or at flower opening when anthers are not yet dehisced and stigmatic surfaces free from pollen; the use of a hand-lens with 10× magnification is recommended. Characters after the em-dash are additional characters to verify the correct determination and need not necessarily appear in the corresponding couplet.

1. Ovary about 1/2–2/3 inferior; stigma of the convolute-umbrella type; fruit a partly septicidal capsule; seeds with appendages of the *Glomeropitcairnia* type, long appendaged on both ends.—Flowers spirally arranged; petals bearing basal appendages ..... ***Glomeropitcairnia***

- Ovary less than 1/2 inferior or superior; stigma not of the convolute-umbrella type, if resembling a convolute type, then of the convolute-blade I type (Fig. 5A) or the convolute-blade II type (Figs. 5B–D) or of the convolute-obconic type (Figs. 5M, N); fruit a septicidal capsule; seeds with appendages of the *Catopsis* type or the Core Tillandsioideae type, usually long appendaged only on one end, but the appendage at the apical end sometimes well developed.—Flowers spirally or distichously arranged; petals bearing or without basal appendages ..... **2.**

2. Ovary superior to about 1/8 inferior; seeds with appendages of the *Catopsis* type, with a plumose flight apparatus formed at the apical end by multicellular hairs folded at maturity, and a multicellular, undivided plume at the basal end.—Flowers spirally arranged; sepals strongly asymmetric; petals without basal appendages ..... ***Catopsis***

- Ovary more than 1/8 inferior, but not more than 1/2 inferior; seeds with appendages of the Core Tillandsioideae type, with a plumose flight apparatus formed at the basal end, appendage at the apical end lacking, short and usually undivided, or

rarely long and occasionally somewhat divided, not folded at maturity.—Flowers spirally or distichously arranged; sepals usually symmetric or subsymmetric, if occasionally asymmetric, then flowers distichously arranged; petals bearing or without basal appendages ..... **3.**

3. Petals conglutinated/connate into a tube for more than 1/4 of their entire length; filaments partially agglutinated/adnate to the conglutinated/connate portion of the petals.—Flowers usually spirally, rarely distichously arranged; petals white, yellow, or green (Figs. 2C, E–I); seeds without a distinct appendage at the apical end ..... **4.**

- Petals free or sometimes conglutinated/connate into a tube shorter than or equalling about 1/4 of their entire length; filaments free, conglutinated/connate, or short agglutinated/adnate to the petals.—Flowers usually distichously, rarely spirally arranged; petals violet, pink, red, orange, yellow, green, white, and rarely bicolored (Figs. 2D, J–T, 3A–T); seeds usually with a distinct appendage at the apical end usually up to the length of the seed proper, occasionally longer..... **6.**

4. Petals without basal appendages.—Stigma of the convolute-blade I type (Fig. 5A) or the simple-erect type, occasionally of the simple-patent type (Fig. 4J) or simple-pinnatisect type (Fig. 4L, O) ..... ***Guzmania***

- Petals bearing basal appendages.—Stigma of the simple-erect type or the conduplicate-spiral type (Fig. 4F) ..... **5.**

5. Inflorescence compound, once or rarely twice branched, with branches composed of dense flower fascicles (Fig. 1L); petals about 1/3–1/2 of their entire length conglutinate/connate into a tube, tips slightly divergent (Fig. 3R), bearing linear and entire basal appendages, highly adnate to the conglutinated/connate portion of the petals; stamens and style included within the corolla; anthers united into a tube surrounding the stigma, not versatile; stigma of the simple-erect type ..... ***Mezobromelia***

- Inflorescence compound, twice or rarely triple branched, a laxly flowered panicle; petals more than 1/2 of their entire length conglutinate/connate into a tube, blades spreading (Fig. 2C), bearing crenulated basal appendages adnate for less than 1/3 of the conglutinated/connate portion of the petals; stamens and style exserted from the corolla; anthers not forming a tube around the stigma, versatile; stigma of the conduplicate-spiral type (weakly spiral) (Fig. 4F) ..... ***Gregbrownia***

6. Stigma of the conduplicate-patent type (Figs. 4A, B) or conduplicate-erect type (Figs. 4C–E); petals linear, forming a tubular corolla with strongly recurved and ± coiled, or spreading and ± spirally twisted blades.—Stamens and style much exserted from the corolla (Figs. 2J, 3C, D); ovary 1/3–1/2 inferior ..... **7.**

- Stigma usually not of the conduplicate-patent type or the conduplicate-erect type, if rarely resembling the conduplicate-patent type, then corolla tubular; petals forming a urceolate, campanulate, salverform or tubular corolla, usually with spreading or recurved blades or tips only (Figs. 2D, 2K–T, 3A–T).—Stamens and style included within or exserted from the corolla; ovary usually up to 1/3, very rarely up to 1/2 inferior ..... **8.**

7. Petals light green, spreading and ± spirally twisted (helicoiform; Figs. 1F, 2J), without basal appendages; ovules appendiculate, shorter than or equalling the ovule proper; seeds with an appendage at the basal end distinctly longer than the seed proper, appendage at the apical end short, about half as long as to equalling the seed proper, undivided; stigma green (Fig. 4E) ..... ***Pseudalcantarea***

- Petals white, cream, pale to bright yellow, rarely pale wine-castaneous or dark wine, recurved or coiled (Figs. 3C, D), bearing well-developed basal appendages; ovules distinctly appendiculate, longer than the ovule proper; seeds with an appendage at the basal end rather short, about equalling the seed proper, appendage at the apical end distinctly larger than the seed proper, sometimes somewhat divided; stigma white (Figs. 4A–D) ..... ***Alcantarea***

8. Stigma of the cupulate type (Figs. 5H–J) ..... ***Werauhia***

- Stigma not of the cupulate type, if occasionally resembling a cupulate type, then of the urceolate type (Figs. 5K, L) or tubo-laciniate type (Figs. 5E–G) ..... **9.**

9. Stigma of the urceolate type (Figs. 5K, L) ..... ***Zizkaea***

- Stigma not of the urceolate type..... **10.**

10. Stigma of the tubo-laciniate type (Figs. 5E–G)..... ***Stigmatodon***

- Stigma not of the tubo-laciniate type ..... **11.**

11. Stigma of the convolute-blade II type (Figs. 5B–D).—Leaves mesomorphic or rarely semi-xeromorphic, usually forming strongly to moderately impounding rosettes (Fig. 1O); petals usually bearing basal appendages ..... ***Vriesea***

- Stigma not of the convolute-blade II type, if rarely resembling a convolute type, then of the convolute-obconic type (Figs. 5M, N) or the convolute-blade I type, the latter with xeromorphic, densely lepidote leaves, not forming impounding rosettes, and petals without basal appendages..... **12.**

12. Filaments conglutinate/connate at least at the base but sometimes for nearly the whole length, free from the petals; stigma of the coralliform type (Fig. 5P).—Leaves narrowly triangular; inflorescence simple, petals white or rarely yellowish with enlarged, spreading blades (Fig. 1E) ..... ***Lemeltonia***

- Filaments free from each other, but sometimes partially agglutinated/adnate to the petals; stigma usually not of the coralliform type, if rarely resembling the coralliform type (Fig. 5O), then filaments free from each other, leaves lingulate, and inflorescence usually compound (Fig. 1I)..... **13.**

13. Stigma of the conduplicate-pinnatisect type (Figs. 4N, P); leaves mostly conspicuously longitudinally reddish (-brown) striped near the base ..... ***Wallisia***

- Stigma not of the conduplicate-pinnatisect type; leaves not longitudinally reddish striped near the base..... **14.**

14. Stigma of the convolute-obconic type (Figs. 5M, N).—Leaves mesomorphic, lingulate, forming an impounding rosette (Fig. 1B) ..... ***Barfussia***

- Stigma not of the convolute-obconic type, if rarely resembling a convolute type, then of the convolute-blade I type and leaves xeromorphic and narrowly triangular, not forming impounding rosettes ..... **15.**

15. Sepals usually distinctly asymmetric, free, and stigma of the simple-erect type or of the conduplicate-spiral type (weakly spiral); rarely sepals subsymmetric and stigma resembling the coralliform type (Fig. 5O) ..... ***Racinaea***

- Sepals usually symmetric or subsymmetic, the adaxial ones often connate (and therefore appearing asymmetric); stigma not of the coralliform type, usually of the simple-erect type (Fig. 4I) or conduplicate-spiral type (Fig. 4G, H), rarely of the simple-truncate type, the simple-patent type (Fig. 4K), the conduplicate-patent type or the convolute-blade I type ..... **16.**

16. Floral bracts deciduous along a basal transversal line after anthesis when dry, 3 times the length of the sepals, laterally strongly compressed and sharply carinate ..... ***Jagrantia***

- Floral bracts persistent when dry, maximally 2 times the length of the sepals, ± rounded in transversal section even if carinate ..... **17.**

17. Petals without basal appendages.—Stigma usually of the simple-erect type or the conduplicate-spiral type (Fig. 4G, H), rarely of the simple-truncate type, simple-patent type or convolute-blade I type ..... **18.**

- Petals bearing basal appendages.—Stigma of the simple-erect type (Fig. 4I), the simple-patent type (Fig. 4K) or the conduplicate-spiral type ..... **19.**

18. Petals short connate at the base forming a common tube with the short adnate filament bases; leaf sheaths very dark, usually becoming silver-grey when dry.—Petals yellow or rarely white; stamens and style included within the corolla; ovules obtuse; stigma of the simple-erect type ..... ***Josemania***

- Petals free and filament bases not adnate to the petals; leaf sheaths usually not very dark and not becoming silver-grey when dry.—Petals violet, pink, red, orange, yellow, green, white, and rarely bicolored (Figs. 2M–T); stamens and style included within or exserted from the corolla; ovules usually appendiculate, rarely obtuse or subobtuse; stigma usually of the conduplicate-spiral type (Figs. 4G, H) or the simple-erect type, occasionally of the simple-patent type (Fig. 4K) or simple-truncate type, rarely of the conduplicate-patent type or the convolute-blade I type ..... ***Tillandsia*** p.p.

19. Leaves xeromorphic to occasionally semi-xeromorphic, usually densely lepidote; leaf blades narrowly triangular.—Petals usually violet, rarely green (Fig. 2O) or yellowish, often bicolored with contrasting margins, sometimes with crenulated margins; ovules appendiculate, shorter than or equalling the ovule proper ..... ***Tillandsia*** p.p. (***T.*** **subg.** ***Pseudovriesea*** p.p.)

- Leaves mesomorphic, not densely lepidote; leaf blades lingulate.—Petals white, greenish-white, or yellow, rarely red or deep pink, margins always entire; ovules obtuse or rarely appendiculate ..... **20.**

20. Corolla unilaterally bent, slightly zygomorphic (Fig. 2M, 3Q); petals free; stamens and style exserted from the corolla; stigma of the conduplicate-spiral type or simple-patent type ..... **21.**

- Corolla actinomorphic (Fig. 3M, S); petals short connate at the base for < 1/4 of their entire length or about 1/4 of their entire length conglutinated/connate into a tube; stamens and style included within the corolla; stigma of the simple-erect type (Fig. 4I) ..... **22.**

21. Stigma of the conduplicate-spiral type; petals red, deep pink, or yellow, tips straight or slightly divergent (Fig. 3Q) ..... ***Lutheria***

- Stigma of the simple-patent type (Fig. 4K); petals white or greenish-white, the adaxial one ± straight, the two abaxial ones recurved (Fig. 2M) ..... ***Tillandsia*** p.p. (**'*Vriesea*' sect. *Cylindrostachys***)

22. Petals short connate at the base for < 1/4 of their entire length, tips cucullate, forming a hardly opened corolla (Fig. 3S), petal appendages spathulate; anthers free; floral bracts ecarinate ..... ***Goudaea***

- Petals about 1/4 of their entire length conglutinated/connate into a tube, tips straight or recurved, petal appendages linear; anthers united into a tube surrounding the stigma, not versatile (Fig. 3M); floral bracts carinate ..... ***Cipuropsis*** and **mesomorphic northern Andean '*Vriesea*'**

Taxonomy

Note:—The following classification differs in some ways from that proposed in Barfuss (2012) and Barfuss *et al*. (2013). Some changes needed to be made concerning some of the provisionally suggested names for taxa (e.g., 'Josemania', *nom. prov.* = *Wallisia*, 'Rothowia', *nom. prov.* = *Barfussia*, 'Waltillia', *nom. prov.* = *Josemania*), mainly because an older generic name is available for one taxonomic group (*Wallisia*). Furthermore, several additional genera are recognized, but we decided, for now, to resurrect *Cipuropsis* only provisionally, since its type and only species *Cipuropsis subandina* could not be investigated phylogenetically. Additionally, investigated mesomorphic northern Andean '*Vriesea*' species appear paraphyletic (though not or weakly supported) and separation from *Mezobromelia* s.str. remains unclear. Therefore, '*Vriesea*' *dubia*, '*V.*' *elata*, '*V.*' *rubra*, '*V.*' *zamorensis*, '*Tillandsia*' *schimperiana* and '*T.*' *amicorum* are not transferred. They remain, for now, 'incertae sedis' in the *Cipuropsis-Mezobromelia* complex. However, all these species can be easily distinguished morphologically and genetically from *Vriesea* s.str. and *Tillandsia* s.str. in their emended circumscriptions. Further splitting and/or comprehensive infrageneric classifications of the species-rich genera *Guzmania*, *Tillandsia* s.str.

and *Vriesea* s.str. as well as the underrepresented genera *Racinaea* and *Werauhia* still need detailed investigations. Taxon sampling in these genera is still unsatisfactory (although much larger in Fig. 9 in supplementary data), the resolution of certain lineages in the molecular trees is insufficient and morphological characters are lacking for several lineages. The *Cipuropsis-Mezobromelia* complex and *Tillandsia* s.str. continue to be the taxonomically most critical groups.

The nomenclatural rules follow the Melbourne Code (McNeill *et al*. 2012); the applying articles are mentioned in parentheses in cases of illegitimate or invalid names. Author abbreviations follow IPNI.

Bromeliaceae subfam. Tillandsioideae Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 100 (1930), **Type**:—*Tillandsia* L.

Diagnostic characters:—***Leaves*** entire. ***Pollen*** mostly sulcate or rarely inaperturate, exine usually reticulate or rarely non-reticulate. ***Fruit*** a septicidal capsule; ***seeds*** with hairs or hair-like appendages forming a flight apparatus, wind dispersed.

Bromeliaceae tribe Catopsideae Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 100 (1930), **Type**:—*Catopsis* Griseb. [≡ *Pogospermum* Brongn., *Tussacia* Willd. ex Beer]

≡ Bromeliaceae [unranked, as '*Sippe*'] Tussaciae Beer, Fam. Bromel.: 9, 19 (Sep–Oct 1856, '1857'), *nom. illeg*. [Art. 19.6], **Type**:—*Tussacia* Willd. ex Beer, *nom. illeg*. [Art. 53.1, 53.3 Ex. 8]

≡ Bromeliaceae tribe Pogospermeae Brongn., Ann. Sci. nat., Bot., ser. 5. 1(6): 327 (Jun 1864), *nom. illeg*. [Art. 19.6], **Type**:—*Pogospermum* Brongn., *nom. illeg*. [Art. 53.3]

Diagnostic characters:—***Plants*** usually epiphytic, rarely terrestrial herbs, acaulescent, usually forming impounding, rarely non-impounding rosettes. ***Leaves*** mesomorphic. ***Inflorescence*** usually compound, once or rarely twice branched, occasionally simple; ***flowers*** spirally arranged. ***Sepals*** free, strongly asymmetric; ***petals*** usually white or rarely yellow, free, usually with inconspicuous blades forming an urceolate or campanulate corolla, rarely with a conspicuous and spreading blades, without basal appendages; ***stamens*** shorter than the petals, included within the corolla, unequal, the first (antesepalous) series usually distinctly longer than the second (antepetalous) series; ***filaments*** free or of the first (antesepalous) series free and of the second (antepetalous) series short agglutinated/adnate to the petal bases; ***pollen*** sulcate, exine reticulate, with a sulcus of the simple *Catopsis* type (subtype b); ***ovary*** superior to about 1/8 inferior; ***ovules*** distinctly multifilametous appendiculate longer than the ovule proper; ***style*** included within the corolla; ***stigma*** of the simple-erect type or occasionally conduplicate-spiral type (weakly spiral). ***Fruit*** a septicidal capsule; ***seeds*** with appendages of the *Catopsis* type, with a plumose flight apparatus formed at the apical end by multicellular hairs folded at maturity, and a multicellular, undivided plume at the basal end.

Note:—Only one genus. Since *Pogospermum* is treated as illegitimate genus, the tribe Pogospermeae (Brongniart Jun 1864), although earlier published than Catopsideae (Harms in Engler 1930), is also illegitimate [Art. 19.6], other than indicated in Barfuss (2012). Beer (Sep–Oct 1856, '1857') uses the German word '*Sippe*', which represents an incorrect rank-denoting term and this name is therefore treated as being unranked [Art. 37.3].

Catopsis Griseb., Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ., Nr. 1: 10, 12, 21 (13 Jan 1864), *nom. nov. pro Tussacia* Willd. ex Beer (Sep–Oct 1856, '1857'), **Type** (designated by Grant & Zijlstra, 1998: 97):—*Tillandsia nitida* Hook. [≡ *Catopsis nitida* (Hook.) Griseb., *Pogospermum nitidum* (Hook.) Brongn., *Tussacia nitida* (Hook.) Beer]

≡ *Pogospermum* Brongn., Ann. Sci. nat., Bot., ser. 4. 2(1): 16 (Jul 1854), *nom. illeg*. [Art. 53.3], *non Pogonospermum* Hochst. (Jul–Dec 1844: Acanthaceae), **Type** (designated by Brongniart, Jun 1864: 327):—*Tillandsia nitida* Hook.

≡ *Tussacia* Willd. ex Beer [Klotzsch ex Beer], Fam. Bromel.: 21, 99, 174 (Sep–Oct 1856, '1857'), *nom. illeg*. [Art. 53.1, 53.3 Ex. 8], *non Tussaca* Raf. (1814: Orchidaceae) *nec* Rchb. (Jan–Jun 1824: Gesneriaceae) *nec Tussacia* Willd. ex Schult. & Schult. f. (1829: Incertae sedis) *nec* Benth. (1846: Gesneriaceae), **Type** (designated by Grant & Zijlstra, 1998: 110):—*Tillandsia nitida* Hook.

≡ *Catopsis* subg. *Eucatopsis* Mez in C. DC., Monogr. phan. 9: 619 (Jan 1896), *nom. inval*. [Art. 21.3, 22.2]

= *Catopsis* subg. *Tridynandra* Mez in C. DC., Monogr. phan. 9: 620 (Jan 1896), **Type** (**designated here**):—*Catopsis morreniana* Mez

Diagnostic characters:—As for the tribe.

Distribution:—Central America and Antilles extending to southern North America (Mexico, Florida) and to northern South America and southeastern Brazil.

Note:—18 species. Brongniart, already in 1854, validly published *Pogospermum* as a new genus for two species formerly placed under *Tillandsia* (*T. nitida* Hook., *T. nutans* Sw.), predating the valid publication of *Tussacia* (Beer Sep–Oct 1856, '1857') and its replacement name *Catopsis* (Grisebach 13 Jan 1864), the latter being legitimate since *Tussacia* did not contain *T. nutans*. Brongniart (Jul 1854) only proposed the combination *Pogospermum nutans*, but did not indicate a type for the genus. All sources known so far cite Brongniart (Jun 1864) as the validating publication of *Pogospermum*, in which he designated *T. nitida* as the type of his genus. With the typification of *Tussacia* and *Catopsis* with *T. nitida* by Grant & Zijlstra (1998), all three names became homotypic, with *Catopsis* still being legitimate. However, according to our view, *Pogospermum* represents a name similar to the earlier published name *Pogonospermum* (Hochstetter Jul–Dec 1844), both being likely to be confused, since grammatically they are variants, with the former representing a non-correctable error of the latter. Therefore, *Pogospermum* is considered a younger, illegitimate homonym of *Pogonospermum* with *Catopsis* being its correct substitute, which is also in the interest of nomenclatural stability. However, a proposal to the Committee for Spermatophyta for a binding desision is in progress.

Bromeliaceae tribe Glomeropitcairnieae Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 100 (1930), **Type**:—*Glomeropitcairnia* (Mez) Mez [≡ *Pitcairnia* subg. *Glomeropitcairnia* Mez]

Diagnostic characters:—***Plants*** epiphytic or terrestrial herbs, large sized, acaulescent, forming impounding rosettes. ***Leaves*** mesomorphic. ***Inflorescence*** compound, once or twice branched; ***flowers*** spirally arranged. ***Sepals*** free, subsymmetric, ***petals*** free, 3 cm long at most, forming a tubular corolla, bearing basal appendages; ***stamens*** shorter than the petals, included within the corolla; ***filaments*** of the first (antesepalous) series free and of the second (antepetalous) series short agglutinated/adnate to the petal bases; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c); ***ovary*** about 1/2–2/3 inferior; ***ovules*** distinctly appendiculate at both ends longer than the ovule proper; ***style*** included within the corolla; ***stigma*** of the convolute-umbrella type. ***Fruit*** a partly septicidal (imperfectly dehiscent) capsule; ***seeds*** with appendages of the *Glomeropitcairnia* type, with long appendages on both ends, with a plumose flight apparatus formed at the basal end by a multifilamentous outgrowths of the outer integument, extending off the basal end, with the innermost cell layer of the outer integument remaining fixed proximally and all cell layers of the outer integument splitting into cell rows, these bent in the middle for 180° but not forming an exostoma, undivided plume formed at the apical end, filiform, about twice the length of the seed proper.

Note:—Only one genus.

Glomeropitcairnia (Mez) Mez, Bull. Herb. Boissier ser. 2. 5(3): 232 (28 Feb 1905)

Basionym:—*Pitcairnia* subg. *Glomeropitcairnia* Mez in C. DC., Monogr. phan. 9: 463 (Jan 1896), **Type**:—*Tillandsia penduliflora* Griseb. [≡ *Pitcairnia penduliflora* (Griseb.) Mez, *Glomeropitcairnia penduliflora* (Griseb.) Mez]

Diagnostic characters:—As for the tribe.

Distribution:—Lesser Antilles extending to Northeastern Venezuela.

Note:—Two species.

Bromeliaceae tribe Tillandsieae Rchb., Consp. regn. veg.: 62 (Dec 1828–Mar 1829), **Type**:—*Tillandsia* L.

≡ Bromeliaceae [unranked] Tillandsidae Burnett, Outlines Bot.: 442, 1151 (Jun 1835), **Type**:—*Tillandsia* L.

≡ Bromeliaceae [unranked, as '*Sippe*'] Tillandsiae Beer, Fam. Bromel.: 12, 23 (Sep–Oct 1856, '1857'), **Type**:—*Tillandsia* L.

= Bromeliaceae [unranked, as '*Sippe*'] Anoplophytae Beer, Fam. Bromel.: 7, 14 (Sep–Oct 1856, '1857'), **Type**:—*Anoplophytum* Beer

= Bromeliaceae [unranked, as '*Sippe*'] Platystachyae Beer, Fam. Bromel.: 7, 14 (Sep–Oct 1856, '1857'), **Type**:—*Platystachys* K. Koch

= Bromeliaceae [unranked, as '*Sippe*'] Guzmaniae Beer, Fam. Bromel.: 9, 19 (Sep–Oct 1856, '1857'), as 'Guzmanniae', **Type**:—*Guzmania* Ruiz & Pav.

= Bromeliaceae [unranked, as '*Hauptabtheilung*'] Diaphoranthemeae Beer, Fam. Bromel.: 11, 12, 23 (Sep–Oct 1856, '1857'), **Type**:—*Diaphoranthema* Beer

≡ Bromeliaceae [unranked, as '*Sippe*'] Diaphoranthemae Beer, Fam. Bromel.: 13, 23 (Sep–Oct 1856, '1857'), as 'Diaphoranthemeae', **Type**:—*Diaphoranthema* Beer

Diagnostic characters:—***Petals*** usually without or occasionally bearing basal appendages; ***pollen*** usually sulcate, rarely inaperturate, exine usually reticulate, rarely non-reticulate, with a sulcus of complex subtypes, mostly of the diffuse type (subtype c) or insulae type (subtype d), occasionally of the operculum type (subtype e), or rarely of the *Alcantarea* type (subtype f), sometimes with smooth transitions between the types; ***ovary*** usually about 1/8–1/3, rarely up to 1/2 inferior; ***stigma*** mostly of the conduplicate-spiral type or simple-erect type, occasionally of the simple-truncate type, the simple-patent type or the convolute-blade I type, rarely of the convolute-obconic type, the coralliform type, the conduplicate-pinnatisect type, or the simple-pinnatisect type. ***Fruit*** a septicidal capsule; ***seeds*** with appendages of the Core Tillandsioideae type, with a plumose flight apparatus formed at the basal end by multifilamentous outgrowths of the outer integument, extending off the basal end, with the innermost cell layer of the outer integument remaining fixed proximally and distally fused to an exostoma with the central and outer cell layers of the outer integument, the latter two layers splitting into cell rows and spreading at maturity, forming a parachute-like architecture, ± straight plume at the apical end, usually short and undivided or lacking.

Note:—Eight genera. Beer (Sep–Oct 1856, '1857') uses the German words '*Sippe*' and '*Hauptabtheilung*', which represent incorrect rank-denoting terms and these names are therefore treated as being unranked [Art. 37.3].

Barfussia Manzan. & W. Till, *gen. nov*.

Diagnosis:—*A genere* Tillandsia *L. s.str. stigmate convoluto-obconico typo laminis-convolutis simili, ovulis obtusis vel subobtusis anguste subcylindrico-claviformibus, seminibus cum endostomio conico vel cylindrico et embryone cum radicula plusminusve distincta differt. Petala caeruleoviolacea.*

Type:—*Tillandsia wagneriana* L.B. Sm. [≡ *Barfussia wagneriana* (L.B. Sm.) Manzan. & W. Till]

Description:—***Plants*** usually epiphytic, rarely terrestrial herbs, acaulescent, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf sheaths*** distinct; ***leaf blades*** lingulate, acute. ***Inflorescence*** pink, compound, once or twice branched, rhachis usually ± alate; ***floral bracts*** glabrous; ***flowers*** distichously arranged. ***Sepals*** symmetric to subsymmetric; ***petals*** violet-blue, free, basally constricted into a claw with enlarged, spreading blades forming a salverform corolla, without basal appendages; ***stamens*** shorter than the petals, deeply included within the corolla; ***filaments*** free, lingulate, narrowed at the apex; ***anthers*** basifixed; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** slenderly cylindric, obtuse or subobtuse; ***style*** very short, deeply included within the corolla; ***stigma*** of the convolute-obconic type. ***Seeds*** with a minute appendage at the apical end, with a conical or cylindrical endostome (type e); ***embryo*** with a ± distinct radicule (type b).

Distribution:—Andean, Ecuador to Bolivia.

Etymology:—Named in honor of Michael Harald Johannes Barfuss (1977−) from Vienna, Austria, who has enormously contributed to the understanding of the phylogeny of Bromeliaceae, especially of the Tillandsioideae.

Note:—Three species and one variety. Seed endostome and embryo types follow Groß (1988).

Barfussia laxissima (Mez) Manzan. & W. Till, *comb. nov*.

Basionym:—*Tillandsia laxissima* Mez, Bull. Herb. Boissier ser. 2. 5(2): 108 (31 Jan 1905), **Type**:—*Bang 2301 p.p.* (holo B; iso G, GH, K!, LE!, M, MO, NY, PH!, US!, W!, WU!)

Barfussia laxissima* var. *moorei (H. Luther) Manzan. & W. Till, *comb. nov*.

Basionym:—*Tillandsia laxissima* var. *moorei* H. Luther, Selbyana 20(1): 13 (1999), **Type**:—*Moore s.n.* (holo SEL!)

Barfussia platyrhachis (Mez) Manzan. & W. Till, *comb. nov*.

Basionym:—*Tillandsia platyrhachis* Mez in C. DC., Monogr. phan. 9: 848 (Jan 1896), **Type**:—*Kalbreyer 1328* (holo K!)

= *Tillandsia platyrhachis* var. *magnifica* Rauh & von Bismarck, Trop. Subtrop. Pflanzenwelt 53: 6, figs. 2–5 (1985), **Type**:—*Rauh & von Bismarck 66107* (holo HEID)

= *Tillandsia platyrhachis* var. *alba* Rauh & Hirtz, Trop. Subtrop. Pflanzenwelt 53: 11, figs. 5–7 (1985), **Type**:—*Rauh & Hirtz 37571* (holo HEID)

Barfussia wagneriana (L.B. Sm.) Manzan. & W. Till, *comb. nov.*
Basionym:—*Tillandsia wagneriana* L.B. Sm., Phytologia 9: 254, pl. 4, figs. 1–3 (1963), **Type**:—*Moore 310* (holo US!)

Note:—Moore (1993) corrected the type locality for the holotype of *Tillandsia wagneriana*, *Moore 310* (holo US), vicinity of Moyobamba, Depto. San Martín, Peru.

Gregbrownia W. Till & Barfuss, *gen. nov.*
Diagnosis:—*A genere* Mezobromelia *L.B. Sm. staminibus tubum corollae distincte superantibus, antheris liberis versatilibus, petalis supra mediam connatis basi cum appendicis crenulatis et stigmatis laeviter conduplicato-spiralibus differt.*
Type:—*Mezobromelia fulgens* L.B. Sm. [≡ *Gregbrownia fulgens* (L.B. Sm.) W. Till & Barfuss]

Description:—***Plants*** epiphytic or terrestrial herbs, large sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate. ***Inflorescence*** compound, twice or rarely triple branched, a laxly flowered panicle; ***flowers*** distichously, rarely spirally arranged. ***Sepals*** symmetric, short connate; ***petals*** yellow-olivaceous or white, more than 1/2 of their entire length conglutinated/connate into a tube, bearing crenulated basal appendages adnate for less than 1/3 of the conglutinated/connate portion of the petals, blades spreading; ***stamens*** shorter than the petals, exserted from the corolla; ***filaments*** partially agglutinated/adnate to the conglutinated/connate portion of the petals; ***anthers*** dorsifixed near the middle, versatile; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c); ***ovules*** slenderly cylindric, obtuse; ***style*** longer than the ovary, about equaling the stamens; ***stigma*** of the conduplicate-spiral type (weakly spiral).

Distribution:—Andes of northern Peru and Ecuador.

Etymology:—Named in honor of Gregory K. Brown (1951−), professor of Botany at the University of Wyoming, Laramie, for his essential contributions to the taxonomy and morphology of Bromeliaceae.

Note:—Four species.

Gregbrownia brownii (H. Luther) W. Till & Barfuss, *comb. nov.*
Basionym:—*Mezobromelia brownii* H. Luther, Selbyana 12: 74, figs. 7, 8 (1991), **Type**:—*Luther*, *Kress*, *Brown & Roesel 2706* (holo SEL!; iso QCA, QCNE, K!, RM, US!)

Gregbrownia fulgens (L.B. Sm.) W. Till & Barfuss, *comb. nov.*
Basionym:—*Mezobromelia fulgens* L.B. Sm., Lloydia 11: 303, fig. 1 (1948), **Lectotype** (designated by Smith & Downs, 1977: 1366):—*Steyermark 54430* (lecto GH!; isolecto F!)

Gregbrownia hutchisonii (L.B. Sm.) W. Till & Barfuss, *comb. nov.*
Basionym:—*Tillandsia hutchisonii* L.B. Sm., Phytologia 13: 145, pl. 7, figs. 23, 24 (1966), **Type**:—*Hutchison & Wright 6801* (holo US!; iso F!, NY!, UC, USC)
≡ *Mezobromelia hutchisonii* (L.B. Sm.) W. Weber & L.B. Sm., J. Bromeliad Soc. 33(3): 121 (1983)
= *Mezobromelia trollii* Rauh, Trop. Subtrop. Pflanzenwelt 21: 5, figs. 1–3 (1977), **Type**:—*Rauh 40104* (holo HEID; iso US!)

Gregbrownia lyman-smithii (Rauh & Barthlott) W. Till & Barfuss, *comb. nov.*
Basionym:—*Mezobromelia lyman-smithii* Rauh & Barthlott, Trop. Subtrop. Pflanzenwelt 16: 13, figs. 6–9 (1976), **Type**:—*Rauh & Barthlott 34477* (holo HEID; iso US!); *Rauh 37521a* (para HEID); *Rauh 38057* (para HEID)

Guzmania Ruiz & Pav., Fl. Peruv. 3: 37, pl. 261 (Aug 1802), **Type**:—*Guzmania tricolor* Ruiz & Pav. [= *Renealmia monostachia* L., *Guzmania monostachia* (L.) Rusby ex Mez]
≡ *Guzmania* subg. *Euguzmania* Mez in C. DC., Monogr. phan. 9: 903 (Jan 1896), *nom. inval.* [Art. 21.3, 22.2]
= *Caraguata* Plum. ex Lindl., Bot. Reg. 13: sub pl. 1068 (1827), *nom. illeg.* [Art. 53.1], *non* Plum. ex Adans. (Jul–Aug 1763), **Type**:—*Tillandsia lingulata* L. [≡ *Caraguata lingulata* (L.) Lindl., *Guzmania lingulata* (L.) Mez]
≡ *Caraguata* Plum. ex Lindl. sect. *Caraguata*, J. Bot. 25: 54 (1887), *nom. inval.* [Art. 22.5]
≡ *Caraguata* Plum. ex Lindl. subg. *Caraguata*, Handb. Bromel.: 142, 149 (17 Aug–15 Oct 1889), *nom. inval.* [Art. 22.5]
≡ *Guzmania* subg. *Caraguata* Mez in C. DC., Monogr. phan. 9: 899 (Jan 1896), *nom. nov. pro* Caraguata Plum. ex Lindl. (1827), **Type**:—Tillandsia lingulata L.
= *Tillandsia* sect. *Conostachys* Griseb., Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ., Nr. 1: 19, 20 (13 Jan 1864), **Type** (**designated here**):—*Tillandsia mucronata* Griseb. [≡ *Guzmania mucronata* (Griseb.) Mez]
≡ *Vriesea* sect. *Conostachys* (Griseb.) E. Morren, Belgique Hort. 24: 313 (1874)
≡ *Tillandsia* subg. *Conostachys* (Griseb.) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

≡ *Vriesea* subg. *Conostachys* (Griseb.) Mez in Mart., Fl. bras. 3(3): 516 (1 Feb 1894)
= *Massangea* E. Morren, Belgique Hort. 27: 59, 199, pl. 8, 9 (1877), **Type**:—*Tillandsia musaica* Linden & André [≡ *Massangea musaica* (Linden & André) E. Morren, *Guzmania musaica* (Linden & André) Mez]
≡ *Caraguata* sect. *Massangea* (E. Morren) Baker, J. Bot. 25: 54, 117 (1887)
≡ *Caraguata* subg. *Massangea* (E. Morren) Baker, Handb. Bromel.: 142, 149 (17 Aug–15 Oct 1889)
≡ *Guzmania* subg. *Massangea* (E. Morren) Mez in C. DC., Monogr. phan. 9: 898 (Jan 1896)
= *Sodiroa* André, Bull. Soc. Bot. France 24: 167 (1878, '1877'), **Type** (designated by Smith, 19 Feb 1957: ING Card No. 02895):—*Sodiroa graminifolia* André ex Baker [≡ *Guzmania graminifolia* (André ex Baker) L.B. Sm.]
= *Schlumbergeria* E. Morren, Belgique Hort. 28: 311 (1878), *nom. illeg.* [Art. 53.3 Ex. 8], *non Schlumbergera* Lem. (1858: Cactaceae), **Type**:—*Schlumbergeria roezlii* E. Morren [≡ *Guzmania roezlii* (E. Morren) Mez]
≡ *Caraguata* subg. *Schlumbergeria* Baker, Handb. Bromel.: 143, 149 (17 Aug–15 Oct 1889), *nom. nov. pro Schlumbergeria* E. Morren (1878), **Type**:—Schlumbergeria roezlii E. Morren
≡ *Guzmania* subg. *Schlumbergeria* (Baker) Mez in C. DC., Monogr. phan. 9: 898 (Jan 1896)
= *Thecophyllum* André, Bromel. Andr.: 107 (24 Aug–Dec 1889), **Type** (designated by Britton & Wilson, 10 Aug 1923: 143):—*Thecophyllum wittmackii* André [≡ *Guzmania wittmackii* (André) André ex Mez]
≡ *Guzmania* subg. *Thecophyllum* (André) Mez in C. DC., Monogr. phan. 9: 915 (Jan 1896)
≡ *Thecophyllum* [unranked] *Pluriflorae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 126 (1930), *nom. inval.* [Art. 22.2]
= *Chirripoa* Suess., Bot. Jahrb. Syst. 72: 293, pl. 4, fig. 11 (30 Jan 1942), **Type**:—*Chirripoa solitaria* Suess. [= *Guzmania polycephala* Mez & Wercklé ex Mez]

Diagnostic characters:—***Plants*** epiphytic or terrestrial herbs, usually acaulescent or rarely caulescent, mostly forming impounding, occasionally non-impounding rosettes. ***Leaves*** mesomorphic. ***Inflorescence*** simple or compound, once to triple branched; ***flowers*** usually spirally, rarely distichously arranged. ***Sepals*** symmetric; ***petals*** white, yellow or green, more than 1/4 of their entire length conglutinated/connate into a tube, blades spreading, recuved or erect with tips occasionally cucullate, rarely with enlarged blades, without basal appendages; ***stamens*** shorter to about equalling the petals, included within or exserted from the corolla; ***filaments*** partially agglutinated/adnate for more than 2/3 of the conglutinated/connate portion of the petals; ***anthers*** free or united into a tube surrounding the stigma; ***pollen*** sulcate or occasionally inaperturate, exine reticulate, with a sulcus, when present, of the complex diffuse type (subtype c) or rarely of the complex insulae type (subtype d); ***ovules*** obtuse; ***style*** longer than the ovary, included within or exserted from the corolla; ***stigma*** of the convolute-blade I type or simple-erect type, occasionally of the simple-patent type or simple-pinnatisect type.

Distribution:—Andean and Central America, extending to the Antilles, the Guianas, and Eastern Brazil.

Note:—More than 210 species. Segregations of *Sodiroa* (as proposed by Betancur & Miranda-Esquivel 1999) and *Massangea* are currently not corroborated.

Lemeltonia Barfuss & W. Till, *gen. nov.*

Diagnosis:—*A genere* Tillandsia *L. s.str. filamentis basi connatis, stigmate coralliforme, ovulis obtusis claviformibusque, seminibus cum endostomio breviter cylindrico et embryone cum radicula plusminusve distincta differt. Petala alba vel rariter flavescentia.*

Type:—*Tillandsia dodsonii* L.B. Sm. [≡ *Lemeltonia dodsonii* (L.B. Sm.) Barfuss & W. Till]

Description:—***Plants*** epiphytic herbs, acaulescent or rarely caulescent, forming non-impounding rosettes. ***Leaves*** usually semi-xeromorphic, rarely mesomorphic or xeromorphic and densely lepidote; ***leaf blades*** very narrowly triangular. ***Inflorescence*** simple, green or brown, lax with the often fragrant flowers mostly spreading; ***flowers*** distichously arranged. ***Sepals*** symmetric; ***petals*** white or rarely yellowish, free, basally constricted into a claw with enlarged, spreading blades forming a salverform corolla, without basal appendages; ***stamens*** shorter than the petals, deeply included within the corolla; ***filaments*** conglutinated/connate at least at the base, but sometimes for nearly the whole length, free from the petals; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d) or rarely tending towards the complex *Alcantarea* type (subtype f); ***ovules*** clavate, obtuse; ***style*** shorter than the ovary, deeply included within the corolla; ***stigma*** of the coralliform type. ***Seeds*** without appendage at the apical end, with a short cylindric endostome (type c or d); ***embryo*** with the radicule ± separated (type b).

Distribution:—Central America to Peru extending to Eastern Venezuela and the Guianas.

Etymology:—Named in honor of Elton Martinez Carvalho Leme (1960−) from Rio de Janeiro, Brazil, leading authority of Brazilian Bromeliaceae.

Note:—Seven species. Seed endostome and embryo types follow Groß (1988). Rauh (1990: 179) already recognized the morphological distinctiveness of this group and provided an identification key for all species.

Lemeltonia acosta-solisii (Gilmartin) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia acosta-solisii* Gilmartin, Phytologia 16: 160 (1968), **Type**:—*Teuscher 2275-56* (holo US!)

Lemeltonia cornuta (Mez & Sodiro) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia cornuta* Mez & Sodiro, Bull. Herb. Boissier ser. 2. 5(2): 106 (31 Jan 1905), **Type**:—*Sodiro 171/42* (holo B!)

Lemeltonia dodsonii (L.B. Sm.) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia dodsonii* L.B. Sm., Phytologia 28: 32, pl. 2, figs. f, g (1974), **Type**:—*Dodson 5225* (holo US!, iso SEL!)

Lemeltonia monadelpha (E. Morren) Barfuss W. & Till, *comb. nov.*

Basionym:—*Phytarrhiza monadelpha* E. Morren, Belgique Hort. 32: 168, pl. 7 (1882), **Type**:—*Linden Hortus s.n.* (holo LG)

≡ *Tillandsia monadelpha* (E. Morren) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 44 (May 1887)

= *Tillandsia graminifolia* Baker, J. Bot. 25: 281 (1887), **Lectotype** (designated by Smith & Downs, 1977: 852):—*Martin s.n.* (lecto BM!); *Poiteau s.n.* (syn ?P); *Sagot 859* (syn K!, P!); *Fendler 828* (syn K); *Parker s.n.* (syn K!)

= *Tillandsia monobotrya* Mez, Repert. Spec. Nov. Regni Veg. 16: 77 (1919), **Type**:—*Wercklé 150 = Inst. Costar. 17444* (holo B!)

Lemeltonia narthecioides (C. Presl) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia narthecioides* C. Presl, Reliq. haenk. 1: 125 (1827), **Type**:—*Haenke s.n.* (holo PR!)

Lemeltonia scaligera (Mez & Sodiro) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia scaligera* Mez & Sodiro, Bull. Herb. Boissier ser. 2. 5(2): 107 (31 Jan 1905), **Type**:—*Sodiro 171/4* (holo B!)

Lemeltonia triglochinoides (C. Presl) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia triglochinoides* C. Presl, Reliq. haenk. 1: 125 (1827), **Type**:—*Haenke s.n.* (holo PR!; iso P!)

Pseudalcantarea (Mez) Pinzón & Barfuss, *stat. nov.*

Basionym:—*Tillandsia* subg. *Pseudalcantarea* Mez in Engl., Pflanzenr. 4.32: 437, 455 (1935), **Type**:—*Platystachys viridiflora* Beer [≡ *Pseudalcantarea viridiflora* (Beer) Pinzón & Barfuss, *Tillandsia viridiflora* (Beer) Baker]

≡ *Tillandsia* sect. *Viridiflorae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type**:—*Platystachys viridiflora* Beer

Diagnostic characters:—***Plants*** epiphytic or epilithic, rarely terrestrial herbs, medium to large sized, acaulescent, forming impounding rosettes. ***Leaves*** mesomorphic, green to moderately lepidote; ***leaf blades*** lingulate or triangular. ***Inflorescence*** simple or coumpound, a once branched panicle with ascending branches; ***floral bracts*** longer than the internodes; ***flowers*** large, distichously, laxly to subdensely arranged. ***Sepals*** symmetric, ecarinate; ***petals*** light green, free, linear or nearly so, 9–12.3 cm long, ephemeral, flaccidescent soon after anthesis, forming a tubular corolla with blades spreading, ± spirally twisted (helicoiform), without basal appendages; ***stamens*** about equaling the petals, long exserted from the corolla; ***filaments*** free; ***anthers*** dorsifixed near the middle, versatile, curved; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c); ***ovary*** about 1/3–1/2 inferior; ***ovules*** appendiculate shorter than or about as long as the ovule proper; ***style*** long exserted from the corolla; ***stigma*** green, of the conduplicate-erect type or conduplicate-patent type. ***Seeds*** with an appendage at the basal end distinctly longer than the seed proper, appendage at the apical end short, about half as long as to as long as the seed proper, undivided.

Distribution:—Mexico to Nicaragua.

Etymology:—Named for resembling the flowers of *Alcantarea*.

Note:—Three species. Excluded from *Pseudalcantarea* and placed under different subgenera or species complexes of *Tillandsia* are *T. baliophylla* (*T. biflora* complex), *T. heterophylla* (*T. biflora* complex), and *T. paniculata* (*T.* subg. *Tillandsia*).

Pseudalcantarea grandis (Schltdl.) Pinzón & Barfuss, *comb. nov.*

Basionym:—*Tillandsia grandis* Schltdl., Linnaea 18: 424 (1845, '1844'), **Lectotype** (designated by Weber, 1984: 587):—*Schiede s.n.* (lecto B; isolecto B, BM!, HAL!, LE, OXF)

Pseudalcantarea macropetala (Wawra) Pinzón & Barfuss, *comb. nov.*

Basionym:—*Tillandsia macropetala* Wawra, Wiener Ill. Gart.-Zeitung 12: 241, fig. 50 (1887), **Type**:—*Morren s.n. in Liège Hortus s.n.* (holo W, lost; iso ?LG); **Lectotype** (designated by Krömer *et al*., 2012: 8):—Figure 50 in Wiener Ill. Gart.-Zeitung 12: 241 (1887); **Epitype** (designated by Krömer *et al*., 2012: 8; isoepitype **designated here**):—*Krömer & Otto 2866* (epi UAMIZ; isoepi MEXU, SEL, XAL)

= *Tillandsia viridiflora* var. *variegata* P. Mitch., J. Bromeliad Soc. 21(3): 51, fig. (1971), *nom. inval*. [Art. 39.1, 40.1]

= *Tillandsia viridiflora* var. *variegata* Seaborn, J. Bromeliad Soc. 29(4): 182, fig. (1979), **Type**:—*Seaborn s.n.* (holo US)

Note:—The epitype designation for *Tillandsia macropetala* by Krömer *et al*. (2012) is further narrowed to a single specimen. Since four different herbaria are stated, the one herbarium (UAMIZ) is specified which is conserving the epitype and the other herbaria (MEXU, SEL, XAL) indicated, holding the duplicated specimens of the epitype [isoepitypes, Rec. 9C.1].

Pseudalcantarea viridiflora (Beer) Pinzón & Barfuss, *comb. nov.*

Basionym:—*Platystachys viridiflora* Beer, Fam. Bromel.: 81 (Sep–Oct 1856, '1857'), **Type**:—*Heller s.n. in Attems Hortus* (holo ?IBF)

≡ *Tillandsia viridiflora* (Beer) Baker, J. Bot. 26: 81 (1888)

= *Tillandsia orizabensis* Baker, J. Bot. 26: 105 (1888), **Lectotype** (designated by Smith & Downs, 1977: 1020; Krömer *et al*., 2012: 12):—*Bourgeau 3055* (lecto K!; isolecto P!, P!); *Hahn s.n.* (syn K!)

= *Tillandsia longiflora* Sessé & Moc., Fl. Mex. ed. 2: 81 (1894), **Type**:—*Sessé & Mociño s.n.* (holo MA)

Racinaea M.A. Spencer & L.B. Sm., Phytologia 74: 152 (1993), **Type**:—*Tillandsia cuspidata* L.B. Sm. [≡ *Racinaea cuspidata* (L.B. Sm.) M. A. Spencer & L.B. Sm.]

= *Tillandsia* subg. *Pseudocatopsis* Baker, Handb. Bromel.: 157, 192 (17 Aug–15 Oct 1889), **Type**:—*Tillandsia parviflora* Ruiz & Pav. [≡ *Racinaea parviflora* (Ruiz & Pav.) M. A. Spencer & L.B. Sm.]

≡ *Tillandsia* sect. *Pseudocatopsis* (Baker) André, Bromel. Andr.: 62, 66 (24 Aug–Dec 1889)

Diagnostic characters:—***Plants*** usually epiphytic or rarely terrestrial herbs, acaulescent or rarely caulescent, forming impounding, or non-impounding, often pseudobulbous rosettes. ***Leaves*** mesomorphic or rarely semi-xeromorphic; ***leaf blades*** lingulate to filiform. ***Inflorescence*** usually compound, once or twice branched, occasionally triple branched, or simple; ***flowers*** distichously arranged, usually small and inconspicuous, less than 1 cm long, occasionally larger and conspicuous. ***Sepals*** free, usually distinctly asymmetric, rarely (sub)symmetric; ***petals*** white to yellow, rarely blue, free or occasionally short conglutinated/connate at the base, often fleshy, usually inconspicuous with claws broader than the blades forming a campanulate or urceolate corolla, rarely conspicuous with claws basally constricted and blades enlarged and spreading, forming a salverform corolla, without basal appendages; ***stamens*** equal in length, shorter than the petals, included within the corolla; ***filaments*** free or occasionally short agglutinated/adnate to the petal bases, often fleshy; ***pollen*** usually orange, sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d) tending towards the complex operculum type (subtype e); ***ovules*** obtuse; ***style*** shorter than the ovary, included within the corolla; ***stigma*** of the simple-erect type or of the conduplicate-spiral type (weakly spiral), rarely of the coralliform type. ***Seeds*** without appendage at the apical end.

Distribution:—Andean, mainly Ecuador, extending to Central America, Bolivia, the Greater Antilles and the Guianas, and southeastern Brazil.

Note:—More than 70 species. The typifications of *Tillandsia* subg. *Pseudocatopsis* by Smith & Downs (1977: 670) and *T.* sect. *Pseudocatopsis* by Grant & Zijlstra (1998: 108) with *T. ropalocarpa* André are in conflict with the earlier by Baker (see Baker 17 Aug–15 Oct 1889: 192) and therefore are superseded. Salverform corollas are present in e.g., *Racinaea dyeriana*, *R. hamaleana*, *R. macrantha* H. Luther, *R. riocreuxii* (André) M.A. Spencer & L.B. Sm. or *R. venusta*.

Racinaea dyeriana (André) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia dyeriana* André, Énum. Bromél. 1888: 8 (13 Dec 1888), **Type**:—*André 4256* (holo K!; iso NY!)

= *Tillandsia rutschmannii* Rauh, Trop. Subtrop. Pflanzenwelt 12: 5, figs. 1–3, [4a], 5 (1974), **Type**:—*Naundorff s.n. in Heidelberg Hortus 31701* (holo HEID; iso US)

Racinaea hamaleana (E. Morren) Barfuss & W. Till, *comb. nov.*

Basionym:—*Wallisia hamaleana* E. Morren, Belgique Hort. 20: 97, pl. 5 (Apr–Dec 1870), **Type**:—*Wallis s.n. in Morren Hortus s.n.* (holo ?LG); **Lectotype** (designated by Smith & Downs, 1977: 842):—Plate 5 in Belgique Hort. 20 (Apr–Dec 1870)

≡ *Tillandsia lindenii* var. *hamaleana* (E. Morren) André, Ill. Hort. 24: 190 (1877)

≡ *Tillandsia hamaleana* (E. Morren) E. Morren, Rev. Hort. 50: 390 (1878)

≡ *Phytarrhiza hamaleana* (E. Morren) E. Morren, Belgique Hort. 29: 297 (1879)

= *Tillandsia platypetala* Baker, J. Bot. 26: 46 (1888), **Type**:—*Hartweg s.n.* (holo K!)

= *Tillandsia nubis* Gilmartin, Phytologia 16: 161 (1968), **Type**:—*Naundorff s.n.* (holo US!)

Racinaea venusta (Mez & Wercklé) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia venusta* Mez & Wercklé, Bull. Herb. Boissier ser. 2. 5(2): 108 (31 Jan 1905), **Type**:—*Wercklé Bromel. Costar. 95* (holo B!)

Tillandsia L., Sp. pl.: 286 (1 May 1753), Gen. pl. ed. 5: 138 (1754), **Type** (designated by Britton & Millspaugh, 1920: 64):—*Tillandsia utriculata* L.

≡ *Caraguata* Plum. ex Adans., Fam. pl. 2: 67, 532 (Jul–Aug 1763), *nom. nov. pro Tillandsia* L. *et Renealmia* L. (1 May 1753, 1754), *nom. illeg.* [Art. 52.1], **Type** (designated by Grant & Zijlstra, 1998: 97):—*Tillandsia utriculata* L.

= *Renealmia* L., Sp. pl.: 286 (1 May 1753), Gen. pl. ed. 5: 139 (1754), *nom. rej. vs.* Renealmia L. f. (1782: Zingiberaceae), **Type** (designated by Smith, 22 Jul 1958: ING Card No. 06039):—*Renealmia paniculata* L. [≡ *Tillandsia paniculata* (L.) L.]

= *Bonapartea* Ruiz & Pav., Fl. Peruv. 3: 38, pl. 262 (Aug 1802), **Type** (designated by Smith, 1 Oct 1955: ING Card No. 00135):—*Bonapartea juncea* Ruiz & Pav. [≡ *Acanthospora juncea* (Ruiz & Pav.) Spreng., *Misandra juncea* (Ruiz & Pav.) F. Dietr., *Tillandsia juncea* (Ruiz & Pav.) Poir.]

≡ *Acanthospora* Spreng., Anleit. Kenntn. Gew. ed. 2, 2(1): 255 (20 Apr 1817), *nom. nov. pro Bonapartea* Ruiz & Pav. (Aug 1802), *nom. illeg.* [Art. 52.1], **Type**:—*Bonapartea juncea* Ruiz & Pav.

≡ *Misandra* F. Dietr., Nachtr. Vollst. Lex. Gärtn. 5: 102 (1819), *nom. nov. pro Bonapartea* Ruiz & Pav. (Aug 1802), *nom. illeg.* [Art. 52.1, 53.1], *non* Comm. ex Juss. (1789: Haloragaceae), **Type**:—*Bonapartea juncea* Ruiz & Pav.

≡ *Tillandsia* sect. *Caricifoliae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type** (**designated here**):—*Bonapartea juncea* Ruiz & Pav.

= *Allardtia* A. Dietr., Berliner Allg. Gartenzeitung 20: 241 (31 Jul 1852), **Type**:—*Allardtia cyanea* A. Dietr. [≡ *Platystachys cyanea* (A. Dietr.) K. Koch, *Tillandsia cyanea* (A. Dietr.) E. Morren, *Tillandsia guatemalensis* L.B. Sm.]

≡ *Platystachys* K. Koch, Index Seminum Hort. Bot. Berol. 1854, App.: 11 (1855), *nom. nov. pro Allardtia* A. Dietr. (31 Jul 1852), *nom. illeg.* [Art. 52.1], **Type**:—*Allardtia cyanea* A. Dietr.

≡ *Tillandsia* sect. *Platystachys* Griseb., Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ., Nr. 1: 14 (13 Jan 1864), *nom. nov. pro Allardtia* A. Dietr. (31 Jul 1852), **Type**:—*Allardtia cyanea* A. Dietr.

≡ *Tillandsia* sect. *Allardtia* (A. Dietr.) E. Morren, Belgique Hort. 27: 272, 273 (1877), *nom. illeg.* [Art. 52.1]

≡ *Tillandsia* subg. *Allardtia* (A. Dietr.) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

= *Pityrophyllum* Beer, Fam. Bromel.: 17, 79, 171 (Sep–Oct 1856, '1857'), **Type** (designated by Pfeiffer, 1873: 735):—*Tillandsia ionantha* Planch. [= *Pityrophyllum erubescens* (H. Wendl.) Beer, *Tillandsia erubescens* H. Wendl.]

≡ *Tillandsia* sect. *Pityrophyllum* (Beer) K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 1 (1874)

≡ *Tillandsia* subg. *Pityrophyllum* (Beer) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

Diagnostic characters:—***Plants*** epiphytic or epilithic, rarely terrestrial herbs, much variable in size and habit, caulescent or acaulescent, forming mostly non-impounding to occasionally impounding, sometimes pseudobulbous rosettes. ***Leaves*** mostly xeromorphic and often highly succulent, occasionally mesomorphic or semi-xeromorphic; ***leaf blades*** narrowly triangular, filiform or lingulate. ***Inflorescence*** simple or compound, up to triple branched, rarely single-flowered; ***flowers*** distichously, rarely spirally arranged. ***Sepals*** usually symmetric or subsymmetric, the adaxial sometimes connate (and therefore appearing asymmetric) and carinate; ***petals*** violet, pink, red, orange, yellow, green or white, rarely bicolored, free, 1.5–7(–13) cm long, usually forming a tubular and conspicuous corolla, with erect blades and often revolute apex margins or slightly cucullate, or sometimes with spreading or recurved blades, or rarely basally constricted into a claw with enlarged, spreading blades forming a salverform corolla, usually without or rarely bearing basal appendages; ***stamens*** shorter to longer than the petals, included within or exserted from the corolla; ***filaments*** free and usually straight, often twinning, occasionally plicate; ***pollen*** yellow to whitish, sulcate, exine reticulate or rarely non-reticulate, with a sulcus of complex subtypes, mostly of the diffuse type (subtype c), insulae type (subtype d), or operculum type (subtype e), rarely of the *Alcantarea* type (subtype f), sometimes with smooth transition between the types; ***ovary*** usually 1/8–1/3 inferior, rarely up to 1/2 inferior; ***ovules*** usually appendiculate shorter than or about as long as the ovule proper, rarely longer or obtuse or

subobtuse; ***style*** distinct, usually much longer, rarely as long as or shorter than the ovary, included within or exserted from the corolla; ***stigma*** usually of the conduplicate-spiral type or simple-erect type, occasionally of the simple-patent type or simple-truncate type, rarely of the conduplicate-patent type or the convolute-blade I type. ***Seeds*** with a short to long appendage at the apical end.

Distribution:—From southern United Stated to the Antilles, central Argentina and Uruguay with centres of diversity in northern Central America and the northern and central Andes.

Note:—More than 650 species. *Platystachys* in Beer (Sep–Oct 1856, '1857': 80, 173, 264) is based on *Platystachys* K. Koch (other than indicated by Baker in G. Nicholson May 1887:41,42; and Baker 17 Aug–15 Oct 1889: 158, 168), since K. Koch is correctly cited as the author and the type, *Allardtia cyanea* A. Dietr., is not excluded. Although Beer does not describe this species in his book (which is not a complete monograph and rather a description of bromeliads known to him), he places *Platystachys havanensis* Beer near '*Allardtia cyanea* Dietrich, *Platystachys* Koch' (Beer Sep–Oct 1856, '1857': 85), which definitely indicates an inclusion. Baker (in G. Nicholson May 1887), on the other hand, excludes *Allardtia cyanea* (within *Tillandsia* subg. *Allardtia*) from the name *T.* subg. *Platystachys* and therefore creates a later homonym of *T.* sect. *Platystachys* Griseb. (13 Jan 1864). Basal appendages can be found in *T. heliconioides*, *T. malzinei* and are common in *T.* subg. *Pseudovriesea*. Although the validly published and accepted subgeneric classification of *Tillandsia* is listed, several species complexes remain unclassified:

***Tillandsia biflora* complex**, key species:—*Tillandsia biflora* Ruiz & Pav. (136 species)

= *Tillandsia* sect. *Caespitosae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type**:—*Tillandsia caespitosa* Schltdl. & Cham., *nom. illeg.* [Art. 53.1] [≡ *Tillandsia multicaulis* Steud.]

***Tillandsia disticha* complex**, key species:—*Tillandsia disticha* Kunth (two species)

***Tillandsia australis* complex**, key species:—*Tillandsia australis* Mez (four species)

***Tillandsia gardneri* complex**, key species:—*Tillandsia gardneri* Lindl. (17 species)

***Tillandsia purpurea* complex**, key species:—*Tillandsia purpurea* Ruiz & Pav. (six species)

***Tillandsia rauhii* complex**, key species:—*Tillandsia rauhii* L.B. Sm. (three species)

***Tillandsia sphaerocephala* complex**, key species:—*Tillandsia sphaerocephala* Baker (six species)

Two species (so far investigated)**, *Tillandsia albertiana*** Verv. and ***T. esseriana*** Rauh & L.B. Sm., remain unclassified (*incertae sedis*) for now.

Tillandsia* subg. *Aerobia Mez in C. DC., Monogr. phan. 9: 812 (Jan 1896), **Type** (**designated here**):—*Tillandsia xiphioides* Ker Gawl.

Note:—50 species. Formerly placed either under *Tillandsia* subg. *Allardtia* or *T.* subg. *Anoplophytum*.

Tillandsia* subg. *Anoplophytum (Beer) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

Basionym:—*Anoplophytum* Beer, Flora 37: 346 (14 Jun 1854), **Type**:—*Tillandsia stricta* Sol. ex Sims [≡ *Anoplophytum strictum* (Sol. ex Sims) Beer]

≡ *Tillandsia* sect. *Anoplophytum* (Beer) Griseb., Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ., Nr. 1: 20 (13 Jan 1864)

Note:—33 species.

Tillandsia* subg. *Diaphoranthema (Beer) Baker, J. Bot. 16: 236 (1878)

Basionym:—*Diaphoranthema* Beer, Flora 37: 349 (14 Jun 1854), **Type**:—*Renealmia recurvata* L. [≡ *Diaphoranthema recurvata* (L.) Beer, *Tillandsia recurvata* (L.) L.]

≡ *Tillandsia* sect. *Diaphoranthema* (Beer) Griseb., Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ., Nr. 1: 20 (13 Jan 1864)

= *Tillandsia* sect. *Strepsia* Nutt., Gen. N. Amer. pl. 1: 208 (1818), **Type** (**designated here**):—*Renealmia usneoides* L. [≡ *Dendropogon usneoides* (L.) Raf., *Tillandsia usneoides* (L.) L.]

≡ *Dendropogon* Raf., Neogenyton: 3 (1825), **Type**:—*Renealmia usneoides* L.

≡ *Strepsia* (Nutt.) Steud., Nomencl. Bot., ed. 2, 2: 645 (1841), *nom. inval.* [Art. 36.1]

≡ *Tillandsia* subg. *Strepsia* (Nutt.) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 41 (May 1887)

Note:—30 species. Steudel (1841: 645) did not validly publish *Strepsia* as a name at a new rank based on *Tillandsia* sect. *Strepsia*, because he did not accept the genus. This is evident by Steudel writing 'Strepsia. *Nuttal*.' and not 'STREPSIA', the capital letters indicating genera accepted by him in the whole publication. Furthermore,

he referred the only species listed, 'Strepsia *usneoides*. *Nutt*.', as synonym to *Tillandsia usneoides* (L.) L., the italicized letters of species epithets indicating species not accepted by him in the whole publication. Under the accepted genus 'TILLANDSIA', 'Strepsia usneoides. *Nutt*.' is also cited as synonym of *Tillandsia usneoides* (Steudel 1841: 688). Currently there is no evidence that *Strepsia* was already earlier validely pubished as a genus.

Tillandsia* subg. *Phytarrhiza (Vis.) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 41 (May 1887)

Basionym:—*Phytarrhiza* Vis., Due Piante Nuove Bromel.: 6 (1854) [= Mem. Reale Ist. Veneto Sci. 5: 340, pl. (1855)], **Type**:—*Tillandsia duratii* Vis. [≡ *Phytarrhiza duratii* (Vis.) Vis.]

≡ *Tillandsia* sect. *Phytarrhiza* (Vis.) K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 1 (1874)

Note:—Eleven species.

Tillandsia* subg. *Pseudovriesea Barfuss & W. Till, *subg. nov*.

Diagnosis:—*Folia xeromorphica, rariter semixeromorphica, anguste triangularia, dense lepidota, petala plerumque biappendiculata, saepe bicoloria, rariter marginibus crenulatis, stigma laminis conduplicato-spiralibus.*

Type:—*Tillandsia tequendamae* André

= *Tillandsia* sect. *Trianisandra* André, Bromel. Andr.: 63 (24 Aug–Dec 1889), **Type**:—*Tillandsia heterandra* André

Description:—***Plants*** epiphytic or terrestrial, occasionally epilithic herbs, usually acaulescent, rarely caulescent, forming non-impounding to inconspicuously impounding rosettes. ***Leaves*** xeromorphic to occasionally semi-xeromorphic, usually densely lepidote; ***leaf blades*** narrowly triangular. ***Inflorescence*** simple or compound, once or twice branched; ***floral bracts*** appressed to the rhachis to imbricate; ***flowers*** distichously arranged. ***Sepals*** symmetric; ***petals*** usually violet to blue-violet, rarely green or yellowish, often bi-colored with contrasting margins, sometimes with crenulated margins, free, forming a tubular and conspicuous corolla with divergent tips, usually bearing or rarely without basal appendages; ***stamens*** shorter to longer than the petals, included within or exserted from the corolla; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c) tending towards the complex operculum type (subtype e); ***ovules*** appendiculate shorter than or about as long as the ovule proper; ***stigma*** usually of the conduplicate-spiral type, occasionally of the simple-erect type.

Distribution:—Northern and central Andes extending to Bolivia, Mesoamerica, the Antilles, and eastern Venezuela.

Etymology:—The name refers to the previous taxonomic misplacement under *Vriesea*.

Note:—49 species. Grant (1993, 1995b, 2005) already excluded the grey-leaved taxa bearing basal petal appendages from *Vriesea* and placed them under *Tillandsia*. Some species without basal petal appendages were formerly placed under *T.* subg. *Allardtia* (e.g., *T. barthlottii*, *T. myriantha*) and *T.* subg. *Tillandsia* (e.g., *T. spathacea*).

Tillandsia* L. subg. *Tillandsia in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

≡ *Tillandsia* sect. *Cyathophora* K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 1, 6 (1874), **Type** (**designated here**):—*Tillandsia utriculata* L.

≡ *Tillandsia* subg. *Cyathophora* (K. Koch) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

≡ *Tillandsia* subg. *Eutillandsia* Mez in Mart., Fl. bras. 3(3): 580 (1 Feb 1894), *nom. inval*. [Art. 21.3, 22.2]

≡ *Tillandsia* sect. *Utriculatae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), *nom. inval*. [Art. 22.2]

= *Tillandsia* sect. *Eriophyllum* (*Eriophorum*) K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 1, 6, 7 (1874), **Type** (**designated here**):—*Tillandsia setacea* Sw.

≡ *Tillandsia* subg. *Platystachys* Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 41 (May 1887), *nom. illeg*. [Art. 53.4], *non Tillandsia* sect. *Platystachys* Griseb. (13 Jan 1864), **Type** (**designated here**):—*Tillandsia setacea* Sw.

= *Vriesea* sect. *Cylindrostachys* Wittm. in Engl. & Prantl, Nat. Pflanzenfam. II.4: 59 (1888), **Type**:—*Vriesea malzinei* E. Morren [≡ *Tillandsia malzinei* (E. Morren) Baker]

≡ *Vriesea* subg. *Conostachys* Mez in C. DC, Monogr. phan. 9: 564 (Jan 1896), *nom. illeg*. [Art. 53.4], *non* (Griseb.) Mez (1 Feb 1894), **Type** (**designated here**):—*Vriesea malzinei* E. Morren

≡ *Vriesea* subg. *Cylindrostachys* (Wittm.) Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 124 (1930)

= *Tillandsia* sect. *Argenteae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type**:—*Tillandsia argentea* Griseb.

= *Tillandsia* sect. *Bulbosae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 118 (1930), **Type**:—*Tillandsia bulbosa* Hook.

= *Tillandsia* sect. *Fasciculatae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type**:—*Tillandsia fasciculata* Sw.

= *Tillandsia* sect. *Filifoliae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type**:—*Tillandsia filifolia* Schltdl. & Cham.

= *Tillandsia* sect. *Streptophyllae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 118 (1930), **Type**:—*Tillandsia streptophylla* Scheidw. ex C. Morren

= *Tillandsia* sect. *Valenzuelanae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 117 (1930), **Type**:—*Tillandsia valenzuelana* A. Rich. [= *Tillandsia variabilis* Schltdl.]

= *Tillandsia* sect. *Vestitae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 118 (1930), **Type**:—*Tillandsia vestita* Schltdl. & Cham., *nom. illeg.* [Art. 53.1] [≡ *Tillandsia schiedeana* Steud.]

Note:—More than 270 species. Some species positioned here were formerly placed under *Tillandsia* subg. *Pseudalcantarea* (*T. paniculata*) and *Vriesea* (*T. heliconioides*, *T. malzinei*). Several species of former *T.* subg. *Allardtia* (including its type *T. guatemalensis*) are also included here. *Tillandsia* subg. *Allardtia* is therefore a synonym of *T.* subg. *Tillandsia*.

Tillandsia* subg. *Viridantha (Espejo) W. Till & Barfuss, *comb. et stat. nov.*

Basionym:—*Viridantha* Espejo, Acta Bot. Mex. 60: 27 (2002), **Type**:—*Tillandsia plumosa* Baker [≡ *Viridantha plumosa* (Baker) Espejo]

= *Viridantha* sect. *Caulescens* Espejo, Acta Bot. Mex. 60: 31 (2002), **Type**:—*Tillandsia tortilis* Klotzsch ex Baker [≡ *Viridantha tortilis* (Klotzsch ex Baker) Espejo]

Note:—23 species. The *Tillandsia tectorum* complex (Hromadnik 2005) is included here.

Wallisia (Regel) E. Morren, Belgique Hort. 20: 97 (Apr–Dec 1870) *excl. gen. Phytarrhiza* Vis.

Basionym:—*Tillandsia* sect. *Wallisia* Regel, Index Seminum Hort. Bot. Petrop. 1868: 92 (Mar 1869), **Type**:—*Tillandsia lindenii* Regel, *nom. illeg.* [Art. 53.1] [≡ *Tillandsia lindeniana* Regel, *Wallisia lindeniana* (Regel) E. Morren]

≡ *Tillandsia* subg. *Wallisia* (Regel) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)

Diagnostic characters:—***Plants*** usually epiphytic, rarely terrestrial herbs, acaulescent, forming non-impounding rosettes. ***Leaves*** semi-xeromorphic, mostly conspicuously longitudinally reddish (-brown) striped near the base; ***leaf blades*** narrowly triangular. ***Inflorescence*** simple, flat, usually lanceolate-elliptic in outline, rarely sublanceolate; ***floral bracts*** strongly to scarcely imbricate; ***flowers*** distichously arranged. ***Sepals*** symmetric; ***petals*** blue to violet, rarely light blue to whitish, free, basally constricted into a claw with usually strongly, rarely slightly enlarged, spreading blades forming a salverform corolla, without basal appendages; ***stamens*** shorter than the petals, deeply included within the corolla; ***filaments*** free; ***anthers*** subbasifixed; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** slenderly cylindric, obtuse; ***style*** (except stigma) shorter than the ovary, deeply included within the corolla; ***stigma*** of the conduplicate-pinnatisect type. ***Seeds*** without appendage at the apical end.

Distribution:—Ecuador and Peru, *Wallisia anceps* extending to Guatemala, eastern Venezuela, the Guianas, and northern Brazil.

Note:—Four species, one hybrid. Morren (Apr–Dec 1870), when elevating *Tillandsia* sect. *Wallisia* to generic rank, cited the legitimate genus *Phytarrhiza* Vis. (type *T. duratii* Vis.) in synonymy and therefore made the genus *Wallisia* nomenclaturally superfluous at that time, but not illegitimate because it has a basionym [Art. 52.3]. As the type of *Phytarrhiza* is now excluded (within *T.* subg. *Phytarrhiza*) from the here adopted generic concept, the generic name *Wallisia* becomes available and must be used for a genus containing its type, *T. lindenii* Regel. The name *Wallisia* Regel (1875: Gentianaceae) is a later homonym.

Wallisia anceps (Lodd.) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia anceps* Lodd., Bot. Cab. 8: pl. 771 (1823), **Type**:—*Adam s.n. in Loddiges Hortus s.n.* (holo ?CGE, ?K); **Lectotype** (designated by Smith & Downs, 1977: 848):—Plate 771 in Bot. Cab. 8 (1823)

≡ *Platystachys anceps* (Lodd.) Beer, Fam. Bromel.: 80 (Sep–Oct 1856, '1857')

≡ *Vriesea anceps* (Lodd.) Lem., Ill. Hort. 6 (Misc.): 15 (1859)

≡ *Phytarrhiza anceps* (Lodd.) E. Morren, Belgique Hort. 29: 368, pls. 20, 21 (1879)

= *Tillandsia lineatifolia* Mez in C. DC., Monogr. phan. 9: 686 (Jan 1896), **Type**:—*Fendler 2447* (holo GOET!)

Wallisia cyanea Barfuss & W. Till, *nom. nov. pro Tillandsia lindenii* K. Koch (23 May 1868)

≡ *Tillandsia lindenii* K. Koch, Wochenschr. Vereines Beförd. Gartenbaues Königl. Preuss. Staaten 11: 168 (23 May 1868), emend. K. Koch, Wochenschr. Vereines Beförd. Gartenbaues Königl. Preuss. Staaten 12: 182 (12 Jun 1869), **Type**:—*Van Geert Hortus s.n.* (holo ?B); **Neotype** (**designated here**):—Plate 18 in Belgique Hort. 19 (Nov–Dec 1869)

≡ *Tillandsia lindenii* [var.] *vera* Dombrain, Fl. Mag. (London), new ser. 5: 9 (May 1872), *nom. inval*. [Art. 24.3, 26.2]
= *Tillandsia lindenii* H. Laurentius, Cat. Gewächsh.-Pfl. Herbst-Cat. 40 (Aug 1868: 6), *nom. illeg*. [Art. 53.1], as '*Lindeni*', *non* K. Koch (23 May 1868), **Type**:—not indicated
= *Tillandsia lindenii* E. Morren, Belgique Hort. 19: 321, pl. 18 (Nov–Dec 1869), *nom. illeg*. [Art. 53.1], as '*Lindeni*', *non* K. Koch (23 May 1868) *nec* H. Laurentius (Aug 1868) *nec* Regel (Mar 1869), **Type**:—*Wallis s.n. in Linden Hortus s.n.* (holo ?LG); **Lectotype** (designated by Smith & Downs, 1977: 849):—Plate 18 in Belgique Hort. 19 (Nov–Dec 1869)
≡ *Tillandsia morreniana* Regel, Gartenflora 19: 41 (Feb–Mar 1870), *nom. nov. pro Tillandsia lindenii* E. Morren (Nov–Dec 1869)
≡ *Wallisia lindenii* E. Morren, Belgique Hort. 20: 102 (Apr–Dec 1870), *nom. nov. pro Tillandsia lindenii* E. Morren (Nov–Dec 1869), *nom. illeg*. [Art. 52.1]
≡ *Tillandsia lindenii* var. *genuina* E. Morren, Gard. Chron., new ser. 12(302): 460 (11 Oct 1879), *nom. inval*. [Art. 24.3]
≡ *Phytarrhiza lindenii* E. Morren, Belgique Hort. 29: 297 (1879), *nom. nov. pro Tillandsia lindenii* E. Morren (Nov–Dec 1869), *nom. illeg*. [Art. 52.1]
≡ *Phytarrhiza lindenii* var. *genuina* E. Morren, Belgique Hort. 29: 297 (1879), *nom. inval*. [Art. 24.3]
≡ *Tillandsia* (*Phytarrhiza*) *cyanea* L.B. Sm., Contr. U.S. Natl. Herb. 29: 489 (20 Jun 1951), *nom. nov. pro Tillandsia lindenii* E. Morren (Nov–Dec 1869), *nom. illeg*. [Art. 52.1, 53.1], *non Tillandsia cyanea* (A. Dietr.) E. Morren (1879) *nec Tillandsia cyanea* Linden ex K. Koch (4 May 1867: 140), *nom. inval*. [Art. 36.1]
= *Tillandsia lindenii* [unranked] *superba rosea* L. Duval ex Dauthenay, Rev. Hort. 70: 539 (16 Nov 1898), *nom. inval*. [Art. 23.6(c), 24.2]
= *Tillandsia lindenii* var. *superba* L. Duval in Truff., J. Soc. Natl. Hort. France, ser. 3. 21: 492 (10 Jul 1899), as '*lindenii* [subsp.] *vera* var. *superba*', **Type**:—*Duval Hortus s.n.* (holo ?Versailles)

Note:—The name *Tillandsia lindenii* was first validly published by Koch (23 May 1868: 168), validated by a diagnosis in German: "*Tillandsia Lindenii* besitzt kleine schmal-lanzettförmige Blätter, welche braune Längsstreifen haben" [*Tillandsia Lindenii* possesses small, narrow-lanceolate leaves, which have brown vertical stripes]. Koch later emended his description (with a reference to Koch 23 May 1868: 168) and indicated the correct use of his name (Koch 12 Jun 1869: 182): "…*Tillandsia Lindeni*, eine mit schmalen, aber dicken und zurückgeschlagenen Blättern versehene Art, wo der breitgedrückte und ährenförmige Blüthenstand eine rosenrothe Farbe besitzt, während die grossen und lang herausragenden Blüthen azurblau gefärbt sind. Die ganze Pflanze erreicht mit dem Blüthenstande kaum die Höhe eines Fusses (s. 11. Jahrg. d. Wochenschr. S. 168). …" [*Tillandsia Lindeni*, a species provided with narrow but thick and recurved leaves, where the flattened and spike-like inflorescence has a pink color, while the large and long exserted flowers are colored azure. The whole plant reaches with the inflorescence barely the height of a foot (see 11th Jahrg. [of] t.[he] Wochenschr. p. 168)]. *Tillandsia lindenii* H. Laurentius (Aug 1868: 6), *T. lindenii* Regel (Mar 1869: 92), and *T. lindenii* E. Morren (Nov–Dec 1869: 321) are therefore illegitimate later homonyms. Because the short German diagnosis of *T. lindenii* K. Koch implies some uncertainty and a holotype could not be located, the proposed neotypification with Plate 18 in Belgique Hort. 19 (Morren Nov–Dec 1869) fixes the common use of the name. However, under *Wallisia*, *T. lindenii* K. Koch needs a new name, since Morren (Apr–Dec 1870) already proposed the valid, but illegitimate name *Wallisia lindenii* E. Morren for his *T. lindenii* E. Morren, overlooking that he should have proposed a new combination based on the replacement name *Tillandsia morreniana* Regel (Feb–Mar 1870).

Koch did not validly publish the name *Tillandsia cyanea* [Linden ex K. Koch] in the article *Gärtnerische Briefe über die Pariser Welt-Ausstellung* (Koch 4 May 1867: 140) [Art. 36.1]. From the description and the context, it is evident that the name refers to a bromelioid taxon and the generic assignment is not accepted by Koch for this plant, since he places it near his *Bromelia* [?*Billbergia*] *angustifolia* K. Koch: "… ebenso sind Arten von *Tillandsia*, *Cryptanthus* und *Billbergia* und wiederum diese letztere und *Bromelia* in den Gärten keineswegs immer richtig erkannt, und doch lassen sie sich im Allgemeinen schon am Blüthenstande erkennen. … Als *Tillandsia cyanea* fand ich eine Pflanze, welche einen etwas gestielten, aber dicht gedrängten und eiförmigen Blüthenstand von rother (nicht blauer) Farbe besass, vor; sie steht der von mir unter dem Namen *Bromelia angustifolia* beschriebenen nahe." [… likewise are species of *Tillandsia*, *Cryptanthus* and *Billbergia*, and again the latter and *Bromelia*, not always correctly identified in the gardens, and nevertheless, they can in general already be recognized by the inflorescence. … As *Tillandsia cyanea* I found a plant, which had a slightly pedunculate, but densely packed and egg-shaped inflorescence of red (not blue) color; it is close to [the plant] that I have described under the name *Bromelia angustifolia*.]. Obviously, the same bromelioid taxon is also named '*T. cyanea* h[ort]. Linden' in the synonymy of *Ortgiesia tillandsioides* var. *subexserta* Regel (1867: 81), which seems to be based on a misslabeling of '*T. rosea* h[ort]. Linden' (Regel 1867: 81, Jul–Aug 1867: 194). Smith's interpretation of Koch's

German text is incorrect (Smith 20 Jun 1951: 489–491). He wrongly assumed that the plant from Linden in the previous paragraph of Koch's article named "*Tillandsia* mit großen blauen Blüthen" [*Tillandsia* with big blue flowers] was identical with the plant labelled as *T. cyanea* (Koch 4 May 1867: 140). Koch actually states about the blue-flowerd *Tillandsia*: "Ob sie schon beschrieben ist, müssen genaue Untersuchungen lehren, in Gärten war sie, wenigstens bis jetzt, noch nicht eingeführt." [If it is already described, detailed studies must show; at least so far, it has not yet been introduced in gardens.]. This plant obviously is the later *T. lindenii* K. Koch (23 May 1868) and was exhibited, according to Koch (25 Jun 1870: 197), as '*T. coerulea* h[ort]. Linden' in Paris in 1867. Smith (20 Jun 1951: 489) actually creates the new name *T. cyanea* L.B. Sm. for *T. lindenii* E. Morren, while referring to an invalid name. However, his new name is illegitimate because *T. cyanea* (A. Dietr.) E. Morren already exists and he should have adopted the name *T. morreniana* Regel.

Since *T. lindenii* K. Koch needs a new name under *Wallisia*, we propose *Wallisia cyanea*. The epithet '*cyanea*' under *Tillandsia* would have to be used for *T. cyanea* (A. Dietr.) E. Morren [≡ *Allardtia cyanea* A. Dietr., *Platystachys cyanea* (A. Dietr.) K. Koch] (Morren 1879), which would make illegitimate its later replacement name *T. guatemalensis* L.B. Sm. (Smith 28 Dec 1949: 281). In order not to create further confusion, a proposal to the Committee for Spermatophyta to conserve *T. guatemalensis* against *T. cyanea* is in progress.

Wallisia* × *duvalii (L. Duval) Barfuss & W. Till, *comb. nov.* [*Wallisia cyanea* × *Wallisia lindeniana*]

Basionym:—*Tillandsia* × *duvalii* L. Duval (pro sp.) in Truff., J. Soc. Natl. Hort. France, ser. 3. 21: 492 (10 Jul 1899), as '*Duvali*', **Type**:—*Duval Hortus s.n.* (holo ?Versailles) [*Tillandsia lindenii* var. *major* (♀) × *Tillandsia lindenii* var. *superba* (♂)]

≡ *Tillandsia lindenii* var. *duvalii* (L. Duval) André, Rev. Hort. 71: 516 (16 Nov 1899), as '*Duvali*'

≡ *Tillandsia lindenii* var. *duvaliana* L.B. Sm., Phytologia 20: 166 (1970), *nom. nov. pro Tillandsia lindenii* var. *duvalii* (L. Duval) André (16 Nov 1899), *nom. illeg.* [Art. 52.1]

= *Tillandsia lindenii* var. × *major* (pro var.) Dombrain, Fl. Mag. (London) 10: pl. 529 (1871), **Type**:—*Veitch Hortus s.n.* (holo ?); **Lectotype** (designated by Smith & Downs, 1977: 845):—Plate 529 in Fl. Mag. (London) 10 (1871) [*Tillandsia lindenii* var. *lindenii* × *Tillandsia lindenii* var. *regeliana*]

≡ *Tillandsia lindenii* var. *intermedia* E. Morren, Rev. Hort. 50: 390 (1878), *nom. nov. pro Tillandsia lindenii* var. *major* Dombrain (1871), *nom. illeg.* [Art. 52.1]

≡ *Phytarrhiza lindenii* var. *intermedia* E. Morren, Belgique Hort. 29: 298 (1879), *nom. nov. pro Tillandsia lindenii* var. *major* Dombrain (1871), *nom. illeg.* [Art. 52.1]

= *Tillandsia lindenii* var. *luxurians* E. Morren, Belgique Hort. 21: 289, pl. 20–21 (1871), **Type**:—*Brussels Hortus s.n.* (holo ?); **Lectotype** (designated by Smith & Downs, 1977: 845):—Plate 20–21 in Belgique Hort. 21 (1871)

≡ *Phytarrhiza lindenii* var. *luxurians* (E. Morren) E. Morren, Belgique Hort. 29: 299 (1879)

≡ *Tillandsia lindenii* var. *abundans* L.B. Sm., Phytologia 20: 166 (1970), *nom. nov. pro Tillandsia lindenii* var. *luxurians* E. Morren (1871), *nom. illeg.* [Art. 52.1]

= *Phytarrhiza lindenii* var. *koutsinskyana* E. Morren, Belgique Hort. 30: 80 (1880), **Type**:—*Warsaw Hortus s.n.* (holo ?LG, ?WA)

≡ *Tillandsia lindenii* var. *koutsinskyana* (E. Morren) L.B. Sm., Contr. U.S. Natl. Herb. 29: 494 (20 Jun 1951)

= *Tillandsia lindenii* [var.] *splendida* Carrière, Rev. Hort. 54: 12, pl. (1882), **Type**:—*Thibaut & Keteleer Hortus s.n.* (holo ?); **Lectotype** (designated by Smith &Downs, 1977: 845):—Plate in Rev. Hort. 54 (1882)

= *Tillandsia lindenii* var. *caeca* D. Barry, Bromeliad Soc. Bull. 12(1): 5 (1962), *nom. inval.* [Art. 40.1]

= *Tillandsia lindenii* var. × *caeca* D. Barry in L.B. Sm. & Downs, Fl. Neotrop. 14(2): 846 (1977), **Type**:—*Barry Hortus s.n.* (holo US)

Note:—This hybrid is treated here because it is generally regarded as the 'true' *Tillandsia lindenii* mainly caused by a wrong interpretation of Smith (20 Jun 1951: 493; see also the notes under *Wallisia lindeniana* and *Wallisia cyanea*) and because some specimens indicate it probably occures also in nature.

Wallisia lindeniana (Regel) E. Morren, Belgique Hort. 20: 102 (Apr–Dec 1870)

Basionym:—*Tillandsia lindeniana* Regel, Gartenflora 18: 193, pl. 619 (Jul–Aug 1869), *nom. nov. pro Tillandsia lindenii* Regel (Mar 1869), **Type**:—*Linden Hortus s.n. in St. Petersburg Hortus s.n.* (holo ?LE); **Lectotype** (designated by Smith & Downs, 1977: 844):—Plate 619 in Gartenflora 18 (Jul–Aug 1869)

≡ *Tillandsia lindenii* Regel, Index Seminum Hort. Bot. Petrop. 1868: 92 (Mar 1869), as '*Lindeni*', *nom. illeg.* [Art. 53.1], *non* K. Koch (23 May 1868) *nec* H. Laurentius (Aug 1868), **Type**:—*Linden Hortus s.n. in St. Petersburg Hortus s.n.* (holo ?LE)

≡ *Vriesea lindenii* Lem., Ill. Hort. 16: pl. 610 (Aug–Dez 1869), as '*Lindeni*', *nom. nov. pro Tillandsia lindeniana* Regel (Jul–Aug 1869), *nom. illeg.* [Art. 52.1]

≡ *Tillandsia lindenii* var. *regeliana* E. Morren, Belgique Hort. 20: 225, pl. 12 (Apr–Dec 1870), *nom. nov. pro Tillandsia lindeniana* Regel

≡ *Phytarrhiza lindenii* var. *regeliana* (E. Morren) E. Morren, Belgique Hort. 29: 298 (1879)
= *Tillandsia umbellata* André, Rev. Hort. 58: 60, pl. (1886), **Type**:—*André K-317* (holo K)

Note:—*Tillandsia umbellata* actually is a new description of *T. lindeniana* in the original sense. Smith (20 Jun 1951: 493) already realized the obvious resemblance (to plate 619 in Regel Jul–Aug 1869), but stressed later illustrations of more vigorous plants (*T. lindenii* var. *major*, Dombrain 1871) with longer peduncles and larger inflorescences, which are actually already the hybrid of *Wallisia cyanea* × *Wallisia lindeniana*, *Wallisia* × *duvalii*.

Wallisia pretiosa (Mez) Barfuss & W. Till, *comb*. *nov*.
Basionym:—*Tillandsia pretiosa* Mez, Repert. Spec. Nov. Regni Veg. 16: 78 (1919), **Type**:—*Sodiro 171/39* (holo B!)
= *Tillandsia lindenii* var. *tricolor* André, Ill. Hort. 24: 190 (1877), **Type**:—*André 4040* (holo K!)
≡ *Tillandsia cyanea* var. *tricolor* (André) L.B. Sm., Contr. U.S. Natl. Herb. 29: 491 (20 Jun 1951)
= *Tillandsia cyanea* var. *elatior* L.B. Sm., Phytologia 5: 181 (1955), **Type**:—*Fagerlind & Wibom 1947* (holo S!)

Bromeliaceae tribe Vrieseeae W. Till & Barfuss, Amer. J. Bot. 92: 348 (2005), **Type**:—*Vriesea* Lindl.
≡ Bromeliaceae [unranked, as '*Sippe*'] Vrieseae Beer, Fam. Bromel.: 9, 19 (Sep–Oct 1856, '1857'), **Type**:—*Vriesea* Lindl.

Diagnostic characters:—***Petals*** usually bearing or rarely without basal appendages; ***pollen*** sulcate, exine reticulate, with a sulcus of complex subtypes, mainly of the insulae type (subtype d), occasionally of the *Alcantarea* type (subtype f), sometimes of the diffuse type (subtype c), or rarely nearly inaperturate; ***ovary*** usually about 1/8–1/3, rarely up to 1/2 inferior; ***stigma*** mainly of the convolute-blade II type and cupulate type, occasionally of the conduplicate-patent type, tubo-laciniate type, simple-erect type, conduplicate-spiral type, conduplicate-erect or urceolate type. ***Fruit*** a septicidal capsule; ***seeds*** with appendages of the Core Tillandsioideae type, with a plumose flight apparatus formed at the basal end by a multifilamentous outgrowth of the outer integument, extending off the basal end, with the innermost cell layer of the outer integument remaining fixed proximally and distally fused to an exostoma with the central and outer cell layers of the outer integument, the latter two layers splitting into cell rows and spreading at maturity, forming a parachute-like architecture, ± straight plume at the apical end, usually short and undivided, occasionally long and somewhat divided, or lacking.

Note:—Eleven genera. Beer (Sep–Oct 1856, '1857') uses the German word '*Sippe*', which represent an incorrect rank-denoting term and this name is therefore treated as being unranked [Art. 37.3].

Bromeliaceae subtribe Cipuropsidinae Barfuss & W. Till, *subtr*. *nov*.
Diagnosis:—*A subtribu typica ovulis obtusis vel subobtusis (rariter appendiculatis) et stigmatibus simplicibus-erectis, conduplicato-spiralibus, urceolatis vel cupulatis differt*.
Type:—*Cipuropsis* Ule

Description:—***Plants*** epiphytic or terrestrial, rarely epilithic herbs, usually acaulescent, rarely caulescent, forming impounding or rarely non-impounding rosettes, vegetatively propagating by subterminal axillary renewal shoots. ***Inflorescence*** usually compound, once or twice branched, occasionally simple; ***floral bracts*** imbricate or rarely lax and spreading; ***flowers*** usually distichously, rarely spirally arranged, sometimes turning secund at anthesis. ***Petals*** free, short connate at the base, or conglutinated/connate up to 1/2 of their entire length, usually bearing or rarely without basal appendages; ***ovules*** obtuse, rarely appendiculate about as long as the ovule proper; ***stigma*** of the simple-erect type, conduplicate-spiral type, urceolate type, or cupulate type.

Note:—Eight genera. Unclassified species (so far investigated) within Cipuropsidinae are:

Mesomorphic northern Andean '*Vriesea*' species: e.g., ***Vriesea dubia*** (L.B. Sm.) L.B. Sm. (= *V. alborubrobracteata* Rauh), ***V. elata*** (Baker) L.B. Sm., ***V. rubra*** (Ruiz & Pav.) Beer, ***V. zamorensis*** (L.B. Sm.) L.B. Sm.; ***Tillandsia amicorum*** I. Ramírez & Bevil., ***T. schimperiana*** Wittm. (= *Vriesea rubrobracteata* Rauh).

Cipuropsis Ule, Verh. Bot. Vereins Prov. Brandenburg 48: 148 (1907, '1906'), **Type**:—*Cipuropsis subandina* Ule [≡ *Vriesea subandina* (Ule) L.B. Sm. & Pittendr.]

Diagnostic characters:—***Plants*** epiphytic or terrestrial herbs, acaulescent, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate. ***Inflorescence*** usually compound, once or twice branched, rarely simple; ***floral bracts*** carinate, 1.5–2.5(–3) cm long; ***flowers*** distichously arranged. ***Sepals*** symmetric, 1.5–2.5(–2.7) cm long;

petals yellow or white, 2.3–3 cm long, about 1/4 of their entire length conglutinated/connate into a tube, forming a tubular, actinomorphic corolla with erect, slightly spreading or recurved blades, bearing linear and entire basal appendages highly adnate to the conglutinated/connate portion of the petals; ***stamens*** shorter than the petals, included within the corolla; ***filaments*** partially agglutinated/adnate to the conglutinated/connate portion of the petals; ***anthers*** not versatile, united into a tube surrounding the stigma; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c) or complex insulae type (subtype d); ***ovules*** obtuse; ***style*** included within the corolla; ***stigma*** of the simple-erect type.

Distribution:—Northern Andes extending to Venezuela, Trinidad, and the Guianas.

Note:—Hitherto monotypic, but probably eight species. Since *Cipuropsis subandina* could not be included phylogenetically, the correct placement within subtribe Cipuropsidinae and the circumscription of the genus *Cipuropsis* remain uncertain. However, most probably the mesomorphic northern Andean '*Vriesea*' species, *V. altomayoensis* H. Luther & K.F. Norton, *V. dubia* (L.B. Sm.) L.B. Sm., *V. duidae* (L.B. Sm.) Gouda, *V. elata* (Baker) L.B. Sm., *V. rubra* (Ruiz & Pav.) Beer, and *V. zamorensis* (L.B. Sm.) L.B. Sm., and *Tillandsia amicorum* I. Ramírez & Bevil. belong here. Further investigations are needed to determine if *Mezobromelia* should be included.

Goudaea W. Till & Barfuss, *gen. nov.*

Diagnosis:—*A genere* Vriesea *Lindl. stigmate simplico-erecto, ovulis obtusis et petalis cucullatis differt.*

Type:—*Vriesea chrysostachys* E. Morren [≡ *Goudaea chrysostachys* (E. Morren) W. Till & Barfuss]

Description:—***Plants*** epiphytic or terrestrial herbs, usually medium sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate, appearing glabrous. ***Inflorescence*** simple or compound, once branched; ***floral bracts*** imbricate, ecarinate, concealing the sepals completely; ***flowers*** distichously arranged. ***Sepals*** symmetric; ***petals*** yellow or whitish, short connate at the base, blades erect, tips cucullate, forming a tubular, hardly opened, actinomorphic corolla, bearing spathulate basal appendages, the appendage tips undivided and obtuse or incised and acute; ***stamens*** shorter than the petals, included within the corolla; ***filaments*** short adnate to the connate portion of the petals; ***anthers*** subbasifixed; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c); ***ovules*** obtuse; ***style*** included within the corolla; ***stigma*** of the simple-erect type, papillose.

Distribution:—Colombia to central Peru.

Etymology:—Named in honor of Eric John Gouda (1957−) from Utrecht, The Netherlands, long-term researcher in Bromeliaceae.

Note:—Two species and two varieties.

Goudaea chrysostachys (E. Morren) W. Till & Barfuss, *comb. nov.*

Basionym:—*Vriesea chrysostachys* E. Morren, Belgique Hort. 31: 87 (1881), **Type**:—*Davis s.n. in Veitch Hortus s.n.* (holo ?LG)

≡ *Tillandsia chrysostachys* (E. Morren) Baker, Bot. Mag. 112: pl. 6906 (1886)

= *Tillandsia trinitensis* Baker, Handb. Bromel.: 211 (17 Aug–15 Oct 1889), **Type**:—*Fendler 820* (holo K!)

Goudaea chrysostachys* var. *stenophylla (L.B. Sm.) W. Till & Barfuss, *comb. nov.*

Basionym:—*Vriesea chrysostachys* var. *stenophylla* L.B. Sm., Bot. Mus. Leafl. 17: 71 (1955), **Type**:—*Schultes & Cabrera 14097* (holo US!; iso COL!, GH, K!, NY!); *Schultes & Cabrera 14596* (para COL, GH, US); *Schultes & Cabrera 14936* (para COL, GH, US)

Goudaea ospinae (H. Luther) W. Till & Barfuss, *comb. nov.*

Basionym:—*Vriesea ospinae* H. Luther, J. Bromeliad Soc. 33(1): 23, fig. (1983), **Type**:—*Kent s.n in Luther s.n.* (holo SEL!); *Luther 320* (para SEL); *Merkers s.n.* (para US); *Wurthmann s.n. in Luther s.n.* (para SEL)

Goudaea ospinae* var. *gruberi (H. Luther) W. Till & Barfuss, *comb. nov.*

Basionym:—*Vriesea ospinae* var. *gruberi* H. Luther, J. Bromeliad Soc. 42(3): 118, fig. 11 (1992), **Type**:—*Gruber s.n.* (holo SEL!; iso HUA)

Jagrantia Barfuss & W. Till, *gen. nov.*

Diagnosis:—*A genere* Vriesea *Lindl. bracteis florigeris deciduis, sepalis triplo longioribus, lateraliter percompressis et acutis carinatis differt.*

Type:—*Tillandsia monstrum* Mez [≡ *Jagrantia monstrum* (Mez) Barfuss & W. Till, *Vriesea monstrum* (Mez) L.B. Sm.]

Description:—***Plants*** epiphytic herbs, medium sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate. ***Inflorescence*** simple; ***floral bracts*** imbricate, 3 times the length of the sepals, laterally strongly compressed and sharply carinate, deciduous along a basal transversal line after anthesis when dry; ***flowers*** distichously arranged. ***Sepals*** symmetric; ***petals*** dull greenish-red, free, forming a tubular, unilaterally bent, zygomorphic corolla, bearing or without basal appendages; ***filaments*** free; ***pollen*** unknown; ***ovules*** obtuse; ***stigma*** of the conduplicate-spiral type.

Etymology:—Named in honor of Jason Randall Grant (1969−), curator of the Herbarium of the University of Neuchâtel, Switzerland, and long term taxonomic researcher in Bromeliaceae, especially in subfam. Tillandsioideae.

Distribution:—From Costa Rica to Colombia.

Note:—A monotypic genus. The unique deciduous floral bracts separate this genus from all remaining tillandsioids.

Jagrantia monstrum (Mez) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia monstrum* Mez, Repert. Spec. Nov. Regni Veg. 16: 78 (1919), **Type**:—*Kalbreyer 1393* (holo B!)
≡ *Vriesea monstrum* (Mez) L.B. Sm., Phytologia 16: 81 (1968)

Josemania W. Till & Barfuss, *gen. nov.*

Diagnosis:—*A genere* Tillandsia *L. petalis base unitis minus quam tertium partem eius longitudinis, floribus distiche et laxe dispositis, et vaginis foliorum statu sicco plerumque griseo-argenteis differt.*

Type:—*Tillandsia asplundii* L.B. Sm. [≡ *Josemania asplundii* (L.B. Sm.) W. Till & Barfuss]

Description:—***Plants*** epiphytic or rarely terrestrial herbs, small to medium sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf sheaths*** very dark, usually becoming silvery-grey when dry, rarely castaneous; ***leaf blades*** lingulate. ***Inflorescence*** compound, once or twice branched; ***floral bracts*** shorter than the sepals; ***flowers*** laxly to sub-densly distichously arranged. ***Sepals*** symmetric; ***petals*** yellow or rarely white, short connate at the base, forming a tubular corolla with slightly divergent blades, without basal appendages; ***stamens*** shorter than the petals, included within the corolla; ***filaments*** short adnate to the connate portion of the petals, antepetalous slightly longer; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** obtuse; ***style*** included within the corolla; ***stigma*** of the simple-erect type.

Distribution:—Costa Rica, Panama, Colombia, Ecuador and Peru.

Etymology:—Named in honor of José Manuel Manzanares Vilaplana (1957−) from Quito, Ecuador, leading authority of Ecuadorian Bromeliaceae.

Note:—Five species and one variety.

Josemania asplundii (L.B. Sm.) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia asplundii* L.B. Sm., Phytologia 6: 441, pl. 2, figs. 18, 19 (1959), **Type**:—*Asplund 19279* (holo S!; iso S!, US!)

Josemania delicatula (L.B. Sm.) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia delicatula* L.B. Sm., Phytologia 5: 36, pl. 3, figs. 1–3 (1954), **Type**:—*Cuatrecasas 15647* (holo VALLE, iso COL!, US!)

Josemania pinnata (Mez & Sodiro) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia pinnata* Mez & Sodiro, Bull. Herb. Boissier, ser. 2. 4: 1130 (1904), **Type**:—*Sodiro 171/35* (holo B!)

Josemania singularis (Mez & Wercklé) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia singularis* Mez & Wercklé, Bull. Herb. Boissier ser. 2. 5(2): 103 (31 Jan 1905), **Type**:—*Wercklé Bromel. Costar. 76* (holo B!)

Josemania truncata (L.B. Sm.) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia truncata* L.B. Sm., Contr. U.S. Natl. Herb. 29: 530, fig. 85 (1954), **Type**:—*Foster 2642* (holo US!)

Josemania truncata* var. *major (H. Luther) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia truncata* var. *major* H. Luther, Selbyana 5: 314, pl. 4 (1981), **Type**:—*Madison & Besse 7447* (holo SEL!).

Lutheria Barfuss & W. Till, *gen. nov.*

Diagnosis:—*A genere* Vriesea *Lindl. stigmate conduplicato-spirale et ovulis obtusis differt.*

Type:—*Tillandsia splendens* Brongn. [≡ *Lutheria splendens* (Brongn.) Barfuss & W. Till, *Vriesea splendens* (Brongn.) Lem.]

= *Vriesea* sect. *Speciosae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 124 (1930), **Type**:—*Vriesea speciosa* Hook. [= *Lutheria splendens* (Brongn.) Barfuss & W. Till]

Description:—***Plants*** epiphytic or terrestrial herbs, medium to large sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate, cross-banded or uniformly colored, appearing glabrous. ***Inflorescence*** simple or compound, once branched; ***floral bracts*** imbricate, concealing the sepals completely; ***flowers*** distichously arranged, often secund, appearing at one side of the inflorecence. ***Sepals*** symmetric; ***petals*** red, deep pink or yellow, free, forming a tubular, unilaterally bent, slightly zygomorphic corolla, blades erect and tips slightly divergent, or the two abaxial ones recurved, bearing linear subobtuse basal appendages; ***stamens*** longer than the petals, exserted from the corolla; ***filaments*** free; ***anthers*** subbasifixed; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c); ***ovules*** obtuse; ***style*** equalling or slightly longer than the stamens, exserted from the corolla; ***stigma*** of the conduplicate-spiral type, papillose. ***Seeds*** with a short cylindrical endostome (type c or d); ***embryo*** without a distinct radicule (type a).

Distribution:—Northeastern South America.

Etymology:—Named in honor of Harry Edward Luther (1952−2012) from Sarasota, Florida, one of the most experienced bromeliophiles in the world.

Note:—Four species and four varieties. Seed endostome and embryo types follow Groß (1988).

Lutheria bi-beatricis (Morillo) Barfuss & W. Till, *comb. nov.*

Basionym:—*Vriesea bi-beatricis* Morillo, Ernstia 39: 2, fig. 1 (1986), **Type**:—*Garófalo 476* (holo VEN)

Lutheria glutinosa (Lindl.) Barfuss & W. Till, *comb. nov.*

Basionym:—*Vriesea glutinosa* Lindl., Gard. Chron. 1856(23): 388 (7 Jun 1856), **Type**:—*Wortley Hortus s.n.* (holo CGE)

= *Tillandsia stenostachya* Baker, J. Bot. 26: 109 (1888), **Type**:—*Crueger s.n.* (holo K!)

≡ '*Tillandsia glutinosa*' *auct. non* Mart. ex Schult. & Schult. f. (1830): Griseb., Fl. Brit. W. I.: 597 (Oct 1864)

≡ *Vriesea stenostachya* (Baker) Mez in C. DC., Monogr. phan. 9: 564 (Jan 1896)

Lutheria soderstromii (L.B. Sm.) Barfuss & W. Till, *comb. nov.*

Basionym:—*Vriesea soderstromii* L.B. Sm., Bromeliad Soc. Bull. 13: 52, fig. (1963), **Type**:—*Cowan & Soderstrom 1862* (holo US!; iso NY!, P!)

Lutheria splendens (Brongn.) Barfuss & W. Till, *comb. nov.*

Basionym:—*Tillandsia splendens* Brongn., Ann. Fl. Pomone, ser. 2. 3: 311, pl. (1845), **Lectotype** (designated by Smith & Downs, 1977: 1217):—*Leprieur s.n. in Paris Hortus s.n.* (lecto P; isolecto K!); *Mélinon s.n. in Paris Hortus s.n.* (syn P)

≡ *Vriesea splendens* (Brongn.) Lem., Fl. Serres Jard. Eur. 6 (Misc.): 162, fig. (1850)

= *Vriesea speciosa* Hook., Bot. Mag. 74: pl. 4382 (1848), **Type**:—*Kew Hortus s.n.* (holo ?K)

Lutheria splendens* var. *chlorostachya (Oliva-Esteve) Barfuss & W. Till, *comb. nov.*

Basionym:—*Vriesea splendens* var. *chlorostachya* Oliva-Esteve, J. Bromeliad Soc. 56(5): 199, fig. 1 (Dec 2006), **Type**:—*Oliva-Esteve 304* (holo VEN)

= *Vriesea splendens* var. *chlorostychya* Oliva-Esteve, J. Bromeliad Soc. 51(4): 184, figs. 23, 24 (2001), *nom. inval.* [Art. 40.1]

Lutheria splendens* var. *formosa (Suringar ex Witte) Barfuss W. & Till, *comb. nov.*

Basionym:—*Vriesea splendens* var. *formosa* Suringar ex Witte, Sempervirens 18: 361 (1889), **Type**:—not indicated

= *Tillandsia longibracteata* Baker, J. Bot. 26: 81 (1888), **Type**:—*Fendler 2449* (holo K; iso GOET)

≡ *Vriesea longibracteata* (Baker) Mez in C. DC., Monogr. phan. 9: 568 (Jan 1896)

≡ *Vriesea splendens* var. *longibracteata* (Baker) L.B. Sm., Smisthsonian Misc. Collect. 126: 36 (1955)

= *Tillandsia appuniana* Baker, Handb. Bromel.: 213 (17 Aug–15 Oct 1889), **Type**:—*Appun s.n.* (holo BM)

Lutheria splendens* var. *oinochroma (Steyerm.) Barfuss & W. Till, *comb. nov.*

Basionym:—*Vriesea splendens* var. *oinochroma* Steyerm., Bromeliad Soc. Bull. 17: 53 (1967), **Type**:—*Steyermark 95320* (holo VEN; iso US!)

Lutheria splendens* var. *striatifolia (M.B. Foster) Barfuss & W. Till, *comb. nov.*

Basionym:—*Vriesea splendens* var. *striatifolia* M.B. Foster, Bromeliad Soc. Bull. 5: 92, fig. (1955), **Type**:—*Foster 2808* (holo US)

Mezobromelia L.B. Sm., Proc. Amer. Acad. Arts 70: 151 (1935), **Type**:—*Mezobromelia bicolor* L.B. Sm.

Diagnostic characters:—***Plants*** epiphytic or terrestrial herbs, medium to large sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate. ***Inflorescence*** compound, once to rarly twice branched, with branches composed of dense flower fascicles; ***flowers*** spirally, rarely distichously arranged. ***Sepals*** symmetric; ***petals*** white or yellow, about 1/3–1/2 of their entire length conglutinated/connate into a tube, blades erect, tips slightly divergent, bearing linear and entire basal appendages highly adnate to the conglutinated/connate portion of the petals; ***stamens*** shorter than the petals, included within the corolla; ***filaments*** partially agglutinated/adnate to the conglutinated/connate portion of the petals; ***anthers*** not versatile, united into a tube surrounding the stigma; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex diffuse type (subtype c), sometimes nearly inaperturate; ***ovules*** obtuse; ***style*** included within the corolla; ***stigma*** of the simple-erect type.

Distribution:—Northern Andes extending to the Antilles, the Guianas, and Bolivia.

Note:—Probably six species: *Mezobromelia bicolor*, *M. capituligera*, *M. pleiosticha* and *Tillandsia schimperiana* Wittm.; the inclusion of *M. hospitalis* and *M. magdalenae* is tentative. Both mesomorphic northern Andean *Vriesea* and *Mezobromelia* do currently not form monophyletic lineages. Without the inclusion of *Cipuropsis subandina* currently *Cipuropsis* cannot be expanded as its phylogenetic position will either corroborate *Mezobromelia* or sink it into synonymy of *Cipuropsis*.

Werauhia J.R. Grant, Trop. Subtrop. Pflanzenwelt 91: 28 (1995), **Type**:—*Tillandsia gladioliflora* H. Wendl. [≡ *Vriesea gladioliflora* (H. Wendl.) Antoine, *Werauhia gladioliflora* (H. Wendl.) J. R. Grant]

≡ *Tillandsia* sect. *Xiphion* (*Gladioliflorae*) E. Morren, Belgique Hort. 24: 291, 292 (Jul–Sep 1874), **Type** (designated by Baker, 17 Aug–15 Oct 1889: 214):—*Tillandsia gladioliflora* H. Wendl.

≡ *Vriesea* sect. *Xiphion* (*Gladioliflorae*) (E. Morren) E. Morren, Belgique Hort. 28: 257 (1878)

≡ *Vriesea* [unranked, as '*Gruppe*'] *Xiphion* (E. Morren) Wawra, Oesterr. Bot. Z. 30: 221 (1880)

= *Thecophyllum* [unranked] *Biflorae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 127 (1930), **Type** (**designated here**):—*Guzmania ororiensis* Mez [≡ *Thecophyllum ororiense* (Mez) Mez, *Werauhia ororiensis* (Mez) J. R. Grant]

= *Werauhia* sect. *Jutleya* J.R. Grant, Trop. Subtrop. Pflanzenwelt 91: 28, 39 (1995), **Type**:—*Thecophyllum pedicellatum* Mez & Wercklé [≡ *Werauhia pedicellata* (Mez & Wercklé) J. R. Grant]

Diagnostic characters:—***Plants*** epiphytic or terrestrial herbs, usually acaulescent, rarely caulescent, forming impounding or rarely non-impounding rosettes. ***Leaves*** mesomorphic; ***leaf sheaths*** often silvery grey when dry; ***leaf blades*** ligulate to linear-triangular. ***Inflorescence*** simple or compound, once or rarely twice branched, usually with reduced spikes; ***flowers*** distichously arranged, often secund. ***Sepals*** symmetric; ***petals*** free, forming a tubular or campanulate corolla, sometimes zygomorphic with a cup-shaped base and one petal blade spreading, the other two forming a hood over the stamens, usually bearing coarsely dentate basal appendages, rarely without basal appendages; ***stamens*** shorter than to about equalling the petals, included within or exserted from the corolla, radially arranged or sometimes asymmetrically arranged at the adaxial side in zygomorphic corollas; ***filaments*** free; ***anthers*** usually free, rarely united into a tube surrounding the stigma; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** obtuse; ***style*** included within or exserted from the corolla; ***stigma*** of the cupulate type. ***Seeds*** without or only with a minute appendage at the apical end.

Distribution:—Central America and Antilles extending to Ecuador and Bolivia.

Note:—More than 90 species. Wawra (1880) uses the German word '*Gruppe*', which represent an incorrect rank-denoting term and this name is therefore treated as being unranked [Art. 37.3]. *Tillandsia* sect. *Xiphion* (*Gladioliflorae*) (Morren Jul–Sep 1874) is typified either by the name-bringing epithet (*T. gladioliflora*) of its alternative name *Gladioliflorae* [Art. 22.6] or by the type designation of Baker (17 Aug–15 Oct 1889: 214). An automatic typification [Art. 22.6] with '*Vriesea xiphion* Platzm. *mss*' (cited in synonymy of *T. jonghei* K. Koch

sensu E. Morren) is not applicable as this name was never validly published and therefore cannot have a type. The statement of Grant (1995a: 26) that *V. jonghei* (K. Koch) E. Morren is the type of *T.* sect. *Xiphion* is incorrect. An attempt by Grant (1996) to conserve *T.* sect. *Xiphion* with the new type *T. jonghei* against *T.* sect. *Synandra* (Koch 1874) was not approved by the Committee for Spermatophyta (Brummitt 1999). *Vriesea ochracea* Rauh & E. Gross [≡ *Werauhia ochracea* (Rauh & E. Gross) J.R. Grant] is excluded from *Werauhia* and transferred back into *Vriesea* s.str.

Zizkaea W. Till & Barfuss, *gen. nov.*

Diagnosis:—*A genere* Vriesea *Lindl. stigmate urceolato et seminibus pseudopappo perbreve differt*.

Type:—*Tillandsia tuerckheimii* Mez [≡ *Vriesea tuerckheimii* (Mez) L.B. Sm., *Zizkaea tuerckheimii* (Mez) W. Till & Barfuss]

Description:—***Plants*** terrestrial or epilithic herbs, acaulescent, large sized, forming impounding rosettes. ***Leaves*** mesomorphic; ***leaf blades*** lingulate, glabrous on the upper surface. ***Inflorescence*** compound, once branched; ***floral bracts*** shorter than the sepals; ***flowers*** laxly distichously arranged, secund, spreading, nocturnal. ***Sepals*** symmetric; ***petals*** free, forming a campanulate corolla, bearing acute basal appendages; ***stamens*** shorter than the petals, exserted from the corolla, with 3 of them disposed in each lateral sides of the corolla; ***filaments*** of the first (antesepalous) series free and of the second (antepetalous) series short agglutinated/adnate to the petal bases; ***anthers*** subbasifixed; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** appendiculate about as long as the ovule proper; ***stigma*** of the urceolate type. ***Seeds*** with an undivided appendage at the apical end, appendage at the basal end about as long as the seed proper.

Distribution:—Greater Antilles.

Etymology:—Named in honor of Georg Zizka (1955−), professor of Botany at the Goethe-Universität Frankfurt/Main, Germany, who has much contributed to the understanding of the phylogeny of Bromeliaceae, especially in Bromelioideae.

Note:—Hitherto monotypic. Probably three to four additional species of the Greater Antilles.

Zizkaea tuerckheimii (Mez) W. Till & Barfuss, *comb. nov.*

Basionym:—*Tillandsia tuerckheimii* Mez in Urb., Symb. Antill. 7: 174 (1912), **Type**:—*Türckheim 3715* (holo B!)

≡ *Vriesea tuerckheimii* (Mez) L.B. Sm., Contr. Gray Herb. 117: 33 (1937) emend. L.B. Sm., Phytologia 20(3): 181 (1970)

Bromeliaceae subtribe Vrieseinae W. Till & Barfuss, *subtr. nov.*

Diagnosis:—*Ovula distincte appendiculata, stigmata laminis-convolutis, conduplicato-patentibus vel rariter conduplicato-erectis, vel tubo-laciniatis*.

Type:—*Vriesea* Lindl.

Description:—***Plants*** usually epiphytic or epilithic, rarely terrestrial herbs, usually acaulescent, rarely caulescent, usually forming impounding, rarely non-impounding rosettes, usually vegetatively propagating by basal axillary renewal shoots or rarely monocarpic. ***Inflorescence*** usually compound, once or rarely twice branched, occasionally simple; ***flowers*** usually distichously, rarely spirally arranged, sometimes turning secund at anthesis. ***Petals*** free or short connate at the base, forming a tubular or campanulate corolla, occasionally stongly recurved or spiraliscent, usually bearing or rarely without basal appendages; ***ovules*** usually distinctly appendiculate shorter than or about as long as the ovule proper, occasionally longer, rarely obtuse; ***stigma*** of the convolute-blade II type, occasionally of the tubo-laciniate type, conduplicate-patent type or conduplicate-erect type.

Note:—Three genera.

Alcantarea (E. Morren ex Mez) Harms, Notizbl. Bot. Gart. Berlin-Dahlem 10: 802 (30 Dec 1929)

Basionym:—*Vriesea* subg. *Alcantarea* E. Morren ex Mez in Mart., Fl. bras. 3(3): 516 (1 Feb 1894), **Type** (designated by Grant & Zijlstra, 1998: 93):—*Tillandsia regina* Vell. [≡ *Alcantarea regina* (Vell.) Harms, *Vriesea regina* (Vell.) Beer]

≡ *Vriesea* [unranked, as '*Gruppe*'] *Reginae* Wawra, Itin. Princ. S. Coburgi 1: 158, 170 (May–Jun 1883), **Type**:—*Tillandsia regina* Vell.

≡ *Vriesea* sect. *Reginae* (Wawra) Wittm. in Engl. & Prantl, Nat. Pflanzenfam. II.4: 58 (1888)

= *Tillandsia* sect. *Macrocyathus* K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 1, 6 (1874), **Type** (**designated here**):—*Vriesea glaziouana* Lem. [= '*Tillandsia gigantea*' *auct. non* Mart. ex Schult. & Schult. f.: K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 6 (1874)]

Diagnostic characters:—***Plants*** usually epilithic, rarely terrestrial (or accidentally epiphytic) herbs, mostly large sized, forming impounding, rarely non-impounding rosettes, vegetatively propagating by short basal axillary shoots and/or by means of numerous filiform-leaved adventitious offsets produced at the old elongated portion of the stem not covered by leaves and monocarpic, occasionally never forming any shoots or offset; rarely pseudoviviparous. ***Leaves*** usually mesomorphic or rarely semi-xeromorphic. ***Inflorescence*** occasionally simple or compound, once branched; ***flowers*** large, laxly to densely distichously arranged and spreading. ***Sepals*** free, coriaceous, obtuse, symmetric; ***petals*** white, cream, pale to bright yellow, rarely pale wine-castaneous or dark wine, free, linear or nearly so, 6–14 cm long, 10–15 times longer than wide, ephemeral, flaccidescent soon after anthesis, forming a tublar corolla with stongly recurved or coiled blades, bearing well-developed basal appendages adnate to the petals for 2/3–4/5 of their length, usually equalling 3/4 of the sepal length upto exceeding it, with the appendage tips rarely exserted from the corolla; ***stamens*** about equalling the petals, long exserted from the corolla; ***filaments*** free or of the first (antesepalous) series free and of the second (antepetalous) series short agglutinated/adnate to the petal bases; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex *Alcantarea* type (subtype f); ***ovary*** 1/3–1/2 inferior; ***ovules*** distinctly appendiculate longer than the ovule proper; ***style*** long exserted from the corolla; ***stigma*** white, usually of the conduplicate-patent, rarely of the conduplicate-erect type. ***Seeds*** with a long appendage at the apical end and a short appendage at the basal end.

Distribution:—Endemic to southeastern Brazil.

Note:—More than 40 species. Wawra (May–Jun 1883) uses the German word '*Gruppe*', which represent an incorrect rank-denoting term and this name is therefore treated as being unranked [Art. 37.3]. *Alcantarea* was elevated to generic rank by Harms (30 Dez 1929, 1930), but was not followed by subsequent monographers (Mez 1935, Smith & Downs 1977). Grant (1995a) resurrected the genus, which was followed by most recent taxonomists (e.g., Versieux & Wanderley 2015).

Stigmatodon Leme, G.K. Br. & Barfuss *gen. nov*.

Diagnosis:—*A genere* Vriesea *Lindl. plantis semper rupestribus in praecipitatibus saxosis nudis; foliis semixeromorphicis vel xeromorphicis, laminis foliorum frequenter anguste triangularo-acuminatis et manifeste lepidotis, coriaceis vel fere, marginibus truncatis; floribus semper nocturnis, odoratis, per anthesin unilateralibus; stigmatis tubo-laciniatis differt.*

Type:—*Vriesea harrylutheri* Leme & G.K. Br. [≡ *Stigmatodon harrylutheri* (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss]

Description:—***Plants*** epilithic herbs in vertical, bare granitic surfaces, usually forming inconspicuously impounding or rarely non-impounding rosettes, vegetatively propagating by short basal axillary shoots, or sometimes regular-leaved adventitious offsets produced at the old portion of the stem not covered by leaves and monocarpic, occasionally never forming any shoots or offsets. ***Leaves*** semi-xeromorphic to xeromorphic, densely lepidote; ***leaf blades*** often narrowly triangular-acuminate, coriaceous or subcoriaceous, margins often truncate. ***Inflorescence*** simple and racemose, or compound, once branched and paniculate; ***floral bracts*** coriaceous or subcoriaceous, greenish, pale purplish-castaneous or stramineous at anthesis, sometimes strongly sulcate-rugose even before anthesis; ***flowers*** nocturnal, fragrant, distichously arranged, distinctly secund at anthesis. ***Sepals*** symmetric, ecarinate, thickly coriaceous near the base; ***petals*** whitish, pale greenish or pale yellowish, free, obovate or obovate-spathulate, rounded or obtuse and emarginate, forming a campanulate corolla, bearing well developed, long dentate to slenderly acuminate basal appendages; ***stamens*** shorter than the petals, included within or exserted from the corolla, usually with 3 of them disposed in each lateral sides of the corolla, sometimes radially arranged; ***filaments*** free; ***anthers*** dorsifixed near the base; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** appendiculate shorter than or about as long as the ovule proper; ***style*** longer than the ovary, included within or exserted from the corolla; ***stigma*** of the tubo-laciniate type, without papillae or rarely sparsely papillate. ***Seeds*** with an appendage at the basal end distinctly longer than the seed proper and a short appendage at the apical end.

Distribution:—Endemic to southeastern Brazil.

Etymology:—The name of this new genus comes from the Greek words stigmatis plus odon, the latter meaning tooth, in reference to the irregularly denticulate to laciniate ('toothed') stigma lobe margins.

Note:—18 species.

Stigmatodon amadoi (Leme) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea amadoi* Leme, Selbyana 16: 111, fig. 3 (1995), **Type**:—*Nahoum & Amado s.n.* (holo HB!)

Stigmatodon apparicianus (E. Pereira & Reitz) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea appariciana* E. Pereira & Reitz, Bradea 1: 441, pl. IV, B (1974), **Type**:—*Duarte s.n.* (holo HB!)

Stigmatodon belloi (Leme) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea belloi* Leme, Bradea 5: 172, pl. 6. (1989), **Type**:—*Leme 1138 et al.* (holo HB!; iso RB!)

Stigmatodon bifidus (Leme & L. Kollmann) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea bifida* Leme & L. Kollmann, Phytotaxa 177(2): 89, figs. 18, 20a–e (2014), **Type**:—*Leme et al. 7368* (holo RB!)

Stigmatodon brassicoides (Baker) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Tillandsia brassicoides* Baker, J. Bot. 26: 12 (1888), **Type**:—*Burchell 1393* (holo K!)
≡ *Vriesea brassicoides* (Baker) Mez in C. DC., Monogr. phan. 9: 598 (Jan 1896)

Stigmatodon costae (B.R. Silva & Leme) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea costae* B.R. Silva & Leme, J. Bromeliad Soc. 51: 151 (2001), **Type**:—*Silva 115*, *Leme 4926 & Garcia* (holo HB!)

Stigmatodon croceanus (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea croceana* Leme & G.K. Br., Vidalia 2(1): 8, figs. 1i–l, 4 (2004), **Type**:—*Gastin s.n.* (holo HB!)

Stigmatodon euclidianus (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea euclidiana* Leme & G.K. Br., Rodriguésia 61: 57, figs. 11i–m, 12c–d (2010), **Type**:—*Colnago s.n.* (holo HB!; iso RB!)

Stigmatodon fontellanus (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea fontellana* Leme & G.K. Br., Vidalia 2(1): 6, figs. 1e–h, 3 (2004), **Type**:—*Leme 692 et al.* (holo HB!)

Stigmatodon funebris (L.B. Sm.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea funebris* L.B. Sm., Arq. Bot. Estado São Paulo n. ser. 1: 117, pl. 122 (1943), **Type**:—*Foster & Foster 896* (holo GH; iso US!)

Stigmatodon gastinianus (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea gastiniana* Leme & G.K. Br., Vidalia 2(1): 9, figs. 1m–o, 5 (2004), **Type**:—*Croce & Gastin s.n.* (holo HB!)

Stigmatodon goniorachis (Baker) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Tillandsia goniorachis* Baker, J. Bot. 25: 303 (1887), **Lectotype** (designated by Smith, 1951: 516):—*Glaziou 15471* (lecto K!; isolecto C, G!, GH!, LE, P!); *Glaziou 16462* (syn K!, P)
≡ *Vriesea goniorachis* (Baker) Mez in Mart., Fl. bras. 3(3): 545 (1 Feb 1894)

Stigmatodon harrylutheri (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea harrylutheri* Leme & G.K. Br., Vidalia 2(1): 4, figs. 1a–d, 2 (2004), **Type**:—*Oliveira s.n.* (holo HB!)

Stigmatodon magnibracteatus (Leme & K. Kollmann) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea magnibracteata* Leme & L. Kollmann, Phytotaxa 177: 94, figs. 20f–i, 21, 22 (2014), **Type**:—*Leme et al. 7357* (holo RB!)

Stigmatodon multifoliatus (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea multifoliata* Leme & G.K. Br., Rodriguésia 61: 59, figs. 14a–g, 15a–b (2010), **Type**:—*Oliveira s.n.* (holo RB!)

Stigmatodon plurifolius (Leme) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea plurifolia* Leme, Bradea 4: 314, fig. 5 (1987), **Type**:—*Araujo s.n.* (holo HB!)

Stigmatodon rosulatulus (Leme) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea rosulatula* Leme, J. Bromeliad Soc. 62: 10, figs. 1–5 (2012), **Type**:—*Vasconcelos & Santos s.n.* (holo RB!)

Stigmatodon sanctateresensis (Leme & K. Kollmann) Leme, G.K. Br. & Barfuss, *comb. nov.*
Basionym:—*Vriesea sanctateresensis* Leme & L. Kollmann, Rodriguésia 61: 61, figs. 14h–n, 15c–d (2010), **Type**:—*Kollmann & Bausen 4350* (holo HB!)

Vriesea Lindl., Edwards's Bot. Reg. 29: sub pl. 10 (7 Feb 1843), as '*Vriesia*', *nom. cons. vs. Hexalepis* Raf., Fl. tellur. 4: 24 (1838) *et vs. Vriesea* Hassk., Flora 25 (Beibl.): 27 (1842: Scrophulariaceae), **Type**:—*Tillandsia psittacina* Hook. [≡ *Hexalepis psittacina* (Hook.) Raf., *Vriesea psittacina* (Hook.) Lindl.]
≡ *Hexalepis* Raf., Fl. tellur. 4: 24 (1838), *nom. rej. vs. Vriesea* Lindl., **Type**:—*Tillandsia psittacina* Hook.
≡ *Tillandsia* sect. *Vriesea* (Lindl.) Griseb., Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ., Nr. 1: 17 (13 Jan 1864)
≡ *Vriesea* [unranked, as '*Gruppe*'] *Psittacinae* Wawra, Itin. princ. S. Coburgi 1: 158, 170 (May–Jun 1883), *nom. inval.* [Art. 22.2]
≡ *Vriesea* sect. *Psittacinae* (Wawra) Wittm. in Engl. & Prantl, Nat. Pflanzenfam. II.4: 57 (1888), *nom. inval.* [Art. 22.2]
≡ *Tillandsia* subg. *Vriesea* (Lindl.) Baker in G. Nicholson, Ill. Dict. Gard., div. 7, 4: 42 (May 1887)
≡ *Vriesea* subg. *Euvriesea* Mez in Mart., Fl. bras. 3(3): 513 (1 Feb 1894), *nom. inval.* [Art. 21.3, 22.2]
≡ *Vriesea* sect. *Genuinae* Mez in Mart., Fl. bras. 3(3): 513 (1 Feb 1894), *nom. inval.* [Art. 22.2]
≡ *Neovriesea* Britton ex Britton & P. Wilson, Sci. Surv. Porto Rico & Virgin Islands (Bot. Porto Rico) 5(1): 141 (10 Aug 1923), *nom. nov. pro Vriesea* Lindl. (7 Feb 1843), *nom. illeg.* [Art. 52.1], **Type**:—*Tillandsia psittacina* Hook.
= *Tillandsia* sect. *Synandra* K. Koch, Index Seminum Hort. Bot. Berol. 1873, App. 4: 1, 5 (1874), **Type**:—*Vriesea corallina* Regel [≡ *Tillandsia corallina* (Regel) K. Koch, = *Vriesea platynema* Gaudich.]
= *Vriesea* sect. *Platzmanniae* E. Morren, Belgique Hort. 25: 349 (1875), **Type**:—*Vriesea platzmannii* E. Morren
= *Vriesea* sect. *Macrostachyae* Wawra, Itin. princ. S. Coburgi 1: 158, 170 (May–Jun 1883), *nom. inval.* [Art. 22.2]
≡ *Vriesea* [unranked] *Macrostachyae* Wittm. in Engl. & Prantl, Nat. Pflanzenfam. II.4: 57 (1888), *nom. inval.* [Art. 22.2]
= *Vriesea* sect. *Brachystachyae* Wawra, Itin. princ. S. Coburgi 1: 158, 170 (May–Jun 1883), **Type**:—*Vriesea carinata* Wawra
≡ *Vriesea* [unranked] *Brachystachyae* (Wawra) Wittm. in Engl. & Prantl, Nat. Pflanzenfam. II.4: 58 (1888)
≡ *Vriesea* sect. *Carinatae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 124 (1930), *nom. illeg.* [Art. 52.1], **Type**:—*Vriesea carinata* Wawra
= *Vriesea* sect. *Barilletianae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 124 (1930), **Type**:—*Vriesea barilletii* E. Morren
= *Vriesea* sect. *Pardalinae* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 124 (1930), **Type**:—*Vriesea pardalina* Mez
= *Vriesea* sect. *Scalares* Harms in Engl., Nat. Pflanzenfam. ed. 2, 15a: 124 (1930), **Type**:—*Vriesea scalaris* E. Morren

Diagnostic characters:—***Plants*** mostly epiphytic, occasionally terrestrial or rarely epilithic herbs, usually forming strongly to inconspicuously impounding, rarely non-impounding rosettes, vegetatively propagating by short basal axillary shoots or long stoloniferous. ***Leaves*** mesomorphic or rarely semi-xeromorphic; ***leaf blades*** lingulate to occasionally narrowly triangular. ***Inflorescence*** simple or compound, usually once branched, occasionally twice branched; ***floral bracts*** lax to imbricate; ***flowers*** usually distichously, rarely spirally arranged. ***Sepals*** symmetric, usually free; ***petals*** yellow (often with green tips), cream, brownish (-red) or rarely white, short connate at the base or rarely free, forming a tubular or campanulate corolla, nearly always bearing appendages; ***stamens*** shorter to longer than the petals, included within or exserted from the corolla, usually radially arranged, rarely asymmetrically grouped on one side at the abaxial side of the corolla; ***filaments*** straight, short adnate to the connate portion of the petals or rarely free; ***pollen*** sulcate, exine reticulate, with a sulcus of the complex insulae type (subtype d); ***ovules*** usually appendiculate shorter than or about as long as the ovule proper, rarely longer or obtuse; ***style*** longer than the ovary, included within or exserted from the corolla; ***stigma*** of the convolute-blade II type. ***Seeds*** with a distinct appendage at the apical end.

Distribution:—Eastern Brazil extending to northwestern Argentina, southeastern Bolivia, ?Peru (*Vriesea oxapampae* Rauh, *Vriesea ochracea* Rauh & E. Groß), Venezuela and the Greater Antilles.

Note:—More than 210 species. Wawra (1880, May–Jun 1883) uses the German word '*Gruppe*', which represent an incorrect rank-denoting term and these names are therefore treated as being unranked [Art. 37.3]. Harms (in Engler 1930: 124–125) also published several names of new sections in a treatment of Bromeliaceae in which he recognized sections (indicated by the sign '§' that is used for sections in the whole publication) within

Vriesea sect. *Vriesea* (as '*Vriesea* Sekt. 1. *Genuinae*'), which do not represent misplaced rank-denoting terms [Art. 37.7 Note 1] and therefore are validly published. *Vriesea* sect. *Xiphion* (Morren 1878) cannot be used under *Vriesea* since *V. jonghei* is not its type. This section, with *Tillandsia gladioliflora* as the correct type, is necessarily a homotypic synonym of *Werauhia* (see the note under *Werauhia*). In addition, *Tillandsia* sect. *Synandra* (Koch 1874) would have priority over *Vriesea* sect. *Xiphion* (see Grant 1996, Brummitt 1999) and would be the correct name for a section of *Vriesea* that encompasses its type *V. corallina* (= *V. platynema*) and possibly *V. jonghei*.

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APPENDIX 1. Taxa used for molecular data and their details (taxon authorities, DNA number, source, field collection, specimen voucher, origin, and GenBank accession numbers). The sign '≡' indicates a clone or material of the same plant (identical genotype), whereas the sign '=' indicates another plant (different genotype) of the same collection or population. Previously used DNA extracts are indicated. Source: WU = Core Facility Botanical Garden of the University of Vienna (HBV); B = Botanischer Garten und Botanisches Museum Berlin (BGBM); GOET = Botanischer Garten der Universität Gottingen; HEID = Botanischer Garten der Universität Heidelberg; MTJB = Montreal Botanical Garden/Jardin botanique de Montréal; SEL = Marie Selby Botanical Gardens (MSBG); M = Botanischer Garten München-Nymphenburg; FRP = Palmengarten der Stadt Frankfurt am Main; LI = Botanischer Garten und Naturkundliche Station der Stadt Linz; HBG = Biozentrum Klein Flottbek und Botanischer Garten; BOCH = Botanischer Garten der Ruhr-Universität Bochum; U = Utrecht University Botanic Gardens; LIM = Botanical Garden Liberec; AVBUN (Belvedere) = Bundesgärten Wien und Innsbruck (Belvedere). Abbreviations: n.d. = no data, s.n. = sine numero (without number).

Taxon and authority	**DNA № (isolate)**	**Source (bio_material): field coll. or living cult.: №**	**Field coll. (collected_by): Collector(s) №**	**Specimen voucher: Herbarium: №**	**Country: Admin. division**	***PHYC***	***rpoB-trnC-petN***	***trnK-matK-trnK***	***ycf1***
Outgroup									
Bromeliaceae subfam. Brocchinioideae Givnish									
Brocchinia micrantha (Baker) Mez	B150	WU: HBV 20269 (B 12/6) ≡ B: BGBM 246-46-88-23 ≡ HEID: 130575 (R:69323) ≡ GOET: 04758 (B 1866) ≡ GOET: 03414 (B 883)	W. Rauh 69323	HEID: 602934–602935	Venezuela: Estdo. Bolívar	KX753984	KX754327	KX754117	KX753774
Bromeliaceae subfam. Bromelioideae Harms									
Aechmea nudicaulis (L.) Griseb.	B118 [2] ≡ MB-118 [1]	field coll.	M.H.J. Barfuss 020221-43 *et al.* ≡ W. Till 18094 *et al.*	WU: 11130–11131	Dominican Republic: Prov. La Altagracia	KX753971	KX754314	AY614024 [1]	KX753761
Bromelia karatas L.	B119 ≡ MB-119 [1]	field coll.	M.H.J. Barfuss 020221-44 *et al.* ≡ W. Till 18095 *et al.*	WU: 11187–11188	Dominican Republic: Prov. La Altagracia	KX753972	KX754315	AY614023 [1]	KX753762
Bromeliaceae subfam. Lindmanioideae Givnish									
Lindmania guianensis (Beer) Mez	B112 [2] ≡ MB-112 [1]	field coll. = WU: HBV B 00B13-1/2	W. Till 16018a *et al.*	WU: 9314–9315	Venezuela: Estdo. Bolívar	KX753970	KX754313	AY614019 [1]	KX753760

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Bromeliaceae subfam. Navioideae Harms									
Navia saxicola L.B. Sm.	B182 [2]	field coll.	T.J. Givnish s.n.	WIS: *Givnish s.n.* (photo)	Venezuela: Estdo. Amazonas	KX753989	KX754332	KX754122	KX753779
Bromeliaceae subfam. Picairnioideae Harms									
Pitcairnia punicea Scheidw.	B77 ≡ MB-77 [1]	WU: HBV 321 (B 234/80)	n.d. (old holdings)	WU: 2481–2482	n.d.	KX753948	KX754291	AY614021 [1]	KX753738
Bromeliaceae subfam. Puyoideae Givnish									
Puya laxa L.B. Sm.	B78 ≡ MB-78 [1]	WU: HBV B 229/95 ≡ Sasse: n.d.	K. Sasse s.n.	WU: 8802, 8948, 9245–9247, 12735–12736, 15103	Bolivia: Depto. Santa Cruz	KX753949	KX754292	AY614022 [1]	KX753739
Ingroup									
Bromeliaceae subfam. Tillandsioideae Harms									
Bromeliaceae tr. Catopsideae Harms									
***Catopsis* Griseb.**									
Catopsis morreniana Mez	B106 [2] ≡ MB-106 [1]	WU: HBV 216 (B 176/80)	n.d. (old holdings)	WU: 4386, 4387–4388	n.d.	KX753967	KX754310	AY614025 [1]	KX753757
Catopsis nitida (Hook.) Griseb.	B463	HEID: 131346 (R:70955)	W. Rauh 70955	HEID: 601930, 602974	Honduras: Depto. Choluteca	KX754033	KX754376	KX754166	KX753823
Catopsis nutans (Sw.) Griseb.	B2 [4] ≡ MB-2 [1]	WU: HBV 23734 (B 5/95)	E. Trauner s.n.	WU: 7683, 9236	Costa Rica: Prov. San Jose	KX753892	KX754235	KX754101 (AY614026 [1])	KX753682
Catopsis paniculata E. Morren	B507	HEID: 103270 (R:44313)	W. Rauh 44313	HEID: 601931	Honduras: Depto. Choluteca	KX754038	KX754381	KX754171	KX753828

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Bromeliaceae tr. Glomeropitcairnieae Harms									
***Glomeropitcairnia* (Mez) Mez**									
Glomeropitcairnia erectiflora Mez	B30 [2] ≡ MB-30 [1]	WU: HBV 23998 (B 206/96)	F.-J. Hase s.n.	WU: 8343, 11768	Venezuela: Estdo. Sucre	KX753910	KX754253	AY614029 [1]	KX753700
Glomeropitcairnia penduliflora (Griseb.) Mez	B13 ≡ MB-13 [1]	WU: HBV 23999 (B 89/96)	W. & S. Till 12012	WU: 15907 (photo)	Dominica: St. Joseph Parish	KX753899	KX754242	KX754103 (AY614030 [1])	KX753689
Bromeliaceae tr. Tillandsieae Rchb.									
***Barfussia* Manzan. & W. Till**									
Barfussia laxissima (Mez) Manzan. & W. Till	B294 ≡ B757 ≡ RBG Kew DNA Bank 36449	WU: HBV 24714 (B 98B165-1) ≡ Tropiflora: 1395 ≡ WU: HBV 23797 (B 98B184-1/2) = WU: HBV 24713 (B 287/95)	D. Cathcart s.n.	WU: 12462–12463, 15488 = WU: 11334–11335 (HBV B 287/95)	Bolivia: Depto. Santa Cruz	KX754009	KX754352	KX754142	KX753799
Barfussia platyrhachis (Mez) Manzan. & W. Till	B753 ≡ RBG Kew DNA Bank 36434–36436	AVBUN (Belvedere): n.d.	n.d. (hort.)	WU: 7626, 8269–8270	n.d.	KX754062	KX754405	KX754195	KX753852
Barfussia wagneriana (L.B. Sm.) Manzan. & W. Till	B58 [4] ≡ MB-58 [1]	WU: HBV 24864 (B 222/93)	n.d. (hort.)	WU: 8518–8519, 10078	Peru: Depto. San Martín	KX753932	KX754275	AY614067 [1]	KX753722
Barfussia wagneriana (L.B. Sm.) Manzan. & W. Till	B217 [4]	Hromadnik: HR324 (948) = Prinsler: n.d. (seedlings) = Ehlers: n.d. = GOET: 02018 (B 762)	J. Rutschmann s.n. (seeds)	WU: 4237, 12784	Peru: Depto. San Martín	KX753996	KX754339	KX754129 (KU848343 [4])	KX753786

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
***Gregbrownia* W. Till & Barfuss**									
Gregbrownia fulgens (L.B. Sm.) W. Till & Barfuss	B195	Manzanares: JM7703	J.M. & R. Manzanares 7703 & B. Patterson	QCNE: *Manzanares 7703*	Ecuador: Prov. Loja	KX753990	KX754333	KX754123	KX753780
Gregbrownia hutchisonii (L.B. Sm.) W. Till & Barfuss	B3 [2] ≡ MB-3 [1] ≡ Horres 083 [7]	WU: HBV 24142 (B 99B76-1) ≡ HEID: 102983 (R:40104) ≡ WU: HBV 24140 (B 21/94) ≡ WU: HBV 24141 (B 97B289-1) ≡ WU: HBV B 12/107 ≡ B: BGBM 246-44-88-20 ≡ B: BGBM 219-02-00-33	W. Rauh 40104 (holotype coll. of *Mezobromelia trollii* Rauh)	HEID: 204688 (spirit), 602297–602307	Peru: Depto. Amazonas	KX753893	KX754236	KX754102 (AY614050 [1]) (GU475467 [2])	KX753683
***Guzmania* Ruiz & Pav.**									
Guzmania acorifolia (Griseb.) Mez	B52 ≡ MB-52 [1]	WU: HBV B 18/84 ≡ MTJB: n.d.	n.d.	WU: 6702	Venezuela: n.d.	KX753928	KX754271	AY614060 [1]	KX753718
Guzmania angustifolia (Baker) Wittm.	B93 ≡ MB-93 [1]	Hromadnik: HR17199a	H. & L. Hromadnik 17199a	WU: 6457	Ecuador: Prov. Pichincha	KX753959	KX754302	AY614052 [1]	KX753749
Guzmania coriostachya (Griseb.) Mez	B481	HEID: 130529 (R:37421)	W. Rauh 37421	HEID: *Rauh 37421*	Colombia: Depto. Putumayo	KX754035	KX754378	KX754168	KX753825
Guzmania graminifolia (André ex Baker) L.B. Sm.	B120 ≡ MB-120 [1]	field coll.	W. Till 19066 & J.M. Manzanares	WU: 11650–11651	Ecuador: Prov. Esmeraldas/Carchi	KX753973	KX754316	AY614057 [1]	KX753763

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Guzmania melinonis Regel	B32 ≡ MB-32 [1]	WU: HBV 355 (B 261/87)	W. Till 3041	WU: 2551, 6824	Peru: Depto. Huánuco	KX753911	KX754254	AY614051 [1]	KX753701
Guzmania monostachia (L.) Rusby ex Mez	B22 ≡ MB-22 [1]	WU: HBV B 204/91	H. & I. Seethaler s.n.	WU: 1763, 8630, 10416	Jamaica: Trelawny Parish	KX753907	KX754250	AY614054 [1]	KX753697
Guzmania mucronata (Griseb.) Mez	B858	WU: HBV 21876 ≡ Speckmaier: n.d.	M. Speckmaier s.n.	WU: 14765–14766, 14934–14935	Venezuela: Estdo. Miranda	KX754072	KX754415	KX754205	KX753862
Guzmania musaica (Linden & André) Mez	B14 ≡ MB-14 [1]	WU: HBV 24041 (B 194/96) ≡ B: BGBM 119-55-74-83	n.d. (old holdings)	WU: 7588, 9258; B: B 10 0605460 (GH 14841) http://herbarium.bgbm.org/object/B100605460	n.d.	KX753900	KX754243	AY614058 [1]	KX753690
Guzmania nicaraguensis Mez & C. F. Baker	B479	HEID: 103855 (R:44013)	W. Rauh 44013	HEID: *Rauh 44013*	Guatemala: Depto. Alta Verapaz	KX754034	KX754377	KX754167	KX753824
Guzmania polycephala Mez & Wercklé ex Mez	B651 ≡ RBG Kew DNA Bank 36443	SEL: MSBG 1992-0165	W. Berg P24 *et al.*	SEL: 92704 (92-0165); WU: 13231 (photo: SEL 92704)	Panama: Prov. Panamá	KX754054	KX754397	KX754187	KX753844
Guzmania rhonhofiana Harms	B96 [2] ≡ MB-96 [1]	WU: HBV 307 (B 224/80)	n.d. (old holdings)	WU: 7654	n.d.	KX753960	KX754303	AY614064 [1]	KX753750
Guzmania roezlii (E. Morren) Mez	B286 [2]	WU: HBV B 166/96 ≡ M: 84/39	n.d.	WU: 8207	n.d.	KX754006	KX754349	KX754139	KX753796
Guzmania wittmackii (André) André ex Mez	B12 ≡ MB-12 [1]	WU: HBV 24077 (B 163/92)	n.d. (old holdings)	WU: 6595, 10422	n.d.	KX753898	KX754241	AY614056 [1]	KX753688

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
***Lemeltonia* Barfuss & W. Till**									
Lemeltonia dodsonii (L.B. Sm.) Barfuss & W. Till	B16 [2, 4] ≡ MB-16 [1]	WU: HBV 24641 (B 14/94) ≡ FRP: 90-10627-0 (1990-1151-4-00) ≡ Hromadnik: HR834 ?≡ HEID: R:34143	W. Rauh 34183 ?= W. Rauh 34143	WU: 678, 7096; FRP: 2881, 2895; ZSS: 19199 ?= HEID: 202533 (spirit), 600710 (*Rauh 34143*)	Ecuador: Prov. Santo Domingo de los Tsáchilas	KX753901	KX754244	AY614072 [1]	KX753691
Lemeltonia dodsonii (L.B. Sm.) Barfuss & W. Till	B127 [2, 4]	WU: HBV 24642 (B 493/96) ≡ SEL: MSBG 1973-0004-033 ≡ Hromadnik: HR833	C.H. Dodson 5225 (holotype coll.)	WU: 12673–12674; US: 2710466–2710467 (01101046, 00089175); SEL: 8700 (73-0004-033); QCA: 434	Ecuador: Prov. Pichincha	KX753975	KX754318	KX754108 (KU848344 [4])	KX753765
Lemeltonia narthecioides (C. Presl) Barfuss & W. Till	B60 [4] ≡ MB-60 [1]	WU: HBV 654 (B 8/90, err. B 18/90) ≡ LI: n.d.	n.d.	WU: 1396, 3054, 7707–7709, 7112	Ecuador: n.d.	KX753934	KX754277	AY614071 [1]	KX753724
Lemeltonia triglochinoides (C. Presl) Barfuss & W. Till	B725 [4] ≡ RBG Kew DNA Bank 36441	HEID: 131737 (R:34378) ≡ WU: HBV n.d.	W. Rauh 34378	HEID: 202399 (spirit)	Ecuador: Prov. Manabi	KX754057	KX754400	KX754190 (KU848345 [4])	KX753847
***Pseudalcantarea* (Mez) Pinzón & Barfuss**									
Pseudalcantarea grandis (Schltdl.) Pinzón & Barfuss	B125	WU: HBV 24680 (B 98B190-1)	E. Zecher s.n.	WU: 15912 (photo)	Mexico: Estdo. Oaxaca	KX753974	KX754317	KX754107	KX753764
Pseudalcantarea macropetala (Wawra) Pinzón & Barfuss	B742 [4]	WU: HBV 25575 (B 12/17-1) ≡ Lautner: 05/17(a) = WU: HBV 25220 (B 12/17-2) = Ehlers: EM051104	J. & U. Lautner 05/17(a), R. Ehlers & M. Kretz = R. Ehlers EM051104, M. Kretz, J. & U. Lautner	WU: 12475 = SEL: *Ehlers EM051104*; MEXU: *Ehlers EM051104*	Mexico: Estdo. Oaxaca	KX754059	KX754402	KX754192	KX753849

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Pseudalcantarea viridiflora (Beer) Pinzón & Barfuss	B6 [2, 4] ≡ MB-6 [1]	WU: HBV 24862 (B 87/80)	n.d. (old holdings)	WU: 7586	n.d.	KX753896	KX754239	AY614066 [1]	KX753686
***Racinaea* M.A. Spencer & L.B. Sm.**									
Racinaea cuspidata (L.B. Sm.) M.A. Spencer & L.B. Sm.	B1034	Höpfel: n.d.	F. Höpfel s.n. (type locality)	WU: 14924, 15483	Peru: Depto. Amazonas	KX754077	KX754420	KX754210	KX753867
Racinaea dyeriana (André) Barfuss & W. Till	B151	Barfuss: s.n.	n.d. (hort.)	WU: 12448	Ecuador: n.d.	KX753985	KX754328	KX754118	KX753775
Racinaea elegans (L.B. Sm.) M.A. Spencer & L.B. Sm.	B51 ≡ MB-51 [1]	Hase: n.d. ≡ Höpfel: n.d.	R. Wülfinghoff s.n.	WU: 9228	Ecuador: Prov. Loja/Zamora Chinchipe	KX753927	KX754270	AY614084 [1]	KX753717
Racinaea fraseri (Baker) M.A. Spencer & L.B. Sm.	B547	field coll.	M.H.J. Barfuss 060205-14a *et al.* ≡ W. Till 21049 *et al.*	WU: 12873–12874; QCNE: *Till 21049*	Ecuador: Prov. Imbabura	KX754043	KX754386	KX754176	KX753833
Racinaea hamaleana (E. Morren) Barfuss & W. Till	B251	Hromadnik: HR4037	H. & L. Hromadnik 4037	WU: 15903 (photo)	Ecuador: Prov. Loja	KX754004	KX754347	KX754137	KX753794
Racinaea multiflora (Benth.) M.A. Spencer & L.B. Sm.	B426	WU: HBV B 98B182-1 ≡ Dills: n.d.	C. Dills s.n.	WU: 8669, 13808–13809	Ecuador: n.d.	KX754031	KX754374	KX754164	KX753821
Racinaea parviflora (Ruiz & Pav.) M.A. Spencer & L.B. Sm.	B335	WU: HBV B 99B78-1 ≡ HEID: 102972 ≡ Behrmann: n.d. ≡ HBG: 85-G-615	G. Behrmann s.n.	WU: 9139, 12008	n.d.	KX754015	KX754358	KX754148	KX753805

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Racinaea ropalocarpa (André) M.A. Spencer & L.B. Sm.	B57 [2] ≡ MB-57 [1]	WU: HBV 24525 (B 256/96) ≡ LI: n.d. = Prinsler: n.d. = WU: HBV B 4/90	H. Prinsler s.n.	WU: 3462–3464, 7342	Ecuador: n.d.	KX753931	KX754274	AY614083 [1]	KX753721
Racinaea spiculosa (Griseb.) M.A. Spencer & L.B. Sm.	B99 ≡ MB-99 [1]	WU: HBV 24532 (B 00B55-1)	W. Till 16111 *et al.*	WU: 12354–12355	Venezuela: Estdo. Aragua	KX753962	KX754305	AY614082 [1]	KX753752
Racinaea venusta (Mez & Wercklé) Barfuss & W. Till	B7 [4] ≡ MB-7 [1]	WU: HBV 24855 (B 98B136-1) = Deroose Plants: T48	n.d.	WU: 8640	n.d.	KX753897	KX754240	AY614081 [1]	KX753687
***Tillandsia* L.**									
***Tillandsia* subg. *Aerobia* Mez**									
Tillandsia aff. *barfussii* W. Till	B387	WU: HBV 24916 (B 170/91)	W. & S. Till 6068	WU: 15614	Paraguay: Depto. Paraguarí	KX754023	KX754366	KX754156	KX753813
Tillandsia bermejoensis H. Hrom.	B34 [3, 4] ≡ MB-34 [1]	WU: HBV 548 (B 5/86) = Till: WT1299 = Till: WT1300 = Hromadnik: HR9207	W. Till 144, E. Haugg & H. Hromadnik = H. Hromadnik 9207, E. Haugg, W. Till	WU: 2641–2643, 15352	Bolivia: Depto. Santa Cruz	KX753913	KX754256	AY614123 [1]	KX753703
Tillandsia caulescens Brongn. ex Baker	B71 [4] ≡ MB-71 [1]	WU: HBV 20273 (BRO140827) = Till: WT1708 = Till: WT1709 ?= WU: HBV 595 (B 63/82)	E. Vitek 820812/72-1 & W. Till = W. Till 182 & E. Vitek	WU: *Vitek 820812/72-1* (photo) ?= WU: 2757 (HBV B 63/82)	Peru: Depto. Apurimac	KX753943	KX754286	AY614126 [1]	KX753733

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia cochabambae E. Gross & Rauh	B392 [3]	WU: HBV B 98B76-1 ≡ HEID: 103158 (R:40609) ≡ WU: HBV 24619 (B 97B293-1)	W. Rauh 40609 (holotype coll.)	HEID: 607598–607599	Bolivia: Depto. Cochabamba	KX754025	KX754368	KX754158	KX753815
Tillandsia didisticha (E. Morren) Baker	B38 [4] ≡ MB-38 [1]	WU: HBV B 40/93	W. & H. Till 10130	WU: 6935	Argentina: Prov. Jujuy	KX753916	KX754259	AY614127 [1]	KX753706
Tillandsia lechneri W. Till & Barfuss	B808 [3]	WU: HBV 24879 (B 09/2-1)	P. Lechner 20.451 (holotype coll.)	WU: 72992	Bolivia: Depto. Santa Cruz	KX754069	KX754412	KX754202	KX753859
Tillandsia lotteae H. Hrom. ex Rauh	B820	Hromadnik: HR5281a	H. & L. Hromadnik 5281a	WU: 14727	Bolivia: Depto. Santa Cruz	KX754070	KX754413	KX754203	KX753860
Tillandsia lotteae H. Hrom. ex Rauh	B822	Hromadnik: HR5040	H. & L. Hromadnik 5040	WU: 14714	Bolivia: Depto. Cochabamba	KX754071	KX754414	KX754204	KX753861
Tillandsia prolata (H. Luther) Gouda & Barfuss	B418	WU: HBV 24863 (B 285/95) ≡ Tropiflora: 1389 ≡ Hromadnik: HR157 (964) = Tropiflora: 3530 = SEL: MSBG 1994-0323 = WU: HBV 24869 (B 02/61-1)	D. Cathcart B-2 (holotype coll.)	WU: 8517, 13060; SEL: 75375 (94-0323); LPB: *Cathcart s.n.*	Bolivia: Depto. La Paz	KX754028	KX754371	KX754161	KX753818
Tillandsia xiphioides Ker Gawl.	B40 [4] ≡ MB-40 [1]	WU: HBV B 17/90	F. Strigl Sto275	WU: 12456	Argentina: Prov. Santiago del Estero	KX753918	KX754261	AY614125 [1]	KX753708
***Tillandsia* subg. *Anoplophytum* (Beer) Baker**									
Tillandsia bergeri Mez	B97 [4] ≡ MB-97 [1]	WU: HBV 24588 (B 191/93)	W. Papsch & G. Hold 89-060/074	WU: 15905 (photo)	Argentina: Prov. Buenos Aires	KX753961	KX754304	AY614134 [1]	KX753751

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia ixioides Griseb.	B43 [3, 4] ≡ MB-43 [1]	WU: HBV B 456/96	G. Neuhuber 96-936/3084 & H. Till	WU: 8992, 13571, 13644	Argentina: Prov. Catamarca	KX753921	KX754264	AY614129 [1]	KX753711
Tillandsia stricta Sol. ex Sims	B81 [4] ≡ MB-81 [1]	WU: HBV 340 (B 245/87) ≡ Till: WT187	E. Markus s.n.	WU: 3681, 3687, 3699, 3711–3712	Brazil: Estdo. Minas Gerais	KX753950	KX754293	KX754105 (AY614130 [1])	KX753740
Tillandsia tenuifolia L.	B26 [3, 4] ≡ MB-26 [1]	WU: HBV 23783 (B 371/87) ?≡ WU: HBV 429 (B 371/82) ≡ Till: WT1326 = Hromadnik: HR9184	W. Till 131, E. Haugg & H. Hromadnik = H. Hromadnik 9184, E. Haugg & W. Till	WU: 7479	Bolivia: Depto. Santa Cruz	KX753909	KX754252	AY614132 [1]	KX753699
***Tillandsia* subg. *Diaphoranthema* (Beer) Baker**									
Tillandsia capillaris Ruiz & Pav.	B916	Hromadnik: HR5106	H. & L. Hromadnik 5106	WU: 15618	Bolivia: Depto. Tarija	KX754073	KX754416	KX754206	KX753863
Tillandsia capillaris Ruiz & Pav.	B1592 ≡ Castello A46 [3]	field coll.	L. Castello & J.O. Chiapella 71	WU: *Castello & Chiapella 71* (photo); CORD: *Castello & Chiapella 71*	Argentina: Prov. Cordoba	KX754099 (KT935161 [3])	KX754442 (KU058824 [3])	KX754232 (KU197180 [3])	KX753889 (KU285427 [3])
Tillandsia funebris A. Cast.	B89 [3, 4] ≡ MB-89 [1]	WU: HBV B 35/94 ≡ FRP: 90-1350-2 (9611) ≡ Blass: 1611	W. Krahn K/158	WU: 13563; FRP: *Krahn K/158*	Bolivia: Depto. Cochabamba	KX753956	KX754299	AY614118 [1]	KX753746
Tillandsia kuehhasii W. Till	B396 [3]	WU: HBV 24709 (B 161/95) ≡ Ehlers: EB950601 ≡ Hromadnik: HR19009a	R. Ehlers EB950601 *et al.* ≡ L. Hromadnik 19009a *et al.*	WU: 15505 (photo)	Bolivia: Depto. Chuquisaca	KX754026 (KT935067 [3])	KX754369 (KU058730 [3])	KX754159 (KU197086 [3])	KX753816 (KU285333 [3])
Tillandsia landbeckii subsp. *andina* W. Till	B423	WU: HBV 22784 (B 424/90) ≡ Hromadnik: HR222a ≡ Till: WT1471	E. Vitek 820726/19-4 (err. 820726/10-4)	WU: 1957, 12712	Peru: Depto. Ancash	KX754029	KX754372	KX754162	KX753819

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia recurvata (L.) L.	B529 [3]	field coll.	M.H.J. Barfuss 060203-6a *et al.* ≡ W. Till 21023 *et al.*	WU: 13010; QCNE: *Till 21023*	Ecuador: Prov. Pichincha	KX754041	KX754384	KX754174	KX753831
Tillandsia usneoides (L.) L.	B83 [2, 3, 4] ≡ MB-83 [1]	WU: HBV 20267 (BRO140823)	G. Palim s.n.	WU: 15362	Venezuela: n.d.	KX753952	KX754295	AY614122 [1]	KX753742
Tillandsia virescens Ruiz & Pav.	B1591 ≡ Castello A33 [3]	field coll.	L. Castello & J.O. Chiapella 88	WU: *Castello & Chiapella 88* (photo); CORD: *Castello & Chiapella 88*	Argentina: Prov. Cordoba	KX754098 (KT935150 [3])	KX754441 (KU058813 [3])	KX754231 (KU197169 [3])	KX753888 (KU285416 [3])
Tillandsia virescens Ruiz & Pav.	B1593 ≡ Castello A37 [3]	field coll.	L. Castello & J.O. Chiapella 81	WU: *Castello & Chiapella 81* (photo); CORD: *Castello & Chiapella 81*	Argentina: Prov. Cordoba	KX754100 (KT935154 [3])	KX754443 (KU058817 [3])	KX754233 (KU197173 [3])	KX753890 (KU285420 [3])
***Tillandsia* subg. *Phytarrhiza* (Vis.) Baker**									
Tillandsia duratii Vis.	B88 [3, 4] ≡ MB-88 [1]	WU: HBV 24644 (B 140/90)	W., S. & H. Till 5072	WU: 6704	Argentina: Prov. La Rioja	KX753955	KX754298	AY614119 [1]	KX753745
Tillandsia kirschnekii Rauh & W. Till	B384 [3]	WU: HBV 23800 (B 262/91) = Hromadnik: HR431 (532) = Hromadnik: HR432	E. Zecher s.n. *et al.*	WU: 15596 = WU: 12788 (HR432) = WU: 12789 (HR431)	Peru: Depto. Apurimac	KX754022	KX754365	KX754155	KX753812
Tillandsia paleacea C. Presl	B404	WU: HBV 402 (B 33/94) ≡ FRP: Rauh 16160 ≡ HEID: R:16160	W. Rauh 16160	WU: 6244, 13835; FRP: *Rauh 16160*	Peru: n.d.	KX754027	KX754370	KX754160	KX753817
***Tillandsia* subg. *Pseudovriesea* Barfuss & W. Till**									
Tillandsia appenii (Rauh) J.R. Grant	B66 ≡ MB-66 [1]	WU: HBV B 291/96 ≡ LI: n.d. = Hromadnik: HR2162	H. & L. Hromadnik 2162 & E. Trauner	WU: 15908 (photo)	Peru: Depto. Piura	KX753939	KX754282	AY614077 [1]	KX753729

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia barthlottii Rauh	B35 [4] ≡ MB-35 [1]	WU: HBV B 265/96 ≡ LI: n.d. = Hromadnik: HR4078	H. & L. Hromadnik 4078	WU: 437, 5017, 6117	Ecuador: Prov. Loja	KX753914	KX754257	AY614076 [1]	KX753704
Tillandsia cereicola Mez	B134	WU: HBV 24966 (B 411/90)	E. Markus s.n.	WU: 4450-4451	Peru: Depto. Ancash	KX753977	KX754320	KX754110	KX753767
Tillandsia espinosae L.B. Sm.	B462	HEID: 104014 (R:24210)	W. Rauh 24210	HEID: *Rauh 24210*	Peru: Depto. Piura	KX754032	KX754375	KX754165	KX753822
Tillandsia myriantha Baker	B760	WU: HBV B 00B48-1	W. Till 16068 *et al.*	WU: 13884	Venezuela: Estdo. Lara	KX754063	KX754406	KX754196	KX753853
Tillandsia spathacea Mez & Sodiro	B565	field coll.	M.H.J. Barfuss 060209-26a *et al.* ≡ W. Till 21087 *et al.*	WU: 12826–12827; QCNE: *Till 21087*	Ecuador: Prov. Napo	KX754045	KX754388	KX754178	KX753835
Tillandsia tequendamae André	B569	field coll.	M.H.J. Barfuss 060209-29a *et al.* ≡ W. Till 21090 *et al.*	WU: 12831–12832; QCNE: *Till 21090*	Ecuador: Prov. Napo	KX754046	KX754389	KX754179	KX753836
Tillandsia* L. subg. *Tillandsia									
Tillandsia adpressiflora Mez	B597 [4]	field coll.	M.H.J. Barfuss 060213-53 *et al.* ≡ W. Till 21158 *et al.* = W. Till 20051 *et al.*	WU: 15915 (photo); QCNE: *Till 21158* = WU: 12153–12155 (*Till 20051*)	Ecuador: Prov. Napo	KX754050	KX754393	KX754183 (KU848347 [4])	KX753840
Tillandsia carlos-hankii Matuda	B62 [4] ≡ MB-62 [1]	WU: HBV 24614 (B 224/91) = Hromadnik: HR15169	L. Hromadnik 15169, D.A. Roller & E. Trauner	WU: *Hromadnik 15169* (photo)	Mexico: Estdo. Oaxaca	KX753936	KX754279	AY614089 [1]	KX753726

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia ecarinata L.B. Sm.	B237	Hromadnik: HR23031 ≡ HEID: 107545	H. & L. Hromadnik 23031	WU: 7864–7866; HEID: 603813, 603816–603817	Peru: Depto. Amazonas	KX754000	KX754343	KX754133	KX753790
Tillandsia fasciculata Sw.	B717 [4]	WU: HBV 24654 (B 113/91)	W. & S. Till 7050	WU: 7493, 9280, 13641	Costa Rica: Prov. San Jose	KX754056	KX754399	KX754189	KX753846
Tillandsia ferreyrae L.B. Sm.	B241	Hromadnik: HR2125	H. & L. Hromadnik 2125 & E. Trauner	WU: 6667	Peru: Depto. Amazonas	KX754001	KX754344	KX754134	KX753791
Tillandsia filifolia Schltdl. & Cham.	B790	Hromadnik: HR1106	H. & L. Hromadnik 1106	WU: 14107–14108	Mexico: Estdo. Chiapas	KX754066	KX754409	KX754199	KX753856
Tillandsia fuchsii W. Till	B391	WU: HBV B 223/90 ≡ Ehlers: EM891111	K.-D. & R. Ehlers EM891111	WU: 12739	Mexico: Estdo. Chiapas	KX754024	KX754367	KX754157	KX753814
Tillandsia guatemalensis L.B. Sm.	B103 [4] ≡ MB-103 [1]	Hromadnik: HR14257	H. & L. Hromadnik 14257	WU: 1041, 6187	Mexico: Estdo. Chiapas	KX753965	KX754308	AY614094 [1]	KX753755
Tillandsia guatemalensis L.B. Sm.	B104 [4] ≡ MB-104 [1]	Hromadnik: HR15127	L. Hromadnik 15127, D.A. Roller & E. Trauner	WU: *Hromadnik 15127* (photo)	Mexico: Estdo. Chiapas	KX753966	KX754309	AY614093 [1]	KX753756
Tillandsia heliconioides Kunth	B1289	WU: HBV 25571 (B 10/24-1/2/3) = B: BGBM 129-73-91-24	B. Radtke & A. Moldenhauer 69	WU: 15102, 15485; B: B 10 0605574 (GH 30364) http://herbarium.bgbm.org/object/B100605574	Guatemala: Depto. Izabal	KX754087	KX754430	KX754220	KX753877
Tillandsia hildae Rauh	B763	Hromadnik: HR2156	H. & L. Hromadnik 2156 & E. Trauner	WU: 13926–13930	Peru: Depto. Cajamarca	KX754065	KX754408	KX754198	KX753855

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia ionantha Planch.	B84 [4] ≡ MB-84 [1]	WU: HBV 25215 (B 320/82) = Hromadnik: HR1***	H. & L. Hromadnik 1***	WU: 9055	Mexico: Estdo. Puebla	KX753953	KX754296	AY614099 [1]	KX753743
Tillandsia juerg-rutschmannii Rauh	B715	WU: HBV B 512/96 = Hromadnik: HR14261 = HEID: 107529	H. & L. Hromadnik 14261	WU: 13750–13753	Mexico: Estdo. Chiapas	KX754055	KX754398	KX754188	KX753845
Tillandsia juncea (Ruiz & Pav.) Poir.	B73 [4] ≡ MB-73 [1]	WU: HBV 23816 (B 101/91)	W. & S. Till 7033	WU: 15902 (photo)	Costa Rica: Prov. Limon	KX753945	KX754288	AY614097 [1]	KX753735
Tillandsia leiboldiana Schltdl.	B323	WU: HBV 663 (B 84/91)	W. & S. Till 7043	WU: 1725, 3008	Costa Rica: Prov. Cartago	KX754012	KX754355	KX754145	KX753802
Tillandsia malzinei (E. Morren) Baker	B145 [4]	B: BGBM 109-37-74-83	n.d. (old holdings)	B: B 10 0605457–B 10 0605458 (GH 11489) http://herbarium.bgbm.org/object/B100605457, http://herbarium.bgbm.org/object/B100605458	Mexico: n.d.	KX753979	KX754322	KX754112 (KU848353 [4])	KX753769
Tillandsia malzinei (E. Morren) Baker	B492	HEID: 108286 ≡ Marx: 0316	R. Ehlers s.n. (EM040202a)	HEID: 204660 (spirit)	Mexico: Estdo. Oaxaca	KX754037	KX754380	KX754170	KX753827
Tillandsia paniculata (L.) L.	B102 [4] ≡ MB-102 [1]	field coll. = Hromadnik: HR25038	W. Till 17057 & H. Hromadnik = H. Hromadnik 25038 & W. Till	WU: 10001	Dominican Republic: Distrito Nacional	KX753964	KX754307	AY614086 [1]	KX753754
Tillandsia propagulifera Rauh	B310 ≡ JP043 [4]	WU: HBV 23792 (B 98B213-2) = Hromadnik: HR2139 = B: BGBM 290-18-00-33	H. & L. Hromadnik 2139 & E. Trauner	WU: 8797–8798, 11953–11955, 13994–13996; W: 2009-19291–2009-19292; B: B 10 0292622–B 10 0292623 (GH 45788) http://herbarium.bgbm.org/object/B100292622, http://herbarium.bgbm.org/object/B100292623	Peru: Depto. Amazonas	KX754010	KX754353	KX754143 (KU848350 [4])	KX753800

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia punctulata Schltdl. & Cham.	B61 [4] ≡ MB-61 [1]	WU: HBV B 126/95	H.-H. Deissl s.n.	WU: 6991	Costa Rica: Prov. Cartago	KX753935	KX754278	AY614087 [1]	KX753725
Tillandsia remota Wittm.	B72 [4] ≡ MB-72 [1]	WU: HBV 318 (B 231/93)	H. & I. Seethaler s.n.	WU: 6176, 11975–11976, 13298	Honduras: Depto. Copán	KX753944	KX754287	AY614095 [1]	KX753734
Tillandsia secunda Kunth	B527 ≡ JP063 [4]	field coll.	M.H.J. Barfuss 060203-5a *et al.* ≡ W. Till 21022 *et al.*	WU: 15916 (photo); QCNE: *Till 21022*	Ecuador: Prov. Imbabura	KX754039	KX754382	KX754172 (KU848348 [4])	KX753829
Tillandsia secunda Kunth	B528	field coll.	M.H.J. Barfuss 060203-5b *et al.* = W. Till 21022 *et al.*	WU: 15916 (photo); QCNE: *Till 21022*	Ecuador: Prov. Imbabura	KX754040	KX754384	KX754173	KX753830
Tillandsia setacea Sw.	B1246	Hromadnik: HR21001	J. & S. Schnopp (Hromadnik) 21001	WU: 10157	Dominican Republic: Prov. María Trinidad Sánchez	KX754081	KX754424	KX754214	KX753871
Tillandsia spiraliflora Rauh	B762 ≡ JP104 [4]	Hromadnik: HR2114	H. & L. Hromadnik 2114 & E. Trauner	WU: 13923–13924	Peru: Depto. Amazonas	KX754064	KX754407	KX754197 (KU848349 [4])	KX753854
Tillandsia utriculata L.	B807 [4]	WU: 4883 (seeds)	W. Janetzky 22	WU: 4883, 4885–4887	Jamaica: Middlesex County	KX754068	KX754411	KX754201 (KU848368 [4])	KX753858
***Tillandsia* subg. *Viridantha* (Espejo) W. Till & Barfuss**									
Tillandsia heteromorpha Mez	B224	Hromadnik: HR23151	H. & L. Hromadnik 23151	WU: 12757	Peru: Depto. Ancash	KX753998	KX754341	KX754131	KX753788

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia lepidosepala L.B. Sm.	B219 [4]	Hromadnik: HR15195	L. Hromadnik 15195, D.A. Roller & E. Trauner	WU: 12778	Mexico: Estdo. Puebla	KX753997	KX754340	KX754130	KX753787
Tillandsia plumosa Baker	B86 [4] ≡ MB-86 [1]	WU: HBV 363 (B 27/88) ≡ Ehlers: EM881905	K.-D. & R. Ehlers EM881905	WU: 3118	Mexico: Estdo. Oaxaca	KX753954	KX754297	AY614075 [1]	KX753744
Tillandsia rupicola Baker	B39 [4] ≡ MB-39 [1]	WU: HBV 24820 (B 9726-1)	W. Till 13081	WU: 15911 (photo); QCA: *Till 13081*; QCNE: *Till 13081*	Ecuador: Prov. Azuay	KX753917	KX754260	AY614073 [1]	KX753707
Tillandsia tortilis Klotzsch ex Baker	B49 [4] ≡ MB-49 [1]	WU: HBV 298 (B 218A/88) ≡ Ehlers: EM88****	K.-D. & R. Ehlers EM88****	WU: 4806	Mexico: Estdo. Oaxaca	KX753926	KX754269	AY614074 [1]	KX753716
***Tillandsia australis* complex**									
Tillandsia australis Mez	B203	Hromadnik: HR9027 = Till: WT1194 = Hromadnik: HR5226	H. Hromadnik 9027, E. Haugg & W. Till = W. Till 23, E. Haugg & H. Hromadnik = H. & L. Hromadnik 5226	WU: *Hromadnik 9027* (photo) = WU: 10600–10601 (*Hromadnik 5226*)	Bolivia: Depto. Chuquisaca	KX753993	KX754336	KX754126	KX753783
Tillandsia aff. *australis* Mez	B1293	WU: HBV 24576 (B 01B26-1) = Hromadnik: HR5316	H. & L. Hromadnik 5316	WU: 15913 (photo)	Bolivia: Depto. Santa Cruz	KX754088	KX754431	KX754221	KX753878
***Tillandsia biflora* complex**									
Tillandsia baliophylla Harms	B101 [4] ≡ MB-101 [1]	field coll. = Hromadnik: HR25014	W. Till 17025 & H. Hromadnik = H. Hromadnik 25014 & W. Till	WU: 10015–10017	Dominican Republic: Prov. La Vega	KX753963	KX754306	AY614114 [1]	KX753753

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia biflora Ruiz & Pav.	B90 [4] ≡ MB-90 [1]	WU: HBV 24591 (B 266/96) ≡ LI: n.d.	F.-G. Gruber s.n.	WU: 452, 7348, 13882, 14775	Venezuela: Estdo. Lara	KX753957	KX754300	AY614107 [1]	KX753747
Tillandsia brevilingua Mez ex Harms	B56 [4] ≡ MB-56 [1]	WU: HBV B 54/96 ≡ LI: n.d.	W. & S. Till 2097 & C. Lindner	WU: 7167, 8026	Peru: Depto. San Martin	KX753930	KX754273	AY614113 [1]	KX753720
Tillandsia complanata Benth.	B562	field coll.	M.H.J. Barfuss 060209-24a *et al.* ≡ W. Till 21085 *et al.*	WU: 12836; QCNE: *Till 21085*	Ecuador: Prov. Napo	KX754044	KX754387	KX754177	KX753834
Tillandsia demissa L.B. Sm.	B75 [4] ≡ MB-75 [1]	WU: HBV B 131/87 ≡ Ehlers: EE84309 = Hromadnik: HR777 (222) = HBG: 85-G-587 = GOET: B 717	R. Ehlers EE84309, G. Haugg & G. Noller	WU: 15910 (photo)	Ecuador: Prov. Loja	KX753947	KX754290	AY614115 [1]	KX753737
Tillandsia aff. *demissa* L.B. Sm.	B619	Manzanares: JM7827	J.M. Manzanares 7827, E.J. Gouda & H. Takizawa	WU: 13954; ECUAMZ: *Manzanares 7827*, QCNE: *Manzanares 7827*, U: *Manzanares 7827*	Ecuador: Prov. El Oro	KX754051	KX754394	KX754184	KX753841
Tillandsia aff. *demissa* L.B. Sm.	B1090	U: 2008GR01451 ≡ HEID: 130202 (R:38141)	W. Rauh 38141	L: *Rauh 38141*; HEID: 201985 (spirit), 201987 (spirit), 207307 (spirit), 603806–603807	Ecuador: Prov. Azuay	KX754078	KX754421	KX754211	KX753868
Tillandsia denudata var. *vivipara* Rauh	B750	WU: HBV B 02/73-3 ≡ HEID: 131605 (R:40030)	W. Rauh 40030 (holotype coll.)	WU: 13710–13711, 13872–13874; HEID: 201948 (spirit), 607602–607603, 607608–607610	Peru: Depto. Amazonas	KX754060	KX754403	KX754193	KX753850
Tillandsia divaricata Benth.	B68 [4] ≡ MB-68 [1]	WU: HBV 24710 (B 9712-1/2)	W. Till 13069	WU: 15914 (photo); QCA: *Till 13069*; QCNE: *Till 13069*	Ecuador: Prov. Chimborazo	KX753940	KX754283	AY614108 [1]	KX753730
Tillandsia floribunda Kunth	B351	WU: HBV 227 (B 18/88)	H. Mik s.n.	WU: 2848	Ecuador: Prov. Loja	KX754018	KX754361	KX754151	KX753808

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia heterophylla E. Morren	B47 [4] ≡ MB-47 [1]	WU: HBV 3200 (B 229/91) = Hromadnik: HR15191	L. Hromadnik 15191, D.A. Roller & E. Trauner	WU: 4686	Mexico: Estdo. Veracruz	KX753924	KX754267	KX754104 (AY614111 [1])	KX753714
Tillandsia imperialis E. Morren ex Mez	B292	WU: HBV B 02/74-1 ≡ HEID: 104740 ≡ Hromadnik: HR634 (413) ≡ BOCH: n.d. ≡ Hase: n.d. ≡ Fecher-Pinkert: n.d.	F.-J. Hase s.n.	WU: *Hase s.n.* (photo); HEID: *Hase s.n.*	Mexico: n.d.	KX754008	KX754351	KX754141	KX753798
Tillandsia kauffmannii Ehlers	B74 [4] ≡ MB-74 [1]	WU: HBV B 97/89	E. Trauner s.n.	WU: 8194, 13729	Peru: Depto. La Libertad	KX753946	KX754289	AY614103 [1]	KX753736
Tillandsia lajensis André	B546	field coll.	M.H.J. Barfuss 060205-13 *et al.* ≡ W. Till 21048 *et al.*	WU: *Till 21048* (photo); QCNE: *Till 21048*	Ecuador: Prov. Carchi	KX754042	KX754385	KX754175	KX753832
Tillandsia macbrideana L.B. Sm.	B70 [4] ≡ MB-70 [1]	WU: HBV 24730 (B 249/87) ≡ Till: WT1737 ≡ Hromadnik: HR39 (593) = Hromadnik: HR791 = M: n.d.	E. Markus s.n. *et al.*	WU: 1280, 10615	Peru: Depto. Ancash	KX753942	KX754285	AY614109 [1]	KX753732
Tillandsia maculata Ruiz & Pav.	B574	field coll.	M.H.J. Barfuss 060209-31b *et al.* = W. Till 21092 *et al.*	WU: 12847–12848; QCNE: *Till 21092*	Ecuador: Prov. Napo	KX754047	KX754390	KX754180	KX753837
Tillandsia multicaulis Steud.	B107 [4] ≡ MB-107 [1]	WU: HBV 23791 (B 237/91) = Hromadnik: HR1087	H. & L. Hromadnik 1087	WU: 10293, 11030	Mexico: Estdo. Veracruz	KX753968	KX754311	AY614112 [1]	KX753758
Tillandsia stenoura Harms	B635	Manzanares: JM8147	J.M. Manzanares 8147, E.J. Gouda & H. Takizawa	QCNE: *Manzanares 8147*; U: *Manzanares 8147*	Ecuador: Prov. Loja	KX754052	KX754395	KX754185	KX753842

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia turneri var. *orientalis* L.B. Sm.	B650	field coll.	W. Adlassnig s.n.	WU: *Adlassnig s.n.* (photo)	Venezuela: Estdo. Bolívar (?Brazil: Estdo. Roraima)	KX754053	KX754396	KX754186	KX753843
***Tillandsia disticha* complex**									
Tillandsia disticha Kunth	B48 [4] ≡ MB-48 [1]	WU: HBV B 212/90	K. Opitz s.n.	WU: *Opitz s.n.* (photo)	Ecuador: Prov. Azuay	KX753925	KX754268	AY614068 [1]	KX753715
Tillandsia disticha Kunth	B202	Hromadnik: HR17059	H. & L. Hromadnik 17059	WU: 12772	Ecuador: Prov. Azuay	KX753992	KX754335	KX754125	KX753782
Tillandsia aff. *disticha* Kunth	B233 [4]	Hromadnik: HR17063	H. & L. Hromadnik 17063	WU: 12769	Ecuador: Prov. El Oro	KX753999	KX754342	KX754132 (KU848346 [4])	KX753789
***Tillandsia gardneri* complex**									
Tillandsia brachyphylla Baker	B82 [4] ≡ MB-82 [1]	WU: HBV 3204 (B 99B16-1) ≡ WU: HBV B 205/88 = Hromadnik: HR8037 = LI: n.d.	H. Hromadnik 8037	WU: 2170, 2647, 2648, 7450, 8367, 10114	Brazil: Estdo. Rio de Janeiro	KX753951	KX754294	AY614105 [1]	KX753741
Tillandsia edithae Rauh	B425	WU: HBV 24650 (B 126A/87) ≡ Till: WT1203 = Hromadnik: HR9231	W. Till 155, E. Haugg & H. Hromadnik = H. Hromadnik 9231, E. Haugg & W. Till	WU: 12742, 15365	Bolivia: Depto. Santa Cruz	KX754030	KX754373	KX754163	KX753820
Tillandsia gardneri Lindl.	B41 [4] ≡ MB-41 [1]	WU: HBV B 37/95	W. Till 11134 *et al.*	WU: 15906 (photo)	Brazil: Estdo. Rio de Janeiro	KX753919	KX754262	AY614104 [1]	KX753709

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Tillandsia heubergeri Ehlers	B42 [4] ≡ MB-42 [1]	WU: HBV B 389/96 ≡ WU: HBV 24689 (B 97B268-1/2) ≡ Ehlers: n.d.	R. Thieken s.n. (type locality)	WU: 10294	Brazil: Estdo. Bahia	KX753920	KX754263	AY614106 [1]	KX753710
***Tillandsia pupurea* complex**									
Tillandsia aurea Mez	B250	Hromadnik: HR23152	H. & L. Hromadnik 23152	WU: 15617	Peru: Depto. Ancash	KX754003	KX754346	KX754136	KX753793
Tillandsia cacticola L.B. Sm.	B44 [4] ≡ MB-44 [1]	WU: HBV 126 (B 140/87) = WU: HBV 85 (B 126/87)	W. & S. Till 2133 & C. Lindner	WU: 508, 2664 = WU: 4642, 5791, 6956 (HBV B126/87)	Peru: Depto. Piura	KX753922	KX754265	AY614070 [1]	KX753712
Tillandsia purpurea Ruiz & Pav.	B246	Hromadnik: HR4246	H. & L. Hromadnik 4246	WU: 12777	Peru: Depto. Lima	KX754002	KX754345	KX754135	KX753792
***Tillandsia rauhii* complex**									
Tillandsia lymanii Rauh	B1098	Hromadnik: HR2183(a)	H. & L. Hromadnik 2183(a) & E. Trauner	WU: 13063	Peru: Depto. Cajamarca	KX754079	KX754422	KX754212	KX753869
Tillandsia lymanii Rauh	B1236	Hromadnik: HR2183(b)	H. & L. Hromadnik 2183(b) & E. Trauner	WU: 13063	Peru: Depto. Cajamarca	KX754080	KX754423	KX754213	KX753870
Tillandsia rauhii L.B. Sm.	B92 [4] ≡ B199 ≡ MB-92 [1]	WU: HBV 24778 (err. B 64/92) ?≡ WU: HBV B 364/82 ≡ HEID: 104552 (R:69417)	W. Rauh 69417 (type locality)	WU: 12008–12018	Peru: Depto. Cajamarca	KX753958	KX754301	AY614101 [1]	KX753748
Tillandsia teres L.B. Sm.	B201	HEID: 104861 (R:24214)	W. Rauh 24214 (type locality)	WU: 12186, 12197–12207, 12219; HEID: 202484 (spirit), 603840, 603845, 603866	Peru: Depto. Cajamarca	KX753991	KX754334	KX754124	KX753781

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
***Tillandsia spaerocephala* complex**									
Tillandsia nana Baker	B343	WU: HBV 21434 (B 379/87) ≡ Till: WT1225	W. Till 197 & E. Vitek = E. Vitek 820814/87-2 & W. Till	WU: 12716	Peru: Depto. Cuzco	KX754016	KX754359	KX754149	KX753806
Tillandsia pseudomicans Rauh	B347	WU: HBV 20268 (BRO140824) ?≡ WU: HBV 444 (B 388/82) = Till: WT1258 = Till: WT1259	E. Vitek 820812/69-1 & W. Till = W. Till 179 & E. Vitek	WU: 3179-3180 ?≡ WU: 3178 (HBV B 388/82)	Peru: Depto. Apurimac	KX754017	KX754360	KX754150	KX753807
Tillandsia sphaerocephala Baker	B366	WU: HBV 24826 (B 19/86) ≡ Till: WT1206 ≡ GOET: 04027 (B 1059)	W. Till 4, E. Haugg & H. Hromadnik	WU: 12746	Bolivia: Depto. Cochabamba	KX754020	KX754363	KX754153	KX753810
***Tillandsia* L.** (incertae sedis)									
Tillandsia albertiana F. Verv.	B33 [3, 4] ≡ MB-33 [1]	WU: HBV B 387/90 ≡ LIM: n.d.	n.d.	WU: *ex cult. LIM* (photo)	Argentina: Prov. Salta	KX753912	KX754255	AY614117 [1]	KX753702
Tillandsia albertiana F. Verv.	B212 [3]	Hromadnik: HR237 (66) ≡ Muzik: n.d.	L.G. Maly s.n.	WU: 12775	Argentina: Prov. Salta	KX753994	KX754337	KX754127	KX753784
Tillandsia esseriana Rauh & L.B. Sm.	B69 [3, 4] ≡ MB-69 [1]	WU: HBV 23847 (B 342/90) ≡ Bercht: 31 ≡ Hromadnik: HR112 (280)	L. Bercht 31, D. Metzing & J. Piltz	WU: 9747	Paraguay: Depto. Amambay	KX753941	KX754284	AY614120 [1]	KX753731
***Wallisia* (Regel) E. Morren**									
Wallisia anceps (Lodd.) Barfuss & W. Till	B741	GOET: 04613 (B 1764) ≡ B: BGBM 039-38-89-23	B. Leuenberger & I. Hagemann s.n.	B: B 10 0605459 (GH 29176) http://herbarium.bgbm.org/object/B100605459	French Guiana: Arr. Saint-Laurent-du-Maroni	KX754058	KX754401	KX754191	KX753848

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Wallisia × *duvalii* (L. Duval) Barfuss & W. Till	B23 [4] ≡ MB-23 [1]	WU: HBV 24718 (B 91/80)	n.d. (old holdings)	WU: 6697, 8045	n.d.	KX753908	KX754251	AY614080 [1]	KX753698
Wallisia lindeniana (Regel) E. Morren	B216	Hromadnik: n.d. ≡ Hase: n.d.	F.-J. Hase s.n.	WU: *Hase s.n.* (photo)	Ecuador: Prov. Loja	KX753995	KX754338	KX754128	KX753785
Bromeliaceae tr. Vrieseeae W. Till & Barfuss									
Bromeliaceae subtr. Cipuropsidinae Barfuss & W. Till									
***Cipuropsis* Ule**									
Tillandsia (‘*Cipuropsis*’) *amicorum* I. Ramírez & Bevil.	B318	WU: HBV 24565 (B 02/31-1) ≡ SEL: MSBG 2002-0098-A ≡ Rousse: n.d.	A. Rousse s.n.	WU: 13059, 13128; SEL: 89597 (02-0098)	Venezuela: Estdo. Yaracuy	KX754011	KX754354	KX754144	KX753801
Tillandsia (‘*Cipuropsis*’) aff. *amicorum* I. Ramírez & Bevil.	B1255	WU: HBV 19028 (BRO130751) = WU: HBV AB339 (seeds)	M. Speckmaier s.n. (seeds)	WU: 14936–14937	Venezuela: Estdo. Aragua	KX754084	KX754427	KX754217	KX753874
Vriesea (‘*Cipuropsis*’) *dubia* (L.B. Sm.) L.B. Sm.	B982 = B1295	U: 2011GR00937 ≡ Kent’s Bromeliad: n.d.(a) = Corn. Bak: 1	J. Kent s.n.(a)	L: *Kent s.n.*; WU: 15119–15120	Ecuador: Prov. Morona Santiago	KX754075	KX754418	KX754208	KX753865
Vriesea (‘*Cipuropsis*’) *dubia* (L.B. Sm.) L.B. Sm.	B1295 = B982	Corn. Bak: 1 ≡ Kent’s Bromeliad: n.d.(b) = U: 2011GR00937	J. Kent s.n.(b)	WU: 15119–15120; L: *Kent s.n.*	Ecuador: Prov. Morona Santiago	KX754090	KX754433	KX754223	KX753880
Vriesea (‘*Cipuropsis*’) *dubia* (L.B. Sm.) L.B. Sm.	B1298 = B981	Corn. Bak: 6 ≡ U: 2011GR00936	F.-G. Gruber s.n.	WU: 15124; L: *Gruber s.n.*	Colombia: Depto. Samtanda	KX754092	KX754435	KX754225	KX753882
Vriesea (‘*Cipuropsis*’) *elata* (Baker) L.B. Sm.	B1297	Corn. Bak: 5	P. Bak s.n.	WU: 15122–15123	Ecuador: n.d.	KX754091	KX754434	KX754224	KX753881

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Vriesea (‘*Cipuropsis*’) *rubra* (Ruiz & Pav.) Beer	B983	U: 2007GR01408 ≡ Tristram: n.d. (seeds) ≡ Kent’s Bromeliad: n.d.	J. Kent s.n.	L: *Kent s.n. in hort. Tristram s.n.*	n.d.	KX754076	KX754419	KX754209	KX753866
Vriesea (‘*Cipuropsis*’) aff. *rubra* (Ruiz & Pav.) Beer	B1259	WU: HBV 25241 (B 12/31-1) ≡ GOET: 00806 (B 588) ≡ HEID: T 32.27 (R:17729)	A. Blass s.n.	WU: 15495–15496; HEID: *Blass s.n.*; US: *Blass s.n.*	Ecuador: n.d.	KX754085	KX754428	KX754218	KX753875
Vriesea (‘*Cipuropsis*’) *zamorensis* (L.B. Sm.) L.B. Sm.	B45 ≡ MB-45 [1]	WU: HBV 25084 (B 278/95) ≡ Kiehn: n.d.	n.d.	WU: 7378, 9673, 9696–9697, 10676–10677	Ecuador: n.d.	KX753923	KX754266	AY614043 [1]	KX753713
***Goudaea* W. Till & Barfuss**									
Goudaea chrysostachys (E. Morren) Barfuss & W. Till	B1300	Corn. Bak: 14 ≡ SEL: MSBG 1977-3007	G. Bergin s.n.	WU: 15127; SEL: 32344–32345 (77-3007)	Colombia: Depto. Amazonas	KX754094	KX754437	KX754227	KX753884
Goudaea aff. *chrysostachys* (E. Morren) Barfuss & W. Till	B5 ≡ MB-5 [1]	WU: HBV 133 (B 142/92)	W. Till 3065 ?= W. Till 3035	WU: 6254, 6794, 6846, 7700, 12862; W: 2001-01700	Peru: Depto. Huánuco	KX753895	KX754238	AY614041 [1]	KX753685
Goudaea aff. *chrysostachys* (E. Morren) Barfuss & W. Till	B1301	Corn. Bak: 15 ≡ SEL: MSBG 1993-0018-A	W. Berg s.n.	WU: *Berg s.n.* (photo); SEL: 93-0018	Peru: n.d.	KX754095	KX754438	KX754228	KX753885
Goudaea ospinae (H. Luther) Barfuss & W. Till	B54 ≡ MB-54 [1]	WU: HBV 25039 (B 96/96) ≡ Papillote Tropical Gardens: n.d. ≡ Hromadnik: HR684	n.d.	WU: 8821	Colombia: Prov. Meta	KX753929	KX754272	AY614040 [1]	KX753719
Goudaea ospinae (H. Luther) Barfuss & W. Till	B1254	WU: HBV n.d. ≡ Speckmaier: s.n.	C. García E. s.n.	WU: 15734	Colombia: Prov. Meta	KX754083	KX754426	KX754216	KX753873

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Goudaea ospinae var. *gruberi* (H. Luther) Barfuss & W. Till	B1253	WU: HBV 25040 (B 97B393-1) ≡ Mania de Bromélia: n.d.	F.-G. Gruber s.n.	WU: 8381, 9601–9602, 10308–10309	Colombia: Prov. Casanare	KX754082	KX754425	KX754215	KX753872
***Jagrantia* Barfuss & W. Till**									
Jagrantia monstrum (Mez) Barfuss & W. Till	B108 ≡ MB-108 [1]	WU: HBV 25032 (B 113/96) = WU: HBV AB87 (seeds) = BSI Seed Fund: n.d. (Feb 1996)	n.d.	WU: 11037	Costa Rica: n.d.	KX753969	KX754312	KX754106 (AY614044 [1])	KX753759
***Josemania* W. Till & Barfuss**									
Josemania asplundii (L.B. Sm.) W. Till & Barfuss	B588	field coll.	M.H.J. Barfuss 060209-46 *et al.* ≡ W. Till 21108 *et al.*	WU: 12822–12825; QCNE: *Till 21108*	Ecuador: Prov. Napo	KX754049	KX754392	KX754182	KX753839
Josemania singularis (Mez & Wercklé) W. Till & Barfuss	B64 [4] ≡ MB-64 [1]	WU: HBV 24807 (B 98B7-2) ≡ Hromadnik: HR629	W. & S. Till 15023 *et al.*	WU: 8399, 8631	Costa Rica: Prov. Alajuela	KX753937	KX754280	AY614039 [1]	KX753727
***Lutheria* Barfuss & W. Till**									
Lutheria glutinosa (Lindl.) Barfuss & W. Till	B130 [2]	WU: HBV 25586 (B 444/87) (err. B 444/80) ≡ Hromadnik: HR685 = WU: HBV AB53/87 (seeds) ?= FRP: 92-10815-0 ?= FRP: 95-14211-0	n.d. (old holdings)	WU: 14737 (photo), 15345 (photo), 15486–15487	Trinidad and Tobago: n.d.	KX753976	KX754319	KX754109 (GU475471 [2])	KX753766
Lutheria splendens (Brongn.) Barfuss & W. Till	B37 ≡ MB-37 [1]	WU: HBV 25067 (B 176/96)	n.d. (hort.)	WU: 7411, 10279	n.d.	KX753915	KX754258	AY614045 [1]	KX753705

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APPENDIX 1. (Continued)

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***Mezobromelia* L.B. Sm.**									
Mezobromelia bicolor L.B. Sm.	B578	field coll.	M.H.J. Barfuss 060209-37 *et al.* ≡ W. Till 21098 *et al.*	WU: 13200; QCNE: *Till 21098*	Ecuador: Prov. Napo	KX754048	KX754391	KX754181	KX753838
Mezobromelia capituligera (Griseb.) J.R. Grant	B978	U: 2006GR00061 = WU: HBV AB534 (seeds) = B: BGBM 074-07-14-40	E.J. Gouda 05-11 & J.M. Manzanares (seeds)	L: *Gouda 05-11 & Manzanares*	Ecuador: Prov. Napo	KX754074	KX754417	KX754207	KX753864
Mezobromelia capituligera (Griseb.) J.R. Grant	B1294	WU: HBV 24138 (B 00B144-2) = WU: HBV AB234 (seeds) = GOET: B 947	T. Krömer 7256 (seeds)	WU: 15008–15011	Bolivia: Depto. Cochabamba	KX754089	KX754432	KX754222	KX753879
Mezobromelia capituligera (Griseb.) J.R. Grant	B1299	Corn. Bak: 9	P. Bak s.n.	WU: 15125–15126	Ecuador: n.d.	KX754093	KX754436	KX754226	KX753883
Mezobromelia aff. *capituligera* (Griseb.) J.R. Grant	B1303	Corn. Bak: 68 ?= field coll. (*Till 16073*) ?= field coll. (*Till 16066*) ?= WU: HBV B 00B43-1	P. Bak s.n. *et al.* ?= W. Till 16073 *et al.* ?= W. Till 16066 *et al.*	WU: 15129–15130	Venezuela: Estdo. Lara	KX754097	KX754440	KX754230	KX753887
Mezobromelia pleiosticha (Griseb.) Utley & H. Luther	B274 [2] ≡ Terry 98 [5] ≡ Crayn 75 [6]	WU: HBV 24143 (B 492/96) ≡ SEL: MSBG 1981-1986	R. Determann & R. Perry s.n.	SEL: 92013 (81-1986)	Suriname: Distr. Sipaliwini	KX754005	KX754348	KX754138	KX753795
Tillandsia (‘*Mezobromelia*’) *schimperiana* Wittm.	B334	Manzanares: JM7765	J.M. Manzanares 7765	WU: *Manzanares 7765* (photo); QCNE: *Manzanares 7765*	Ecuador: Prov. Pastaza	KX754014	KX754357	KX754147	KX753804
Tillandsia (‘*Mezobromelia*’) *schimperiana* Wittm.	B1302	Corn. Bak: 58	P. Bak s.n.	WU: 15128	Ecuador: n.d.	KX754096	KX754439	KX754229	KX753886

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Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
***Werauhia* J.R. Grant**									
Werauhia gladioliflora (H. Wendl.) J.R. Grant	B149	B: BGBM 120-56-74-63	n.d.	B: B 10 0605452–B 10 0605453 (GH 11375) http://herbarium.bgbm.org/object/B100605452, http://herbarium.bgbm.org/object/B100605453	n.d.	KX753983	KX754326	KX754116	KX753773
Werauhia insignis (Mez) W. Till, Barfuss & R. Samuel	B17 ≡ MB-17 [1]	WU: HBV 24696 (B 98B21-1)	W. & S. Till 15027 *et al.*	WU: 15909 (photo)	Costa Rica: Prov. Puntarenas	KX753902	KX754245	AY614049 [1]	KX753692
Werauhia pedicellata (Mez & Wercklé) J.R. Grant	B752 ≡ RBG Kew DNA Bank 36447	WU: HBV B 65/91	W. & S. Till 7093	WU: 9268, 9974, 13712	Costa Rica: Prov. Cartago/San José	KX754061	KX754404	KX754194	KX753851
Werauhia ringens (Griseb.) J.R. Grant	B19 ≡ MB-19 [1]	WU: HBV 25131 (B 76/96)	W. & S. Till 12025	WU: 8377	Dominica: Parish Mahaut	KX753904	KX754247	AY614047 [1]	KX753694
Werauhia tarmaensis (Rauh) J.R. Grant	B18 ≡ MB-18 [1]	WU: HBV 25584 (B 97B277-1) ≡ HEID: 103077 (R:21147a)	W. Rauh 21147a (holotype coll.)	WU: 8378; W: 2004-14707–2004-14710; 2009-19298–2009-19299; HEID: 200578 (spirit), 602725–602731	Peru: Depto. Junín	KX753903	KX754246	AY614046 [1]	KX753693
Werauhia viridiflora (Regel) J.R. Grant	B325	WU: HBV 25127 (B 98B17-1)	W. & S. Till. 15045 *et al*	WU: 8644	Costa Rica: Prov. Puntarenas	KX754013	KX754356	KX754146	KX753803

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
***Zizkaea* W. Till & Barfuss**									
Zizkaea tuerckheimii (Mez) W. Till & Barfuss	B148	B: BGBM 289-33-00-63 ≡ WU: HBV n.d.	G. Palim s.n.	B: B 10 0162215–B 10 0162217 (GH 42669) http://herbarium.bgbm.org/object/B100162215, http://herbarium.bgbm.org/object/B100162216, http://herbarium.bgbm.org/object/B100162217	Dominican Republic: n.d.	KX753982	KX754325	KX754115	KX753772
Bromeliaceae subtr. Vrieseinae W. Till & Barfuss									
***Alcantarea* (E. Morren ex Mez) Harms**									
Alcantarea duarteana (L.B. Sm.) J.R. Grant	B59 [2] ≡ MB-59 [1]	WU: HBV 23584 (B 75/95)	W. Till 11052 *et al.*	WU: 6550, 6567	Brazil: Estdo. Minas Gerais	KX753933	KX754276	AY614031 [1]	KX753723
Alcantarea farneyi (Martinelli & A.F. Costa) J.R. Grant	B170	Leme: 1910	E.M.C. Leme 1910	RB: *Leme 1910*	Brazil: Estdo. Rio de Janeiro	KX753988	KX754331	KX754121	KX753778
Alcantarea geniculata (Wawra) J.R. Grant	B153	Leme: 2061	E.M.C. Leme 2061	RB: *Leme 2061*	Brazil: Estdo. Rio de Janeiro	KX753986	KX754329	KX754119	KX753776
Alcantarea glaziouana (Lem.) Leme	B167	Leme: 3593	E.M.C. Leme 3593	RB: *Leme 3593*	Brazil: Estdo. Rio de Janeiro	KX753987	KX754330	KX754120	KX753777
Alcantarea imperialis (Carrière) Harms	B1 ≡ MB-1 [1]	WU: HBV 23590 (B 59/95)	W. Till 11112 *et al.*	WU: 15904 (photo)	Brazil: Estdo. Rio de Janeiro	KX753891	KX754234	AY614032 [1]	KX753681

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Alcantarea regina (Vell.) Harms	B136	B: BGBM 120-72-74-83	n.d. (old holdings)	B: B 10 0171454, B 10 0024707–B 10 0024709 (GH 39235) http://herbarium.bgbm.org/object/B100171454, http://herbarium.bgbm.org/object/B100024707, http://herbarium.bgbm.org/object/B100024708, http://herbarium.bgbm.org/object/B100024709	Brazil: n.d.	KX753978	KX754321	KX754111	KX753768
***Stigmatodon* Leme, G.K. Br. & Barfuss**									
Stigmatodon croceanus (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss	B802	WU: HBV B 09/41-1 ≡ Ehlers: n.d. = SEL: MSBG 2001-0240 = Leme: 4316	G. Croce & J. Gastin s.n. (holotype coll.)	HB: *Leme 4316*; SEL: 01-0240	Brazil: Estdo. Rio de Janeiro	KX754067	KX754410	KX754200	KX753857
Stigmatodon harrylutheri (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss	B1282	Leme: 8026	E.M.C. Leme 8026	HB: *Leme 8026*	Brazil: Estdo. Espirito Santo	KX754086	KX754429	KX754219	KX753876
Stigmatodon plurifolius (Leme) Leme, G.K. Br. & Barfuss	B376	WU: HBV B 357/90 ≡ Leme: 906A	L. Correia de Araujo s.n. (holotype coll.)	WU: 9125; HB: 72850	Brazil: Estdo. Espirito Santo	KX754021	KX754364	KX754154	KX753811
***Vriesea* Lindl.**									
Vriesea carinata Wawra	B21 ≡ MB-21 [1]	WU: HBV 100 (B 132/80)	n.d. (old holdings)	WU: 4348, 4358	Brazil: n.d.	KX753906	KX754249	AY614033 [1]	KX753696

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APPENDIX 1. (Continued)

Taxon and authority	DNA № (isolate)	Source (bio_material): field coll. or living cult.: №	Field coll. (collected_by): Collector(s) №	Specimen voucher: Herbarium: №	Country: Admin. division	*PHYC*	*rpoB-trnC-petN*	*trnK-matK-trnK*	*ycf1*
Vriesea jonghei (K. Koch) E. Morren	B65 ≡ MB-65 [1]	WU: HBV 25021 (B 01B69-1/2/3/4) = WU: HBV AB213 (seeds) = B: Seed catalog 1996: 2275	n.d.	WU: 13692–13694; B: n.d.	Brazil: Estdo. Rio de Janeiro	KX753938	KX754281	AY614037 [1]	KX753728
Vriesea longicaulis (Baker) Mez	B290	WU: HBV 25088 (B 01B107-1) = WU: HBV 25087 (B 01B107-2) = WU: HBV AB301 (seeds)	S. Vogel. s.n.	WU: 12799–12800 = WU: 15473 (B 01B107-2)	Brazil: Estdo. Espirito Santo	KX754007	KX754350	KX754140	KX753797
Vriesea maxoniana (L.B. Sm.) L.B. Sm.	B490	HEID: 107458 = GOET: B 1219 = GOET: B 1869 = GOET: 22075 (B 2207) = WU: HBV 25232 (B 12/22-1) = B: BGBM 146-41-12-30	T. Krömer 5997	HEID: *Krömer 5997*	Bolivia: Depto. Santa Cruz	KX754036	KX754379	KX754169	KX753826
Vriesea pabstii McWill. & L.B. Sm.	B357	WU: HBV 25043 (B 12/96)	E.M.C. Leme 1133	WU: 11254–11256	Brazil: Estdo. Espirito Santo	KX754019	KX754362	KX754152	KX753809
Vriesea platynema Gaudich.	B146	B: BGBM 044-49-74-83	n.d. (old holdings)	B: B 10 0605455–B 10 0605456 (GH 11305) http://herbarium.bgbm.org/object/B100605455, http://herbarium.bgbm.org/object/B100605456	n.d.	KX753980	KX754323	KX754113	KX753770
Vriesea psittacina (Hook.) Lindl.	B20 ≡ MB-20 [1]	WU: HBV 111 (B 138/80)	n.d. (old holdings)	WU: 2839–2840, 4370	Brazil: n.d.	KX753905	KX754248	AY614034 [1]	KX753695
Vriesea saundersii (Carrière) E. Morren ex Mez	B4 ≡ MB-4 [1]	WU: HBV 137 (B 144/80)	n.d. (old holdings)	WU: 4316, 5675	Brazil: n.d.	KX753894	KX754419	AY614036 [1]	KX753684
Vriesea scalaris E. Morren	B147	B: BGBM 120-76-74-83	n.d. (old holdings)	B: B 10 0605454 (GH 12723) http://herbarium.bgbm.org/object/B100605454	Brazil: n.d.	KX753981	KX754237	KX754114	KX753771

Notes:
[1] Barfuss *et al.* (2005a), [2] Givnish *et al.* (2011, 2014), [3] Castello *et al.* (2016), [4] Pinzón *et al.* (2016), [5] Terry *et al.* (1997a, b), [6] Crayn *et al.* (2004), [7] Horres (2003)

APPENDIX 2. Taxa used for photographs and their details (taxon authorities, photographers and accession numbers).

Alcantarea *cerosa* Leme, A.P. Fontana & O.B.C. Ribeiro (*Leme 8551*), *A. extensa* (L.B. Sm.) J.R. Grant (*Leme 1942*), *A. farneyi* (Martinelli & A.F. Costa) J.R.Grant (*Leme 1910*), *A. heloisae* J.R. Grant (*Leme 8055*), *A. imperialis* Harms (*Leme 304*), *A. roberto-kautskyi* Leme (*Leme 3866*); ***Barfussia*** *laxissima* (Mez) Manzan. & W. Till (*Takizawa s.n.*), *B. platyrhachis* (Mez) Manzan. & W. Till (*Belvedere s.n.*), *B. wagneriana* (L.B. Sm.) Manzan. & W. Till (*Takizawa s.n.*); ***Catopsis*** *floribunda* (Brongn.) L.B. Sm. (*Leme 8101*), *C. hahnii* Baker (*Leme 2482*), *C. pisiformis* Rauh (*Leme 2410*); ***Gregbrownia*** *lyman-smithii* (Rauh & Barthlott) W. Till & Barfuss (*Leme 4655*); ***Goudaea*** *chrysostachys* (E. Morren) W. Till & Barfuss (*Leme 2509*); ***Guzmania*** *cylindrica* L.B. Sm. (*Leme 4586*), *G. musaica* Mez (*Leme 3538*), *G. patula* Mez & Wercklé (*Leme 4062*), *G. sanguinea* var. *comosa* H. Luther (*Leme 3253*), *G. sprucei* L.B. Sm. (*Leme 3551*), *G. kareniae* H. Luther & K. Norton (*Leme 3439*), *G. wittmackii* (André) André ex Mez (*Leme 2520*); ***Josemania*** *singularis* (Mez & Wercklé) W. Till & Barfuss (*Leme 2838*); ***Lemeltonia*** *dodsonii* (L.B. Sm.) Barfuss & W. Till (*MSBG 1981-0055*; *Leme 2523*); ***Lutheria*** *glutinosa* (Lindl.) Barfuss & W. Till (*Leme 2525*); ***Mezobromelia*** *capituligera* (Griseb.) J.R. Grant (*Leme 5111*); ***Pseudalcantarea*** *viridiflora* (Beer) Pinzón & Barfuss (*Leme 2835; Takizawa s.n.*); ***Racinaea*** *crispa* (Baker) M.A. Spencer & L.B. Sm. (*Leme 2437*), *R. hamaleana* (E. Morren) Barfuss & W. Till (*Leme 7319*), *R. pugiformis* (L.B. Sm.) M.A. Spencer & L.B. Sm. (*Leme 5180*); *R. venusta* (Mez & Wercklé) Barfuss & W. Till (*Leme 2590*); ***Stigmatodon*** *amadoi* (Leme) Leme, G.K. Br. & Barfuss (*Leme 5953*), *S. apparicianus* (E. Pereira & Reitz) Leme, G.K. Br. & Barfuss (*Leme 7379*), *S. bifidus* (Leme & K. Kollmann) Leme, G.K. Br. & Barfuss (*Leme 7368*), *S. euclidianus* (Leme & G.K. Br.) Leme, G.K. Br. & Barfuss (*Leme 5712*), *S. funebris* (L.B. Sm.) Leme, G.K. Br. & Barfuss (*Leme 7976*), *S. plurifolius* (Leme) Leme, G.K. Br. & Barfuss (*Leme 6997*), *S. rosulatulus* (Leme) Leme, G.K. Br. & Barfuss (*Leme 8621*); ***Tillandsia*** (*Tillandsia*) *fasciculata* Sw. s.l. (*Leme 4833*), *T. gardneri* Lindl. (*Leme s.n.*), *T. geminiflora* Brongn. (*Leme s.n.*), *T.* (*Phytarrhiza*) *graomogulensis* Silveira (*Leme 1489*), *T.* (*Pseudovriesea*) *incurva* Griseb. (*Leme 7299*), *T.* (*Tillandisa*) *malzinei* (E. Morren) Baker (*Leme 361*), *T.* (*Viridantha*) *tectorum* E. Morren (*Takizawa s.n.*), *T.* (*Diaphoranthema*) *usneoides* L. (L.) (*Leme 306*), *T.* (*Aerobia*) *xiphioides* Ker Gawl. (*Takizawa s.n.*); ***Vriesea*** *breviscapa* (E. Pereira & I.A. Penna) Leme (*Leme 8235*), *V. flammea* L.B. Sm. (*Leme 5471*), *V. gradata* (Baker) Mez (*Leme 5738*), *V. jonghei* (E. Morren) E. Morren (*Leme 2189*), *V. platynema* Gaudich. (*Leme 1670*), *V. pseudoatra* Leme (*Leme 3917*), *V. psittacina* (Hook.) Lindl. (*Leme 7075*); *V.*(‘***Cipuropsis***’) *elata* (Baker) L.B. Sm. (*Leme 743*); ***Wallisia*** *anceps* (Lodd.) Barfuss & W. Till (*Till et al.15046*), *Wa. lindeniana* E. Morren (*Barfuss s.n.*; *Leme 2406*); ***Werauhia*** *gladioliflora* (H. Wendl.) J.R. Grant (*Leme 3967*), *W. nephrolepis* (L.B. Sm. & Pittendr.) J.R. Grant (*Leme 3955*), *W. pedicellata* (Mez & Wercklé) J.R. Grant (*Leme 7320*), *W. subsecunda* (Wittm.) J.R. Grant (*Leme 2561*), *W. sp*. (*Leme 3987*); ***Zizkaea*** *tuerckheimii* (Mez) W. Till & Barfuss (*Till 17055 & Hromadnik 25033*, *Gouda s.n*).