Phylogeny, Biogeography and Taxonomy of the *Barbacenia* inselbergs group (Velloziaceae)

Filogenia, Biogeografia e Taxonomia do grupo *Barbacenia* dos inselbergues (Velloziaceae)

Andressa Cabral

São Paulo
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CONTENTS

RESUMO

Distribuído ao longo da costa leste da América do Sul, o Domínio da Mata Atlântica abriga uma ampla região de Inselbergues inserida na borda sudeste do Escudo Brasileiro ao longo da Serra do Mar e Serra da Mantiqueira. Dentre os elementos mais conspícuos destes inselbergues está Velloziaceae, que compreende plantas heliófitas adaptadas às condições xéricas e aos substratos específicos. Cinco gêneros, *Acanthochlamys, Barbacenia*, *Barbaceniopsis*, *Vellozia* e *Xerophyta*, e aprox. 250 espécies, distribuídas principalmente em um padrão anfiatlântico, são reconhecidas na família atualmente. *Barbacenia s.l.* (incluindo *Aylthonia*, *Barbacenia*, *Burlemarxia* e *Pleurostima*), abrange cerca de 100 espécies, exclusivamente neotropicais, que ocorrem predominantemente na Serra do Espinhaço e Planalto Central do Brasil. O gênero é sustentado pela presença de bainha dupla nos feixes vasculares foliares e pela presença de corona. Em recentes reconstruções filogenéticas, *Barbacenia* foi recuperado como dois principais clados caracterizados pela sua ocorrência ambiental e geográfica, o clado dos Inselbergues da Mata Atlântica (AFI, *Atlantic Forest Inselbergs*) e o clado dos Campos Rupestres (CR). Considerando que as análises disponíveis não incluíram todas as espécies de *Barbacenia* que ocorrem nos AFI, mais evidências e uma amostragem mais ampla são necessárias para inferir sua história evolutiva e biogeográfica. Portanto, os objetivos do presente estudo foram: (i) reconstruir as relações filogenéticas de *Barbacenia* usando uma amostragem mais ampla para o grupo *Barbacenia* AFI; (ii) estimar idades de divergência, reconstruir as áreas ancestrais e comparar a diversidade morfológica entre as linhagens do gênero; e (iii) conduzir um tratamento taxonômica do grupo *Barbacenia* AFI. A análise filogenética apresentada neste estudo recuperou as mesmas linhagens supracitadas (*Barbacenia* AFI e CR). Estase morfológica foi constatada no clado *Barbacenia* AFI, e possivelmente heterogeneidade ambiental combinada com diferentes dinâmicas paleovegetacionais durante o Plio-Pleistoceno influenciaram na disparidade morfológica entre os clados AFI e CR. Conservantismo de nicho em interação com as dinâmicas da paleovegetação durante o resfriamento global no Mioceno e oscilações climáticas no Pleistoceno, provavelmente contribuíram com a diversificação e distribuição das linhagens modernas de *Barbacenia*. Na revisão taxonômica do clado *Barbacenia* AFI, reconhecemos doze táxons e descrevemos duas novas espécies, *Barbacenia amphirupia* e *B. maritima*. Esta monografia incluiu uma lista completa de sinônimos, descrições anatômicas e morfológicas, chave de identificação, informações sobre conservação, distribuição geográfica, habitat, fenologia e comentários taxonômicos para todas as espécies. Esta dissertação destaca a importância de estudos filogenéticos, biogeográficos e taxonômicos na descoberta da diversidade oculta, evidenciando grandes lacunas amostrais sobre a biodiversidade dos Inselbergues da Floresta Atlântica e dos Campos Rupestres brasileiros, ambientes ricos em espécies e endemismos. Estes estudos são particularmente importantes para fornecer base de conhecimento para a conservação e manutenção da biodiversidade.

Palavras-chave: biogeografia, campos de altitude, conservantismo de nicho, diversidade morfológica, Floresta Atlântica, taxonomia.

ABSTRACT

Distributed along the east coast of South America, the Atlantic Forest Domain houses a widespread Inselberg region, which is inserted in the southeastern rim of the Brazilian Shield along the Serra do Mar and Serra da Mantiqueira. Among the most conspicuous elements of these inselbergs is Velloziaceae, which comprises heliophyte plants adapted to xeric conditions and to specific substrates. Five genera, *Acanthochlamys, Barbacenia, Barbaceniopsis, Vellozia* and *Xerophyta*, and approx. 250 species, distributed mostly in an amphiatlantic pattern, are nowadays recognized within the family. *Barbacenia s.l.* (including *Aylthonia, Barbacenia, Burlemarxia,* and *Pleurostima*), encompasses about 100 species, exclusively Neotropical, that occur predominantly in the Espinhaço Range and Central Plateau of Brazil. The genus is supported for double sheath in leaf vascular bundles and presence of corona. In recent phylogenetic reconstructions, *Barbacenia* was recovered as two major clades characterized by the environmental and geographical occurrence, the Atlantic Forest Inselbergs clade (AFI clade) and the Campos Rupestres (CR) clade. Whereas the available analyses did not include all *Barbacenia* species that occur in AFI, more evidence and a wider sampling are necessary to infer its evolutionary and biogeographic history. Therefore, the aims of the present study were: (i) to reconstruct the phylogenetic relationships of *Barbacenia* using a wider taxon sampling for *Barbacenia* AFI group; (ii) to estimate divergence times, reconstruct the ancestral areas and compare the morphological diversity of *Barbacenia* lineages; and (iii) to conduct a taxonomic treatment of *Barbacenia* AFI group. The phylogenetic analysis presented in this study recovered the same lineages mentioned above (Barbacenia AFI and CR). Morphological stasis was found in *Barbacenia* AFI clade, and possibly environmental heterogeneity combined with different paleovegetational dynamics during the Plio-Pleistocene influenced the morphological disparity between AFI and

CR clades. Niche conservatism in interplay with paleovegetation dynamics during the global Miocene cooling and Pleistocene climatic oscillations likely contributed to diversification and distribution of modern *Barbacenia* lineages. In taxonomic revision of *Barbacenia* AFI clade*,* we recognized twelve taxa and described two new species, *Barbacenia amphirupia* and *B. maritima*. This monograph included a complete list of synonyms, anatomical and morphological descriptions, identification key, information on the conservation, geographic distribution, habitat, phenology, and taxonomic comments of all species. This Master's thesis highlights the importance of phylogenetic, biogeographic and taxonomic studies in the discovery of hidden diversity, highlighting large sample gaps on the biodiversity of the Brazilian Atlantic Forest Inselbergs and Campos Rupestres, environments with high species richness and endemisms. These studies are particularly important to provide a knowledge base for the conservation and maintenance of biodiversity.

Key words: Atlantic Forest, biogeography, *campos de altitude*, morphological diversity, niche conservatism, taxonomy.

GENERAL INTRODUCTION

Velloziaceae is a family of monocotyledons placed in the small and morphologically diverse Pandanales, along with Cyclanthaceae, Pandanaceae, Stemonaceae and Triuridaceae (Chase *et al.,* 2000, APG IV). The family has five genera, *Barbacenia* Vand., *Vellozia* Vand., *Barbaceniopsis* L.B.Sm., *Xerophyta* Juss., and *Acanthochlamys* P.C.Kao, and approx. 250 species, distributed mostly in an amphiatlantic pattern, are currently recognized within the family (Mello-Silva *et al.,* 2011). The majority of the species is Neotropical, about 30 species occur in continental Africa, three in Madagascar, one in the Arabian Peninsula and one in China (Mello-Silva *et al.,* 2011). The distribution of Velloziaceae suggests a Gondwanan origin with vicariant splitting of main clades (Mello-Silva *et al.,* 2011). On the other hand, the chronogram suggests a long distance dispersal event through the Boreotropical connection during the Eocene and with subsequent diversification mainly in the Miocene (Alcantara *et al.,* 2018).

The family comprises heliophile plants (Smith, 1962), with its center of diversity located in the Brazilian Campos Rupestres Archipelago (Prance, 1994), a vegetation with rocky or sandy soils and open vegetation on mountain areas from Central and South-Eastern Brazil. Velloziaceae is also the most conspicuous elements of Atlantic Forest Inselbergs (de Paula *et al.,* 2016, 2017). These Inselbergs are Precambrian granites and gneisses outcrops inserted in the southeastern rim of the Brazilian Shield along the Serra do Mar and Serra da Mantiqueira (Safford and Martinelli, 2000).

From the first species of Velloziaceae described by Vandelli (1788) to the classification of Smith and Ayensu (1974, 1976) and Menezes (1980, 1981), nine genera have been recognized in Velloziaceae (Mello-Silva, 1991), with very conflicting delimitations. Thereafter, in phylogenetic analyses using morphological and DNA evidence, Mello-Silva *et* *al.* (2011) recognized five genera, *Acanthochlamys, Barbacenia s.l.* (including *Aylthonia*, *Burlemarxia*, and *Pleurostima*), *Barbaceniopsis*, *Vellozia s.l.* (including *Nanuza*), and *Xerophyta s.l.* (including *Talbotia*), related as (*Acanthochlamys* (*Xerophyta* (*Barbacenia* (*Barbaceniopsis*, *Vellozia*)))).

Barbacenia s.l. comprises about 100 species, exclusively Neotropical, that occur predominantly in the Espinhaço Range and Central Plateau of Brazil. Only one species is not endemic to Brazil, *Barbacenia celiae* Maguire, which also occurs in Venezuela (Mello-Silva in FDB 2019). The genus is supported for the presence of double sheath in leaf vascular bundles and corona (Mello-Silva, 2005b, Mello-Silva *et al.,* 2011).

In a recent phylogenetic reconstructions using a large sampling of Velloziaceae and outgroup species, *Barbacenia* was recovered as two major lineages (Alcantara *et al.*, 2018). One of the clades comprised only endemic species from Brazilian Atlantic Forest Inselbergs (granite/gneissic inselbergs and *campo de altitude* of Serra do Mar and Serra da Mantiqueira, Safford and Martinelli, 2000), viz., *Barbacenia fanniae*, *B. gounelleana*, *B. irwiniana*, *B. mantiqueirae*, *B. purpurea*, and *B. spectabilis*. Its sister clade included the other 44 analyzed species of *Barbacenia*, all from the Campos Rupestres in central/south-eastern Brazil (Vasconcelos, 2011).

Nevertheless, all endemic species to the Atlantic Forest Inselbergs displayed morphological atributes of *Pleurostima* sensu Menezes (1981), a genus re-established based on presence of basifixed and auriculate anthers, style with subapical stigmatic region, leaves with spiny trichomes on the margins and midvein, and fissuricidal capsule (Menezes, 1981). However, in phylogenetic analyses of Velloziaceae so far performed (Behnke *et al.,* 2000, 2013, Mello-Silva, 2005a, Mello-Silva *et al.,* 2011, Alcantara *et al.,* 2018), Menezes *et al.* (1994) and Salatino *et al.* (2001) excepted *Pleurostima* would be a non-monophyletic group.

The fast and recent radiation in *Barbacenia* during the Neogene is likely associated with Miocene cooling (Zachos *et al.,* 2008) and the expansion of rocky outcrops and the diversification of its flora (Alcantara *et al.,* 2018, Antonelli *et al.,* 2010, Arakaki *et al.,* 2011, Lavor *et al.,* 2019, Luebert and Wen, 2008, Perret *et al.,* 2012, Särkinen *et al.,* 2012). Besides, paleovegetation dynamics of Pleistocene and global climatic oscillations may have contributed to shaping the current diversity and distribution of *Barbacenia* lineages (Alcantara *et al.,* 2018). However, the evidence for an evolutionary and biogeographical history of the *Barbacenia* Atlantic Forest inselbergs clade is still limited.

Given this scenario, this dissertation aimed to:

1. Reconstruct the phylogenetic relationships of *Barbacenia* using a wider taxon sampling for *Barbacenia* Atlantic Forest Inselbergs group (chapter one);

2. Estimate divergence times, reconstruct ancestral areas and compare the morphological diversity of *Barbacenia* lineages (chapter one);

3. Conduct a taxonomic treatment of *Barbacenia* AFI clade (chapter two).

CHAPTER ONE: Evidence for morphological evolutionary stasis in a Middle Miocene Inselbergs clade of *Barbacenia* (Velloziaceae)

*Manuscript to be submitted for publication in the Molecular Phylogenetics and Evolution journal

ABSTRACT

Barbacenia (Velloziaceae) comprises ca. 100 species distributed in the Neotropics and corresponds to conspicuous elements of rocky environments. According to previous phylogenetic studies, *Barbacenia* was recovered as two main clades; one comprising only of endemic species from Atlantic Forest Inselbergs (AFI) and its sister clade which includes mainly Campos Rupestres (CR) species. We investigated the phylogenetic relationships within *Barbacenia* inferred from plastid (*atpB-rbcL*, *trnH-psbA* and *trnL-trnF*) and nuclear (ITS) markers, including the wider taxon sampling for AFI species. We also estimated divergence times and ancestral areas of *Barbacenia* lineages and compared their morphological diversity. Phylogenetic analysis recovered the same lineages of previous phylogenies. Morphological stasis was found in *Barbacenia* AFI clade, and morphological disparity between AFI and CR clades possibly is related to environmental heterogeneity combined with different paleovegetational dynamics during the Plio-Pleistocene. We provide evidence that niche conservatism in interplay with paleovegetation dynamics during the global Miocene cooling and Pleistocene climatic oscillations played an important role in the diversification and distribution of modern *Barbacenia* lineages.

Key words: Atlantic Forest, biogeography, *campos de altitude*, *campos rupestres*, morphological diversity, Neotropics, niche conservatism.

1. INTRODUCTION

Inselbergs ("Island mountain" in German, Bornhardt, 1900) are Precambrian granite and gneiss outcrops that occur particularly in tropical and subtropical regions, and less often in temperate zones (Porembski *et al.,* 1997). These outcrops are characterized by extreme edaphic and microclimatic conditions, leading to ecological isolation from their surroundings, and are often reported as of island-like character (Burke, 2003, Porembski *et al.,* 2000); they harbor highly specialized vegetation adapted to these harsh environmental conditions, and are a center of diversity for desiccation-tolerant vascular plants (Porembski and Barthlott, 2000).

Distributed along the east coast of South America, the Atlantic Forest Domain houses a widespread Inselberg region (hereafter AFI), which is inserted in the southeastern rim of the Brazilian Shield along the Serra do Mar and Serra da Mantiqueira (Safford and Martinelli, 2000). Geological evidence suggests that although these environments became scenario of many geological changes, their final exposure and shaping likely began after erosion processes under arid conditions of the Neogene (Varajão and Alkmim, 2015). These environmental changes are reflected in the wide variety of shapes and elevations of AFI found nowadays, such as isolated dome-shaped outcrops found mainly along the east coast (Sugar Loaf type, de Paula *et al.,* 2016, Porembski, 2007) and the flatter outcrops occurring inland generally above 1.500 m (*Campos de Altitude* or high altitude outcrops and grasslands, Vasconcelos, 2011). Atlantic Forest Inselbergs display high levels of plant species richness and elevated rates of endemism (Porembski *et al.,* 1998, Porembski, 2007, Safford and Martinelli, 2000), comprising one of the hotspots for global Inselberg plant diversity (Porembski, 2007).

Among the most conspicuous elements of AFI is Velloziaceae, which comprises heliophyte plants (Smith, 1962) adapted to xeric conditions and to specific substrates, being a particularly rich family in Inselbergs (Porembski, 2007, Behnke *et al.,* 2013). Five genera, *Barbacenia* Vand., *Vellozia* Vand., *Barbaceniopsis* L.B.Sm., *Xerophyta* Juss., and *Acanthochlamys* P.C.Kao, and approx. 250 species, distributed mostly in an amphiatlantic pattern, are nowadays recognized within the family, most of which are Neotropical. About 30 species occur in continental Africa, four in Madagascar, one in the Arabian Peninsula and one in China (Mello-Silva *et al.,* 2011). In AFI, the family is represented by 12 species of *Barbacenia* (Figure 1) and 6 of *Vellozia* (Mello-Silva in FDB 2019, de Paula *et al*. ined.).

Previous phylogenetic reconstructions (Alcantara *et al.,* 2018) resulted in the relationships (*Acanthochlamys* (*Barbacenia* (*Xerophyta* (*Barbaceniopsis*, *Vellozia*))), showing the same clades and genera as in Mello-Siva *et al.* (2011). In *Barbacenia*, the basal cladogenesis presents a surprising geographical division of the genus. One of the clades comprises only endemic species from AFI, viz., *Barbacenia fannieae*, *B. gounelleana*, *B. irwiniana*, *B. mantiqueirae*, *B. purpurea*, and *B. spectabilis*, while its sister clade includes the remaining species of *Barbacenia*, all from Campos Rupestres (CR) in central/south-eastern Brazil.

Based on evidence of time-calibrated phylogenies, it is thought that the Neogene, especially the last 10 million years, was a crucial period for the establishment and diversification of Neotropical flora (Hughes *et al.,* 2013). A global cooling during the Miocene (Zachos *et al.,* 2008) caused an expansion of open habitats and was concomitant to the diversification of many dry-adapted plant lineages (Alcantara *et al.,* 2018, Antonelli *et al.,* 2010, Arakaki *et al.,* 2011, Lavor *et al.,* 2019, Luebert and Wen, 2008, Perret *et al.,* 2012, Särkinen *et al.,* 2012). We expect the origin of *Barbacenia* AFI species will fall into this timeframe as previously suggested by Alcantara *et al.* (2018) with an incomplete sampling.

Aquiferous parenchyma between bundles in the leaves might be a key specialization of *Barbacenia* in order for it to occupy rocky outcrops, improving its survival chances in the arid Miocene conditions. Subsequent diversification of lineages has been associated with colonization of geographic regions with similar edaphic and xeric conditions (Alcantara *et al.,* 2018). Given the remarkable diversity of CR *Barbacenia* (85 endemic species) compared to AFI (12 species) (Mello-Silva in FDB 2019), it appears that different factors were important drivers in the diversification of these sister clades, likely leading to different patterns of morphological diversification.

Whereas the available phylogenetic inferences had not included all *Barbacenia* species that occur in AFI, the evidence for its evolutionary and biogeographical history is still limited. Therefore, we present in this study a phylogenetic analysis including the wider taxon sampling so far for *Barbacenia* AFI. Based on a phylogeny inferred using plastid (*atpB-rbcL*, *trnH-psbA* and *trnL-trnF*) and nuclear (ITS) markers, we estimated divergence times and reconstructed the ancestral areas of *Barbacenia* lineages and also compared their morphological diversity. We used these results to elucidate the following main questions: (i) Are *Barbacenia* AFI a monophyletic group with a wider taxon sampling? (ii) How are *Barbacenia* AFI species related to each other? (iii) When and where did these species evolve? (iv) Are there differences in morphological disparity between *Barbacenia* AFI species compared to the CR species? Herein, we discuss hypotheses about the past relationship between AFI and CR biota, based on our results on *Barbacenia* and provide insights into the morphological diversification of the major lineages of the genus.

2. **MATERIAL AND METHODS**

2.1. Taxon sampling

One population from each occurrence locality of the 10 *Barbacenia* AFI species was sampled in the field (see Supplementary Material 1 for voucher information**)**. These samples were collected and pressed according to standard methods and deposited in the herbarium SPF. Leaves were preserved in silica gel for DNA extraction; for anatomical and morphological analysis, leaves, pedicels, fruits and flowers were kept in alcohol 70%.

Morphological analysis was focused on *Barbacenia* species. For phylogenetic and biogeographic approaches species of *Acanthochlamys, Barbaceniopsis, Vellozia*, *Xerophyta*, and outgroups obtained from Alcantara *et al.* (2018, Supplementary Material 2) were added to analysis. Outgroup taxa also comprised other Pandanales species (*Cyclanthus bipartitus* Poit. ex A.Rich., *Pandanus pygmaeus* Thouars, and *Thoracocarpus bissectus* (Vell.) Harling) and Dioscoreales species (*Aletris farinosa* L., *Dioscorea membranacea* Pierre ex Prain & Burkill, and *Tacca chantrieri* André), which is the sister order to Pandanales (*sensu* APG IV, 2016).

2.2. DNA sequencing

Total genomic DNA was extracted from leaf tissue using the Nucleospin II kit (Macherey-Nagel, Düren, Germany) following the manufacturer's protocol. DNA quantification was performed via gel electrophoresis using 1% agarose gels and using a Nanodrop spectrophotometer (NanoDrop Technologies, Wilmington, DE, USA). For each sample, we amplified the internal transcribed spacer (ITS) and the chloroplast regions *atpB-rbcL, trnH-psbA* and *trnL-trnF* (information on PCR conditions available in Supplementary Material 3). The choice of molecular markers was based on previous studies, which showed regions with a good phylogenetic signal for Velloziaceae, either at intergeneric or infrageneric levels (Alcantara *et al.,* 2018, Behnke *et al.,* 2000, Mello-Silva *et al.,* 2011, Salatino *et al.,* 2001). Sequencing reactions were performed using the BigDye Terminator kit 3.1 (Applied Biosystems, Foster, CA, USA). The purified sequencing products were run on an ABI3130XL sequencer (Applied Biosystems) in the GaTE Laboratory, Institute of Biosciences, University of São Paulo. Raw sequences were imported and assembled using Geneious v.9 (Kearse *et al.,* 2012). Sequence files were edited and manually aligned separately for each region using PhyDE v.0.9971 (Müller *et al.,* 2005). The ITS region was also aligned using MAFFT v.7.22 (Katoh *et al.,* 2002).

2.3. Phylogenetic and dating analysis

Three datasets were constructed: (i) combined plastid dataset with *atpB-rbcL, trnH-psbA* and *trnL-trnF*; (ii) nuclear dataset (ITS); (iii) combined plastid and nuclear dataset. Phylogenetic analyses were conducted with Bayesian (BA, Mau *et al.,* 1999) and Maximum Likelihood (ML, Felsenstein, 1981) approaches on the Cyberinfrastructure for Phylogenetic Research (Cipres Science Gateway; Miller *et al*., 2010). For BA we used MrBayes v.3.2.6 (Ronquist *et al.,* 2012) with four Markov Chain Monte Carlo (MCMC) runs with four chains for 6 million generations, with trees sampled every 1000th generation and discarding the initial 25% trees as burn-in after convergence checking in Tracer v.1.7.1 (Rambaut *et al.,* 2018). ML analysis was performed using RAxML 8.1.18 (Stamatakis, 2014) with partitions unlinked under the GTR+Γ model. Branch support was calculated through ML bootstrap, with 1,000 non-parametric replicates. Results from both analyses were visualized using TreeGraph 2 (Stöver and Müller, 2010).

Calibration of the relevant nodes to estimate divergence times was based on fossil records available for Pandanales, i.e., Cyclantaceae from Middle Eocene of Messel, Germany (Smith *et al.,* 2008), and Triuridaceae from the Upper Cretaceous of New Jersey, United States of America (Gandolfo *et al.,* 2002). Triuridaceae fossil constraint was not used by Alcantara *et al.* (2018), although both records come from well-dated stratigraphic sequences (Iles *et al.,* 2015) and could be associated with the clades sampled in the present study. The first calibration point was based on *Cyclanthus messelensis* S.Y.Sm., M.E.Collinson & Rudall (Cyclanthaceae) record, and the crown node of *Cyclanthus* was constrained to a median age of 48.6 Ma. A lognormal prior distribution (mean: 12.18, standard deviation: 1.0 and offset: 41.2 Ma) and an exponential prior distribution (mean: 10.68 and offset: 41.2) were applied. The second calibration point was based on *Mabelia connatifila* Gandolfo, Nixon & Crepet 2002

(Triuridaceae), and the crown node of Pandanales was constrained to a median age of 86.3 Ma, using a lognormal prior distribution (mean in real space: 4.45, standard deviation: 1.0 and offset: 83.6 Ma) and exponential prior distribution (mean: 3.9 and offset: 83.6 Ma).

Divergence times were estimated in BEAST 1.8.4 (Drummond *et al.,* 2012) with site and clock models unlinked for each partition. The analysis was based on uncorrelated exponential and lognormal relaxed-clocks and GTR+Γ molecular evolution models. Speciation birth-death model was adopted as tree prior (Gernhard, 2008). The monophyly of Cyclanthaceae, Pandanales and *Barbacenia* AFI clade was used as topological constraints in order to reduce the tree space. Searches of 400 million generations were performed with trees sampled every 40,000 generations. Convergence was checked using effective sample size (ESS> 200) in Tracer v.1.7 (Rambaut *et al.,* 2018). Maximum clade credibility species tree was obtained with TreeAnnotator (Beast 1.8.4 package). Tree topology was visualized using FigTree 1.4 (Rambaut, 2012).

In order to compare general estimates with the first calibrated phylogeny specifically for Velloziaceae (Alcantara *et al.,* 2018), the results will be presented and discussed based on the analysis with lognormal priors.

2.4. Biogeographical analysis

Geographic distribution data of *Acanthochlamys, Barbaceniopsis*, *Vellozia* and *Xerophyta* were based on Mello-Silva *et al.* (2011) and Mello-Silva in FDB (2019). *Barbacenia* occurrence locations were obtained from GBIF (www.gbif.org) and cleaned with the R-package CoordinateCleaner v.2.0-13 (Zizka *et al.,* 2019). In the cleaned dataset, each record was evaluated in relation to the accuracy of the geographic coordinates and taxonomic validation. This dataset was merged with our records gathered for decades in many herbarium collections and alongside geo-referenced points obtained during fieldtrips carried out in the present study. The species distribution patterns were analyzed through insertion of the georeference on topographic maps using the QGIS software (QGIS Development Team 2009).

The biogeographic units were defined to reflect patterns of distribution found in *Barbacenia* species and Velloziaceae as a whole. Therefore, the operational areas were compiled in two separate datasets. In a more comprehensive dataset for Velloziaceae (approach A), we defined the following units: Atlantic Forest (Parana Dominion, area A), Caatinga (Caatinga Province, area B), Cerrado (Cerrado Province, area C), Africa (area D), Asia (area E), Andes (South American transition zone, area F), and Amazonia and Guiana Shield (Boreal Brazilian Dominion, area G). The Neotropical phytogeographic units (areas A, B, C, F and G) were based on Morrone (2014). The second dataset included only *Barbacenia* species (approach B) distributed in seven Neotropical areas as operational units: Serra da Mantiqueira (area A), Serra do Mar (area B), Guyana Shield (area C), Southern Espinhaço Province (area D), Chapada Diamantina Province (area E) and Cerrado Province (area F). *Campos Rupestres* subunits (areas D-F) were based on Colli-Silva *et al.* (2019) classification. For the operational units delimitation of the AFI, we adopted the definitions of Serra do Mar and Serra da Mantiqueira of PROJETO RADAMBRASIL (1983, 1987).

We used the dispersal-extinction-cladogenesis (DEC; Ree and Smith, 2008) approach, as implemented in the R-package BioGeoBears v.1.1.2 (Matzke, 2013), to perform ancestral range estimation analyses. The analyses were conducted with no dispersal constraints, and the max areas parameter was set based on the maximum number of areas occupied by any species in the dataset. Therefore, a maximum of three areas were adopted in approach A, and two areas in approach B.

2.5. Morphological analysis

Barbacenia AFI species were analyzed regarding anatomical and morphological characters (Supplementary Material 4, 5). Transverse sections of the median portion of leaves and pedicels were prepared as described in Mello-Silva (2000). The external structures were described following the terminology used by Mello-Silva *et al.* (2011). Based on specialized literature and information from digitized herbarium collections, we also included species of *Campos Rupestres* clade in the morphological analyses (see Supplementary Material 6 for AFI and CR voucher information).

Morphological diversity was estimated for the two major clades of *Barbacenia.* An Euclidean dissimilarity matrix was constructed using the general coefficient proposed by Gower (1971) and the smallest positive constant (Cailliez, 1983). This matrix was subsequently used to perform a principal coordinate analyses (PCoA). Separate analyses were conducted for all characters (Supplementary Material 4) and for vegetative (characters 1–7, Supplementary Material 4) and reproductive characters (characters 8–16, Supplementary Material 4). The pairwise differences in variance among clades were tested using the permutation test (Anderson, 2006) with 10,000 permutations. To avoid bias caused by different species numbers per clade (39 versus 11 espécies), we conducted the same analyses for 1,000 randomly built reduced matrices with 12 species in each clade. These analyses were implemented in the R-packages ade4 v.1.7-13 (Dray *et al.,* 2007), cluster v.2.1.0 (Maechler *et al.*, 2005) and vegan v.2.5-6 (Oksanen *et al.,* 2010).

3. RESULTS

3.1. Phylogenetic analysis

The combined dataset aligned had 178 terminals, 65 of which were *Barbacenia* samples. This matrix included 3,962 aligned sites (plastid: 2,875, ITS nrDNA: 1,087) and 2,309 informative sites. Visual inspection indicated that the BA and ML inference from the individual nuclear and plastid datasets resulted in mostly congruent topologies (Supplementary Material 7, 8). The rare incongruences were poorly supported in the bootstrap (BS) and posterior probability (PP) values. Both analyses recovered the monophyly of *Barbacenia* (ITS, PP = 1, BS = 95; Plastid, PP = 0.88, BS = 46).

Bayesian and Maximum Likelihood trees recovered the five currently recognized genera of Velloziaceae with the topology (*Acanthochlamys* (*Barbacenia* (*Xerophyta* (*Barbaceniopsis*, *Vellozia*)))) (Figure 2). Two major lineages were recovered in *Barbacenia*, one including the endemic species from AF Inselbergs (PP = 1.0, BS = 89), and the second comprising most of the *Campos Rupestres* endemic species (PP = 0.68, BS = 66). Within the AFI clade five well-supported groups can be recognized: clade 1, *Barbacenia squamata* and *B. purpurea* (PP = 1, BS = 99); clade 2, *Barbacenia pabstiana* and *Barbacenia rogieri* (PP = 1, BS = 100); clade 3, *B. gounelleana, B. mantiqueirae*, and *B. spectabilis* (PP = 1, BS = 78); clade 4, *B. irwiniana* (PP = 1, BS = 100); and clade 5, *Barbacenia brevifolia, B. fannieae*, and *B. squamata* (PP = 1, BS = 84). The lineage comprising clades 3 to 5 was well supported (PP = 1, BS = 68). *Barbacenia amphirupia* was related to the clade 2 with low support (PP = 0.58, BS = 36). Five clades were recovered within the CR clade: clade 6, *Barbacenia blanchetii*, *B. celiae*, and *B. flavida* (PP = 1, BS = 84); clade 7, *B. delicatula*, *B. excapa*, and *B. riparia* (PP = 0.93, BS = 0.56); clade 8, *B. bishopii*, *B. blackii*, *B. gentianoides*, *B. macrantha*, and *B. nana* (PP = 0.84, BS = 53); clade 9, *B. serracabralea* and *B. minima* (PP = 1, BS = 100), and clade 10, formed by all remaining species of CR (PP = 1, BS = 97).

3.2. Divergence times and ancestral area analysis

Divergence time estimates using exponential and lognormal priors resulted in different ages, with exponential model producing older time estimates (Table 1, Supplementary Material 9, 10).

Our analysis (approach A, Figure 3) suggests that the ancestral lineage of core Veloziaceae (i.e., excluding *Acanthoclamys*, which is sister to all remaining Velloziaceae) already occupied Africa, Andes and Cerrado during the Early Oligocene. Basal cladogenesis gives rise to two major lineages, one of them comprising the Neotropical genus *Barbacenia* and the other formed by Neotropical (*Barbaceniopsis* and *Vellozia*) and Paleotropical (*Xerophyta*) genera. The diversification of *Barbacenia* likely took place during the Middle Miocene, in the Atlantic Forest and Cerrado domains. The clade *Xerophyta*+*Barbaceniopsis*+*Vellozia* arose towards the beginning of Late Oligocene with the same distribution as its ancestor. The crown age of the clade *Barbaceniopsis*+*Vellozia* was dated to the Late Oligocene, with an ancestral distribution in the Andes and Cerrado. Its sister clade (*Xerophyta*) diversified from the Early Miocene in Africa. *Vellozia* firstly diversified in the Andes and in Brazil during the Early Miocene, and later exclusively in Brazil. The diversification of *Barbaceniopsis* occurred in the Andes during the Middle Miocene.

DEC analysis (approach B, Figure 4) also indicates that the ancestor of the *Barbacenia* CR clade arose also during the Middle Miocene in *Campos Rupestres* areas, which included Southern Espinhaço and Chapada Diamantina. Subsequently, the two major lineages (clades 6 and 7–10) originated during the Miocene. Clade 6 diversified in the Late Miocene, with a disjunct ancestral area including Chapada Diamantina and the Guyana Shield, and its sister clade comprises the largest lineage in *Barbacenia*, which diversified in the Middle Miocene in the Southern Espinhaço. *Barbacenia* AFI ancestral lineage arose during the Middle Miocene and was distributed in the Serra do Mar. The basal cladogenesis generated clade 1 during the

Pliocene in the Serra do Mar, and its sister clade (clade 2–5) during the Late Miocene, expanded the distribution also to the Serra da Mantiqueira. Subsequently four major splits occurred within this clade. The first split generated the clade 2 during Pliocene with ancestral distribution in the Serra da Mantiqueira. Its sister clades originated during Late Miocene with ancestral range in the Serra da Mantiqueira (clade 3), during the Pleistocene also in the Serra da Mantiqueira (clade 4) and during the Late Miocene in Serra do Mar (clade 5).

3.3. Morphological diversity between the two major clades of *Barbacenia*

Most of the vegetative and reproductive characters did not vary among the AFI clade species. However, they differed significantly between CR-species (for the phylogenetic distribution of each character see Supplementary Material 11). Phyllotaxis and indumentum on leaf and hypanthium, transverse section and exposure of pedicel, length of hypanthial tube, relative position of stigma and stamens, apical appendage in anther, capsule type, furrows and phloem strands in leaves, did not vary among the AFI species. The only exceptions are the leaf and hypanthium indumentum of *B. amphirupia*, and transverse section of pedicel of *B. purpurea* (Supplementary Material 11).

The first two principal coordinates of the PCo explained 25.9% and 8.6% of the total variance, respectively. The AFI clade occupied a significantly smaller proportion of morphospace than the CR clade in the three analyses (vegetative, reproductive and all characters; Figure 5). Pairwise permutation test corroborated with the significantly morphological disparity between the clades (all characters, $P<0.001$; vegetative, $P<0.001$; reproductive, $P<0.001$), and also for the analyses with 1,000 random reductions of species (all characters, P values=0.001; vegetative, P values=0.001; reproductive, P values=0.001).

4. DISCUSSION

4.1. Middle Miocene origin of the two major lineages of *Barbacenia*

Distribution of Velloziaceae suggests a Gondwanian origin and a vicariant split of the main clades (Mello-Silva *et al.,* 2011), although long distance dispersal through the Boreotropical connection during the Early Eocene (Davis *et al.,* 2002) seems to be corroborated with the last dated tree of Velloziaceae (Alcantara *et al.,* 2018). Eocene Boreotropical flora connection is congruent with our ancestral area analyses, given that the ancestral Velloziaceae core lineage already presented an amphiatlantic distribution during the Early Oligocene. This age is too young compared to other groups for which West Gondwanan vicariance has been proposed (e.g., Luebert *et al.,* 2017).

The results obtained in the present study also provide evidence for a diversification of *Barbacenia* during the Middle Miocene to Pleistocene, as previously proposed by Alcantara *et al.* (2018). This diversification coincides with the exposure of Inselbergs surface (Varajão and Alkmim, 2015) and the expansion of dry environments (Hughes *et al.,* 2013). A distribution of the ancestral *Barbacenia* lineage throughout Serra do Mar and Southern Espinhaço could have therefore been facilitated by such Miocene environmental conditions. Subsequent origin of the two largest clades in *Barbacenia* may have been through colonization of isolated habitats and later geographical isolation.

Dated phylogenies including other plants that occur in AFI support the idea of the origin of this flora during the Miocene. Clades comprising AFI species of Alstroemeriaceae (*Alstroemeria* and *Bomarea*), Gesneriaceae (*Sinningia* and *Vanhouttea*) and Lentibulariaceae (*Utricularia*) provide examples of colonization of these areas during the Miocene (Chacón *et al.,* 2012, Perret *et al.,* 2012, Silva *et al.,* 2018). Recent diversifications have been reported for AFI species of Bromeliaceae (*Aechmea, Pitcairnia* and *Tillandsia*) and Malpighiaceae

(*Amorimia*) during Pliocene (Almeida *et al.,* 2018, Givnish *et al.,* 2011) and Melastomataceae (*Leandra*) in the Pleistocene (Reginato and Michelangeli, 2019).

Distribution of the common ancestor of *Barbacenia* AFI lineages was in Serra do Mar. This clade began the diversification during Middle Miocene, forming an endemic lineage to Serra do Mar and a sister clade which expanded its distribution into Serra da Mantiqueira. From this widespread lineage, four clades were originated at different times since the Late Miocene. These clades have both endemic and non-endemic members to these AFI areas, suggesting independent dispersal events.

The largest *Barbacenia* clade 7–10 was originated in *Campos Rupestres* from Southern Espinhaço. This group diversified towards the Middle/Late Miocene boundary, and has remained restricted to this area until today, with the exception of single dispersals to Chapada Diamantina, Cerrado and northern Serra da Mantiqueira. Its sister clade 6, comprising three species, diversified from the disjunct ancestral area comprising Chapada Diamantina and Guyana Shield during the Late Miocene. This asymmetric richness and the disjunct distribution between Southern Espinhaço and Guyana Shield resemble Araliaceae, Bonnetiaceae, Bromeliaceae, Eriocaulaceae, Fabaceae, Melastomataceae, Rubiaceae, and Melastomataceae, which suggest recent dispersal events between these areas (Fiaschi and Pirani, 2009).

4.2. Overall picture of *Barbacenia* AFI lineages

Most species of *Barbacenia* AFI clade are distributed along Serra do Mar and Mantiqueira, in Espirito Santo (ES), Minas Gerais (MG), Rio de Janeiro (RJ) and São Paulo (SP) states, except *B. amphirupia* that also occurs in the south of Chapada Diamantina, Bahia (BA). There is no evident morphological synapomorphy uniting the species of this lineage. Shared characters appear to be plesiomorphic rather than synapomorphic. The same applies to strongly supported subclades, which overlap in character variation with other *Barbacenia* AFI subclades, indicating possible homoplasies. All subclades within *Barbacenia* AFI have a relatively continuous geographic distribution (Supplementary Material 12) except for clade 3, which has a disjunct distribution. *Barbacenia squamata* was recovered as a non-monophyletic group, belonging to two different clades of Serra do Mar. Clades discussion includes information on these separated populations.

Clade 1 is composed of *Barbacenia squamata* and *B. purpurea*, sister group to the rest of the *Barbacenia* AF Inselbergs lineage. These species are endemic of the coastal region of Serra do Mar, Rio de Janeiro (RJ) state, occurring from sea level up to 940 m a.s.l.

Clade 2 is represented by *Barbacenia pabstiana*, a species restricted to the north of Serra da Mantiqueira, Espírito Santo (ES) state, at altitudes between 420 to 1500 m a.s.l., and by *B. rogieri*, a widespread species along this mountain range and also along Serra do Mar, including ES, RJ and Minas Gerais (MG) states, from 150 to 1760 m a.s.l. In the phylogenetic analyses *B. amphirupia* was also related to the clade 2, although with low support. This species occurs at the transition between northern Serra da Mantiqueira and southern Chapada Diamantina, Bahia state (BA), in altitudes between 380 and 1550 m a.s.l.

Clade 3 comprises *Barbacenia gounelleana, B. mantiqueirae*, and *B. spectabilis. Barbacenia gounelleana* and *B. mantiqueirae* occur both in high-altitude regions of south-central Serra da Mantiqueira, in ES, MG and São Paulo (SP) states, from 1550 to 2800 m a.s.l., and *B. spectabilis* occurs at low altitudes in coastal regions north of the same mountain range in ES state, from 120 to 750 m a.s.l.

Clade 4 is represented only by *Barbacenia irwiniana,* an endemic species to the north of Serra da Mantiqueira, including ES and MG states. This species occurs in small populations in high altitude regions, from 1200 to 2743 m a.s.l.

Clade 5 includes *Barbacenia brevifolia*, *B. fannieae* and *B. squamata*. Species in this clade are endemic to Serra do Mar, RJ state, occurring in small populations in high altitude regions, from 700 to 2400 m a.s.l.

4.3. Role of climatic changes in shaping geographic patterns within *Barbacenia* AFI clade

Barbacenia AFI diversity was generated from Late Miocene (~5.71 Ma) to Pleistocene times (~0.65 Ma). Retraction of forests along with spread of open habitats in the current area of the Atlantic Forest during the Miocene (see above) may have caused the expansion of the geographical range of *Barbacenia* AFI. Pleistocene climatic fluctuations generated consecutive expansions and retractions of the Atlantic Forest vegetation (Carnaval and Moritz, 2008). Paleopalinological records corroborate that this biome was fragmented into forest patches surrounded by semiarid formations during Quaternary glacial periods (Martins, 2011). During the wetter interglacial periods, dry areas were subsequently contracted and the Atlantic Forest expanded (Carnaval and Moritz, 2008). This paleovegetational dynamics may also have contributed to the speciation process in *Barbacenia* AFI lineages, whose species may have extended their geographic distribution during glacial periods and subsequently the expansion of dry habitats.

Whereas the definition of the areas adopted in the reconstruction of ancestral ranges is comprehensive, they overshadow the endemism of each recent lineage related to particular mountain ranges. Endemic clades with ancestral distribution restricted to one of those areas originated five times. Given the distribution of common ancestors, we suggest that stepping-stone dispersal across mountaintops was the key for the range expansion of this group. These dispersals were possibly limited by niche conservatism and ecological preferences for rocky environments, which together with their geographical isolation, could explain the endemism of several species to single inselbergs. These factors have also been associated with the long-term isolation of Sinningieae in these environments (Perret *et al.,* 2012). Secondary diversification events were limited by the colonization of geographic regions with similar xeric conditions also for Cactaceae (e.g., Lavor *et al.,* 2019).

Environmental heterogeneity is thought to play a relevant role in species diversification (Stein *et al.,* 2014). The AFI comprises granite and gneiss outcrops (Safford and Martinelli, 2000), while quartzite, ironstone and sandstone formations are found in CR. Besides, although both areas are inserted in the Atlantic Forest Domain, CR areas are also formed within Cerrado and Caatinga (Vasconcelos, 2011). Given that cladogenetic events were more frequent in CR than in AFI during the Plio-Pleistocene, we propose that the differences in morphological disparity between these lineages were influenced by environmental heterogeneity and different paleovegetational dynamics during these periods. *Barbacenia* AFI clade exhibits a homogeneous morphology, and provides an interesting example of long-term morphological stability. Low genetic connectivity has been repeatedly verified for different groups in the AFI, corroborating that Inselberg species are maintained as discrete evolutionary units (e.g., Barbará *et al.,* 2007, Hmeljevski *et al.,* 2017, Mota *et al.,* 2019, Palma-Silva *et al.,* 2011, Pinheiro *et al.,* 2011). Given the habitat specialization of *Barbacenia* AFI clade and the discontinuity of these areas, it is surprising that either selection or genetic drift did not result in morphological divergence. Morphological stasis has been considered a challenging problem in evolutionary biology (Gould and Eldredge, 1977), and understanding this in the face of long-term population fragmentation and isolation provides an intriguing area for future studies of this lineage.

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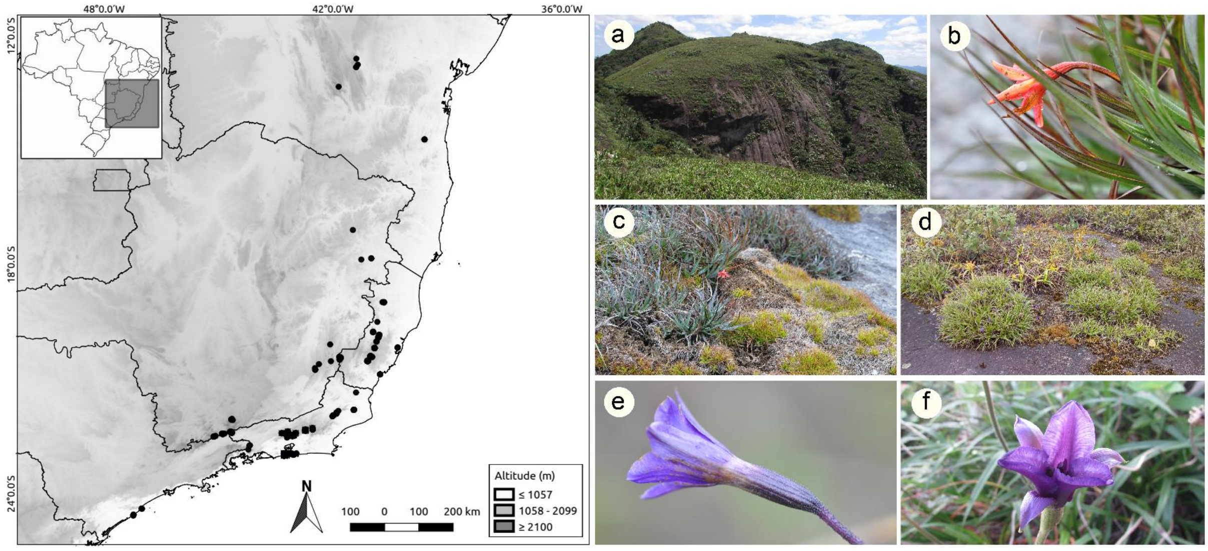


Figure 1. Left panel: Distribution of *Barbacenia* Atlantic Forest Inselbergs clade. Right panel: (a) Typical view of the Inselbergs vegetation in Serra, Espírito Santo. Selected *Barbacenia* AFI species. (b–c) *Barbacenia squamata*; (d–e) *Barbacenia pabstiana*; (f) *Barbacenia purpurea*. Photos by A. Cabral.

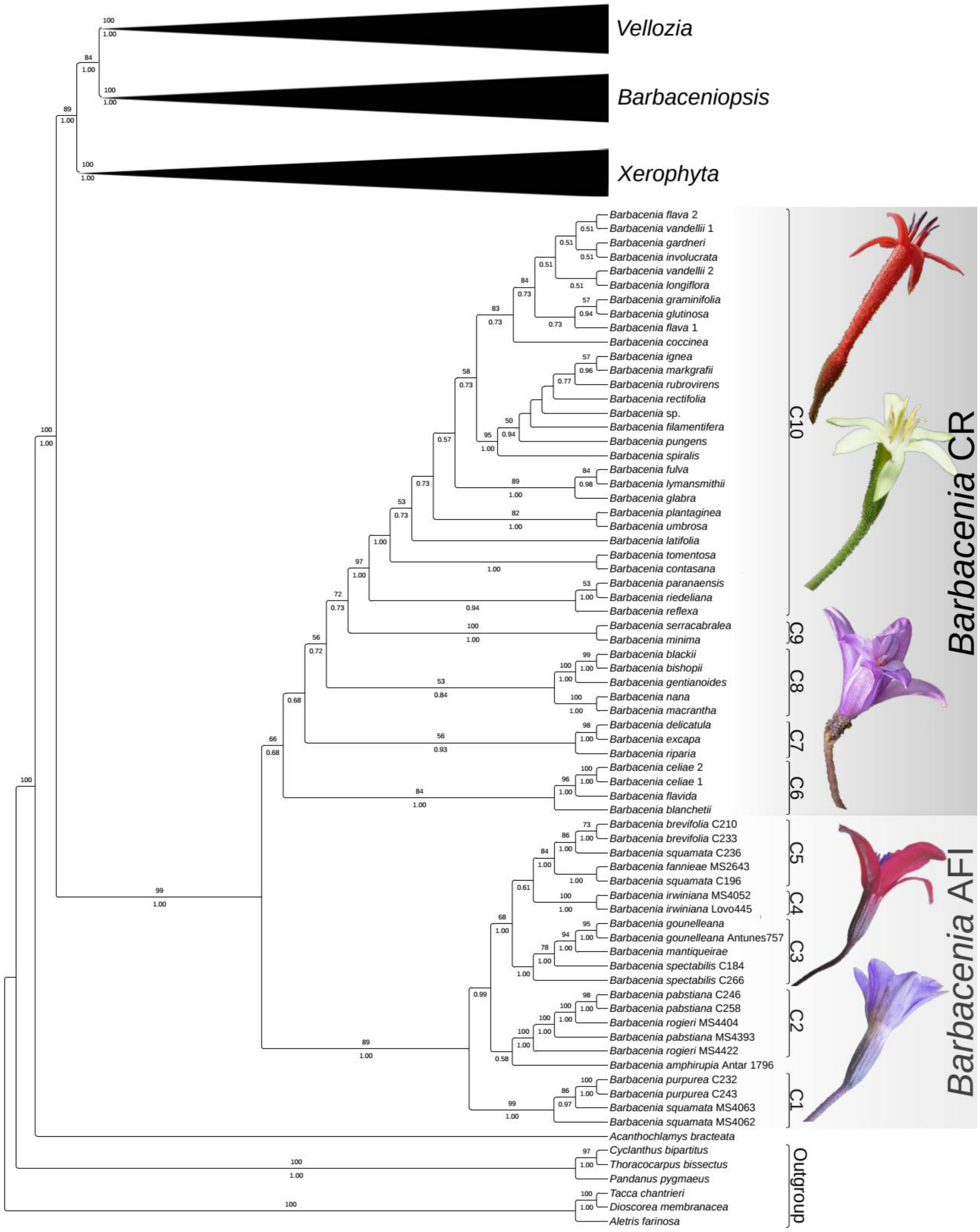


Figure 2. Maximum Likelihood tree based on combined nuclear (ITS) and plastid (*atpB-rbcL* + *trnH-psbA* + *trnL-trnF*) datasets. Numbers above branches are Maximum Likelihood Bootstrap values, and below branches are Bayesian Posterior Probabilities. Major clades are indicated.

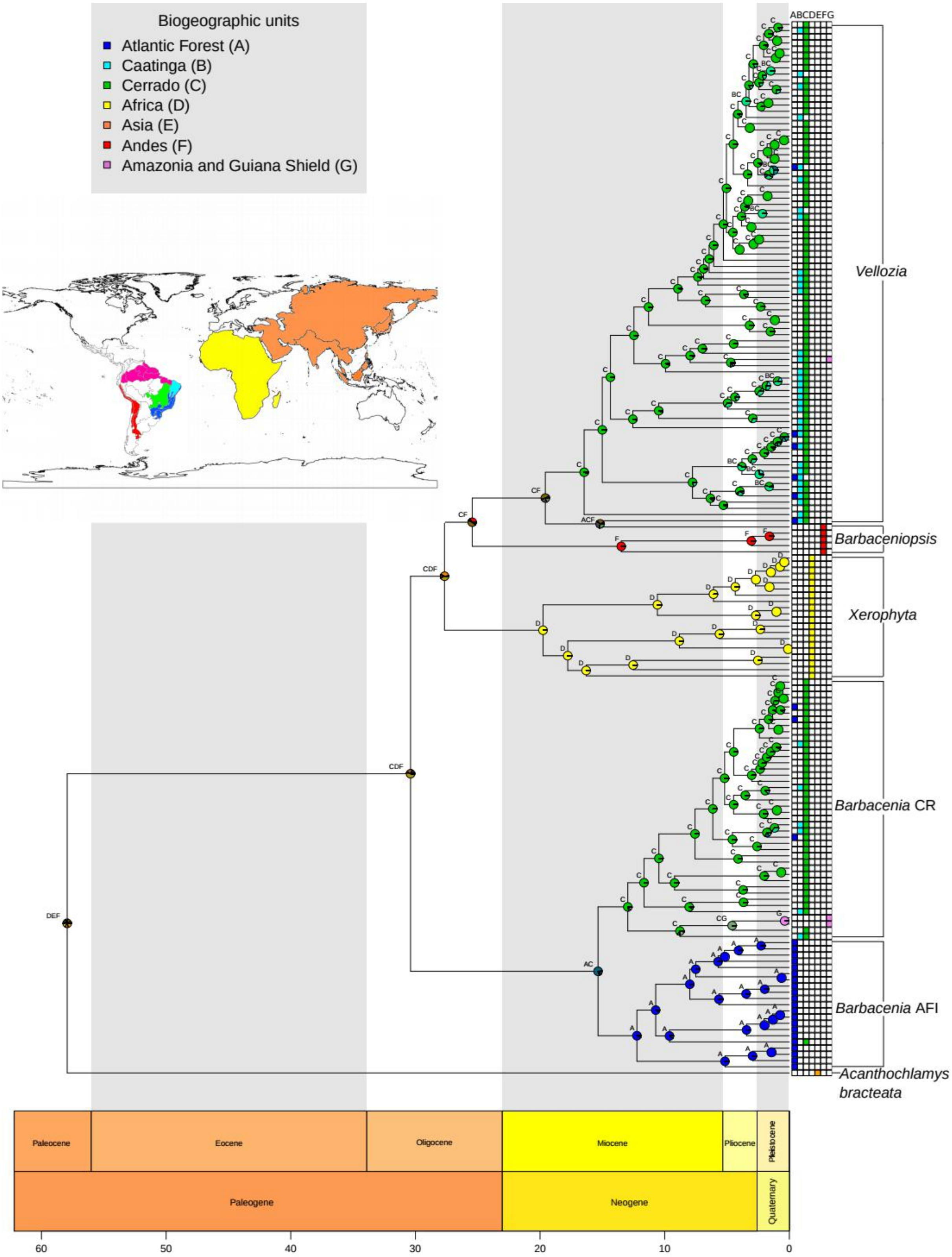


Figure 3. Approach A, ancestral area reconstruction of Velloziaceae with DEC model. Analyses based on the BEAST maximum clade credibility tree. Pie charts show the relative probability of each range. Letters next to nodes are the ancestral ranges with the greatest relative probability. Timescale is in millions of years ago.

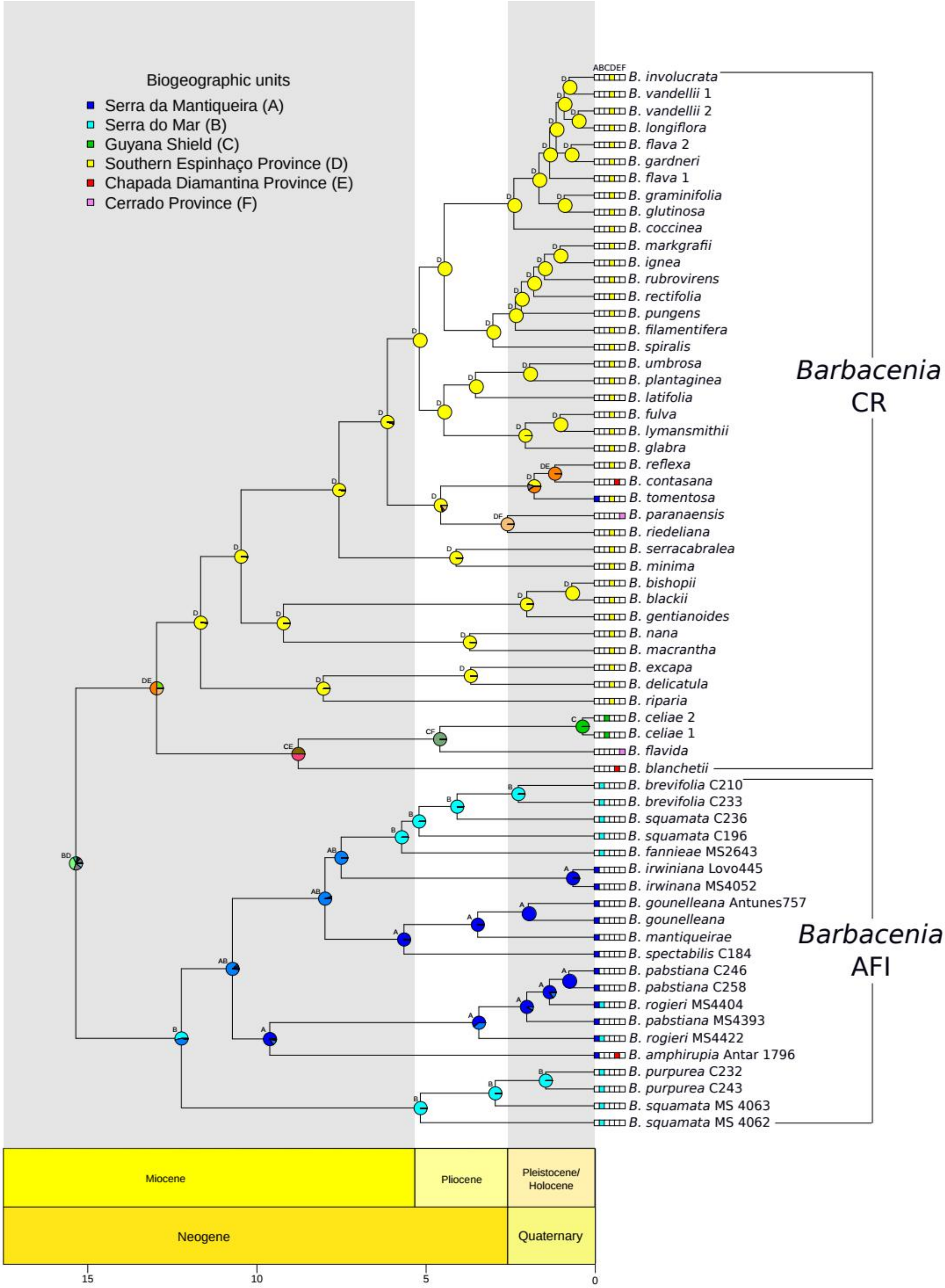


Figure 4. Approach B, ancestral area reconstruction of *Barbacenia* with DEC model. Analyses based on the BEAST maximum clade credibility tree. Pie charts show the relative probability of each range. Letters next to nodes are the ancestral ranges with the greatest relative probability. Timescale is in millions of years ago.

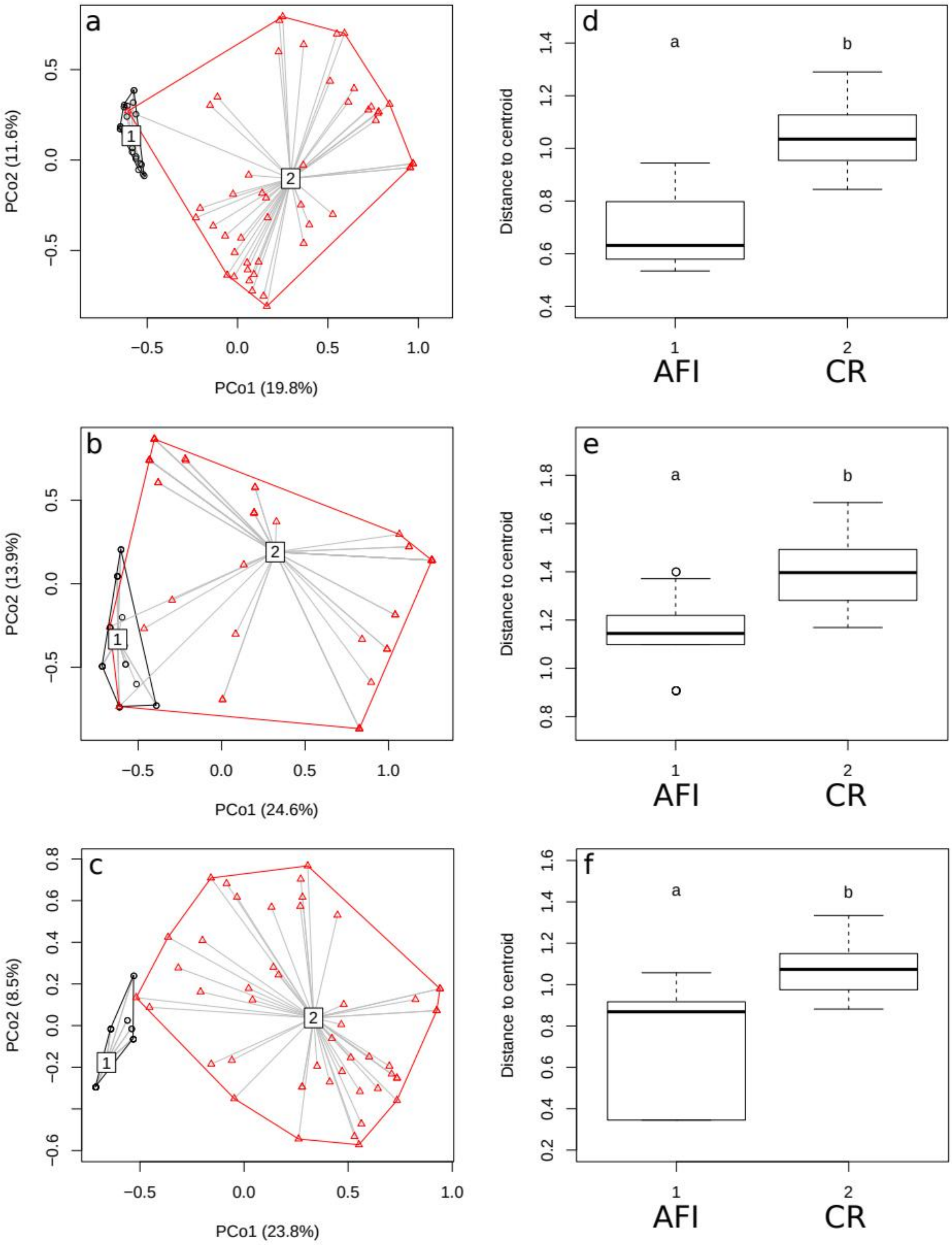


Figure 5. Morphospace occupancy of *Barbacenia*. a–c. Distribution of clades in the first two axes of the PCo analyses: a, all characters; b, vegetative characters; c, reproductive characters; 1, AFI clade; 2, CR clade. d–f, Box-and-whisker plots representing the distance to the clade centroid (=morphological diversity) in the PCoA space including all axes: d, all characters; e, vegetative characters; f, reproductive characters.

Table 1. Divergence time estimates obtained for the major clades with exponential and lognormal priors in the BEAST analysis of Velloziaceae. Median ages and 95% HPD intervals are indicated. PP indicates the posterior probability of the clade in the corresponding analysis.

Crown node	**Lognormal**	**Exponential**
Velloziaceae	57.93 (44.25 - 72.22); PP=1	60.83 (48.26 - 73.73); PP=1
Velloziaceae core	30.38 (22.21 - 40.38); PP=1	38.42 (28.54 - 49.10); PP=1
Barbacenia	15.34 (10.50 - 21.24); PP=1	18.20 (12.58 - 25.74); PP=1
Barbacenia AFI	12.22 (8.21 - 17.08); PP=1	14.30 (9.46 - 20.45); PP=1
Barbacenia CR	12.95 (9.05 - 17.85); PP=1	15.56 (10.71 - 21.54); PP=1
Barbaceniopsis+Vellozia+Xerophyta	27.66 (19.78 - 36.38); PP=0.97	34.57 (25.44 - 44.29); PP=0.98
Xerophyta	19.76 (13.82 - 27.12); PP=1	22.83 (15.50 - 31.23); PP=1
Barbaceniopsis+Vellozia	25.44; PP=0.91	32.17; PP=0.92
Barbaceniopsis	13.48 (7.79 - 20.65); PP=1	14.81 (7.90 - 23.81); PP=1
Vellozia	19.57 (13.97 - 26.35); PP=1	24.50 (17.92 - 32.41); PP=1
Barbacenia AFI clade 1	5.16 (2.65 - 8.51); PP=1	7.04 (3.78 - 11.45); PP=1
Barbacenia AFI clade 2+3+4+5	10.72; PP=0.73	12.50; PP=0.66
Barbacenia AFI clade 2	3.43 (1.66 - 5.74); PP=1	5.36 (2.95 - 8.61); PP=1
Barbacenia AFI clade 3+4+5	7.98 (5.11 - 11.50); PP=1	9.76 (6.24 - 14.04); PP=1
Barbacenia AFI clade 3	5.64 (3.23 - 8.60); PP=1	5.73 (3.25 - 8.98); PP=1
Barbacenia AFI clade 4+5	7.50; PP=0.31	-
Barbacenia AFI clade 4	0.65 (0.08 - 1.79); PP=1	0.75 (0.07 - 2.21); PP=1
Barbacenia AFI clade 5	5.71 (3.33 - 8.41); PP=1	6.44 (3.73 - 9.99); PP=0.99
Barbacenia CR clade 6	8.77 (5.09 - 13.32); PP=1	9.92 (5.24 - 15.39); PP=1
Barbacenia CR clade 7+8+9+10	11.65; PP=0.91	14.23; PP=0.88
Barbacenia CR clade 7	8.03 (4.42 - 12.13); PP=1	7.63 (3.59 - 12.80); PP=0.99
Barbacenia CR clade 8+9+10	10.46 (7.28 - 14.54); PP=0.99	12.93 (8.89 - 18.01); PP=0.99
Barbacenia CR clade 8	9.21; PP=0.92	11.10 (6.44 - 16.32); PP=0.97
Barbacenia CR clade 9+10	7.56 (5.15 - 10.82); PP=1	10.35 (6.76 - 14.34); PP=1
Barbacenia CR clade 9	4.11 (1.58 - 7.00); PP=1	4.87 (1.58 - 9.12); PP=1
Barbacenia CR clade 10	6.14 (4.05 - 8.76); PP=1	8.06 (5.43 - 11.42); PP=1

Supplementary Material 1. *Barbacenia* AFI species sampled in the present study, collection localities, voucher (collector number/SPF Herbarium).

Species	**Locality**	**Voucher**
1. *Barbacenia amphirupia*	BA - Lençóis (Chapada Diamantina)	Antar 1796
2. *Barbacenia brevifolia*	RJ - Petrópolis (Pedra do Cuca)	Cabral 210
2. *Barbacenia brevifolia*	RJ - Nova Friburgo (Pedra do Cônego)	Cabral 233
3. *Barbacenia fannieae*	RJ - Santa Maria Madalena	Mello-Silva 2643
4. *Barbacenia gounelleana*	RJ - Resende (Parque Nacional do Itatiaia)	Antunes 757
5. *Barbacenia irwiniana*	MG - Alto Caparaó (Parque Nacional do Caparaó)	Lovo 445
5. *Barbacenia irwiniana*	MG - Fervedouro (Pedra do Pato)	Mello-Silva 4052
6. *Barbacenia pabstiana*	ES - Itaguaçu. (Cachoeirão)	Mello-Silva 4393
6. *Barbacenia pabstiana*	ES - Domingos Martins (Pedra Azul)	Cabral 246
6. *Barbacenia pabstiana*	ES - Itarana (Pedra da Onça)	Cabral 258
7. *Barbacenia purpurea*	RJ - Rio de Janeiro (Pedra da Urca)	Cabral 232
7. *Barbacenia purpurea*	RJ - Niterói (Pedra das Andorinhas)	Cabral 243
8. *Barbacenia rogieri*	ES - Espírito Santo Baixo Guandu (Morro Maquiji)	Mello-Silva 4404
8. *Barbacenia rogieri*	MG - Teófilo Otoni	Mello-Silva 4422
9. *Barbacenia spectabilis*	ES - Piúma (Morro do Aghá)	Cabral 184
9. *Barbacenia spectabilis*	ES - Serra (Morro do Mestre Álvaro)	Cabral 266
10. *Barbacenia squamata*	RJ - Rio de Janeiro (Pedra da Gávea)	Mello-Silva 4062
10. *Barbacenia squamata*	RJ - Rio de Janeiro (Pedra Bonita)	Mello-Silva 4063
10. *Barbacenia squamata*	RJ - Serra dos Órgãos (Pedra do Sino)	Cabral 196
10. *Barbacenia squamata*	RJ - Nova Friburgo (Cabeça do Dragão)	Cabral 236

Supplementary Material 2. Velloziaceae and outgroup species added to the molecular matrix. Source of molecular data in Alcantara *et al.* (2018).

Species	**Voucher**
(Acoraceae) *Acorus gramineus* Aiton	Chase s.n. (K)
(Bromeliaceae) *Encholirium scrutor* (L.B.Sm.) Rauh	Forzza 1488 (BHCB, K, SP, SPF, US)
(Cyclanthaceae) *Cyclanthus bipartitus* Poit. ex A.Rich.	Mello-Silva 3180 (SPF)
(Cyclanthaceae) *Thoracocarpus bissectus* (Vell.) Harling	Fiaschi 603 (SPF)
(Dioscoreaceae) *Dioscorea membranacea* Pierre ex Prain & Burkill	Chase 21050 (K)
(Dioscoreaceae) *Tacca chantrieri* André	Chase 18201 (K)
(Nartheciaceae) *Aletris farinosa* L.	Chase 105 (K)
(Pandanaceae) *Pandanus pygmaeus* Thouars	Pirani 4755 (SPF)
Acanthochlamys bracteata P.C.Kao	Chase 842 (K)
Barbacenia bishopii L.B.Sm.	CFSC11228 (SPF)
Barbacenia blackii L.B.Sm.	Mello-Silva 1103 (SPF)
Barbacenia blanchetii Goethart & Henrard	Mello-Silva 2582 (SPF)
Barbacenia celiae Maguire	Rodrigues s.n. (SPF); Rando 1171 (SPF)
Barbacenia coccinea Mart. ex Schult. & Schult.f.	Trovó 380 (SPF)
Barbacenia contasana L.B.Sm. & Ayensu	Mello-Silva 2136 (SPF)
Barbacenia delicatula L.B.Sm. & Ayensu	Mello-Silva 2668 (SPF)
Barbacenia exscapa Mart.	Mello-Silva 3466 (SPF)
Barbacenia filamentifera L.B.Sm. & Ayensu	Mello-Silva 2555 (SPF); Mello-Silva 3404 (SPF)
Barbacenia flava Mart. ex Schult. & Schult.f.	Mello-Silva 2662 (SPF); Alcantara 195 (SPF)
Barbacenia flavida Goethart & Henrard	Alcantara 160 (SPF)
Barbacenia fulva Goethart & Henrard	Mello-Silva 1675 (SPF)
Barbacenia gardneri Seub.	Mello-Silva 3414 (SPF)
Barbacenia gentianoides Taub. ex Goethart & Henrard	Mello-Silva 2370 (SPF)
Barbacenia glabra Goethart & Henrard	Trovó 393 (SPF)
Barbacenia glutinosa Goethart & Henrard	Mello-Silva 3396 (SPF)
Barbacenia gounelleana Beauverd	Mello-Silva 2849 (SPF)
Barbacenia graminifolia L.B.Sm.	Lovo 442

Barbacenia ignea Mart. ex Schult. & Schult.f.	Mello-Silva 2554 (B, K, RB, SPF, US)
Barbacenia involucrata L.B.Sm.	Mello-Silva 3402 (SPF)
Barbacenia latifolia L.B.Sm. & Ayensu	Mello-Silva 1509 (SPF); Mello-Silva 2473 (SPF)
Barbacenia longiflora Mart.	Mello-Silva 3427 (SPF)
Barbacenia lymansmithii Mello-Silva & N.L.Menezes	Farinaccio 139 (SPF)
Barbacenia macrantha Lem.	Mello-Silva 2900 (SPF)
Barbacenia mantiqueirae Goethart & Henrard	Trovó 323 (SPF)
Barbacenia markgrafii Schulze-Menz	Mello-Silva 1504 (BHCB, K, NY, SPF, W)
Barbacenia minima L.B.Sm. & Ayensu	Mello-Silva 3435 (SPF)
Barbacenia nana L.B.Sm. & Ayensu	Miliken 4295 (K, SPF)
Barbacenia paranaensis L.B.Sm.	Mello-Silva 3586 (SPF)
Barbacenia plantaginea L.B.Sm.	Salatino CFCR11901 (K, SPF)
Barbacenia pungens (N.L.Menezes & Semir) Mello-Silva	Mello-Silva 319 (SPF)
Barbacenia rectifolia L.B.Sm. & Ayensu	Trovó 409 (SPF)
Barbacenia reflexa L.B.Sm. & Ayensu	Mello-Silva CFCR10793 (F, SPF)
Barbacenia riedeliana Goethart & Henrard	Mello-Silva 3565 (SPF)
Barbacenia riparia (N.L.Menezes & Mello-Silva) Mello-Silva	Menezes 1167 (SPF)
Barbacenia rubrovirens Mart.	Mello-Silva 3405 (SPF)
Barbacenia serracabralea Mello-Silva	Mello-Silva 2505 (B, BHCB, K, L, M, MBM, MO, NY, RB, SP, SPF, US); Mello-Silva 3439 (SPF)
Barbacenia sp.	Alcantara 118 (SPF)
Barbacenia spiralis L.B.Sm. & Ayensu	Mello-Silva 2548 (SPF)
Barbacenia tomentosa Mart.	Mello-Silva 1600 (K, MBM, RB, SP, SPF, UB, W); Mello-Silva 2929 (SPF); Prado 2166 (SP, SPF)
Barbacenia umbrosa L.B.Sm. & Ayensu	Mello-Silva CFCR9658 (F, K, MBM, RB, SPF)
Barbacenia vandellii Pohl ex Seub.	Mello-Silva 3411 (SPF); Alcantara 200 (SPF)
Barbaceniopsis boliviensis (Baker) L.B.Sm.	Mello-Silva 2107 (B, BHCB, CDBI, CTES, L, LPB, K, MBM, NY, SI, SPF)
Barbaceniopsis castillonii (Hauman) Ibisch	Mello-Silva 1857 (B, CESJ, CTES, L, K, MBM, MCNS, NY, SI, SPF, US)

Barbaceniopsis humahuaquensis Noher	Mello-Silva 1872 (B, CESJ, CTES, K, MCNS, SI, SPF, US)
Barbaceniopsis vargasiana (L.B.Sm.) L.B.Sm.	Rauh 25942 (HEID)
Vellozia abietina Mart.	Mello-Silva 1733 (B, K, NY, RB, SPF, US)
Vellozia alata L.B.Sm.	Mello-Silva 2368 (K, SPF)
Vellozia albiflora Pohl	Mello-Silva 1514 (SPF); Mello-Silva 2616 (SPF)
Vellozia albohexandra Mello-Silva ined.	Mello-Silva 1449 (SPF)
Vellozia aloifolia Mart.	Salatino 67 (SPF)
Vellozia andina Ibisch, R.Vásquez & Nowicki	Ibisch 98.133 (BONN)
Vellozia armata Mello-Silva	Mello-Silva 1451 (SPF)
Vellozia auriculata Mello-Silva & N.L.Menezes	Mello-Silva 3469 (SPF)
Vellozia barbata Goethart & Henrard	Mello-Silva 1732 (SPF)
Vellozia bradei Schulze-Menz	Mello-Silva CFCR9663 (RB, SPF, US)
Vellozia brevifolia Seub.	Mello-Silva 1373 (SPF)
Vellozia breviscapa Mart. ex Schult. & Schult.f.	Mello-Silva 2692 (SPF)
Vellozia burlemarxii L.B.Sm. & Ayensu	Mello-Silva 2148 (B, CDBI, CTES, HUEFS, K, M, NY, RB, SPF)
Vellozia caespitosa L.B.Sm. & Ayensu	Lovo 438
Vellozia candida J.C.Mikan	Mello-Silva 2877 (SPF)
Vellozia canelinha Mello-Silva	Mello-Silva 2131 (K, SPF)
Vellozia caput-ardeae L.B.Sm. & Ayensu	Mello-Silva 1520 (G, NY, SPF, UB)
Vellozia caruncularis Mart. ex Seub.	Mello-Silva 2925 (SPF); Mello-Silva 3434 (SPF)
Vellozia caudata Mello-Silva	Mello-Silva 2135 (SPF); Mello-Silva 2132 (HUEFS, K, SPF); Mello-Silva 2770 (K, SPF)
Vellozia ciliata L.B.Sm.	Mello-Silva 3184 (SPF)
Vellozia cipoensis Mello-Silva ined.	Farinaccio 440 (SPF)
Vellozia compacta Mart. ex Schult. & Schult.f.	Mello-Silva 1386 (MBM, MO, SP, SPF)
Vellozia crinita Goethart & Henrard	Mello-Silva 3249 (SPF)
Vellozia cryptantha Seub.	Mello-Silva 3428 (SPF)
Vellozia dasypus Seub.	Mello-Silva 2578 (SPF)
Vellozia declinans Goethart & Henrard	Mello-Silva 1770 (SPF)

Vellozia epidendroides Mart. ex Schult. & Schult.f.	Mello-Silva 1772 (G, SPF)
Vellozia exilis Goethart & Henrard	Alcantara 156 (SPF)
Vellozia froesii L.B.Sm.	Mello-Silva 3095 (SPF)
Vellozia furcata L.B.Sm. & Ayensu	Mello-Silva 2571 (SPF)
Vellozia geotegens L.B.Sm. & Ayensu	Mello-Silva 2422 (SPF)
Vellozia gigantea N.L.Menezes & Mello-Silva	Forzza 1076 (RB, SPF); Trovó 213 (SPF)
Vellozia giuliettiae N.L.Menezes & Mello-Silva	Mello-Silva 3167 (MBM, SPF)
Vellozia glabra J.C.Mikan	Mello-Silva 2400 (SPF)
Vellozia glauca Pohl	Mello-Silva CFCR11585 (BHCB, F, K, MBM, RB, SPF, UEC, US)
Vellozia goiasensis L.B.Sm.	Trovó 236 (SPF)
Vellozia graminea Pohl	Alcantara 107 (SPF)
Vellozia graomogolensis L.B.Sm.	Mello-Silva 1424 (SPF)
Vellozia hatschbachii L.B.Sm. & Ayensu	Mello-Silva 2474 (G, SPF)
Vellozia hemisphaerica Seub.	Mello-Silva 2576 (SPF); Mello-Silva 2800 (B, HUEFS, K, M, NY, RB, SPF, US)
Vellozia hirsuta Goethart & Henrard	Mello-Silva 1503 (SPF)
Vellozia intermedia Seub.	Mello-Silva 3246 (G, RB, SPF, US)
Vellozia jolyi L.B.Sm.	Mello-Silva 2146 (B, K, NY, RB, SPF, US)
Vellozia luteola Mello-Silva & N.L.Menezes	Mello-Silva CFCR10051 (K, RB, SPF, US)
Vellozia marcescens L.B.Sm.	Mello-Silva 3194 (SPF)
Vellozia maxillarioides L.B.Sm.	Mello-Silva CFCR8425 (F, K, MBM, SPF)
Vellozia metzgerae L.B.Sm.	Mello-Silva 3457 (SPF)
Vellozia minima Pohl	Mello-Silva 1735 (CTES, K, M, NY, RB, SPF)
Vellozia nanuzae L.B.Sm. & Ayensu	Mello-Silva 3394 (SPF)
Vellozia nivea L.B.Sm. & Ayensu	Mello-Silva 3442 (SPF)
Vellozia obtecta Mello-Silva	Sasaki s.n. (SPF 172980)
Vellozia ornata Mart. ex Schult. & Schult.f.	Alcantara 165 (SPF)
Vellozia patens L.B.Sm. & Ayensu	Mello-Silva 2667 (SPF)
Vellozia peripherica Mello-Silva	Mello-Silva 1989 (BHCB, CTES, F, G, HUEFS, K, NY, SP, SPF, US)
Vellozia plicata Mart.	Mello-Silva 2133

Vellozia prolifera Mello-Silva	Mello-Silva CFCR10000 (BHCB, CEPEC, NY, SPF)
Vellozia punctulata Seub.	Mello-Silva 2587 (HUEFS, K, SPF)
Vellozia religiosa Mello-Silva & D.Sasaki	Mello-Silva 2577 (SPF)
Vellozia resinosa Mart. ex Schult. & Schult.f.	Mello-Silva 3403 (SPF)
Vellozia scoparia Goethart & Henrard	Mello-Silva 1507 (SPF)
Vellozia sellowii Seub.	Mello-Silva CFCR11170 (SPF)
Vellozia semirii Mello-Silva & N.L.Menezes	Mello-Silva 3161 (K, M, MBM, SPF)
Vellozia sessilis L.B.Sm. ex Mello-Silva	Mello-Silva 2263 (CTES, K, SPF)
Vellozia seubertiana Goethart & Henrard	Mello-Silva 2154 (SPF)
Vellozia spiralis L.B.Sm.	Mello-Silva CFCR10789 (F, K, SPF)
Vellozia stenocarpa Mello-Silva	Mello-Silva 2522 (SPF)
Vellozia stipitata L.B.Sm. & Ayensu	Alcantara 110 (SPF)
Vellozia strangii L.B.Sm. ex Mello-Silva	Mello-Silva 3537 (F, SPF)
Vellozia strangii x variabilis	Mello-Silva 3538 (SPF)
Vellozia streptophylla L.B.Sm.	Mello-Silva 3540 (SPF)
Vellozia subscabra J.C.Mikan	Mello-Silva 3506 (SPF)
Vellozia taxifolia (Mart. ex Schult. & Schult.f.) Mart. ex Seub.	Alcantara 179 (SPF)
Vellozia tillandsioides Mello-Silva	Mello-Silva 2525 (SPF)
Vellozia tragacantha (Mart. ex Schult. & Schult.f.) Mart. ex Seub.	Mello-Silva 1374 (SPF)
Vellozia tubiflora (A.Rich.) Kunth	Mello-Silva 2158 (BHCB, HRCB, HUFU, K, MBM, NY, SP, SPF, SPFR, UEC)
Vellozia variabilis Mart. ex Schult. & Schult.f.	Mello-Silva 3406 (SPF)
Vellozia variegata Goethart & Henrard	Mello-Silva 2644 (SPF)
Xerophyta dasylirioides Baker	Treutlein 412 (TEX)
Xerophyta eglandulosa H.Perr.	Treutlein 410 (TEX)
Xerophyta cf. *eglandulosa* H.Perr.	Röösli 84 (BONN)
Xerophyta elegans (Balf.) Baker	Chase 253 (K)
Xerophyta equisetoides Baker	Rodrigues s.n. (SPF 181828)
Xerophyta humilis (Baker) T.Durand & Schinz	Seine 1495 (BONN)
Xerophyta pauciramosa (L.B.Sm. & Ayensu) Behnke	Seine s.n. (BONN 11776)

Xerophyta pectinata Baker	s.c., s.n. (BONN 13691); Fischer 3021a (BONN)
Xerophyta pinifolia Lam.	Treutlein 406 (TEX)
Xerophyta retinervis Baker	Cultivated (UConn 199700041)
Xerophyta schlechteri (Baker) N.L.Menezes	Seine 1403 (BONN)
Xerophyta sp. 1	Seine 1167 (BONN)
Xerophyta sp. 2	Seine 1496 (BONN)
Xerophyta sp. 3	Seine 1292 (BONN)
Xerophyta sp. 4	Seine 767 (BONN)
Xerophyta sp. 5	Amirante 511 (BONN)
Xerophyta sp. 6	Amirante 563 (BONN)
Xerophyta sp. 7	Amirante 584 (BONN)
Xerophyta villosa (Baker) L.B.Sm. & Ayensu	Seine s.n. (BONN 11775)
Xerophyta viscosa Baker	Behnke s.n. (BONN 23981)

Supplementary Material 3. *Primers* and thermocycler conditions used (based on Mello-Silva *et al.* 2011, Alcantara *et al.* 2018).

DNA markers	Voucher	References	Thermocycler conditions
atpB-rbcL	atpB-1 (ACA TCK ART ACK GGA CCA ATA A) rbcL-1 (AAC ACC AGC TTT RAA TCC AA)	Chiang *et al.* (1998)	denaturation at 94ºC 2 min, 28 cycles with denaturation at 94ºC 1 min, annealing at 52ºC 1 min, extension at 72ºC 1 min and last extension 7 min
trnH-psbA	trnHGUG (CGC GCA TGG TGG ATT CAC AAT CC) psbA (GTT ATG CAT GAA CGT AAT GCT C)	Shaw *et al.* (2005)	denaturation at 80ºC 5 min, 35 cycles with denaturation at 94ºC 30 s, annealing at 50-56ºC 30 s, extension at 72ºC 1 min and last extension 10 min
trnL-trnF	tab c (CGA AAT CGG TAG ACG CTA CG) tab f (ATT TGA ACT GGT GAC ACG AG)	Taberlet *et al.* (1991)	denaturation at 94ºC 2 min, 33 cycles with denaturation at 94ºC 1 min, annealing 54-62ºC 45 s, extension 72ºC 1 min 20 s and last extension 5 min
ITS rnDNA	26SE (ACG AAT TCA TGG TCC GGT GAA GTG TTC G) 17SE (TAG AAT TCC CCG GTT CGC TCG CCG TTA C)	Sun *et al.* (1994)	denaturation at 94ºC 2 min, 28 cycles with denaturation at 94ºC 1 min, annealing at 52ºC 1 min, extension at 72ºC 1 min and last extension 7 min

Supplementary Material 4. Characters analysis and coding of character states used in the morphological analysis (based on Mello-Silva 2005, Mello-Silva *et al.* 2011, ined.; Menezes *et al.* 1994).

1. Phyllotaxis: tristichous (0); spirotristichous (1)
2. Transverse posture of leaf blade: arcuate (0); plane (1)
3. Longitudinal posture of dry leaf blade: involute or flat (0); revolute (1)
4. Furrows in leaf blade: absent (0); on abaxial surface only (1); on both surfaces (2)
5. Leaf trichomes or emergences: absent (0); multicellular base, on lamina (1); multicellular base, on margins and midrib (2)
6. Stomatal distribution in leaves: hypostomatic (0); hypoamphistomatic (1); amphistomatic (2)
7. Specialized cells: absent (0); present on adaxial surface (1)
8. Phloem strands: two, separated (0); two, united at bottom (1); one (2)
9. Pedicel exposure: evident (0); hidden by leaves (1)
10. Transverse section of pedicel: triangular (0); circular (1)
11. Hypanthial emergences: absent (0); laxly disposed (1); densely disposed (2)
12. Hypanthial tube: absent or much shorter than ovary (0); shorter than ovary (1); equal to ovary (2); longer than ovary (3)
13. Predominant perianth color: purple (0); white (1); yellow (2); red (3); green (4); orange (5); pink (6)
14. Apical appendage in anther: absent (0); present (1)
15. Relative position of stigma and stamens: stigma above stamens (0); stigma at same level or below stamens (1)
16. Capsule: loculicidal (0); apical loculicidal (1); fissuricidal (2)

Supplementary Material 5. Morphological matrix of Barbacenia species. '?', missing data; A, 0 and 1; B, 0 and 2; C, 1 and 2; D, 2 and 3; E, 2 and 5; F, 3 and 6; G, 3, 5 and 6.

Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
B. amphirupia	0	0	0	0	C	0	0	0	0	1	0	1	6	1	1	2
B. blackii	1	1	0	0	1	2	0	0	0	1	C	3	5	0	0	0
B. blanchetii	0	0	0	0	1	0	1	0	0	1	2	3	3	0	0	0
B. brevifolia	0	1	0	0	2	C	0	0	0	1	1	1	G	1	1	2
B. celiae	0	0	1	0	2	?	?	0	0	1	1	0	0	1	0	?
B. coccinea	1	1	?	?	?	?	?	?	0	?	2	2	3	?	1	?
B. contasana	1	1	?	?	?	?	?	?	0	?	1	3	1	1	1	?
B. delicatula	?	0	?	?	2	?	?	?	0	?	0	1	1	1	1	2
B. excapa	0	0	?	?	2	?	?	?	1	?	1	3	2	1	0	?
B. fannieae	0	0	0	0	2	1	0	0	0	1	1	1	6	1	1	2
B. filamentifera	1	1	0	0	2	?	?	0	0	?	2	3	3	0	0	?
B. flava	1	1	0	0	2	2	0	0	0	0	2	C	2	A	1	0
B. flavida	0	0	?	?	2	?	?	?	0	?	1	2	3	1	1	2
B. fulva	1	1	?	?	2	?	?	?	0	?	2	1	0	1	1	1
B. gardneri	1	1	0	0	2	?	?	0	0	?	1	3	3	0	1	0
B. gentianoides	1	0	0	0	2	1	1	0	1	1	0	3	2	1	0	0
B. glabra	0	0	1	0	2	?	?	0	0	1	0	2	2	1	0	2
B. glutinosa	1	1	?	?	1	?	?	?	0	?	2	1	5	1	1	?
B. gounelleana	0	0	1	0	2	0	A	0	0	1	1	1	6	1	1	2
B. graminifolia	1	0	?	?	2	?	?	?	0	?	1	3	5	0	0	0
B. ignea	1	1	0	0	1	2	0	0	0	1	2	1	5	0	1	0
B. involucrata	1	1	?	?	2	?	?	?	1	?	2	1	E	0	1	1
B. irwiniana	0	0	1	0	2	0	1	0	0	1	1	1	6	1	1	2
B. latifolia	1	1	0	0	1	?	?	0	0	0	1	2	1	0	0	0
B. longiflora	1	1	?	?	2	?	?	?	0	?	2	3	D	0	0	0
B. lymansmithii	1	1	0	0	1	?	?	0	0	0	1	1	4	1	1	?
B. macrantha	0	0	0	0	1	?	?	1	1	?	1	3	6	0	0	0
B. mantiqueirae	0	0	1	0	2	1	0	0	0	1	1	1	6	1	1	2
B. maritima	0	0	0	0	2	1	0	0	0	1	1	1	0	1	1	2
B. markgrafii	1	1	0	A	1	2	0	0	0	1	1	3	4	0	1	0
B. minima	1	0	?	1	2	?	?	?	0	?	1	1	2	1	1	?
B. nana	1	0	?	?	1	?	?	?	1	?	1	3	6	0	0	?
B. pabstiana	0	0	0	0	2	1	0	0	0	1	1	1	0	1	1	2
B. paranaensis	1	0	?	?	1	?	?	?	0	?	1	3	6	0	0	?
B. plantaginea	0	0	0	0	2	2	0	0	0	0	0	3	3	0	0	2
B. pungens	1	1	0	2	1	2	0	0	0	0	1	2	6	0	0	1
B. purpurea	0	0	1	0	2	C	0	0	0	A	1	1	0	1	1	2

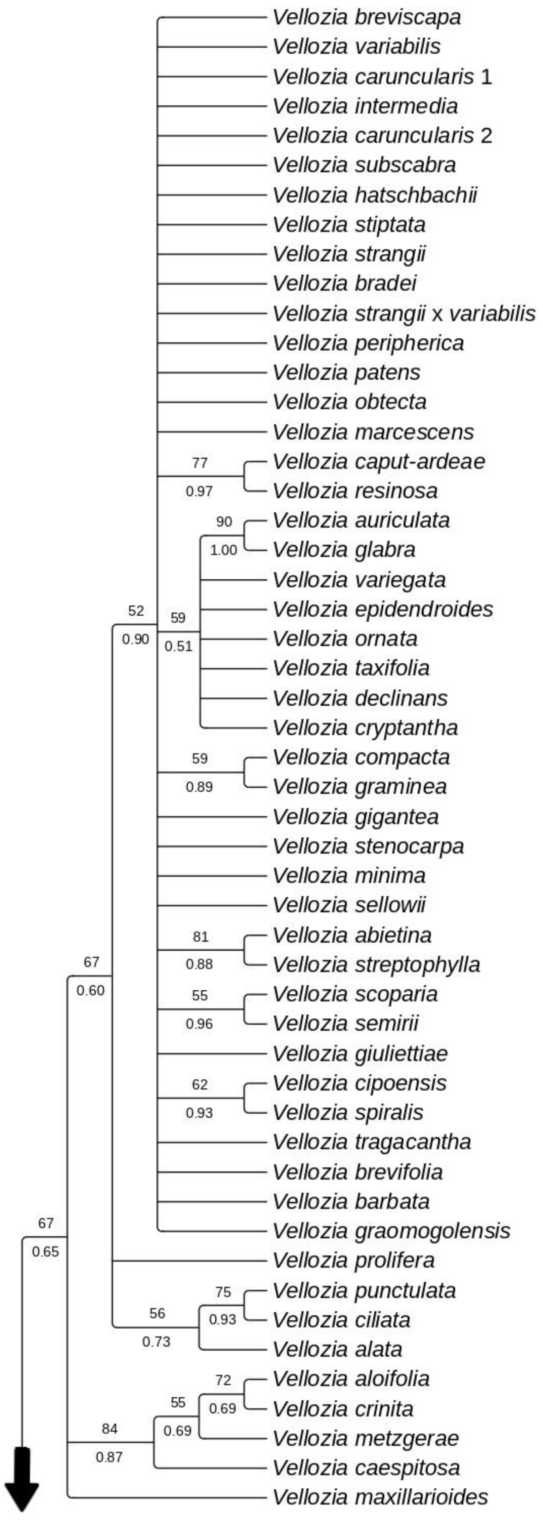
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
B. rectifolia	0	0	?	?	2	?	?	?	1	?	1	3	2	?	?	?
B. reflexa	1	1	0	0	2	2	0	0	0	1	2	3	4	0	0	1
B. riedeliana	1	1	0	2	2	?	?	0	0	1	1	3	2	0	0	0
B. riparia	0	0	1	0	2	1	0	0	0	1	0	1	1	1	1	2
B. rogieri	0	1	0	0	2	1	0	0	0	1	1	1	0	1	1	2
B. rubrovirens	1	1	0	0	2	?	?	0	0	1	2	3	4	0	1	1
B. serracabralea	1	0	?	?	2	?	?	?	0	1	1	1	0	1	1	1
B. spectabilis	0	0	0	0	2	1	0	0	0	1	1	1	0	1	1	2
B. spiralis	1	1	0	0	2	2	0	0	0	1	0	1	6	1	0	1
B. squamata	0	0	0	0	2	C	0	0	0	1	1	1	F	1	1	2
B. tomentosa	1	0	0	0	1	?	?	0	0	1	1	3	3	1	0	0
B. umbrosa	1	1	0	0	1	1	0	0	0	1	C	3	3	0	0	0
B. vandellii	1	1	0	0	2	?	?	0	0	1	2	1	3	0	1	0

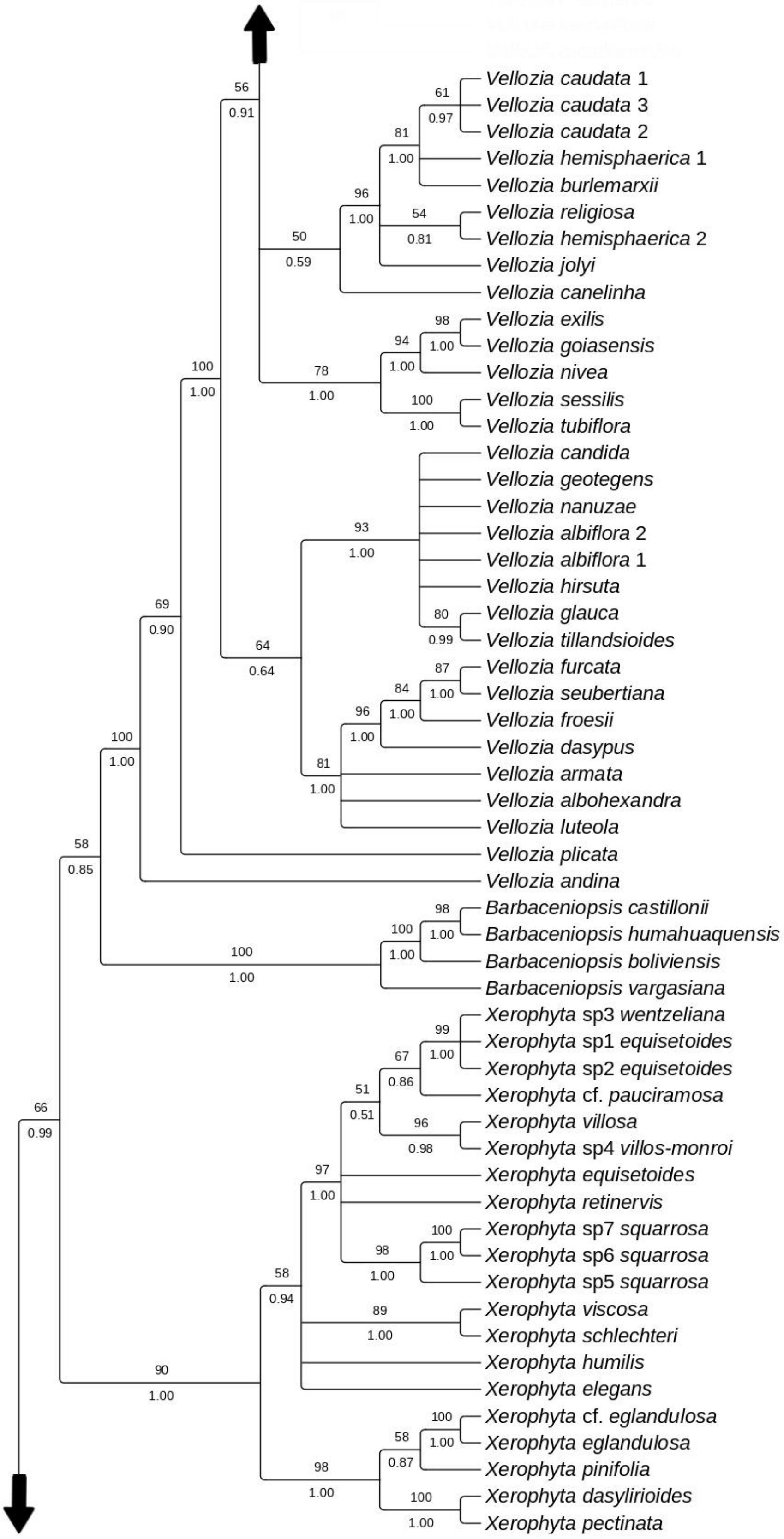
Supplementary Material 6. Source of information used in the morphological analysis for each species. Complete reference list is presented below.

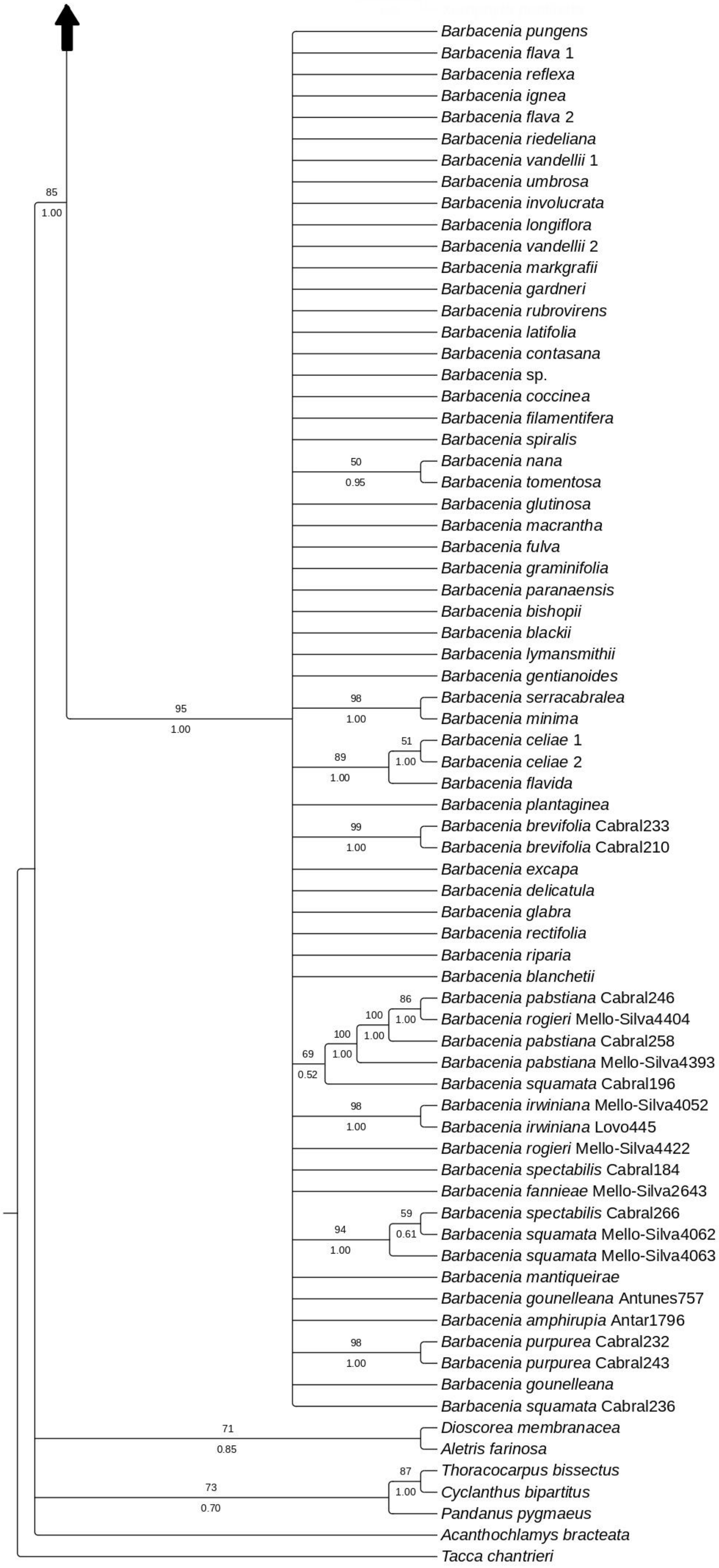
Species	**Literature**	**Herbarium**
Acanthochlamys bracteata	Mello-Silva *et al.* 2011	–
Barbacenia amphirupia	–	Antar 1796 (SPF), Cabral 315 (SPF), Daneu 330 (SPF)
Barbacenia bishopii	Smith 1985, Menezes *et al.* 1993	King 8440 (SPF)
Barbacenia blackii	Mello-Silva *et al.* 2011	–
Barbacenia blanchetii	Menezes *et al.* 1993, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Blanchet 3278 (BM)
Barbacenia brevifolia	–	Cabral 210 and 233 (SPF), Martinelli 3555 (SPF), Orsich s.n. SPF 33978 (SPF)
Barbacenia celiae	Ayensu 1974, Menezes *et al.* 1993, Alcantara *et al.* 2018	Maguire 40025 (NY), Maguire 40298 (NY)
Barbacenia coccinea	Schultes & Schultes 1829, Menezes *et al.* 1993	Martius 1479 (M)
Barbacenia contasana	Menezes *et al.* 1993, Mello-Silva 1995	Harley 15157 (U)
Barbacenia delicatula	Ayensu 1974, Smith & Ayensu 1976, Menezes *et al.* 1993	Smith 15975 (US), Hatschbach 35399 (SP), Menezes 1366 (NY)
Barbacenia exscapa	Martius 1823, Ayensu 1974, Menezes *et al.* 1993, Alcantara *et al.* 2018	Anderson 35831 (NY)
Barbacenia fannieae	–	Cabral 240 (SPF), Mello-Silva 2643 (SPF)
Barbacenia filamentifera	Smith & Ayensu 1976, Alcantara *et al.* 2018	Hatschbach 27955 (US)
Barbacenia flava	Mello-Silva *et al.* 2011	–
Barbacenia flavida	Henrard 1937, Menezes *et al.* 1993, Mello-Silva FDB 2019	Glaziou 22207bis (L)
Barbacenia fulva	Henrard 1937, Menezes *et al.* 1993, Alcantara *et al.* 2018	Saint-Hilaire C1-362 (P), Romero 6541 (HUFU)
Barbacenia gardneri	Seubert 1847, Ayensu 1974, Menezes *et al.* 1993, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Gardner 5217 (GH)
Barbacenia gentianoides	Henrard 1937, Ayensu 1974, Menezes *et al.* 1993, Mello-Silva FDB 2019	Forzza 469 (NY)
Barbacenia glabra	Henrard 1937, Menezes *et al.* 1993, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Saint-Hilaire C1-352 (P), Farinaccio206 (HUFU)
Barbacenia glutinosa	Henrard 1937, Menezes *et al.* 1993	Riedel 1060 (L)
Barbacenia gounelleana	–	Meireles 3014 (SPF), Mello-Silva 2849 (SPF), Trovó 322 (SPF), Sasaki 1075 (SPF)
Barbacenia graminifolia	Smith 1963, Menezes *et al.* 1993, Mello-Silva FDB 2019	Heringer 5950 (UB)
Barbacenia ignea	Mello-Silva *et al.* 2011	–
Barbacenia involucrata	Ayensu 1974, Smith 1963, Smith & Ayensu 1976, Menezes *et al.* 1993, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Heringer 5944 (US)
Barbacenia irwiniana	–	Brade 16969 (SPF), Mello-Silva 4052 (SPF)
Barbacenia latifolia	Smith & Ayensu 1976, Menezes *et al.* 1993, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Duarte 7884 (US)
Barbacenia longiflora	Martius 1823, Ayensu 1974, Menezes *et al.* 1993, Alcantara *et al.* 2018	Martius 1317 (M), Menezes CFCR10657 (NY), Mello-Silva CFCR11127 (NY)

Barbacenia lymansmithii	Mello-Silva & Menezes 1999, Alcantara *et al*. 2018, Mello-Silva FDB 2019	Farinaccio 133 (SPF)
Barbacenia macrantha	Ayensu 1974, Menezes *et al*. 1993, Alcantara *et al*. 2018, Mello-Silva FDB 2019	Menezes 606 (NY)
Barbacenia mantiqueirae	_	Mello-Silva 4717 (SPF), Trovó 323 (SPF)
Barbacenia markgrafii	Mello-Silva *et al*. 2011	_
Barbacenia minima	Menezes *et al*. 1993, Alcantara *et al*. 2018, Mello-Silva FDB 2019	Menezes 613 (NY)
Barbacenia nana	Ayensu 1974, Smith & Ayensu 1976, Menezes *et al*. 1993, Alcantara *et al*. 2018	Smith 15973 (US)
Barbacenia pabstiana	_	Brade 19774 (SPF), Cabral 246, 258 and 260 (SPF), Mello-Silva 4400 (SPF)
Barbacenia paranaensis	Ayensu 1974, Menezes *et al*. 1993, Mello-Silva FDB 2019	Hatschbach 5359 (MBM), Hatschbach 54860 (HUEFS)
Barbacenia plantaginea	Mello-Silva *et al*. 2011	_
Barbacenia pungens	Mello-Silva *et al*. 2011	_
Barbacenia purpurea	_	Cabral 232 and 243 (SPF), Menezes 635 (SPF)
Barbacenia rectifolia	Smith & Ayensu 1976	Anderson 35674 (US)
Barbacenia reflexa	Mello-Silva *et al*. 2011	_
Barbacenia riedeliana	Henrard 1937, Ayensu 1974, Menezes *et al*. 1993, Alcantara *et al*. 2018, Mello-Silva FDB 2019	Riedel 1058 (LE)
Barbacenia riparia	Mello-Silva *et al*. 2011	_
Barbacenia rogieri	_	Mello-Silva 4404 and 4422 (SPF)
Barbacenia rubrovirens	Martius 1823, Menezes *et al*. 1993, Alcantara *et al*. 2018, Mello-Silva FDB 2019	Tamashiro 17212 (UEC)
Barbacenia serracabralea	Mello-Silva 2014, Alcantara *et al.* 2018	Mello-Silva 2505 (NY)
Barbacenia spectabilis	_	Anorikopoulos s.n. SPF 180490 (SPF), Cabral 184 and 266 (SPF), Menezes 722 (SPF)
Barbacenia spiralis	Mello-Silva *et al*. 2011	_
Barbacenia squamata	_	Cabral 196 and 236 (SPF), Mello-Silva 4062 and 4063 (SPF), Sucre 2381 (SPF)
Barbacenia tomentosa	Henrard 1937, Ayensu 1974, Menezes *et al.* 1993, Mello-Silva 2005, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Forzza 2121 (HUFU)
Barbacenia umbrosa	Mello-Silva *et al*. 2011	_
Barbacenia vandellii	Seubert 1847, Ayensu 1974, Menezes *et al.* 1993, Alcantara *et al.* 2018, Mello-Silva FDB 2019	Mello-Silva CFCR5454 (SPF)

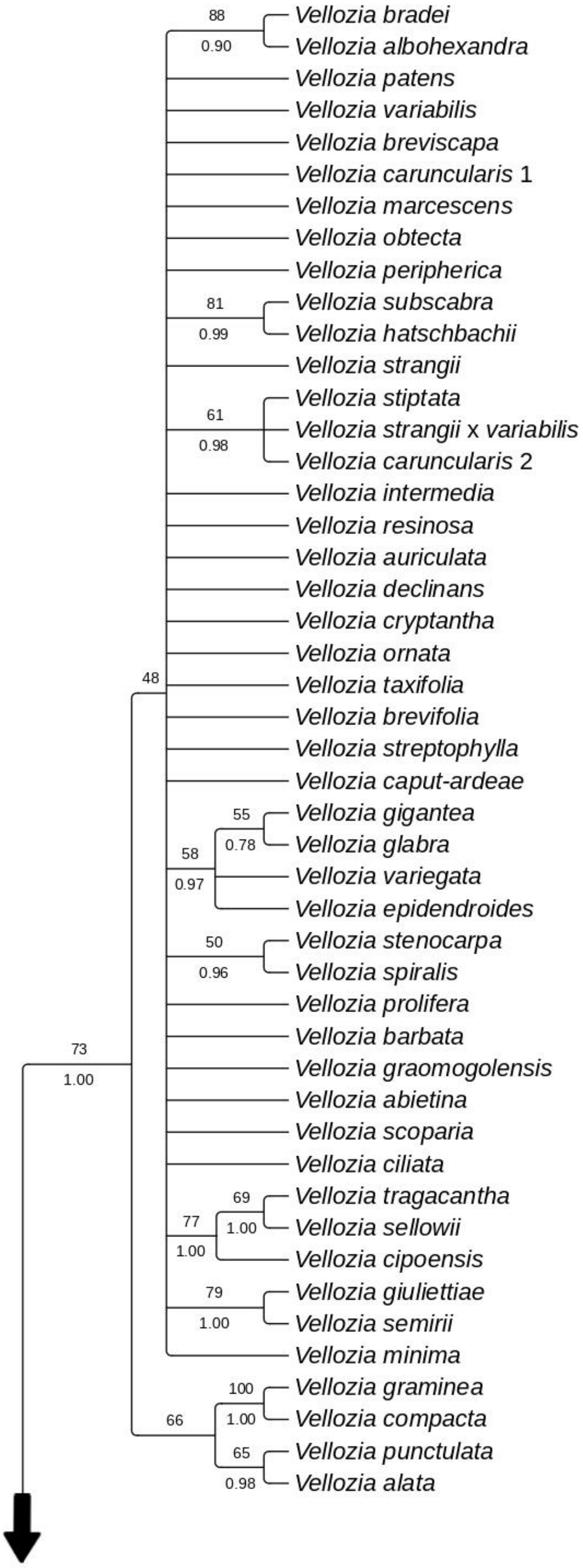
Supplementary Material 7. Maximum Likelihood tree based on nuclear (ITS) dataset. Numbers above branches are Maximum Likelihood Bootstrap values and below branches are Bayesian Posterior Probabilities.

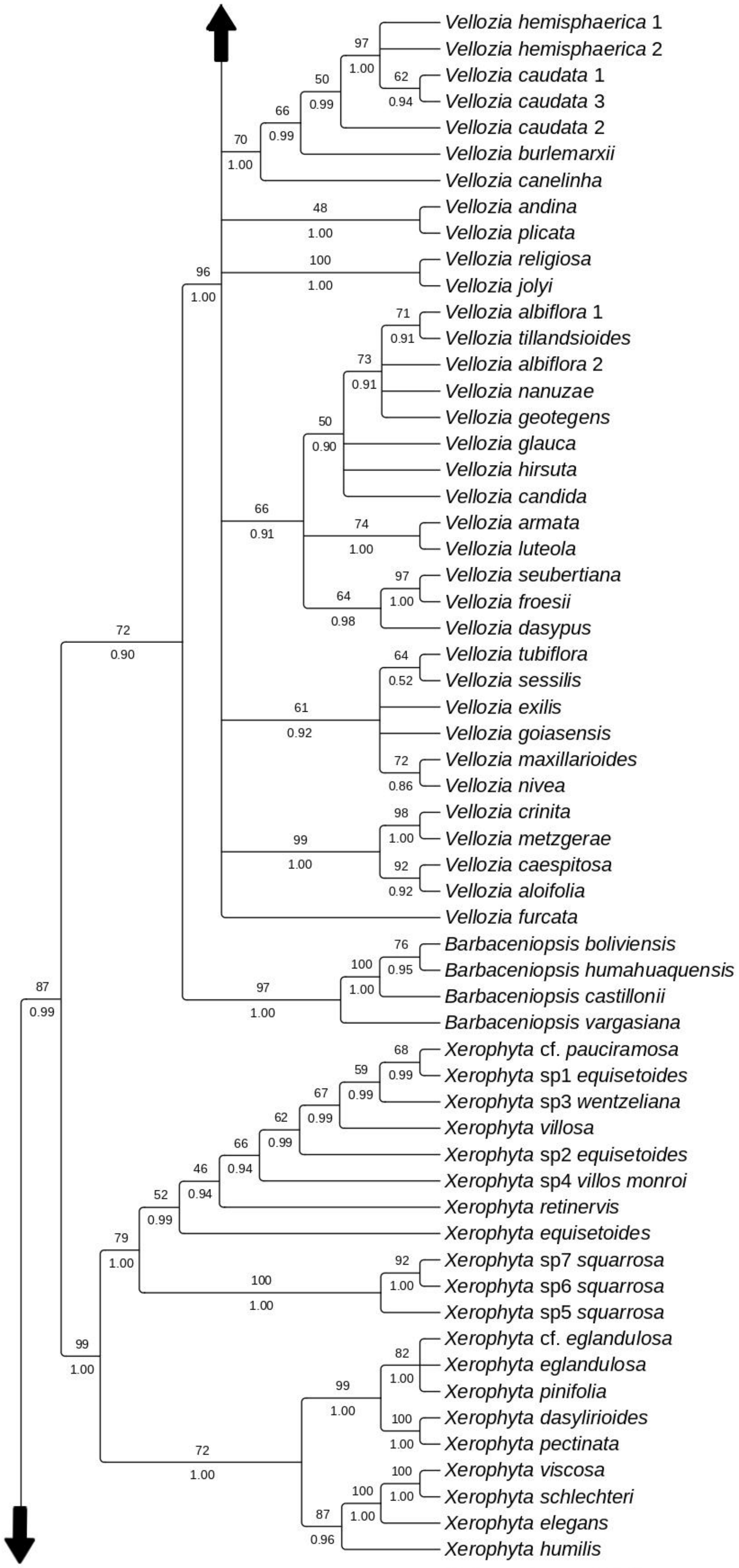


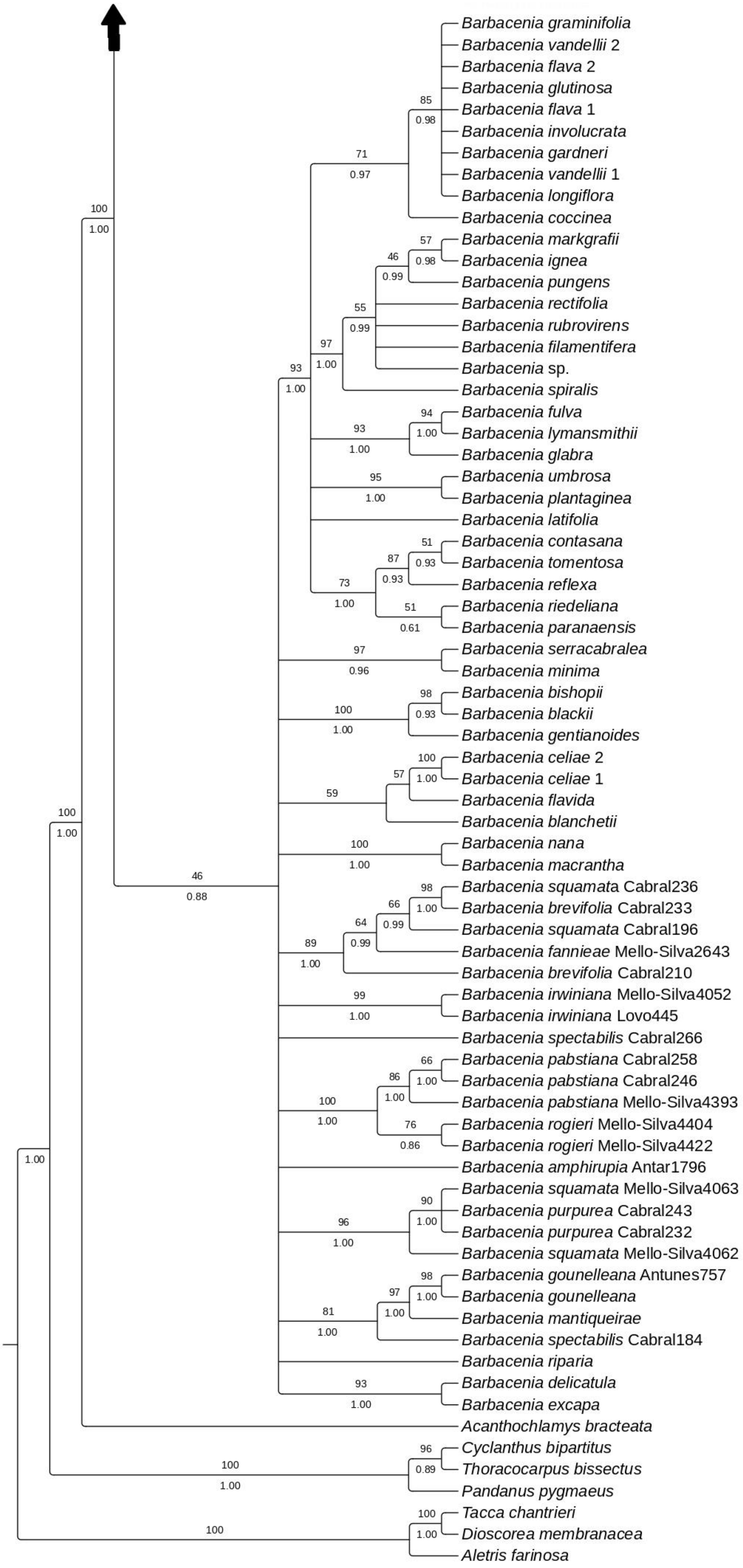

56
0.91
61
Vellozia caudata 1
Vellozia caudata 3
0.97
Vellozia caudata 2
81
1.00
Vellozia hemisphaerica 1
Vellozia burlemarxii
96
1.00
54
Vellozia religiosa
50
0.81
Vellozia hemisphaerica 2
0.59
Vellozia jolyi
Vellozia canelinha
98
Vellozia exilis
94
1.00
Vellozia goiasensis
100
1.00
78
Vellozia nivea
1.00
1.00
100
Vellozia sessilis
1.00
Vellozia tubiflora
Vellozia candida
Vellozia geotegens
Vellozia nanuzae
93
Vellozia albiflora 2
1.00
Vellozia albiflora 1
Vellozia hirsuta
69
0.90
80
Vellozia glauca
0.99
Vellozia tillandsioides
64
0.64
87
Vellozia furcata
84
1.00
Vellozia seubertiana
96
1.00
Vellozia froesii
100
1.00
1.00
Vellozia dasypus
81
Vellozia armata
1.00
Vellozia albohexandra
Vellozia luteola
58
0.85
Vellozia plicata
Vellozia andina
98
Barbaceniopsis castillonii
100
1.00
Barbaceniopsis humahuaquensis
100
1.00
1.00
Barbaceniopsis boliviensis
1.00
Barbaceniopsis vargasiana
Xerophyta sp3 wentzeliana
99
Xerophyta sp1 equisetoides
1.00
67
Xerophyta sp2 equisetoides
0.86
51
Xerophyta cf. pauciramosa
66
0.51
0.99
96
Xerophyta villosa
0.98
Xerophyta sp4 villos-monroi
97
Xerophyta equisetoides
1.00
Xerophyta retinervis
100
Xerophyta sp7 squarrosa
98
1.00
Xerophyta sp6 squarrosa
1.00
Xerophyta sp5 squarrosa
58
0.94
89
Xerophyta viscosa
1.00
Xerophyta schlechteri
Xerophyta humilis
90
Xerophyta elegans
1.00
100
Xerophyta cf. eglandulosa
58
1.00
Xerophyta eglandulosa
0.87
Xerophyta pinifolia
98
1.00
100
Xerophyta dasylirioides
1.00
Xerophyta pectinata


Barbacenia pungens
Barbacenia flava 1
Barbacenia reflexa
Barbacenia ignea
Barbacenia flava 2
Barbacenia riedeliana
Barbacenia vandellii 1
Barbacenia umbrosa
85
1.00
Barbacenia involucrata
Barbacenia longiflora
Barbacenia vandellii 2
Barbacenia markgrafii
Barbacenia gardneri
Barbacenia rubrovirens
Barbacenia latifolia
Barbacenia contasana
Barbacenia sp.
Barbacenia coccinea
Barbacenia filamentifera
Barbacenia spiralis
50
0.95
Barbacenia nana
Barbacenia tomentosa
Barbacenia glutinosa
Barbacenia macrantha
Barbacenia fulva
Barbacenia graminifolia
Barbacenia paranaensis
Barbacenia bishopii
Barbacenia blackii
Barbacenia lymansmithii
Barbacenia gentianoides
98
1.00
Barbacenia serracabralea
95
1.00
Barbacenia minima
51
1.00
Barbacenia celiae 1
89
1.00
Barbacenia celiae 2
Barbacenia flavida
Barbacenia plantaginea
99
1.00
Barbacenia brevifolia Cabral233
Barbacenia brevifolia Cabral210
Barbacenia excapa
Barbacenia delicatula
Barbacenia glabra
Barbacenia rectifolia
Barbacenia riparia
Barbacenia blanchetii
86
1.00
100
1.00
100
1.00
69
0.52
Barbacenia pabstiana Cabral246
Barbacenia rogieri Mello-Silva4404
Barbacenia pabstiana Cabral258
Barbacenia pabstiana Mello-Silva4393
Barbacenia squamata Cabral196
98
1.00
Barbacenia irwiniana Mello-Silva4052
Barbacenia irwiniana Lovo445
Barbacenia rogieri Mello-Silva4422
Barbacenia spectabilis Cabral184
Barbacenia fannieae Mello-Silva2643
59
0.61
94
1.00
Barbacenia spectabilis Cabral266
Barbacenia squamata Mello-Silva4062
Barbacenia squamata Mello-Silva4063
Barbacenia mantiqueirae
Barbacenia gounelleana Antunes757
Barbacenia amphirupia Antar1796
98
1.00
Barbacenia purpurea Cabral232
Barbacenia purpurea Cabral243
Barbacenia gounelleana
Barbacenia squamata Cabral236
71
0.85
Dioscorea membranacea
Aletris farinosa
87
1.00
73
0.70
Thoracocarpus bissectus
Cyclanthus bipartitus
Pandanus pygmaeus
Acanthochlamys bracteata
Tacca chantrieri

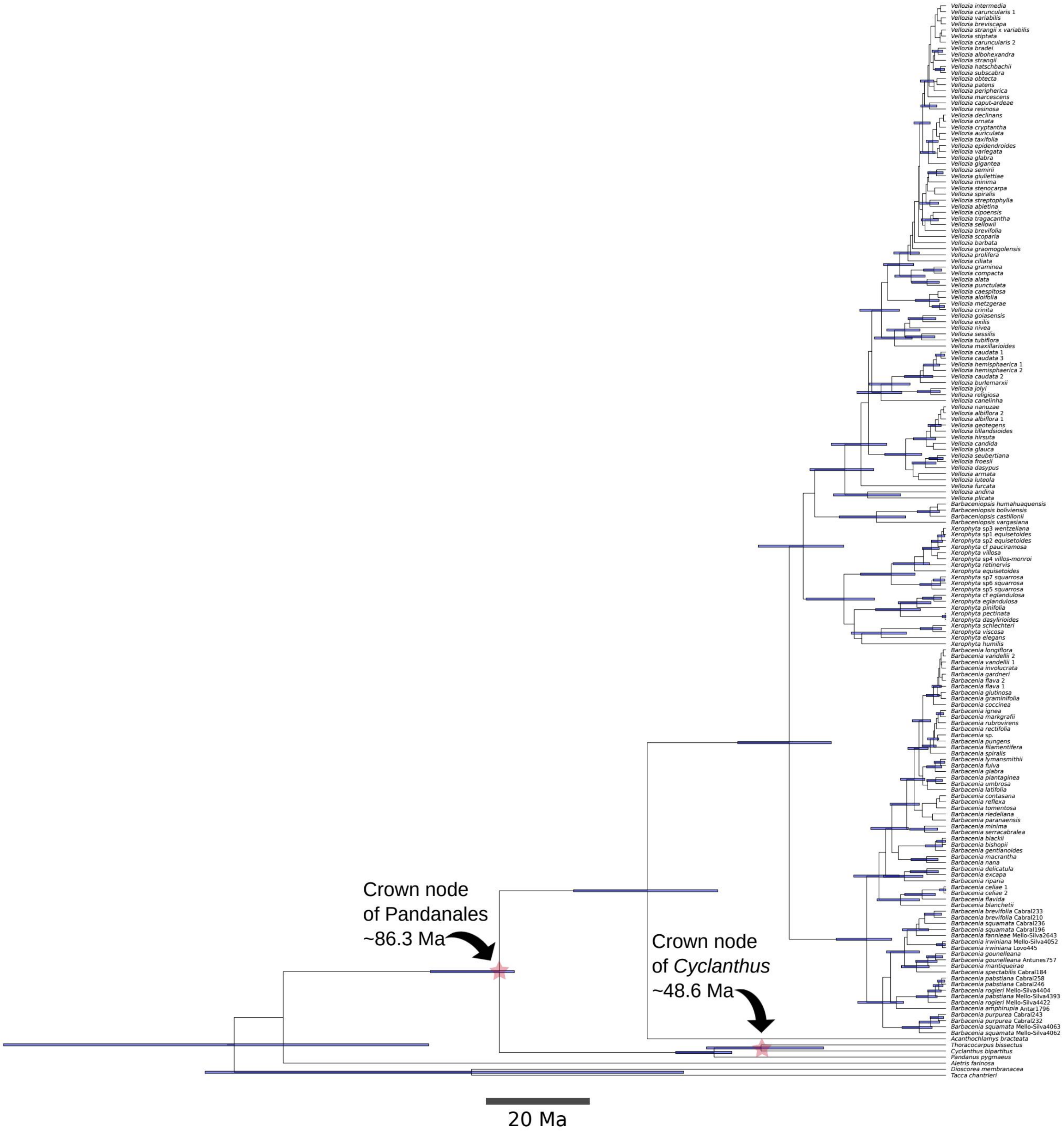
Supplementary Material 8. Maximum Likelihood tree based on plastid (*atpB-rbcL* + *trnH-psbA* + *trnL-trnF*) dataset. Numbers above branches are Maximum Likelihood Bootstrap values and below branches are Bayesian Posterior Probabilities.



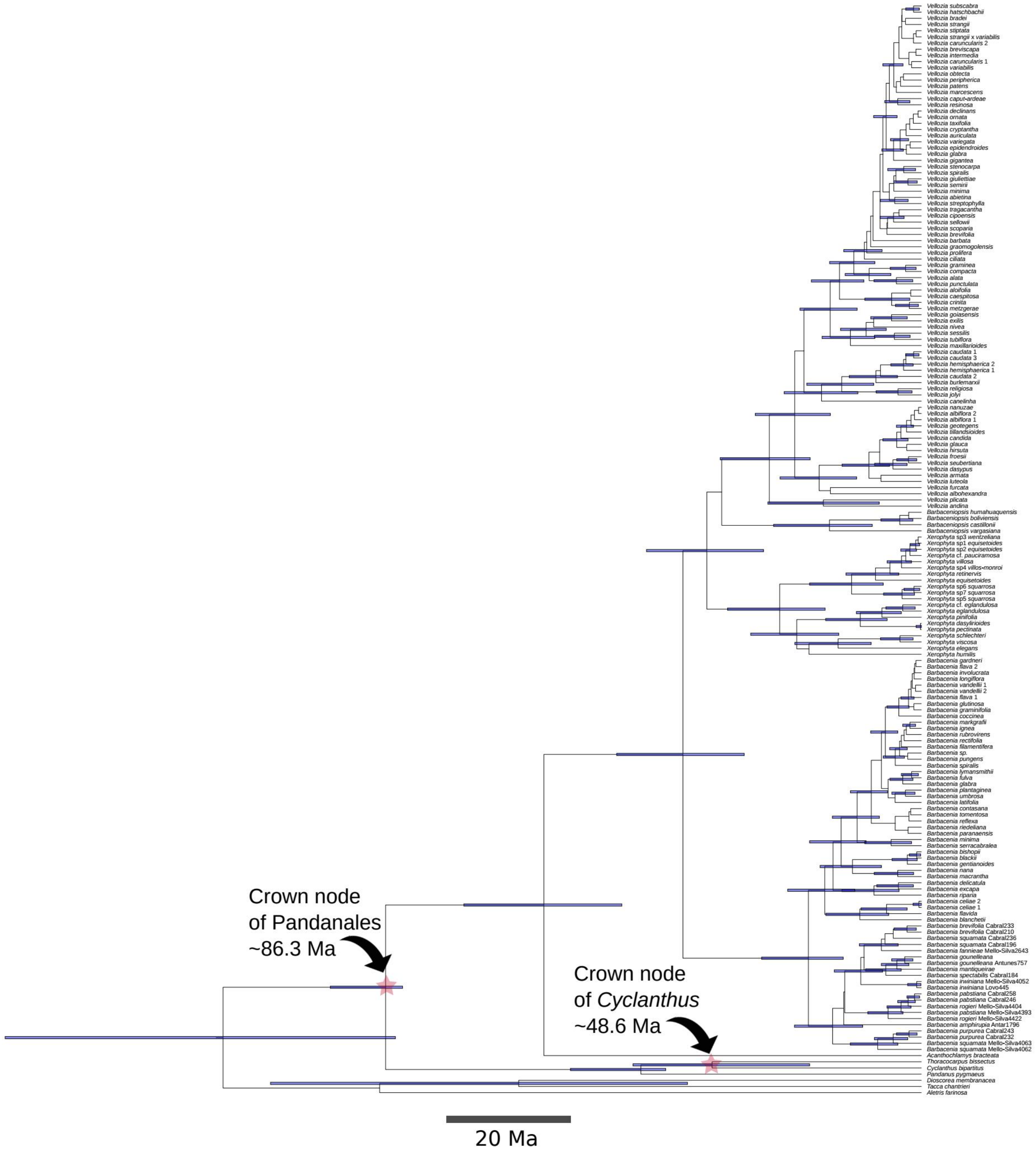

Vellozia hemisphaerica 1
Vellozia hemisphaerica 2
Vellozia caudata 1
Vellozia caudata 3
Vellozia caudata 2
Vellozia burlemarxii
Vellozia canelinha
Vellozia andina
Vellozia plicata
Vellozia religiosa
Vellozia jolyi
Vellozia albiflora 1
Vellozia tillandsioides
Vellozia albiflora 2
Vellozia nanuzae
Vellozia geotegens
Vellozia glauca
Vellozia hirsuta
Vellozia candida
Vellozia armata
Vellozia luteola
Vellozia seubertiana
Vellozia froesii
Vellozia dasypus
Vellozia tubiflora
Vellozia sessilis
Vellozia exilis
Vellozia goiasensis
Vellozia maxillarioides
Vellozia nivea
Vellozia crinita
Vellozia metzgerae
Vellozia caespitosa
Vellozia aloifolia
Vellozia furcata
Barbaceniopsis boliviensis
Barbaceniopsis humahuaquensis
Barbaceniopsis castillonii
Barbaceniopsis vargasiana
Xerophyta cf. pauciramosa
Xerophyta sp1 equisetoides
Xerophyta sp3 wentzeliana
Xerophyta villosa
Xerophyta sp2 equisetoides
Xerophyta sp4 villos monroi
Xerophyta retinervis
Xerophyta equisetoides
Xerophyta sp7 squarrosa
Xerophyta sp6 squarrosa
Xerophyta sp5 squarrosa
Xerophyta cf. eglandulosa
Xerophyta eglandulosa
Xerophyta pinifolia
Xerophyta dasylirioides
Xerophyta pectinata
Xerophyta viscosa
Xerophyta schlechteri
Xerophyta elegans
Xerophyta humilis
97
1.00
62
0.94
50
0.99
66
0.99
70
1.00
48
1.00
100
1.00
96
1.00
71
0.91
73
0.91
50
0.90
66
0.91
74
1.00
97
1.00
64
0.98
72
0.90
64
0.52
61
0.92
72
0.86
98
1.00
99
1.00
92
0.92
76
0.95
100
1.00
97
1.00
87
0.99
68
0.99
59
0.99
67
0.99
62
0.99
66
0.94
46
0.94
52
0.99
79
1.00
92
1.00
100
1.00
99
1.00
82
1.00
99
1.00
100
1.00
72
1.00
100
1.00
100
1.00
87
0.96


Barbacenia graminifolia
Barbacenia vandellii 2
Barbacenia flava 2
Barbacenia glutinosa
85
Barbacenia flava 1
0.98
Barbacenia involucrata
71
Barbacenia gardneri
0.97
Barbacenia vandellii 1
Barbacenia longiflora
100
Barbacenia coccinea
1.00
57
Barbacenia markgrafii
46
0.98
Barbacenia ignea
0.99
Barbacenia pungens
55
Barbacenia rectifolia
0.99
Barbacenia rubrovirens
97
Barbacenia filamentifera
93
1.00
Barbacenia sp.
1.00
Barbacenia spiralis
94
Barbacenia fulva
93
1.00
Barbacenia lymansmithii
1.00
Barbacenia glabra
95
Barbacenia umbrosa
1.00
Barbacenia plantaginea
Barbacenia latifolia
51
Barbacenia contasana
87
0.93
Barbacenia tomentosa
0.93
73
Barbacenia reflexa
1.00
51
Barbacenia riedeliana
0.61
Barbacenia paranaensis
97
Barbacenia serracabralea
0.96
Barbacenia minima
98
Barbacenia bishopii
100
0.93
Barbacenia blackii
1.00
Barbacenia gentianoides
100
Barbacenia celiae 2
100
57
1.00
Barbacenia celiae 1
1.00
59
Barbacenia flavida
Barbacenia blanchetii
100
Barbacenia nana
1.00
Barbacenia macrantha
46
98
Barbacenia squamata Cabral236
0.88
66
1.00
Barbacenia brevifolia Cabral233
64
0.99
Barbacenia squamata Cabral196
89
0.99
Barbacenia fannieae Mello-Silva2643
1.00
Barbacenia brevifolia Cabral210
99
Barbacenia irwiniana Mello-Silva4052
1.00
Barbacenia irwiniana Lovo445
Barbacenia spectabilis Cabral266
66
Barbacenia pabstiana Cabral258
86
1.00
Barbacenia pabstiana Cabral246
100
1.00
Barbacenia pabstiana Mello-Silva4393
1.00
76
Barbacenia rogieri Mello-Silva4404
0.86
Barbacenia rogieri Mello-Silva4422
1.00
Barbacenia amphirupia Antar1796
Barbacenia squamata Mello-Silva4063
90
Barbacenia purpurea Cabral243
96
1.00
Barbacenia purpurea Cabral232
1.00
Barbacenia squamata Mello-Silva4062
98
Barbacenia gounelleana Antunes757
97
1.00
Barbacenia gounelleana
81
1.00
Barbacenia mantiqueirae
1.00
Barbacenia spectabilis Cabral184
Barbacenia riparia
93
Barbacenia delicatula
1.00
Barbacenia excapa
Acanthochlamys bracteata
96
Cyclanthus bipartitus
100
0.89
Thoracocarpus bissectus
1.00
Pandanus pygmaeus
100
Tacca chantrieri
100
1.00
Dioscorea membranacea
Aletris farinosa

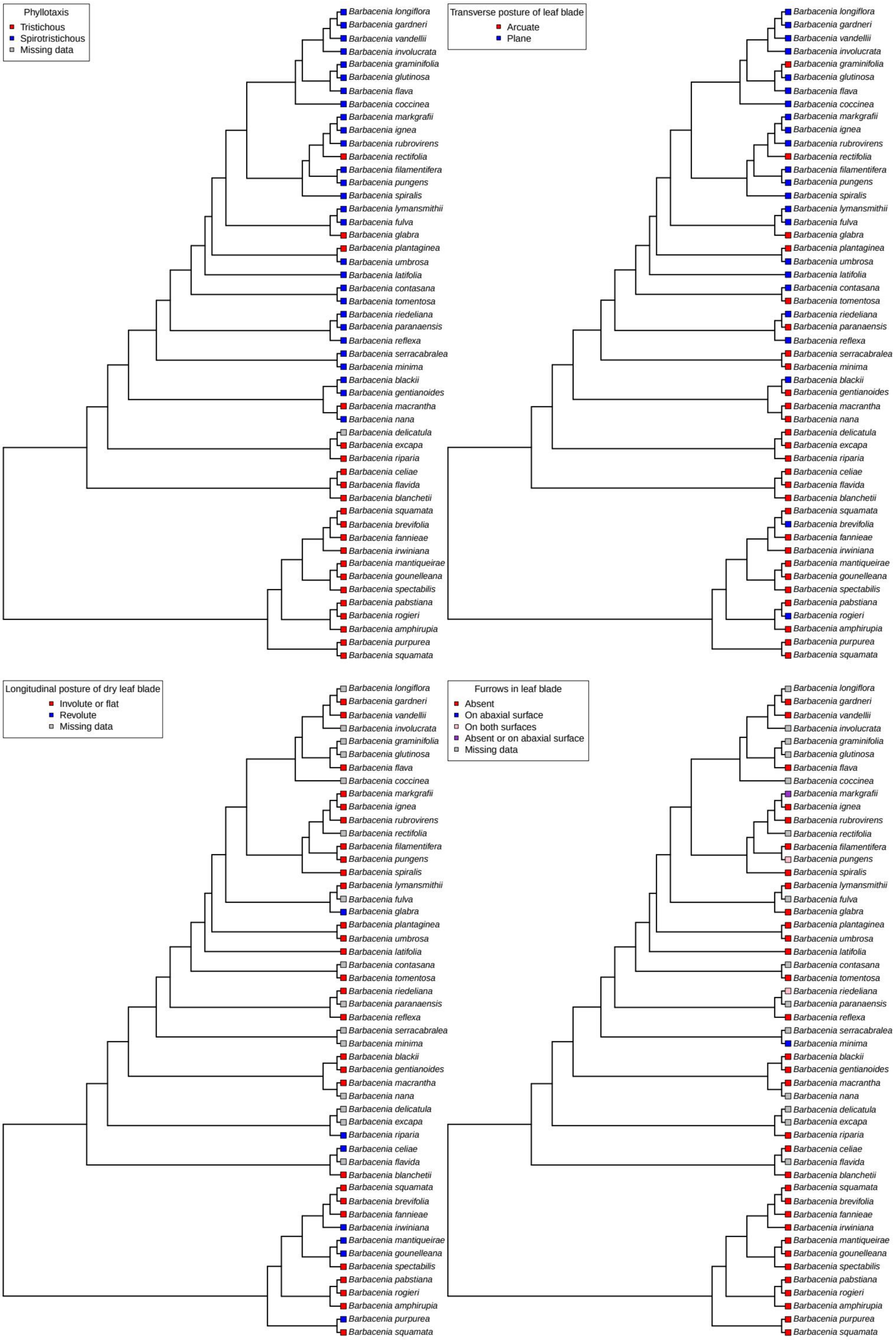
Supplementary Material 9. Chronogram of Velloziaceae based on BEAST analysis adopting Lognormal clock-model.

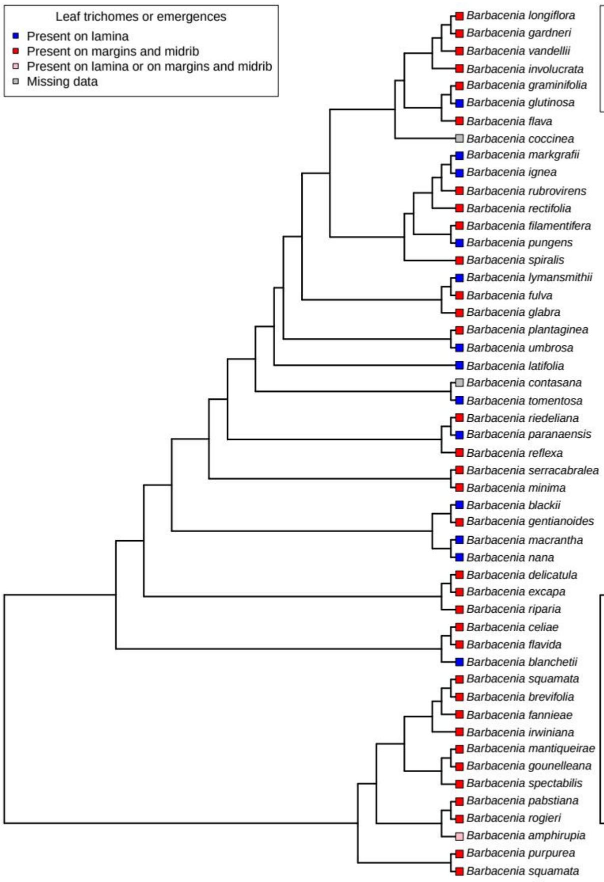


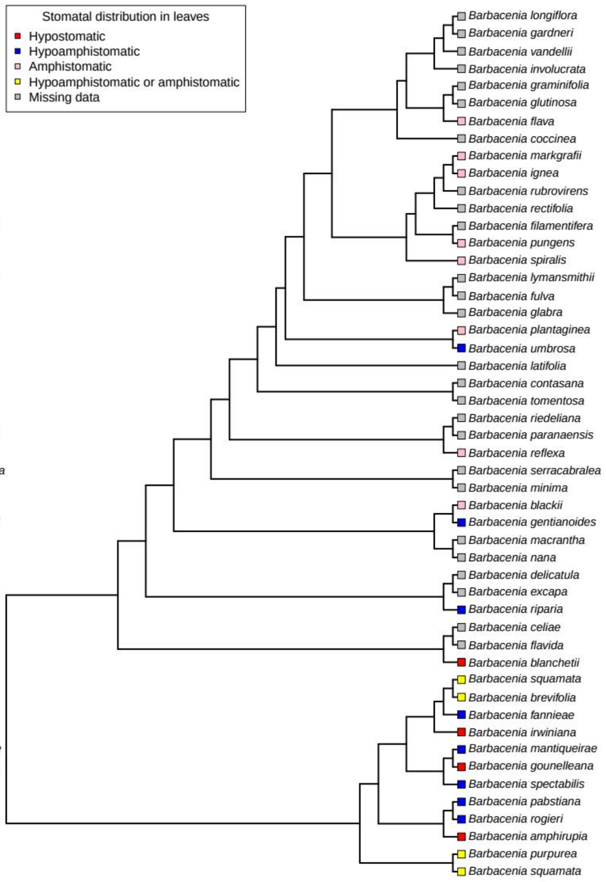
Supplementary Material 10. Chronogram of Velloziaceae based on BEAST analysis adopting Exponential clock-model.

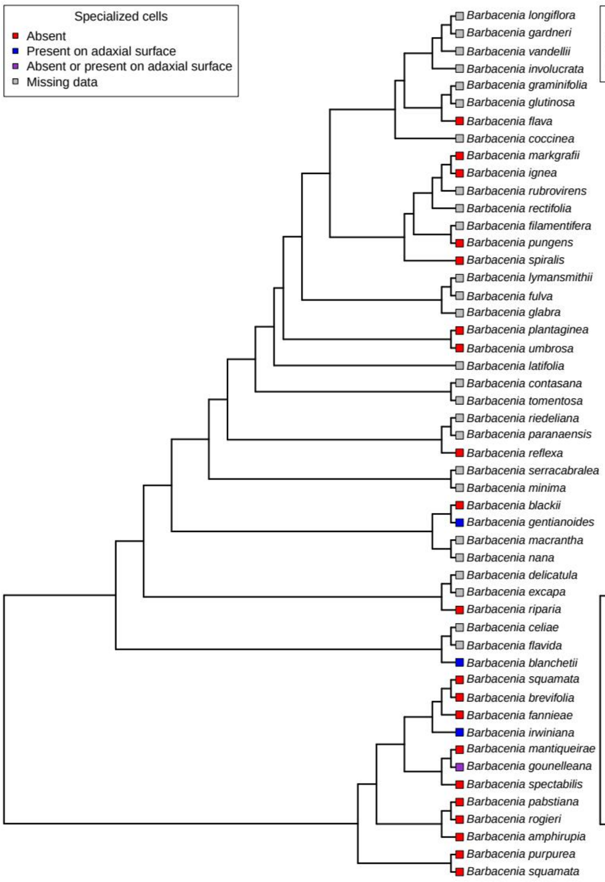


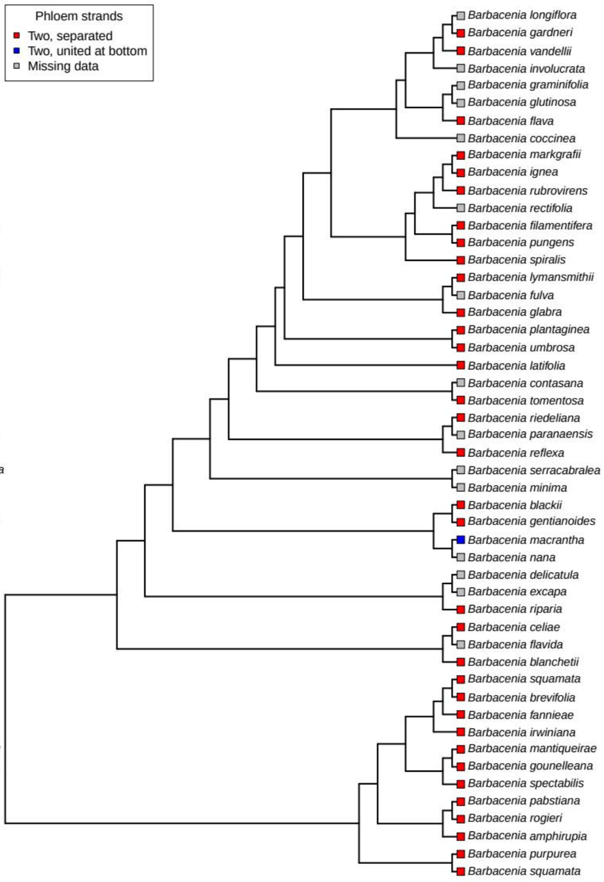
Supplementary Material 11. Mapping of morphological characters on the Maximum Likelihood tree.

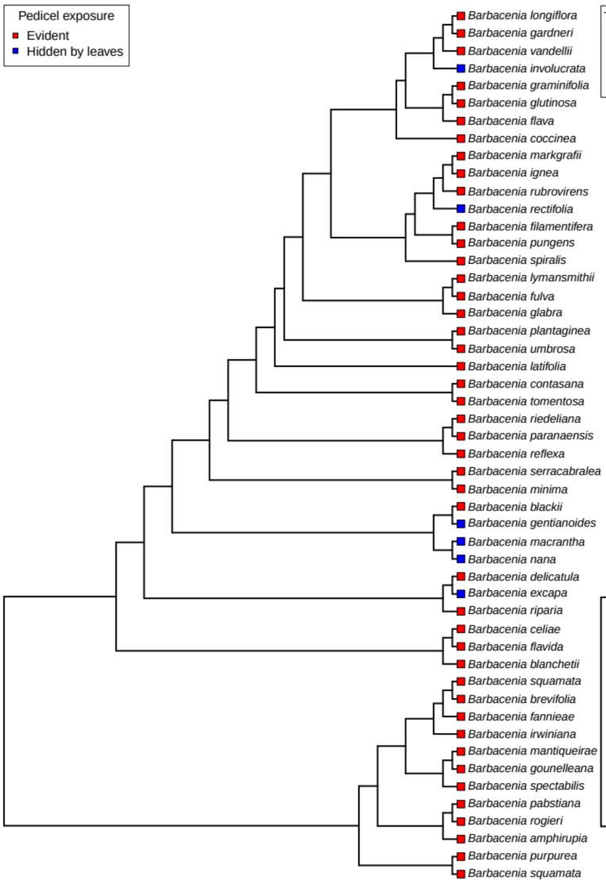


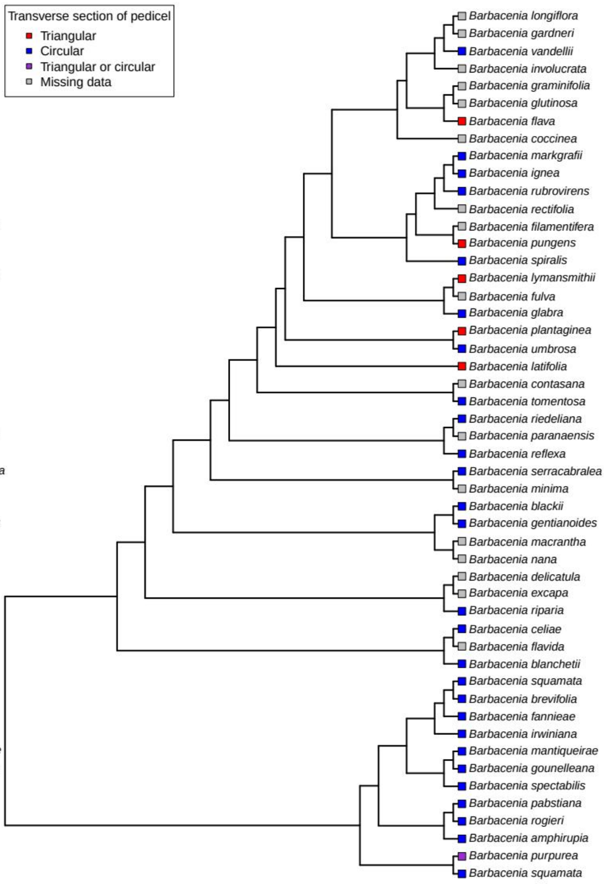

Leaf trichomes or emergences
🟦 Present on lamina
🟥 Present on margins and midrib
◻ Present on lamina or on margins and midrib
⬜ Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata

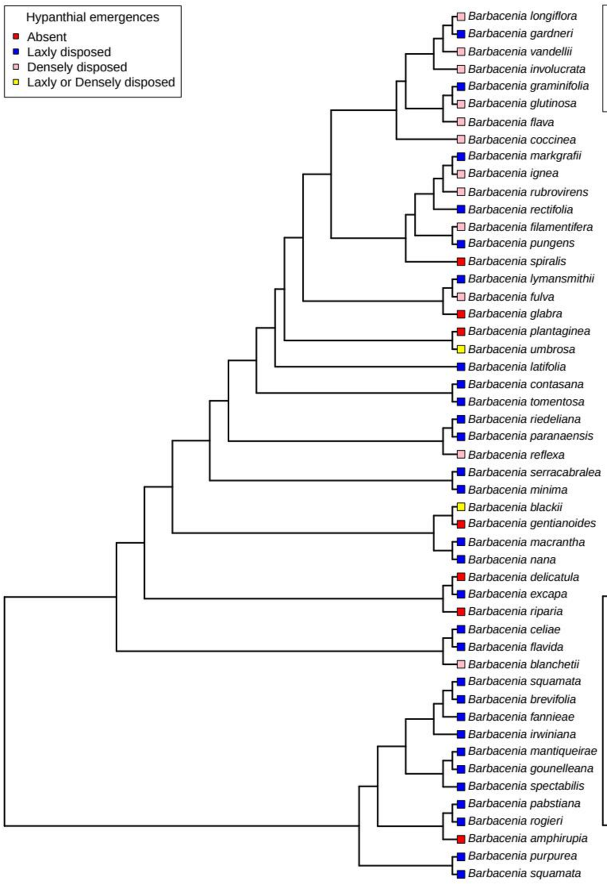

Stomatal distribution in leaves
🟥 Hypostomatic
🟦 Hypoamphistomatic
◻ Amphistomatic
🟨 Hypoamphistomatic or amphistomatic
⬜ Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata

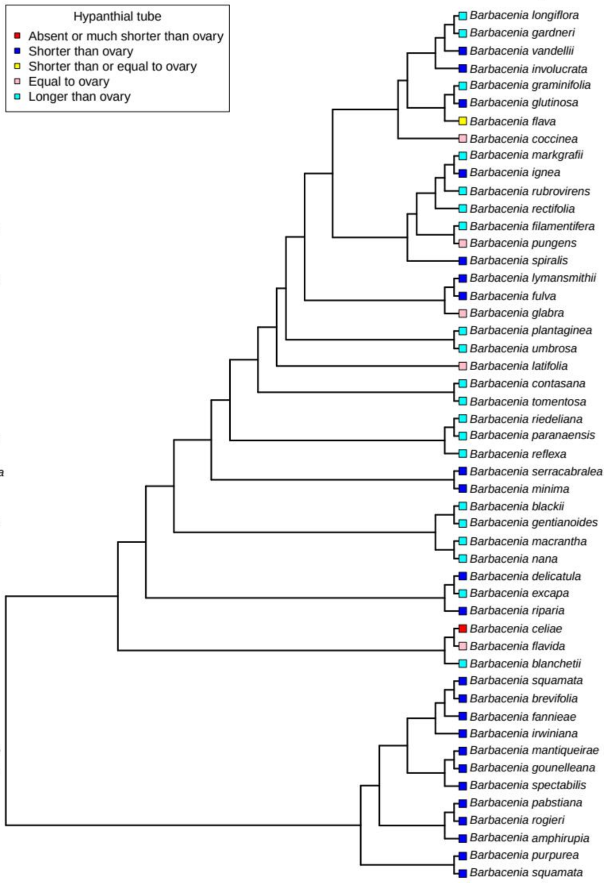

Specialized cells
🟥 Absent
🟦 Present on adaxial surface
🟪 Absent or present on adaxial surface
⬜ Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata

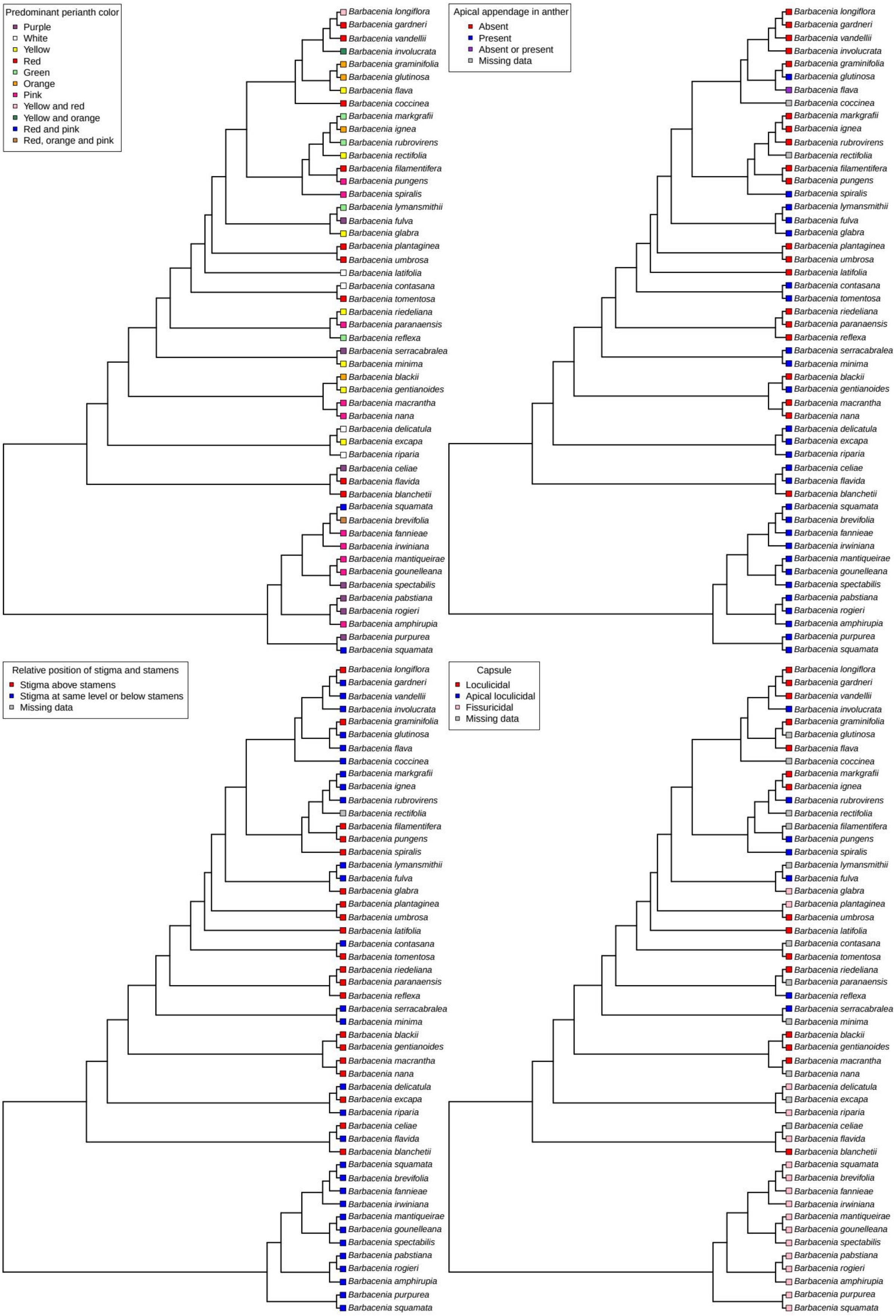

Phloem strands
🟥 Two, separated
🟦 Two, united at bottom
⬜ Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata


Pedicel exposure
Evident
Hidden by leaves
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata


Transverse section of pedicel
Triangular
Circular
Triangular or circular
Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata


Hypanthial emergences
Absent
Laxly disposed
Densely disposed
Laxly or Densely disposed
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata


Hypanthial tube
Absent or much shorter than ovary
Shorter than ovary
Shorter than or equal to ovary
Equal to ovary
Longer than ovary
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
Barbacenia latifolia
Barbacenia contasana
Barbacenia tomentosa
Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata


Predominant perianth color
Purple
White
Yellow
Red
Green
Orange
Pink
Yellow and red
Yellow and orange
Red and pink
Red, orange and pink
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
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Barbacenia pungens
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Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
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Barbacenia latifolia
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Barbacenia riedeliana
Barbacenia paranaensis
Barbacenia reflexa
Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata
Apical appendage in anther
Absent
Present
Absent or present
Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
Barbacenia rubrovirens
Barbacenia rectifolia
Barbacenia filamentifera
Barbacenia pungens
Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
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Barbacenia paranaensis
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Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata
Relative position of stigma and stamens
Stigma above stamens
Stigma at same level or below stamens
Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
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Barbacenia filamentifera
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Barbacenia spiralis
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Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
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Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata
Capsule
Loculicidal
Apical loculicidal
Fissuricidal
Missing data
Barbacenia longiflora
Barbacenia gardneri
Barbacenia vandellii
Barbacenia involucrata
Barbacenia graminifolia
Barbacenia glutinosa
Barbacenia flava
Barbacenia coccinea
Barbacenia markgrafii
Barbacenia ignea
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Barbacenia rectifolia
Barbacenia filamentifera
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Barbacenia spiralis
Barbacenia lymansmithii
Barbacenia fulva
Barbacenia glabra
Barbacenia plantaginea
Barbacenia umbrosa
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Barbacenia serracabralea
Barbacenia minima
Barbacenia blackii
Barbacenia gentianoides
Barbacenia macrantha
Barbacenia nana
Barbacenia delicatula
Barbacenia excapa
Barbacenia riparia
Barbacenia celiae
Barbacenia flavida
Barbacenia blanchetii
Barbacenia squamata
Barbacenia brevifolia
Barbacenia fannieae
Barbacenia irwiniana
Barbacenia mantiqueirae
Barbacenia gounelleana
Barbacenia spectabilis
Barbacenia pabstiana
Barbacenia rogieri
Barbacenia amphirupia
Barbacenia purpurea
Barbacenia squamata

Supplementary Material 12. Distribution of the *Barbacenia* AFI clades.

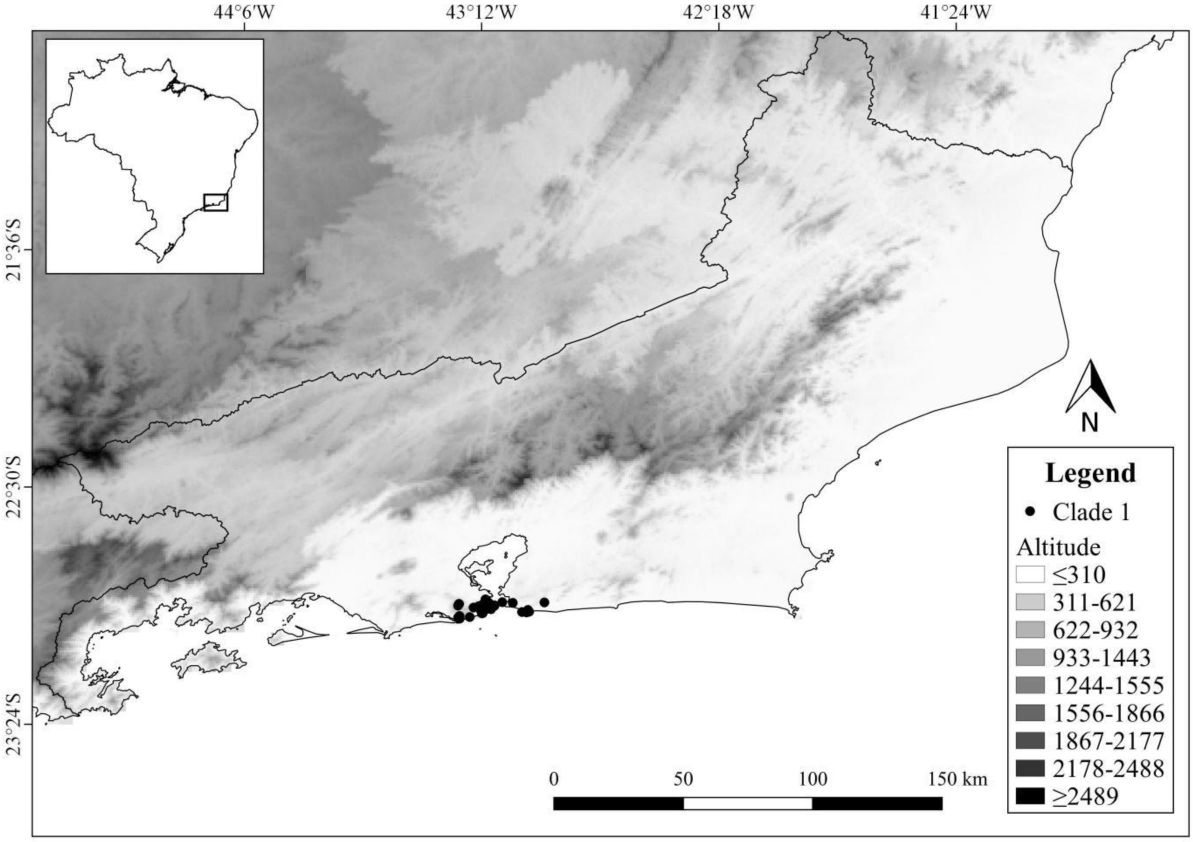

Figure 1. Distribution of Clade 1 (*Barbacenia purpurea* and *B. squamata*) in the Serra do Mar.

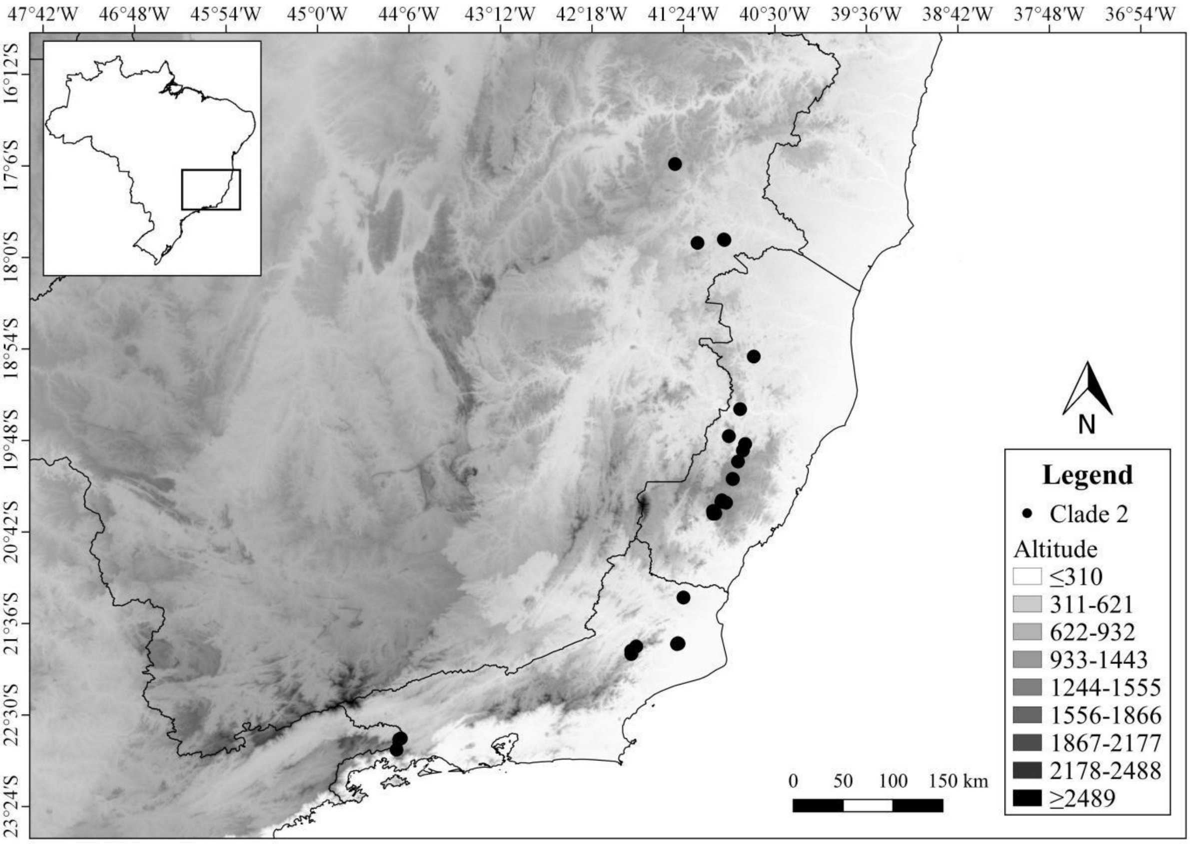

Figure 2. Distribution of Clade 2 (*Barbacenia pabstiana* and *Barbacenia rogieri*) in the Serra do Mar and Mantiqueira.

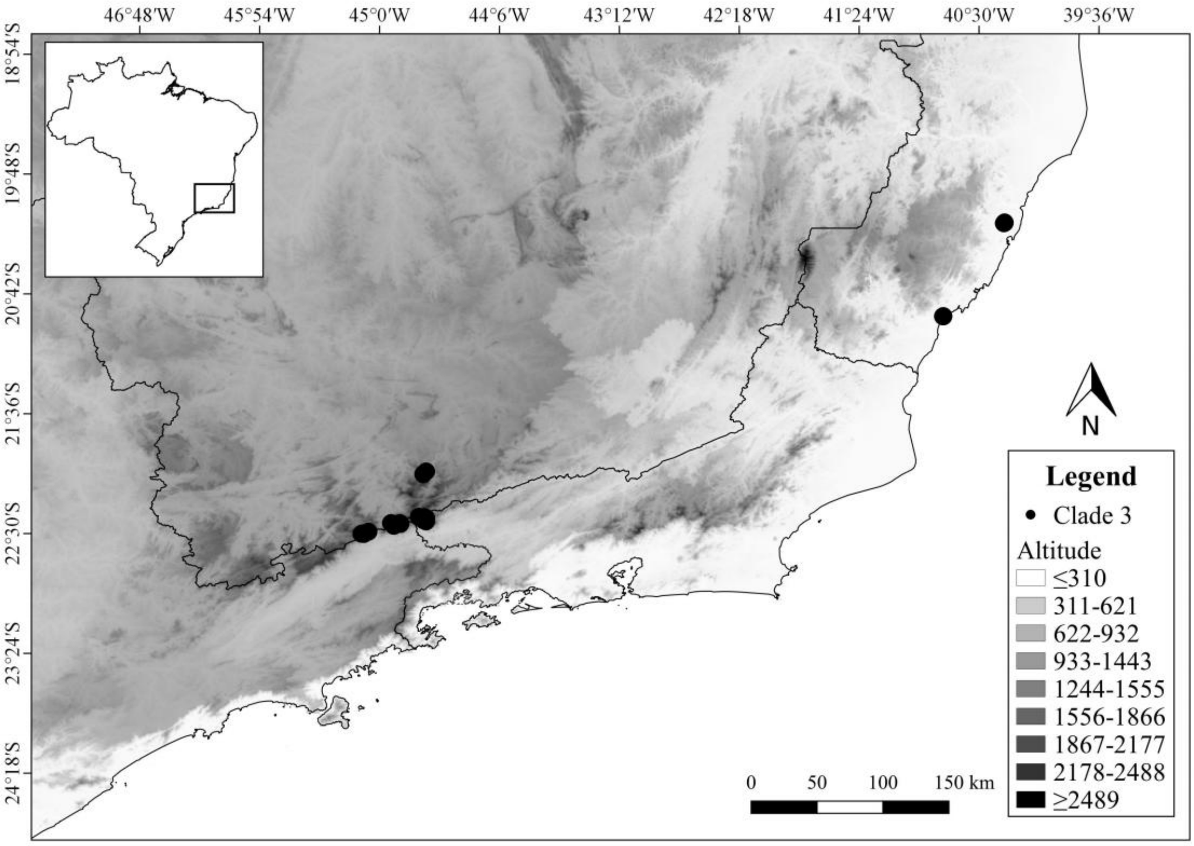

Figure 3. Distribution of Clade 3 (*Barbacenia gounelleana, B. mantiqueirae*, and *B. spectabilis*) in the Serra da Mantiqueira.

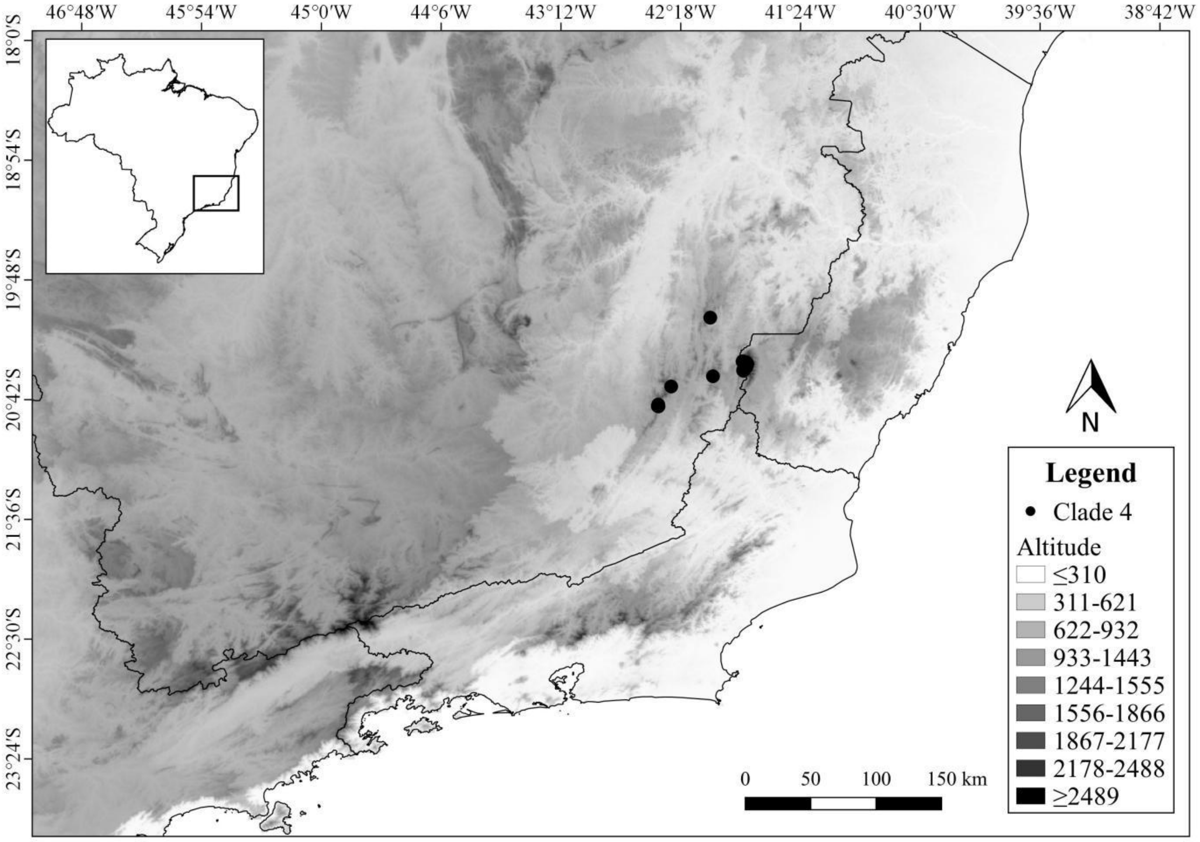

Figure 4. Distribution of Clade 4 (*Barbacenia irwiniana*) in the Serra da Mantiqueira.

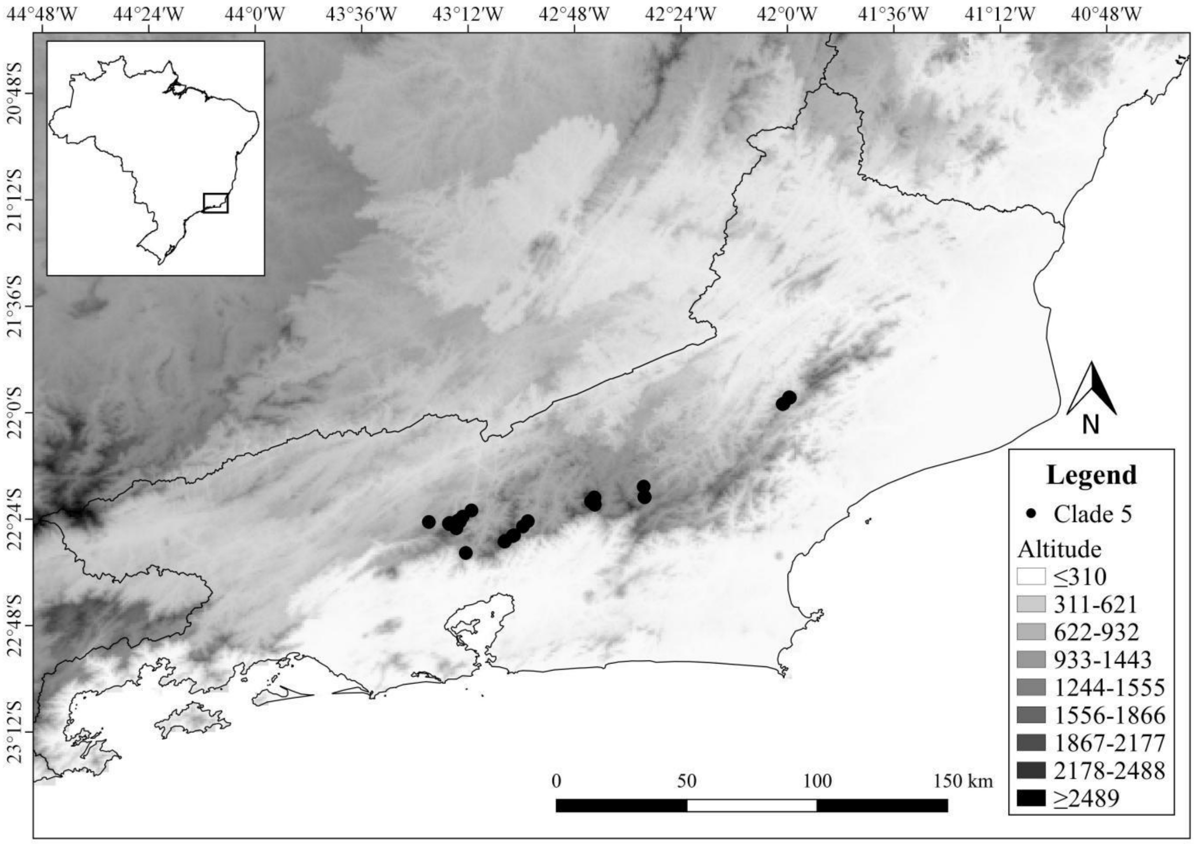

Figure 5. Distribution of Clade 5 (*Barbacenia brevifolia, B. fannieae*, and *B. squamata*) in the Serra do Mar.

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CHAPTER TWO: The group of *Barbacenia* (Velloziaceae) from inselbergs, with two new species

*Manuscript to be submitted for publication in the Journal of the Missouri Botanical Garden

ABSTRACT

Species of *Barbacenia* (Velloziaceae) from inselbergs s.l. from southeastern Brazil are presented. The group is composed by 12 species, *Barbacenia amphirupia* sp. nov. ined., *B. brevifolia* Taub., *B. fannieae* (N.L.Menezes) Mello-Silva, *B. gounelleana* Beauverd, *B. irwiniana* L.B.Sm., *B. mantiqueirae* Goethart & Henrard, *B. maritima* sp. nov. ined., *B. pabstiana* L.B.Sm. & Ayensu, *B. purpurea* Hook., *B. rogieri* T.Moore & Ayres, *B. spectabilis* L.B.Sm. & Ayensu, and *B. squamata* Herb., which in some molecular analyses forms a monophyletic assemblage. Identification keys for the species group, their morphological and anatomical descriptions, as well as comments on the affinities among the species, geographical distribution, and conservation status are presented. Two new species, *B. amphirupia* and *B. maritima*, are described. Lectotypes are designated for *B. fannieae, B. mantiqueirae, B. purpurea* var. *minor*, *B. squamata*, and *Vellozia coerulescens*, and a neotype is designated for *B. foliosa*. *Barbacenia burlemarxii* L.B.Sm. & Ayensu, *B. caricina* Goethart & Henrard, *B. gaveensis* Goethart & Henrard, *B. foliosa* Goethart & Henrard, *B. ionantha* L.B.Sm., *B. monticola* L.B.Sm. & Ayensu, *B. purpurea* var. *minor* Seub., *B. seubertiana* Goethart & Henrard, and *Vellozia coerulescens* Gumbl. are considered synonyms.

Key words: *Barbacenia*, Brazil, anatomical and morphological descriptions, identification key, IUCN Red List, lectotypes, Neotropics, neotype, synonyms.

INTRODUCTION

Seubert (1847) made one of the first grouping of the *Barbacenia* from inselbergs species, putting together *B. purpurea* and *B. squamata* in his treatment, based on the presence of a costate hypanthium. Sixty years latter and based on the same character, Beauverd (1907) added *B. gounelleana* to the group. This feature, which is the morphological basis for the development of a fissuricidal capsule (Sousa-Baena & Menezes 2019), was latter used by Menezes (1981), together with basifixed and auriculate anthers, style with subapical stigmatic region, and leaves with spiny trichomes on the margins and midvein, to justify the re-establishment of the genus *Pleurostima* (Rafinesque 1837). In phylogenetic analyses of Velloziaceae so far performed (Behnke et al. 2000, 2013, Mello-Silva 2005a, Mello-Silva et al. 2011, Alcantara et al. 2018), Menezes et al. (1994) and Salatino et al. (2001) excepted, *Pleurostima* showed to be a non-monophyletic assemblage. Nevertheless, the species that could belong to that genus and are endemic to the Atlantic Forest Inselbergs, i.e., granite/gneissic lowland inselbergs along eastern Brazilian coast and outcrops from "campos de altitude" at Serra da Mantiqueira and Serra do Mar (Safford & Martinelli 2000), emerged as a clade in some analyses (Alcantara et al. 2018, Cabral et al. ined.). The systematics of the 12 recognized species of that clade is presented, including morphological and anatomical descriptions, identification keys, putative relationships among species, geographical distribution and habitat, conservation status, and nomenclatural and taxonomic procedures, along with considerations of cladistic results in which the inselberg clade was recovered.

MATERIALS AND METHODS

Morphological studies were based on herbarium specimens and field observations. External structures were analysed with a stereomicroscope Olympus SZ-STB1 and described following the terminology used by Menezes *et al.* (1994), Stevenson & Loconte (1995), Mello-Silva (2005a) and Mello-Silva *et al.* (2011). Samples conserved in 70% ethanol or rehydrated herbarium specimens were used in the anatomical analyses. Transverse sections of the leaf and pedicel median portion were made employing a hand-held razor blade. The sections were clarified with 20% Sodium Hypochlorite (Kraus & Arduim 1997) and stained with astra blue and basic fucsin (Roeser 1972). Leaf epidermis was diaphanized and stained with alcoholic safranin (Franklin 1945) for analysis in a paradermic view. Transverse sections and epidermis tissue were included in distilled water, analysed with an optical microscope (Leica DM4000 M) and photographed with a digital coupled camera (Leica DFC 450). Anatomical descriptions, regarded as necessary for the systematics of the Velloziaceae (Mello-Silva 1996), follows, e.g., Mello-Silva (1990, 2000), Menezes (1971), and Smith and Ayensu (1976). Exsiccatae are deposited in listed herbaria, acronyms according to Thiers (2019 continuously updated). All cited specimens were examined, except where indicated. Many of them were accessed via online specimens available mainly in REFLORA. Author names are abbreviated according to IPNI. Species delimitation was based in exclusive morphological features or a combination of them, following the Taxonomic Species Concept (Rieppel 2007, Assis & Brigandt 2009).

Phenology and distribution were based in data gathered from herbarium specimens. Geographic coordinates marked with an asterisk (*), together with respective elevations, were inferred or corrected based on information on labels. Conservation status is in accordance with IUCN Red List Categories and Criteria (2012). Extent of Occurrence (EOO) and the Area of Occupancy (AOO) were inferred through Geospatial Conservation Assessment Tool (GeoCat, Bachman *et al.* 2011), with AOO based on the default cell width (2 km), because of lacking of information on size of populations. The categories were base on the AOO only, as the populations of Velloziaceae are mostly endemic to altitudinal spots, rendering the EOO meaningless. Species distribution maps were elaborated using the QGIS software (QGIS Development Team 2009).

THE INSELBERGS *BARBACENIA* SPECIES GROUP IN CLADISTIC ANALYSES

Two recent cladistic analyses of the *Barbacenia* from inselbergs have been presented. That of Alcantara et al. (2018) analyses six species among other 42 species of *Barbacenia*. The maximum clade credibility (MCC) tree derived from BEAST analysis (Fig. S8 of Alcantara et al. 2018) shows the *Barbacenia* from inselbergs forming a clade sister to all other *Barbacenia*: ((all other *Barbacenia*) (*B. purpurea* (*B. irwiniana* (*B. fannieae* (*B. spectabilis* (*B. gounelleana*, *B. mantiqueirae*)))))). On the other hand, the majority-rule consensus tree from the MrBayes analysis (Fig. S4) shows five of the *Barbacenia* from inselbergs forming a clade, but nested in *Barbacenia*, except from *B. gounelleana*, positioned in a basal polytomy.

A more comprehensive analysis, that of Cabral et al. (ined.), involves 20 specimens belonging to 10 species of *Barbacenia* from inselbergs, analysed together with all other terminals from Alcantara et al. (2018). The Bayesian and Maximum Likelihood trees recovered the *Barbacenia* from inselbergs species forming a clade, sister to all other *Barbacenia*. The relationships among its species, ((*B. squamata* (*B. squamata*, *B. purpurea*)) ((*B. amphirupia* (*B. rogieri* (*B. pabstiana* (*B. rogieri*, *B. pabstiana*)))) ((*B. spectabilis* (*B. mantiqueirae*, *B. gounelleana*)) (*B. irwiniana* (*B. fannieae* (*B. squamata* (*B. squamata*, *B. brevifolia*))))))), shows *B. pabstiana* and *B. squamata* non monophyletic. Molecular characters only support the group, and no morphological character is exclusive of it. The morphological attributes of the group, *e.g.*, apical appendaged and auriculated anthers, free and lateral stigmas, and fissuricidal capsules, are those characterizing *Pleurostima* (Menezes 1980, 1981). Nevertheless, homoplasies in many species belonging to the *Campos Rupestres* clade, which have been also ascribed to *Pleurostima*, confirm it as a non-monophyletic assemblage (Mello-Silva 2005a, Mello-Silva et al. 2011).

TAXONOMIC TREATMENT

KEY TO THE SPECIES OF *BARBACENIA* FROM INSELBERGS AMONG BRAZILIAN VELLOZIACEAE

1a. Corona absent or with fringed or alate appendages; stamens (6--)18--36(--74), filaments always present; stigma lobes horizontal, fused at center .... *Vellozia*

1b. Corona always present, with flattened, petaloid appendages; stamens 6, filaments almost always absent; stigma lobes vertical, fused at apex or free .... *Barbacenia*

  2a. Sandstone or limestone substrate, rarely granite or gneiss, and then species from Minas Gerais and Espírito Santo with hypanthial tube much longer than ovary and loculicidal capsules .... *Barbacenia* excluding *Barbacenia* from inselbergs group

  2b Granitic or gneissic substrate, rarely sandstone, and then species from Bahia with deep pink perianth and fissuricidal capsules .... *Barbacenia* from inselbergs group

    3a. Pedicel and hypanthium smooth or sparsely covered with subulate emergences

      4a. Perianth purple (ES) .... *B. pabstiana*

      4b. Perianth deep pink, red or orange-red (BA, RJ)

        5a. Leaf lamina sparsely ciliate on margins, abaxial midrib and on proximal region of both sides, hypanthium smooth to very sparsely covered with subulate emergences, perianth deep pink, pollen yellow, stigmas confluent at apex (BA) .... *B. amphirupia*

        5b. Leaf lamina sparsely serrate on margins and on midrib on abaxial side, hypanthium sparsely covered with subulate emergences, rarely sparsely covered with capitate or capitate-truncated emergences, perianth deep pink, red or orange-red, pollen white, stigmas elliptic or oblong-elliptic, free (RJ)

6a. Stems 3.5 to 5 mm wide at apex, leaf lamina plane, 3.5 to 13 cm long, perianth deep pink, red or orange-red, corona red to orange-red to deep pink, connective cream (RJ, Órgãos Mountains) .... *B. brevifolia*

6b. Stems (5--)6 to 12 mm wide at apex, leaf lamina arcuate, (4.9--11--)13.5 to 43 cm long, perianth red or orange-red, corona pale red, connective purple (RJ, Órgãos Mountains, Paty do Alferes, Rio de Janeiro) .... *B. squamata*

3b. Pedicel and hypanthium sparsely covered with capitate or capitate-truncated emergences

7a. Petals purple, deep purple or vinaceous-purple

8a. Leaf lamina plane, to 2 cm wide (ES, MG, RJ) .... *B. rogieri*

8b. Leaf lamina arcuate, to 1,5 cm wide

9a. Sepals 35 to 60 mm long, petals 40 to 75 mm long, corona lobes 25.3--40.3 X 4.4--6.3 mm, anthers 24.5 to 39 mm long, connective cream, style 31 to 50.5 mm long, white (ES) .... *B. spectabilis*

9b. Sepals 20 to 31 mm long, petals 19 to 30 mm long, corona lobes 6--14 X 2--4 mm, anthers 8 to 15 mm long, connective purple, style 12 to 24 mm long, pale purple or purple (RJ, SP)

10a. Stems 9 to 12 mm wide at apex, perianth purple to deep purple, corona lobes 10 to 14 mm long, seeds yellowish cinereous (RJ, Niteroi, Rio de Janeiro) .... *B. purpurea*

10b. Stems 15 to 17 mm wide at apex, perianth vinaceous-purple, corona lobes 6 to 8.5 mm long, seeds black (SP, Iguape, Peruíbe) .... *B. maritima*

7b. Petals pink, red, orange-red or yellowish pink

11a. Petals red to orange-red, corona pale red (RJ, Nova Friburgo) .... *B. squamata*

11b. Petals pink, corona pink or purple

13a. Petals and corona dull pink, corona emarginated at apex or rarely with rounded lobules to 2 mm long, connective cream (RJ, Santa Maria Madalena) .... *B. fannieae*

13b. Petals pink to deep pink, corona pink to purple, bifid at apex, lobules oblong to oblong-lanceolate, connective purple

14a. Leaves 35 to 53 cm long, sparsely serrate-ciliate to ciliate on margins and on midrib on abaxial side, corona lobes 10.5 to 12 mm long, style 11 to 19 mm long, stigmas linear-elliptic, free .... *B. mantiqueirae*

14b. Leaves 4.5 to 18 cm long, sparsely serrate on margins and on midrib on abaxial side, corona lobes 4.5 to 8.2 mm long, style 7.5 to 10 mm long, stigmas linear or linear-lanceolate, confluent or almost fused at apex

15a. Hypanthium yellow reddish to pink, sepals yellowish red to pink on abaxial side, petals with small capitate or capitate-truncated emergences on midrib at abaxial side, corona lobes deep pink, pollen white, capsules 7 to 16 mm long, seeds yellowish cinereous (ES, eastern MG) .... *B. irwiniana*

15b. Hypanthium vinaceous, sepals deep pink on abaxial side, petals smooth, corona lobes purple, pollen yellow, capsules 23 to 34 mm long, seeds black (Mantiqueira Mountains around the border MG, RJ, SP) .... *B. gounelleana*

THE SPECIES OF *BARBACENIA* FROM INSELBERGS

1. **Barbacenia amphirupia** sp. nov. ined. TYPE: BRAZIL. BAHIA: Almadina, Serra do Corcovado, 9,8 km a SW de Coaraci na estrada para Almadina, daí N até a Fazenda São José, proprietário Senhor Francisco, parte alta da encosta, 14°42'21"S 39°36'12"W, 23 May 2010, fl, *L. Daneu 330*. Figures 1A-C; 4A; 5A; 6A; 7A; 8A; 9 and 10.

Stems 3.6--6.5 cm long, 16--22 mm wide at apex. Leaves tristichous; leaf lamina 11--19.5 X 0.7--1.8 cm, linear-triangular, long attenuate, arcuate, sparsely ciliate on margins, abaxial midrib and on proximal region of both sides. Flowers solitary; pedicel 9--10.5 cm long, smooth to sparsely covered with subulate emergences towards apex; hypanthium 10.3--15.5 mm long, trigonous in transverse section, smooth to very sparsely covered with subulate emergences, mostly on proximal region, pink to vinaceous; section fused to ovary 7.5--12 X 2--3.5 mm, oblong-ellipsoid, hypanthial tube 2.8--3.5 mm long, 2.5--6 mm wide at apex. Perianth deep pink; sepals 10.8--14.5 X 3--4 mm, oblong-lanceolate, smooth to very sparsely covered with subulate emergences on abaxial midrib, sometimes only at apical portion, adaxial smooth; petals 11.8--14.5 X 3.7--6.2 mm, ovate to elliptic, smooth; corona lobes 5.3--5.9 X 2.4--3.2 mm, oblong, deep to light pink, lobules 2.3--3 mm long, oblong with rounded apex. Anthers 3.4--5.1 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective pink, appendiculate at apex, pollen yellow. Style c. 8 mm long, deep to light pink, stigmatic regions 3, c. 2.3 mm long, linear, at distal 1/4 of style, confluent at apex. Capsule c. 12 X 6 mm, ellipsoid, fissuricidal. Seeds non-analysed.

Leaf and pedicel anatomy (*Antar 1796*, *Daneu 330*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces, mostly on abaxial one, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--3) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along both surfaces. Pedicel circular in transverse section; fibro-vascular bundles 6; belt of sclerified cells present.

Distribution. *Barbacenia amphirupia* is endemic to an isolated inselberg at Almadina, southeastern Bahia, and to some places of the Espinhaço Range in Bahia, in Abaíra, Andaraí, and Lençóis, at elevations from 380 to 1550 m.

Phenology. Barbacenia amphirupia has been collected in flower from March to September, through the dry and cold season, with fruits in August.

IUCN Red List category. Barbacenia amphirupia has an Area of Occupancy of 28 km^2 and Extent of Occurrence of 13876 km^2. The species is partially protected by conservation units, and two disjunct populations are currently known. The majority of the populations are found in the Parque Nacional da Chapada Diamantina. The only population occurring in inselberg, the one from Serra do Corcovado, Almadina, Bahia state, is threatened by grazing and fire in the surrounding environment. According to IUCN (2012) criteria, *B. amphirupia* would be considered Vulnerable (VU).

Etymology. The epithet *amphirupia* states the occurrence of the species both over granite/gneiss and sandstone.

Discussion. *Barbacenia amphirupia* is quite distinct from the other species of the group for the sparsely ciliate trichomes at margins, abaxial midrib, and proximal region of both sides of the foliar lamina. It is also the only species of the group to have six fibro-vascular bundles in pedicel, while in the other species they are always 12. The beautiful deep pink perianth of *B. amphirupia* resembles that of *B. gounelleana*, but its smooth to almost smooth hypanthium contrasts sharply whit the sparsely capitate glandular one of *B. gounelleana*.

Additional specimens examined. BRAZIL. BAHIA: **Abaíra**, Serra da Bicota, Vira Saia, próximo à Pedra do Requeijão, 13°19'20.33"S 41°51'14.31"W*, elev. 1550 m, 5 Jul. 1993, fl fr, *W. Ganev 1812* (HUEFS); **Almadina**, Serra do Corcovado, 9,8 km a SW de Coaraci na estrada para Almadina, fazenda São José, proprietário Senhor Francisco, no topo da encosta, 14°42'15.98"S 39°36'15.12"W*, elev. 650 m, 23 May 2006, fl, *M.M.M. Lopes 742* (CEPEC); Serra do Corcovado, 13,8 km SW de Coaraci, fazenda São José, proprietário Sr. Francisco, 14°42'15.83"S 39°36'15.73"W*, elev. 710 m, 12 Aug. 2007, fl fr, *D. Cardoso 2150* (HUEFS); Serra do Corcovado, 9,8 km a SW de Coaraci na estrada para Almadina, fazenda São José, proprietário Senhor Francisco, parte alta da encosta, 14°42'21"S 39°36'12"W, elev. 650 m, 19 Apr. 2007, fl, *M.M.M. Lopes 1259* (CEPEC); **Andaraí**, Cachoeira da Garapa, nas rochas do rio, 12°44'34.72"S 41°21'10.83"W*, elev. 380 m, 23 Mar. 2002, fl, *C. van den Berg 920*

(HUEFS); Ladeira do Império, trilha para o Vale do Pati, 12°48'25"S 41°23'41.5"W, elev. 1054 m, 8 Jan. 2019, st, *A. Cabral 314* (SPF); Ladeira do Império, trilha para o Vale do Pati, 12°48'24.6"S 41°23'41.7"W, elev. 1059 m, 8 Jan. 2019, st, *A. Cabral 315* (SPF); **Lençóis**, Ribeirão do Meio, margens, 12°35'11.24"S 41°23'27.31"W*, 410 m, 30 Apr., 2004, fl, *A.A. Conceição 1142* (HUEFS); trilha para a Cachoeira do Sossego, Parque Nacional da Chapada Diamantina, 12°35'28"S 41°24'24"W, elev. 570 m, 12 Sep. 2017, fl, *G.M. Antar 1796* (SPF).

2. **Barbacenia brevifolia** Taub., Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 12(27): 2. 1890. TYPE: BRAZIL. RIO DE JANEIRO: Nova Friburgo, Pedra do Cônego, 22°18'59.94"S 42°32'08.51"W*, elev. 1320 m, 20 Oct. 1882, fl, *A.F.M. Glaziou 13271* (holotype, B; isotypes, BR, C, K, L, LE, P 3 sheets; photo, SPF). Figures 1D-G; 4B; 5B; 6B; 7B; 8B; 9 and 11.

Barbacenia caricina Goethart & Henrard in Henrard, Blumea 2(4): 340. 1937. TYPE: BRAZIL. RIO DE JANEIRO: Nova Friburgo, Pedra do Cônego, 22°18'58.09"S 42°32'14.81"W*, elev. 1330 m, 23 Jun. 1880 (st.), *A.F.M. Glaziou 12222* (holotype, L; isotypes, BR, C 2 sheets, K, LE, P 2 sheets; photo, SPF).

Pleurostima brevifolia (Taub.) N.L.Menezes, Boletim de Botânica da Universidade de São Paulo 8: 66. 1980.

Pleurostima caricina (Goethart & Henrard) N.L.Menezes, Boletim de Botânica da Universidade de São Paulo 8: 66. 1980.

Stems 12--22 cm long, 3.5--5 mm wide at apex. Leaves tristichous; leaf lamina 3.5--13 X 0.25--0.4 cm, linear-triangular, long attenuate, plane, sparsely serrate on margins and on midrib on abaxial side. Flowers solitary; pedicel 3.5--17 cm long, sparsely covered with subulate emergences towards apex; hypanthium 8--18 mm long, trigonous in transverse section, sparsely covered with subulate emergences, mostly on proximal region, sometimes also on costae, yellowish red; section fused to ovary 5.5--12 X 2--4 mm, oblong-campanulate, hypanthial tube 2.5--6 mm long, 2--5 mm wide at apex. Perianth red to orange-red to deep pink; sepals 12.5--16 X 3.3--3.6 mm, oblong-lanceolate, sparsely covered with subulate emergences on midrib on abaxial side, adaxial smooth; petals 11--15 X 4--5 mm, oblong-ovate to oblong-lanceolate, smooth; corona lobes 4.5--6.5 X 1.5--2.3 mm, oblong, red to orange-red to deep pink, lobules 1.3--1.9 mm long, oblong-lanceolate. Anthers ca. 5 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective cream, slightly appendiculate at apex, pollen white. Style c. 5 mm long, red to orange-red to deep pink, stigmatic regions 3, 1--1.5 mm long, elliptic, at middle of distal 1/4 of style, free, white. Capsule 14--20 X 7--10 mm, ellipsoid, fissuricidal. Seeds 1--2 mm long, trapezoidal, yellowish cinereous.

Leaf and pedicel anatomy (*Cabral 210*, *233*, *Martinelli 3555*, *Orsich* SPF 33978). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces, mostly on abaxial one, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, the adaxial girder narrowly obtrapeziform in outline, slightly larger than the abaxial one. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia brevifolia* is endemic to Serra dos Órgãos Mountains, in the State of Rio de Janeiro. The populations occur in rocky slopes of *campos de altitude*, at elevations from 700 to 2350 m.

Phenology. Barbacenia brevifolia has been collected with flowers from August to June, through the wetter and warmer season in southeastern Brazil. The fruiting immediately follows the flowering, and fruits may remain in the plant for long periods after seed release.

IUCN Red List category. Barbacenia brevifolia has Area of Occupancy of 44 km² and Extent of Occurrence of approximately 666 km². Populations are found in mountains from Nova Friburgo and Petrópolis, and some of them are included in conservation units such as Reserva Biológia de Araras, Área de Preservação Ambiental de Petrópolis, and Parque Estadual dos Três Picos. Although occurring over non-utilizable grounds, the populations of *B. brevifolia* are threatened by increasing frequency of fire in the Serra dos Órgãos region (Martinelli *et al.* 2018). Thus, according to IUCN (2012) criteria, *B. brevifolia* would be considered Endangered (EN).

Etymology. The epithet *brevifolia*, meaning short leaf, suggests the small proportions of the leaf blade relative to that of other Velloziaceae.

Discussion. *Barbacenia brevifolia* is quite distinct from the other species of the group for the erect and thin habit, and the patent and plane leaf blade, which distinguish the species from its sympatric species, *B. squamata*. The perianth color varies from deep pink, resembling those of *B. amphirupia* and *B. gounelleana*, to red or orange-red.

Additional specimens examined. BRAZIL. RIO DE JANEIRO: **Magé**, Morro Açu (Morro Assu), 22°29'10.02"S 43°03'39.85"W*, elev. 2350 m, Aug. 1918, fl, *P.F. Lützelburg 6411* (M); **Nova Friburgo**, Pedra do Cônego ("Pedra do Conico"), 22°19'03.89"S 42°32'10.33"W*, elev. 1345 m, Jan. 1898, fl, *E.H.G. Ule s.n.* (B, R 6372); Pedra do Cônego, an Felsengehängen des Pedra do Cônego ("Conico"), 22°19'00.55"S 42°32'12.43"W*, elev. 1400 m, Jan. 1898, fl fr, *E.H.G. Ule 4616* (B); Pedra do Cônego (ou Pedra do Imperador), no perímetro urbano, 22°18'58.6"S 42°32'13.3"W, elev. 1344 m, 11 Jul. 2018, fl fr, *A. Cabral 233* (SPF); **Petrópolis**, 20 Dec. 1977, fl, *N.L. Menezes 818* (US); Morro Açu (Morro Assu), 22°28'54.37"S

43°03'39.39"W*, elev. 2300 m, Nov. 1915, fl, *P.F. Lützelburg 6619* (M); estrada do contorno, 22°31'36.64"S 43°12'30.03"W*, elev. 700 m, 16 Mar. 1968, fl fr, *D. Sucre 2481* (CEPEC, INPA, K 2 sheets, MG, NY, RB 2 sheets, SPF); morro Bolo de Milho, Araras, 22°23'24.52"S 43°13'11.96"W*, elev. 700 m, 27 Jun. 1968, fl, *D. Sucre 2804* (RB, SPF); Pedra do Cuca, Araras, 22°24'59"S 43°16'14.8"W, elev. 1619 m, 17 Jun. 2018, fr, *A. Cabral 210* (SPF); Pedra do Cuca, Araras, 22°24'57.29"S 43°16'18.80"W*, elev. 1500 m, 2 Mar. 1994, fr, *R.J.V. Alves 4386* (RB); Pedra do Cuca, Vale das Videiras, 22°24'50.45"S 43°16'06.82"W*, elev. 1400 m, 22 Nov. 1977, fl, *G. Martinelli 3555* (RB, SPF); Pedra do Cuca, Vale das Videiras, 22°25'05.16"S 43°16'14.07"W*, elev. 1400 m, 22 Nov. 1977, fl fr, *G. Martinelli 3557* (RB, US); Pedra do Cuca, entre Vale das Videiras e Araras, 22°25'05.58"S 43°16'13.58"W*, elev. 1600 m, 6 Oct. 1983, fl, *G. Martinelli 9583* (RB, US); Pedra do Cuca, Vale das Videiras, Área de Preservação Ambiental de Petrópolis, vertente N/NE, 22°24'21.05"S 43°14'18.69"W*, elev. 1570 m, 26 Feb. 2006, fl, *M.A. Moraes s.n.* (RB 422227, SPF); Pedra do Oratório, Araras, zona de anuência da Reserva Biológica de Araras, 22°25'50"S 43°14'41"W, elev. 1043 m, 21 Oct. 2016, fl, *M.S. Wängler 1824* (RB 734604); Pedra do Oratório, Reserva Biológica de Araras, 22°25'58.11"S 43°14'41.24"W*, elev. 1200 m, s.d., fl, *C. Farney 119* (RB); Pedra do Oratório, Serra de Santa Catarina, Área de Proteção Ambiental de Petrópolis, 22°26'03.37"S 43°14'38.87"W*, elev. 1300 m, 28 Jul. 2008, fl, *M.A. Moraes 175* (RB); Serra da Maria Comprida, contrafortes, 22°24'01.54"S 43°12'28.22"W*, elev. 1500 m, 24 Jun. 2006, fl, *M.A. Moraes 110* (RB); **Teresópolis**, 25 Mar. 1975, fr, *B. Orsich s.n.* (SPF 33978); s.d., fl, *N.L. Menezes 515* (SPF); **no locality**, cultivated at Bonn University, 22 Nov. 2012, fl, *W. Lobin s.n.* (BONN 26162).

3. **Barbacenia fannieae** (N.L.Menezes) Mello-Silva. Neodiversity 3: 1. 2008 ("*fanniae*").

Figures 1H-J; 4C; 5C; 6C; 7C; 8C; 9 and 11.

Pleurostima fannieae N.L.Menezes. Boletim de Botânica da Universidade de São Paulo 8: 65. 1980 ("*fanniei*"). TYPE: BRAZIL. RIO DE JANEIRO: Santa Maria Madalena, cultivada no Departamento de Botânica da Universidade de São Paulo, 20 Jan. 1977 (fl), *N.L. Menezes 670* (holotype, SPF, never deposited?; lectotype, here designated, Figures 1-9 of Menezes [1980b]).

Stems 2.7--40 cm long, 13--22 mm wide at apex. Leaves tristichous; leaf lamina 19.5--45 X 0.5--2.3 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and midrib on abaxial side. Flowers 1(--2); pedicel 11.5--54 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 16.5--32 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, pink; section fused to ovary 11.5--25 X 4--7 mm, oblong-campanulate to oblong-ellipsoid, hypanthial tube 4--10 mm long, 5--9 mm wide at apex. Perianth dull pink; sepals 17--30 X 4--8.5 mm, oblong-lanceolate, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth; petals 17--30 X 6--11.5 mm, narrowly oblong-ovate, sparsely covered with capitate or capitate-truncated emergences in the proximal half of midrib on abaxial side, adaxial smooth; corona lobes 5--11 X 2--4 mm, oblong-spatulate, dull pink, emarginated at apex or rarely with rounded lobules to 2 mm long. Anthers 8--16 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective cream, slightly appendiculate at apex, pollen white. Style 17.5--18.5 mm long, pale pink, stigmatic regions 3, 1.5--3.5 mm long, elliptic, at base of distal 1/4 of style, free, cream. Capsule 13.5--19 X 7--9.5 mm, ellipsoid, fissuricidal. Seeds 1--1.5 mm long, narrowly trapezoidal, black.

Leaf and pedicel anatomy (*Cabral 240*, *Mello-Silva 2643*). Blade dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces, mostly on abaxial one, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2--4) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along both surfaces, sometimes with lateral extensions merged with bundles of sclerified cells on adaxial surface. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia fannieae* is endemic to Santa Maria Madalena municipality, on rocky outcrops, at elevations from 800 to 1230 m.

Phenology. Barbacenia fannieae has been collected with flowers throughout the year. The fruits normally follow the flowers.

IUCN Red List category. Barbacenia fannieae has Area of Occupancy of 8 km^2 and Extent of Occurrence of 0.677 km^2. Despite being large and occurring over non-utilizable grounds, its populations could be reduced by increase of agricultural and grazing procedures in the surrounding areas (Martinelli *et al.* 2018). Therefore, its conservation status would be described as “CR” (Critically Endangered), according to IUCN (2012) criteria.

Etymology. *Barbacenia fannieae* was named after Fannie L. Forman Marx, wife of Walter and sister in law of Roberto Burle Marx, renowned Brazilian artists, "for her extraordinary love of nature" (Menezes 1980: 65, as Fanni).

Nomenclatural notes. Apparently, the holotype collection of *B. fannieae* (*Menezes 670* [SPF 17220]) has never been made and was neither deposited at SPF herbarium. *Menezes 670* actually deposited in SPF is *Vellozia epidendroides*, and SPF 17220 houses a *Mollinedia* *schottiana* (*Rossi 121*). Thus, a lectotype based on the published illustration is selected here, as no other original material is available.

Discussion. *Barbacenia fannieae* is a narrow endemic species, known only from rocky outcrops neighboring Santa Maria Madalena, in Rio de Janeiro State, where it is especially abundant in the huge inselberg Pedra Dubois. It can be distinguished from the other species of the group by its dull pink perianth and corona lobes almost always entire.

Additional specimens examined. BRAZIL. RIO DE JANEIRO. **Santa Maria Madalena**, Morro da Estação, 21°57'51.35"S 42°00'59.41"W*, elev. 800 m, 28 Feb. 1935, fl, *J. Santos Lima 14287* (RB); Morro da Torre, no perímetro urbano, encostas do alto do morro, 21°58'03"S 42°01'03"W, elev. 1004 m, 17 Apr. 2004, fl, *R. Mello-Silva 2643* (CTES, F, G, K, MBM, NY, RB, SP, SPF 2 sheets, US); Morro da Torre, Mata do Criminoso, propriedade do Sr. João Batista Bizzo, 21°57'55.44"S 42°00'49.97"W*, elev. 1038 m, 21 Apr. 2008, fl fr, *M.M. Saavedra 725* (RB, SPF); Morro de Madalena, 11 Aug. 1975, fl fr, *N.L. Menezes 446* (SPF); Pedra Dubois, 21°56'35.26"S 41°59'37.07"W*, elev. 1200 m, 22 Mar. 1955, fl, *E. Pereira 1299* (RB); Pedra Dubois, 21°56'31.32"S 41°59'32.05"W*, elev. 1000 m, 22 Feb. 1983, fl, *H.C. Lima 1874* (RB); Pedra Dubois, 21°56'35.06"S 41°59'29.48"W*, elev. 1100 m, 25 Jun. 1987, fl, *C. Farney 1435* (RB); Pedra Dubois, subida para a Pedra Dubois, 21°56'36.01"S 41°59'25.47"W*, elev. 1070 m, 9 May 2009, fl, *V.C. Souza 33529* (ESA, SPF); Pedra Dubois, 21°56'34"S 41°59'32"W, elev. 1136 m, 17 Apr. 2015, fl, *M.S. Wängler 1628* (RB); Pedra Dubois, última subida, já na pedra, 21°56'35"S 41°59'33"W, elev. 1162 m, 30 Aug. 2016, fl fr, *C. Baez 1013* (RB, S, SPF); Pedra Dubois, Parque Estadual do Desengano, 21°56'36.8"S 41°59'36.6"W, elev. 1229 m, 14 Aug. 2018, fr, *A. Cabral 240* (SPF); **no locality**, cultivated at Botany Department, University of São Paulo, Jan. 1977, fl, *N.L. Menezes 646* (SPF); 20 Jan. 1977, fl, *N.L. Menezes 660* (SPF); 26 Dec. 1979, fl, *N.L. Menezes 868* (SPF); Feb. 1980, fl, *N.L. Menezes 900* (SPF); 11 Nov. 1980, fl, *N.L. Menezes 959* (SPF).

4. **Barbacenia gounelleana** Beauverd, Bulletin de l'Herbier Boissier, sér. 2, 7: 704. 1907. TYPE: BRAZIL. RIO DE JANEIRO: Resende, Serra do Itatiaia (Itatiaya), Sítio de Ramos, elev. 2300 m, Feb. 1899, fl, fr, *E. Gounelle s.n.* (holotype, G 4 sheets; photo, K). Figures 1K-M; 4D, S; 5D; 6D; 7D; 8D; 9 and 11.

Pleurostima gounelleana (Beauverd) N.L.Menezes, Revista Brasileira de Botânica 3: 44. 1981.

Stems 2--8.5 cm long, 4--10 mm wide at apex. Leaves tristichous; leaf lamina 5.5--18 X 0.3--1.5 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and on midrib on abaxial side. Flowers 1--3; pedicel 6--17.5 cm long, circular in transverse section, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 9.5--21 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, mostly on the costae, vinaceous; section fused to ovary 7--16 X 2.5--5 mm, oblong-campanulate, hypanthial tube 2.5--5 mm long, 4--7 mm wide at apex. Perianth deep pink; sepals 13--25 X 3--7 mm, oblong-lanceolate, sparsely covered with capitate or capitate-truncated emergences on costae of abaxial side, adaxial smooth; petals 12--24 X 3.5--8 mm, elliptic, smooth; corona lobes 7.5--8.2 X 1.5--3.5 mm, oblong, purple, lobules 3.5--5.5 mm long, oblong. Anthers 5.5--7.5 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, appendiculate at apex, pollen yellow. Style 9.5--10 mm long, purple, stigmatic regions 3, 2.5--4.5 mm long, linear, at distal 1/3 of style, confluent at apex. Capsule 23--34 X 8--19 mm, ellipsoid, fissuricidal. Seeds 1--2.5 mm long, trapezoidal, black.

Leaf and pedicel anatomy (*Meireles 3014*, *233*, *Mello-Silva 2849*, *Sasaki 1075*, *Trovó 322*). Blade inconspicuously dorsiventral. Cuticle thickened on both surfaces. Stomata present on abaxial surface only, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1--3 large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, narrowly obtrapeziform in outline, the abaxial one slightly larger than the adaxial one. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia gounelleana* is endemic to the massif of Itatiaia and neighboring mountains to the West, Serra da Mina and Pico dos Marins, and to North, Serra do Papagaio, in the highest portion of Mantiqueira Mountains, surrounding the borders of the states of Minas Gerais, Rio de Janeiro, and São Paulo. The populations occur in rocky slopes of *campos de altitude*, at elevations from 1550 to 2600 m.

Phenology. Barbacenia gounelleana has been collected with flowers from October to May, and in fruiting from November to June, following the wetter and warmer season in southeastern Brazil.

IUCN Red List category. Barbacenia gounelleana has Area of Occupancy of 56 km^2 and Extent of Occurrence of approximately 1060 km^2. Most records are within conservation units, in the Área de Proteção Ambiental da Serra da Mantiqueira, Parque Estadual do Papagaio and Parque Nacional do Itatiaia. Its conservation status would be described as “EN” (Endangered), according to IUCN (2012) criteria.

Etymology. *Barbacenia gounelleana* was named after Pierre-Émile Gounelle, a French entomologist who did several expeditions to Brazil, visiting Itatiaia in 1899 (Millot 1920), where he collected it.

Discussion. As noted by Beauverd (1907), *B. gounelleana* is the only species of the group, except *B. amphirupia*, showing linear and apically confluent stigmas. Its violet corona, contrasting with the deep pink perianth, is another distinguishing feature. This is the same color pattern of *Fuchsia* sect. *Quelusia* (Onagraceae) flowers, with deep pink hypanthium and sepals, and violet petals. Species from that section, from which two, *F. campos-portoi* Pilg. & Schulze-Menz and *F. regia* (Vell.) Munz, are sympatric with *B. gounelleana*, are unspecific visited by different species of hummingbirds (Berry 1989), and one could expect that they also visit *B. gounelleana*.

Additional specimens examined. BRAZIL. MINAS GERAIS: **Aiuruoca**, Matutu, Morro Cabeça de Leão, 22°04'08.07"S 44°37'53.97"W*, elev. 1550 m, 10 Oct. 2004, fl, *R.C. Mota 2501* (BHCB, SPF); Parque Estadual do Papagaio, 22°03'09.84"S 44°40'17.92"W*, elev. 2100 m, 27 Dec. 2003, fl, *F.M. Ferreira 623* (CESJ, SPF); Pico do Papagaio, Parque Estadual do Papagaio, subida para o Pico, saindo do Retiro dos Pedros, Pedra do Abrigo, 22°02'00"S 44°39'00"W, elev. 1900 m, 12 Mar. 2008, fl, *P.L. Viana 3933* (BHCB, SPF); Serra do Papagaio, Retiro dos Pedros, alto da Serra, gruta próxima ao Retiro dos Pedros , 22°03'18"S 44°40'17"W, elev. 2190 m, 18 Feb. 2005, fl fr, *R. Mello-Silva 2849* (CESJ, K, RB, SPF); **Itamonte**, Serra do Itatiaia, Prateleiras, 22°22'38.64"S 44°39'41.87"W*, elev. 2650 m, 15 Nov. 1991, fl, *F. Rivadávia-Lopes 22* (SPF); **Passa Quatro**, Pico do Itaguaré, 22°29'07.24"S 45°04'59.79"W*, elev. 2225 m, 21 Mar. 2006, fl fr, *L.D. Meireles 2155* (SPF, UEC); Serra Fina, Campo do Muro, 22°25'15.70"S 44°54'51.13"W*, elev. 2120 m, 22 Mar 2006, fl, *L.D. Meireles 2234* (SPF, UEC); Serra Fina, Campo do Muro, 22°25'16.96"S 44°54'46.78"W*, elev. 2170 m, 23 Nov. 2006, fl fr, *L.D. Meireles 2618* (SPF, UEC); Serra Fina, Pedra da Mina, 22°25'16"S 44°50'52"W, elev. 2498 m, 15 May 2005, fl, *L.D. Meireles 1653* (SPF, UEC). RIO DE JANEIRO: **Itatiaia**, Serra do Itatiaia, 22°23'S 44°39'W, elev. 2250 m, 12 Apr. 1977, fl fr, *R.M. Harley 20350* (K 2 sheets); Serra do Itatiaia, abrigo Rebouças, 22°23'08.71"S

44°40'39.77"W*, elev. 2400 m, 3 Dec. 1966, fl, *H.E. Strang 759* (M, K, HB n.v.); Serra do Itatiaia, entre abrigo Rebouças e Prateleiras, 22°23'32.20"S 44°40'14.93"W*, elev. 2380 m, Oct. 1964, fl, *H.E. Strang 149* (M, HB n.v.); Serra do Itatiaia, Estrada das Flores, em direção às Prateleiras, 22°23'16.90"S 44°40'33.57"W*, elev. 2390 m, 3 Dec. 2008, fl fr, *D. Monteiro 420* (CESJ, SPF); Serra do Itatiaia, Pedra Assentada, 22°23'58.13"S 44°39'46.27"W*, elev. 2500 m, 12 Mar. 1903, fl, *A. Löfgren CGG5968* (C, MBM, SP n.v.); Serra do Itatiaia, Pedra do Cérebro, elev. 2400 m, Jan. 1939, fl, *L. Laustyak 930* (RB, SPF); Serra do Itatiaia, Pedra do Urubu, 22°23'49.11"S 44°39'6.46"W*, elev. 2400 m, Jan. 1939, fl fr, *L. Laustyak 230* (RB, UB); Serra do Itatiaia, Pico das Agulhas Negras, Parque Nacional do Itatiaia, 22°23'02.70"S 44°40'10.92"W*, elev. 2350 m, 29 Apr. 1977, fl, *H. Makino 24* (UEC, US 2 sheets); Serra do Itatiaia, Planalto, 22°23'24.87"S 44°40'20.36"W*, elev. 2240 m, 6 Nov. 1976, fl, *G. Martinelli 1073* (RB); Serra do Itatiaia, Prateleiras, próximo à base, 22°23'44.50"S 44°39'12.91"W*, elev. 2350 m, 2 May 2005, fl fr, *D. Sasaki 1075* (SPF); Serra do Itatiaia, elev. 2350 m, 18 Dec. 1968, fl, *H. Merxmüller 25557* (M); **Resende**, Serra do Itatiaia, abrigo Rebouças, 22°23'09.93"S 44°40'44.87"W*, elev. 2400 m, 18 Oct. 1977, fl, *V.F. Ferreira 230* (RB); Serra do Itatiaia, abrigo Rebouças, pedras fronteiras ao abrigo, 22°23'05.55"S 44°40'46.36"W*, elev. 2400 m, 20 Apr. 1957, fl, *L.E. Mello Filho 1428* (US); Serra do Itatiaia, abrigo Rebouças, trilha para o Pico das Agulhas Negras, próximo ao abrigo, 22°23'05"S 44°40'38"W, elev. 2600 m, 16 Apr. 2005, fl fr, *R. Mello-Silva 2874* (SPF); Serra do Itatiaia, abrigo Rebouças, trilha do abrigo Rebouças, 22°23'05.67"S 44°40'53.27"W*, elev. 2430 m, 17 May 2007, fl, *V.F. Mansano 07-395* (RB, SPF); Serra do Itatiaia, abrigo Rebuças, trilha em frente ao abrigo Rebouças, 22°23'05.53"S 44°40'41.47"W*, elev. 2395 m, 22 Jan. 2003, fl fr, *V.F. Mansano 188* (MBM, RB, SPF); Serra do Itatiaia, Agulhas Negras, base, 22°22'49.59"S 44°40'03.62"W*, elev. 2500 m, 24 Fev. 1948, fl, *M.G. Ferri s.n.* (SPF 42487); Serra do Itatiaia, entre Pedra Assentada e Prateleiras, 22°24'02.58"S 44°39'56.28"W*, elev. 2300 m, Mar. 1937, fl, *A.C. Brade 15663* (B, RB 2 sheets, SPF); Serra do Itatiaia, Felsen auf einer Bergkuppe, 2 Mar. 1931, fl, *R.W. Kaempfe 401* (RB); Serra do Itatiaia, final da estrada para o pico das Agulhas Negras, 22°22'33.58"S 44°39'58.41"W*, elev. 2300 m, 15 Fev. 1995, fl, *J.M.A. Braga 2006* (RB); Serra do Itatiaia, Morro do Couto, Planalto, início da trilha do Morro do Couto, Parque Nacional do Itatiaia, 22°22'47"S 44°42'09"W, elev. 2540 m, 24 Oct. 2018, fl, *D.R. Couto 4194* (RB); Serra do Itatiaia, Parque Nacional do Itatiaia, 7 Feb. 1960, fl, *O.M. Barth 7263* (US); Serra do Itatiaia, Pedra Assentada, 22°23'56.70"S 44°39'45.48"W*, elev. 2400 m, 14 Feb. 1935, fl, *P. Campos Porto 2782* (RB); Serra do Itatiaia, Pedra da Tartaruga, Parque Nacional do Itatiaia, 22°23'56.56"S 44°40'5.53"W*, elev. 2440 m, May 1938, fl fr, *L. Laustyak 180* (RB 2 sheets); Serra do Itatiaia, Pico das Agulhas Negras, along rio Ribeirão, at base of Pico, 22°23'01.52"S 44°40'02.72"W*, elev. 2400 m, 5 Feb. 1970, fl, *T. Koyama 13684* (NY, SPF); Serra do Itatiaia, Planalto, 22°23'45.10"S 44°39'53.95"W*, elev. 2400 m, 6 Mar. 1962, fl, *E. Pereira 7050* (M, HB n.v., US); Serra do Itatiaia, Planalto do Parque Nacional de Itatiaia, 22°23'30.29"S 44°40'21.54"W*, elev. 2600 m, 8 May 1981, fl, *R.F. Ferlini 1* (BAUR, SPF); Serra do Itatiaia, Planalto, caminho para as Prateleiras, 22°23'54.10"S 44°40'12.97"W*, elev. 2450 m, 19 Oct, 2009, fl, *L.J.T. Cardoso 857* (RB); Serra do Itatiaia, Planalto, início da trilha do Morro do Couto, Parque Nacional do Itatiaia, 22°22'47"S 44°42'09"W, elev. 2540 m, 24 Oct. 2018, fl, *D.R. Couto 4188* (RB); Serra do Itatiaia, Planalto, margem da estrada que leva às Antenas e Morro do Couto, Parque Nacional do Itatiaia, 22°22'27"S 44°42'15"W, elev. 2460 m, 24 Oct. 2018, fl, *D.R. Couto 4152* (RB); Serra do Itatiaia, Planalto, margem da estrada que leva às Antenas e Morro do Couto, próximo ao estacionamento, Parque Nacional do Itatiaia, 22°22'27"S 44°42'16"W, elev. 2460 m, 24 Oct. 2018, fl, *M.M. Moreira 259* (RB); Serra do Itatiaia, Planalto, próximo ao abrigo Massenas, 22°24'33.31"S 44°39'03.79"W*, elev. 2350 m, 13 Jan. 1961, fl, *H.E. Strang 254* (GUA, RB, US); Serra do Itatiaia, Planalto, próximo ao abrigo Rebouças, 22°23'08.21"S 44°40'48.73"W*, elev. 2400 m, 11 Oct. 1977, fl, *G. Martinelli 3218* (RB 2 sheets); Serra do Itatiaia, Prateleiras, base, 22°23'53.53"S 44°40'13.45"W*, elev. 2600 m, 2 Dec. 1983, fl, *Cesar & A. Furlan 120* (HRCB, VIES); Serra do Itatiaia, Prateleiras, Parque Nacional do Itatiaia, 22°23'59.18"S 44°40'06.49"W*, elev. 2300 m, 15 Mar. 1975, fl, *A.M. Camerik 65* (RUSU, U 2 sheets); Serra do Itatiaia, Prateleiras, 22°23'24.24"S 44°40'18.91"W*, elev. 2300 m, 1 Mar. 1950, fl, *A.C. Brade 20246* (RB, SPF); Serra do Itatiaia, Prateleiras, 22°23'49.66"S 44°40'12.79"W*, elev. 2440 m, 30 Jan. 1975, fl fr, *N.L. Menezes 401* (M, RB, SPF); Serra do Itatiaia, Pratelerias, base, 22°23'55.67"S 44°40'11.06"W*, elev. 2460 m, 2 Apr. 1966, fl, *S. Andrade 796* (RB); Serra do Itatiaia, sobre pedras, elev. 2300 m, 22 Nov. 1938, fl, *F. Markgraf 3706* (RB); Serra do Itatiaia, subida das Agulhas Negras, 22°22'32.53"S 44°39'54.58"W*, elev. 2500 m, 6 Feb. 1969, fl, *D. Sucre 4666* (RB); Serra do Itatiaia, Várzea das Flores, 22°23'37.43"S 44°39'38.65"W*, elev. 2400 m, 24 Feb. to 3 Mar. 1921, fl, *B. Lobo 15* (B, R n.v.); Serra do Itatiaia, 1953, fl, *F. Segadas-Vianna SerraI1129* (B, R n.v., US); Serra do Itatiaia, 1953, fr, *F. Segadas-Vianna SerraI1382* (MBM, PEUFR, R n.v., US). SÃO PAULO: **Cruzeiro**, Pico do Itaguaré, alto do Pico, limite entre São Paulo e Minas Gerais, 22°29'09.04"S 45°05'02.70"W*, elev. 2400 m, 4 Jun. 1995, fr, *A.M. Giulietti 1094* (SPF); Pico dos Marins, Serra da Mantiqueira, divisa entre São Paulo e Minas Gerais, 22°30'12.31"S 45°07'2.45"W*, elev. 2000 m, Jun. 2004, fl, *S.T. Aidar 7* (SPF); **Lavrinhas**, Serra Fina, Capim Amarelo, 22°26'31.4"S 44°53'35.6W, elev. 1974 m, 14 Mar. 2007, fl, *L.D. Meireles 3014* (SPF, UEC); Serra Fina, Capim Amarelo, trilha para o Pico do Capim Amarelo, Área de Proteção Ambiental Serra da Mantiqueira, 22°26'14"S 44°53'25"W, elev. 2265 m, 15 Feb. 2015, fl, *D.R. Gonzaga 492* (RB); **Piquete**, Pico dos Marins, trilha para o Pico dos Marins, próximo ao pico, 22°30'08.42"S 45°07'15.12"W*, elev. 2370 m, 16 Dec. 2006, fl fr, *M.L.O. Trovó 322* (SPF); **Queluz**, Serra da Mantiqueira, crista da montanha vizinha à Serra da Mina, 22°28'03"S 44°50'03"W, elev. 2500 m, 18 Feb. 1997, fl, *G.J. Shepherd 97-75* (SPF, UEC).

5. **Barbacenia irwiniana** L.B.Sm., Contributions from the United States National Herbarium 35: 276. 1962. TYPE: BRAZIL. ESPÍRITO SANTO: Ibitirama, Serra do Caparaó, Pico da Bandeira, c. 9000 ft., 20°25'57"S 41°47'58"W*, elev. 2743 m, 3 Mar. 1959, fl, *H.S. Irwin 2803* (holotype, US; isotype, NY). Figures 2A-C; 4E, T; 5E; 6E; 7E; 8E; 9 and 12.

Barbacenia ionantha L.B.Sm., Phytologia 9(4): 262. 1963. TYPE: BRAZIL. MINAS GERAIS: Alto Caparaó, Serra do Caparaó, perto dos Dois Lagos, acima da Casa de Pedra, 20°25'12.65"S 41°48'41.22"W*, elev. 2360 m, 2 Mar. 1960, fl, *F. Tórgo 14* (holotype, HB *n.v.*; isotype, fragment and photo, US).

Barbacenia monticola L.B.Sm. & Ayensu, Smithsonian Contributions to Botany 30: 14. 1976. TYPE: BRAZIL. MINAS GERAIS: Alto Caparaó, Parque Nacional do Caparaó, 16 Feb. 1973, fl, *G.G. Hatschbach 31402* (holotype, US; isotypes, C, CTES, HB, MBM, MO, NY, SPF, US; photo, HB, K).

Pleurostima irwiniana (L.B.Sm.) N.L.Menezes, Revista Brasileira de Botânica 3: 44. 1981.

Pleurostima monticola (L.B.Sm. & Ayensu) N.L.Menezes, Boletim de Botânica da Universidade de São Paulo 8: 67. 1980.

Stems 1.5--21 cm long, 4.5--5 mm wide at apex. Leaves tristichous; leaf lamina 4.5--15 X 0.3–0.8 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and on midrib on abaxial side. Flowers solitary; pedicel 4.5--27 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 6--18 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, mostly on costae, yellow reddish to pink; section fused to ovary 4--10 X 2--4 mm, oblong-campanulate, hypanthial tube 2--8 mm long, 2--5(--8) mm wide at apex. Sepals 8--15 X 3--4 mm, oblong-lanceolate, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth, yellowish red to pink on abaxial side, pink on adaxial side; petals 10--14 X 3--6 mm, ovate to oblong-ovate to elliptic to oblong-lanceolate, with small capitate or capitate-truncated emergences on midrib at abaxial side, deep pink; corona lobes 4.5--6.4 X 2--2.4 mm, oblong-spatulate, deep pink, lobules 0.3--3.8 mm long, oblong-lanceolate. Anthers 4.5--8 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, slightly appendiculate at apex, pollen white. Style 7.5--8 mm long, pale pink, stigmatic regions 3, 1.5--2.2 mm long, liner-lanceolate, at distal 1/3 of style, almost fused at apex, pale pink. Capsule 7--16 X 8--10.5 mm, ellipsoid to widely ellipsoid, fissuricidal. Seeds 0.8--1.2 mm long, trapezoidal, yellowish cinereous.

Leaf and pedicel anatomy (*Brade 16969*, *Mello-Silva 4052*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on abaxial surface only, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1--3 large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, the adaxial girder narrowly obtrapeziform in outline, slightly larger than the abaxial one. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. Most of the known populations of *Barbacenia irwiniana* occur in the Serra do Caparaó massif, at the borders of Espírito Santo and Minas Gerais. Other populations have been found in the Serra do Brigadeiro, 80 km southwest, and two more records are one between the previous two and other, 50 km north of this, all in Minas Gerais state. The populations occur in rocky slopes of *campos de altitude*, at elevations from 1200 to 2730 m.

Phenology. Barbacenia irwiniana has been collected with flowers in every month of the year.

IUCN Red List category. Barbacenia irwiniana has Area of Occupancy (AOO) of 44 km² and Extent of Occurrence of approximately 2051 km². Most records fall within conservation units, the Parque Estadual da Serra do Brigadeiro and Parque Nacional do Caparaó. According to IUCN (2012) criteria, *B. irwiniana* would be considered “EN” (Endangered).

Etymology. The epithet *irwiniana* was named after Howard Samuel Irwin, an US American botanist who did several expeditions to Brazil between 1950's and 1970's, while PhD student and latter as researcher of The New York Botanical Garden.

Discussion. Among the species of the group with hypanthium sparsely covered with capitate or capitate-truncated emergences and pink perianth, viz., *B. fannieae*, *B. gounelleana*, *B. irwiniana*, and *B. mantiqueirae*, *B. irwiniana* is the only combining small leaves, up to 15 cm long, corona and petals of the same color, and yellowish pink sepals. Smith (1962, 1963) and Smith & Ayensu (1976) described as three different species, three specimens collected at the same place based on their supposed small differences of scape measurements and relative dimensions of anthers and corona, and, more specifically, on different parianth colors reported in herbarium labels. The dimensional differences proved to be small, labile and interchangeable among several collections now available, leading to the recognition of only one species among them. The discrepant reported flower colors, yellow for *B. irwiniana* (*Irwin 2803*), purple for *B. ionantha* (*Tórgo 14*), and red for *B. monticola* (*Hatschbach 31402*), is a result of the multicolored nature of *B. irwiniana*'s flowers, which shows sometimes almost pure yellow abaxial face of sepals and almost pure red adaxial face of petals. Purple flowers reported by Flávia Tórgo (*in sched.*) must be a misdescription of the predominant deep pink of the flowers.

Additional specimens examined. BRAZIL. ESPÍRITO SANTO: **Iúna**, Serra do Caparaó, Vale Encantado, entrada pelo município de Alto Caparaó, Parque Nacional do Caparaó, 20°24'40"S 41°50'03"W, elev. 2015 m, 16 Jan. 2016, fl, *J.A. Oliveira 686* (RB); MINAS GERAIS: **Alto Caparaó**, Serra do Caparaó, elev. 2500 m, 18 Nov. 1941, fl, *A.C. Brade 16969* (RB, SPF); Serra do Caparaó, elev. 2100 m, 28 Mar 1986, fl fr, *G. Hashimoto s.n.* (CPHN 7258, SPF); Serra do Caparaó, Campo de altitude, Parque Nacional do Caparaó, elev. 2240 m, Nov. 1998, fl, *L.S. Leoni 4060* (GFJP, SPF); Serra do Caparaó, campos altos, Parque Nacional do Caparaó, elev. 2000 m, 19 Nov. 1988, fl fr, *L. Krieger FPNC538* (CESJ, SPF); Serra do Caparaó, encosta do Pico da Bandeira, 20°26'29.83"S 41°48'9.66"W*, elev. 2730 m, 25 Apr. 1941, fl, *A.C. Brade 17014* (RB, SPF); Serra do Caparaó, encosta do Pico da Bandeira, 20°25'52.18"S 41°47'58.36"W*, elev. 2730 m, 25 Sep. 1941, fl, *A.C. Brade 17019* (K, RB); Serra do Caparaó, Pico da Bandeira, elev. 1800-2000 m, 6 Sep. 1977, fl fr, *G.J. Shepherd 5798* (UEC, US); Serra do Caparaó, Macieira, subida, Parque Nacional do Caparaó, 20°28'56.52"S 41°49'41.20"W*, elev. 1900 m, 22 Mar. 2012, fl, *J. Kunz 605* (HUEMG); Serra do Caparaó, Macieira, Parque Nacional do Caparaó, 20°28'50.68"S 41°49'50.42"W*, elev. 1860 m, 30 Apr. 2006, fl, *C.G. Viana 182* (HUEMG); Serra do Caparaó, Macieira, Parque Nacional do Caparaó, 20°28'31.75"S 41°49'47.74"W*, elev. 1900 m, 28 Jan. 2013, fl, *B.A.P. Cosenza 380* (HUEMG); Serra do Caparaó, Pico do Cristal, Casa Queimada, Parque Nacional do Caparaó, 20°27'14.69"S 41°48'25.31"W*, elev. 2290 m, 30 Mar. 2006, st, *B.V. Tinti 178* (HUEMG); Serra do Caparaó, Pico do Cristal, Casa Queimada, Parque Nacional do Caparaó, 20°27'29.58"S 41°48'36.57"W*, elev. 2190 m, 1 Apr. 2006, fl, *C.G. Viana 143* (HUEMG); Serra do Caparaó, planalto do Caparaó, Nov. 1922, fl, *B. Lobo s.n.* (B, R 30365); Serra do Caparaó, subida ao Pico da Bandeira, no meio da trilha, Parque Nacional do Caparaó, 20°25'21.62"S 41°48'13.89"W*, elev. 2500 m, 12 Jun. 1993, fl, *F. Rivadávia-Lopes 217* (SPF); Serra do Caparaó, Terreirão, arredores, Parque Nacional do Caparaó, 20°25'15.70"S

41°48'43.52"W*, elev. 2300 m, 17 Feb. 2000, fl, *V.C. Souza 23278* (RB); Serra do Caparaó, Terreirão, caminho acima para o Pico da Bandeira, 20°25'23.36"S 41°48'13.88"W*, elev. 2050 m, 23 Oct. 2004, fl fr, *M.T.U. Rodrigues s.n.* (SPF 165314); Serra do Caparaó, trilha da subida ao Pico da Bandeira, Parque Nacional do Caparaó, 20°24'52"S 41°49'35"W, elev. 2130 m, 5 Jul. 2006, fl fr, *M.L.O. Trovó 252* (K, SPF); Serra do Caparaó, Tronqueiras, Parque Nacional do Caparaó, 20°24'46.03"S 41°50'3.18"W*, elev. 1900 m, 5 Feb. 1985, fl, *H.C. Lima 2553* (RB, SPF); Serra do Caparaó, Tronqueiras, Parque Nacional do Caparaó, 20°24'44.94"S 41°50'2.70"W*, elev. 2000 m, 14 Jun. 1991, fl, *G.G. Hatschbach 55482* (BR, C, K, MBM n.v., S, SPF, U); Serra do Caparaó, Tronqueiras, subida ao Pico da Bandeira, aprox. 514 m a partir da Tronqueira, antes do Terreirão, Parque Nacional do Caparaó, 20°24'47.6"S 41°50'00.5"W, elev. 2092 m, 19 Dec. 2013, fl fr, *J. Lovo 445* (SPF); Serra do Caparaó, Tronqueiras, trilha entre a Tronqueira e o Pico da Bandeira, Parque Nacional do Caparaó, 20°24'49.77"S 41°49'54.02"W*, elev. 2000 m, 11 Apr. 2010, fl, *G.O. Romão 2732* (ESA, SPF); **Alto Jequitibá**, Serra do Caparaó, Cachoeira Bonita, margem do rio Caparaó, Parque Nacional do Caparaó, 20°24'27.03"S 41°50'14.00"W*, elev. 1900 m, 29 Dec. 1997, fl, *J.M.A. Braga 4576* (CEPEC, NY, RB, SPF); **Araponga**, Serra do Brigadeiro, Pedra do Índio, 20°42'14.42"S 42°28'33.77"W*, elev. 1450 m, 21 Nov. 2014, fl, *A.H. Salles 3465* (BHZB, SPF); **Espera Feliz**, Taboão, Área de Proteção Ambiental do Taboão, 20°31'25.3"S 42°03'26.6"W, elev. 1445 m, 5 Apr. 2012, fl, *R.L. Silva 73* (HUEMG); **Fervedouro**, Serra do Brigadeiro, Pedra do Pato, Parque Estadual da Serra do Brigadeiro (ou Serra dos Arrepiados), 20°44'52.0"S 42°28'19.9"W, elev. 1800 m, 21 Dec. 2016, fl, *R. Mello-Silva 4052* (SPF); Serra do Brigadeiro, Pedra do Pato, sopé (Serra da Grama), 20°44'11.95"S 42°28'6.73"W*, elev. 1200 m, 17 Aug. 1992, fl, *L.S. Leoni 1937* (RB); Serra do Brigadeiro, Pedra do Ararica, abaixo da Pedra, partindo de São Pedro, 20°36'01.22"S 42°22'16.57"W*, elev. 1250 m, 20 May 2011, fl, *C.G. Viana 472* (HUEMG); **Miradouro**, Serra do Brigadeiro (Serra da Grama), Pedra do Pato, 20°45'S 42°28' W, elev. 1600 m, 8 Jun. 1991, fl, *L.S. Leoni s.n.* (GFJP 1591, SPF); **Simonésia**, Mata do Sossego, Reserva Particular do Patrimônio Natural Mata do Sossego, 20°04'59.48"S 42°04'38.94"W*, elev. 1320 m, 30 Dec. 2016, fl, *B.A.P. Cosenza 363* (HUEMG) ; **no locality**, Cultivated at Botany Department, University of São Paulo, Sep. 1975, fl, *N.L. Menezes 513* (SPF); Dec. 1975, fl, *N.L. Menezes 588* (SPF).

6. **Barbacenia mantiqueirae** Goethart & Henrard in Henrard, Blumea 2(4): 355. 1937. TYPE: BRAZIL. SÃO PAULO: Cruzeiro, Serra da Mantiqueira, Pico dos Marins, 22°30'05.86"S 45°07'15.86"W*, elev. 2350 m, 10 Jan. 1897, fl, *A. Löfgren CGG3570* (lectotype, SP, here designated; isolectotype, C). Figures 2D-F; 4F, G; 5F; 6F; 7F; 8F; 9 and 11.

Stems 2--12(--32) cm long, 8--18 mm wide at apex. Leaves tristichous; leaf lamina 27--53(--80) X 0.5--2 cm, linear-triangular, long attenuate, arcuate, sparsely serrate-ciliate to ciliate on margins and on midrib on abaxial side. Flowers 1--2; pedicel 16--33 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 9.5--26 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, more on the costae, greenish pink to vinaceous; section fused to ovary 10--18 X 3--5 mm, oblong-campanulate to oblong-ellipsoid, hypanthial tube 4--8 mm long, 4--6 mm wide at apex. Perianth pink to vinaceous; sepals 17--36 X 4--8.5 mm, oblong-elliptic, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth; petals 16--36 X 7--15 mm, elliptic, smooth; corona lobes 10.5--12 X 3--4 mm, oblong-spatulate, light pink, lobules 2--6 mm long, obtuse. Anthers 7--16 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple to light purple, appendiculate at apex, pollen white. Style 11--19 mm long, cream, stigmatic regions 3, 1.3--3(--5) mm long, linear-elliptic, at middle of distal 1/3 of style, free, cream. Capsule 25--30 X 10--15 mm, ellipsoid, fissuricidal. Seeds 1--2 mm long, trapezoidal, black to castaneous.

Leaf and pedicel anatomy (*Trovó 323*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces, mostly on abaxial one, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2--3) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along adaxial surface, sometimes with lateral extensions merged with bundles of sclerified cells on adaxial surface. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia mantiqueirae* is endemic to Pico dos Marins and Pedra da Mina massifs, in Serra da Mantiqueira chain along eastern borders of Minas Gerais and São Paulo states. The populations occur in rocky slopes of *campos de altitude*, at elevations from 1880 to 2800 m.

Phenology. The few flowered collections of *B. mantiqueirae* have been done in April and May, and from October to December. Just one collection bears fruits.

IUCN Red List category. Barbacenia mantiqueirae has an Area of Occupancy of 12 km^2 and Extent of Occurrence of approximately 8 km^2. Only two populations, both located in a conservation unit, the Área de Proteção Ambiental da Serra da Mantiqueira, are known. Therefore, its conservation status would be described as “EN” (Endangered), according to IUCN (2012) criteria.

Etymology. The epithet *mantiqueirae* is derived from the Serra da Mantiqueira chain, where the species comes from.

Nomenclatural notes. Henrard (1937) does not cite a herbarium when describing *B. mantiqueirae*, and a specimen of *Löfgren CGG3570* has not been found in L, although Smith & Ayensu (1976) ascribed the holotype to that herbarium. Therefore, we lectotypify here the name.

Discussion. *Barbacenia mantiqueirae* forms wide almost monospecific mats over flat rocky slopes. As commonly observed in monocotyledonous mats of typical inselbergs (Porembski et al. 1998), the mats of *B. mantiqueirae* are only glued to the underlying rock and can be lift together. *Barbacenia mantiqueirae* is distinct from its sympatric species, *B. gounelleana*, for the much longer leaves and the perianth and corona of the same color.

Additional specimens examined. BRAZIL. MINAS GERAIS: **Marmelópolis**, Pico dos Marins, arredores do acampamento do primeiro mirante, Área de Proteção Ambiental Serra da Mantiqueira, 22°30'06"S 45°08'10"W, elev. 2002 m, 29 Apr. 2013, fl, *L.N. Gonçalves 54* (RB); Pico dos Marins, arredores do acampamento do primeiro mirante, Área de Proteção Ambiental Serra da Mantiqueira, 22°29'58"S 45°07'59"W, elev. 1995 m, 3 Oct. 2013, fl, *L.N. Gonçalves 232* (RB); Pico dos Marins, trilha para o Pico dos Marins, no divisor de águas ao longo da trilha, 22°29'55.7"S 45°07'53.8"W, elev. 1980 m, 16 Nov. 2019, fl fr, *R. Mello-Silva 4717* (SPF); SÃO PAULO: **Piquete**, Pico dos Marins, trilha para o Pico dos Marins, pouco após a Pedra do Careca, 22°30'05.60"S 45°08'07.74"W *, elev. 1880 m, 16 Dec. 2006, fl, *M.L.O. Trovó 323* (SPF); **Queluz**, Pedra da Mina, próximo ao ponto culminante da Serra da Mantiqueira, 22°25'40.92"S 44°50'37.51"W, elev. 2800 m, 30 May 2001, fl, *S.T. Aidar 6* (SPF).

7. **Barbacenia maritima** sp. nov. ined. TYPE: BRAZIL. SÃO PAULO: Peruíbe, Jureia, Estação Ecológica Jureia-Itatins, núcleo Arpoador, Praia do Arpoador, sobre afloramento

rochoso na praia, 24°23'46.83"S 47°00'37.46"W*, elev. 10 m, 13 Aug. 2001, fl fr, *I. Cordeiro 2724*. Figures 2G-I; 4H, I; 5G; 6G; 7G; 8G; 9 and 13.

Stems 8--80 cm long, 15--17 mm wide at apex. Leaves tristichous; leaf lamina 13.5--69 X 0.5--0.9 cm, linear-triangular, long attenuate, arcuate, sparsely serrate to ciliate on margins and midrib on abaxial side. Flowers 1--3; pedicel 13--35 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 13.5--29.5 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, vinaceous to sometimes greenish vinaceous; section fused to ovary 10.5--24 X 2.5--5 mm, oblong-campanulate to oblong-ellipsoid, hypanthial tube 3--5.5 mm long, 5--7 mm wide at apex. Perianth vinaceous-purple; sepals 21--31 X 5.5--10 mm, oblong-elliptic, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth; petals 21--30 X 8--15 mm, oblong-elliptic, sparsely covered with capitate or capitate-truncated emergences in the proximal region of midrib on abaxial side, adaxial smooth; corona lobes 6--8.5 X 2--3 mm, oblong, deep pink to purple, lobules 1.3--2.5 mm long, triangular, acute. Anthers 8--10.5 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, appendiculate at apex, pollen white. Style 12--16.5 mm long, pale purple, stigmatic regions 3, 1.3--2.4 mm long, elliptic, at base of distal 1/4 of style, free, white. Capsule 18.5--25.5 X 6.5--15.5 mm, ellipsoid, fissuricidal. Seeds 1--1.5 mm long, narrowly trapezoidal, black.

Leaf and pedicel anatomy (*Cabral 237*, *Catharino 1113*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces, slightly less on adaxial one, in the region between fibro-vascular bundles. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along both surfaces, sometimes with lateral extensions merged with bundles of sclerified cells on adaxial surface. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia maritima* occurs in rocky slopes along the sea coast facing two massifs, Serra de Itatins and Serra da Jureia, south to the city of Peruíbe, between parallels 24°22' and 24°35' S, from sea level to c. 300 m altitude.

Phenology. Barbacenia maritima has been collected with flowers from March to November, through the drier and less warm season in southeastern Brazil. Apparently, the fruits follow the flowers.

IUCN Red List category. Barbacenia maritima has Area of Occupancy of 24 km² and Extent of Occurrence of approximately 52 km². Although narrowly distributed, the two main populations are located in the Estação Ecológica Jureia-Itatins, a conservation unit. According to IUCN (2012) criteria, *B. maritima* would be considered "EN" (Endangered).

Etymology and vernacular name. The epithet *maritima* is a reference to the habitat of the species on the rocks by the sea. *Barbacenia maritima* is locally known as *alho-de-pedra* or *alho-da-pedra*, which means garlic from the rocks.

Discussion. The new species is quite similar to *B. mantiqueirae*, from which it can be distinguished by the purple to deep purple perianth. Their populations, growing apart for more than 300 km, have been considered to belong to a single species (Mello-Silva 2005b). *Barbacenia maritima* is one of the few species of Velloziaceae, together with *B. purpurea* and *Vellozia candida* (Mello-Silva 2004), that also grow very next to the seawater.

Additional specimens examined. BRAZIL. SÃO PAULO: **Iguape**, Jureia, Estação Ecológica Jureia-Itatins, alto do morro, 24°33'29.53"S 47°14'01.30"W*, elev. 300 m, 16 Aug. 1990, fl, *L. Rossi 666* (SP, SPF); Jureia, Estação Ecológica Jureia-Itatins, alto do morro próximo ao alojamento, 24°33'29.63"S 47°14'00.67"W*, elev. 320 m, 20 Mar. 1991, fl, *L. Rossi 851* (SP, SPF); Jureia, Estação Ecológica Jureia-Itatins, próximo ao alojamento, 24°32'40.28"S 47°13'51.49"W*, elev. 60 m, 17 Nov. 1987, fl, *E.L.M. Catharino 1113* (SP, SPF); Jureia, Estação Ecológica Jureia-Itatins, trilha do Imperador, 1-5 km S do rio Verde, encosta da Serra da Jureia, em fenda de rocha granítica em leito de córrego com lamina d'água de poucos mm, 24°34'16.27"S 47°14'13.36"W*, elev. 30-50 m, 28 May 1996, fl, *L.P. Queiroz 4502* (SP, SPF); Jureia, Estação Ecológica Jureia-Itatins, trilha do Imperador, entre o rio Verde e Praia da Juréia, 24°34'18.25"S 47°14'15.66"W*, elev. 40 m, 8 Jun. 1994, fl, *F.A. Vitta s.n.* (SPF 111955); Jureia, Serra da Jureia, 24°33'19.31"S 47°14'07.25"W*, elev. 310 m, 5 Apr. 1980, fl, *G. Hashimoto 7262* (CPHN, SPF); **Peruíbe**, Guaraú, Praia Arpoador, 24°23'22.11"S 47°00'39.27"W*, elev. 20 m, 12 Oct. 1987, fl fr, *G. Hashimoto 7263* (CPHN, SPF); Guaraú, Praia do Guarauzinho, afloramento rochoso antes da Praia do Arpoador, 24°22'58.5"S 47°01'05.6"W, elev. 3 m, 19 Jul. 2018, fl fr, *A. Cabral 237* (SPF); Guaraú, Praia do Guarauzinho, encosta do morro Jureia-Guaraú, 24°23'08.22"S 47°01'16.16"W*, elev. 120 m, 22 Jun. 1988, fl fr, *V.C. Souza 26* (HUSC, SPF).

8. **Barbacenia pabstiana** L.B.Sm. & Ayensu, Smithsonian Contributions to Botany 30: 12. 1976. TYPE: BRAZIL. ESPÍRITO SANTO: Domingos Martins, Aracê, paredões da encosta do morro, 20°23'26.46"S 41°01'4.90"W*, elev. 800-1000 m, 7 Feb. 1973, fl, *G.G. Hatschbach 31360* (holotype US; isotypes, C, CEPEC, HB, M, MBM, MBML, NY, S, R, SPF, US, VIES; photo, HB, K). Figures 2J-L; 4J; 5H; 6H; 7H; 8H; 9 and 12.

Barbacenia burlemarxii L.B.Sm. & Ayensu, Smithsonian Contributions to Botany 30: 15. 1976. ("*burle-marxii*"). TYPE: BRAZIL. ESPÍRITO SANTO: Venda Nova do

Imigrante, cultivated at Santo Antônio da Bica estate, Guaratuba, Rio de Janeiro, of Roberto Burle Marx, 30 Jan. 1972, fl, *L.B. Smith 16014* (holotype, US; photo, HB, K).

Pleurostima burlemarxii (L.B.Sm. & Ayensu) N.L.Menezes, Boletim de Botânica da Universidade de São Paulo 8: 66. 1980.

Pleurostima pabstiana (L.B.Sm. & Ayensu) N.L.Menezes, Boletim de Botânica da Universidade de São Paulo 8: 67. 1980.

Stems 3.5--22 cm long, 5--9 mm wide at apex. Leaves tristichous; leaf lamina 10--26 X 0.3–0.8 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and on midrib on abaxial side. Flowers 1(--3); pedicel 7--25 cm long, sparsely covered with subulate emergences towards apex; hypanthium 11--23 mm long, trigonous in transverse section, sparsely covered with subulate emergences, mostly on costae, purple to deep purple; section fused to ovary 9--17 X 3--6.5 mm, oblong-ellipsoid to oblong-campanulate, hypanthial tube 2--5.5 mm long, 3.5--7.2 mm wide at apex. Perianth purple; sepals 14--19 X 4--7.7 mm, elliptic to oblong-elliptic, sparsely covered with inconspicuous subulate emergences on midrib on abaxial side, adaxial smooth; petals 14--19 X 5--13.5 mm, large elliptic, smooth, ; corona lobes 5.7--7.4 X 2.8--3.3 mm, oblong-spatulate, purple, lobules 1.2--1.6 mm long, triangular. Anthers 8.5--9.3 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, slightly appendiculate at apex, pollen white. Style c. 10.5 mm long, purple, stigmatic regions 3, 1--1.5 mm long, elliptic, in the base of distal 1/3 of style, free, white. Capsule 19--24 X 8.5--15.5 mm, ellipsoid, fissuricidal. Seeds 1.2--1.5 mm long, trapezoidal, black to castaneous.

Leaf anatomy (*Cabral 246*, *258*, *260*, *Mello-Silva 4400*, *Menezes 678*, *Brade 19774*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces in the region between fibro-vascular bundles, slightly more on abaxial one. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2--3) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along both surfaces, sometimes with lateral extensions merged with bundles of sclerified cells on adaxial surface. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia pabstiana* is distributed in lowland inselbergs from the core of the Sugar Loaf Land (de Paula et al. 2016), in Espírito Santo state, at elevations from 420 to 1500 m, mostly above 1000 m.

Phenology. Barbacenia pabstiana has been collected with flowers throughout the year, mostly with accompanying fruits.

IUCN Red List category. Barbacenia pabstiana has Area of Occupancy of 52 km² and Extent of Occurrence of approximately 2000 km². The species is widely distributed in the inselbergs of Espírito Santo state where some populations are located in two conservation units, the Parque Estadual do Forno Grande and the Parque Estadual da Pedra Azul. According to IUCN (2012) criteria, *B. pabstiana* would be considered "EN" (Endangered).

Etymology. *Barbacenia pabstiana* was named after Guido Frederico João Pabst, Brazilian botanist, specialized in orchids, and founder of Herbarium Bradeanum (HB).

Discussion. Both *B. burlemarxii* and *B. pabstiana* are based on types from the Pedra Azul region, in Espírito Santo State, and share the same attributes, mainly the purple perianth. Because of a misinterpretation of the hypanthium covering, a minutely pale-glandular hypanthium attributed to *B. burlemarxii*, Smith & Ayensu (1976) placed them far apart in their identification key, which functions as a classification system (Mello-Silva 1999).

Nevertheless, they share a hypanthium sparsely covered with subulate emergences, mostly on costae. For those reasons, *B. burlemarxii* is here sunk into *B. pabstiana*. *Barbacenia pabstiana* shows beautiful flowers of pure purple and is distinct among the other species of the group for combining this attribute with a hypanthium sparsely covered with subulate emergences. Cabral et al. (ined.) found it paraphyletic with an allopatric population of *B. rogieri*, a quite different species.

Additional specimens examined. BRAZIL. ESPÍRITO SANTO: **Águia Branca**, Pedra da Bandeira, Santa Luzia, propriedade de Ciro Ferreira, 18°58'40"S 40°39'56"W, elev. 420 m, 26 Jul. 2006, fr, *L.F.S. Magnago 1119* (MBML, SPF); **Castelo**, Forno Grande, no lajão, 20°29'34"S 41°06'31"W*, elev. 1200 m, 12 May 1944, fl fr, *A.C. Brade 19774* (CEPEC, K, NY, RB, SPF); Forno Grande, Parque Estadual do Forno Grande, trilha das piscinas para o mirante, 20°31'01.44"S 41° 5'19.17"W*, elev. 1100 m, 12 Feb. 2008, fl fr, *A.P. Fontana 4787* (MBM, RB 2 sheets); Forno Grande, Parque Estadual do Forno Grande, trilha para a base do Fornão, 20°31'06.94"S 41°06'18.52"W*, elev. 1500 m, 14 Oct. 2008, fl, *P.H. Labiak 4942* (CEPEC, MBML, RB 2 sheets, SPF, UPCB); Forno Grande, Parque Estadual do Forno Grande, trilha para o mirante, 20°31'03.46"S 41°05'14.94"W*, elev. 1100 m, 7 Apr. 2009, fl, *R. Goldenberg 1411* (CEPEC, MBML, RB 2 sheets, SPF); Forno Grande, Parque Estadual do Forno Grande, 20°30'53.5"S 41°05'21.1"W, elev. 1374 m, 18 Sep. 2018, fl fr, *A. Cabral 260* (SPF); 20°30'58.26"S 41°06'05.77"W*, elev. 1500 m, 13 Dec. 2014, fl, *V.C. Manhães 527* (VIES); **Domingos Martins**, Pedra Azul, 20°23'16.74"S 41°01'17.84"W*, elev. 950 m, 16 Oct. 1983, fl, *G.G. Hatschbach 46888* (BR, C, ESA, MBM, MEXU, MO, NY, S, SPF, U); Pedra Azul, Parque Estadual Pedra Azul, 20°23'59"S 41°01'13"W, elev. 1315 m, 20 Nov. 2013, fl, *A.C.S. Dal 207* (VIES); Pedra Azul, propriedade do Canal, 20°24'41.92"S 40°58'48.05"W, elev. 1285 m, 12 Jul. 2006, fl, *A.P. Fontana 2238* (RB); Pedra Azul, rodovia Vitória-Belo Horizonte Km 85, 20°24'11.27"S 41°01'33.16"W*, elev. 1350 m, 16 Jun. 1984, st, *O.J.*

Pereira s.n. (VIES 448); Pedra Azul, 20°24'02.19"S 41°01'12.90"W*, elev. 1460 m, 14 Feb. 1986, fl, *G.F. Santos s.n.* (VIES 915); Pedra Azul, 20°24'00.84"S 41°01'15.30"W*, elev. 1000 m, 24 Aug. 1970, fl, *R.A. Kautsky 279* (HB, US); Pedra Azul, Parque Estadual da Pedra Azul, caminho de turistas, 20°24'04.7"S 41°01'31.4"W, elev. 1259 m, 16 Sep. 2018, fl fr, *A. Cabral 246* (SPF); Pedra Azul, Parque Estadual da Pedra Azul, caminho de turistas, 20°23'58.6"S 41°01'09.7"W, elev. 1461 m, 16 Sep. 2018, fr, *A. Cabral 252* (SPF); 15 Jun. 1985, fl, *G.G. Hatschbach 49411* (MBM); **Itaguaçu**, Cachoeirão, propriedade do Sr. Hilário Lopes, trilha da cachoeira, 19°45'23.10"S 40°57'09.72"W*, elev. 725 m, 22 Nov. 2006, fl, *R.C. Britto 142* (MBML, SPF); Cachoeirão, sopés do inselbergue Caparaó, sítio de Hilário Lopes, vizinho ao sítio de João Romeu Zooca, cerca de 6 km de Sobreiro, 19°45'24.4"S 40°57'08.3"W, elev. 693 m, 2 Jan. 2018, fr, *R. Mello-Silva 4393* (SPF); **Itarana**, Pedra da Onça, 19°53'45" S 40°48'46"W, elev. 892 m, 19 Apr. 2013, fl, *R.C. Forzza 7527* (K, RB 2 sheets, SPF, VIES); Pedra da Onça, 4,4 km de Praça Oito, início da trilha no ponto 19°53'18.5"S/40°48'51.6"W, topo da Pedra da Onça, 19°53'54.5"S 40°48'53.1"W, elev. 1015 m, 3 Jan. 2018, fl, *R. Mello-Silva 4400* (SPF); Pedra da Onça, , 20°23'55.1"S 41°01'14.3"W, elev. 1339 m, 17 Sep. 2018, fl fr, *A. Cabral 258* (SPF); **Santa Maria de Jetibá**, Alto São Sebastião, propriedade da Sra. Maria Herzog Rogge, 20°00'26"S 40°51'45"W, elev. 1000 m, 16 May 2006, fl fr, *A.P. Fontana 2114* (RB); Garrafão, sítio Renascer, 20°10'42.19"S 40°54'46.49"W*, elev. 1030 m, 7 Feb. 2009, fl, *T.S. Lorencini 185* (VIES); Garrafão, sítio Renascer, 20°10'45.39"S 40°54'49.04"W*, elev. 1030 m, 18 Apr. 2009, fl, *T.S. Lorencini 227* (VIES); Garrafão, 20°10'37.24"S 40°54'55.60"W*, elev. 1200 m, 25 Nov. 2015, fl, *W.C. Cardoso 393* (VIES); **Santa Teresa**, Pedra Paulista, 19°50'05.88"S 40°47'31.10"W*, elev. 1000 m, 29 Sep. 1988, fl, *D. Loss s.n.* (CEPEC, MBML 5267, SPF); Pedra Paulista, limite com Itaguaçu, cerca de 23 km de Itaguaçu, 19°50'05.6"S 40°47'32.0"W, elev. 1030 m, 2 Jan. 2018, fl, *R. Mello-Silva 4398* (SPF); **Venda Nova do Imigrante**, Pedra Azul, fazenda Pedra Azul, elev. 1200 m, 29 Mar.

1976, fr, *G. Martinelli 1481* (RB); **no locality**, cultivated at Botany Department of University of São Paulo, Dec. 1975, fl, *N.L. Menezes 583* (SPF); cultivated at Santo Antônio da Bica estate, of Roberto Burle Marx, Jan. 1975, fl, *N.L. Menezes 397* (SPF); cultivated at Santo Antônio da Bica estate, of Roberto Burle Marx, 26 Sep. 1975, fl, *N.L. Menezes 450* (SPF); cultivated at Koiti Mori's estate, Rio de Janeiro, from Venda Nova, Apr. 1977, fl, *N.L. Menezes 678* (SPF); cultivated at Santo Antônio da Bica estate, of Roberto Burle Marx, 4 Oct. 1985, fl fr, *N.L. Menezes 447* (SPF).

9. **Barbacenia purpurea** Hook., Botanical Magazine 54, pl. 2777. 1827.TYPE: Plate 2777 of Hooker (1827, lectotype, designated by Smith & Ayensu 1976). Figures 3A-C; 4K, L; 5I; 6I; 7I; 8I; 9 and 11.

Pleurostima purpurea (Hook.) Raf., Flora Telluriana 2: 97. 1837.

Vellozia coerulescens Gumbl., The Gardeners' Chronicle. A Weekly Illustrated Journal of Horticulture and Allied Subjects, n.s., 2: 623. 1874. ("*Vellosia*"). TYPE: cultivated in Belgrove, Cork, Ireland, Nov. 1874, fl fr, *hortus Gumbleton s.n.* (lectotype, here designated, K000400834).

Stems 5.5--30 cm long, 9--12 mm wide at apex. Leaves tristichous; leaf lamina 13--49 X 0.5--1 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and midrib on abaxial side. Flowers 1--2; pedicel 23--58 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 14--35.5 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, green to sometimes greenish vinaceous; section fused to ovary 11--29 X 3.5--7.5 mm, oblong-ellipsoid, hypanthial tube 3--6.5 mm long, 4.5--8.5 mm wide at apex. Perianth purple to dark purple, almost black; sepals 20--26 X 5--6.5 mm, oblong-lanceolate, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth; petals 19--27 X 5.5--12 mm, oblong-elliptic to wide elliptic, sparsely covered with capitate or capitate-truncated emergences in the proximal region and to the half of midrib at abaxial side, adaxial smooth; corona lobes 10.3--14 X 3.2--4 mm, oblong-lanceolate, purple to deep purple, lobules 1.3--2.3 mm long, oblong to triangular, obtuse. Anthers 14--15 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, appendiculate at apex, pollen white. Style 20--24 mm long, purple, stigmatic regions 3, 5--6.4 mm long, elliptic, at base of distal 1/2 of style, free, white. Capsule 24--38.5 X 14--20.5 mm, ellipsoid, fissuricidal. Seeds 1.5--2.8 mm long, narrowly trapezoidal, yellowish cinereous.

Leaf and pedicel anatomy (*Cabral 232*, *243*, *Menezes 635*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces in the region between fibro-vascular bundles, more on abaxial one. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along both surfaces, sometimes with lateral extensions merged with bundles of sclerified cells on adaxial surface. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia purpurea* is endemic to the coastal inselbergs of Niterói and Rio de Janeiro municipalities, flanking the mouth of the Guanabara Bay, from sea level up to 700 m altitude.

Phenology. Barbacenia purpurea has been collected with flowers and fruits all over the year.

IUCN Red List category. Barbacenia purpurea has Area of Occupancy of 72 km² and

Extent of Occurrence of approximately 144 km². Most populations are located inside conservation units, the Parque Estadual da Serra da Tiririca and Parque Nacional da Floresta da Tijuca, but the intense touristic activity in those regions could threaten them. According to IUCN (2012) criteria, *B. purpurea* would be considered “EN” (Endangered).

Etymology. The epithet *purpurea*, meaning purple, comes from the deep and lively purple color (Hooker 1827) of the species perianth.

Nomenclatural notes. Hooker (1827) cited no specimen when describing *B. purpurea*. Smith & Ayensu (1976) suggested the original plate as the type of the species, thus effecting the lectotypification. Gumbleton (1874: 623) presented *Vellozia coerulescens* as a superb species. Some time latter, someone from Kew ascertained him that the plant was, in fact, a *Barbacenia purpurea* (Gumbleton 1874: 657). Nevertheless, no type was chosen in the original description of *V. coerulescens*, a communication of a new plant received from van Houtte nursery in Ghent, Belgium, and flowered in cultivation at Gumbleton's stoves in Belgrove, Ireland. Therefore, we selected here, as lectotype, the plant Gumbleton sent to Kew for identification.

Discussion. *Barbacenia purpurea*, the first species of the group, was also the first described from cultivated material (Hooker 1827, Mello-Silva & Montserrat 2015). It is noteworthy that neither Martius (1823) nor Pohl (1828) had described or even collected such a common and flamboyant species, its first dated records dating back to 1829. The purple to, more frequently, dark purple flowers of *B. purpurea* only finds similar in *B. rogieri* flowers. In comparison to that species, *B. purpurea* shows arcuate and often narrower leaves and shorter perianth.

Additional specimens examined. BRAZIL. RIO DE JANEIRO: **Niterói**, Forte do Pico (Forteresse du Pic de Santa Cruz), 22°56'12.46"S 43° 07'17.98"W*, elev. 160 m, 7 Aug. 1872, fl, *A.F.M. Glaziou 5707a* (B 2 sheets, C, K, P); Serra da Tiririca, Parque Estadual da Serra da

Tiririca, parte final da trilha entre Itaipu e Itaipuassu para o Alto Mourão até o cume, 22°58'23"S 43°01'11"W, elev. 404 m, 21 Jun. 2011, fl, *C.N. Fraga 3290* (RB, SPF); Cafubá, Morro da Viração, afloramento rochoso voltado para a Lagoa de Piratininga, 22°56'22"S 43°04'54"W, elev. 40 m, 8 Aug. 2015, fl fr, *D.N.S. Machado 730* (RB); Itaipu, Parque Estadual da Serra da Tiririca, Morro das Andorinhas, Trilha das Andorinhas, 22°58'27.21"S 43° 2'48.00"W*, elev. 30 m, 27 Jun. 2012, fr, *A.A.M. Barros 4701* (RB); Pico do Mourão, trilha para o Pico do Mourão, 22°57'58.02"S 43°01'27.86"W*, elev. 290 m, 29 Apr. 2006, fl, *S. Vieira 202* (RB); Serra da Tiririca, Pedra de Itacoatiara, Parque Estadual da Serra da Tiririca, 22°58'32.09"S 43° 1'45.56"W*, elev. 40 m, 19 Aug. 1997, fl, *K.M. Leal 5* (RB); Serra da Tiririca, Parque Estadual da Serra da Tiririca, afloramento final na trilha da Pedra das Andorinhas. 22°58'52.7"S 43°03'03.1"W, elev. 29 m, 15 Aug. 2018, fl fr, *A. Cabral 243* (SPF); **Rio de Janeiro**, Botafogo, Morro Mundo Novo, 22°56'22.17"S 43°11'05.91"W*, elev. 65 m, 4 Aug. 1968, fl fr, *D. Sucre 3406* (GUA, HB, IPA, INPA, L, NY, P, RB, UB); Copacabana, , 22°57'48.20"S 43°09'52.08"W*, elev. 25 m, 13 Sep. 1835, fl fr, *F.C.C. Raben 319* (BR 2 sheets, C); Copacabana, rochers granitiques de Copa-cabana, 22°57'46.84"S 43°09'50.56"W*, elev. 30 m, Aug. 1862, fl, *J. Nadeaud s.n.* (P002085750); Copacabana, montagnes dénudeés de Copa-cabana, 22°57'53.59"S 43°11'09.23"W*, elev. 100 m, Sep. 1862, fl, *J. Nadeaud s.n.* (P002085756); Copacabana, sur les roches, près de la mer, 22°58'08.53"S 43°11'27.10"W*, elev. 50 m, Jul. 1870, fl, *A.F.M. Glaziou 5707* (L, P 2 sheets); Copacabana, Morro, 22°57'41.20"S 43°10'35.62"W*, elev. 60 m, Jul. 1880, fr, *R. Galvão 514* (P); Copacabana, Parque da Chacrinha. Paredão acima de 100 m, 22°57'40.75"S 43°10'51.86"W*, elev. 100 m, 4 Mar. 2004, fl, *L.J.T. Cardoso 110* (RB); Copacabana, in rupibus prope Domingas Lopes, Jun., fl, *s.c. s.n.* (P002085769); Corcovado, sommets arides, 22°57'09.83"S 43°12'43.13"W*, elev. 690 m, 1862, fl, *J. Nadeaud s.n.* (P002101660); Corcovado, Pedra d'Água, 22°57'26.41"S 43°13'50.40"W*, elev. 400 m, 14 Jul. 1936, fl, *A.C. Brade 15326* (RB);

Corcovado, 22°57'07.36"S 43°12'36.89"W*, elev. 700 m, 5 Oct. 1976, fl fr, *N.L. Menezes 635* (BM, M, SPF); Lagoa Rodrigo de Freitas, 22°58'44.89"S 43°11'56.57"W*, elev. 30 m, fr, *E. Warming 1076* (C 2 sheets); Laranjeiras, on dry rocks of Laranjeiras, 22°56'36.01"S 43°11'37.74"W*, elev. 100 m, 1837, fl, *J. Tweedie 11063* (K); Maricá, Inoã, Serra escarpada, 22°56'16.00"S 42°57'42.61"W*, elev. 300 m, 23 Jul. 1961, fl, *Gomes 1208* (RB); Morro da Urca, pista Cláudo Coutinho, após o final da trilha, no costão, 22°57'01.96"S 43° 9'4.42"W*, elev. 20 m, 14 Mar. 2016, fl fr, *P. Feliz 77* (RB); Morro das Laranjeiras, 500 m acima do Parque Guinle, 22°55'33.54"S 43°11'07.51"W*, elev. 200 m, 9 Jun. 1987, fl, *R.J.V. Alves 19* (RB); Morro do Caranguejo, alto do complexo Pavão-Pavãozinho, 22°58'44.20"S 43°11'45.96"W*, elev. 140 m, 4 Sep. 2012, fr, *D. Pimenta s.n.* (RB 603836); Morro do Flamengo ("Flamingo") (ou Morro da Viúva), 22°56'26.37"S 43°10'29.75"W*, elev. 40 m, Sep. 1831, fl, *G. Gardner 131* (BM, K 2 sheets, NY, OXF, P); Morro dos Cabritos, Gávea, cultivada no Jardim Botânico, 22°58'09.47"S 43°12'07.84"W*, elev. 90 m, Jun. 1945, fr, *O. Voll s.n.* (RB 53639); Morro dos Cabritos, 22°58'09.12"S 43°12'02.71"W*, elev. 170 m, 5 Sep. 1946, fl fr, *A.P. Duarte 283* (RB, SPF, UB); Morro dos Cabritos, 22°58'10.04"S 43°11'58.86"W*, elev. 240 m, 9 Sep. 1946, fl, *P. Occhioni 669* (RFA, US); Morro dos Cabritos, 22°58'10.09"S 43°12'05.98"W*, elev. 120 m, 13 Nov. 1992, fr, *M. Gomes 533* (RB); Morro dos Cabritos, 22°58'9.77"S 43°12'04.66"W*, elev. 140 m, 13 Nov. 1992, fr, *M. Gomes 534* (RB); Morro Flamengo (ou Morro da Viúva), 22°56'22.11"S 43°10'22.63"W*, elev. 40 m, fl, *J. Miers 3043* (BM, K); Morro Flamengo (ou Morro da Viúva), 22°56'23.76"S 43°10'22.67"W*, elev. 40 m, fl, *J. Miers 3044* (BM); Rio de Janeiro, Pão de Açúcar, 22°56'54.39"S 43°09'07.90"W*, elev. 20 m, 14 Mar. 1887, fl destroyed fr, *H. Schenck 3071* (B 2 sheets, C); Pão de Açúcar, encosta S, 22°57'11.36"S 43° 9'44.86"W*, elev. 10 m, 8 May 1966, fr, *H.E. Strang 698* (HB n.v. K 2 sheets, M); Pão de Açúcar, Dec. 1968, fl, *C. Koczick 194* (MBM); Pão de Açúcar, Praia Vermelha, Urca, 22°57'12.22"S 43°09'44.89"W*, elev. 10

m, 17 Aug. 1977, fl, *L. Mautone 192* (RB); Pão de Açúcar, costão, 22°56'59.80"S 43° 9'8.57"W*, elev. 50 m, 17 Feb. 1980, fl, *J.P.P. Carauta 246* (GUA, US); Pão de Açúcar, Urca, 22°57'13.04"S 43°09'50.38"W*, 20 m, fl, *L. Mautone 232* (RB); Pedra Bonita, 22°59'21.12"S 43°17'3.26"W*, elev. 560 m, Jul. 1934, fl, *O. Voll s.n.* (RB 29559); Pedra da Urca, Parque Nacional da Tijuca, 22°57'13.5"S 43°09'48.4"W, elev. 21 m, 1 Jul. 2018, fl fr, *A. Cabral 232* (SPF); Praia do Flamengo (Praya Flamingo), 22°56'25.32"S 43°10'19.38"W*, elev. 10 m, 1835, fl fr, *B. Luschnath s.n.* (LE); Oct.-Dec. 1829, fl, *L. Riedel s.n.* (LE); 1831, fl, *A.-C. Vauthier 73* (P); 1831, fl, *hort. Hamb. s.n.* (S); Jan. 1832, fl destroyed, *L. Riedel 850* (LE, P 2 sheets); 1832, fl, *A.-C. Vauthier 147* (K); 1834, fl, *B. Luschnath herbarium Martii 34* (BR); 1835, fl destroyed, fr, *C. Gaudichaud-Beaupré 346* (B, P 2 sheets); 1836, fl, *A.I. Gomes s.n.* (K001242527); environs de Rio Janeiro, 1843, st, *H.A. Weddell 354* (NY, P 2 sheets); 1852, fl, *s.c. s.n.* (BR); 1854, fl destroyed, *s.c. s.n.* (BR); 1872, fl, *A.F.M. Glaziou 5513* (B); 1910, fl, *P.F. Lützelburg s.n.* (M 340/11); s.d., fr, *J. Miers s.n.* (K001242533); s.d., fl fr, *B. Luschnath s.n.* (OXF); s.d., fl, *s.c. 1173* (S); **no locality**, cultivated, Chamgresson, Serre Chaude, 24 Sep. 1857, fr, *s.c. s.n.* (K); cultivated, from the garden of E. Leeds, May, 1876, fl, *s.c. s.n.* (K); cultivate at Kew Gardens, 3 Sep. 1890, fl, *N.E. Brown s.n.* (K); cultivated at Botany Department of University of São Paulo, Jul. 1974, fl, *N.L. Menezes 508* (SPF); cultivated at Botany Department of University of São Paulo, Dec. 1974, fl, *N.L. Menezes 510* (SPF); cultivated at Botany Department of University of São Paulo, 1 Jul. 1974, fl, *N.L. Menezes 509* (SPF); cultivated at Botany Department of University of São Paulo, Mar. 1975, fl, *N.L. Menezes 511* (SPF); cultivated at Botany Department of University of São Paulo, Dec. 1975, fl, *N.L. Menezes 584* (SPF); cultivated at Santo Antônio da Bica state, Guaratuba, Rio de Janeiro, of Roberto Burle Marx, Nov. 1976, fl, *N.L. Menezes* 652 (SPF); cultivated at Santo Antônio da Bica state, Guaratuba, Rio de Janeiro, of Roberto Burle Marx, number 110, May 1980, fl fr, *N.L. Menezes 946* (SPF); cultivated at Botanical Garden München, 4 Nov. 2002, fl, *C. Reed s.n.* (M 97/1247w); cultivated from seeds donated by Botanical Garden University of Bonn, living collections 2003-727, 25 Feb. 2008, fl, *O. Weber s.n.* (K000501351); cultivated at Bonn Universität, 23 Jan. 2013, fl, *W. Lobin s.n.* (BONN 19766); cultivated at Botanical Garden München, fl, *J. Bogner 2688* (M).

10. **Barbacenia rogieri** T.Moore & Ayres, 1850. Gardeners' Magazine of Botany, Horticulture, Floriculture, and Natural Science 2: 209. 1850. TYPE: s.d., *hortus van Houtte s.n.* (lectotype, BM). Figures 3D-F; 4M, O; 5J; 6J; 7J; 8J; 9 and 12.

Stems 7--15(--30) cm long, 9--16 mm wide at apex. Leaves tristichous; leaf lamina 14--51 X 0.6--2 cm, linear-triangular, long attenuate, plane, sparsely serrate on margins and midrib on abaxial side. Flowers 1--3; pedicel 13--46.5 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 12.5--34 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, deep purple to sometimes greenish vinaceous; section fused to ovary 9.5--26 X 4--6.5 mm, oblong-campanulate to oblong-ellipsoid, hypanthial tube 3--8 mm long, 5.2--7 mm wide at apex. Perianth purple to dark purple, almost black; sepals 17--36 X 5.4--11 mm, oblong-lanceolate, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth; petals 15.5--35 X 7.5--13 mm, oblong-elliptic-lanceolate, sparsely covered with capitate or capitate-truncated emergences in the midrib at abaxial side, adaxial smooth; corona lobes 18--21 X 2--3 mm, oblong-lanceolate, purple to deep purple, lobules 2.5--3 mm long, oblong-triangular. Anthers c. 13 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, appendiculate at apex, pollen white. Style c. 25 mm long, purple, stigmatic regions 3, c. 2 mm long, elliptic, at middle of style, free, white. Capsule 19--21 X 9--9.5 mm, ellipsoid, fissuricidal. Seeds 1--2.1 mm long, narrowly trapezoidal, yellowish cinereous.

Leaf and pedicel anatomy (*Mello-Silva 4400*, *4422*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces, in the region between fibro-vascular bundles, slightly more on abaxial one. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1--2(--3) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, often with lateral extensions along both surfaces. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia rogieri* is the most widespread species of the group, ranging from southern Rio de Janeiro state, through Espírito Santo to northeastern Minas Gerais. The populations occur mostly in rocky slopes of lowland inselbergs, at elevations from 150 to 1760 m.

Phenology. Barbacenia rogieri has been collected with flowers and fruits from January to April and from July to October.

IUCN Red List category. Barbacenia rogieri has Area of occupancy of 60 km² and Extent of Occurrence of approximately 99000 km². The species is widely distributed, and occurs over non-utilizable grounds. One population is located in a conservation unit, the Parque Estadual do Desengano. According to IUCN (2012) criteria, *B. rogieri* would be considered “EN” (Endangered).

Etymology. *Barbacenia rogieri* was probably named after Charles Latour Rogier, a leader in the Belgian revolution of 1830, and Belgian prime minister for two periods (Moore & Ayres 1850, Discailles 1895).

Nomenclatural notes. Moore & Ayres (1850) cited no specimen when describing *B. rogieri*. Smith & Ayensu (1976) assigned *hortus van Houtte s.n.*, which is deposited in BM herbaria, as the putative type collection of this species, thus effecting the lectotypification, although they did not indicate that.

Discussion. Lemaire (1851) informs that *B. rogieri* was consider to be of hybrid origin (*species, ut dicunt, hybrida*), being *B. purpurea* one of the putative parents, and *B. sanguinea*, an unknown species, the other. Nevertheless, the depicted specimen, cultivated in Regent's Park, London, and coming from the nursery of van Houtte, in Ghent, Belgium (Moore & Ayres 1850, Lemaire 1851, Mello-Silva & Monteserrat 2015), are rather similar to representatives of wild populations of *Barbacenia rogieri*, as already noted by Smith & Ayensu (1976). Some of those populations occur in Rio Claro, RJ, situated between São João Marcos and Bananal, a route taken by everyone traveling from Rio de Janeiro to São Paulo in the 19th century. Thus, it can be assumed that plants from these populations have been found and sent to Europe for cultivation, perhaps by Louis van Houtte himself, who had probably taken this route when travelling to São Paulo, Paraná and Mato Grosso from Rio de Janeiro (Le Tesnier 1911). *Barbacenia rogieri* is quite distinct from the other species of the group for the combination of a plane, erect and glaucous leaf with hypanthium sparsely covered with capitate or capitate-truncated emergences, together with the purple to dark purple, almost black, perianth.

Additional specimens examined. BRAZIL. ESPÍRITO SANTO: **Águia Branca**, Três Pontões, 18°58'26.04"S 40°42'27.00"W, elev. 240 m, 29 Apr. 2015, fl fr, *L.F.T. Menezes 2176* (RB, SAMES); **Baixo Guandu**, morro Maquiji, fazenda Pedra Grande, 11 km da rodovia Colatina-Baixo Guandu (BR 259), entrada no ponto 19°30'37.5"S 40°51'08.7"W, 19°29'29.6"S 40°50'29.9"W, elev. 643 m, 3 Jan. 2018, st, *R. Mello-Silva 4404* (SPF); MINAS GERAIS: **Carlos Chagas**, Pedra da Baleia, inselbergues do Kaladão, fazenda de Aroldo

Rangel, próximo da BR 418, 17°49'39"S 40°59'45"W, elev. 365 m, 1 Apr. 2016, fr, *L.F.A. Paula 985* (RB, SPF); Pedra da Baleia, inselbergues do Kaladão, fazenda de Aroldo Rangel, entrada a 2 km da rodovia Teófilo Otoni-Carlos Chagas (BR 418), em direção a Presidente Pena, 17°49'21.04"S 41°00'04.75"W, elev. 531 m, 4 Oct. 2018, fl fr, *R. Mello-Silva 4422* (SPF); cultivado no sítio de Burle Marx, nº 53, from **Padre Paraíso** (?), 17°04'50.92"S 41°28'54.44"W*, elev. 750 m, Oct. 1976, fl, *N.L. Menezes 637* (SPF); **Teófilo Otoni**, rodovia MG 418, ca. 30 km N de Teófilo Otoni, lado esquerdo, 17°51'22"S 41°15'39"W, elev. 560 m, 28 Sep. 2013, fl, *L.F.A. Paula 640* (BHCB, SPF); RIO DE JANEIRO: **Campos dos Goytacazes**, Ibitioca, fazenda Pedra Negra, 21°48'08.71"S 41°27'46.08"W*, elev. 175 m, 9 Oct. 1993, fl, *J.M.A. Braga 665* (RB, RUSU); Ibitioca, fazenda Pedra Negra, 21°48'11.74"S 41°27'50.27"W*, elev. 150 m, 9 Oct. 1993, fl, *J.M.A. Braga 682* (RB, RUSU); Ibitioca, fazenda Pedra Negra, 21°47'51.36"S 41°27'36.27"W*, elev. 180 m, 10 Oct. 1993, fl, *J.M.A. Braga 708* (RB, RUSU); Ibitioca, Maciço do Itaoca, 21°47'50"S 41°26'53"W*, elev. 201 m, 25 May 2011, st, *M.C. Gaglianone 78* (HUENF, RB); Ibitioca, Maciço do Itaoca, Morro do Macaco, 21°47'40"S 41°27'14"W, elev. 20-200 m, 15 Sep. 2007 fl, *M.L. Dan Ita007* (K, NY, RB, SPF); Ibitioca, Maciço do Itaoca, Morro do Macaco, 21°47'35.72"S 41°27'13.69"W*, elev. 20-200 m, 24 Nov. 2007, fl, *M.L. Dan Ita071* (RB); Ibitioca, Maciço do Itaoca, Maciço do Itaoca, 21°47'49"S 41°26'52"W, elev. 207 m, 23 Aug. 2011, fl, *T.P. Souza 68* (HUENF); Morro do Coco, 21°20'38.86"S 41°23'56.48"W*, elev. 300 m, 1981, fl, *R. Burle Marx 149* (RB); **Rio Claro**, Passa Três, estrada do Passa Três, 22°44'17.81"S 44°11'42.34"W*, elev. 400 m, 20 Jan. 1962, fl fr, *H.F. Martins 260* (GUA); Passa Três, pedreira de granito, 22°43'47.61"S 44°10'46.00"W*, elev. 1000 m, 20 Feb. 1978, fl, *R. Burle Marx in N.L. Menezes 784* (US); próximo a túnel da rodovia RJ-16, perto de Lídice, 22°50'29.55"S 44°13'19.59"W*, 500 m, 17 Mar. 1978, fr, *G. Martinelli 4066* (RB); **Santa Maria Madalena**, Pedra do Desengano, Parque Estadual do Desengano, 21°53'57.65"S 41°54'42.83"W*, elev.

1700 m, 1 Jul. 1989, fl, *M. Leitman 345* (RB); Pedra do Desengano, próximo do cume, Parque Estadual do Desengano, 21°53'56"S 41°54'43"W, elev. 1729 m, 26 Jan. 2016, fl, *C. Baez 375* (RB, SPF); Pedra do Desengano, vertente norte, Parque Estadual do Desengano, 21°53'57.66"S 41°54'44.56"W*, elev. 1760 m, 5 Oct. 1988, fl, *G. Martinelli 13147* (HUNI, RB); **São Fidélis**, Itacolomi, região serrana, à margem da estrada principal, em rochedo, 21°49'32.62"S 41°51'50.47"W*, elev. 950 m, 27 Apr. 2013, fl, *I.G. Costa 211* (RB); Serra Pedra do Marial, Parque Estadual do Desengano, 21°52'01"S 41°54'48"W, elev. 1400 m, 27 Jan. 2016, fl, *C. Baez 444* (RB); **unknown municipality**, estrada para Itacambira, pedreira na beira da estrada, Apr. 1981, fl, *N.L. Menezes 1147* (SPF); **no locality**, cultivated at Santo Antônio da Bica estate, of Roberto Burle Marx, Guaratuba, Rio de Janeiro, Jul. 1976, fl, *N.L. Menezes 612* (SPF); cultivated at Bonn University, 27 Mar. 2013, fl, *W. Lobin s.n.* (BONN 34454).

11. **Barbacenia spectabilis** L.B.Sm. & Ayensu, Smithsonian Contributions to Botany 30: 17. 1976. TYPE: BRAZIL. ESPÍRITO SANTO: Piúma, Morro do Aghá, 20°52'00"S 40°46'03"W*, elev. 120 m, 10 Jul. 1967, fl, *E.C. Oliveira Filho 3* (holotype US; isotype, SP; photo HB, K, SPF). Figures 3G-I; 4P; 5K; 6K; 7K; 8K; 9 and 12.

Pleurostima spectabilis (L.B.Sm. & Ayensu) N.L.Menezes, Revista Brasileira de Botânica 3: 44. 1981.

Stems 3.6--50 cm long, 12--14 mm wide at apex. Leaves tristichous; leaf lamina 18--54 X 0.9--1.5 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and midrib on abaxial side. Flowers solitary; pedicel 39--47 cm long, sparsely covered with capitate or capitate-truncated emergences towards apex; hypanthium 19.5--36 mm long, trigonous in transverse section, sparsely covered with capitate or capitate-truncated emergences, deep purple to sometimes greenish vinaceous; section fused to ovary 15--25 X 5--9 mm, oblong-campanulate, hypanthial tube 4.5--11 mm long, 7--12.5 mm wide at apex. Perianth purple; sepals 35--60 X 7.5--14 mm, oblong-elliptic to elliptic, sparsely covered with capitate or capitate-truncated emergences on abaxial side, adaxial smooth; petals 40--75 X 9.5--22 mm, oblong-elliptic to elliptic to widely elliptic, sparsely covered with capitate or capitate-truncated emergences in the midrib at abaxial side, adaxial smooth; corona lobes 25.3--40.3 X 4.4--6.3 mm, oblong, purple to deep purple, lobules 4.5--15 mm long, oblong-acuminate. Anthers 24.5--39 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective cream, appendiculate at apex, pollen white. Style 31--50.5 mm long, white, stigmatic regions 3, 4--5.3 mm long, elliptic, at base of median 1/3 of style, free, white. Capsule 27.5--30 X 14.5--18.5 mm, ellipsoid, fissuricidal. Seeds 1.1--1.8 mm long, narrowly trapezoidal, yellowish cinereous.

Leaf and pedicel anatomy (*Anorikopoulos s.n.* SPF 180490, *Cabral 184*, *266*, *Menezes 722*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces in the region between fibro-vascular bundles, slightly more on abaxial one. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1(--2--3) large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders next to epidermis on both sides, with lateral extensions along both surfaces, sometimes with lateral extensions merged with bundles of sclerified cells on adaxial surface. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia spectabilis* is endemic to two coastal inselbergs from Espírito Santo, the Morro do Aghá, in Piúma, and the Morro do Mestre Álvaro, in Serra, 90 km apart each other. The populations occur at elevations from 120 to 750 m.

Phenology. Barbacenia spectabilis has been collected with flowers, often with also fruits, from August to April.

IUCN Red List category. Barbacenia spectabilis has Area of Occupancy of 12 km² and Extent of Occurrence of approximately 27 km². Its two known populations are extensive, occur over non-utilizable grounds and one of them is located in a conservation unit, the Área de Proteção Ambiental do Mestre Álvaro. According to IUCN (2012) criteria, *B. spectabilis* would be considered "EN" (Endangered).

Etymology. The epithet *spectabilis* points out the spectacular flowers of that species.

Discussion. *Barbacenia spectabilis* flowers massively, producing the showiest flowers among the species of the group, with large petals from 4 to 7.5 cm, and with exerted and showy corona.

Additional specimens examined. BRAZIL. ESPÍRITO SANTO: **Piúma**, Morro do Aghá, 20°52'03.22"S 40°46'08.55"W*, elev. 250 m, 8 Aug. 1969, fl, *N.L. Menezes 56* (US); Morro do Aghá, 20°52'03.38"S 40°46'05.66"W*, elev. 250 m, 8 Aug. 1969, fl fr, *N.L. Menezes 57* (US); Morro do Aghá, da localidade-tipo, 20°52'00"S 40°46'03"W*, elev. 120 m, 10 Dec. 1977, st, *N.L. Menezes 722* (SPF); Morro do Aghá, 20°52'03.06"S 40°46'11.10"W*, elev. 230 m, 19 Dec. 1979, fl, *N.L. Menezes 887* (SPF); Morro do Aghá, 20°52'05.42"S 40°46'13.14"W*, elev. 240 m, 4 Mar. 1982, fl, *N.L. Menezes 1170* (SPF); Morro do Aghá, 20°52'07.9"S 40°46'02.3"W, elev. 260 m, 11 Jan. 2018, fl, *A. Cabral 184* (SPF); **Serra**, Morro do Mestre Álvaro, 20°10'10"S 40°18'48"W*, elev. 733 m, Oct. 2006, fl, *F.B. Anorikopoulos s.n.* (SPF 180490); Morro do Mestre Álvaro, 20°10'02.67"S 40°18'35.96"W*, elev. 750 m, 21 Apr. 2008, fl fr, *Y.S. Deus 19* (VIES); Morro do Mestre Álvaro, Área de Proteção Ambiental

Mestre Álvaro, 20°09'45"S 40°18'27"W, elev. 630 m, 23 Nov. 2012, fl, *W.C. Cardoso 221* (VIES); Morro do Mestre Álvaro, Área de Proteção Ambiental Mestre Álvaro, trilha principal, 20°09'52"S 40°18'26"W, elev. 683 m, 15 Mar. 2015, fl, *W.C. Cardoso 335* (VIES); Morro do Mestre Álvaro, Área de Proteção Ambiental Mestre Álvaro, 20°09'57.9"S 40°18'28.1"W, elev. 737 m, 15 Nov. 2018, fr, *A. Cabral 266* (SPF); Morro do Mestre Álvaro, Área de Proteção Ambiental Mestre Álvaro, 20°09'57.9"S 40°18'28.1"W, elev. 737 m, 15 Nov. 2018, fl fr, *A. Cabral 267* (SPF).

12. **Barbacenia squamata** Herb., Edwards's Botanical Register 29: Misc. 64. 1843. TYPE: Plate of *Barbacenia squamata* in Paxton (1844, lectotype, here designated). Figures 3J-L; 4Q, R; 5L; 6L; 7L; 8L; 9 and 11.

Barbacenia gaveensis Goethart & Henrard in Henrard, Blumea 2(4): 360. 1937. TYPE: BRAZIL. RIO DE JANEIRO: Rio de Janeiro: Rio de Janeiro, Pedra da Gávea, sommet de la Gávea, 22°59'53.06"S 43°17'05.54"W*, elev. 840 m, 29 Jun. 1875, fl, *A.F.M. Glaziou s.n.* (holotype, P00104875; photo, L).

Barbacenia foliosa Goethart & Henrard in Henrard, Blumea 2(4): 344. 1937. TYPE: BRAZIL. RIO DE JANEIRO: Rio de Janeiro, Tijuca, Pico da Tijuca, an Felsen der Tijuca, 22°56'35.60"S 43°17'11.33"W*, elev. 930 m, Nov. 1894, fl, *E.H.G. Ule 4056* (holotype, B *n.v.*, probably lost). NEOTYPE, here designated: Brazil. Rio de Janeiro: Rio de Janeiro, Pico da Tijuca, 22°56'37.40"S, 43°17'9.30"W*, elev. 940 m, Sep. 1916, fl, *F.C. Hoehne 320* (neotype, SP; isoneotype, NY).

Barbacenia purpurea var. *minor* Seub., Flora brasiliensis 3(1): 68.1847. TYPE: BRAZIL. RIO DE JANEIRO: Serra dos Órgãos ("near summit Organ mountains"), Mar. 1841, fl, *G.*

Gardner 5897 (lectotype, K000400864, here designated; isolectotypes, K, BM, OXF; photo, SPF).

Barbacenia seubertiana Goethart & Henrard in Henrard, Blumea 2(4): 360. 1937. TYPE: BRAZIL. RIO DE JANEIRO: Serra dos Órgãos ("Chaine dos Orgãos"), 6 Mar. 1888, fl, *A.F.M. Glaziou 17824* (holotype, L; isotypes, K, P; photo SPF).

Pleurostima gaveensis (Goethart & Henrard) N.L.Menezes, Revista Brasileira de Botânica 3: 44, 1981.

Pleurostima seubertiana (Goethart & Henrard) N.L.Menezes, Revista Brasileira de Botânica 3: 44. 1981.

Pleurostima squamata (Herb.) N.L.Menezes, Revista Brasileira de Botânica 3: 44. 1981.

Stems 2.5--36.5 cm long, (5--)6--12 mm wide at apex. Leaves tristichous; leaf lamina, (4.9--11--)13.5--43 X 0.3–1.25 cm, linear-triangular, long attenuate, arcuate, sparsely serrate on margins and on midrib on abaxial side. Flowers 1(--2); pedicel (4.1--)11--33.5 cm long, sparsely covered with subulate emergences towards apex, rarely sparsely covered with capitate or capitate-truncated emergences; hypanthium 11.5--23 mm long, trigonous in transverse section, sparsely covered with subulate emergences, rarely sparsely covered with capitate or capitate-truncated emergences, red to yellowish red; section fused to ovary 8.7--16 X 2--5 mm, oblong-campanulate, hypanthial tube 2.3--7 mm long, 2--5 mm wide at apex. Perianth red to orange-red; sepals 14--27 X 3.5--7.7 mm, oblong-elliptic, smooth to sparsely covered with subulate or capitate or capitate-truncated emergences on abaxial side; petals 11.6--27 X 3.9--7.7 mm, oblong-elliptic, smooth to sparsely covered with subulate or capitate or capitate-truncated emergences on midrib on abaxial side; corona lobes 5.9--8.7 X 1.8--2.8 mm, oblong-spatulate, pale red, lobules 0.6--3.5 mm long, triangular. Anthers 5.6--11 mm long, basifixed, auriculate at base, inserted on the hypanthium apex and corona base, connective purple, slightly appendiculate at apex, pollen white. Style 8--11 mm long, red to pale red, stigmatic regions 3, 1.3--2.6 mm long, oblong-elliptic, in the middle of distal 1/3 of style, free, white. Capsule (10.2--16.8--)20--30 X 6--13 mm, ellipsoid, fissuricidal. Seeds 0.8--2.3 mm long, trapezoidal, yellowish cinereous.

Leaf and pedicel anatomy (*Cabral 196*, *236*, *Mello-Silva 4062*, *4063*, *Sucre 2381*). Blade inconspicuously dorsiventral. Cuticle slightly thickened on both surfaces. Stomata present on both surfaces in the region between fibro-vascular bundles, slightly more on abaxial one. Epidermis uniseriate. Spongy parenchyma surrounding an aquiferous parenchyma occupying the central region between bundles. Fibro-vascular bundles surrounded by a distinct bundle sheath, 1--2 large vessels present in each fibro-vascular bundle. Phloem strands 2. Fibers extending as girders to epidermis on both sides, sometimes with lateral extensions along both surfaces. Pedicel circular in transverse section; fibro-vascular bundles 12; belt of sclerified cells present.

Distribution. *Barbacenia squamata* occurs in the coastal inselbergs of Rio de Janeiro City and in the high altitude outcrops of central Rio de Janeiro state, at elevations from 400 to 2400 m.

Phenology. Barbacenia squamata has been collected with flowers throughout the year, and for five interspersed months with fruits.

IUCN Red List category. Barbacenia squamata has Area of Occupancy of 60 km² and Extent of Occurrence of approximately 2600 km². . Most of the populations are within conservation units, in the Parque Nacional da Floresta da Tijuca, Parque Nacional da Serra dos Órgãos, and Parque Estadual dos Três Picos. Its conservation status would be described as "EN" (Endangered), according to IUCN (2012) criteria.

Etymology. The epithet *squamata* refers to the elements of the corona (squamis sex petaloideis stamina et limbi lacinias interpositis, Herbert 1843).

Nomenclatural notes. Herbert (1843) cited no specimen nor presented any illustration of the new species when describing *B. squamata*. Therefore, we choose here a lectotype for that name. *Ule 4056*, type of *Barbacenia foliosa*, has not been found at B or in any other herbarium. As no other original material exists, a neotype of the name must be elected. Seubert (1847) cited no herbaria when describing *B. purpurea var. minor*, and *Gardner 5897* has not been found at B herbarium. Smith & Ayensu (1976) assumed K to house the holotype. Facing the two sheets of *Gardner 5897* at K, we choose here a lectotype for the name.

Discussion. *Barbacenia squamata* was described from a cultivated specimen, nursed from seeds sent to England by William Lobb to his employer, James Veitch (Paxton 1844, Hooker 1845, Mello-Silva & Montserrat 2015). Veicht desired it to be described in a new section, or genus, named after him, *Veitchia* (Herbert 1843), an invalid name. *Barbacenia squamata*, as the other species of the group, two of them described from nursery specimens as well, is easy to cultivate, holds very beautiful flowers, and the seeds are also easy to germinate (Strang 1961). Three taxa are considered synonym of *B. squamata*. They have been distinguished by leaf width, nature of hypanthial emergences, relative length of corona lobes and anthers, and supposed adnation of corona lobes (Henrard 1937, Smith & Ayensu 1976). Cabral et al. (ined.) found the populations from Rio de Janeiro city paraphyletic and more related to *B. purpurea* than with the populations from high altitudes in Serra dos Órgãos, which emerged also as a paraphyletic assemblage, related to *B. brevifolia*. These relationships are of geographical nature, perhaps reflecting a gene tree instead of a species tree (Wheeler 2012), and deserve more investigation. Nevertheless, as well as with the species sunk into *B. squamata*, no morphological feature puts any population of *B. squamata* apart, excepted those from Cabeça do Dragão, with glandular emergences in hypanthium, but this variation can be typical of other Velloziaceae species, such as *Vellozia albiflora* and *V. hirsuta* (Mello-Silva 1990, 1995, 2011). The flowers of *B. squamata* are similar to those red or orange-red of *B.*

brevifolia, but these sympatric species can be differentiated, apart from the sometimes deep pink flowers of *B. brevifolia*, by the longitudinal posture and dimensions of their leaves, arcuate and much larger in *B. squamata*.

Additional specimens examined. BRAZIL. RIO DE JANEIRO: **Guapimirim**, Serra dos Órgãos, Morro Açu, 22°29'01.82"S 43°03'42.51"W*, elev. 2400 m, Aug. 1915, st, *P.F. Lützelburg 6246* (K, M); Pedra da Baleia, 22°27'39.74"S, 43°01'38.14"W*, elev. 2150 m, 20 Dec. 1952, fl, *J. Vidal II5732* (R, US); Pedra do Sino, 22°27'44.81"S 43°01'51.34"W*, elev. 2260 m, 8 Oct. 1929, fl, *A.C. Brade 9626* (B, R n.v.); Pedra do Sino, 22°27'44.67"S 43°01'50.25"W*, elev. 2200 m, Feb. 1952, fl, *J. Vidal II650* (R, US); Pedra do Sino, 22°27'42.92"S 43°01'51.24"W*, elev. 2170 m, Feb. 1952, fl, *J. Vidal II681* (R, US); Pedra do Sino, Felspalten an Winderken, 22°27'43.55"S 43°01'52.16"W*, elev. 2200 m, Oct. 1952, fl, *F. Markgraf 10156* (RB); Pedra do Sino, 22°27'40.93"S 43°01'49.42"W*, elev. 2000 m, 20 Dec. 1952, fl, *J. Vidal II5771* (R, US); Pedra do Sino, 22°27'43.77"S 43°01'51.93"W*, elev. 2170 m, Feb. 1953, fl, *J. Vidal II6482* (R, US); Pedra do Sino, 22°27'44.25"S 43°01'52.06"W*, elev. 2170 m, Feb. 1953, fl, *J. Vidal II6496* (R, US); Pedra do Sino, 22°27'43.00"S 43°01'48.68"W*, elev. 2180 m, 30 Dec. 1979, fl fr, *D.S. Amorin CFCR5064* (SPF); Pedra do Sino, 22°27'45.13"S 43°01'52.06"W*, elev. 2170 m, 18 Dec. 1986, fl, *S.V.A. Pessoa 154* (RB); Pedra do Sino, no alto, 22°27'45.01"S 43°01'52.23"W*, elev. 2200, 12 Oct. 1993, fl, *F. Rivadávia-Lopes 245* (SPF); Pedra do Sino, 22°27'44"S 43°01'51"W, elev. 2248 m, 25 Oct. 2012, fl, *D. Araújo vermelho80* (HRCB, UPCB); Pedra do Sino, final da trilha, 22°27'42.64"S 43°01'49.80"W*, elev. 2203 m, 16 Jun. 2018, fl, *A. Cabral 196* (SPF); Pedra do Sino, final da trilha, 22°27'42.64"S 43°01'49.80"W*, elev. 2203 m, 16 Jun. 2018, fl, *A. Cabral 197* (SPF); **Magé**, Serra dos Órgãos, Pedra Açu, 22°29'03.20"S 43°03'46.43"W*, elev. 2230 m, 22 Oct. 1872, fl, *A.F.M. Glaziou 6453* (C, K, L n.v.; photo K); **Nova Friburgo**, Serra dos Órgãos, Parque Estadual dos Três Picos, Cabeça do Dragão, Cume, 22°19'6"S 42°43'32"W, elev. 2085 m, 22 Apr. 2014, fl, *C. Baez 13* (RB, SPF); Cabeça do Dragão, 22°19'11.3"S 42°43'27.6"W, elev. 2020 m, 11 Jul. 2018, fr, *A. Cabral 236* (SPF); Caixa de Fósforos, 22°19'60"S 42°44'17"W, elev. 1304 m, 22 Mar. 2014, fl, *L.N. Gonçalves 369* (RB); Pico do Capacete, rota Solidões-Ilusões, 22°20'04"S 42°43'38"W, elev. 2000 m, 19 Mar. 2015, fl, *G. Martinelli 18459* (RB); Seio da Mulher de Pedra, próximo ao cume, 22°20'44"S, 42°43'26"W, elev. 1822 m, 17 Jan. 2015, fl, *C. Baez 167* (RB); Serra dos Órgãos, Suspiro, 22°16'39.12"S 42°32'23.72"W*, elev. 1000 m, st, *A.F.M. Glaziou 13270* (K, L); **Paty do Alferes**, Alto da Boa Vista, 22°24'38"S 43°20'50"W, elev. 908 m, 7 Nov. 2014, fl, *M.S. Wängler 1570a* (RB); **Petrópolis**, Serra dos Órgãos, Morro Açu, 22°28'57.36"S, 43°03'42.91"W*, elev. 2140 m, 6 Mar 1910, fl, *P.F. Lützelburg s.n.* (M); Pedra do Porto das Antas, entre Araras e Secretário, 22°24'35"S 43°13'51"W, elev. 1600 m, 13 Mar. 2006, fl, *G. Martinelli 16060* (RB, SPF); Rocinha, 22°22'01.54"S 43°11'13.66"W*, elev. 900 m, 12 Apr. 1968, fl fr, *D. Sucre 2681* (RB, SPF); **Teresópolis**, Serra dos Órgãos, Parque Estadual dos Três Picos, Branca de Neve, trilha para o cume, 22°20'40.19"S 42°43'24.42"W*, elev. 1780 m, 3 Feb. 2015, fl, *C. Baez 238* (RB, SPF); Três Picos, cume do Pico Médio, 22°20'34"S 42°43'33"W, elev. 2310 m, 11 Apr. 2015, fl, *C. Baez 285* (K, NY, MBM, R, RB, SPF); Pedra do Sino, trilha para a Pedra do Sino, 22°27'42.44"S 43°01'49.52"W*, elev. 2190 m, 16 Mar. 2014, fl, *M.L.O. Trovó 613* (RB); Posse, topo do morro das antenas de televisão, 22°24'27.07"S 42°58'31.26"W*, elev. 960 m, 12 Feb. 1968, fl fr, *D. Sucre 2381* (K, NY, RB, SPF); à Taboinha, 22°25'38.41"S 42°59'37.85"W*, elev. 1260 m, 8 Mar. 1887, fl, *A.F.M. Glaziou 17296* (K, L; photo K); Serra dos Órgãos, elev. 1600 m, Jul. 1888, st, *J.T. Moura 976* (B); **Rio de Janeiro**, Morro do Midosi, "Morro do Midozi", 22°56'59.20"S 43°17'21.66"W*, elev. 3000 ft, 8 Aug 1867, fr, , *A.F.M. Glaziou 1625a* (BR 2 sheets); Morro Dois Irmãos, vertente SW, no início do costão de pedra, 22°59'35.60"S 43°14'42.45"W*, elev. 400 m, 15 May 1966, fr, *H.E. Strang 699* (GUA, US); Pedra Bonita, Parque Nacional da Tijuca, 22°59'21.92"S 43°17'3.27"W*, elev. 500 m, 27

Mar. 1974, fl, *G. Martinelli 5774* (RB, SPF); Pedra Bonita, Parque Nacional da Tijuca, afloramento rochoso granítico, na extremidade sul da Pedra, 22°59'22.1"S 43°16'59.7"W, elev. 690 m, 27 Jul. 2017, fl, *R. Mello-Silva 4063* (SPF); Pedra da Gavea, summit, ledge by top of chinmey, on west face, 22°59'49.76"S 43°17'05.10"W*, elev. 850 m, 8 Apr. 1952, fl, *L.B. Smith 6445* (NY, P, US); Pedra da Gávea, Morro da Gávea, 22°59'55.11"S 43°16'59.06"W*, elev. 810 m, 30 Oct. 1865, st, *A.F.M. Glaziou 1625* (L; photo, K); Pedra da Gávea, 22°59'40.09"S 43°17'20.55"W*, elev. 660 m, 27 May 1971, fl, *D. Sucre 7573* (RB); Pedra da Gávea, Mesa, lado sul, encosta ensolarada em frente ao Pico dos Quatro, 22°59'56.61"S 43°17'00.85"W*, elev. 820 m, 16 Sep. 1973, fl, *J.P.P. Carauta 1662* (RB); Pedra da Gávea, on top of Pedra, 22°59'52.65"S 43°17'04.97"W*, elev. 840 m, 21 Feb. 1976, fl, *W.R. Anderson 11674* (MBM, NY); Pedra da Gávea, Mesa, escarpa em frente ao Joá, 22°59'56.24"S 43°17'3.06"W*, elev. 800 m, 1 May 1977, fl, *J.P.P. Carauta 1662a* (RB 2 sheets); Pedra da Gávea, on rocks, 22°59'48.86"S 43°17'03.80"W*, elev. 800 m, 23 Oct. 1977, fl, *P.J.M. Maas 3426* (MO, RB, U, US); Pedra da Gávea, topo da Pedra, 22°59'44"S 43°17'04"W*, elev. 850 m, 8 Feb. 2007, fl, *R.C. Forzza 4477a* (RB, SPF, Z); Pedra da Gávea, cume, Parque Nacional da Tijuca, 22°59'57"S 43°16'59"W, elev. 821 m, 6 Mar. 2016, fl, *C. Baez 535* (NY, RB, SPF, US); Pedra da Gávea, Parque Nacional da Tijuca, afloramento rochoso granítico na extremidade norte da Pedra, 22°59'48.1"S 43°17'04.1"W, elev. 830 m, 27 Jul. 2017, fl, *R. Mello-Silva 4062* (SPF); Pico da Tijuca, 22°56'36.07"S 43°17'09.91"W*, elev. 930 m, 17 Jul. 1941, fl, *A.C. Brade 16846* (RB); Pico da Tijuca, encostas do Pico, 22°56'38.45"S, 43°17'18.72"W*, elev. 880 m, 3 Jul. 1957, fl, *H.E. Strang 45* (R); Pico da Tijuca, 22°56'35.93"S 43°17'08.47"W*, elev. 940 m, 22 Jun. 1960, fl, *C. Angeli 376* (RB, US); Tijuca, Passo das Pedras, escarpa em frente à Estação Biológica, 22°58'13.14"S 43°16'14.10"W*, elev. 470 m, 9 Nov. 1965, fl, *J.P. Lanna Sobrinho 1164* (RB, US); **unknown municipality**, Serra dos Órgãos 21 Jan. 1887, fl, *A.F.M. Glaziou 16387* (B, BR, C, K, L, LE, P 2 sheets;

photo, K); Serra dos Órgãos, elev. 2200 m, Jun. 1915, st, *P.F. Lützelburg 6184* (M); Serra dos Órgãos, elev. 2300 m, Jun. 1915, fl, *P.F. Lützelburg 6369* (M); Serra dos Órgãos, elev. 2400 m, Aug. 1915, fl, *P.F. Lützelburg 12306* (M); Serra dos Órgãos, elev. 2000 m, Jan. 1916, st, *P.F. Lützelburg 6603* (K, M); 1851, fl, *s.c., s.n.* (BR); Dec. 1890, fl, s.c., s.n. (K); st, *A.F.M. Glaziou 3625* (C); fl, *A.F.M. Glaziou 4621* (C); fr, *A.B. Joly s.n.* (SPF 33966); **no locality**, cultivada no Centro de Pesquisas Florestais, 11 Nov. 1965, fl, *N.L. Menezes 2* (US).

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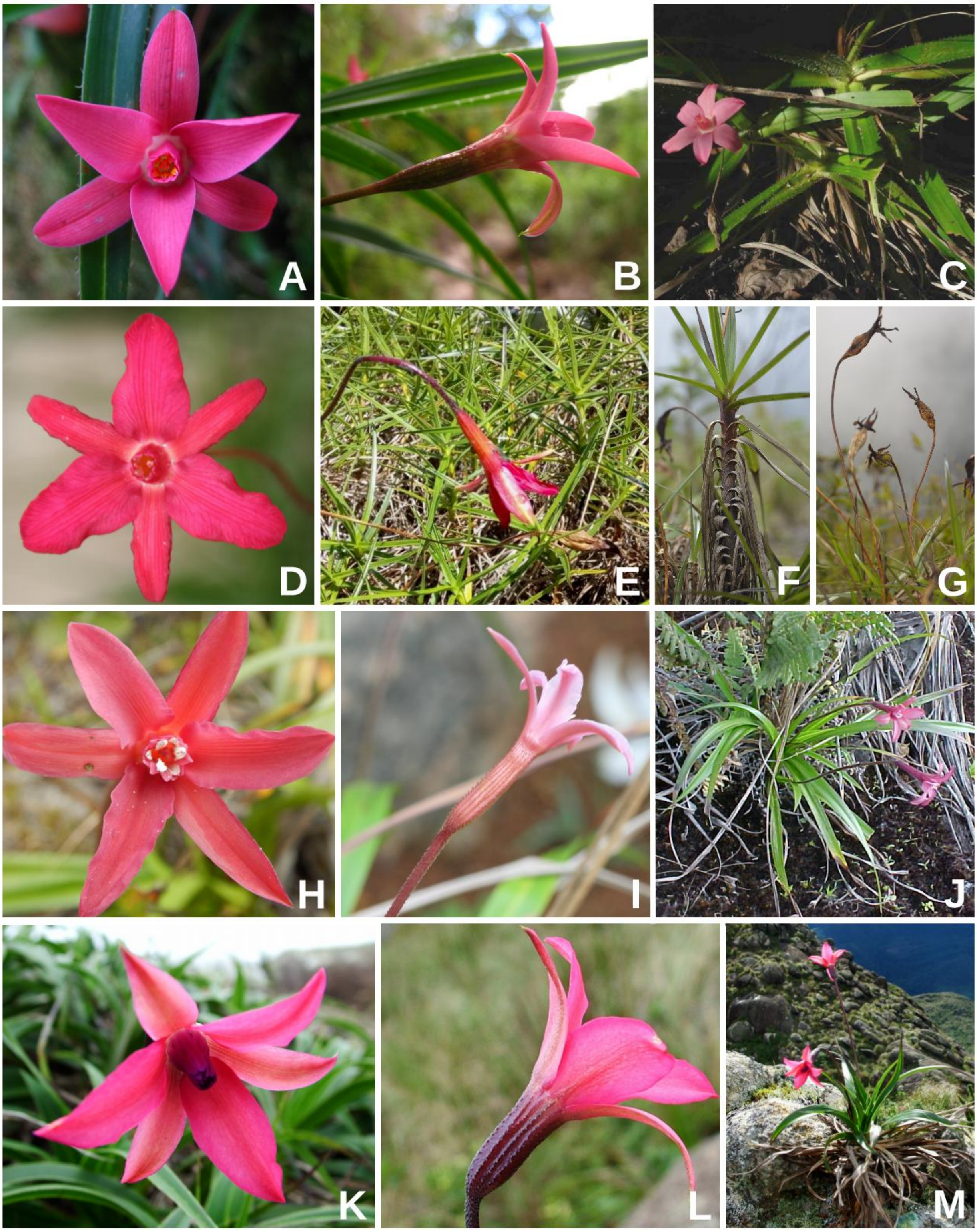


Figure 1. A--M. Frontal and lateral view of the flower, and habit. A--C. *Barbacenia amphirupia*. D--G *Barbacenia brevifolia.* H--J. *Barbacenia fannieae.* K--M. *Barbacenia gounelleana.* A, B. Photos by Vinícius Dittrich; C. from *Conceição 1142 ;* D, E. from *Lobin s.n.* (BONN 26162); F, G. from *Cabral 210*; H. from *Wängler 1628;* I. from *Menezes 646*; J. from *Mello-Silva 2643*; K--M. from *Trovó 322.*

Figure 2. A--R. Frontal and lateral view of the flower, and habit. A--C. *Barbacenia irwiniana*. D--F. *Barbacenia mantiqueirae.* G--I. *Barbacenia maritima*. J--L. *Barbacenia pabstiana*. A, B. from *Lovo 445*; C. from *Mello-Silva 4052*; D--F. from *Mello-Silva 4717*; G--I. from *Cabral 237*; J--L. from *Cabral 260.*

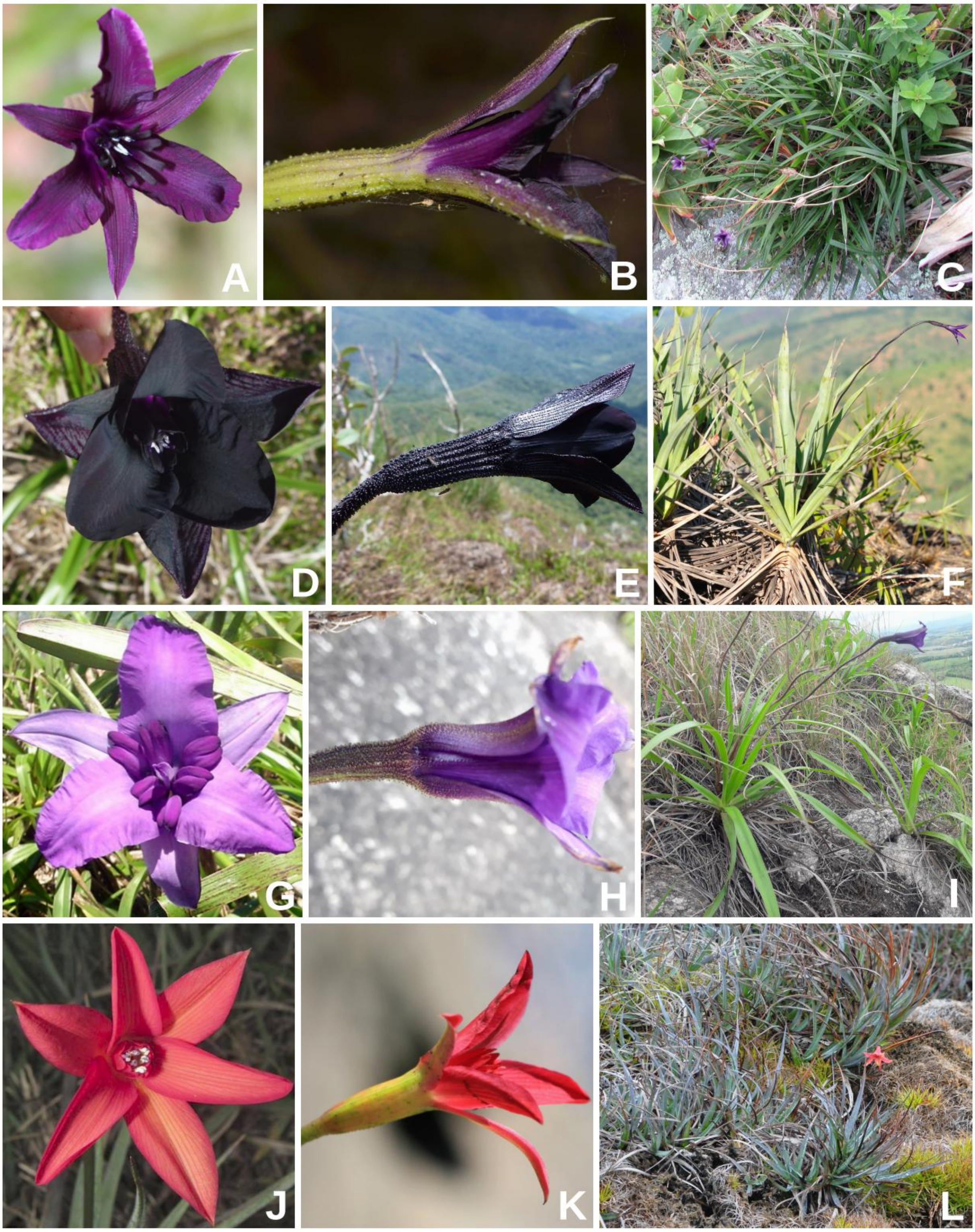
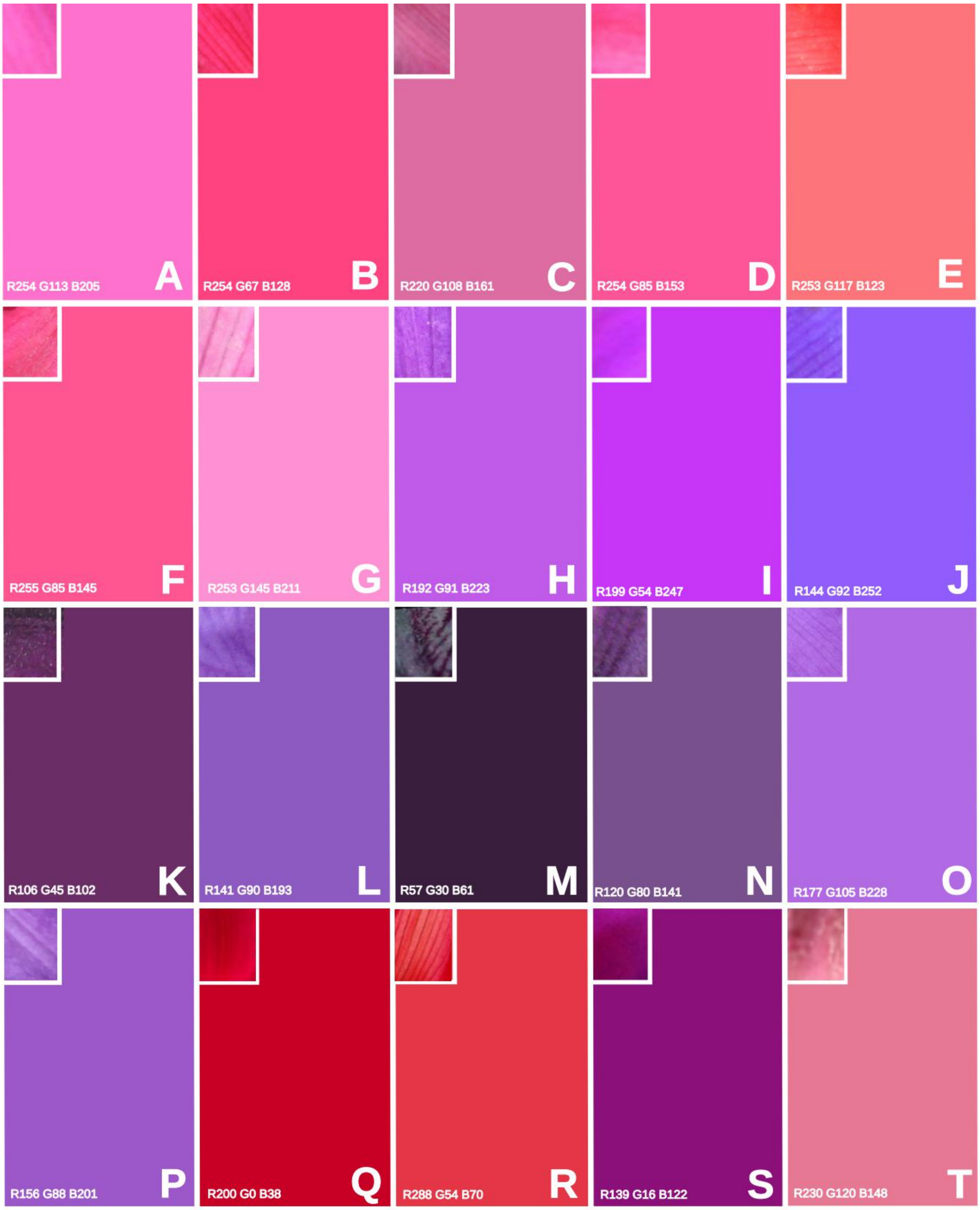


Figure 3. A--L. Frontal and lateral view of the flower, and habit. A--C. *Barbacenia purpurea*. D--F. *Barbacenia rogieri.* G--I. *Barbacenia spectabilis*. J--L. *Barbacenia squamata*. A. from *Lobin s.n.* (BONN 19766); B. Photo by Maria Ogrzewalska; C. from *Cabral 243*; D, E. *Baez 375*; F. from *Paula 640*; G. from *Anorikopoulos* SPF 180490; H, I. from *Cabral 184*; J. Photo by Guilherme Peres Coelho; K. from *Mello-Silva 4062*; L. from *Cabral 196.*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F
R253 G145 B211
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R192 G91 B223
H
R199 G54 B247
I
R144 G92 B252
J
R106 G45 B102
K
R141 G90 B193
L
R57 G30 B61
M
R120 G80 B141
N
R177 G105 B228
O
R156 G88 B201
P
R200 G0 B38
Q
R288 G54 B70
R
R139 G16 B122
S
R230 G120 B148
T

Figure 4. A--R. Adaxial petal color. A. *Barbacenia amphirupia.* --- hot pink (R254 G113 B205). B. *Barbacenia brevifolia.* --- deep pink (R254 G67 B128). C. *Barbacenia fannieae* --- pale violet red (R220 G108 B161). D. *Barbacenia gounelleana.* --- deep pink (R254 G67 B128). E. *Barbacenia irwiniana.* --- salmon (R253 G117 B123). F, G. *Barbacenia mantiqueirae.* F. --- deep pink (R255 G85 B145). G. --- plum (R253 G145 B211). H, I. *Barbacenia maritima*. H.--- medium orchid (R192 G91 B223), I. --- dark orchid (R199 G54 B247). J. *Barbacenia pabstiana*. --- medium slate blue (R144 G92 B252). K, L. *Barbacenia purpurea*. K. --- purple (R106 G45 B102), L. medium purple (R141 G90 B193). M--O. *Barbacenia rogieri*. M. --- dark purple (R57 G30 B61), N. --- medium purple (R120 G80 B141), O. --- medium purple (R177 G105 B228). P. *Barbacenia spectabilis.* --- dark orchid (R156 G88 B201). Q, R. *Barbacenia squamata*. Q. --- red (R200 G0 B38), R. crimson (R288 G54 B70). S--T. Abaxial corona colour. S. *Barbacenia gounelleana.* --- dark magenta (R139 G16 B122). T. *Barbacenia irwiniana.* --- pale violet red (R230 G120 B148). A. from photo by Vinícius Dittrich; B. from *Lobin s.n.* (BONN 26162); C. from *Menezes 646*; D, S. *Trovó 322*; E, T. from *Lovo 445*; F, G. from *Mello-Silva 4717*; H. from *Cabral 237*; I. from *Cordeiro 2724*; J. from *Cabral 260*; K. from *Menezes 508*; L. from *Cabral 243*; M. from *Baez 375*; N. from *Paula 640*; O. from *Paula 985*; P. from *Cabral 184*; Q. from *Mello-Silva 4062*; R. from photo by Guilherme Peres Coelho.

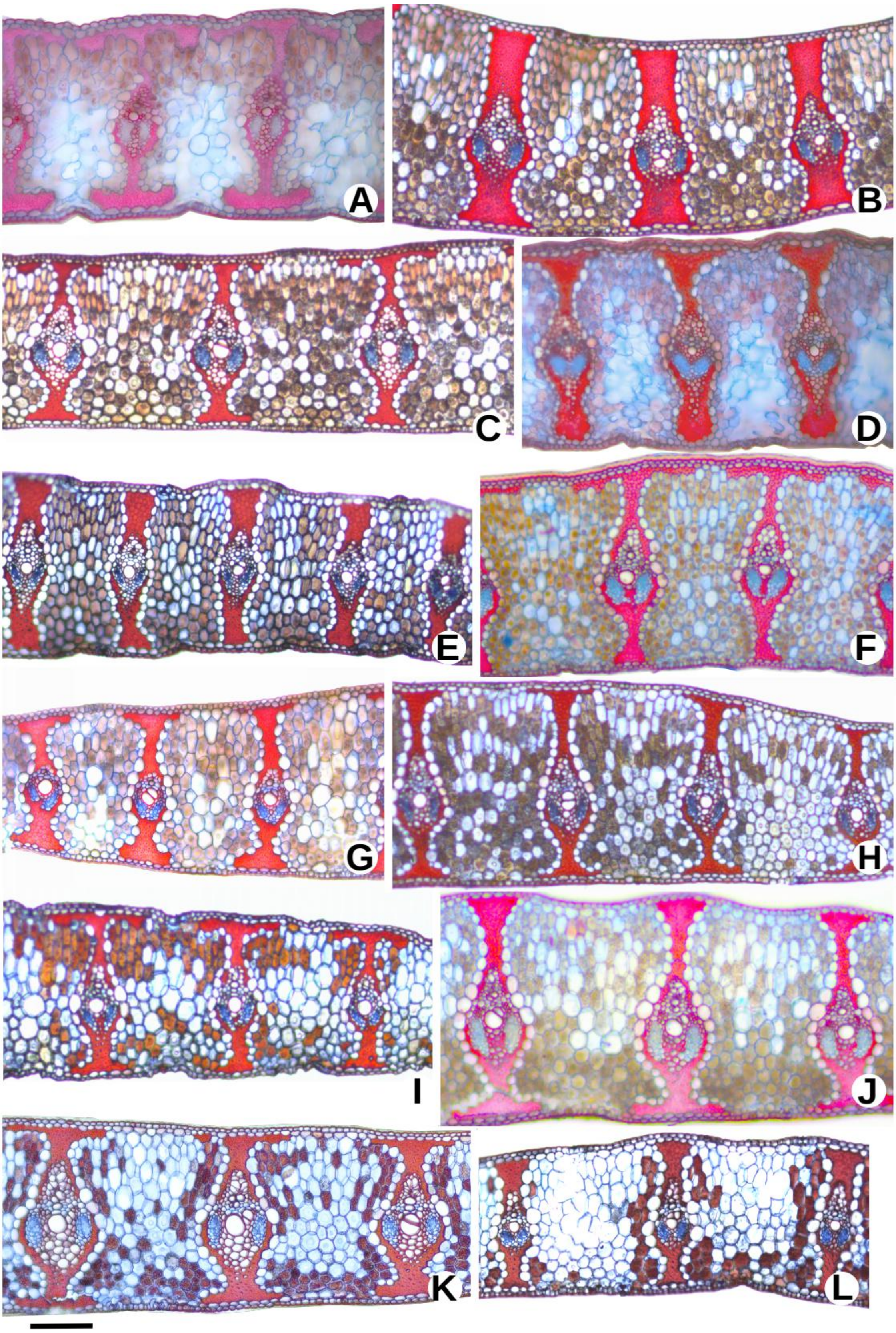
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Figure 5. A--L. Cross-section of median region of lamina. A. *Barbacenia amphirupia* (from *Antar 1796*); B. *Barbacenia brevifolia* (from *Cabral 210*); C. *Barbacenia fannieae* (from *Mello-Silva 2643*); D. *Barbacenia gounelleana* (from Sasaki 1075); E. *Barbacenia irwiniana* (from *Brade 16969*); F. *Barbacenia mantiqueirae* (from *Mello-Silva 4717*); G. *Barbacenia maritima* (from *Cabral 237*); H. *Barbacenia pabstiana* (from *Mello-Silva 4400*); I. *Barbacenia purpurea* (from *Menezes 635*); J. *Barbacenia rogieri* (from *Mello-Silva 4404*); K. *Barbacenia spectabilis* (from *Cabral 184*); L. *Barbacenia squamata* (from *Mello-Silva 4062*). Scale bar = 100 μm.

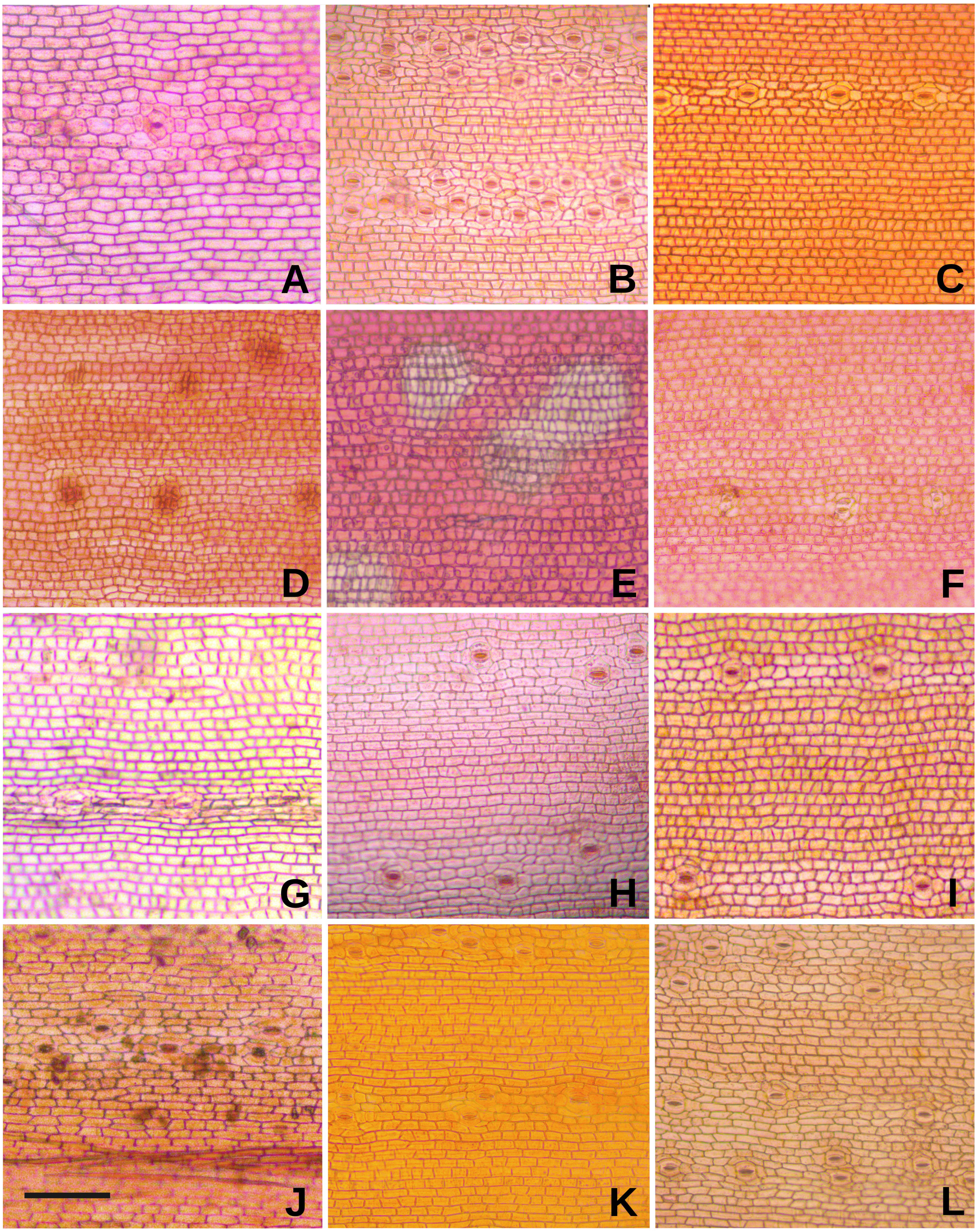

Figure 6. A--L. Leaf adaxial epidermis. A. *Barbacenia amphirupia* (from *Daneu 330*); B. *Barbacenia brevifolia* (from *Cabral 233*); C. *Barbacenia fannieae* (from *Mello-Silva 2643*); D. *Barbacenia gounelleana* (from *Meireles 3014*); E. *Barbacenia irwiniana* (from *Brade 16969*); F. *Barbacenia mantiqueirae* (from *Trovó 323*); G. *Barbacenia maritima* (from *Catharino 1113*); H. *Barbacenia pabstiana* (from *Cabral 260*); I. *Barbacenia purpurea* (from *Cabral 243*); J. *Barbacenia rogieri* (from *Mello-Silva 4404*); K. *Barbacenia spectabilis* (from *Menezes 722*); L. *Barbacenia squamata* (from *Mello-Silva 4062*). Scale bar = 100 µm.

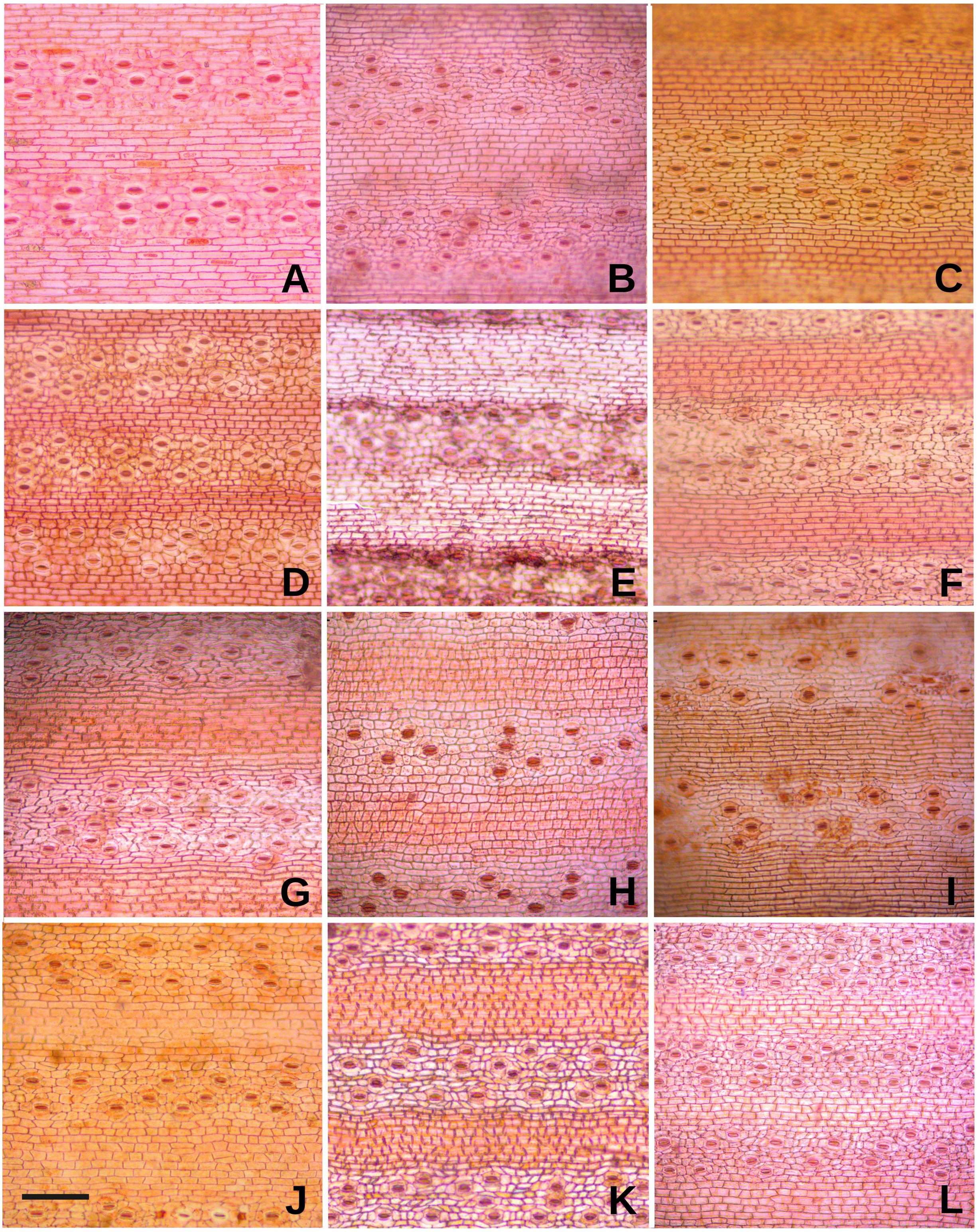

Figure 7. A--L. Leaf abaxial epidermis. A. *Barbacenia amphirupia* (from *Antar 1796*); B. *Barbacenia brevifolia* (from *Cabral 210*); C. *Barbacenia fannieae* (from *Mello-Silva 2643*); D. *Barbacenia gounelleana* (from *Meireles 3014*); E. *Barbacenia irwiniana* (from *Brade 16969*); F. *Barbacenia mantiqueirae* (from *Trovó 323*); G. *Barbacenia maritima* (from *Cabral 237*); H. *Barbacenia pabstiana* (from *Cabral 258*); I. *Barbacenia purpurea* (from *Cabral 243*); J. *Barbacenia rogieri* (from *Mello-Silva 4404*); K. *Barbacenia spectabilis* (from *Cabral 266*); L. *Barbacenia squamata* (from *Cabral 236*). Scale bar = 100 µm.

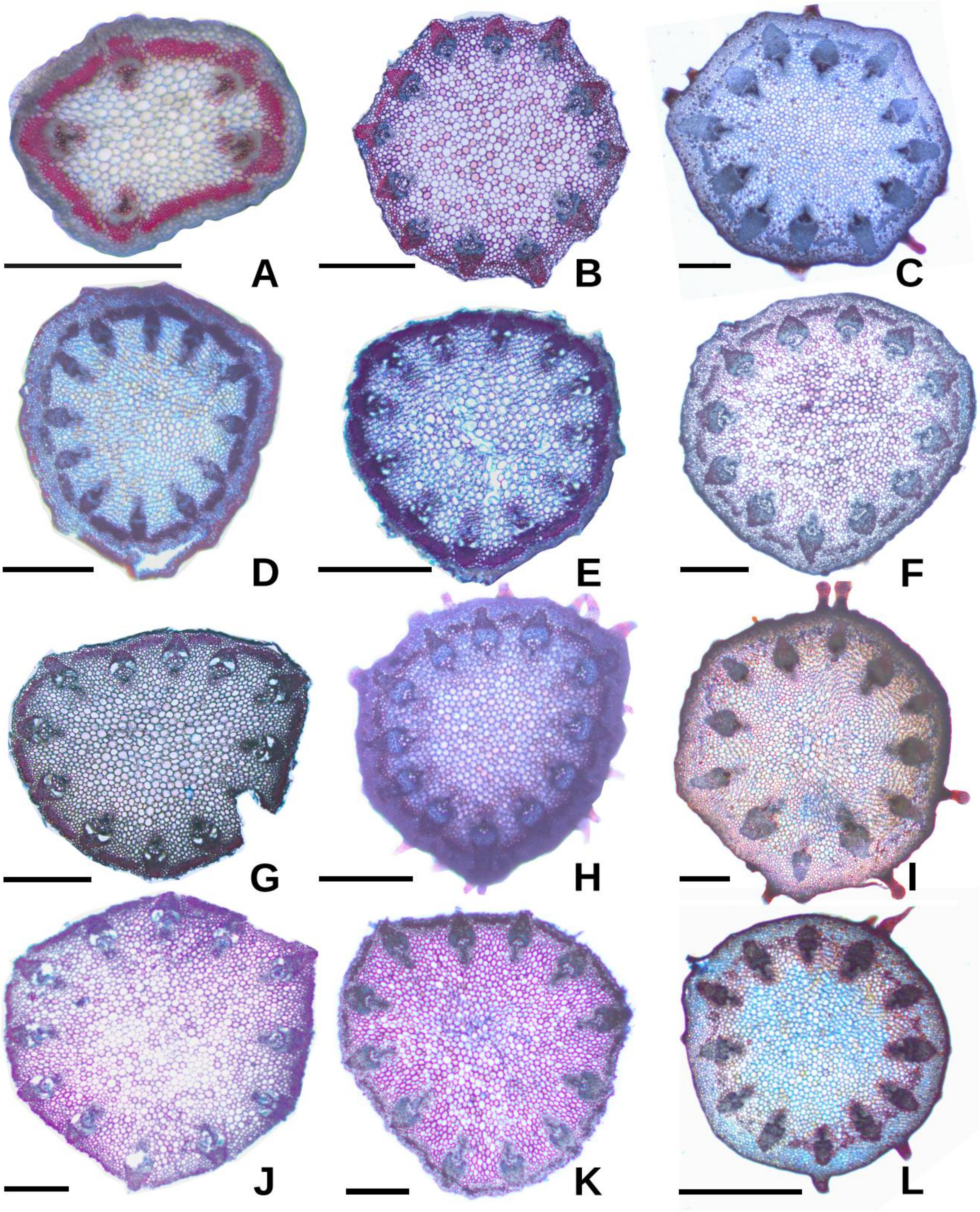

Figure 8. A--L. Pedicel cross-section. A. *Barbacenia amphirupia* (from *Antar 1796*); B. *Barbacenia brevifolia* (from *Orsich* SPF 33978); C. *Barbacenia fannieae* (from *Mello-Silva 2643*); D. *Barbacenia gounelleana* (from *Sasaki 1075*); E. *Barbacenia irwiniana* (from *Krieger FPNC538*); F. *Barbacenia mantiqueirae* (from *Trovó 323*); G. *Barbacenia maritima* (from *Cabral 237*); H. *Barbacenia pabstiana* (from *Mello-Silva 4400*); I. *Barbacenia purpurea* (from *Cabral 243*); J. *Barbacenia rogieri* (from *Mello-Silva 4422*); K. *Barbacenia spectabilis* (from *Cabral 184*); L. *Barbacenia squamata* (from *Mello-Silva 4063*). Scale bar = 500 µm.

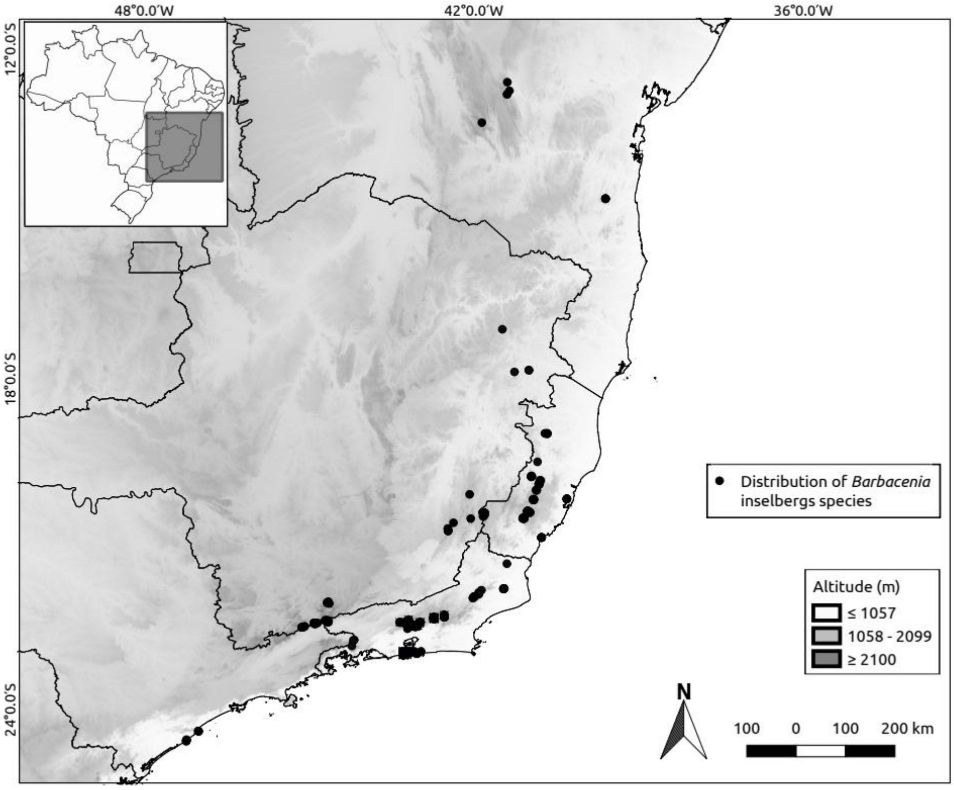

Figure 9. Distribution of *Barbacenia* Atlantic Forest Inselbergs species.

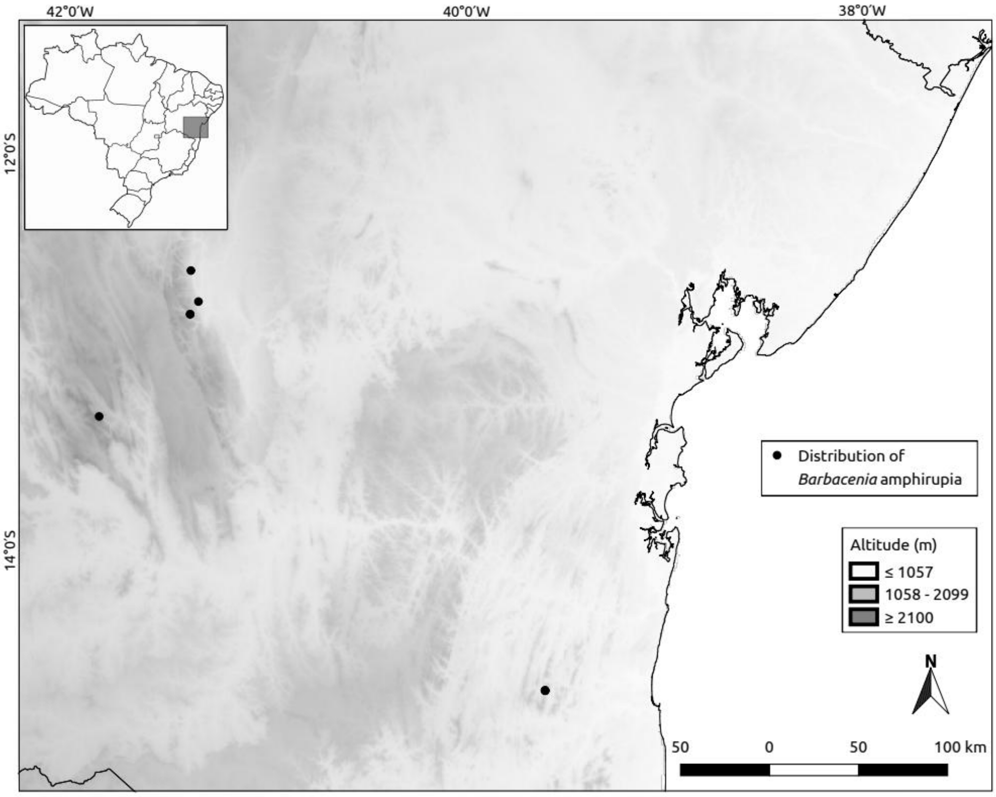

Figure 10. Distribution of *Barbacenia amphirupia*.

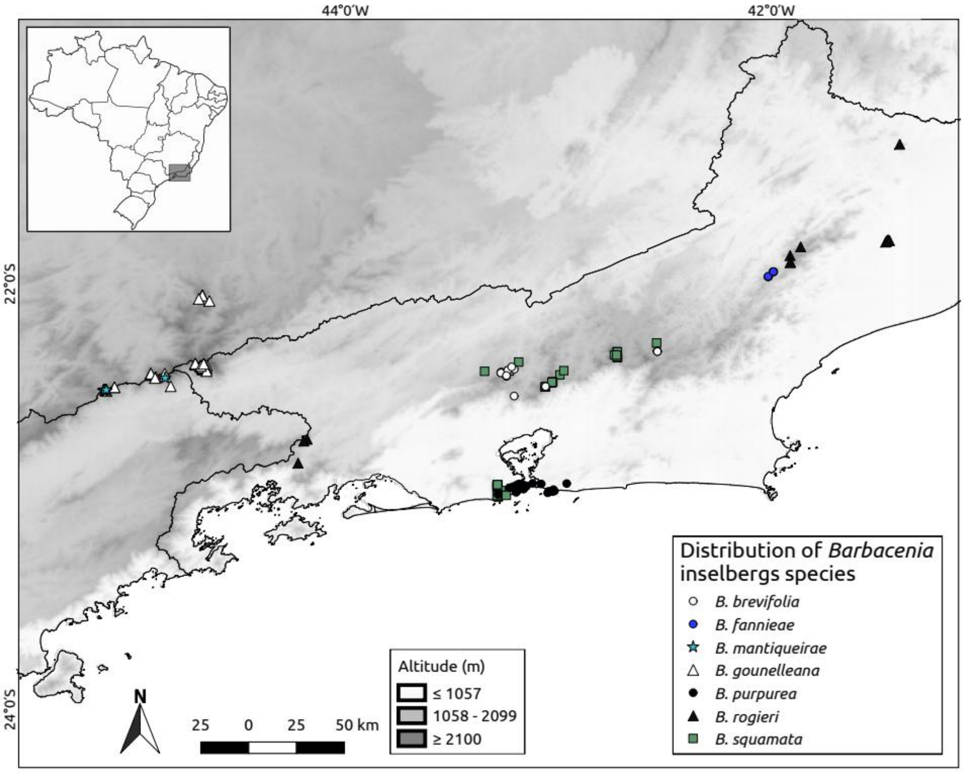

Figure 11. Distribution of *Barbacenia brevifolia*, *B. fannieae*, *B. gounelleana*, *B. mantiqueirae, B. purpurea*, and *B. squamata.*

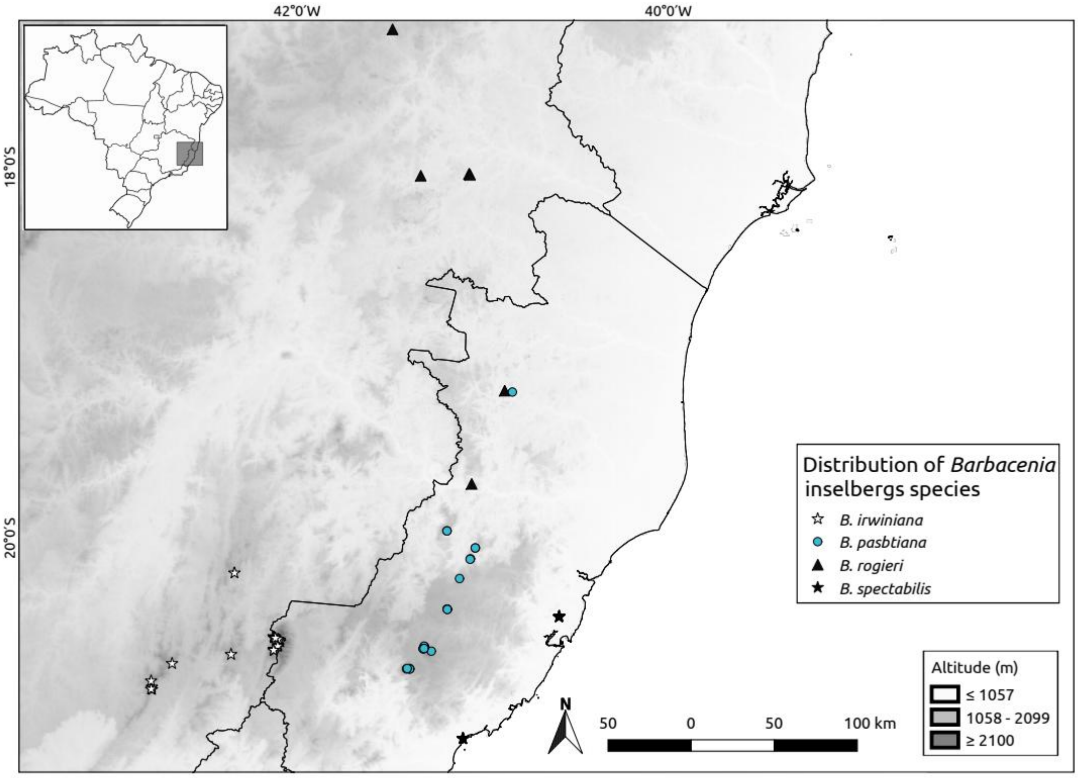

Figure 12. Distribution of *Barbacenia irwiniana, B. pabstiana, B. rogieri*, and *B. spectabilis*.

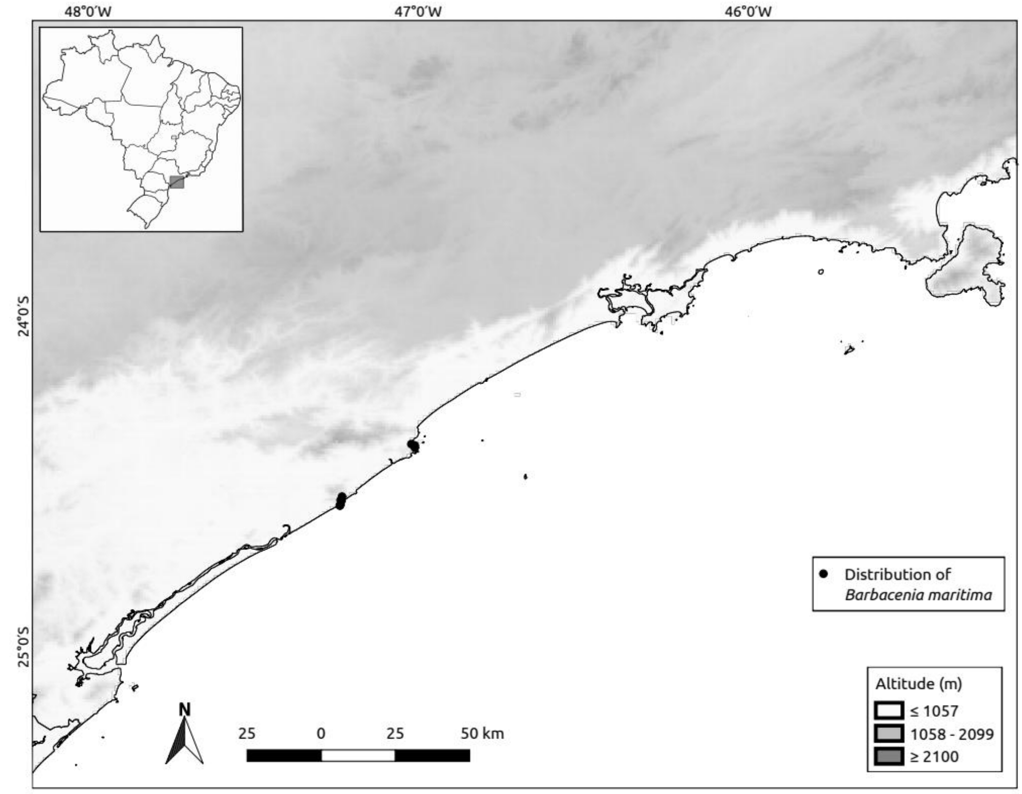

Figure 13. Distribution of *Barbacenia maritima*.

CONCLUSIONS

This Master's thesis focuses on the phylogeny, biogeography and taxonomic review of *Barbacenia* species from the Atlantic Forest Inselbergs (AFI). In the context of a wide-family sampling, we were able to infer the phylogeny of *Barbacenia* lineages, in particular if the *Barbacenia* species from the AFI are a monophyletic group (chapter one).

This study included the analysis of nuclear and plastid DNA sequences under Maximum Likelihood and Bayesian approaches. As a result, two major lineages were recovered in *Barbacenia*, each one including most of AFI and Campos Rupestres (CR) endemic species.

Morphological analyses consisted of building up a dataset that enabled to map several morphological characters onto the phylogenetic trees towards comparing morphological diversity between species from *Barbacenia* AFI and CR clades (chapter one). When mapping the morphological characters, we observed that there is no evident synapomorphy uniting the species of *Barbacenia* AFI lineage and its strongly supported subclades. Morphological diversity analysis provided an interesting evidence of long-term morphological stability (stasis) in *Barbacenia* AFI when compared to its sister-group, and different paleovegetational dynamics during the Plio-Pleistocene likely influenced in these morphological disparities between *Barbacenia* lineages.

In the context of a biogeographical analysis, we have conducted divergence time estimations using fossil calibrated molecular clocks and analyzed the resulting dated trees to estimate the likely ancestral distribution of species and clades of this study (chapter one). Our analyses showed that the *Barbacenia* diversification likely took place during the Middle Miocene, in the Atlantic Forest and Cerrado phytogeographic domains. This ancestral distribution of *Barbacenia* may have been facilitated by the expansion of open/dry environments in the Miocene, and subsequent cladogenesis may have been through colonization of isolated habitats and geographical isolation. Pleistocene climatic fluctuations and the paleovegetational dynamics may also have contributed to the speciation process in *Barbacenia* AFI lineages, whose species may have extended their geographic distribution during glacial periods.

Finally, by using an integrative approach that included the interpretation of the molecular phylogeny considering the morphology of *Barbacenia* AFI species, we were able to take important taxonomical decisions, including the description of two new species, *Barbacenia amphirupia* and *B. maritima*, five lectotypes and one neotype. In total, we recognized twelve species of *Barbacenia* AFI clade, which are treated in a monograph of the clade (chapter two). This taxonomic review of *Barbacenia* AFI clade includes a complete list of synonyms, anatomical and morphological descriptions of species and an identification key, information on conservation, geographical distribution, habitat, phenology, and taxonomical comments of all the species. In addition, we provide plates with anatomical and morphological characters and distribution maps of the species.

This Master's thesis highlights the importance of phylogenetical, biogeographical and taxonomical studies in the discovery of hidden diversity, highlighting many sampling gaps about the biodiversity of the Atlantic Forest Inselbergs and Brazilian Campos Rupestres, environments with high species richness and endemism. These studies are particularly important for providing knowledge base on environmental conservation measures.

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