



Flora of Espírito Santo, Brazil

Flora of Espírito Santo: Pontederiaceae

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Abstract

Pontederiaceae is a small family of Monocots, composed of two genera (*i.e.*, *Heteranthera* and *Pontederia*) and ca. 40 species. Two genera and 27 species are accepted for Brazil. In the state of Espírito Santo, *Heteranthera* is represented by two species and *Pontederia* by four species. Its species are exclusively found growing in aquatic or paludal, perennial or seasonal environments. We present descriptions, comments, and illustrations for the species.

Key words: aquatic plants, Atlantic Forest, Brazil, Commelinales, pickerelweeds.

Resumo

Pontederiaceae é uma pequena família de Monocotiledôneas, composta por dois gêneros (*i.e.*, *Heteranthera* e *Pontederia*) e ca. 40 espécies. No Brasil são registrados dois gêneros e 27 espécies. No estado do Espírito Santo, *Heteranthera* é representado por duas espécies e *Pontederia* por quatro espécies. As espécies são encontradas exclusivamente associadas a ambientes aquáticos e palustres, perenes ou sazonais. Nós apresentamos descrições, comentários e ilustrações para as espécies.

Palavras-chave: plantas aquáticas, Floresta Atlântica, Brasil, Commelinales, aguapé.

Introduction

Pontederiaceae is a small family of aquatic Monocots, arranged in two genera [*i.e.*, *Heteranthera* and *Pontederia*] and ca. 40 species. It is placed in Commelinales, together with Commelinaceae, Haemodoraceae, Hanguanaceae, and Philydraceae (APG IV 2016; Pellegrini *et al.* 2018; Pellegrini 2019). The family can be uniquely characterized by its dimorphic, late-bifacial and ligulate leaves, involute ptyxis in which the blade of the new leaf encloses the petiole of the preceding leaf, perianth connate producing a conspicuous tube, bisulcate pollen grains, and the presence of an anthocarp (Pellegrini *et al.* 2018). Pontederiaceae possesses a Pantropical distribution, with Brazil as its diversity center (Pellegrini *et al.* 2018). In Brazil, the family is represented by both accepted genera and 27 species, growing in damp and aquatic environments in all states and vegetation domains (Pellegrini *et al.* 2018; Sousa 2020). Nonetheless, the Pontederiaceae

are exceptionally diverse in perennial and annual water bodies in the Caatinga domain, followed by the Atlantic Forest and Cerrado as the most species-rich domains (Pellegrini *et al.* 2018; Pellegrini 2019; Sousa 2020). In the state of Espírito Santo, the family is represented by six species arranged in the two genera known for the Brazilian territory.

Material and Methods

Descriptions, phenological data, and vernacular names are based on herbarium and field studies, complemented with data from cultivated plants and the literature, whenever necessary. Specimens from the following herbaria were analyzed: CEPEC, COR, CVRD, HUEFS, IPA, K, KANU, MBM, MBML, MO, NY, P, RB, SAMES, UNA, US, and VIES (acronyms according to Thiers, continuously updated). The vegetation types follow IBGE (2012) and Garbin *et al.* (2017). The indumentum and shape terminology follow Radford

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et al. (1974); the inflorescence terminology and morphology follow Weberling (1965, 1989), Panigo *et al.* (2011), and Pellegrini & Horn (2017); fruit terminology follows Spjut (1994); seed terminology follows Faden (1991); and general terminology follows Pellegrini *et al.* (2018).

Results and Discussion

In the state of Espírito Santo, Pontederiaceae is represented by both recognized genera, with *Heteranthera* represented by two species (plus a dubious species), and *Pontederia* represented by four species. *Heteranthera multiflora* (Grisebach 1879: 323) C.N.Horn (1986: 290) is cited for Espírito Santo for the first time, while the occurrence of *H. zosterifolia* Martius (1823: 7) is considered dubious. Since no specimens matching *H. zosterifolia* were located for Espírito Santo, we do not present a description for the species. We include *H. zosterifolia* in the identification key and provide detailed comments allowing it to be correctly identified in the event it is ever collected in the state. We also increase the number of records for Espírito Santo of the recently described *P. gigantea* Sousa (in Sousa *et al.* 2020: 253).

Pontederiaceae Kunth.

Herbs perennial or annual, paludal or aquatic, rooted-emerged or rooted-floating or free-floating or submerged. Rhizome present or not. Stems inconspicuous or short to elongated, rarely producing stolons. Ligules truncate or flabellate or ovate or 2-parted, membranous or fibrous. Sessile leaves distichously- or spirally-alternate, early-deciduous or late-deciduous or persistent in mature individuals, congested at the apex of the stems or evenly distributed along the stems, submerged, rarely floating to emerged. Petiolate leaves distichously- or spirally-alternate, rarely or always produced, pulvinate or not, congested at the apex or evenly distributed along the stems, floating or emerged, petioles inflated or not, blades membranous or chartaceous or

coriaceous. Thyrsi terminal or axillary, sessile or pedunculate, many-branched or reduced to a solitary cincinnus; basal bract conduplicate or tubular, erect or deflexed, margin flat or revolute or involute; main axis elongated or inconspicuous; cincinni 1–20-flowered, sessile, internodes congested to slightly elongate. Flowers sessile, zygomorphic, enantiostylous or not, tristylous or not, chasmogamous, rarely cleistogamous, perianth tubular or hypocrateriform or infundibuliform, lobes in a 3+3 or 5+1 arrangement, outer anterior lobe slightly narrower than the other two, inner posterior lobe slightly broader than the other two, sometimes with a posterior nectar guide; stamens (1–)3–6, dimorphic, filaments inflated or not, glabrous or puberulous or barbate or glandular-pubescent, anthers basifixed or dorsifixed or versatile, rimose; ovary 1–3-locular, locules all developed or 2 aborted and 1 developed (pseudomonomerous), 1–many-ovulate, placentation axial or intrusive-parietal or pendulous, septal nectaries present or not, style glabrous or puberulous or glandular-pubescent, stigma unevenly trilobate or evenly trilobate to capitate or truncate. Fruits loculicidal capsules, 3-valved, rarely achenes; anthocarp thin or hardened, free or fused to the fruit, smooth or ridged. Seeds longitudinally winged, sometimes smooth.

In the state of Espírito Santo, Pontederiaceae can be found growing in open or shaded freshwater environments, except in fast-running water bodies. As with most aquatics, the family is poorly collected in Espírito Santo, especially the smaller and more delicate species of *Heteranthera*. Conspicuous species, such as members of *Pontederia*, tend to be more consistently collected. Furthermore, Pontederiaceae also presents very ephemeral flowers, which also discourage their collection by most botanists. These factors, added to the lack of focused studies for the family in the region, have contributed few herbarium records, even for weedy and widely distributed species, such as *H. reniformis* Ruiz & Pavón (1798: 43).

Key to the genera of Pontederiaceae in Espírito Santo, Brazil

1. Sessile leaves spirally-alternate; petiolate leaves not pulvinate; thyrsi consisting of a solitary cincinni; flowers enantiostylous, stamens (1–)3, anthers basifixed, septal nectaries absent, stigma unevenly trilobate 1. *Heteranthera*
- 1'. Sessile leaves distichously-alternate; petiolate leaves pulvinate; thyrsi many-branched; flowers tristylous, stamens 6, anthers dorsifixed or versatile, septal nectaries present, stigma evenly trilobate to capitate or truncate 2. *Pontederia*

1. *Heteranthera* Ruiz & Pav., Fl. Peruv. Prodr.: 9. 1794, nom. cons.

Herbs perennial or annual, paludal or aquatic, rooted-floating or submerged. Rhizome absent. Stems elongated, rarely short, not producing stolons. Ligules ovate or 2-parted, membranous. Sessile leaves spirally-alternate, early-deciduous or late-deciduous or persistent in mature individuals, congested at the apex of the stems or evenly distributed along the stems, submerged, rarely floating to emerged. Petiolate leaves distichously- or spirally-alternate, rarely to always produced, non-pulvinate, congested at the apex or evenly distributed along the stems, floating, petioles not inflated, blades membranous. Thyrsi terminal or axillary, pedunculate, consisting of a solitary cincinnus; basal bract conduplicate, erect, margin flat or involute; main axis inconspicuous; cincinni 1–20-flowered, sessile, internodes congested to slightly elongate. Flowers enantiostylous, chasmogamous, rarely cleistogamous, perianth tubular, lobes in a 5+1 arrangement, outer anterior lobe slightly narrower than the other two, inner posterior lobe slightly broader than the other

two, sometimes with a nectar guide; stamens (1–)3, dimorphic (2 small laterals + 1 long medial), filaments inflated or not, puberulous or barbate or glandular-pubescent, anthers basifixed, rimose; ovary 1-locular, locules all developed, multi-ovulate, placentation intrusive-parietal, septal nectaries absent, style puberulous, stigma unevenly trilobate. Capsules loculicidal, 3-valved; anthocarp thin, free from the fruit, smooth. Seeds longitudinally winged.

Heteranthera is the smallest genus of Pontederiaceae, comprising ca. 25 species (Pellegrini & Horn, personal observation). It is mainly Neotropical, with only two species native to the Paleotropics (Pellegrini 2017). The genus is monophyletic in its broader circumscription, including the satellite genera *Eurystemon*, *Hydrothrix*, *Scholleropsis*, and *Zosterella* (Pellegrini 2017; Pellegrini *et al.* 2018). *Heteranthera* is easily recognized by its sessile leaves spirally-alternate, non-pulvinate petiolate leaves (when produced), inflorescence reduced to a solitary cincinnus, stamens (1–)3, the lack of septal nectaries, and by its unevenly trilobate stigma (Pellegrini 2017; Pellegrini *et al.* 2018).

Key to the species of *Heteranthera* in Espírito Santo, Brazil

1. Submerged herbs; ligule entire; sessile leaves persistent; petiolate leaves rarely produced, blades linear-oblong to narrowly obovate; inflorescences 2-flowered; perianth lobes with rounded apex, lateral filaments medially inflated 1.3. *Heteranthera zosterifolia*
- 1'. Paludal or rooted-floating herbs; ligule 2-parted; sessile leaves early deciduous; petiolate leaves always produced, blades cordate to broadly cordate to reniform, rarely narrowly cordate; inflorescences 2–16-flowered; perianth lobes with acute to acuminate apex, filaments not inflated 2
 2. Leaf-blade cordate (length/width around 1); peduncle longer than 1 cm long, cincinnus 5–16-flowered, much longer than the spathe, main axis glabrous; all filaments barbate with long, purple hairs 1.1. *Heteranthera multiflora*
 - 2'. Leaf-blade commonly reniform (length/width mostly smaller than 1); peduncle shorter than 1 cm long, cincinnus 3–8-flowered, shorter or as long as the spathe, main axis glandular-pubescent; lateral stamens barbate with long hairs, central stamen sparsely villose, hairs white 1.2. *Heteranthera reniformis*

1.1. *Heteranthera multiflora* (Griseb.) C.N.Horn, Phytologia 59(4): 290. 1986.

Herbs paludal or rooted-floating. Ligules 2-parted. Sessile leaves early-deciduous, congested at the apex of the stems. Petiolate leaves distichously-alternate, always produced, evenly distributed along the stems; petioles 6.1–21.5 cm long, blades 1.7–6 × 2.6–7.6 cm, cordate to broadly cordate. Thyrsi axillary, peduncle (1.6–)4–11 cm

long; basal bract 1.5–7 × 0.6–1.4 cm, erect, margin flat, apex mucronate; cincinnus 5–16-flowered. Flowers white, perianth externally glandular-pubescent, lobes 3.3–6.2 × 1–3.2 mm, narrowly elliptic to elliptic to broadly elliptic, posterior one with a nectar guide, consisting of 2 yellow spots involved by a dark purple to dark blue blur, apex acute to acuminate; filaments not inflated, lateral ones barbate at apex, medial one barbate at base,

hairs purple. Capsules 8.4–14 × 1.5–2.8 mm, narrowly oblongoid. Seeds 0.6–1 × 0.4–0.5 mm, oblongoid, wings 9–12.

Material examined: Santa Teresa, Estação Biológica Santa Lúcia, 21.XI.2015, fl., *M.O.O. Pellegrini & R.F. Almeida 460* (RB).

Additional material examined: BRAZIL. ALAGOAS: São José, BR-316, ca. 140 km W of Maceió, 14.VI.1982, fl., *C.N. Horn et al. 519* (IPA, KANU, MO, UNA - 2 exemplars). MATO GROSSO DO SUL: Corumbá, BR-262, km 723, ao sul da estrada da Fazenda Alvorada e 0,9 km da Fazenda Noroeste, 24.V.1989, fl. and fr., *A. Pott et al. 4866* (COR, MBM). RIO DE JANEIRO: Silva Jardim, ReBio Poço das Antas, num remanso do Rio São João, 17.XI.1976, fl., *M.C. Vianna et al. 908* (RB).

This species is native to Brazil (states of Mato Grosso do Sul, Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo), Argentina, Bolivia, and Paraguay (Pellegrini & Horn 2017; Horn 2020). *Heteranthera multiflora* has recently been recircumscribed to include only South American plants, with the North American plants now included in two newly recognized species (Horn 2020). It is recorded for the first time for Espírito Santo, represented by a single collection with young inflorescences. This record also represents the northernmost distribution record for this species. It was found growing as a rooted-floating plant at the slow-moving waters of the riverbanks at Estação Biológica Santa Lúcia, municipality of Santa Teresa. It was not assessed in the Espírito Santo red list (Fraga *et al.* 2019). Thus, we propose this species to be considered Data Deficient (DD), based on regional context since it is known from a single record.

Heteranthera multiflora is similar to *H. reniformis* due to its gross vegetative and floral morphology. They can be differentiated by the length/width ratio of their leaf-blades, the length of their basal bract compared to the cincinnus, the pubescence of the medial filament, and the coloration of the staminal pubescence. *Heteranthera multiflora* is a larger and more robust species than the generally smaller and delicate *H. reniformis*. It can be further confused with *H. longirachilla* Sousa & Giulietti (in Sousa *et al.* 2018: 503) (which does not occur in Espírito Santo) due to the size of their cincinnus compared to the basal bract and gross floral morphology. They can be differentiated by their cincinnus and perianth externally with multicellular glandular hairs (*vs.* with unicellular glandular hairs in *H. multiflora*), and glabrous medial filament (*vs.* barbate at base) (Sousa *et al.* 2018).

Vernacular names: agrião-do-brejo, aguapé-do-arroz, aguapé-mirim.

1.2. *Heteranthera reniformis* Ruiz & Pav., Fl. Peruv. 1: 43, pl. 71, f. a. 1798. Fig. 1a

Herbs paludal or rooted-floating. Ligules 2-parted. Sessile leaves early-deciduous, congested at the apex of the stems. Petiolate leaves distichously-alternate, always produced, evenly distributed along the stems; petioles 5–14 cm long, blades 1.5–3 × 2–4 cm, cordate to broadly cordate. Thyrsi axillary, peduncle 2–3 cm long; basal bract 2–3 × 0.4–1.2 cm, erect, margin flat, apex mucronate; cincinnus 3–8-flowered. Flowers white, sometimes pale pink to lilac, perianth externally glandular-pubescent, lobes 3.3–5.6 × 1–2.5 mm, narrowly elliptic to elliptic, posterior one with a nectar guide or not, consisting of 2 green to yellowish-green spots involved by a maroon to vinaceous blur, apex acute to acuminate; filaments not inflated, lateral ones barbate at apex, medial one evenly puberulous, hairs white. Capsules 7.8–12 × 1.2–2 mm, narrowly oblongoid. Seeds 0.5–0.9 × 0.3–0.5 mm, oblongoid, wings 8–14.

Material examined: Santa Teresa, Estação Biológica Santa Lúcia, 29.IX.1998, fl., *L. Kollmann et al. 634* (MBML, UFP); 21.XI.2015, fl. and fr., *M.O.O. Pellegrini & R.F. Almeida 462* (CEPEC, RB, UEC).

The species is widely distributed in the Neotropics, from the USA to Argentina, Brazil, and Uruguay (Horn 1985). In Brazil, it is known for the states of Acre, Amazonas, Pará, Rondônia, Roraima, Bahia, Paraíba, Pernambuco, Distrito Federal, Goiás, Mato Grosso do Sul, Mato Grosso, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul, and Santa Catarina (Horn 1985; Sousa 2020). *Heteranthera reniformis* is known to occur in seasonally-flooded environments, damp disturbed areas (*e.g.*, rice and sugarcane plantations), and still or slow-moving water bodies. It is considered a weedy species, despite being native. It was assessed in the Espírito Santo red list (Fraga *et al.* 2019) as Least Concern (LC) due to the species' overall distribution. We propose this species to be considered Data Deficient (DD) considering regional context since it is known from two records in the same locality.

Heteranthera reniformis is similar to *H. multiflora* but can be differentiated by its leaf-blade dimensions, the relative size of the basal bract compared to the cincinnus, and the type and coloration of the staminal pubescence. The posterior tepal of *H. reniformis* can present a

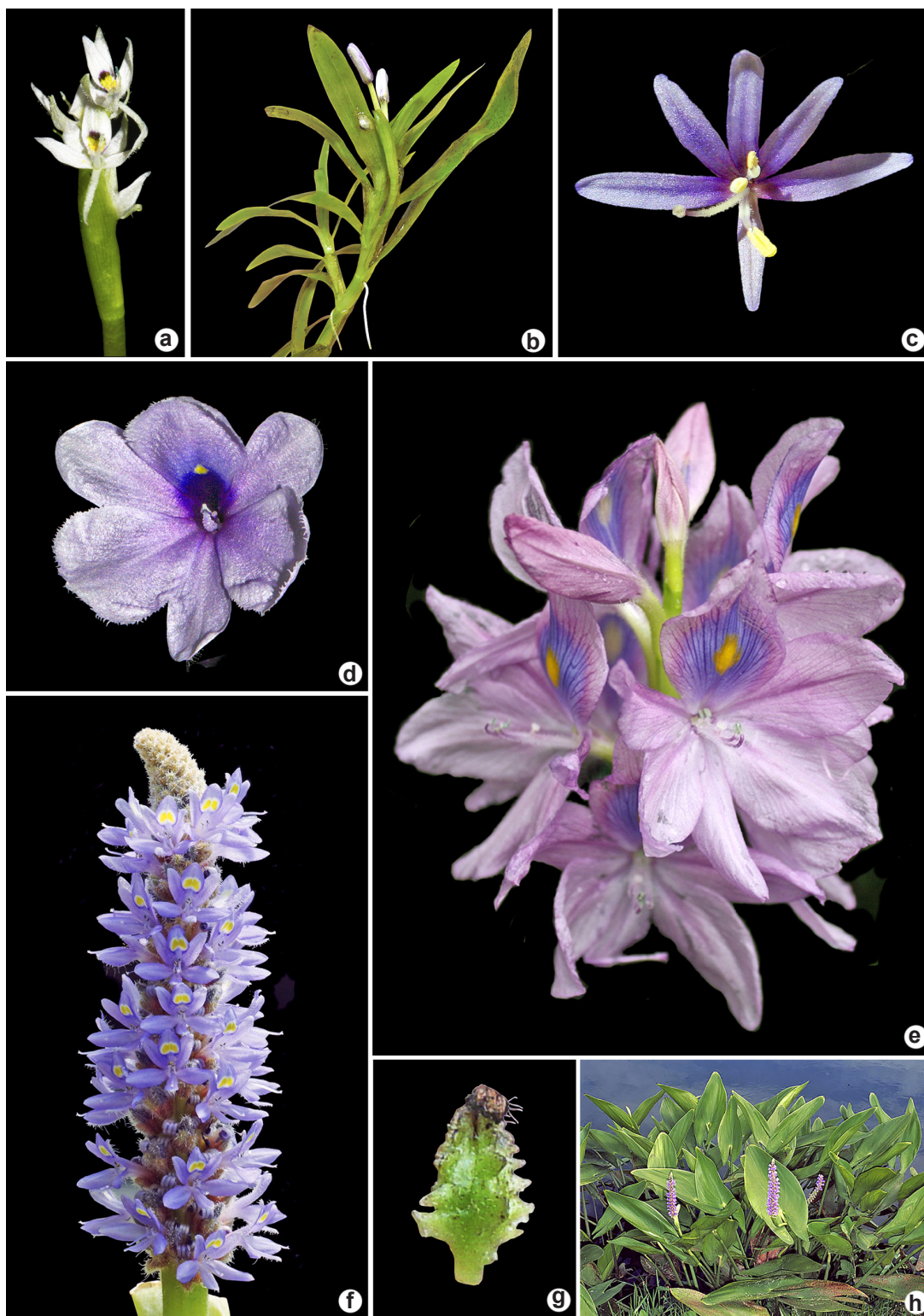


Figure 1 – a. Inflorescence of *Heteranthera reniformis*. b. Habit of *H. zosterifolia*. c. Flower of *H. zosterifolia*. d. Flower of *Pointederia azurea*. e. Inflorescence of *P. crassipes*. f. Inflorescence of *P. cordata*. g. Achene of *P. cordata*; h. Habit of *P. gigantea*. Photos: a,d,e. M.O.O. Pellegrini; b. D. Grasel; c. S.S. de Oliveira; f. A. Shitaka; g. A. Haines; h. V. Bittrich.

nectar guide or not, *versus* nectar guide always present in *H. multiflora*. *Heteranthera reniformis* is similar to *H. pumila* M. Pellegrini & C.N. Horn (2017: 43), which does not occur in Espírito Santo, due to its cincinnus equal to shorter than the basal bract, inflorescence and perianth externally glandular-pubescent with multicellular hairs, and medial filament puberulous (Pellegrini & Horn 2017). They can be differentiated based on their petiolate leaf-blade dimensions [3.5–11.8(–13.2) × 3.2–12.1 mm in *H. pumila* vs. 12–75 × 10–81 mm in *H. reniformis*], the number of flowers per inflorescence [1–2(–3)-flowered vs. 3–8-flowered], the shape of the apex of the basal bract (aristate vs. mucronate), and the ornamentation of the seed (smooth or with 7–9 inconspicuous longitudinal wings vs. 8–14 conspicuous wings).

Vernacular names: agrião-do-brejo, aguapé-do-arroz, aguapé-mirim.

1.3. *Heteranthera zosterifolia* Mart., Nov. Gen. Sp. Pl. 1: 7. 1823. Fig. 1b-c

The species is native to Brazil (states of Tocantins, Rondônia, Bahia, Rio Grande do Norte, Mato Grosso, Mato Grosso do Sul, Goiás, Distrito Federal, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina, and Rio Grande do Sul), Bolivia, northeastern Argentina, Uruguay, and Paraguay, with disjunctive populations in Colombia (Horn 1985). *Heteranthera zosterifolia* is not confirmed for Espírito Santo, but it is suspected to occur in the state based on its overall distribution. This species is poorly collected since it grows in calm water bodies, which require collectors to enter such environments. As it is not confirmed to occur in the state of Espírito Santo, we refrain from making a regional conservation assessment for this species.

Heteranthera zosterifolia is morphologically very different from *H. multiflora* and *H. reniformis*, due to its persistent sessile leaves and sporadic production of petiolate leaves. When produced, these petiolate leaves are always associated with inflorescences and are morphologically very similar to the sessile and submerged leaves, except for the presence of short petioles and floating on the water surface. These features represent a persistent neotenic phase. Furthermore, the tepals have an obtuse apex, and the filaments are medially inflated.

Vernacular names (other regions of Brazil): aguapé-cinta, aguapé-de-fita.

2. *Pontederia* L., Sp. Pl.: 288. 1753.

= *Eichhornia* Kunth, Enum. Pl. 4: 129. 1843.

Herbs perennial, rarely annual, paludal or aquatic, rooted-emerged or rooted-floating or free-floating. Rhizome present, short. Stems inconspicuous or short to elongated, rarely producing stolons. Ligules truncate or flabellate, membranous or fibrous. Sessile leaves distichously-alternate, early- or late-deciduous, congested at the apex of the stems or evenly distributed along the stems, submerged. Petiolate leaves distichously- or spirally-alternate, always produced, pulvinate, congested at the apex, rarely distributed along the stems, emerged, petioles inflated or not, blades chartaceous or coriaceous. Thyrsi terminal or axillary, pedunculate, many-branched; basal bract tubular, erect or deflexed, margin flat or revolute; main axis elongated; cincinni 1–6-flowered, sessile, internodes congested. Flowers tristylous, chasmogamous, perianth hypocrateriform or infundibuliform, lobes in a 3+3 arrangement, outer anterior lobe slightly narrower than the other two, inner posterior lobe slightly broader than the other two, with a posterior nectar guide; stamens 6, filaments not inflated, glandular-pubescent, anthers dorsifixed or versatile, rimose; ovary 1–3-locular, locules all developed or 2 aborted and 1 developed (pseudomonomerous), 1–many-ovulate, placentation axial or pendulous, septal nectaries present, style glabrous or glandular-pubescent, stigma evenly trilobate to capitate or truncate. Fruits loculicidal capsules, 3-valved, rarely achenes; anthocarp thin or hardened, free or fused to the fruit, smooth or ridged, ridges sinuate or toothed. Seeds longitudinally winged or smooth.

In this study, differently from Sousa (2020), we present taxonomic binomials based on the current *Pontederia* circumscription, where it has finally been rendered monophyletic by the inclusion of the polyphyletic *Eichhornia* and the Old World *Monochoria* (Pellegrini *et al.* 2018). The genus is organized into five subgenera, *P.* subg. *Cabanisia*, *P.* subg. *Oshunae*, *P.* subg. *Monochoria*, *P.* subg. *Eichhornia*, and *P.* subg. *Pontederia* (Pellegrini *et al.* 2018). Out of these, *P.* subg. *Oshunae*, *P.* subg. *Eichhornia*, and *P.* subg. *Pontederia* occur in the state of Espírito Santo, with the first two represented by a single species each and the third represented by two species. *Pontederia* can be currently recognized by its sessile leaves distichously-alternate, petiolate leaves always produced and pulvinate, inflorescences with 1–many cincinni, stamens 6, septal nectaries generally present, and by its evenly trilobate to capitate or truncate stigma (Pellegrini *et al.* 2018).

Key to the species of *Pontederia* in Espírito Santo, Brazil

1. Floating herbs; ovary 3-locular, locules many-ovulate, placentation axial; fruit a capsule, anthocarp thin, ridges smooth; seeds longitudinally winged..... 2
- 1'. Emergent herbs; ovary 1-locular by abortion (pseudomonomerous), fertile locule 1-ovulate, placentation pendulous; fruit an achene, anthocarp hardened, ridges sinuate, toothed or echinate; seeds smooth... 3
 2. Rooted-floating herbs, not producing stolons; ligule truncate; petiolate leaves distichously-alternate, petioles never inflated; main florescence axillary; inner lobes of the perianth margins fimbriate to erose, style glabrous..... 2.1. *Pontederia azurea*
 - 2'. Free-floating herbs, producing stolons; ligule flabellate; petiolate leaves spirally-alternate, petioles commonly inflated; main florescence terminal; inner lobes of the perianth margins entire, style glandular-pubescent in the upper third..... 2.2. *Pontederia crassipes*
 3. Petiolate leaf-blades elliptic to broadly elliptic to narrowly ovate, rarely subcordate; basal bract with mucronate apex, cincinni (1–)2–3-flowered; filaments glandular-pubescent in the upper third, style glandular-pubescent in the upper third, stigma evenly trilobate to cordate; anthocarp with toothed ridges 2.3. *Pontederia cordata*
 - 3'. Petiolate leaf-blades narrowly sagittate to sagittate to broadly sagittate or hastate to broadly hastate; basal bract with aristate apex, cincinni 4–6-flowered; filaments glandular-pubescent in the upper half, style glabrous, stigma truncate; anthocarp with slightly sinuate ridges 2.4. *Pontederia gigantea*

2.1. *Pontederia azurea* Sw., Prodr.: 57. 1788.

≡ *Eichhornia azurea* (Sw.) Kunth, Enum. Pl. 4: 129. 1843. Fig. 1d

Herbs rooted-floating. Stems elongate, not producing stolons. Ligules truncate, membranous. Sessile leaves late-deciduous, congested at the apex of the stems. Petiolate leaves distichously-alternate, evenly distributed along the stems; petioles 10.7–28.4 cm long, blades 9–14 × 6.2–13 cm, broadly elliptic to narrowly rhomboid to obovate, rarely rotund. Thyrsi axillary, peduncle 2.6–7 cm long; basal bract 4–6 × 2–3.5 cm, erect, margin flat, apex mucronate; main axis 9.5–16 cm long, glabrous; cincinni (1–)2-flowered. Flowers infundibuliform, lilac to purple, rarely light blue or white, perianth externally villose, lobes 0.8–2.2 × 1.7–3.9 cm, elliptic to narrowly obovate to obovate to broadly obovate, posterior one with a nectar guide, consisting of 1 yellow spot involved by dark blue to dark purple blur, outer ones with margin entire, inner ones with margin fimbriate to erose, apex obtuse to round; filaments glandular-pubescent in the upper third, hairs hyaline; style glabrous, stigma evenly trilobate to capitate. Capsules 1–1.5 × 0.4–0.6 cm, ovoid; anthocarp free from the fruit, thin, smooth. Seeds 1–1.8 × 0.7–1.1 mm, ellipsoid, longitudinally winged, wings 10–13.

Material examined: Conceição da Barra, Parque Estadual de Itaúnas, 7.IV.2014, fl., *W.O. Souza* 295 (VIES); 5.XII.2013, fl., *W.O. Souza* 200 (VIES); 8.VIII.2013, fl., *W.O. Souza* 158 (VIES).

This species is widespread in the Neotropics, ranging from Mexico to Uruguay (Pellegrini *et al.* 2018). In Brazil, it is recorded for almost all states, except for Acre, Ceará, Maranhão, Paraíba, Piauí, and Rio Grande do Norte (Sousa 2020). *Pontederia azurea* was assessed as Least Concern (LC) in the regional red list (Fraga *et al.* 2019) due to its global distribution and the substantial number of collections for the state.

Pontederia azurea is morphologically very similar to *P. heterosperma* (Alexander 1939: 170) M.Pellegrini & C.N.Horn (2018: 67), which does not occur in Espírito Santo, due to their emergent petiolate leaves, blades obovate to broadly obovate to rounded, base cuneate, inflorescences 5–many-flowered, flowers heterostylous, margins of the internal perianth lobes erose to fimbriate (Pellegrini *et al.* 2018). It can be differentiated from *P. heterosperma* due to its axillary inflorescences much longer than the basal bract (*vs.* terminal and ca. the same size as the basal bract in *P. heterosperma*), main axis glandular-pubescent (*vs.* glabrous), central-superior perianth lobe with a yellow spot (*vs.* lacking a yellow spot), filaments glandular-pubescent (*vs.* glabrous), and seeds monomorphic (*vs.* dimorphic) (Pellegrini *et al.* 2018).

Vernacular names: aguapé-azul, aguapé-de-baraço, bico-de-pato, orelha-de-burro, orelha-de-veado.

2.2. *Pontederia crassipes* Mart., Nov. Gen. Sp. Pl. 1: 9. 1823.

≡ *Eichhornia crassipes* (Mart.) Solms, Monogr. Phan. 4: 527. 1883. Fig. 1e

Herbs free-floating. Stems inconspicuous, producing stolons. Ligules flabellate, membranous. Sessile leaves early-deciduous, evenly distributed along the stems. Petiolate leaves spirally-alternate, congested at the apex of the stems; petioles 8–35 cm long, blades 2–12 × 3–8 cm, reniform to rhomboid to obovate, rarely rotund. Thyrsi terminal, sessile; basal bract 4–9.8 × 1.5–2.6 cm, erect, margin flat, apex acute to mucronate; main axis 10–21 cm long, glandular-pubescent; cincinni 1-flowered. Flowers hypocrateriform, pink to lilac to purple, rarely white, perianth externally villose, lobes 0.7–1.3 × 3.4–4.7 cm, narrowly elliptic to elliptic to broadly elliptic or narrowly obovate to obovate, posterior one with a nectar guide, consisting of 1 yellow spot involved by a sky-blue to bluish-purple blur, margin entire, apex acute; filaments glandular-pubescent in the upper third, hairs hyaline; style glandular-pubescent in the upper third, hairs hyaline, stigma evenly trilobate to capitate. Capsules 1.2–1.6 × 0.4–0.7 cm, ellipsoid; anthocarp free from the fruit, thin, smooth. Seeds 1.1–2.1 × 0.5–0.9 mm, ovoid, longitudinally winged, wings 10–16.

Material examined: Cachoeiro de Itapemirim, Burarama Barra Alegre, 22.XI.2008, fl., *G.R. Souza 138* (VIES). Conceição da Barra, Parque Estadual de Itaúnas, 29.III.2000, fl. and fr., *O.J. Pereira 6070* (VIES); 7.IV.2014, fl., *W.O. Souza 293* (VIES); 5.XII.2013, fl., *W. Souza 199* (VIES). Vitória, Ilha do Frade, 18.X.1986, fl., *L.C. Fabris 71* (VIES).

This species is widespread in the Neotropics, ranging from Mexico to Uruguay (Pellegrini *et al.* 2018). In Brazil, it is recorded for all states, except for Amapá (Sousa 2020). *Pontederia crassipes* was assessed as Least Concern (LC) in the regional red list (Fraga *et al.* 2019) due to its global distribution and the substantial number of collections for the state.

Pontederia crassipes is morphologically very different from the remaining species of *Pontederia* due to its free-floating habit, the production of stolons, the flabellate ligules, and inflated petioles. It is generally easily identified by most collectors and botanists but can sometimes be confused with *P. azurea*. It can be easily differentiated due to its free-floating habit (*vs.* rooted-floating in *P. azurea*), producing stolons (*vs.* not producing), ligules flabellate (*vs.* truncate), petiolate leaves spirally-alternate with petioles commonly inflated (*vs.*

distichously-alternate with petioles never inflated), inflorescences terminal and sessile (*vs.* axillary and pedunculate), inner lobes of the perianth margins entire (*vs.* fimbriate to erose), and style glandular-pubescent in the upper third (*vs.* glabrous).

Vernacular names: aguapé, água-pé, aguapé-de-flor-roxa, baroneza, camalote, gigoga, jacinto-d'água, mãe-d'água, orquídea-d'água, parecí, pavoã, purú-a.

2.3. *Pontederia cordata* L., Sp. Pl. 1: 288. 1753.

Fig. 1f-g

Herbs emergent. Stems short, not producing stolons. Ligules truncate, fibrous. Sessile leaves early deciduous, congested at the apex of the stems. Petiolate leaves distichously-alternate, congested at the apex of the stems; petioles 3.6–113.1 cm long, blades 7.4–27.2 × 2.7–5.4 cm, elliptic to broadly elliptic to narrowly ovate, rarely subcordate. Thyrsi axillary, peduncle 93–154 mm long; basal bract 4–5.5 × 1.5–2.6 cm, erect, margin revolute, apex mucronate; main axis 11–19.1 cm long, glabrous to velutine; cincinni (1–)2–3-flowered. Flowers infundibuliform, lilac to purple to bluish-purple, rarely light blue or white, perianth externally villose, lobes 2–6 × 4–9 mm, ovate to elliptic, posterior one with a nectar guide, consisting of 2 green to yellowish-green spots involved by white blur, margin entire, apex obtuse to round; filaments glandular-pubescent in the upper third, hairs hyaline; style glandular-pubescent in the upper third, hairs hyaline, stigma evenly trilobate to capitate. Achenes 3.4–5 × 2.6–4.2 mm, broadly ellipsoid to subglobose; anthocarp fused to the fruit, hardened, ridged, ridges toothed. Seeds 1.7–3.5 × 0.9–2 mm, ovoid, smooth.

Material examined: Linhares, Areal, 14.XI.1991, fl., *O.J. Pereira 2462* (VIES); Lagoa Nova, 16.XII.1997, fl., *O.J. Pereira 5771* (VIES); Pontal do Ipiranga, 9.VIII.2000, fl., *O.J. Pereira 6338* (VIES). Aracruz, área 103 da Aracruz Celulose, 27.X.1992, fl., *O.J. Pereira 3959* (VIES).

The species is widely distributed in the Neotropics, from Canada and the USA to the West Indies, Central America, and South America. In Brazil, it is known for the states of Amazonas, Amapá, Pará, Tocantins, Alagoas, Bahia, Paraíba, Pernambuco, Sergipe, Mato Grosso, Mato Grosso do Sul, Goiás, Distrito Federal, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul (Lowden 1973; Pellegrini *et al.* 2018). *Pontederia cordata* was assessed as Least Concern (LC) in the regional

red list (Fraga *et al.* 2019), due to its wide global distribution and the number of collections for the state.

Pontederia cordata has long been the origin of much debate and taxonomical confusion in the genus (Pellegrini *et al.* 2018). Most species currently accepted in *P.* subg. *Pontederia* have either been confused or compared with *P. cordata* at some point, with such confusion even extending to species currently placed in one of the other four recognized subgenera (Pellegrini *et al.* 2018). Based on the combination of morphological and molecular data, Pellegrini *et al.* (2018) supported the reestablishment of *P. ovalis* Martius (1930: 1140) but retained *P. lancifolia* Muhlenberg (1813: 34) as a synonym of *P. cordata*. Sousa *et al.* (2020) recognize two varieties for *P. cordata* s.str., differentiating them based on the shape of the petiolate leaf-blades (which has been demonstrated to be highly variable) and the shape of the apical cell of the hairs in the outer part of the perianth (oblongoid in *P. cordata* var. *cordata* vs. obovoid in *P. cordata* var. *lancifolia*). *Pontederia cordata* is recovered as sister to *P. lancifolia*, with only weak differences related to leaf and perianth hair morphology, and thus should not be recognized taxonomically (Pellegrini *et al.* 2018). The specimens collected at Espírito Santo fit what would represent *P. cordata* var. *lancifolia*.

Vernacular names: dama-dos-lagos, murerê, murerê, mureru, muriru, murumuru, mururé-de-canudo, rainha-dos-lagos.

2.4. *Pontederia gigantea* Sousa in Sousa *et al.*, Phytotaxa 432(3): 253. 2020. Fig. 1h

Herbs emergent. Stems short, not producing stolons. Ligules truncate, fibrous to membranous. Sessile leaves early deciduous, congested at the apex of the stems. Petiolate leaves distichously-alternate, congested at the apex of the stems; petioles 17–130 cm long, blades 10–35 × 8.5–22 cm, narrowly sagittate to sagittate to broadly sagittate or hastate to broadly hastate. Thyrsi axillary, peduncle 7.5–15 cm long; basal bract 4–7.2 × 2.5–3.7 cm, erect, margin revolute, apex aristate; main axis 1.1–1.5 cm long, glabrous to pilose; cincinni 4–6-flowered. Flowers infundibuliform, lilac to purple to bluish-purple, rarely light blue, perianth externally glabrous to sparsely villose, lobes 4–5.3 × 2–3.5 mm, ovate to elliptic, posterior one with a nectar guide, consisting of 2 green to yellowish-green spots involved by white blur, margin entire, apex obtuse to round; filaments glandular-pubescent in

the upper half, hairs hyaline; style glabrous, stigma truncate. Achenes 7–8.6 × 6–7.7 mm, broadly ellipsoid to subglobose; anthocarp fused to the fruit, hardened, ridged, ridges slightly sinuate. Seeds 4–4.5 × 1.9–2.3 mm, ovoid, smooth.

Material examined: fl. and fr., *A. Saint-Hilaire B2 274* (P - 3 exemplars); fl., (RB00631897). Vila Velha, 22.VI.1986, fl. and fr., *P.C. Vinha* (VIES000954). Vitória, fl., *A. Sellow 237* (P).

The species is endemic to Brazil (states of Bahia, São Paulo, Rio de Janeiro, Paraná, and Santa Catarina) (Pellegrini *et al.* 2018; Sousa *et al.* 2020). *Pontederia gigantea* is poorly collected, being considered a rare species. It grows in calm water bodies near the coast. In the regional red list (Fraga *et al.* 2019), it was assessed under *P. sagittata* C.Presl s.lat. (1827: 116), and thus considered to be Least Concern (LC). Nonetheless, it is known for Espírito Santo by only four very old collections. Even though the dates are unknown for the Sellow and Saint-Hilaire collections, they were certainly made over a century ago. Alternatively, Vinha collected this species in 1986, making this collection currently 35 years old. The lack of current or even recent collections of *P. gigantea* suggests the extreme rarity or possibly the inexistence of extant populations in Espírito Santo. Thus, we suggest it be treated as Critically Endangered (CR).

Pontederia gigantea is morphologically similar to *P. cordata* and *P. ovalis* Mart., which does not occur in the state, due to its robust habit, spike-like thyrsi, and flowers ranging from light blue to lilac to purple to bluish-purple. It is vegetatively more easily confused with some specimens of *P. cordata* with cordate petiolate leaf-blades. It can be differentiated by the number of flowers per cincinnus (4–6 in *P. gigantea* vs. 2–3 in *P. cordata*), the color of the nectar guide (spots yellow vs. green), and the ornamentation of the hardened anthocarp ridges (slightly sinuate vs. toothed). Alternatively, *P. gigantea* is morphologically similar to *P. ovalis* regarding reproductive features, such as the yellow spots on the nectar guide, the filaments glandular-pubescent on the upper half, the glabrous style, and the slightly sinuate ridges of the anthocarp. They can be differentiated based on the shape of their petiolate leaf-blades (narrowly sagittate to sagittate to broadly sagittate or hastate to broadly hastate in *P. gigantea* vs. ovate to broadly ovate to subcordate in *P. ovalis*), the posture of the margin of their basal bracts (revolute vs. flat), and the number of flowers per cincinnus (4–6 in *P. gigantea* vs. 2–3 in *P. ovalis*).

Pontederia gigantea was first suggested as distinct from *P. sagittata* s.str. by Pellegrini *et al.* (2018), who highlighted the disjunctive distribution between both species. It was formally described as a new species by Sousa *et al.* (2020). Aside from their disjunctive distribution, *P. gigantea* can be differentiated from *P. sagittata* s.str. by the shape of the apex of their basal bracts (aristate in *P. gigantea* vs. mucronate in *P. sagittata*), the pubescence of their perianth (glabrous to sparsely pilose vs. glandular-pubescent), the distribution of the filament hairs (in the upper half vs. upper third), the pubescence of the style (glabrous vs. glandular-pubescent in the upper third), the shape of their stigmas (truncate vs. evenly trilobate to capitate), and the length of their seeds (4–4.5 mm long vs. 2–2.5 mm long).

Vernacular names: dama-dos-lagos, mureré, murerê, mureru, muriru, murumuru, mururé-decanudo, rainha-dos-lagos.

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