Phytotaxa 721 (1): 001–049
https://www.mapress.com/pt/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

https://doi.org/10.11646/phytotaxa.721.1.1

A taxonomic treatment of Alismataceae (Alismatales) in the Brazilian Pantanal

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Abstract

This study provides a taxonomic treatment of Alismataceae species occurring in the Brazilian Pantanal. Field collections were carried out and analysis of sheets housed in the most representative herbaria of Pantanal were consulted. A total of five genera and 19 species were confirmed in the Brazilian Pantanal. *Echinodorus* was the most representative genus, with nine species, followed by *Sagittaria* with four. Taxonomic analyses exclude *E. cylindricus* and *E. lanceolatus*, which were reassigned as *E. glaucus*. *Echinodorus grandiflorus* was identified as *E. longiscapus*, and specimens previously identified as *E. macrophyllus* were mostly updated as *E. scaber*, with a few reassigned as *E. floribundus*. New records in *E. longiscapus*, *E. grisebachii* and *S. planitiana* were also documented. Additionally, *Aquarius* is here proposed as a synonym of *Echinodorus*, as its segregation is considered unjustified. This study also provides the lectotypification of *Sagittaria montevidensis*, based on study of original material preserved at G and HAL herbaria. The taxonomic treatment includes identification keys, morphological descriptions, diagnostic and comparative notes for morphologically related taxa, discussions on previously reported taxa, photographic plates, illustrations, and species distribution maps.

Key words: Alismatidae, aquatic plants, herbarium records, Monocots, Tropical wetlands, Taxonomy

Introduction

The Pantanal is the largest seasonally flooded wetland in the world, covering to 140,000–150,000 km², across Brazil, Bolivia, and Paraguay (Silva & Abdon 1998, Junk & Nunes da Cunha 2016). Due to its biological significance, the region has been designated a UNESCO Biosphere Reserve and declared National Heritage by the Brazilian Constitution of 1988 (Junk *et al*. 2006, WWF 2018). The Pantanal is also one of the main diversity centers of aquatic plant in the neotropics (Pedralli 1992), comprising over 530 species (Pott & Pott 2021). This high diversity is associated with a mosaic of aquatic environments that arise during seasonal floods of the Paraguay River and its tributaries, such as freshwater lagoons (*baías*), river branches (*corixos*), flooded grasslands, seasonal streams (*vazantes*), oxbow lakes, and shallow lakes (Signor *et al*. 2010, Pott & Silva 2015, Pott & Pott 2021). Such dynamic conditions promote the proliferation of aquatic plants, particularly species of Alismataceae (Pott & Pott 2000, 2021).

Alismataceae is a monophyletic lineage of monocots in Alismatales (Lehtonen 2009, Les & Tippery 2013, APG IV 2016, Ross *et al.* 2016). All families within this order exhibit morpho-anatomical adaptations for colonizing aquatic and marshy environments, both freshwater and marine (Chen *et al.* 2022). However, Alismataceae consists exclusively of freshwater aquatic plants rooted in the substrate, with emergent, submerged, or floating leaves (Haynes & Holm-

Accepted by Guilherme Antar: 18 Sept. 2025; published: 3 Oct. 2025

Nielsen 1994, Cook 1996). Species of the family share a set of characters, such as secretory ducts with milky resin; rhizomatous stems; basal rosettes of leaves, differentiated into a leaf blade and a long petiole; actinomorphic and trimerous flowers with an apocarpous gynoecium; an androecium with numerous free stamens bearing versatile or basifixed anthers; fruits generally achenes; and seeds lacking endosperm and containing a strongly recurved embryo (Haynes & Holm-Nielsen 1992, 1994, Haynes *et al*. 1998a, b, Leme *et al*. 2021).

Alismataceae currently comprises 17 genera and 113 species with a cosmopolitan distribution, including most genera formerly placed in Limnocharitaceae, i.e. *Butomopsis* Kunth (1841: 164), *Hydrocleys* Richard (1815: 368), and *Limnocharis* Bonpland (1807: 116) (Les & Tippery 2013). The family likely originated in the Late Cretaceous, with early diversification across the Neotropical, Afrotropical, and Western Palearctic regions (Li *et al*. 2022), and is particularly diverse in New World wetlands (Bogin 1955, Haynes & Holm-Nielsen 1994, Haynes *et al*. 1998a). *Echinodorus* Richard & Engelmann in A.Gray (1848: 460), *Sagittaria* Linnaeus (1753: 993), *Helanthium* (Engelm. ex Bentham & Hooker 1883: 1005) J.G.Smith in Britton (1905: 54), *Hydrocleys*, and *Limnocharis* account for about 60% of the family's species in the neotropics (Lehtonen 2009, POWO 2025). In Brazil, these five genera comprise 39 native species distributed across all regions and phytogeographic domains, notably in the Northeast (28 spp.) and Central-West (30 spp.) regions where they are distributed in permanent or seasonal aquatic environments (Matias & Pestana 2025).

Since Seubert (1847) in the *Flora Brasiliensis*, and later the revision by Rataj (1978), the Brazilian Alismataceae has been the subject of local or regional taxonomic studies. Most of these have focused on the Caatinga phytogeographic domain (Matias 2007, 2010, Matias *et al*. 2008, Matias & Sousa 2011, Sousa *et al*. 2015), with additional contributions from the Amazon Forest (Hall & Gil 2016) and the Atlantic Forest (Pansarin & Amaral 2004, 2005, Canalli & Bove 2017, Matias & Nascimento 2022). Despite the high diversity of Alismataceae in the Pantanal (previously ~16 species in Matias 2020), the family has been poorly studied from a taxonomic perspective. Available data consist mainly in surveys of aquatic plants (e.g. Pott *et al*. 1989, 1997, Prado *et al*. 1994) and do not include identification keys, detailed descriptions, or taxonomic notes. The only focused taxonomic study is a Master's thesis restricted to the southern Pantanal (Guimarães 1999), which recorded only eight species.

Given the limited taxonomic knowledge of Alismataceae in the Pantanal, and in light of increasing pressures from climate change (Alho & Silva 2012, Marengo *et al*. 2015, Lázaro *et al*. 2020) and threats from large-scale governmental projects (Boulange *et al*. 2021, Wantzen *et al*. 2024), detailed taxonomic documentation of its biodiversity is essential for conservation efforts. This study provides a taxonomic treatment of Alismataceae in the Brazilian Pantanal, including an updated species list, identification keys for genera and species, detailed morphological descriptions, taxonomic notes, phenological data, etymology, illustrations, and distribution maps.

Material & Methods

Study area

The Pantanal is located within the Upper Paraguay River Basin in central South America, between latitudes 18º15' and 15º2' S and longitudes 61º4' and 54º43' W (Assine 2015), with elevations ranging from 80 to 190 m a.s.l. (Silva & Abdon 1998). Pantanal covers the Central-West region in Brazil, occurring within the states of Mato Grosso (~49,000 km²) and Mato Grosso do Sul (~91,000 km²) (Junk *et al*. 2011; Figure 1). The region has a tropical savanna climate (Aw), with distinct wet (October–April) and dry (May–September) seasons (Alvares *et al*. 2013, Freitas *et al*. 2014, Junk & Nunes da Cunha 2016). The annual precipitation ranges from 800 to 1,400 mm and the average annual temperature is 26 °C, with peaks above 40 °C during the summer months (Silva & Abdon 1998, Lázaro *et al*. 2020). Relative humidity averages 82% during the rainy season (Freitas *et al*. 2014), whereas monthly precipitation during the dry season often remains below 100 mm (Marengo *et al*. 2015).

Field collections and herbarium specimens

Field collections were carried out in June 2023 along the Estrada Parque Pantanal, covering the Abobral and Miranda sub-regions, and in September 2024 through the sub-regions of Porto Murtinho, Paiaguás, and Paraguai. The floristic survey was carried out through systematized walks along the margins of aquatic and marshy environments, and by boat in permanently flooded areas. Representative habitats surveyed during the expeditions are illustrated in Figure 2.

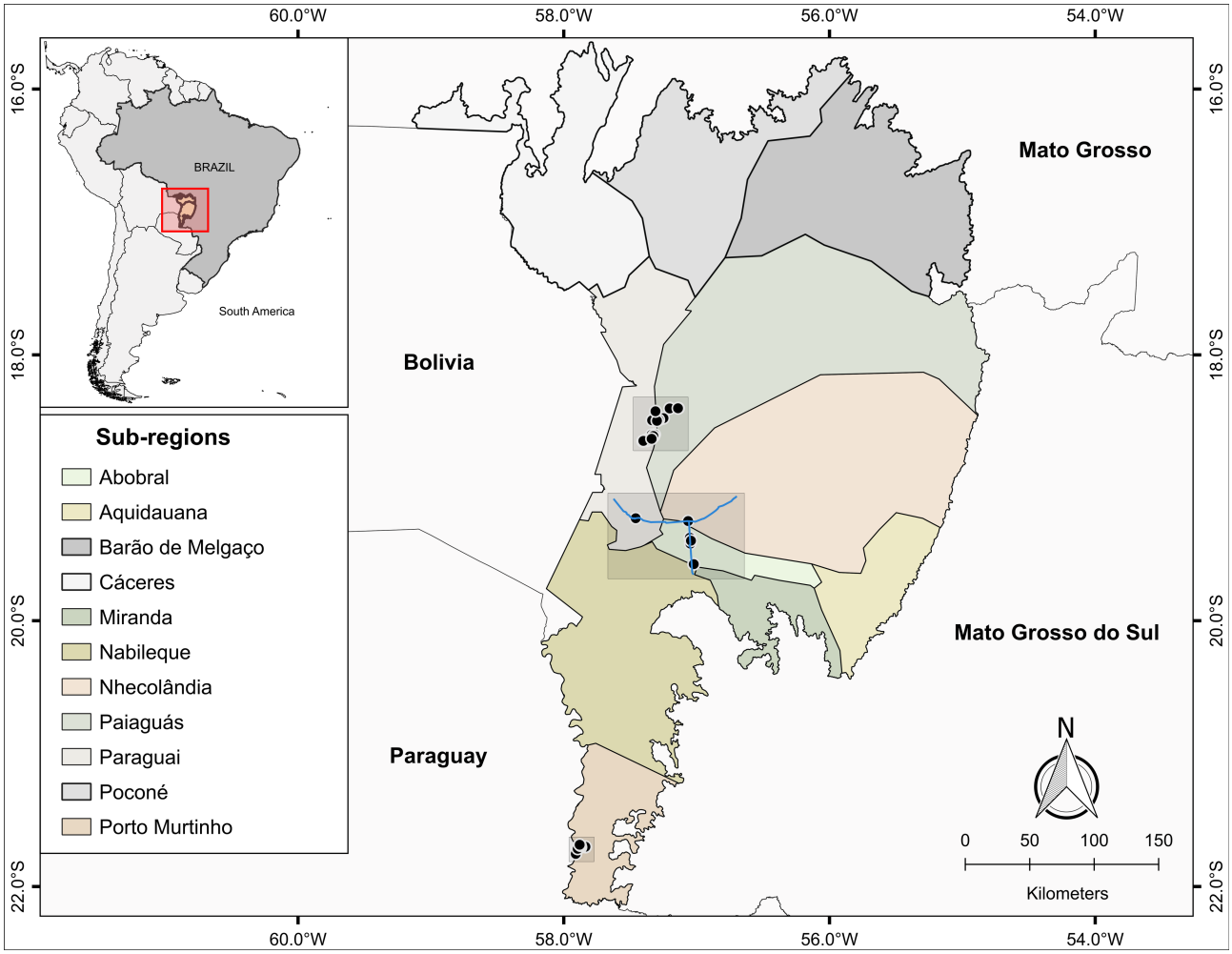

FIGURE 1. Location map of the Pantanal in Brazil showing its sub-regions (Silva & Abdon 1998). Surveyed areas are outlined in grey, sampling sites are shown in black, and the course of the *Estrada Parque Pantanal* is indicated in blue. Map credits: M.C.A. Pestana.

Specimens were collected and preserved using standard protocols for aquatic plants (Haynes 1984), and deposited in the DDMS herbarium, with duplicates sent to TUR (University of Turku, Finland). Flowers, fruits, and vegetative structures were preserved in 70% ethanol for morphological analysis. Photographs were taken in the field to document habit, habitat, and morphological features. Tissue samples of each specimen were preserved in silica gel and stored in DDMS and TUR.

Additionally, herbarium specimens were consulted in representative collections from Pantanal. Specimens from CGMS, COR, CEN, CPAP, ICN, and UFMT herbaria (acronyms follow Thiers, continuously updated) were examined. Digital images from BHCB, ESA, HPAN, HUCS, HUEFS, HUEM, MBM, NY, R, RB, SP, UB, UEC, UPCB, HRCB, and US herbaria were examined using *species*Link (CRIA 2023) and JABOT (JBRJ 2024) databases. Specimens with uncertain identifications due to poor preservation or lack of access to key structures were excluded from the analysis.

Taxonomic delimitation, species identification, and morphological descriptions

The circumscription of the family and accepted genera follows Les & Tippery (2013). Morphological analyses were conducted using stereoscopic microscope. Specimens' identification was performed through comparative morphological analyses and consultation of specialized literature (e.g. Haynes & Holm-Nielsen 1992, 1994, Rataj 1978, Matias 2007, Lehtonen 2008, Matias & Sousa 2011, Canalli & Bove 2017, Matias & Nascimento 2022). Nomenclatural types were consulted using JSTOR Global Plants (2025) and protologues accessed through the Biodiversity Heritage Library (2025). Species names and author abbreviations follow the International Plant Names Index (2025) and Flora e Funga do Brasil (2025). Synonymy was checked in Lehtonen (2008).

FIGURE 2. Examples of aquatic habitats surveyed during field collections. **A:** Lagoon (*Baía*). **B:** Forest patches with soil slightly above the water level (*Capão*). **C:** Flooded grassland (detail showing a population of *Tuiuiú* [*Jabiru mycteria*] storks in the background – an iconic bird of the Pantanal). **D:** Permanent lagoon (detail showing *Carandá* palms [*Copernicia alba* Morong] in the background). **E:** River channels. Photo credits: M.C.A. Pestana (**A, D, E**) and S. Lehtonen (**B, C**).

Species descriptions were based on the analyses of both herbarium and alcohol-preserved samples. The flowers and fruits were dissected and described based on specimens rehydrated in boiling water for approximately two minutes. Measurements were taken using a ruler and a digital caliper (0.01 mm precision). Additional measurements of macroscopic structures (e.g. leaf blade, petiole) taken from high-resolution images were obtained using ImageJ software (Schneider *et al*. 2012). All measurements are presented in the format length × width. As the morphological descriptions reflect only the variation observed in Pantanal specimens, certain characters may differ from descriptions of the same taxa in other parts of their distribution.

General morphological characters follow the terminology of Beentje (2016) while specific characters of Alismataceae follow Haynes & Holm-Nielsen (1992, 1994). Morphological data of each specimen was converted into spreadsheets to generate standardized descriptions using function "tableToDescription" of R package *monographaR* (Reginato 2016, R Core Team 2025). Complementary description of additional samples from other locations were included under "Additional Specimens Examined". Specimen lists were compiled using the function "examinedSpecimens" of *monographaR*. A complete list of all specimens examined is provided in Appendix 1.

Growth forms were categorized following Pott & Pott (2000). Data on geographic distribution, phenology, growth habit, and habitat preferences were obtained from herbarium specimen labels, field observations, and literature sources. Pellucid marks in *Echinodorus* and *Helanthium* were observed by illuminating the abaxial surface of the leaf blade with a stereoscopic light source. Dichotomous keys were developed using a combination of vegetative and reproductive characters commonly employed in Alismataceae taxonomy. Botanical illustrations were produced using dried and spirit collection.

Distribution maps

Distribution maps were generated in QGIS software version 3.34.0 (QGIS Development Team 2023; Fig. 3). To analyze species distribution across the Pantanal, the delimitation of its sub-regions by Silva & Abdon (1998) was adopted. Geographic coordinates were obtained from fieldwork or extracted from herbaria records. Additionally, records site coordinates were estimated using Google Earth (https://earth.google.com) for specimens with location notes but without georeferencing. The municipality centroid was retrieved using GeoLoc tool (CRIA 2023) when precise information was unavailable.

Results

We recognized the occurrence of five genera and 19 species of Alismataceae in the Pantanal (Figs. 4, 6, 9–11) with records from all sub-regions of the region (Fig. 3A–F). The most representative genera were *Echinodorus*, with nine species, and *Sagittaria*, with four. Furthermore, two species were recorded within each of the genera *Helanthium, Hydrocleys*, and *Limnocharis*. Three species are new records, i.e. *Sagittaria planitiana* G.Agostini (1970: 1) and *E. longiscapus* Arechavaleta (1903: 67) for the state of Mato Grosso, and *E. grisebachii* Small (1909: 46) for the Pantanal.

The most sampled municipalities based on herbarium records were Poconé (170) and Cáceres (63) in Mato Grosso, while in Mato Grosso do Sul were Corumbá (445), Porto Murtinho (42) and Aquidauana (29). Species with most records were *E. paniculatus* Micheli in De Candolle & De Candolle (1881: 51) (160 records), *Helanthium tenellum* (Martius ex Schultes 1830: 1600) Britton (1905: 54) (120), *S. rhombifolia* Chamisso (1835: 219) (72), *E. scaber* Rataj (1969: 438) (67), and *Hydrocleys nymphoides* (Willdenow 1806: 821) Buchenau (1868: 9) (54). In contrast, species with few records and not relocated in the field despite sampling efforts were *E. grisebachii* (1 record), *Helanthium bolivianum* (Rusby 1927: 208) Lehtonen & Myllys (2008: 228) (2), and *E. subalatus* (Martius 1830: 1609) Grisebach (1866: 218) (3).

The species of Alismataceae in the Pantanal can be distinguished by a combination of morphological traits observed in the field and in herbarium specimens, such as the pellucid marks on the leaf blades and the number of glands on the achenes in *Echinodorus*; orientation and shape of the leaf blades in *Helanthium*; relative proportion between corolla and calyx, and the type of indumentum on the seed testa in *Hydrocleys*; relative length of the floral peduncle compared to the petiole in *Limnocharis*; and the leaf blade shape, achene surface and beak ornamentation, together with the number of inflorescence whorls in *Sagittaria*.

Taxonomic Treatment

Alismataceae Ventenat (1799: 157 [as "Alismoidae"]), *nom. cons*. **Type**: *Alisma* Linnaeus (1753: 342).

Freshwater **aquatic herbs**, perennials, rarely annuals; amphibious, emergent, rooted-floating or rarely rooted-submerged; monoecious or rarely dioecious; robust or occasionally slender; glabrous or with an indumentum of simple

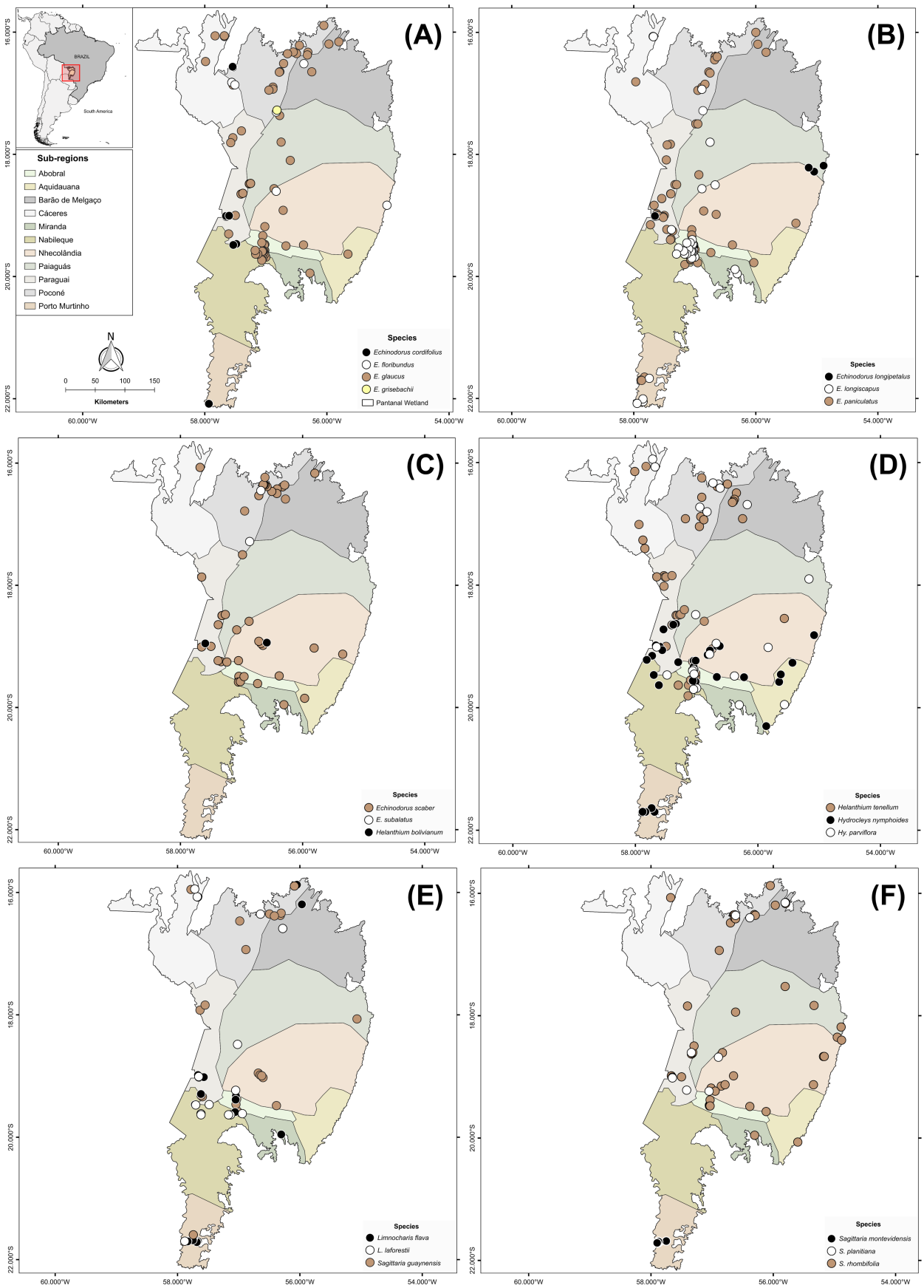

FIGURE 3. Geographical distribution maps of Alismataceae species in the Brazilian Pantanal. Map credits: M.C.A. Pestana.

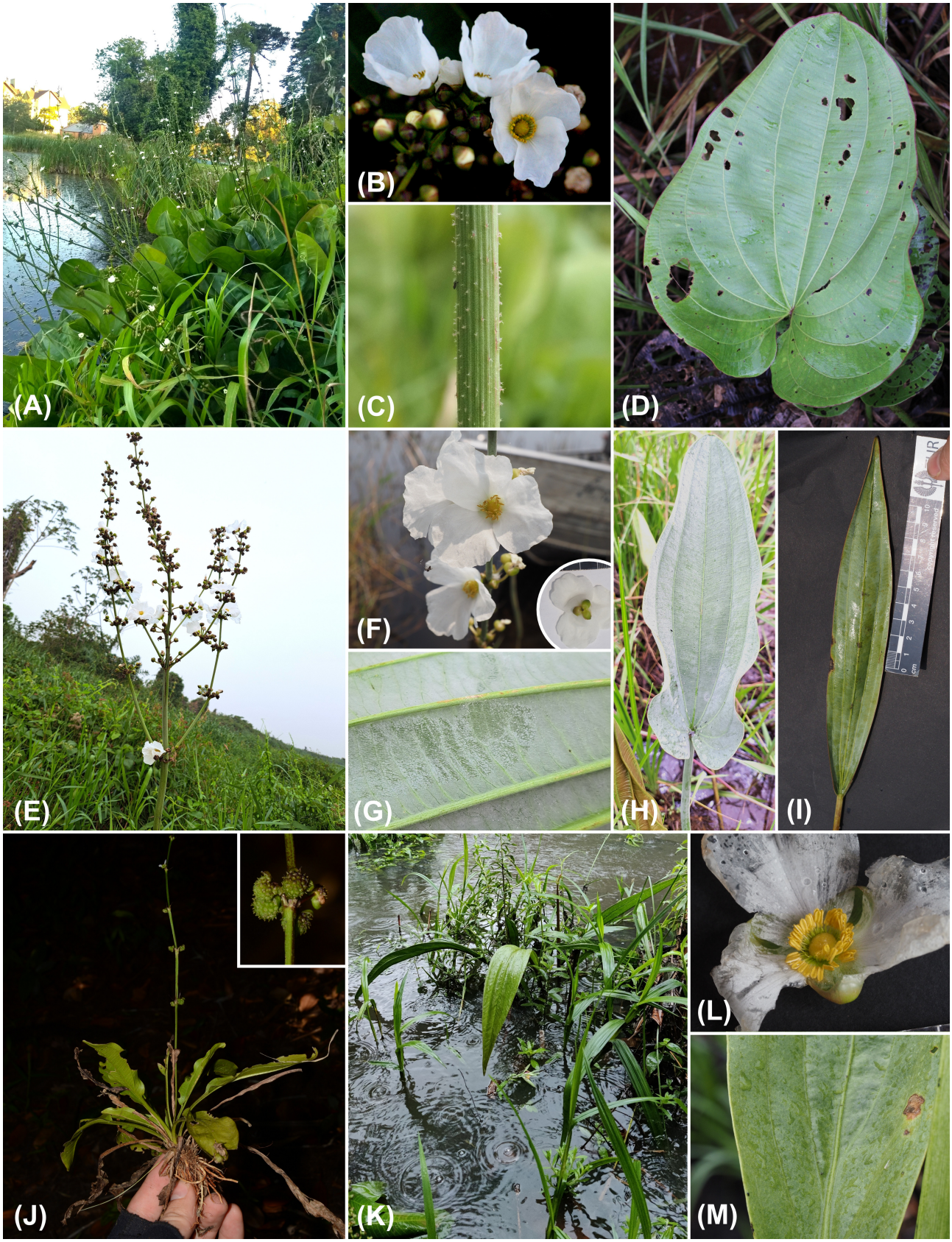

FIGURE 4. Alismataceae species found in the Brazilian Pantanal. **A–D:** *Echinodorus floribundus*. **A:** Habit. **B:** Flowers. **C:** Stem with trichomes. **D:** Adaxial surface of the leaf blade. **E–I:** *E. glaucus*. **E:** Inflorescence with erect branches. **F:** Flowers in front view (opposite view in detail). **G:** Abaxial surface of the leaf blade with whitish wax. **H:** Ovate leaf blade with cordate base. **I:** Lanceolate leaf blade with attenuate base. **J:** Habit of *E. grisebachii* (fruiting aggregate in detail). **K–M:** *E. longipetalus*. **K:** Habit. **L:** Flower. **M:** Detail of the venation in the leaf blade. Photo credits: J. Leroy (**A, B**), D. Falck (**C, F, G, I, K–M**), M.C.A. Pestana (**D, E, H**), and M. Figueira (**J**).

or stellate trichomes; resiniferous ducts present throughout the plants, exuding a milky resin. **Stems** rhizomatous or stoloniferous, with short internodes. **Roots** numerous, adventitious, fibrous, septate or aseptate. **Leaves** simple, spirally arranged in rosettes or alternate and distichous, generally emergent, sometimes floating, well differentiated into leaf blade and petiole; **petioles** usually longer than the blade, basally enclosed by a persistent sheath with hyaline margins; stipules absent; **leaf blades** chartaceous, coriaceous or membranaceous, highly variable in shape; venation acrodromous or campylodromous; primary veins parallel to the margins, converging toward the apex, interconnected by fine secondary veins; pellucid marks present or absent. **Inflorescence** paniculate, racemose, or umbellate, emergent or floating, erect or rarely decumbent, lax (often congested when immature), with acropetal anthesis; **peduncle** septate or aseptate, winged or not; vegetative proliferation present or absent; **bracts** 3, deltoid or lanceolate, chartaceous or membranaceous. **Flowers** actinomorphic, trimerous, imbricate, unisexual or bisexual, pedicellate, sessile when immature; **sepals** 3, aposepalous, green, elliptic, ovate or lanceolate, vertically keeled or not, membranaceous or coriaceous, with delicate hyaline marginal wings, free or basally connate, persistent; **petals** 3, apopetalous, white, yellow or pale yellow, elliptic, obovate, ovate or broadly-ovate; sometimes with basal spots of different colors; stamens 6–9, 12, or usually numerous, free; anthers basifixed or versatile, extrorse, dehiscing longitudinally; filaments linear or basally dilated, glabrous or pubescent; staminodes present or absent; gynoecium apocarpous, with 3–8 carpels, or usually numerous; style present or absent; ovary superior, unilocular, with one ovule per locus or pluriovulate; placentation basal or laminar. **Fruit** achene or rarely a follicle; beak (remnant of the style apex) present or rarely absent; when present, it may be apical, lateral, or horizontal in position. **Seeds** 1 to numerous; testa smooth or ornamented, glabrous or with glandular trichomes or lateral wings; embryo strongly curved, U-shaped, without endosperm.

Identification key to the genera of Alismataceae in the Brazilian Pantanal

1. Inflorescence with distinct whorls of staminate (upper) and carpellate (lower) flowers ..... 5. ***Sagittaria***
- Inflorescence with whorls of only bisexual flowers.....**2**
2. Leaf blades coriaceous; inflorescence racemose or paniculate, composed of 6–30 whorls; stamens with versatile anthers..... ..... 1. ***Echinodorus***
- Leaf blades chartaceous or membranaceous; inflorescence umbellate, composed of 1–3 whorls; stamens with basifixed anthers **3**
3. Slender plants; leaf blades lanceolate or oblong; petals short-clawed, white, persistent; fruit achene (Fig. 5J–K) with 1 seed ....**2 *Helanthium***
- Robust plants; leaf blades ovate, orbicular, or linear; petals sessile, yellow or pale yellow, deciduous; fruit a follicle (Fig. 5L–O) with numerous seeds.....**4**
4. Rooted-floating plants; cylindrical pedicels, septate; fruit lanceolate, style present; seeds with glandular trichomes (Fig. 9G), without lateral wings ..... 3. ***Hydrocleys***
- Emergent plants (never rooted-floating); triangular pedicels, aseptate; fruit semicircular, style absent; seeds glabrous, with lateral wings (Fig. 9I) .....4. ***Limnocharis***

1. *Echinodorus* Richard & Engelmann in A.Gray (1848: 460). **Type:** *Alisma rostratum* Nuttal (1835: 159) = *Echinodorus berteroi* (Sprengel 1825: 163) Fasset (1955: 139).

= ***Aquarius*** Christenhusz & Byng (2018: 51). ***syn. nov***. **Type:** *Aquarius cordifolius* (L.) Christenhusz & Byng (2018: 51).

Aquatic herbs, perennials, predominantly emergent, sometimes amphibious of marshy habitats or rooted-submerged, monoecious, robust, glabrous or stellate-pubescent; branches surface with or without a bluish wax layer. **Stem** rhizomatous. **Roots** septate or aseptate. **Leaves** emergent, long-petiolate; **petioles** longer than blades, cylindrical or triangular in cross section, surface smooth or ridged, glabrous or stellate-pubescent, aseptate; **leaf blades** coriaceous, often very thin in submerged or young plants; lanceolate, linear or ovate, base attenuate, rounded, cordate or truncate, apex acuminate, obtuse or rounded, abaxially glabrous or stellate-pubescent, margin entire or undulate; venation acrodromous or campylodromous; basal lobes present or absent; pellucid marks present or absent, when present forming lines (Fig. 7D), a reticulate network independent of the primary and secondary veins (Fig. 7B), dots and lines (Fig. 7C), or only dots (Fig. 7A). **Inflorescence** paniculate or racemose, emergent, erect or rarely decumbent; **peduncle** aseptate, winged or not, glabrous or stellate-pubescent; rachis cylindrical, subcylindrical (D-shaped), or triangular in cross section, composed of 6 to numerous whorls; vegetative proliferation present or absent; **bracts** deltoid or lanceolate, apex acute, acuminate or long-acuminate, chartaceous, margin entire, free or connate at base. **Flowers** bisexual, short- or long-pedicellate; pedicels triangular in cross section, glabrous, rarely with stellate trichomes; **sepals** ovate or elliptic, apex acute or rounded, not keeled, coriaceous, glabrous, free at base, reflexed in anthesis and in fruit, rarely adpressed in fruit (when completely surrounding the fruit aggregate); **petals** white, sessile, persistent, reflexed or erect, ovate or

obovate, apex rounded or retuse, without spots at base; stamens 6–12 to numerous, filaments linear, glabrous; anthers versatile, elliptic, apex obtuse or acuminate, shorter than filaments; staminodes absent; carpels numerous, arranged in a spiral, style present, short; ovary with one ovule per carpel, placentation basal. **Fruit** achene (Fig. 5A–I), oblanceolate, obovate or rarely falcate; predominantly circular in cross section and not winged, rarely flattened in cross section and winged; surface ribbed, keeled, glands between the ribs present, rarely absent; beak present, apical or lateral. **Seeds** 1, testa smooth, foveolate, reticulate, or tenuous-reticulate, glabrous.

Echinodorus was recently subject to a broad taxonomic change by Christenhusz *et al*. (2018). That study transferred all species to the newly circumscribed genus *Aquarius*, except for *E. berteroi*. The taxonomic decision was based on the observation that *E. berteroi* sometimes appeared isolated from other species in phylogenetic analyses (Lehtonen & Myllys 2008). However, we reject that classification, as it overlooks broader phylogenetic evidence and taxonomic logic.

The total-evidence analysis conducted by Lehtonen & Myllys (2008), using nuclear and chloroplast DNA, as well as morphological characters, consistently recovered *E. berteroi* as sister lineage to the remaining species of *Echinodorus*, and not outside the genus. These combined approaches support a monophyletic *Echinodorus s. str*. when *Helanthium* and *Albidella* Pichon (1947: 174) are treated as separate genera. This result was later confirmed (Lehtonen 2017) but apparently overlooked by Christenhusz *et al*. (2018). Since then, a complete chloroplast phylogeny has also verified this topology (Li *et al*. 2022). We fully agree with Christenhusz *et al.* (2018) that naming each clade in a grade as a separate genus should be avoided when possible, and especially when the historical usage of names can be maintained by avoiding such re-naming. Following this taxonomic logic we here treat *Aquarius* as a synonym of *Echinodorus*.

Currently, *Echinodorus* comprises ca. 28 species distributed across the Americas, from the United States to Argentina (Lehtonen 2008), and is represented in Brazil by 23 species (Matias & Pestana 2025), nine of which occur in the Pantanal. The genus holds considerable economic and medicinal importance (Haynes & Holm-Nielsen 1994). *Echinodorus* species are widely cultivated in aquarium trade and water gardens (Lehtonen & Falck 2011). Additionally, some species, commonly referred to as *Chapéu-de-couro*, are traditionally used in herbal teas to treat rheumatic conditions (Pott & Pott 2000). In the state of Minas Gerais, the leaves are used to produce the local soft drink *Mate-Couro*.

Etymology:—From the Greek *echius* (rough or spiny husk) and *doros* (leather bag), in reference to the species' ovaries, which bear persistent styles forming the spiny projections of the achenes, known as beaks (Haynes & Hellquist 2000).

Identification key to the *Echinodorus* species in the Brazilian Pantanal

1. Pellucid marks on leaf blades present **2**
- Pellucid marks on leaf blades absent **7**
2. Leaf blades with pellucid marks forming a reticulate network (Fig. 7B); sepals elliptic, elongated (1.2–1.5 cm long), adpressed around the fruit aggregate (Fig. 8K); achenes flattened and winged ..... 1.5. ***E. longipetalus***
- Leaf blades with pellucid marks forming lines (Fig. 7D), dots (Fig. 7A) or dots and lines (Fig. 7C); sepals ovate, short (0.3–0.8 cm long), reflexed around the fruit aggregate (e.g. Fig 8N); achenes cylindrical, not winged **3**
3. Glabrous plants; leaf blades with pellucid marks forming lines **4**
- Stellate-pubescent plants; leaf blades with pellucid marks forming dots or dots and lines **6**
4. Leaf blades with cordate base, venation pattern campylodromous; inflorescence decumbent; pedicels 5–10 cm long ..... 1.1. ***E. cordifolius***
- Leaf blades with attenuate or rounded base, venation pattern acrodromous; inflorescence erect; pedicels < 1 cm mm long **5**
5. Obovate achenes, multiglandular, 4–6 glands between the ribs; beak 0.2 mm long ..... 1.4. ***E. grisebachii***
- Oblanceolate achenes, few glandular, 1–2(–3) glands between the ribs; beak 0.6 mm long ..... 1.9. ***E. subalatus***
6. Branches covered by long (ca. 3 mm) and hyaline stellate trichomes; leaf blades with pellucid marks forming only dots; inflorescence paniculate, 2–3 erect lateral branches; pedicels pubescent ..... 1.2. ***E. floribundus***
- Branches covered by short (ca. 1 mm) and yellowish stellate trichomes; leaf blades with pellucid marks forming dots and lines; inflorescence racemose; pedicels glabrous ..... 1.6. ***E. longiscapus***
7. Petioles triangular; inflorescence rachis triangular, winged; bracts apex long-acuminate; achenes eglandular ..... 1.7 ***E. paniculatus***
- Petioles cylindrical; inflorescence rachis cylindrical or subcylindrical, not winged; bracts apex acute; achenes with ≥ 2 glands ... **8**
8. Plants with a layer of bluish wax covering the branches; bracts deltoid; flowers 5–5.3 cm diam., petals erect, 19–35 stamens; achenes with beak lateral ..... 1.3. ***E. glaucus***
- Plants without a layer of bluish wax covering the branches; bracts lanceolate; flowers 1.2–1.6 cm diam., petals reflexed, 12–16 stamens; achenes with apical beak ..... 1.8. ***E. scaber***

1.1 *Echinodorus cordifolius* (L.) Grisebach (1857: 257) ≡ *Alisma cordifolium* Linnaeus (1753: 343). **Lectotype:**—Illustration in Morison, *Plantarum Historia Universalis* 3: t. 4, fig. 6 (1699), designated by Haynes & Holm-Nielsen (1986: 329). Figs. 5A; 8A–F.

Aquatic herbs, emergent, 30–95 cm tall, glabrous, branches surface without a bluish wax layer. **Rhizome** to 2 cm in diameter. **Roots** aseptate. **Leaves** 5–18.9 cm long; **petioles** 1.6–17.3 × 0.2–0.5 cm, cylindrical, surface ridged; basal sheath 2–5 cm long, glabrous; **leaf blades** 1.4–11.2 × 1.8–7.5 cm, ovate, base cordate, apex rounded, margin entire; venation pattern acrodromous, 3–8 veins, impressed on the adaxial surface, slightly prominent on the abaxial surface; basal lobes present with rounded apex, 0.5–1.7 × 1–4.4 cm, 2–3 veins; pellucid marks present forming lines. **Inflorescence** racemose, decumbent; **peduncle** 18.4–62 cm long, cylindrical; rachis 20–38 cm long, triangular, composed of 6–8 whorls, each with 3–5 flowers, internodes between whorls 9–18 cm long; vegetative propagation present; **bracts** 0.7–1.5 × 0.2–0.7 cm, lanceolate, apex acute, 15–23 veins, shorter than pedicels, free at base. **Flowers** 2–2.4 cm in diameter, long-pedicellate; pedicels 51.55–95 mm long, erect in anthesis and in fruit; **sepals** 0.3–0.5 × 0.2–0.4 cm, ovate, apex rounded, 15–27 veins, glabrous, reflexed in anthesis and in fruit; **petals** 1.5–1.8 × 0.9–1.2 cm, erect, ovate, apex rounded; stamens 17–32, anthers 1.3 × 0.3 mm, apex obtuse, filaments ca. 2 mm long; carpels ca. 0.7 × 0.2 mm. **Achenes** 1.8–2 × 0.4–0.9 mm, obovate, cylindrical in cross section, not winged; 5–7 ribs, 1–3 elliptic glands between the ribs, the glands ca. 0.3 mm long; beak apical, ca. 0.3 mm long. **Seeds** ca. 1 mm long, testa foveolate, dark brown.

Distribution and Habitat:—*Echinodorus cordifolius* is distributed across Brazil, Colombia, Cuba, the United States, Haiti, the Dominican Republic, and Venezuela (POWO 2025). In Brazil, it has been recorded in the Central-West (Mato Grosso do Sul) and South (Paraná, Santa Catarina) regions, occurring within the Atlantic Forest and Pantanal phytogeographic domains (Matias & Pestana 2025). In the Pantanal, occurrences of *E. cordifolius* have been reported in Nabileque, Poconé, and Paraguai sub-regions (Fig. 3A). The species predominantly grows in temporary lagoons, at depths of 10–15 cm, and is associated with calcimorphic clay soils.

Phenology:—The species was recorded with flowers and fruits from February to July.

Etymology:—The epithet *cordifolius* derives from the Latin that means leaves that resembles a heart in shape (*cordis* means heart and *folium* means leaf).

Vernacular Names:—Chapéu-de-couro (Portuguese), Creeping Burhead.

Notes:—*Echinodorus cordifolius* can be distinguished from other *Echinodorus* species occurring in the Pantanal by its ovate leaf blades, long decumbent inflorescence, and flowers with long pedicels reaching up to 95 mm in length (Fig. 8A, D). These features also differentiate *E. cordifolius* from other species in the genus that exhibit pellucid lines in leaf blade. Additional diagnostic features of this species are the oblanceolate achenes with multiple ribs and, frequently, three elliptical glands (Fig. 5A).

Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Corumbá, Albuquerque, 21 May 1988, *V.J. Pott et al. 538* (CGMS, CPAP); km 723 BR-262, 24 May 1989, *A. Pott et al. 4867* (CGMS, CPAP, MBM); 5.6 km oeste da BR-262 na estrada para estação ferroviária Albuquerque, 28 February 1993, *V.J. Pott et al. 1851* (CPAP); Albuquerque, 21 July 2014, *C.P. Bove et al. 2400* (R). Ladário, Assentamento 72, 24 February 2012, *P.P. Oliveira et al. 70* (COR). Porto Murtinho, Rio Apa, 59 km da BR-267, 22 June 2005, *V.J. Pott & A. Pott 7794* (CGMS).

1.2 *Echinodorus floribundus* (Seub.) Seubert in Warming (1872: 113) ≡ *Alisma floribundum* Seub. in Martius (1847: 110). **Type:**—BRAZIL. Ceará: s.l., 18 August 1838, *Gardner 1860* (lectotype: NY [NY00311400!], designated by Haynes & Holm-Nielsen 1994: 48); isolectotypes: BM [BM000629754!, BM000629755!, BM000629756!], G [G00098003!, G00098004!], K [K000098930!, K000098934!], NY [NY00311398!, NY00311399!]). Figs. 4A–D; 5B; 7A; 8G–H.

Aquatic herbs, emergent, 140–300 cm tall, stellate-pubescent, the trichomes to 3 mm long, hyaline; branches surface without a bluish wax layer. **Rhizome** 3 cm in diameter. **Roots** aseptate. **Leaves** 46.3–94.8 cm long; **petioles** 22.6–58.2 × 0.5–1 cm, cylindrical, surface ridged, densely stellate-pubescent, the trichomes concentrated at the proximal ends; basal sheath 8.4–13.8 cm long, sparsely stellate-pubescent; **leaf blades** 15.3–28.8 × 15.7–26.9 cm, ovate, base cordate, apex obtuse, margin entire, sparsely stellate-pubescent on the abaxial surface, the trichomes concentrated along the primary and secondary veins; venation pattern campylodromous, 10–20 veins, impressed on the adaxial surface, strongly prominent on the abaxial surface, elevated; basal lobes present, with rounded apex, 2.6–3.9 × 5.5–9 cm, 3–5 veins; pellucid marks present forming small dots. **Inflorescence** paniculate, erect, 2–3 lateral branches; **peduncle** 67.2–100 cm long, cylindrical, ridged, densely stellate-pubescent; rachis 30–40 cm long, triangular, not winged, composed

of 10–12 whorls, each with 8–20 flowers, internodes between whorls 3.4–5.5 cm long; vegetative propagation rare; **bracts** 0.8–2.8 × 0.3–0.4 cm, lanceolate, apex acute or caudate, 8–20 veins, shorter or sometimes longer than pedicels, free at base. **Flowers** 3–3.4 cm in diameter, short-pedicellate; pedicels 8.7–11.6 mm long, pubescent, erect in anthesis and in fruit; **sepals** 0.4–0.6 × 0.3–0.4 cm, ovate, apex rounded or acute, 12–33 veins, with rigid trichomes on the veins, reflexed in anthesis and in fruit; **petals** 1.8–2 × 0.7–0.9 cm, erect, ovate, apex rounded; stamens 22–25, anthers 2 × 0.8 mm, apex obtuse, filaments ca. 2.8 mm long; carpels ca. 0.8 × 0.2 mm. **Achenes** 1.6–2 × 0.5–1 mm, oblanceolate, cylindrical in cross section, not winged; 2–4 ribs, 2–3 elliptic glands between the ribs, the glands ca. 0.7 mm long; beak apical, ca. 0.2 mm long. **Seeds** ca. 1.4 mm long, testa foveolate, dark brown.

Distribution and Habitat:—*Echinodorus floribundus* occurs in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela (POWO 2025). In Brazil, the species occurs in North (Acre), Northeast (Ceará, Maranhão, Paraíba, Pernambuco), Central-West (Goiás, Mato Grosso, Mato Grosso do Sul), Southeast (Minas Gerais, Rio de Janeiro, São Paulo), and South (Paraná, Santa Catarina) regions, and is present across all Brazilian phytogeographic domains (Matias & Pestana 2025). In the Pantanal, *E. floribundus* occurs in the sub-regions of Barão de Melgaço, Cáceres, Nhecolândia, and Poconé (Fig. 3A), growing along the margins of rivers and bays, associated with sandy soils enriched with organic matter.

Phenology:—It was recorded with flowers and fruits from April to November.

Etymology:—The epithet *floribundus* derives from the Latin *florum* (flower) and *abundus* (abundant), meaning "abundant in flowers", in reference to the large number of flowers commonly produced per floral whorl.

Vernacular Name:—Chapéu-de-couro.

Notes:—*Echinodorus floribundus* can be distinguished from other species of the genus occurring in the Pantanal by its typically large size in well-developed individuals, along with ovate leaf blades bearing pellucid marks in the form of small spherical dots (Fig. 7A). Other diagnostic features are the presence of hyaline stellate trichomes (≥ 3 mm long; Fig. 8G), typically concentrated on the abaxial surface of the leaf blade and the distal portion of the petiole, a high number of flowers per whorl (6–20), and numerous primary veins in the leaf blade (10–20).

Specimens Examined:—BRAZIL. **Mato Grosso:** Cáceres, Estação Ecológica Taimã, 19 September 1980, *C.J. Silva 207* (UFMT); *ibid.*, 19 November 1980, *C.J. Silva 208* (UFMT); *ibid*., 29 October 1983, *C.J. Silva s.n.* (UFMT4575); *ibid*., 12 November 2013, *G.A. Damasceno-Junior et al. 5294* (CGMS); Sesc Pantanal-Porto Cercado, 22 April 2013, *I.G.C. Bieski & S.I.G. Rosa s.n.* (UFMT40740). Poconé, km 136 da Rodovia Transpantaneira Poconé-Porto Jofre, 26 June 1992, *A.L. Prado et al. 5354* (UFMT). **Mato Grosso do Sul:** Corumbá, Porto Rolon, margem do Rio Taquari, 13 September 2002, *V.J. Pott & A. Pott 5777* (CGMS, CPAP, CEN). Rio Verde de Mato Grosso, 13 October 1993, *A. Pott et al. 6517* (CPAP).

Additional Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Alcinópolis, Lagoa associada a Vereda com buriti, 3 Km da sede da Fazenda Harmonia, 20 October 2017, *L.S. Savala et al. 37* (CGMS). Jateí, Curupaí District, crossing of the road and a tributary of Córrego Curipaí, 10 October 2024, *M.C.A. Pestana et al. 214* (DDMS, TUR). Fátima do Sul, 3 December 2013, *M.C. Vieira et al. 206* (DDMS).

1.3 *Echinodorus glaucus* Rataj (1975: 69). **Type:**—BRAZIL. **Mato Grosso:** Cuiabá, Coxipó da Ponte, March 1911, *F. C. Hoehne 4599* (holotype: R [R000004447!]). Figs. 4E–I; 5C; 8I–J.

Aquatic herbs, emergent, 70–250 cm tall, glabrous, branches surface with a bluish wax layer. **Rhizome** to 3.3 cm in diameter. **Roots** aseptate. **Leaves** 15.7–117.5 cm long; **petioles** 4.5–47.5 × 0.4–1.5 cm, completely cylindrical, surface smooth, covered with a bluish wax layer; basal sheath 3.7–28 cm long, glabrous, with the edge reddish *in vivo*; **leaf blades** 7.5–42 × 0.5–16.5 cm, lanceolate or ovate, base cordate or rounded, apex rounded or acute, margin entire, densely covered with a bluish wax layer; venation pattern acrodromous or campylodromous, 3–11 veins, impressed on the adaxial surface, prominent on the abaxial surface, elevated in ovate blades; basal lobes present in ovate blades with rounded apex, 2.5–4.4 × 3.8–5.9 cm, 3–5 veins; pellucid marks absent. **Inflorescence** frequently paniculate, rarely racemose, erect, 1–3 erect lateral branches; **peduncle** 18–81.6 cm long, cylindrical; rachis 7–64.5 cm long, cylindrical, composed of 9–11 whorls, each with 4–8 flowers, internodes between whorls 3.2–11.8 cm long; vegetative propagation absent; **bracts** 0.3–0.8 × 0.3–0.6 cm, deltoid, apex acute, 28–37 veins, shorter than pedicels, free at base. **Flowers** 5–5.3 cm in diameter, short- or long-pedicellate; pedicels 4.9–13.2 mm long, erect in anthesis, erect or spreading in fruit; **sepals** 0.4–0.7 × 0.4–0.6 cm, ovate, apex rounded, 30–37 veins, glabrous, reflexed in anthesis and in fruit; **petals** 1.7–2.2 × 0.9–1.1 cm, erect, ovate, apex retuse; stamens 19–35, anthers 1.7 × 0.5 mm, apex obtuse, filaments ca. 2.5 mm long; carpels ca. 1.2 × 0.3 mm. **Achenes** 2.4–2.9 × 0.6–1 mm, oblanceolate or falcate, both cylindrical in cross

section, not winged; 4–5 ribs, 2–4 elliptic glands between the ribs, the glands ca. 0.5 mm long; beak lateral, ca. 0.9 mm long. **Seeds** ca. 1.2 mm long, testa foveolate, longitudinally ribbed, dark brown.

Distribution and Habitat:—*Echinodorus glaucus* occurs only in Bolivia and Brazil (POWO 2025). In Brazil, it is recorded in the North (Roraima) and Central-West (Mato Grosso, Mato Grosso do Sul) regions, occurring exclusively in the Amazon Forest and Pantanal (Matias & Pestana 2025). *Echinodorus glaucus* is one of the most widely distributed species in the Pantanal, occurring throughout all sub-regions of Mato Grosso and in nearly all sub-regions of Mato Grosso do Sul, except Porto Murtinho (Fig. 3A). The species grows in a variety of aquatic and palustrine environments, including the edges of floodplain channels, riverbanks within forest fragments (*capões*), riparian forest, river branches, seasonally flooded grasslands, and lagoons; associated with waterlogged clayey soils.

Phenology:—It was collected with flowers and fruits throughout the year.

Etymology:—The epithet *glaucus* derives from the Latin and means bluish or grayish in reference to the bluish waxy layer that covers throughout the plant.

Vernacular Name:—Chapéu-de-couro.

Notes:—*Echinodorus glaucus* is characterized by its cylindrical petioles and floral peduncles, a leaf sheath with a reddish margin *in vivo*, large flowers (≥ 5 cm in diameter), and the bluish waxy coating that covers throughout the plant, a mostly notably distinctive feature (e.g. Fig. 4G, H). Additionally, seeds with a longitudinal keel were observed, a pattern previously unrecorded for species of Alismataceae. More investigation must be performed to elucidate longitudinal keel is related to populations from the Pantanal. In natural conditions, the bluish wax in *E. glaucus* is abundantly concentrated on the leaf blade and along the petiole, with minimal presence on the floral peduncle. Although the wax is poorly preserved after the herbarium preparation process, the blades often turn whitish or pale when dry (*in sicco*), accompanied by visible ducts under a stereoscopic microscope, possibly responsible for the wax secretion. These features can also be used for field and herbarium identification of the taxon.

Echinodorus glaucus exhibits significant phenotypic plasticity in the Pantanal, particularly concerning leaf blade morphology and inflorescence architecture (Fig. 4H, I). Robust specimens typically have large ovate leaf blades with a cordate base and a paniculated inflorescence, with two to three erect lateral branches (Fig. 4E). In contrast, lanceolate leaves with an attenuated base (Fig. 4I) and inflorescence racemose or, when paniculate, branching only at the first whorl (e.g. *A. Pott* 5757) are assigned to smaller specimens. Robust morphotype have been identified as *E. glaucus* in the analyzed herbaria while smaller morphotype were frequently mistaken with *Echinodorus cylindricus* (Rataj 1975: 66).

This morphological interpretation is supported by fieldwork observation in which specimens with lanceolate leaves and typical paniculate inflorescences (assigned as smaller morphotype) were recorded coexisting with specimens of ovate leaves with a cordate base (assigned as robust morphotype) but with racemose inflorescences (e.g. *M.C.A. Pestana 186*, *194*, *195*). Furthermore, during fieldwork individuals of *E. glaucus* with lanceolate leaves and distinctly paniculate inflorescences (with two or more lateral branches) were observed coexisting with individuals bearing ovate leaves with a cordate base and racemose inflorescences (*M.C.A. Pestana 186*, *194*, *195*).

Notably, Rataj (2004) treated *Echinodorus cylindricus* as a synonym of *E. glaucus*, a view supported by the morphological observations presented in this study. Although Lehtonen (2008) did not adopt Rataj's synonymization at the time, some specimens from the Pantanal that he referred to as *E. cylindricus* (e.g. *A. Pott 2147*, *Pott et al. 406*) correspond to *E. glaucus* after our analysis of these samples. Given this pronounced plasticity and the consistent overlap in diagnostic features, we agree with Rataj (2004) in treating both names as conspecific, with *E. glaucus* accepted as the correct name in accordance with priority (Art. 11.5 of the ICN; Turland *et al*. 2025).

Selected Specimens:—BRAZIL. **Mato Grosso**: Barão de Melgaço, RPPN Sesc Pantanal, 2 February 2002, *R.R.B. Negrelle s.n.* (UPCB50051); *ibid*., 22 January 2005, *G.A. Lima-Júnior & E.C. Arruda 553* (UFMT); *ibid*., 19 November 2005, *V.J. Pott & A. Pott 8387* (CGMS, CPAP). Cáceres, Fazenda Campo Belo, 16 November 2005, *V.J. Pott & A. Pott 8357* (CGMS, CPAP); Rio Paraguai, próximo à Ilha Taiamã, 31 July 2008, *V.J. Pott & A. Pott 10350* (CGMS). Poconé, 7–12 km sudoeste do rio Cassangé, na estrada para Porto Jofre, 25 October 1985, *W.W. Thomas 4557* (INPA); Transpantaneira, 16 August 1996, *A. Pott et al. 7874* (CPAP); *ibid*., 16 August 1996, *A. Pott et al. 7876* (CPAP); *ibid*., 1 November 2016, *F.H. Barbosa da Silva 262* (UFMT); Pirizal, próximo à fazenda Nossa Senhora Aparecida, 1 November 2016, *F.H. Barbosa da Silva 236* (UFMT). Santo Antônio do Leverger, Alagado norte da Baía de Chacororé, MT-040, Mimoso, 18 November 2005, *V.J. Pott & A. Pott 8377* (CGMS). **Mato Grosso do Sul**: Aquidauana, Fazenda Fazendinha (brejo), 6 February 1991, *A. Pott et al. 5843* (CGMS, CPAP); Fazenda Santana, 5 February 2006, *V.J. Pott & A. Pott 8618* (CGMS); *ibid*., 5 February 2006, *V.J. Pott & A. Pott 8630* (CGMS). Corumbá, Fazenda Acurizal, 29 September 1987, *A. Pott et al. 3528* (CGMS, CPAP); Rio Paraguai, entre Parque Nacional do Pantanal e fazenda Acurizal, 24 March 2001, *A. Pott et al. 8699* (CGMS, CPAP); Passo do Lontra, caminho para a

torre, 24 October 2008, *M.G. Caxambú 2314* (HCF); Paraguai-Mirim, Paiaguás, 24 September 2024, *M.C.A. Pestana et al. 175* (DDMS, TUR); Fazenda Santa Tereza, 27 September 2024; *ibid*., *M.C.A. Pestana et al. 186* (DDMS, TUR), *M.C.A. Pestana et al. 194* (DDMS, TUR), *M.C.A. Pestana et al. 195* (DDMS, TUR), *M.C.A. Pestana et al. 196* (DDMS, TUR), *M.C.A. Pestana et al. 197* (DDMS, TUR), *M.C.A. Pestana et al. 198* (DDMS, TUR), *M.C.A. Pestana et al. 201* (DDMS, TUR), *M.C.A. Pestana et al. 202* (DDMS, TUR), *M.C.A. Pestana et al. 203* (DDMS, TUR), *M.C.A. Pestana et al. 204* (DDMS, TUR). Miranda, Estância Caiman, 10 April 1998, *V.J. Pott et al. 3339* (CPAP).

1.4 *Echinodorus grisebachii* Small (1909: 46). **Type:**—CUBA. s.l., s.d., *Wright 3198* (lectotype: US [US00086701!], designated by Rataj 1967: 615); isolectotypes: BM [BM000578835!], G [G00098006!, G00488746!], GH [00026760!], K [000098921!], NY [NY00071028!, NY00071029!], P [P00541985!], S [S-R-1819!], GOET [GOET000070!]). Figs. 4J; 5D; 7D.

Aquatic herbs, emergent, 15–40 cm tall, glabrous, branches surface without a bluish wax layer. **Rhizome** to 1 cm in diameter. **Roots** aseptate. **Leaves** 3.9–32 cm long; **petioles** 1.5–25 × 0.1–0.4 cm, triangular, not winged; basal sheath 0.9–2.8 cm long, glabrous; **leaf blades** 1.5–4.2 × 1.3–4 cm, elliptic, base attenuate, apex acute or mucronate-apiculate, margin entire; venation pattern acrodromous, 3–4 veins, slightly prominent on both surfaces, basal lobes absent; pellucid marks present forming long and narrow lines. **Inflorescence** racemose, erect; **peduncle** 5.2–30 cm long, triangular, not winged; rachis 6.8–8 cm long, triangular, slightly winged, composed of 4–7 whorls, each with 3–5 flowers, internodes between whorls 2–4.8 cm long; vegetative propagation absent; **bracts** 0.4–2.5 × 0.3–1.4 cm, lanceolate, apex acuminate, 9–11 veins, shorter than pedicels, slightly connate at base. **Flowers** 0.8–1 cm in diameter, short-pedicellate; pedicels 5.8–8 mm long; **sepals** 0.2–0.7 × 0.1–0.3 cm, ovate, apex rounded, 8–12 veins, glabrous, erect in anthesis, reflexed in fruit; **petals** 0.3–0.5 × 0.2–0.3 cm, erect, obovate, apex rounded; stamens 6–12, anthers 2.8 × 0.4 mm, apex obtuse, filaments ca. 3 mm long; carpels ca. 2 × 0.6 mm. **Achenes** 1.6–1.8 × 0.7–0.8 mm, obovate, cylindrical in cross section, not winged; 4–5 ribs, 4–6 elliptic or globose glands between the ribs, the glands ca. 0.7 mm long; beak apical, ca. 0.2 mm long. **Seeds** ca. 0.9 mm long, testa tenuous-foveolate, light brown.

Distribution and Habitat:—*Echinodorus grisebachii* occurs in Bolivia, Brazil, Costa Rica, Cuba, Ecuador, French Guiana, Honduras, Nicaragua, Peru, Suriname, and Venezuela (POWO 2025). In Brazil, its presence has been confirmed in the North (Amazonas, Amapá, Pará, Rondônia, Roraima), Central-West (Goiás, Mato Grosso, Mato Grosso do Sul), and South (Paraná) regions, occurring in the Amazon Forest, Atlantic Forest, Cerrado (Matias & Pestana 2025), and Pantanal. In the Pantanal, *E. grisebachii* is restricted to the Poconé sub-region, with only two known specimens, both collected near Porto Jofre in Poconé (Fig. 3A), and grows in seasonally flooded grasslands with silty-clayey soils.

Phenology:—The species was recorded with flowers and fruits in October.

Etymology:—The epithet *grisebachii* honors Heinrich Rudolf August Grisebach (1814–1879), who contributed significantly to the understanding of the genus *Echinodorus*.

Vernacular Names:—Espada-da-Amazônia (Portuguese), Amazon sword.

Notes:—*Echinodorus grisebachii* is characterized by its small flowers (up to 1 cm in diameter) with 6–9 stamens and obovate, multiglandular achenes (4–6 glands), bearing elliptical or often globose reddish glands (Fig. 5D). This species is poorly documented in the Pantanal, and is known from a few collections made in 1989 in the northern portion of the domain. It is currently treated as a single species with highly polymorphic morphology (Lehtonen 2008). However, Rataj (1975, 2004) recognized several taxa now considered synonyms of *E. grisebachii* as distinct species. Similarly, Lehtonen & Falck (2011) likewise suggested that *E. grisebachii* may represent a species complex, but emphasized that available molecular data remain limited in both sampling and geographic coverage (see also Lehtonen 2008).

Specimens Examined:—BRAZIL. **Mato Grosso:** Poconé, Fazenda Porto Jofre—sede, sub-região de Poconé, Pantanal—rio São Lourenço/Cuiabá, 14 October 1989, *A. Pott 5255* (CGMS, CPAP, MBM).

Additional Specimens Examined:—BRAZIL. **Amapá:** Mâncio Lima, nas cercanias da ARIE Japiim-Pentecoste, 7 August 2024, *M. Figueira et al. 2126* (UFACPZ). **Goiás:** Cavalcante, Margem esquerda do rio Preto, 26 June 2001, *G. Pereira-Silva 5163* (CEN). **Mato Grosso do Sul:** Três Lagoas, 23 May 1964, *Gomes-Jr. 1817* (CPAP).

1.5 *Echinodorus longipetalus* Micheli in De Candolle & De Candolle (1881: 60). **Type:**—PARAGUAY. Cordillera de Peribebuy: Patiño Cué, 28 February 1875, *Balansa 570* (lectotype: K [K000098939!], designated by Rataj 1969: 332); isolectotypes: G [G00488759!], K [K000098938!]). Figs. 4K–M; 5E; 7B; 8K–M).

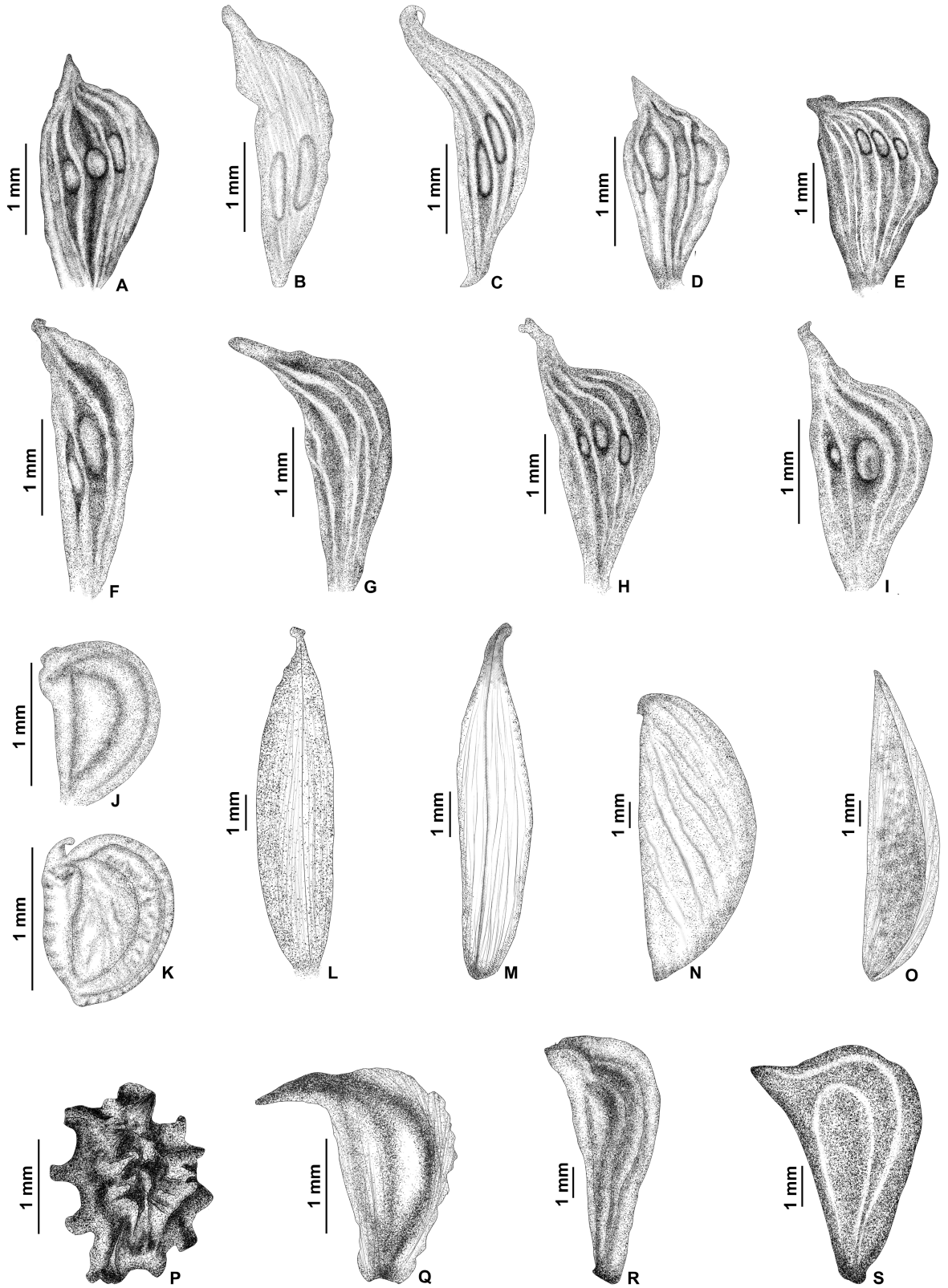

FIGURE 5. Fruits of Alismataceae species occurring in the Brazilian Pantanal. **A–I:** Achenes in *Echinodorus*. **A:** *E. cordifolius* (drawn from *A. Pott 4867*). **B:** *E. floribundus* (*V.J. Pott 5777* & *A. Pott*). **C:** *E. glaucus* (*M.C.A. Pestana et al. 175*). **D:** *E. grisebachii* (*A. Pott 5255*). **E:** *E. longipetalus* (*V.J. Pott 2416*). **F:** *E. longiscapus* (*V.J. Pott 5794*). **G:** *E. paniculatus* (*M.C.A. Pestana et al. 171*). **H:** *E. scaber* (*M.C.A. Pestana et al. 173*). **I:** *E. subalatus* (*V.J. Pott 1733*). **J–K:** Achenes in *Helanthium*. **J:** *H. bolivianum* (*V.J. Pott 3943*). **K:** *H. tenellum* (*M.C.A. Pestana et al. 139*). **L–M:** Follicle in *Hydrocleys*. **L:** *H. nymphoides* (*M.C.A. Pestana et al. 156*). **M:** *Hydrocleys parviflora* (*V.C. Soares et al. 29*). **N–O**: Follicle in *Limnocharis*. **N**: *L. flava* (*V.J. Pott et al. 4491*). **O**: *L. laforesti* (*M.C.A. Pestana et al. 145*). **P–S**: Achenes in *Sagittaria*. **P**: *S. guayanensis* (*M.C.A. Pestana et al. 146*). **Q**: *S. montevidensis* (*M.C.A. Pestana et al. 149*). **R**: *S. planitiana* (*M.C.A. Pestana et al. 182*). **S**: *S. rhombifolia* (*M.C.A. Pestana et al. 192*). Illustrator: R.S. Soares.

Aquatic herbs, emergent, 75–250 cm tall, glabrous, branches surface without a bluish wax layer. **Rhizome** to 3 cm in diameter. **Roots** septate. **Leaves** 71.3–137.2 cm long; **petioles** 43.6–73.2 × 0.7–0.8 cm, cylindrical from the base to the middle, becoming triangular towards the apex; basal sheath 13.5–30 cm long, glabrous; **leaf blades** 14.2–34 × 2.8–7.6 cm, lanceolate, base attenuate, apex acute, margin entire; venation pattern acrodromous, 3–5 veins, slightly prominent on both surfaces, basal lobes absent; pellucid marks present forming a reticulate network. **Inflorescence** racemose, erect; **peduncle** 60–108.2 cm long, cylindrical; rachis 60.8–77.5 cm long, triangular, not winged, composed of 7–13 whorls, each with 5–15 flowers, internodes between whorls 4.4–12 cm long; vegetative propagation rare; **bracts** 0.7–2.2 × 0.2–0.7 cm, lanceolate, apex acuminate, 11–14 veins, shorter or sometimes equal in length to the pedicels, slightly connate at base. **Flowers** 5.3–5.8 cm in diameter, long-pedicellate; pedicels 12–20 mm long, erect in anthesis, descending in fruit; **sepals** 1.2–1.5 × 0.8–1 cm, elliptic, apex rounded, 29–35 veins, glabrous, reflexed in anthesis, adpressed in fruit (completely surrounding the fruit aggregate); **petals** 2.7–3.5 × 2–3.1 cm, erect, ovate, apex rounded; stamens 35–48, anthers 2.3 × 1 mm, apex acuminate, filaments ca. 2.5 mm long; carpels ca. 2 × 0.6 mm. **Achenes** 2.4–2.8 × 1.6–1.8 mm, obovate, flattened in cross section, winged dorsally and ventrally, the wings 2.5 × 0.2 mm; 4–7 ribs, 2–5 elliptic glands between the ribs, the glands ca. 0.2 mm long; beak lateral or horizontal, ca. 0.4(–0.8) mm long. **Seeds** ca. 1.5 mm long, testa tenuous-reticulate, light brown.

Distribution and Habitat:—*Echinodorus longipetalus* is a neotropical species that occur in Argentina, Brazil, Paraguay, Suriname, and Venezuela (POWO 2025). In Brazil, it has been recorded in the North (Tocantins), Northeast (Bahia), Central-West (Distrito Federal, Goiás, Mato Grosso do Sul, Mato Grosso), Southeast (Minas Gerais, São Paulo), and South (Paraná, Santa Catarina) regions, occurring within the Atlantic Forest, Cerrado, and Pantanal (Matias & Pestana 2025) phytogeographic domains. In the Pantanal, *E. longipetalus* is restricted to the Paraguai, and Paiaguás sub-regions (Fig. 3B). The species grows in seasonally flooded grasslands, oxbow lakes, temporary lagoons, and particularly along the margins of seasonally flooded forest fragments. It is associated with sandy soils and waterlogged organic soils.

Phenology:—Flowers and fruits were recorded from February to November.

Etymology:—The epithet *longipetalus* is derived from the Latin in reference to the notably elongated petals (*longus* means long and *petalum* means petal).

Vernacular Name:—Chapéu-de-couro.

Notes:—*Echinodorus longipetalus* is distinguished by its long and lanceolate leaf blades (14.2–34 cm) with 3–5 slightly prominent primary veins on both surfaces (Fig. 4M), large flowers with numerous stamens (35–48), and long sepals (up to 1.5 cm), which fully enclose the fruiting aggregate. The species can be distinguished from other members of the genus in the Pantanal by pellucid marks forming a reticulate network on the leaf blade (Fig. 7B) and by its flattened, slightly winged achenes with 2–5 elliptical glands (Fig. 5E).

Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Corumbá, Estrada na Fazenda Aldeia, margem direita do rio Taquari, sub-região do Paiaguás, Pantanal, 14 November 1994, *V.J. Pott et al. 2416* (CPAP, CGMS, MO); *ibid*., 21 May 2013, *S.N. Moreira et al. 1565* (BHCB). Coxim, Fazenda Aldeia, 67 km W de Coxim, próximo ao rio Taquari, sub-região do Paiaguás, Pantanal, 25 February 1996, *V.J. Pott et al. 2958* (CGMS, CPAP).

Additional Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Naviraí, Parque Estadual das Várzeas do Rio Ivinhema, 10 October 2024, *M.C.A. Pestana et al. 219* (DDMS, TUR). Nova Andradina, Road 376 between Pôrto Cristalino and Nova Andradina, 11 October 2024, *M.C.A. Pestana et al. 221* (DDMS, TUR), *M.C.A. Pestana et al. 223* (DDMS, TUR).

1.6 *Echinodorus longiscapus* Arechavaleta (1903: 67). **Type:**—URUGUAY. Tacuarembó: Arroyo Cardoso, s.d., *Arechavaleta 4239* (lectotype: MVM!, designated by Lehtonen 2008: 553). Figs. 5F; 6A–D; 7C; 8N–O.

Aquatic herbs, emergent or amphibious of marshy habitats, 20–100 cm tall, stellate-pubescent, the trichomes less than 1 mm long, yellowish; branches surface without a bluish wax layer. **Rhizome** to 3.2 cm in diameter. **Roots** aseptate. **Leaves** 15.8–87.5 cm long; **petioles** 6–47.1 × 0.2–0.8 cm, cylindrical, surface ridged, pubescent; basal sheath 4–15 cm long, glabrous; **leaf blades** 5.8–25.4 × 3.9–11.8 cm, ovate, base cordate or truncate in young plants, apex obtuse, margin entire, sparsely stellate-pubescent on the abaxial surface; venation pattern campylodromous, 6–11 veins, impressed on the adaxial surface, strongly prominent on the abaxial surface, elevated; basal lobes present, with rounded or obtuse apex, 2.2–5 × 1.5–2 cm, 2–3 veins; pellucid marks present forming dots and short lines. **Inflorescence** racemose, erect; **peduncle** 16–40 cm long, cylindrical, sparsely stellate-pubescent; rachis 6.1–60 cm long, triangular, not winged, composed of 4–11 whorls, each with 2–18 flowers, internodes between whorls 5.7–12.6 cm long; vegetative propagation absent; **bracts** 0.7–1.6 × 0.3–0.8 cm, lanceolate, apex acuminate, 11–21 veins, shorter

or slightly longer than pedicels, free at base. **Flowers** 3.1–3.6 cm in diameter, long-pedicellate; pedicels 5–27.6 mm long, glabrous, erect in anthesis, descending in fruit; **sepals** 0.4–0.8 × 0.4–0.5 cm, ovate, apex rounded, 17–26 veins, glabrous, reflexed in anthesis and in fruit; **petals** 1.5–2.1 × 1–2 cm, erect, ovate, apex rounded; stamens 20–26, anthers 1.4 × 0.3 mm, apex obtuse, filaments ca. 1.8 mm long; carpels ca. 1.4 × 0.3 mm. **Achenes** 1–2.7 × 0.6–1.8 mm, obovate or oblanceolate, cylindrical in cross section, not winged; 3–4 ribs, 2–4 elliptic glands between the ribs, the glands ca. 0.3 mm long; beak apical, lateral, ca. 0.5(–1) mm long. **Seeds** ca. 1.2 mm long, testa reticulate, pale yellow.

Distribution and Habitat:—*Echinodorus longiscapus* is native to southern South America and occurs in Argentina, Brazil, Paraguay, and Uruguay (POWO 2025). In Brazil, it has been recorded in the Northeast (Bahia, Pernambuco), Central-West (Mato Grosso do Sul, Mato Grosso), Southeast (Rio de Janeiro, São Paulo), and South (Paraná, Rio Grande do Sul, Santa Catarina) regions, occurring in the Atlantic Forest, Caatinga, Cerrado, Pampa, and Pantanal phytogeographic domains (Matias & Pestana 2025). This study reports a new occurrence for the state of Mato Grosso. In the Pantanal, *E. longiscapus* is present in nearly all sub-regions, except Aquidauana and Barão de Melgaço (Fig. 3B). The species grows along the margins of temporary lagoons, flooded grasslands, and *vazantes*, typically associated with sandy-silty soils.

Phenology:—It was recorded with flowers and fruits from January to December.

Etymology:—The epithet *longiscapus* is derived from the Latin and means elongated inflorescence peduncle (*longus* means long and *scapus* means scape or peduncle).

Vernacular Name:—Chapéu-de-couro.

Notes:—*Echinodorus longiscapus* is distinguished by its ovate leaf blades with pellucid marks arranged as dots and lines (Fig. 7C), and by its long racemose inflorescence, reaching up to 100 cm in height, with a rachis significantly longer than the petioles. In the Pantanal, specimens of this species have often been previously identified as *E. grandiflorus* (Chamisso & Schlechtendal 1827: 152) Micheli in De Candolle & De Candolle (1881: 57) in local studies (e.g. Pott & Pott 1997, 2000, 2021, Guimarães 1999) and in herbarium records, by the presence of pellucid marks in the form of dots and lines on the leaf blades, a feature shared exclusively by *E. longiscapus* and *E. grandiflorus* within the genus.

The species can be distinguished by the racemose inflorescence (Fig. 6A) reaching up to 100 cm long in *E. longiscapus* (*vs*. paniculate with up to three horizontal branches and over 100 cm long in *E. grandiflorus*). Additionally, in Uruguay, where both species co-occur, *E. longiscapus* consistently exhibits a smaller stature, strictly unbranched inflorescences, and an earlier flowering period (S. Lehtonen pers. obs.). Thus, the distinguishing characteristics described here are reliable and useful for identifying Pantanal specimens as *E. longiscapus*.

Selected Specimens:—BRAZIL. **Mato Grosso:** Poconé, Fazenda Nova Berlim com Transpantaneira Km 85, 12 December 1991, *M. Schessl 2783* (UFMT); *ibid*., Km 85, Transpantaneira, 16 September 1992, *M. Schessl 2790* (UFMT); Transpantaneira Km 120, Pantanal, 3 October 1992, *M. Schessl s.n.* (UFMT 127). **Mato Grosso do Sul:** Corumbá, Fazenda Acurizal, 15 December 1986, *C.N. Cunha et al. 2150* (CPAP); *ibid*., 3 September 1987, *A. Pott et al. 3335* (CGMS, CPAP), *A. Pott et al. 3345* (CGMS, CPAP); *ibid*., 20 October 1987, *V.J. Pott et al. 385* (CPAP); *ibid*., 21 October 1987, *V.J. Pott 2115* (CPAP); Fazenda Sagrado, sub-região do Abobral, Pantanal, 15 September 1989, *A. Pott et al. 4952* (CPAP); Fazenda Campo Alegre, direção Mata do Fuzil próximo à vazante Atolador, 14 September 2002, *V.J. Pott et al. 5794* (CPAP, CGMS, CEN); Fazenda São Bento, 10 December 2009, *A.T. Carvalho 101* (BHCB, JPB); *ibid*., 28 June 2011, *V.C. Soares et al. 26* (CGMS); *ibid*., 12 July 2011, *V.J. Pott & P.R. Souza 11297* (CGMS); *ibid*., 12 November 2011, *F. Bao et al. 66* (CGMS); Fazenda São Bento, 16 October 2011, *A. Pott et al. 16252* (CGMS); Fazenda São Miguel, estrada de acesso à sede, 11 March 2012, *G.A. Damasceno-Junior et al. 5208* (CGMS); *ibid*., 15 March 2013, *E.B. Souza 183* (CGMS); *ibid*., 6 October 2013, *E.B. Souza 235* (CGMS); Fazenda São José do Baú, próximo à Estrada Parque, Rodovia MS-184, 12 October 2021, *V.J. Pott et al. 12835* (CGMS); Base de Estudos do Pantanal (BEP), próximo à torre de observação, 15 October 2012, *V.J. Pott & A. Pott 11490* (CGMS); *ibid*., 20 January 2015, *C.S. Souza et al. 225* (CGMS); Fazenda São João, Estrada Parque, sub-região Abobral, 15 December 2014, *G. Catian 157* (CGMS); *ibid*., *G. Catian 98* (CGMS); Próximo à estrada vicinal, 1,5 km a leste da Estrada Parque (MS-184), 12 December 2014, *J.P.S.P. Bento et al. 52* (CGMS); Pousada Santa Clara, 11 March 2005, *V.J. Pott et al. 7527* (CGMS). Miranda, Estância Caiman, piquete do Capão da Onça, 5 April 1998, *V.J. Pott et al. 3333* (CGMS, CPAP). Porto Murtinho, Fazenda Santa Virgínea, 3 December 2024, *S.J.B. Silva et al. 36* (CGMS); Fazenda Santa Virgínia, 5 December 2024, *J. Crepaldi et al. 66* (CGMS); Fazenda Anahi, Reserva Ambiental, Beira de estrada, 26 November 2024, *A.S. Campos et al. 15* (CGMS); Morro Pão de Açúcar, 2 December 2024, *R. Garcia-Silva et al. 148* (CGMS).

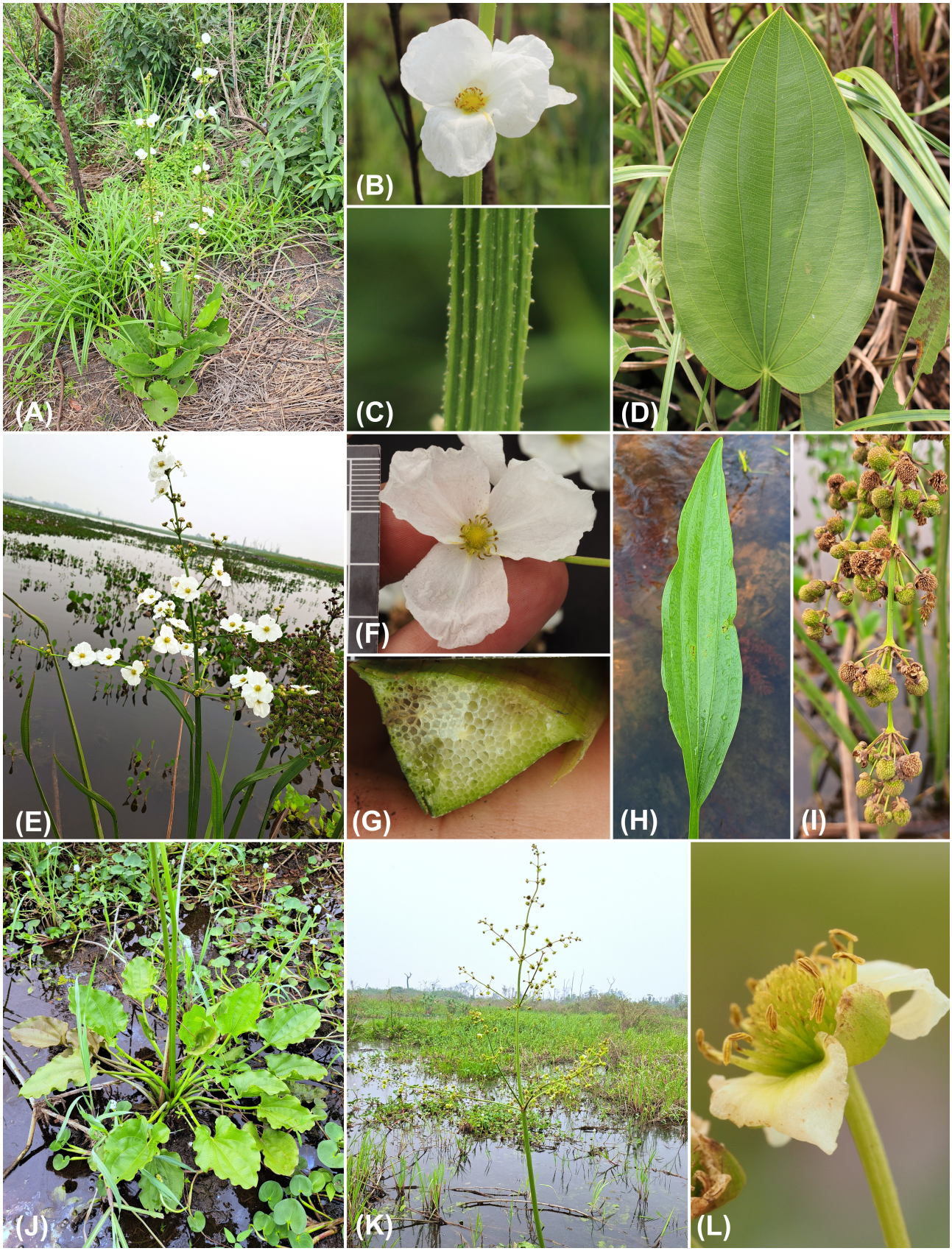

FIGURE 6. Alismataceae species found in the Brazilian Pantanal. **A–D:** *Echinodorus longiscapus*. **A:** Habit. **B:** Flower. **C:** Stem with trichomes. **D:** Leaf blade. **E–I:** *E. paniculatus*. **E:** Habit. **F:** Flower. **G:** Cross-section of the petiole. **H:** Leaf blade. **I:** Branch with fruits. **J–L:** *E. scaber*. **J:** Habit where are seen undulated margin leaves. **K:** Inflorescence highly branched with long internodes. **L:** Flower with reflexed petals. Photo credits: M.C.A. Pestana (**A, B, D, E, H, I, J, K**) and D. Falck (**C, F, G, L**).

Additional Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Dourados, Anel Viário Norte, 9 October 2024, *D. Falck et al*. 259 (DDMS, TUR), *D. Falck et al*. 260 (DDMS, TUR), *D. Falck et al. 261* (DDMS, TUR). Ivinhema, Amandina District, Porto Cristalino, 9 October 2024, *M.C.A. Pestana et al. 213* (DDMS, TUR). Naviraí, Parque Estadual das Várzeas do Rio Ivinhema, Near the bridge over the old drainage channel, 10 October 2024, *M.C.A. Pestana et al. 216* (DDMS, TUR); *ibid*., *M.C.A. Pestana et al. 217* (DDMS, TUR), *M.C.A. Pestana et al. 218* (DDMS, TUR), *M.C.A. Pestana et al. 220* (DDMS, TUR).

1.7 *Echinodorus paniculatus* Micheli in De Candolle & De Candolle (1881: 51). **Type:**—GUYANA. s.l., s.d., *Schomburgk 220* S (lectotype: K [K000098524!], designated by Rataj 1968: 45); isolectotype: K [K000098525!]). Figs. 6E–I; 8P–R.

Aquatic herbs, emergent or amphibious of marshy habitats, 50–120 cm tall, glabrous, branches surface without a bluish wax layer. **Rhizome** to 3.3 cm in diameter. **Roots** aseptate. **Leaves** 22.2–91.7 cm long; **petioles** 6–45.6 × 0.3–0.5 cm, triangular, winged; basal sheath 2.8–7.8 cm long, glabrous; **leaf blades** 8.4–38.3 × 3.1–8.5 cm, lanceolate or elliptic, base attenuate or rounded, apex acuminate, margin entire; venation pattern acrodromous, 3–7 veins, impressed on the adaxial surface, strongly prominent on the abaxial surface, elevated; basal lobes absent; pellucid marks absent. **Inflorescence** paniculate, erect, with 1–3 lateral branches commonly horizontal (some seen erect), or racemose, generally in amphibious plants; **peduncle** 21–35 cm long, triangular, winged; rachis 17.5–30 cm long, triangular, winged, composed of 8–21 whorls, each with 4–14 flowers, internodes between whorls 0.5–5.3 cm long; vegetative propagation present, very common in amphibious plants; **bracts** 1.6–7.2 × 0.2–0.6 cm, lanceolate, apex long-acuminate, 8–16 veins, longer or shorter than pedicels, slightly connate at base. **Flowers** 2.2–2.5 cm in diameter, long-pedicellate; pedicels 8.2–24.7 mm long, erect in anthesis, descending in fruit; **sepals** 0.6–0.9 × 0.1–0.2 cm, ovate, apex acute, 7–10 veins, glabrous, reflexed in anthesis and in fruit; **petals** 1.5–1.8 × 0.9–1.2 cm, erect, obovate, apex rounded; stamens 20–23, anthers 1.7 × 0.9 mm, apex obtuse, filaments ca. 1.9 mm long; carpels ca. 1.1 × 0.3 mm. **Achenes** 1.7–2.6 × 0.9–1.1 mm, oblanceolate, cylindrical in cross section, not winged; 3–5 ribs, without glands between the ribs; beak lateral, ca. 0.8 mm long. **Seeds** ca. 1.1 mm long, testa foveolate, light brown.

Distribution and Habitat:—*Echinodorus paniculatus* is broadly distributed across the neotropical region, ranging from southeastern Mexico to northern Argentina (POWO 2025). In Brazil, the species occurs in all regions and nearly all states, except Acre and Rondônia (North) and Espírito Santo (Southeast), and is present across all phytogeographic domains (Matias & Pestana 2025). In the Pantanal, *E. paniculatus* is the most frequently recorded species in herbaria. It is present in all sub-regions of the floodplain, especially in the Abobral, Nabileque, Paraguai, and Poconé sub-regions (Fig. 3B). The species grows along circular lagoons, river branches, seasonally flooded grasslands, and temporary lagoons, associated with hydromorphic clay soils and moist sandy soils.

Phenology:—It was collected with flowers and fruits throughout the year.

Etymology:—The specific epithet *paniculatus* is derived from Latin, referring to its inflorescence which is commonly paniculate.

Vernacular Names:—Chapéu-de-couro-folha-fina, língua-de-vaca (both in Portuguese).

Notes:—*Echinodorus paniculatus* is distinguished from other *Echinodorus* species in the Pantanal by its triangular petioles and rachis (Fig. 6G), its paniculate inflorescence, typically branching at the first whorl (Fig. 6E), and by its eglandular achenes (Fig. 5G). In the Pantanal, *E. paniculatus* was commonly confused with *E. lanceolatus* Rataj (1968: 406). These taxa differ by the shape of the petiole, with triangular and unchanneled in *E. paniculatus* (*vs*. pentagonal and channeled in *E. lanceolatus*), and by the eglandular achenes in *E. paniculatus* (*vs*. 4–7-glandular achenes in *E. lanceolatus*) (Rataj 1969, Matias & Sousa 2011). Additionally, *E. lanceolatus* commonly occurs in northeastern Brazil, inhabiting seasonal wetlands of the Caatinga domain (Matias & Sousa 2011).

Selected Specimens:—BRAZIL. **Mato Grosso:** Barão de Melgaço, Lagoas localizada no Pantanal Matogrossense, 25 September 2017, *U.M. Pozzobom & R.S. Celestino s.n.* (UFMT); [sem localidade], 29 May 2015, *G. Martinelli et al. 18620* (HERBAM). Cáceres, Ilha de Taiamã (baía ao lado esquerdo do alojamento), 19 November 1980, *C.J. Silva 209* (UFMT); Rodovia BR-174, ponte do Rio Paraguai, 06 May 1995, *G. Hatschbach et al. 62398* (MBM); Porto Limão, 14 July 2004, *M.A. Carniello 352* (UFMT, HRCB). Poconé, Fazenda Porto Jofre, 08 October 1989, *A. Pott 5132* (CPAP); Fazenda Ronco do Bugiu área de 6 Km à esquerda no Km 26 da rodovia Transpantaneira, 21 January 1992, *A.L. Prado 5175* (UFMT). **Mato Grosso do Sul:** Aquidauana, Fazenda Fazendinha, 12 April 1991, *S.M. Salis et al. 377* (CPAP); Fazenda Taboco, 29 August 1998, *V.J. Pott & R. Foster 3643* (COR, ICN). Corumbá, Fim do Polder, 11 September 1985, *V.J. Pott et al. 205* (CPAP); Hotel Pesqueiro Paraíso dos Dourados, 3 September 1986, *A. Rego 827* (COR); Estrada do Leque, 12 September 1988, *V.J. Pott et al. 600* (CPAP, COR); Fazenda Leque (Murundu

Alegre), 07 October 1989, *V.J. Pott et al. 1085* (CPAP); Baía do Tuiuiú—beira do rio Paraguai, 05 May 1992, *V.J. Pott et al. 1762* (CPAP); Colônia Bracinho, corixo Carro Quebrado, próximo ao corixo São Domingos, 13 September 2002, *V.J. Pott & A. Pott 5763* (CGMS); Fazenda Redenção, 21 September 2005, *V.J. Pott & A. Pott 8225* (EVB); Estrada Parque, 23 June 2023, *M.C.A. Pestana et al. 140* (DDMS); *ibid*., Rodovia MS-184, Vazante 3, próximo à ponte, 04 September 2014, *V.J. Pott & A. Pott 11685* (CGMS); Próximo à base de estudos da UFMS, 23 June 2023, *M.C.A. Pestana et al. 141* (DDMS); Paraguai-Mirim, 24 September 2024, *M.C.A. Pestana et al. 170* (DDMS, TUR); *ibid*., *M.C.A. Pestana et al. 171* (DDMS, TUR), *M.C.A. Pestana et al. 172* (DDMS, TUR), *M.C.A. Pestana et al. 142* (DDMS), *M.C.A. Pestana et al. 143* (DDMS), *M.C.A. Pestana et al. 144* (DDMS). Ladário, Codrasa, 23 November 2002, *W.R.F.M. Navarro 9* (COR); Fim do Polder, 11 September 1985, *V.J. Pott et al. 205* (CPAP). Miranda, Fazenda Arara Azul, 12 September 2012, *G. Catian 12* (CGMS). Porto Murtinho, Leito do rio Nabileque, 15 April 1998, *E.S. Guimarães & S. Mamede 72* (CPAP); Pantanal de Nabileque, 24 July 1998, *E.S. Guimarães 106* (R); Três Barras, on the west side of the urban area, 18 September 2024, *M.C.A. Pestana et al. 160* (DDMS, TUR).

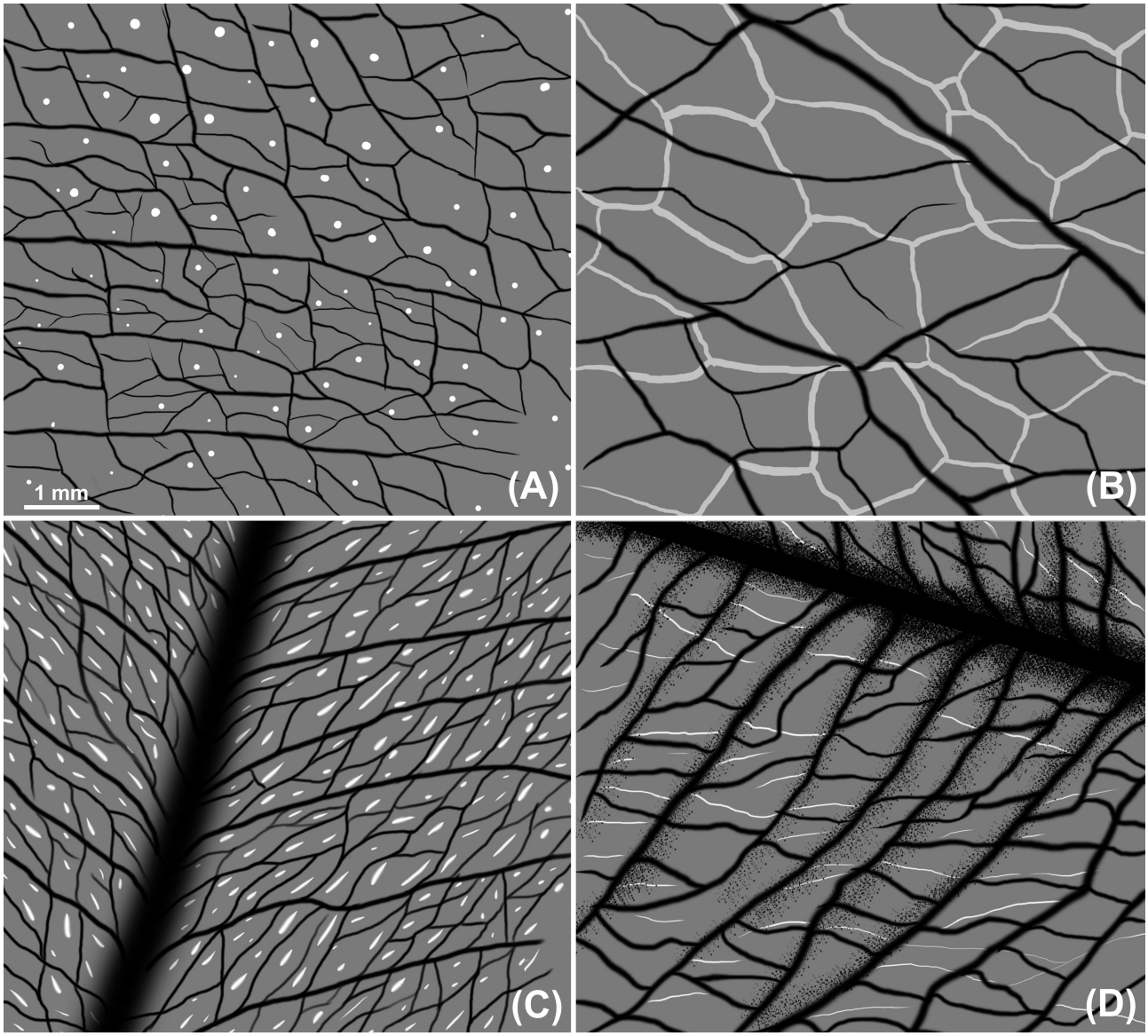

FIGURE 7. Pellucid marks found in *Echinodorus* species occurring in the Brazilian Pantanal. **A:** "pellucid dots" pattern, exclusive to *E. floribundus* (*V.J. Pott et al. 5777*). **B:** "reticulate network" pattern, unique to *E. longipetalus* (*V.J. Pott 2958*). **C:** "dots and lines" pattern, unique to *E. longiscapus* (*E.B. Souza 235*). **D:** "Pellucid lines" pattern found in *E. cordifolius*, *E. grisebachii* (drawn from *A. Pott 5255*), and *E. subalatus*. Illustrator: R.S. Soares.

1.8 *Echinodorus scaber* Rataj (1969: 438). **Type:**—GUYANA. "Mounth of Canje River", December 1887, *Jenman 4310* (holotype: K [K000098302!]). Figs. 5H; 6J, L; 8S–T.

Aquatic herbs, emergent, 95–280 cm tall, stellate-pubescent, the trichomes to 1 mm long, yellowish, ridge; branches surface without a bluish wax layer. **Rhizome** to 5 cm in diameter. **Roots** aseptate. **Leaves** 46.8–121.3 cm long; **petioles** 17.8–7 × 0.6–1.1 cm, with a thickened node at the junction with the blades, cylindrical, surface ridged, densely stellate-pubescent, the trichomes concentrated at the proximal ends; basal sheath 14–20 cm long, glabrous; **leaf blades** 15–31.3 × 11–21.2 cm, ovate, base cordate or truncate, apex retuse, margin undulate, sparsely stellate-pubescent on the abaxial surface; venation pattern campylodromous, 12–14 veins, impressed on the adaxial surface, strongly prominent on the abaxial surface, elevated, basal lobes present, with rounded apex, 3.8–7.5 × 4.7–10 cm, 5–7 veins; pellucid marks absent. **Inflorescence** paniculate, erect, with 3–4 erect lateral branches; **peduncle** 70.9–81.2 cm long, cylindrical, stellate-pubescent; rachis 42.5–61.8 cm long, subcylindrical, not winged, composed of 16–30 whorls, each with 5–7 flowers, internodes between whorls 6–20 cm long; vegetative propagation absent; **bracts** 0.6–3.5 × 0.2–0.6 cm, lanceolate, apex acute, 11–15 veins, shorter than pedicels, free at base. **Flowers** 1.2–1.6 cm in diameter, long-pedicellate; pedicels 12.8–35.9 mm long, erect in anthesis and in fruit; **sepals** 0.2–0.4 × 0.2–0.3 cm, ovate, apex acute, 12–15 veins, glabrous, reflexed in anthesis and in fruit; **petals** 0.3–0.5 × 0.2–0.3 cm, reflexed, obovate, apex acute; stamens 12–16, anthers 1.4 × 0.7 mm, apex obtuse, filaments ca. 3 mm long; carpels ca. 0.5 × 0.1 mm. **Achenes** 1.7–2.8 × 0.8–1.2 mm, oblanceolate, cylindrical in cross section, not winged; 5–7 ribs, 2–4 elliptic glands between the ribs, the glands ca. 0.1 mm long; beak apical, ca. 0.9 mm long. **Seeds** ca. 1.1 mm long, testa tenuous-foveolate, dark brown.

Distribution and Habitat:—*Echinodorus scaber* occurs in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Guyana, Nicaragua, Paraguay, Suriname, and Venezuela (POWO 2025). In Brazil, it has been recorded in the North (Amazonas, Amapá, Pará, Roraima), Northeast (Bahia, Maranhão), Central-West (Goiás, Mato Grosso do Sul, Mato Grosso), Southeast (Minas Gerais, Rio de Janeiro, São Paulo), and South (Paraná, Rio Grande do Sul, Santa Catarina) regions, and is present in all Brazilian phytogeographic domains (Pestana *et al*. 2024; Matias & Pestana 2025). In the Pantanal, *E. scaber* occurs in nine of the eleven sub-regions, except Nabileque and Porto Murtinho (Fig. 3C). The species grows in seasonally flooded grasslands, circular lagoons, temporary lagoons, and river margins, typically associated with moist sandy-silty soils.

Phenology:—It was collected with flowers and fruits from February to December.

Etymology:—The epithet *scaber* (rough, scabrous—Rataj 1969) refers to the rigid indumentum on petioles and inflorescence.

Vernacular Name:—Chapéu-de-couro.

Notes:—Earlier authors considered *E. scaber* as an infraspecific taxon of *E. macrophyllus* (Kunth 1841: 151) Micheli in De Candolle & De Candolle (1881: 50) (Haynes & Holm-Nielsen 1986, 1994, Matias 2007). In addition, *E. scaber* has frequently been identified as *E. macrophyllus* in herbarium records from the Pantanal. Although both species share morphological characteristics, such as ovate leaf blades with a generally cordate base and paniculate inflorescence, both taxa can be easily distinguished in vegetative and reproductive structures. In the Pantanal, *E. scaber* differs from other species of the genus (including *E. macrophyllus*), by its small sepals (up to 0.4 mm long) and small flowers (1.2–1.6 cm in diameter) with reflexed petals and fewer stamens (12–16) (Fig. 6L); stellate-pubescent petioles and peduncles with rigid, rough trichomes (Rataj 1969; e.g. Fig. 8T), as well as a long and highly branched inflorescence (3–4 erect branches) with internodes approximately 20 cm apart between the first and second floral whorls (Fig. 6K). In contrast, typical specimens of *E. macrophyllus* are glabrous or glabrescent, lacking the distinctly developed stellate indumentum characteristic of *E. scaber*; have larger flowers (to 2.5 cm in diameter) with 20–24 stamens; and leaves with widely spaced basal lobes, whereas *E. scaber* has comparatively smaller ovate leaves typically with a truncate leaf base (Lehtonen 2008, Matias 2020).

Selected Specimens:—BRAZIL. **Mato Grosso:** Cáceres, BR-343, Caixa de empréstimo, 27 February 2002, *U.M. Resende & V.F. Kinupp 1680* (CGMS); BR-070, fronteira Brasil-Bolívia, 29 January 2008, *M.A. Carniello 1683* (HPAN). Poconé, Rodovia Transpantaneira, Km 17, 06 June 1981, *C.J. Silva 320* (UFMT); Fazenda Porto Jofre, retiro São Francisco, sub-região de Poconé, 08 October 1989, *A. Pott 5133* (CPAP); Transpantaneira, sub-região de Poconé, Pantanal, próximo à porteira do Ibama, 15 April 1993, *V.J. Pott et al. 1894* (CPAP); *ibid*., MT-060, km 10, 27 February 1996, *V.J. Pott et al. 2975* (CPAP); Estrada-parque Poconé-Porto Cercado, 02 June 2011, *H. Ferreira 1* (CGMS); Pirizal, próximo à Baia dos Coqueiros, 01 November 2016, *F.H. Barbosa da Silva 123* (UFMT); *ibid*., próximo à Fazenda Nossa Senhora Aparecida, 01 November 2017, *F.H. Barbosa da Silva 324* (UFMT). Santo Antônio do Leverger, Baía Chacororé, Pantanal, 22 April 1993, *V.J. Pott et al. 2076* (CPAP). **Mato Grosso do Sul:**

Aquidauana, Fazenda Fazendinha, 07 July 1991, *S.M. Salis et al. 451* (CPAP); Fazenda Retirinho (retiro), sub-região de Aquidauana, Pantanal, brejo do Taboco, 22 November 1989, *A. Pott et al. 5364* (CPAP). Corumbá, Pantanal do Abobral, entre o Porto da Manga e o Passo do Lontra, 26 October 1986, *A. Rego 849* (COR); Fazenda Acurizal, invernadinha do retiro Lontra, 01 October 1987, *V.J. Pott 2109* (CPAP); Base de Pesquisa da UFMS, Passo do Lontra, 24 April 1989, *A. Pott & N. Petzold 4734* (CPAP); Fazenda São Bento, 08 July 1995, *E. Scremin-Dias et al. 230* (CGMS), *E. Scremin-Dias et al. 235* (CGMS); Fazenda Xaraés, Estrada Porto da Manga, 11 June 1993, *A.D. Silva et al. 31* (CGMS, CPAP); Passo do Lontra, Pantanal do Miranda, 12 July 1997, *E.S. Guimarães et al. 7* (CGMS, CPAP, MBM); Estrada Parque, 5ª ponte, Corixão, 03 July 1999, *R. Hayd et al. 10* (CGMS); Entre a 4ª e 5ª pontes, perto do corixão, 15 February 2001, *A.L. Barros 3* (CGMS); Colônia Bracinho, corixo São Domingos, sub-região de Paiaguás, Pantanal, 13 September 2002, *V.J. Pott & A. Pott 5771* (CGMS); Fazenda Santo Antônio do Amolar, Oeste da Serra do Amolar, 02 April 2003, *V.J. Pott & M.C.V. Santos 6147* (CPAP, CGMS); Fazenda Santa Ana, próximo ao Rio Taquari, sub-região do Paiaguás, 30 July 2009, *V.J. Pott & A. Pott 10558* (CGMS); Paraguai-Mirim, Pantanal, sub-region of Paiaguás, 24 September 2024, *M.C.A. Pestana et al. 173* (DDMS, TUR); *ibid*., 27 September 2024, *M.C.A. Pestana et al. 183* (DDMS, TUR); *ibid*., *M.C.A. Pestana et al. 184* (DDMS, TUR), *M.C.A. Pestana et al. 185* (DDMS, TUR); *ibid*., 28 September 2024, *M.C.A. Pestana et al. 199* (DDMS, TUR). Miranda, Estância Caiman, sub-região de Miranda, Pantanal, 04 April 1998, *V.J. Pott et al. 3330* (CPAP).

1.9 *Echinodorus subalatus* (Mart.) Grisebach (1866: 218) ≡ *Alisma subalatum* Martius (1830: 1609). **Type:**—BRAZIL. s.l., s.d., *Martius 150* (lectotype: M [M0086267!], designated by Rataj 1971: 15); isolectotype: M [M0086268!]). Figs. 5I; 10A.

Aquatic herbs, emergent, 45–70 cm tall, glabrous, branches surface without a bluish wax layer. **Rhizome** to 1.4 cm in diameter. **Roots** aseptate. **Leaves** 37.2–55.8 cm long; **petioles** 22.4–30.8 × 0.5–1 cm, triangular, winged; basal sheath 4.3–9.4 cm long, glabrous; **leaf blades** 10.5–24.2 × 2.4–12 cm, lanceolate or ovate, base attenuate or rounded, apex acuminate or acute, margin entire; venation pattern acrodromous, 3–9 veins, impressed on the adaxial surface, strongly prominent on the abaxial surface, slightly elevated; basal lobes absent; pellucid marks present forming lines. **Inflorescence** racemose or paniculate, in the latter case with up to 2 erect lateral branches; **peduncle** 22.8–81.3 cm long, triangular, winged; rachis 16.5–33.8 cm long, triangular, winged, composed of 7–19 whorls, each with 5–19 flowers, internodes between whorls 2.2–5.1 cm long; vegetative propagation absent; **bracts** 1.2–2.5 × 0.4–0.6 cm, lanceolate, apex acute or long-caudate, 10–12 veins, longer or shorter than pedicels, free at base. **Flowers** 2.8–3 cm in diameter, short-pedicellate; pedicels 6.1–10 mm long; **sepals** 0.3–0.5 × 0.2–0.3 cm, ovate, apex acute, 11–15 veins, glabrous, reflexed in anthesis and in fruit; **petals** 0.9–1.8 × 0.9–1 cm, erect, ovate, apex rounded or acute; stamens 18–21, anthers 1.7 × 0.9 mm, apex obtuse, filaments ca. 1.9 mm long; carpels ca. 1.1 × 0.3 mm. **Achenes** 2–2.3 × 0.6–0.9 mm, oblanceolate, cylindrical in cross section, not winged; 5–8 ribs, 1–2(–3) elliptic or globose glands between the ribs, the glands ca. 0.2 mm long; beak apical, ca. 0.6 mm long. **Seeds** ca. 1 mm long, testa foveolate, light brown.

Distribution and Habitat:—*Echinodorus subalatus* occurs from southeastern Mexico to central Brazil (POWO 2025). In Brazil, it has been recorded in the North (Amazonas, Amapá, Pará, Roraima), Northeast (Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Sergipe), Central-West (Goiás, Mato Grosso do Sul, Mato Grosso), and Southeast (Minas Gerais, Rio de Janeiro, São Paulo) regions, and occurs in the Amazon Forest, Atlantic Forest, Caatinga, Cerrado, and Pantanal phytogeographic domains (Matias & Pestana 2025). In the Pantanal, *E. subalatus* is restricted to the Cáceres and Poconé sub-regions (Fig. 3C) in Mato Grosso. It occurs along riverbanks, in clayey soils.

Phenology:—Flowers and fruits were recorded in August.

Etymology:—The epithet *subalatus* is derived from Latin and means "almost winged" (*sub* meaning "under" or "almost," and *alatus* meaning "winged"), in reference to the morphology of the peduncle and petiole in the type specimen.

Vernacular Name:—Língua-de-vaca (Portuguese).

Notes:—*Echinodorus subalatus* is distinguished by its distinctly winged petioles and peduncles, floral whorls in the inflorescence closely spaced and achenes with an apical beak, typically possessing a central ovoid gland (Fig. 5I). *Echinodorus subalatus* is poorly documented in the Pantanal with three specimens collected at least 22 years ago from independent collections although nearby sites.

Specimens Examined:—BRAZIL. **Mato Grosso:** Cáceres, Porto Limão, August 2003, *M.A. Carniello et al. 50* (UFMT); ibid., 14 July 2004, *M.A. Carniello et al. 352* (UFMT). Poconé, Rio Bento Gomes, Pantanal, 3 August 1992, *V.J. Pott et al. 1717* (CPAP); *ibid*., 5 August 1992, *V.J. Pott & C.W. Heckman 1733* (CPAP).

Additional Specimens Examined:—BRAZIL. **Ceará:** Aiuaba, Alegrete Esterco Aiuaba, 9 May 2002, *L.Q. Matias 355* (CGMS). Independência, Fazenda Cetro-Estr. Pedra Branca, 25 June 2003, *L.Q. Matias 463* (CGMS). **Mato Grosso:** Barra do Bugres, beira do rio Paraguai, 27 August 1984, *L. Coradin 6998* (CEN). **Mato Grosso do Sul:** Três Lagoas, 23 May 1964, *J.C. Gomes Jr. 1817* (CGMS).

2. *Helanthium* (Engelm. ex Bentham & Hooker f. 1883: 1005) J.G.Smith in Britton (1905: 54). **Type:** *Helanthium tenellum* (Martius ex Schultes 1830: 1600) Britton (1905: 54).

Aquatic herbs, annual, predominantly emergent, sometimes rooted-submersed or amphibious of marshy habitats, delicate, rhizomatous, stoloniferous, glabrous. **Roots** septate or aseptate. **Leaves** predominantly emersed, rarely submerged, erect or patent, long-petiolate; **petioles** generally shorter than blades (exceptions in *H. tenellum*); cylindrical in cross section, aseptate; **leaf blades** chartaceous, lanceolate or oblong, base attenuate, apex acute or obtuse, margin entire; venation pattern acrodromous; basal lobes absent; pellucid marks present or absent. **Inflorescence** umbellate, emersed; **peduncle** aseptate, cylindrical in cross section, not winged, composed of 1–3 whorls, vegetative propagation present by pseudostolons, especially in submerged plants; **bracts** lanceolate, apex acuminate, chartaceous, coarse, margin entire, free at base, shorter than pedicels. **Flowers** bisexual, long-pedicellate; pedicels cylindrical in cross section, glabrous, spreading in anthesis and in fruit; **sepals** ovate, apex acute, not keeled, coriaceous, glabrous, connate at base, reflexed in anthesis, adpressed in fruit (surrounding the fruit aggregate); **petals** white, short-clawed, persistent, erect, elliptic, apex emarginate, obtuse or retuse, without spots at base; stamens 6–9, filaments linear, glabrous; anthers basifixed, elliptic, apex obtuse, shorter than filaments; staminodes absent; carpels 15–19, style present, short; ovary with one ovule per carpel, placentation basal. **Fruit** achene (Fig. 5J, K), obovate, surface ribbed, without glands between the ribs, not winged; beak present, lateral. **Seeds** 1, testa smooth, vinaceous, glabrous.

Helanthium was long treated as a subgenus of *Echinodorus* in classical taxonomic literature (Fassett 1955, Rataj 1975, 2004, Haynes & Holm-Nielsen 1994). However, *Helanthium* was segregated from *Echinodorus* to maintain it monophyletic supported by a molecular phylogenetic study of Lehtonen & Myllys (2008). These results justified the reestablishment of *Helanthium* as an independent genus, a position further supported by phylogenomic data (Li *et al*. 2022). The genus currently includes three morphologically polymorphic species (*H. tenellum*, *H. bolivianum*, and *H. zombiense* (Jérémie) Lehtonen & Myllys 2008: 228), distributed from the southeastern United States to the Caribbean and southern Brazil (Lehtonen & Falck 2011, POWO 2025). Only *H. tenellum* and *H. bolivianum* occur in Brazil, both of which are found in the Pantanal. It is worth noting that *Helanthium* remains one of the least studied genera within Alismataceae from a phylogenetic perspective, and its diversity is likely underestimated (Lehtonen & Falck 2011).

Etymology:—The genus name is derived from the Greek and means "marsh flower" (*helos* means marsh and *anthos* means flower) in reference to the typical habitat of the genus.

Identification key to the *Helanthium* species in the Brazilian Pantanal

1. Roots septate; leaves patent; leaf blades oblong, pellucid marks present forming lines.....2.1. ***H. bolivianum***
- Roots aseptate; leaves erect; leaf blades lanceolate, pellucid marks absent.....2.2. ***H. tenellum***

2.1 *Helanthium bolivianum* (Rusby) Lehtonen & Myllys (2008: 228) ≡ *Alisma bolivianum* Rusby (1927: 208) ≡ *Echinodorus bolivianus* (Rusby) Holm-Nielsen (1979: 276). **Type:**—BOLIVIA. Reyes, 25 October 1921, *White 1540* (lectotype: NY [NY00214633!], designated by Haynes & Holm-Nielsen 1994: 14); isolectotypes: GH [GH00026755!], K [K000061663!], MICH [MICH1115687!], NY [NY00214633!], US [US00086693!]). Figs. 5J; 9A–C; 10B.

Aquatic herbs, predominantly emergent, occasionally amphibious of marshy habitats, 9–30 cm tall. **Roots** septate. **Rhizome** short, ca. 0.2 cm in diameter. **Stolons** 2.8–9.4 cm long. **Leaves** 0.4–18.7 cm long, patent; **petioles** 1.8–12.4 × 0.1–0.8 cm, shorter than leaf blades; basal sheath 0.5–1.4 cm long; **leaf blades** 1.1–4.9 × 0.2–1.6 cm, oblong, 2–3 veins, pellucid marks present forming lines. **Inflorescence** umbellate; **peduncle** 1–18.5 cm long; composed of 1–2 whorls, each with 2–6 flowers, internodes between whorls 4.8–7.6 cm long; **bracts** 2–4.2 × 1–2 mm, 4–6 veins. **Flowers** 1–1.3 cm in diameter; pedicel 9.4–18 mm long; **sepals** 2.7–3.3 × 1–2 mm, 3–6 veins; **petals** 2.8–4.4 × 2–5 mm, apex emarginate, the claw with ca. 0.7 mm; stamens 9, anthers 0.5 × 0.8 mm, filaments ca. 0.6 mm; carpels 16–18, ca. 1 × 0.3 mm. **Achenes** 0.9–1.1 × 0.4–0.6 mm, 3 ribs; beak ca. 0.2 mm long. **Seeds** ca. 0.5 mm long.

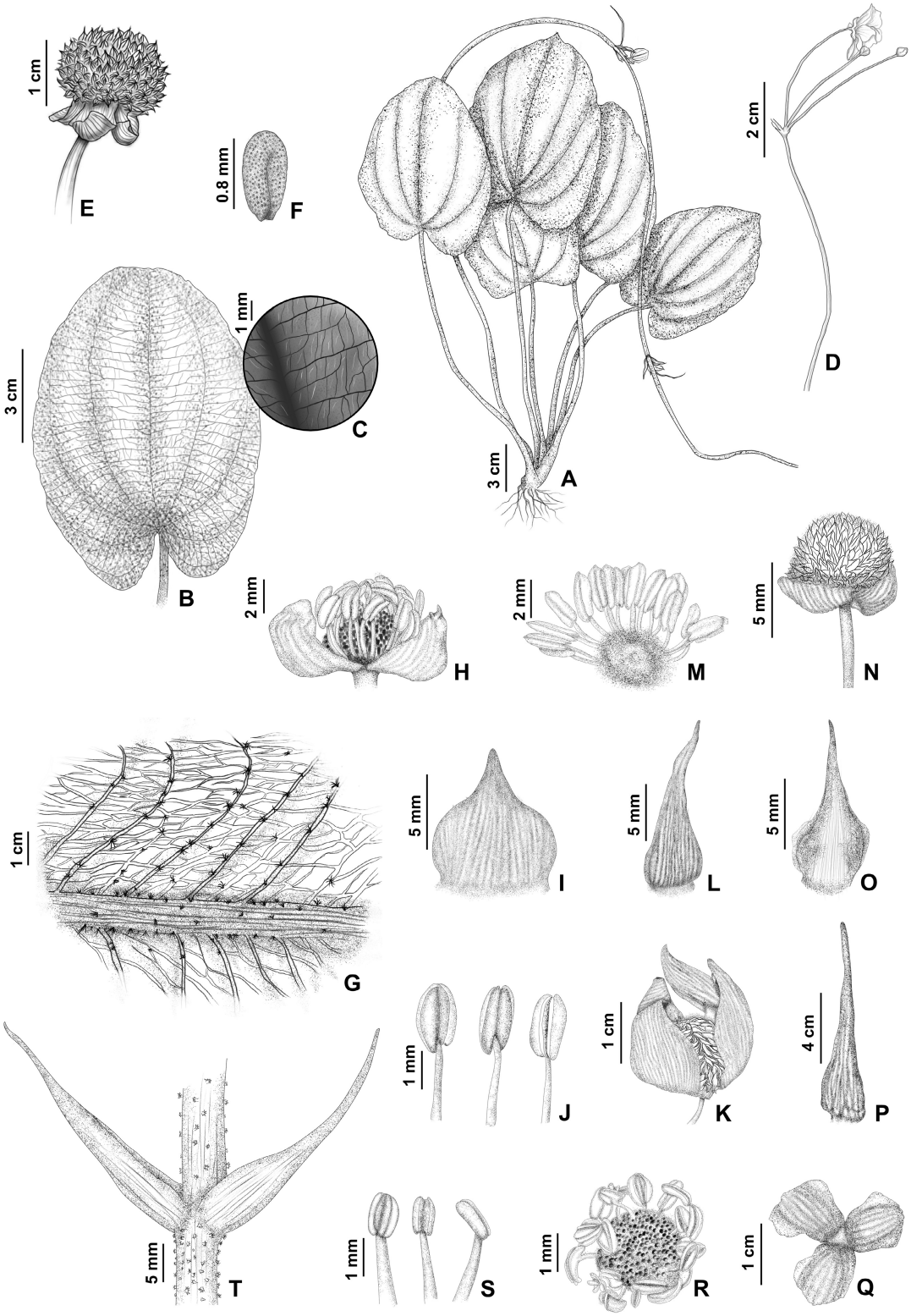

FIGURE 8. Morphological features of *Echinodorus* species occurring in the Pantanal. **A–F:** *Echinodorus cordifolius*. **A:** Habit (drawn from *V.J. Pott 7794 & A. Pott*). **B:** Leaf blade (*A. Pott 4867*). **C:** Pellucid lines (*A. Pott 4867*). **D:** Inflorescence peduncle and long pedicels (*P.P. Oliveira 70*). **E:** Fruiting aggregate with open calyx (*A. Pott 4867*). **F: Seed** (*A. Pott 4867*). **G–H:** *E. floribundus* **G:** Abaxial surface of leaf blade with stellate trichomes (*G.A. Damasceno-Junior 5294*). **B:** Sepals and stamens (*M.C.A. Pestana 214*). **I–J:** *E. glaucus* (drawn from *M.C.A. Pestana 203*). **I:** Deltoid bract. **J:** Stamens. **K–M:** *E. longipetalus*. **K:** Sepals surrounding the fruiting aggregate completely (*V.J. Pott 2416*). **L:** Bract (*V.J. Pott 2416*). **M:** Stamens with acuminate apex (*M.C.A. Pestana et al. 221*). **N–O:** *E. longiscapus*. **N:** Fruiting aggregate with reflexed calyx (*V.J. Pott 11297*). **O:** Bract (*E.B. Souza 183*). **P–R:** *E. paniculatus* (drawn from *M.C.A. Pestana 170*). **P:** Bract. **Q:** Sepals. **R:** Stamens. **S–T:** *E. scaber*. **S:** Stamens (*M.C.A. Pestana et al. 173*). **T:** Stem with stellate trichomes (*V.J. Pott 2740*). Illustrator: R.S. Soares.

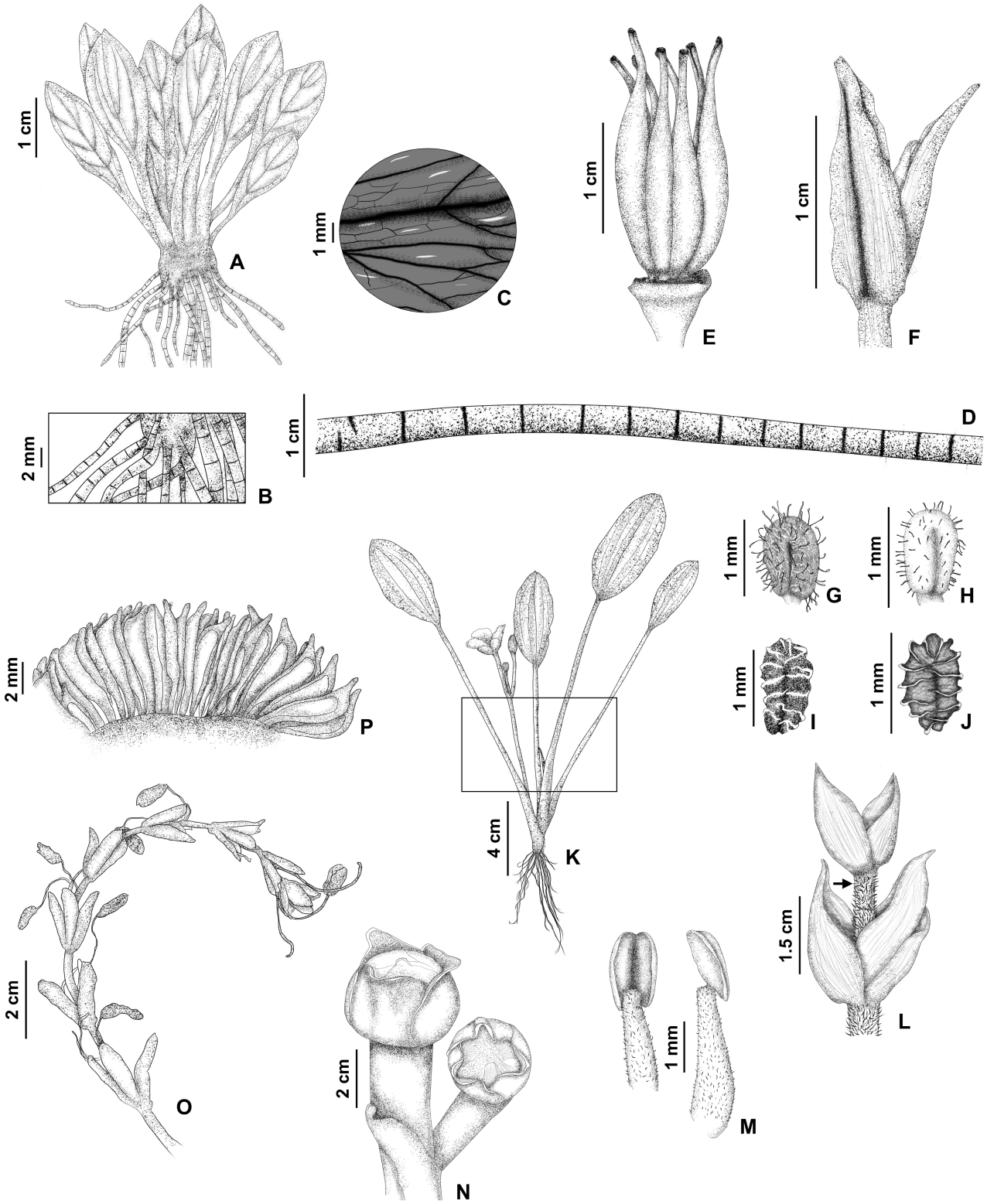

FIGURE 9. Morphological features of Alismataceae species occurring in the Brazilian Pantanal. **A–C:** *Helanthium bolivianum* (drawn from *A. Rego 803a*). **A:** Habit. **B:** Detail of septate roots. **C:** Pellucid lines. **D, E, G:** *Hydrocleys nymphoides*. **D:** Septate petiole (*D. Falck 258*). **E:** Gynoecium with eight distinct carpels (*M.C.A. Pestana et al. 156*). **G:** Seed with long trichomes (*A. Pott 11820*). **F, H:** *Hydrocleys parviflora* (drawn from *V.C. Soares 29*). **F:** Sepals with a prominent central vein. **H:** Seed with sparsely glandular trichomes. **I:** Winged seeds of *Limnocharis flava*. **J–K:** *Limnocharis laforestii*. **J:** winged seeds (*M.C.A. Pestana et al. 145*). **K:** Detail of the peduncle shorter than the petioles (*M.C.E. Amaral 97-38*). **L:** Pubescent rachis of *Sagittaria guyanensis* (*G. Catian 46*). **M:** Pubescent filaments of *S. montevidensis* (*M.C.A. Pestana et al. 153*). **N:** Thickened pistillate pedicel of *S. planitiana* (*M.C.A. Pestana et al. 182*). **O–P:** *S. rhombifolia*. **O:** Part of the inflorescence showing the numerous floral whorls (*V.J. Pott 5776*). **P:** Detail of the fruiting aggregate (*M.C.A. Pestana et. al. 210*). Illustrator: R.S. Soares.

Distribution and Habitat:—*Helanthium bolivianum*, as currently circumscribed (Lehtonen & Myllys 2008), is widely distributed in the neotropical region, occurring from southeastern Mexico to southern Brazil (POWO 2025). In Brazil, it has been recorded in all major regions, but within the Northeast confirmed occurrences are restricted to the state of Bahia (Matias & Pestana 2025). *Helanthium bolivianum* is known from only two gatherings in the Pantanal, both lacking reproductive structures (e.g. Fig. 9A). Despite this, we include these specimens, since vegetative traits allow the recognition of *H. bolivianum* as well as its distinction from *H. tenellum* (see identification key and notes). *Helanthium bolivianum* was recorded in the Paraguay and Nhecolândia sub-regions (Fig. 3C). Its habitat preferences within the Pantanal remain unclear.

Phenology:—The reproductive period of *Helanthium bolivianum* remains undocumented in the Pantanal. In nearby regions, it flowers and fruits from April to December.

Etymology:—The epithet *bolivianum* means "from Bolivia" in reference to the type locality.

Vernacular Name:—Erva-do-pântano (Portuguese), Marsh flower.

Notes:—*Helanthium bolivianum* is distinguished by its small, delicate habit, reaching 28 cm in height. It is morphologically similar to *H. tenellum*, but differs by having patent leaves (*vs*. erect), oblong blades with pellucid marks arranged in long lines (*vs*. lanceolate blades without pellucid marks), and septate roots (*vs*. non-septate).

Although the occurrence of *H. bolivianum* in the Pantanal was based on the voucher *V.J. Pott et al. 3215* (CPAP) (Pott & Pott 2000), this sample is originally from Bonito (Mato Grosso do Sul), a municipality located on the western edge of the Pantanal but outside the region's limits (Silva & Abdon 1998). Another sample (*V.J. Pott et al. 733*—CPAP) previously identified as *H. bolivianum* was later assigned to *H. tenellum* after our review of this specimen.

Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Corumbá, Próximo ao Porto, nas mediações da olaria Borowsk, 6 August 1986, *A. Rego s.n*. (CGMS 2293); Fazenda Nhumirim, 20 October 1986, *A. Rego 803a* (ICN).

Additional Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Bonito, Fazenda São Geraldo, rio Sucuri—ponto turístico de bar com mergulho, 25 April 1995, *V.J. Pott et al. 2595* (CPAP); Baía Bonita, ponto turístico (aquário natural), 26 April 1995, *V.J. Pott et al. 2618* (CPAP); Fazenda São Geraldo, 7 September 1996, *V.J. Pott et al. 3215* (CPAP); *ibid*., 4 km adiante da sede da Fazenda São Geraldo, em direção à nascente do rio Formoso, 7 August 1999, *V.J. Pott et al. 3943* (CPAP); Rio Formoso, 4 December 1998, *E. Scremin-Dias s.n.* (CGMS 10924); *ibid*., 26 August 2002, *V.J. Pott et al. 5706* (CGMS). Bodoquena, Córrego Azul, 26 km Norte de Bodoquena, 4 December 1998, *V.J. Pott et al. 3851* (CPAP). Chapadão do Sul, Fazenda Ribeirão, entrada no km 130 da rodovia MS-306, próximo à taipa para o bebedouro do gado, 30 May 2001, *V.J. Pott et al. 4679* (CGMS). Dourados, Nascente Água Boa, Microbacia Água Boa, 17 August 2010, *G.S.V. Duarte 48* (CGMS).

2.2 *Helanthium tenellum* (Mart. ex Schult.f.) Britton (1905: 54) ≡ *Alisma tenellum* Martius ex Schultes f. (1830: 1600) ≡ *Echinodorus tenellus* (Mart. ex Schult.f.) Buchenau (1868: 21). **Type:**—BRAZIL. Minas Gerais: "In udis, stagnante aqua ad Buritisaës prope Contendas", s.d., *Martius s.n.*, *obs*. *1624* (lectotype: M [M0086265!], designated by Rataj 1975: 13). Figs. 5K; 10C, D.

Aquatic herbs, predominantly emergent, occasionally rooted-submersed or amphibious of marshy habitats, 5–20 cm tall. **Roots** aseptate. **Rhizome** to 0.5 cm in diameter. **Stolons** 1–1.5 cm long. **Leaves** 2–13.5 cm long, erect; **petioles** 0.5–7.2 × 0.05–0.2 cm, shorter than leaf blades in small plants, longer than leaf blade in robust plants; basal sheath 0.2–2.7 cm long; **leaf blades** 1.1–3.5 × 0.2–0.6 cm, lanceolate, 2–4 veins, pellucid marks absent. **Inflorescence** umbellate; **peduncle** 1–17 cm long; composed of 1–3 whorls, each with 3–14 flowers, internodes between whorls 2.3–5.6 cm long; **bracts** 1.5–5 × 0.8–1.2 mm, 5–8 veins. **Flowers** 0.5–1 cm in diameter; pedicel 5–30 mm long; **sepals** 1.5–2.6 × 1–2.3 mm, 4–8 veins; **petals** 2–4 × 2–3 mm, apex retuse, obtuse or emarginate, the claw with ca. 0.5 mm long; stamens 6–9, anthers 0.7 × 0.3 mm, filaments ca. 0.5 mm long; carpels 15–19, ca. 1.2 × 0.5 mm. **Achenes** 1–1.2 × 0.5–0.7 mm, (2–)3 ribs; beak ca. 0.1 mm long. **Seeds** ca. 0.8 mm long.

Distribution and Habitat:—*Helanthium tenellum* is widely distributed throughout the Americas, from the United States to southern Brazil (POWO 2025). However, as discussed in the generic note, the circumscription of *H. tenellum* remains uncertain. Its broad geographical range may result from the inclusion of distinct taxa currently treated as synonyms. For example, Lehtonen & Falck (2011) argued that *H. parvulum* Small (1909: 45) is morphologically and molecularly distinct from *H. tenellum*. This distinction may help to explain the wide distribution currently attributed to *H. tenellum*, particularly across disjunct areas of South and North America, the latter being where *H. parvulum* populations are widely distributed (Lehtonen & Falck 2011).

FIGURE 10. Representative Alismataceae species found in the Brazilian Pantanal. **A:** Habit of *Echinodorus subalatus* (flowers and fruiting aggregate in detail). **B:** Habit of *Helanthium bolivianum* (flower in detail). **C–D:** *Helanthium tenellum*. **C:** Habit showing the plant size in scale. **D:** Populations in the banks of a lagoon. **E–G:** *Hydrocleys nymphoides*. **E:** Habit. **F:** Flower in front view (side view in detail; note the petal longer than the calyx). **G:** Abaxial side of the leaf blade. **H–I:** *Hydrocleys parviflora*. **H:** Habit. **I:** Reproductive branch; note the petal shorter than the calyx. Photo credits: E. Leite (**A**), M.C.A. Pestana (**B, F, G**), D. Falck (**C, D**), S. Lehtonen (**E**), and F.H.B. Silva (**H, I**).

In Brazil, *H. tenellum* has been recorded in all regions and nearly all states, except Amazonas and Acre in the North, and is present in all major phytogeographic domains (Matias & Pestana 2025). For the Pantanal, it is the second most common Alismataceae species, with records from six municipalities and nine sub-regions, especially in the Abobral, Cáceres, and Paraguai sub-regions (Fig. 3D). It is found in swamps, circular lagoons, flooded grasslands, streams, clear watercourses, and shallow lagoons, associated with sandy and moist soils. It is very commonly found growing alongside *Eleocharis* cf. *minima* Kunth (1837: 139), especially on the sandy soil of riverbanks.

Phenology:—It was collected with flowers and fruits throughout the year.

Etymology:—The epithet *tenellum* is derived from Latin and means "delicate" or "smooth" (*tenellus* meaning tender or delicate), in reference to the typically small and slender habit of the plant, especially its petals.

Vernacular Name:—Erva-do-pântano (Portuguese), Marsh flower.

Notes:—*Helanthium tenellum* is morphologically similar to *H. bolivianum* but can be set apart by a sort of characteristics provided in subsection 2.1. Although the morphological characters presented are useful for distinguishing the two species in the Pantanal, some authors (e.g. Jérémie *et al*. 2001, Matias 2007) have considered both as phenotypic variations of *H. tenellum*. This highlights the need for a taxonomic revision of the genus, incorporating molecular data to clarify the species delimitation in the genus.

Helanthium tenellum populations from the Pantanal show wide variation in overall size, number of whorls in the inflorescence and life form. The most recurrent morphotype consists of small amphibious or emergent plants with inflorescence composed of 1(–2) whorls and flowers ca. 1 cm in diameter (e.g. Fig. 10D). However, herbarium specimens also include more robust, submerged individuals (up to 18 cm tall) with inflorescences composed of up to three whorls (*S.M. Salis 518*, *V.J. Pott et al. 566*).

This phenotypic variation appears to be influenced by local environmental conditions, such as substrate type, nutrient availability, and water depth (Scremin-Dias 2000). Nevertheless, the extent and mechanisms of phenotypic plasticity in *H. tenellum* remain poorly understood and warrant further investigation, particularly in relation to the more robust morphotypes historically assigned to taxa now treated as synonyms of *H. tenellum* (see Rataj 1975, 2004).

Selected Specimens:—BRAZIL. **Mato Grosso:** Cáceres, Fazenda Espírito Santo, SESC Pantanal, 06 May 2004, *G.A. Lima-Júnior & H. Ferreira 282* (UFMT); Parque Estadual Guirá, 09 September 2022, *M.S.A. Abdo et al. 1444* (UFMT). Poconé, Fazenda Baía de Dom Bosco, campo ao lado da sede, 12 September 1991, *S.M. Salis et al. 518* (CGMS, CPAP); Fazenda Ipiranga, Transpantaneira, Km 10, 26 June 1991, *M. SchessI 2017* (UFMT); Rodovia Porto Cercado, 01 April 2017, *F.H. Barbosa da Silva 799* (UFMT). Santo Antônio do Leverger, Baía Chacororé, Pantanal, 23 April 1993, *V.J. Pott et al. 2087* (CPAP). **Mato Grosso do Sul:** Aquidauana, Fazenda Fazendinha, área rio Negro, Pantanal, 06 February 1991, *A. Pott et al. 5853* (CPAP, CGMS); Fazenda Rio Negro, corixo da Ariranha, 02 August 1998, *V.J. Pott & R. Foster 3698* (CPAP, CGMS, COR). Corumbá, Fazenda Ipanema, sub-região da Nhecolândia, 25 June 1985, *V.J. Pott & A. Pott 172* (CPAP); Fazenda Nhumirim, 15 June 1986, *V.J. Pott & A. Rego 260* (CPAP); Pantanal do Abobral, Fazenda Santa Helena, 01 July 1992, *G.A. Damasceno-Júnior & M.A.O. Bezerra 702* (COR); Passo do Lontra, 11 July 1997, *E.S. Guimarães et al. 1* (CGMS); Campo Dora, 01 September 1999, *V.J. Pott & A. Rodrigues 3982* (CGMS); Passo do Lontra, 05 January 1998, *E.S. Guimarães et al. 57* (CGMS, R); Colônia Bracinho, corixo São Domingos, sub-região de Paiaguás, Pantanal, 13 September 2002, *V.J. Pott & A. Pott 5768* (CGMS); Fazenda Santo Antônio do Amolar, oeste da Serra do Amolar, 02 April 2003, *V.J. Pott & M.C.V. Santos 6148* (CGMS); Curva do Leque, 23 June 2023, *M.C.A. Pestana et al. 139* (DDMS); 28 June 2023, *M.A. Farinaccio et al. 1106* (COR); Paraguai-Mirim, Pantanal, sub-region of Paiaguás, Baía close to Rancho do Pescador, 23 September 2024, *M.C.A. Pestana et al. 166* (DDMS, TUR); *ibid*., *M.C.A. Pestana et al. 168* (DDMS, TUR), *M.C.A. Pestana et al. 169* (DDMS, TUR); *ibid*., Rio Taquari river system, 25 September 2024, *M.C.A. Pestana et al. 176* (DDMS, TUR); *ibid*., 27 September 2024, *D. Falck et al. 253* (DDMS, TUR); *ibid*., Baía do Cervo, 27 September 2024, *D. Falck et al. 252* (DDMS, TUR); *ibid*., 28 September 2024, *S. Lehtonen et al. 1161* (DDMS, TUR); *ibid*., 29 September 2024, *D. Falck et al. 256* (DDMS, TUR), *D. Falck et al. 257* (DDMS, TUR). Miranda, Miranda-Abobral, Fazenda Boa Sorte, 23 March 2013, *G. Catian 26* (CGMS). Porto Murtinho, Bacia do Rio Paraguai, 14 December 2010, *G.S.V. Duarte 128* (CGMS, ICN).

3. *Hydrocleys* Richard (1815: 368). **Type:** *Hydrocleys nymphoides* (Willdenow 1806: 821) Buchenau (1868: 9).

Aquatic herbs, perennials, rooted-floating, robust, rhizomatous or stoloniferous, glabrous. **Roots** aseptate. **Leaves** floating, long-petiolate; **petioles** longer than blades, cylindrical in cross section, septate; **leaf blades** membranaceous, orbicular, ovate or linear, base obtuse, rounded or subcordate, apex rounded, obtuse or mucronate-apiculate, margin entire, venation pattern acrodromous; basal lobes present or absent; pellucid marks absent. **Inflorescence** umbellate,

floating; **peduncle** cylindrical in cross section, septate, composed of 1 whorl; vegetative proliferations present or absent; **bracts** lanceolate, apex acute, margin entire, delicate, shorter than pedicels, free at base. **Flowers** bisexual, long-pedicellate; **pedicels** cylindrical in cross section, erect in anthesis and in fruit; **sepals** elliptic or lanceolate, apex acute, not keeled, membranaceous, with or without an evident central vein, adpressed in anthesis and in fruit, free at base; **petals** yellow, sessile, deciduous, erect, broadly-ovate, apex rounded, longer or shorter than sepals, with or without spots at base; stamens 6 or numerous, filaments linear, glabrous; anthers basifixed, sagittate, apex acuminate, longer than filaments; staminodes present or absent; carpels 3–8, arranged in a spiral; style present, short; ovary pluriovulate, placentation laminar. **Fruit** a follicle (Fig. 5L, M), lanceolate, circular in cross section, not winged; surface without ribs or glands; beak present, apical. **Seeds** numerous, more than 50 per fruit, testa foveolate or tenuous-foveolate, with few to many glandular trichomes (Fig. 9G, H).

Hydrocleys is native to tropical and subtropical regions of the Americas, ranging from southeastern Mexico to northeastern Argentina and Central Brazil, and has been introduced to other regions such as the United States and Australia (Haynes & Holm-Nielsen 1992, POWO 2025). All five known species occur in Brazil (Matias & Pestana 2025), two of which are recorded in the Pantanal. Despite its relatively small number of species, *Hydrocleys* holds ecological significance in shallow lentic and lotic freshwater habitats (Haynes & Holm-Nielsen 1998). Also, *Hydrocleys* species are commonly used in aquarium trade and water gardens.

Etymology:—Derived from the Greek *hydro* (water) and *kleis* (key or hook), possibly referring to the plant's aquatic habit and its anchorage to the substrate.

Identification key to the *Hydrocleys* species in the Brazilian Pantanal

1. Flowers with 6-8 carpels; sepals without an evident central vein; petals longer than sepals; seed coat sparsely glandular-pubescent ..... 3.1. ***H. nymphoides***
- Flowers with 3 carpels; sepals with an evident central vein (blackened); petals shorter or in equal size as the sepals; seed coat densely glandular-pubescent ..... 3.2. ***H. parviflora***

3.1 *Hydrocleys nymphoides* (Willd.) Buchenau (1868: 9) ≡ *Stratiotes nymphoides* Willdenow (1806: 821). **Type:**—VENEZUELA. Caracas: "en la laguna de la quebrada de Tacagua près de Catin[?] à l'ouest de Caracas", January 1800, *Bonpland & Humboldt 662* (holotype: B- W [B- W 18477 -010!]). Figs. 5L; 9D, E, G; 10E, F.

Aquatic herbs, 25–55 cm tall, stoloniferous. **Stolons** 10–40 cm long. **Leaves** 15.4–34.2 cm long; **petioles** 9.5–22 × 0.2–0.7 cm, visibly septate; basal sheath 2–5 cm long; **leaf blades** 3.9–7.2 × 3.2–6.5 cm, orbicular or ovate, base rounded or subcordate, apex obtuse or mucronate-apiculate, 5–9 veins, impressed on both surfaces, midrib commonly inflated abaxially, accompanied by numerous aerenchyma lacunae; reticulate veins prominent on the abaxial surface, visible only under intense stereoscopic light; basal lobes sometimes present, when present, 1–2 cm, (2–)3 veins. **Inflorescence** with 1–3 flowers; vegetative proliferation present; **peduncle** 9–35 cm long, septate, septation similar to that of the petioles; **bracts** 2.9–3.2 × 1–1.8 cm, apex acute, 13–18 veins. **Flowers** 6–7 cm in diameter; pedicels 17.8–117 mm long; **sepals** 1.2–2.7 × 0.8–1.2 cm, elliptic, without an evident central vein, 25–30 veins; **petals** 2.2–3.3 × 3.2–4.7 cm, yellow, becoming pale yellow after anthesis, with a yellow spot at base, longer than sepals; stamens (16–)18–25, anthers 2.5–5 × 0.2–0.6 mm; filaments ca. 2 mm long; staminodes 4–5 mm long, 20–25, fusiform, vinaceous; carpels 6–8, ca. 14.8 × 2.5 mm. **Follicles** 20–25 × 3.7–8.6 mm; beak ca. 5 mm long. **Seeds** ca. 1.2 mm long, 50–80 per fruit; testa foveolate, brown, sparsely glandular-pubescent, the trichomes elongated, ca. 0.1 mm long.

Distribution and Habitat:—*Hydrocleys nymphoides* occurs in Argentina, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Guyana, Netherlands Antilles, Panama, Paraguay, Puerto Rico, Suriname, Trinidad and Tobago, and Venezuela (POWO 2025). In Brazil, it is recorded in all regions and nearly all states, except in the North (Acre, Roraima, Rondônia, Tocantins) and the Northeast (Alagoas, Sergipe) regions, and is present in all Brazilian phytogeographic domains (Matias & Pestana 2025). In the Pantanal, it has been recorded in the sub-regions of Abobral, Aquidauana, Nabileque, Nhecolândia, Paraguai, Paiaguás, and Porto Murtinho (Fig. 3D). The species grows in bays, seasonally flooded grasslands, dikes, and roadside temporary ponds, associated with sandy, organic clay, and hydromorphic soils. It often grows with *Nymphaea* spp. and *Pistia stratiotes* Linnaeus (1753: 963).

Phenology:—It was collected with flowers and fruits from February to December.

Etymology:—The specific epithet refers to the similarity of its leaves and habit to those of the genus *Nymphaea*.

Vernacular Names:—Lagartixa, Papoula-d'água (Water Poppy).

FIGURE 11. Alismataceae species found in the Brazilian Pantanal. **A–B:** *Limnocharis flava*. **A:** Habit. **B:** Winged flower pedicel. **C–D:** *L. laforestii*. **C:** Habit. **D:** Floral peduncle. **E–I:** *Sagittaria guayanensis*. **E:** Habit. **F–G:** Leaf blade in adaxial and abaxial view, respectively. **H:** Staminate flower. **I:** Pistillate flower. Photo credits: F.H.B. Silva (**A, C–I**) and D. Falck (**B**).

Notes:—*Hydrocleys nymphoides* is distinguished by its orbicular (Fig. 10G) to ovate floating leaves and pale-yellow flowers with a yellowish spot at the base of the petals (Fig. 10F). It can be confused with *H. parviflora*, a species with which it often co-occurs and shares a rooted-floating growth form. However, they can be distinguished by the elliptic or ovate sepals without a central vein in *H. nymphoides* (*vs*. lanceolate sepals with a distinct central vein in *H. parviflora*), and by the inflorescence with up to 3 flowers per whorl in *H. nymphoides* (*vs*. up to 14 in *H. parviflora*). Additionally, the seeds of *H. nymphoides* are larger and have few long glandular trichomes on the seed coat whereas the seeds of *H. parviflora* are smaller and have many short glandular trichomes.

Selected Specimens:—BRAZIL. **Mato Grosso:** Santo Antônio do Leverger, Baía Chacororé-MT, 25 November 1993, *V.J. Pott & A. Pott 2128* (CPAP). **Mato Grosso do Sul:** Aquidauana, Fazenda Fazendinha, 07 February 1991, *A. Pott et al. 5894* (CPAP); Fazenda Santa Emília, Instituto de Pesquisa do Pantanal—IPPAN, 27 December 2004, *L.C. Costa & U.M. Resende 264* (DDMS); Fazenda Rio Negro, 15 August 2005, *V.J. Pott & A. Pott 7890* (CPAP, CGMS); Fazenda São Francisco, 14 September 2004, *A. Pott 11820* (CGMS, IAC). Corumbá, Fazenda Ipanema, 02 April 1984, *A. Pott 1471* (CPAP); Fazenda Nhumirim, 03 October 1984, *G.L. Webster & A. Pott 25355* (CPAP, UEC); *ibid*., 26 June 1985, *A. Pott & V.J. Pott 1947* (CPAP); *ibid*., 10 June 1986, *A. Rego 329* (COR); *ibid*., baía do Oito, 10 August 1986, *A. Rego 799* (COR); *ibid*., baía do Arame, 09 September 1988, *V.J. Pott et al. 557* (CPAP); *ibid*., baía da Sanguessuga, 27 October 1988, *V.J. Pott et al. 727* (CPAP, COR); Fazenda Leque (Murundu Alegre), brejão do búfalo, 04 April 1990, *V.J. Pott & N.C. Bueno 1337* (CPAP); Nhecolândia, 02 July 1990, *T.S.M. Grandi 2783* (BHCB); Fazenda Águaçu, estrada inacabada para Forte Coimbra, Pantanal, 07 May 1992, *V.J. Pott et al. 1788* (CPAP); Fazenda Três Alzira, 27 May 1992, *V.J. Pott et al. 1683* (CPAP); Estrada do Passo do Lontra, entre Fazenda Boa Sorte e Fazenda Baú, estrada MS-164, 12 August 1992, *V.J. Pott et al. 1942* (CPAP); Fazenda Cáceres, baía da Passagem, sub-região da Nhecolândia, Pantanal, 08 September 1998, *S.M. Salis et al. 1084* (CPAP); Campo Dora, 01 September 1999, *V.J. Pott & A. Rodrigues 3978* (CPAP); Porto Rolon, margem do Rio Taquari, sub-região de Paiaguás, 13 September 2002, *V.J. Pott & A. Pott 5776* (CPAP); Fazenda Redenção, retiro Carandá Preto, 08 September 2006, *V.J. Pott & A. Pott 8879* (CPAP, CGMS); Baía 33 da Fazenda Nhumirim, 08 December 2008, *R.B. Rodrigues et al. 80* (CGMS); Assentamento Taquaral, 11 November 2009, *A.M. Almeida et al. 42* (CPAP); Pantanal, sub-região do Paraguai, 02 March 2023, *D.G. Franco et al. 98* (CGMS); Paraguai-Mirim, Pantanal, sub-region of Paiaguás, 24 September 2024, *M.C.A. Pestana et al. 174* (DDMS, TUR); *ibid*., Fazenda Santa Teresa, 29 September 2024, *D. Falck et al. 258* (DDMS, TUR). Ladário, Assentamento 72, beira de estrada, 17 April 2012, *P.P. Oliveira et al. 115* (COR). Miranda, Passo do Lontra, Pantanal, 13 October 1972, *G. Hatschbach & P. Schere 30443* (CPAP). Porto Murtinho, Estrada, 3 km do aterro (dique) de Porto Murtinho, 04 April 2001, *V.J. Pott et al. 4512* (CPAP, CGMS); Lagoa a 5 km da Fazenda Anahí, 27 November 2024, *L. Daviny et al. 1* (CGMS); Side road of Rodovia Vital Brasil (267), Pantanal of Porto Murtinho, 17 September 2024, *M.C.A. Pestana et al. 156* (DDMS, TUR).

3.2 *Hydrocleys parviflora* Seubert in Martius (1847: 117). **Type:**—BRAZIL. Bahia: probably Juazeiro, s.d., *Martius s.n.* (holotype: M [M0242660!]). Figs. 5M; 9F–H; 10H, I.

Aquatic herbs, 20–30 cm tall, rhizomatous. **Rhizome** to 1.5 cm in diameter. **Leaves** 6.7–24.8 cm long; **petioles** 3–15.9 × 0.1–0.2 cm; basal sheath 1.5–3.1 cm long; **leaf blades** 2.2–5.8 × 1–2.5 cm, elliptic, base rounded or slightly cuneate, apex acute or obtuse, 5–7 veins, impressed on both surfaces, midrib not inflated abaxially; reticulate veins prominent on the adaxial surface, easily visible; basal lobes absent. **Inflorescence** with 4–14 flowers; vegetative proliferation absent; **peduncle** 22–54 cm long; **bracts** 1.7–2.2 × 0.4–0.8 cm, apex acute, 10–16 veins. **Flowers** 1.8–2.1 cm in diameter; pedicels 11.6–38.7 mm long; **sepals** 1.2–1.5 × 0.2–0.4 cm, lanceolate, with an evident blackened central vein, 19–26 veins; **petals** 1–1.5 × 0.5–1.3 cm, yellow, without pots at base, shorter or as long as the sepals; staminodes absent; stamens (5–)6, anthers 1.7–2 × 0.1–0.3 mm; filaments ca. 0.9 mm long; carpels 3, ca. 8 × 3 mm. **Follicles** 10–13 × 2.8–3.3 mm; beak ca. 0.5 mm long. **Seeds** ca. 0.8 mm long, more than 100 per fruit; testa smooth, yellowish-brown, densely glandular-pubescent, the trichomes small, ca. 0.01 mm long.

Distribution and Habitat:—*Hydrocleys parviflora* occurs in Bolivia, Brazil, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Venezuela (POWO 2025). In Brazil, it has a distribution in the Northeast (Alagoas, Bahia, Paraíba, Pernambuco, Sergipe), Central-West (Mato Grosso do Sul, Mato Grosso), and Southeast (Minas Gerais, Rio de Janeiro), and occurs in the Atlantic Forest, Caatinga, Cerrado, and Pantanal (Matias & Pestana 2025). In the Pantanal, the species is found in the sub-regions of Abobral, Aquidauana, Barão de Melgaço, Cáceres, Miranda, Nabileque, Nhecolândia, Paiaguás, and Poconé (Fig. 3D). It grows in seasonally flooded grasslands, lagoons, shallow depressions 20–60 cm deep, and roadside artificial lakes, associated with sandy or clayey soils rich in organic matter. It is usually found sympatrically with *Sagittaria guayanensis* Kunth in Humbolt *et al*. (1816: 250), *S. rhombifolia*, *Nymphaea* spp., and some submerged species of *Utricularia* spp.

Phenology:—The species was recorded with flowers and fruits from February to December.

Etymology:—The epithet *parviflora* is derived from the Latin *parvus* (small) and *florum* (flower), in reference to the species' small flowers.

Vernacular Names:—Camalotinho, Lagartixa (both in the Pantanal—Portuguese).

Notes:—*Hydrocleys parviflora* is distinguished by its elliptic leaves, completely yellow flowers lacking a spot at the base of the petals (detail in Fig. 10H–I), and lanceolate sepals with a distinct central vein, considered the most

diagnostic feature of the species (Fig. 9F). It may be confused with *H. nymphoides* but differs by the characteristics provided in subsection 3.1. An additional diagnostic trait includes petal shorter than sepal or equal in length in *H. parviflora* (*vs.* petals longer than sepals in *H. nymphoides*) (Fig. 10I).

Specimens Examined:—BRAZIL. **Mato Grosso:** Barão de Melgaço, RPPN Sesc Pantanal, 16 July 2003, *C.P. Bove et al. 1135* (R). Cáceres, Rodovia Transpantaneira, km 13, 09 April 1981, *L.J. Silva 227* (UFMT); *ibid*., km 13, 26 March 1982, *L.J. Silva 428* (UFMT); *ibid*., km 17, 18 May 1982, *L.J. Silva 446* (UFMT); Fazenda Santo Antônio, Estrada Particular da BR-364, Fazenda Cáceres Florestal, Pantanal, 19 March 1996, *A. Pott et al. 7720* (CPAP). Poconé, Fazenda Ipiranga, 09 April 1992, *A.L. Prado & L.M. Rodrigues 3593* (UEC); Estrada de Piraputanga, Córrego Rabo de Bugio, Pantanal, 15 April 1993, *V.J. Pott et al. 1898* (CPAP); Fazenda Ipiranga, Sub-região de Poconé, Pantanal—km 11 na Transpantaneira, Porteira de Entrada, 27 February 1996, *V.J. Pott et al. 2982* (CPAP). Santo Antônio do Leverger, 1 March 1996, *V.J. Pott et al. 3056* (CPAP). **Mato Grosso do Sul:** Aquidauana, Road to Santa Isabel from Jofre, 13 June 1979, *G.T. Prance 26286* (NY); Fazenda Fazendinha, Sub-região de Aquidauana, Pantanal—Invernadinha, Área do Rio Negro, June 1991, *W.W. Thomas 6* (CPAP); *ibid*., Invernada Fartura, Baixada do Cocho, Sub-região de Aquidauana, Pantanal, 18 May 1991, *S.M. Salis et al. 390* (CPAP); *ibid*., Pantanal—Invernada São Bento, 14 November 1992, *S.M. Salis et al. 748* (CPAP); *ibid*., 14 November 1992, *S.M. Salis et al. 748* (CGMS); 39 km do Rio Taboco—Estrada MS-419, 31 July 1992, *V.J. Pott et al. 1703* (CGMS, CPAP). Corumbá, Beira da Estrada MS-325, 200 m da BR-262, próximo ao Morro do Azeite, Sub-região do Nabileque, Pantanal, próximo ao Ponto 84, 30 July 1987, *A. Pott et al. 3154* (CPAP); Pantanal da Nhecolândia, Fazenda Nhumirim, Baía do Arame, 09 September 1988, *N. Bueno et al. 557* (COR); Fazenda Anhuma, Aterro, Sub-região da Nhecolândia, Pantanal, 05 December 1988, *A. Pott 4541* (CPAP); 4,6 km Oeste da BR-262, Estrada para Estação Ferroviária Albuquerque, Periferia do Pantanal, 28 February 1993, *V.J. Pott et al. 1848* (CPAP); Estrada do Abobral, MS-184, Pantanal, 28 February 1995, *V.J. Pott & A. Pott 2545* (CPAP); Abobral, Pantanal, 27 March 1995, *C.P.A. Prado 149* (CPAP); Fazenda São Bento, 19 May 1995, *E. Scremin-Dias et al. 216* (CGMS); Estrada da Laguna, 11 July 1995, *E. Scremin-Dias 243* (CGMS); Fazenda Campo Dora, Sub-região da Nhecolândia, Pantanal—Riozinho, próximo ao Capão do Mamão, 24 February 1999, *V.J. Pott et al. 3895* (CPAP); Fazenda Boa Sorte—Estrada Parque, Sub-região Abobral, 15 December 2014, *G. Catian 164* (CGMS); Fazenda São João, Sub-região do Abobral, Pantanal—Vazante próximo à entrada da sede, 27 June 2003, *V.J. Pott et al. 6396* (CGMS, CPAP); Fazenda São Bento, 28 June 2011, *V.C. Soares et al. 29* (CGMS). Coxim, Fazenda Santa Rosa, Sub-região do Paiaguás, Pantanal—junto à sede, 28 June 1992, *A. Pott & A.A. Franco 6189* (CPAP). Miranda, Estância Caiman, Sub-região de Miranda, Pantanal, 04 April 1998, *V.J. Pott et al. 3319* (CPAP).

4. *Limnocharis* Bonpland (1807: 116). **Type:** *Limnocharis flava* (Linnaeus 1753: 343) Buchenau (1868: 13).

Aquatic herbs, perennials, emergent, robust, glabrous, rhizomatous. **Roots** aseptate. **Leaves** emergent, long-petiolate; **petioles** longer than blades, triangular in cross section, glabrous, aseptate, winged or not; **leaf blades** chartaceous, ovate or linear, base obtuse or subcordate, apex acute, mucronate-apiculate or rounded, glabrous on both surfaces, margins entire, venation pattern acrodromous; basal lobes absent; pellucid marks absent. **Inflorescence** umbellate, emergent; vegetative proliferation absent; **peduncle** septate or aseptate, not winged, longer or shorter than petioles; **bracts** lanceolate, apex acute or obtuse, margin entire, delicate, shorter than pedicels, free at base. **Flowers** bisexual, long-pedicellate; **pedicels** triangular in cross section, erect in anthesis and in fruit, winged or not; **sepals** ovate, apex acute, not keeled, membranaceous, adpressed in anthesis and in fruit, slightly connate at base; **petals** yellow or pale yellow, broadly-ovate, sessile, erect, deciduous, apex rounded, longer than sepals, without spots at base, deciduous, sessile; stamens numerous, filaments linear, glabrous; anthers basifixed, linear, apex obtuse, shorter than filaments; staminodes 8–15, filiform, hyaline; carpels 12–20, flattened laterally, style absent; ovary pluriovulate, placentation laminar. **Fruit** a follicle (Fig. 5N, O), semicircular, not winged; surface without ribs or glands; beak absent. **Seeds** numerous, more than 30 per fruit, testa smooth, with horizontal wings (Fig. 9I, J).

Limnocharis consist of two species (*L. flava* and *L. laforestii*) with native distribution in the neotropics, from the Gulf of Mexico to Paraguay (POWO 2025). It has also become naturalized in Southeast Asia and tropical Africa, particularly *L. flava*, which has been widely introduced for use as food and ornamental plant (Haynes & Holm-Nielsen 1992). In Brazil, both species are present and occur in the Pantanal. The flowers and young buds of *L. flava* are occasionally consumed in non-conventional diets (Knupp & Lorenzi 2014), and both species are also cultivated in decorative aquatic settings (Pott & Pott 2000).

Etymology:—The genus name is derived from the Greek *limnos* (lake, marsh) and *charis* (grace, beauty) that means "graceful of the lake".

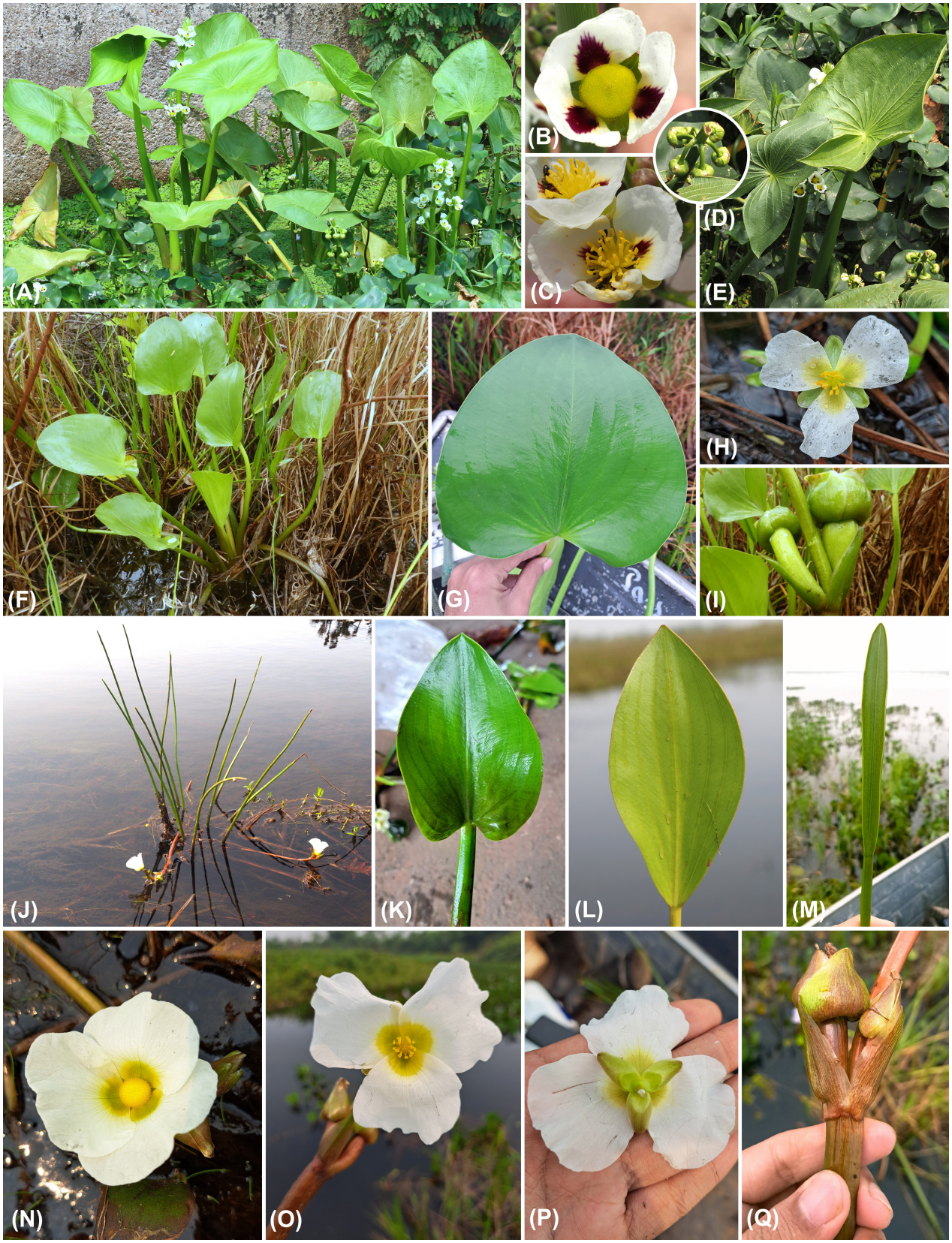

FIGURE 12. Alismataceae species found in the Brazilian Pantanal. **A–E:** *Sagittaria montevidensis*. **A:** Habit. **B:** Pistillate flower. **C:** Staminate flower. **D:** Reflexed pistillate pedicels in detail. **E:** Sagittate leaf blade. **F–I:** *S. planitiana*. **F:** Habit. **G:** Leaf blade. **H:** Staminate flower. **I:** Pistillate floral bud with strongly thick pedicels. **J–Q:** *S. rhombifolia*. **J:** Habit (Morphotype with linear leaves). **K–M:** Morphological variation of the leaf blade. **K:** Ovate with subcordate base (submerged plant). **L:** Ovate. **M:** Linear. **N:** Pistillate flower. **O–P:** Staminate flower in front and rear views, respectively. **Q:** Bracts and floral bud. Photo credits: S. Lehtonen (**A, D–F**), D. Falck (**B, C, I, J**), and M.C.A. Pestana (**G, H, K–Q**).

Identification key to the *Limnocharis* species in the Brazilian Pantanal

1. Plants 25–35 cm tall; petioles distinctly winged; inflorescence with 5–16 flowers, pedicels winged; peduncle usually longer, or sometimes as long as the petioles; seeds ≥ 1 mm long.....4.1. ***L. flava***
- Plants 15–30 cm tall; petioles not winged; inflorescence with 3–6 flowers, pedicels not winged, peduncle shorter than the petioles; seeds ≤ 0.8 mm long.....4.2. ***L. laforestii***

4.1 *Limnocharis flava* (L.) Buchenau (1868: 2) ≡ *Alisma flavum* Linnaeus (1753: 343). **Lectotype:**—Illustration in Plumier, Plantarum Americanum t. 115! (designated by Howard 1979: 19). Figs. 5N; 9I; 14A, B.

Aquatic herbs, 25–35 cm tall. **Rhizome** to 2.8 cm in diameter. **Leaves** 20–57 cm long; **petioles** 8–25 × 0.7–1.4 cm, winged; basal sheath 6.9–13 cm long; **leaf blades** 5.5–19 × 4.9–13 cm, ovate, rarely lanceolate, base attenuate or subcordate, apex mucronate-apiculate or rounded; venation pattern acrodromous, 10–14 veins, impressed on both surfaces, reticulate veins prominent, easily visible. **Inflorescence** with 5–16 flowers; **peduncle** 15–27 cm long, longer than petioles; **bracts** 0.9–2.1 × 0.2–0.6 cm, lanceolate, apex obtuse, 8–12 veins. **Flowers** 1.8–2.2 cm in diameter; pedicels 20–50 mm long, winged; **sepals** 0.8–1.5 × 0.2–1.8 cm, 15–25 veins; **petals** 2.3–2.8 × 1.9–2.5 cm, yellow; staminodes 10–15, 5–8 mm long; stamens 20–30, filaments 4–5 mm long, anthers 1.5–2 mm; carpels 14–20, ca. 8 × 4 mm. **Follicles** 8–13.2 × 6–7.7 mm. **Seeds** ca. 1.3 mm, 30–40 per fruit, 18–25 horizontal wings.

Distribution and Habitat:—*Limnocharis flava* is widely distributed in the neotropical region, where it is native to Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, and Venezuela (POWO 2025). In Brazil, the species is recorded in the North (except Roraima), Northeast (except Alagoas and Sergipe), and Central-West (except the Distrito Federal), as well as in all states of the Southeast and South regions, and across all phytogeographic domains (Matias & Pestana 2025). In the Pantanal, it has been recorded in the sub-regions of Abobral, Barão de Melgaço, Miranda, Paraguai, Poconé, and Porto Murtinho (Fig. 3E). It is found in bays, seasonally flooded grasslands, temporary ponds, and along riverbanks, associated with moist sandy soils.

Phenology:—Flowers and fruits from February to December, with peak in November.

Etymology:—The epithet *flava* is derived from Latin and means "yellow" in reference to the petals' color.

Vernacular Names:—Camalote, couve-d'água, mureré (Portuguese).

Notes:—*Limnocharis flava* is morphologically similar to *L. laforestii* but they can be distinguished by predominantly ovate leaves (*vs.* elliptic in *L. laforestii*), petioles shorter than the floral peduncle or equal in length (*vs.* longer in *L. laforestii*), winged floral pedicels (*vs.* not winged in *L. laforestii*), and broad fruits with seeds longer than 1 mm (*vs.* narrow fruits with seeds shorter than 1 mm in *L. laforestii*).

Specimens Examined:—BRAZIL. **Mato Grosso:** Barão de Melgaço, posto Santo André, estrada do Bodoque, 1 February 2002, *M.C. Souza et al. 2804* (HUEM). Santo Antônio do Leverger, 1 March 1996, *V.J. Pott et al. 3056* (CPAP). **Mato Grosso do Sul:** Corumbá, Rodovia federal BR-262, Km 747, 20 September 1987, *S.S. Palmeira 2* (COR); Jacadigo, 5 August 1986, *A. Rego 721* (COR); Estrada inacabada a Forte Coimbra, a 2.5 km da BR-262, Lagoa do Jacadigo, 1 May 1989, *A. Pott et al. 4736* (CGMS, CPAP); Fazenda Três Alziras, 7 May 1992, *V.J. Pott et al. 1781* (CPAP); Planície do rio Taquari—baixo, 28 May 1993, *S. Hamilton et al. 23* (CPAP); Margem da Estrada-Parque, 10 June 1993, *U.M. Resende 852* (CGMS); Lagoa do Jacadigo, próximo à BR-262, próximo ao Morro São Domingos, Pantanal, 28 February 1995, *V.J. Pott et al. 2537* (CGMS, CPAP); Baía do Jacadigo, 5 October 2002, *W.R.F.M. Navarro 6* (COR); Fazenda Arara Azul, Estrada Parque, 15 December 2014, *G. Catian 180* (CGMS); *ibid*., 15 December 2014, *G. Catian 133* (CGMS); Fazenda São Miguel, campo inundável, 1 December 2013, *E.B. Souza 231* (CGMS); Codrasa, 27 November 2004, *A.F. Souza-Júnior & C.S. Siqueira 32* (COR); Estrada Parque em direção a Corumbá, a 17 km após o rio Abobral, 27 June 2012, *J. Lovo et al. 351* (SPF). Miranda, Estância Caiman, sub-região de Miranda, Pantanal, 4 April 1998, *V.J. Pott et al. 3320* (CPAP). Porto Murtinho, 22 km de Porto Murtinho, BR-267, 18 February 1989, *A. Pott et al. 4642* (CPAP); 21 km Leste de Porto Murtinho na BR-267, fazenda Fronteira, 2 October 1995, *V.J. Pott et al. 2850* (CPAP); 15 km da cidade sentido Leste, fazenda Santa Terezinha, estrada Bocaiuval para Tereré, 27 March 1996, *V.J. Pott et al. 3091* (COR, CPAP); BR-267, 20 km de Porto Murtinho, 4 April 2001, *V.J. Pott et al. 4491* (CGMS, CPAP); Small lake south of Rodovia Vital Brasil (267) opposite side from Restaurant Vicari Caminho dos Andes, 17 September 2024, *M.C.A. Pestana et al. 154* (DDMS, TUR); Fazenda Anahí, 25 November 2024, *S.J.B. Silva et al. 15* (CGMS); Fazenda Anahi—Reserva ambiental—Beira de estrada, 26 November 2024, *A.S. Campos et al. 9* (CGMS), *A.S. Campos et al. 14* (CGMS).

4.2 *Limnocharis laforestii* Duchassaing ex Grisebach (1858: 11). **Type:**—PANAMA. s.l., s.d., *Duchassaing s.n.* (lectotype: GOET [GOET000493!], designated by Novelo 1987: 93); isolectotypes: GOET [GOET000494!], P [P00729840!]). Figs. 5O; 9J, L; 10C, D.

Aquatic herbs, 15–30 cm tall. **Rhizome** to 1.5 cm in diameter. **Leaves** 14–29 cm long; **petioles** 5.1–15 × 0.1–0.3 cm, not winged; basal sheath 2.2–4 cm long; **leaf blades** 7.3–10.6 × 0.5–2.1 cm, elliptic, base attenuate, apex acute or mucronate-apiculate; venation pattern acrodromous, 6–8 veins, impressed on both surfaces, reticulate veins prominent, easily visible. **Inflorescence** with 3–6 flowers; **peduncle** 4.8–6.6 cm long, shorter than petioles; **bracts** 1–1.2 × 0.2–0.9 cm, apex acute, 6–10 veins. **Flowers** 2.2 cm in diameter; pedicels 18–40 mm, not winged; **sepals** 0.8–1 × 0.4–0.7 cm, 18–29 veins; **petals** 1.4–1.6 × 0.5–0.9 cm, pale yellow; staminodes 8–12, 5–8 mm; stamens 15–20, filaments 4.4–4.7 mm, anthers 1.3–1.8 × 1–1.2 mm. **Carpels** 12–16, ca. 5 × 3 mm. **Follicles** 8.2–12.6 × 2.7–3.4 mm. **Seeds** ca. 0.8 mm long, 25–45 per fruit, 10–14 horizontal wings.

Distribution and Habitat:—*Limnocharis laforestii* is widely distributed in the neotropical region, occurring in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, and Venezuela (POWO 2025).

In Brazil, it is recorded in the North (Acre, Amapá, Pará), Northeast (Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí), and Central-West (Mato Grosso do Sul, Mato Grosso) regions, occurring in the Amazon Forest, Caatinga, Cerrado, and Pantanal phytogeographic domains (Matias & Pestana 2025). In the Pantanal, the species is distributed in the sub-regions of Abobral, Paraguai, Nabileque, and Porto Murtinho (Fig. 3E). It grows in flooded grasslands, river margins, shallow ponds, and seasonally flooded areas, typically in fertile clay soils.

Phenology:—It was recorded with flowers and fruits from February to November.

Etymology:—The epithet *laforestii* honors John James Laforest Audubon (1785–1851).

Vernacular Name:—Camalote (Portuguese).

Notes:—*Limnocharis laforestii* is morphologically similar to *L. flava*, as discussed in subsection 4.2. Sousa *et al*. (2015) raised doubts about the species-level distinction between these two taxa. Nevertheless, future studies integrating molecular data will be essential to more rigorously assess the boundaries between these species.

Specimens Examined:—BRAZIL. **Mato Grosso:** Barão de Melgaço, RPPN Sesc Pantanal, 30 May 2015, *G. Martinelli et al. 18701* (CGMS, R, US). Cáceres, Porto Esperidião, 23 November 1984, *M. Emmerich et al. 5265* (R); Fazenda Santo Antônio, estrada particular da BR-364, para a fazenda Cáceres Florestal, Pantanal, 19 March 1996, *A. Pott et al. 7718* (CPAP). Poconé, Fazenda Ipiranga, sub-região de Poconé, Pantanal—km 11 na Transpantaneira—porteira de entrada, 27 February 1996, *V.J. Pott et al. 2981* (CPAP); Lago na entrada da Fazenda Pixaim, Rodovia Transpantaneira, entre Poconé e Porto Jofre, 22 July 1997, *M.C.E. Amaral et. al*. 97/98 (UEC); February 1999, *M.C.E. Amaral et. al. s.n* (UEC 116125). **Mato Grosso do Sul:** Corumbá, Estrada da Manga, Estrada Parque, rodovia estadual MS-228, 2 August 1987, *R.A. Mauro et al. 22* (COR); *ibid*., 2 August 1987, *A. Lescano 9* (COR); Fazenda Acurizal—invernada Cerca Nova, 1 September 1987, *A. Pott et al. 3306* (CPAP); Fazenda Acurizal—invernada Jacú, 22 October 1987, *A. Pott et al. 3690* (CPAP); Estrada (aterro) do Leque, 1 km, próximo à MS-184, sub-região do Abobral, Pantanal, 3 April 1990, *V.J. Pott & N.C. Bueno 1328* (CPAP); Estrada para Forte Coimbra, MS-454, a 24 km da BR-262, lado esquerdo, Pantanal, 27 May 1992, *V.J. Pott et al. 1688* (CGMS); Fazenda Três Alziras, sub-região do Nabileque, Pantanal, estrada MS-454, a 27 km da BR-262, Jacadigo, 27 May 1992, *V.J. Pott et al. 1682* (CPAP); 5,6 km Oeste da BR-262 na estrada para estação ferroviária Albuquerque, a 0,5 km Sul do Pantanal, 28 February 1993, *V.J. Pott et al. 1850* (CPAP); Pantanal do Abobral, Fazenda Santa Helena, 20 June 1993, *G.A. Damasceno-Júnior et al. 646* (COR); Estrada da Manga, Estrada Parque, rodovia estadual MS-228, 15 February 1999, *M. Moraes et al. 20* (COR); Fazenda São Bento, 28 June 2011, *V.C. Soares et al. 30* (CGMS). Miranda, Margem do rio Vermelho, Pantanal do Miranda, 7 September 1998, *S.M. Salis et al. 1066* (CPAP); Pantanal do Miranda, 23 June 2023, *M.C.A. Pestana et al. 145* (DDMS). Porto Murtinho, 26 October 2004, *V.J. Pott & A. Pott 7101* (CPAP).

5. *Sagittaria* Linnaeus (1753: 993). **Type:** *Sagittaria sagittifolia* Linnaeus (1753: 993).

Aquatic herbs, perennials, amphibious of marshy habitats, emergent, rooted-floating or rooted-submerged, monoecious, rarely dioecious, robust, glabrous or pubescent with simple trichomes, rhizomatous. **Roots** septate. **Leaves** emergent or floating, long-petiolate; **petioles** longer than leaf blades, cylindrical in cross section, glabrous or pubescent, septate or aseptate; basal sheath septate; **leaf blades** chartaceous or membranaceous, lanceolate, linear, ovate, broadly-ovate, sagittate, or hastate, base attenuate, cuneate, subcordate, truncate or sagittate, apex acuminate, acute or rounded, glabrous on both surfaces, margin entire; venation pattern acrodromous or campylodromous; basal

lobes present or absent, when present with acuminate or rounded apex; pellucid marks absent. **Inflorescence** racemose or rarely paniculate, emergent or floating, erect or decumbent, lax (congested when immature); **peduncle** cylindrical in cross section, septate or aseptate, not winged; rachis cylindrical, not winged, glabrous or pubescent, composed of 2–10 whorls; vegetative proliferation absent; **bracts** lanceolate, apex acute, margin entire, membranaceous or chartaceous, robust, free or connate at base. **Flowers** unisexual; staminate flowers in the upper whorls, with long and thin pedicels, erect, with pistillodes; carpellate flowers in the lower whorls, with shorter and thickened pedicels (commonly after anthesis), erect or reflexed when in fruit; ring of staminodes surrounding the carpels present or absent; pedicels cylindrical in cross section, glabrous or pubescent; **sepals** lanceolate or oblong, apex acute or rounded, reflexed in staminate flowers, coriaceous, vertically keeled, glabrous or with papillae, free or slightly connate at base, adpressed in carpellate flowers (completely surrounding the fruit aggregate), ribbed longitudinally; **petals** white, sessile or clawed, persistent, erect, obovate, ovate or broadly-ovate, apex rounded, base with yellow or vinaceous spots; stamens 12–28, filaments dilated at base, glabrous or pubescent; anthers basifixed, elliptic, apex acute, shorter than filaments; carpels numerous, arranged in a spiral, style present, short; ovary with one ovule per carpel, placentation basal. **Fruit** achene (Fig. 5P–S), obovate or oblanceolate; flattened in cross section, winged, dorsal and lateral wings conspicuous; surface ribbed or echinate, glands between the ribs present or absent; beak present, lateral or horizontal. **Seeds** 1, testa smooth or tenuous-reticulate.

Sagittaria is the most species-rich genus within Alismataceae, currently comprising approximately 40 species with a cosmopolitan distribution, especially in North America (Les & Tippery 2013, POWO 2025). In Brazil, four of the six species occur in the Pantanal. The genus includes economically important species cultivated for ornamental use in aquariums and aquatic gardens, and some are commercially produced for use in phytoremediation systems due to their capacity to absorb heavy metals and excess nutrients (Pott & Pott 2000, Gomez *et al*. 2020).

Etymology:—The generic epithet is derived from the Latin *sagitta* (arrow), in reference to the typical sagittate shape of the leaf blades.

Identification key to the *Sagittaria* species in the Brazilian Pantanal

1. Leaves floating (never emergent or submerged in mature plants); achenes with an echinate surface ..... 5.1. ***S. guayanensis***
- Leaves emergent, rarely submerged (never floating); achenes with a 1–2-ribbed surface **2**
2. Petioles aseptate; leaf blades with venation pattern campylodromous, basal lobes present with acuminate apex; inflorescence erect; pedicel reflexed in fruit; filaments pubescent ..... 5.2. ***S. montevidensis***
- Petioles septate; blades with venation pattern acrodromous, basal lobes absent or reduced; inflorescence decumbent; pedicel erect in fruit; filaments glabrous **3**
3. Inflorescence rachis with 2–5 whorls; carpellate pedicels strongly thickened in fruit; achenes 7–7.5 mm long; seed testa tenuous-reticulate ..... 5.3. ***S. planitiana***
- Inflorescence rachis with 6–14 whorls; carpellate pedicels slightly thickened in fruit; achenes 4.2–5.3 mm long; seed testa smooth ..... 5.4. ***S. rhombifolia***

5.1 *Sagittaria guayanensis* Kunth in Humbolt *et al*. (1816: 250). **Type:**—VENEZUELA. Bolívar: "Crescit in paludibus Provinciae Guayanensis propter El Trapiche de Don Felix Farreras, et urbem Angosturae" [= Ciudad Bolívar], s.d., *Bonpland & Humboldt 1079* (lectotype: B- W [B- W 17559- 01 0!], designated by Lot & Novelo 1994: 6). Figs. 5P; 9L; 11F–I.

Aquatic herbs, rooted-floating, 10–20 cm tall, rhizomatous, pubescent, trichomes to 1 mm long, erect, hyaline. **Rhizome** to 2.7 cm in diameter. **Leaves** 10.9–18.4 cm long, floating; **petioles** 5.6–8.4 × 0.3–0.9 cm, septate, pubescent; **basal sheath** 0.5–2 cm long, glabrous; **leaf blades** 4.8–8 cm × 3.2–5.2 cm, membranaceous, ovate or sagittate, base sagittate, apex acute or rounded, margin entire, campylodromous venation pattern, 8–13 veins, impressed on both surfaces, reticulate veins prominent on the adaxial surface, easily visible, blackened; basal lobes present, with acuminate or obtuse apex, 1.4–2.6 × 1–1.7 cm, 4–7 veins. **Inflorescence** racemose, floating; **peduncle** 8.5–15 cm long; rachis 3–4.2 cm long, cylindrical, densely pubescent, composed of 2–4 whorls, each with 1–7 flowers, internodes between whorls 1–1.5 cm long; **staminate bracts** 0.4–0.8 × 0.2–0.4 cm, lanceolate, apex acute, membranaceous, 13–28 veins, shorter than pedicels, free at base; **carpellate bracts** 1.8–2.5 × 0.5–0.7 cm, lanceolate, apex acute, membranaceous, 5–11 veins, shorter than pedicels, slightly connate at base. **Staminate flowers** 1.3–2.5 cm in diameter; pedicels 18–30 mm long, pubescent; **sepals** 1.1–1.5 × 0.2–0.5 cm, oblong, apex rounded, 5–12 veins, glabrous, slightly connate at base; **petals** 0.9–1.3 × 0.1–0.6 cm, ovate, apex rounded, sessile, with a vinaceous spot at base; stamens 12, anthers 1.4 × 0.3 mm, filaments ca. 2.3 mm long, pubescent, simple trichomes. **Carpellate flowers** 2–2.4 cm in diameter; **pedicels** 8.2–18 × 0.2–0.3 mm, erect in anthesis and in fruit, pubescent; **sepals** 1–1.6 × 0.5–1 cm, ovate, apex acute, 20–28

veins, papillose, free at base; **petals** 0.7–1.6 × 0.5–1 cm, ovate, apex rounded, sessile, with a yellow spot at base; ring of staminodes present; carpels ca. 3 × 2 mm. **Achenes** 1.8–2.2 × 0.5–1.3 mm, obovate, surface echinate; ribs or glands absent; wings inconspicuous; beak lateral, ca. 0.2 mm long. **Seeds** ca. 0.6 mm long, testa smooth, light brown.

Distribution and Habitat:—*Sagittaria guayanensis s. str.* has a New World distribution (Ito *et al*. 2020), from southeastern Mexico to southern Paraguay (POWO 2025). The species is widely distributed in Brazil, occurring in all regions, states and phytogeographic domains (Matias & Pestana 2025). In the Pantanal, it occurs in all sub-regions except Aquidauana (Fig. 3E). The species inhabits stagnant-water lagoons with shallow to moderately deep water, where leaves and inflorescences float on the surface. During the dry season in the Pantanal, it persists as a seed bank in moist substrates and regenerates with the return of seasonal floods (Pott & Pott 2000). It is commonly found in association with other floating species, such as *Hydrocleys parviflora*, *Nymphaea* spp., and *Salvinia* spp.

Phenology:—Collected with flowers and fruits throughout the year, with peaks observed in April and May.

Etymology:—The spelling of the specific epithet has historically generated confusion. The original and correct form *guayanensis* appears in the protologue (Kunth 1816), but an orthographic variant *guyanensis* was introduced by Buchenau (1903) and subsequently adopted by some authors (e.g. Rataj 1972, 1978). A proposal to conserve the variant spelling was submitted by Gituru *et al*. (2002), but was rejected. The epithet *guayanensis* refers to the historical Province of Guayana (present-day Venezuela), as originally published by Kunth (1816).

Vernacular Names:—Golfe (northeastern Brazil), lagartixa (Pantanal).

Notes:—*Sagittaria guayanensis* is easily distinguished from other species of the genus occurring in the Pantanal by its floating leaves (*vs.* emergent) and achenes with echinate surfaces (*vs.* 1–2-ribbed surfaces). In the study area, *S. guayanensis* displays polymorphism in response to water depth. In drier environments, individuals develop smaller, thinner leaves, whereas in deeper water leaves are larger and more rigid.

Selected Specimens:—BRAZIL. **Mato Grosso:** Cáceres, BR-174, 17 km de Cáceres, 06 May 1995, *V.J. Pott et al. 2649* (CPAP); Porto Limão, fronteira BR-BO, 01 February 2006, *M.A. Carniello 1112* (HRCB). Poconé, Rodovia Transpantaneira, Km 13, margem esquerda, 09 April 1981, *C.J. Silva 226* (UFMT); Base Norte do CPAP, 4 km NE de Poconé, 13 February 1990, *A. Pott 5521* (CPAP); Pirizal, 01 April 2017, *F.H. Barbosa da Silva 898* (UFMT); *ibid*., próximo à fazenda Nossa Senhora Aparecida, 01 April 2017, *F.H. Barbosa da Silva 803* (UFMT); Rodovia Porto Cercado, cerca de 8 km após a ponte do Rio Bento Gomes, 01 April 2017, *F.H. Barbosa da Silva 299* (UFMT). Santo Antônio do Leverger, Próximo ao Morro de Santo Antônio do Leverger, 16 April 1982, *L. Amorim Neto 14* (UFMT); Km 2,5 na estrada MT-040/361 de Santo Antônio do Leverger a Barão de Melgaço, 01 March 1996, *V.J. Pott et al. 3053* (CPAP). Mato Grosso do Sul: Aquidauana, Fazenda Fazendinha, 12 April 1991, *S.M. Salis et al. 429* (CPAP); *ibid*., 20 July 1992, *S.M. Salis et al. 675* (CPAP); Fazenda Fazendinha, 12 November 1992, *S.M. Salis et al. 753* (CPAP). Corumbá, Fazenda Nhumirim, 26 February 1985, *A. Pott & V.J. Pott 1733* (CPAP); *ibid*., sub-região da Nhecolândia, Pantanal, 09 September 1987, *V.J. Pott et al. 330* (CPAP); *ibid*., 10 June 1986, *A. Rego 326* (COR); *ibid*., 11 June 1986, *A. Pott et al. 2247* (CPAP); *ibid*., 20 August 1991, *A.C. Cervi et al. 3245* (CPAP, MBM, UPCB); Estrada inacabada para Forte Coimbra, MS-454, a 24 km da BR-262 lado esquerdo, 27 May 1992, *V.J. Pott et al. 1687* (CPAP); Passo do Lontra, 13 July 1997, *E.S. Guimarães 19* (HUEFS); *ibid*., rodovia MS-184, após a Curva do Leque, 05 January 1998, *E.S. Guimarâes et al. 56* (CPAP); Fazenda Campo Dora, 24 February 1999, *V.J. Pott et al. 3897* (CPAP); Reserva Acurizal, córrego do Retiro, logo abaixo do brejo do Pirizal, 25 November 2001, *V.J. Pott et al. 5029* (CGMS); Fazenda Mandioré, lado Norte, próximo à sede, oeste da Serra do Amolar, 01 April 2003, *V.J. Pott et al. 6141* (CGMS); Fazenda São João, Estrada Parque, sub-região Abobral, 15 December 2014, *G. Catian 119* (CGMS); Fazenda Arara Azul, Estrada Parque, sub-região Abobral, 15 December 2014, *G. Catian 207* (CGMS), *G. Catian 46* (CGMS). Coxim, Fazenda Lambari, sub-região do Paiaguás, Pantanal, estrada MS-222, 23 February 1987, *A. Pott 2475* (CPAP). Miranda, Estrada de terra próximo à Miranda, lagoa temporária, 24 June 2023, *M.C.A. Pestana et al. 146* (DDMS); Miranda-Abobral, Fazenda Boa Sorte, 23 March 2013, *G. Catian 35* (CGMS). Porto Murtinho, Fazenda Anahi, Reserva ambiental, beira de estrada, 26 November 2024, *A.S. Campos et al. 6* (CGMS).

5.2 *Sagittaria montevidensis* Chamisso & Schlechtendal (1827: 156). **Type:**—BRAZIL. (Brasilia Meridionalis) Rio Grande do Sul, s.l., s.d., *F. Sellow s.n.* (lectotype: G [G00488931!, designated here]; isolectotype: HAL [HAL0063582!]). Figs. 5Q; 9M; 12A–D.

Aquatic herbs, emergent, 40–95 cm tall, rhizomatous, glabrous. **Rhizome** to 4 cm in diameter. **Leaves** 49.4–84.6 cm long, emergent; **petioles** 29.6–46 × 0.8–1.2 cm, aseptate; **basal sheath** 8.8–22 cm long; **leaf blades** 11–16.6 × 4.7–13.3 cm, membranaceous, sagittate or hastate, base sagittate, apex acute, margin entire, campylodromous venation pattern, 10–21 veins, impressed on the abaxial surface, reticulate veins inconspicuous, translucid, visible only under intense

stereoscopic light; basal lobes present, long, with acuminate apex, 2.3–8.4 × 2.1–5.6 cm, 5–11 veins. **Inflorescence** predominantly racemose, rarely paniculate (branching only at the first whorl), emergent, erect; **peduncle** 37.1–52.6 cm long, non-septate; rachis 15–37 cm long, composed of 5–12 whorls, each with 3–7 flowers, internodes between whorls 2–6.8 cm long; **staminate bracts** 1.1–1.3 × 0.3–0.1 cm, lanceolate, apex acute, membranaceous, 12–26 veins, shorter than pedicels, connate at base; **carpellate bracts** 0.7–0.9 × 0.2–0.4 cm, lanceolate, apex acute, chartaceous, 13–28 veins, shorter than pedicels, connate at base. **Staminate flowers** 3–3.5 cm in diameter; pedicels 18–24 mm long; **sepals** 0.4–0.7 × 0.2–0.5 cm, lanceolate, apex acute, 30–35 veins, glabrous, free at base; **petals** 1.2–1.6 × 0.5–1.3 cm, ovate, apex rounded, clawed, the claw ca. 1.2 mm long, with a vinaceous spot at base; stamens 18–24, anthers 1.6 × 0.4 mm, filaments ca. 2.4 mm long, dilated at base, pubescent, simple trichomes. **Carpellate flowers** 3.3–3.9 cm diameter; pedicels 6.6–12.7 × 1–1.9 mm, erect in anthesis, reflexed in fruit, glabrous; **sepals** 0.5–0.7 × 0.4–0.7 cm, ovate, apex rounded, 12–36 veins, without papillae, free at base; **petals** 1–2 × 0.8–1.7 cm, ovate, apex rounded, clawed, the claw ca. 1.2 mm long, with a purple spot at base; ring of staminode absent; carpels ca. 1.2 × 0.3 mm. **Achenes** 1.9–2.5 × 0.5–1.3 mm, oblanceolate, 1 rib, 1 gland; dorsal wings ca. 2.5 × 0.3 mm, ventral wings ca. 4 × 0.09 mm; beak horizontal, ca. 1 mm long. **Seeds** ca. 0.9 mm long, testa tenuous-reticulate, light brown.

Distribution and Habitat:—*Sagittaria montevidensis* is native to South America, occurring in Argentina, Bolivia, Brazil, Chile, Ecuador, Paraguay, Peru, and Uruguay, with introduced populations in the United States and Tanzania (POWO 2025). In Brazil, it is recorded in the North (Acre), Central-West (Goiás, Mato Grosso do Sul, Distrito Federal), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo), and South (Paraná, Rio Grande do Sul, Santa Catarina) regions, and occurs in the Amazon Forest, Atlantic Forest, Cerrado, Pampa, and Pantanal phytogeographic domains (Matias & Pestana 2025). In the Pantanal, *S. montevidensis* is restricted to the Porto Murtinho sub-region, in the southernmost portion of the floodplain (Fig. 3F). The species grows along riverbanks and is predominantly found in disturbed and polluted environments, such as canals, dikes, and landfills, typically in sandy-clay soils.

Phenology:—It was recorded with flowers and fruits from March to November.

Etymology:—The specific epithet *montevidensis* means "of Montevideo" in reference to Montevideo, Uruguay.

Vernacular Names:—Aguapé-de-flecha (Portuguese), Giant Arrowhead.

Notes:—*Sagittaria montevidensis* can be distinguished from other species of the genus by its sagittate leaf blades with prominent, acuminate basal lobes (*vs.* absent or reduced lobes), carpellate and staminate flowers with a purple spot at the base of the petals (*vs.* petals with other colored spots), and oblanceolate achenes with a long horizontal beak (*vs.* lateral or short beaks). Additionally, populations of *S. montevidensis* from the Pantanal have stamens with filaments densely pubescent with simple hyaline trichomes, consistent with *S. montevidensis s. str*. (Keener 2005, Ito *et al*. 2020). It contrasts with *S. montevidensis* subsp. *chilensis* Bogin (1955: 196) which has glabrous filaments and carpellate flowers with strongly inflated pedicels at the receptacle base.

Sagittaria montevidensis was described by Chamisso & Schlechtendal (1827: 156) based on collections made by Friedrich Sellow from the southern provinces of Brazil and Uruguay (i.e. "In regni Brasiliensis provinciis Montevideo et Rio Grande do Sul legit Sellow"). The specimen traditionally regarded as the holotype was deposited at the Berlin Herbarium (B), but it was destroyed during the Second World War (*fide* Rataj 1972). Photographs of this specimen survive at GH and US (Bogin 1955) and a photographic negative prepared by Macbride is also available at the Field Museum (no. 11572), thereby preserving unequivocal evidence of the original material. Because it was long believed that no authentic F. Sellow material had survived, Rataj (1972: 45) designated *Lorentz 103* (W) as the neotype. This treatment was later followed by Haynes & Holm-Nielsen (1994) and Keener (2005).

During the present revision, however, we located two specimens collected by F. Sellow that represent original material of *S. montevidensis*. The first, preserved at Herbarium G (G00488931), is well preserved and labelled "Brasilia meridionalis" in F. Sellow's hand, including complete vegetative and reproductive structures. The second, preserved at Herbarium HAL (HAL0063582), also bears original handwriting by F. Sellow with the locality "Brasilia meridionalis", identical to that cited on the specimen at B. Although morphologically less complete than the G specimen, the HAL sheet also represents part of the original material examined by Schlechtendal at the time of species publication, being a duplicate ex herb. B later transferred to Halle (*cf.* Heuchert *et al*. 2017). According to the International Code of Nomenclature for algae, fungi, and plants (ICN; Turland *et al*. 2025), *Original material* includes specimens associated with the name and available to the author at the time of its publication, even if there is no direct evidence that they were seen (Art. 9.4). Therefore, the F. Sellow specimens preserved at G and HAL qualify as original material, which makes them eligible for lectotypification.

Consequently, the specimen considered the "holotype" at B must instead be regarded as a syntype, and the specimens preserved at G and HAL, both bearing F. Sellow's handwriting and identical locality, are likewise syntypes (Art. 9.6). In this context, following Art. 9.3 and Arts. 9.11–9.13 of the ICN we designate the specimen G00488931 (G)

as the lectotype of *Sagittaria montevidensis* and treat HAL0063582 (HAL) as an isolectotype. The neotype designated by Rataj (1972) is thereby superseded (Art. 9.19), ensuring greater nomenclatural stability.

Specimens Examined:—BRAZIL. **Mato Grosso do Sul:** Porto Murtinho, Próximo ao Saladero Cue, 30 September 1988, *E.S. Guimarães & S. Mamede 65* (CGMS, CPAP); Valo do lado do aterro que circunda a cidade, 14 April 1998, *V.J. Pott et al. 3074* (COR, CPAP); 25 July 1998, *E.S. Guimarães 108* (R); Hotel dos Camalotes, sub-região de Porto Murtinho, 5 March 1994, *A. Pott et al. 4411* (CPAP); *ibid*., 27 March 1996, *V.J. Pott & L.C.P. Lima 4506* (CPAP, MBM); *ibid*., 4 April 2001, *V.J. Pott & L.C.P. Lima 4506* (CGMS); Dique, casa de bombas do DNOS, 29 March 2004, *A. Pott 6810* (CPAP); Dique 1, 14 April 2005, *G.P. Nunes et al. 152* (CGMS); Dique 7, 15 April 2005, *L.E.AM. Lescano et al. 189* (CGMS); Canal do dique do contorno da cidade de Porto Murtinho, próximo à bomba, 16 June 2007, *V.J. Pott & A. Pott 9422* (CGMS); Bairro Caacupê, 05 March 2014, *S.S. Moura & C.G. Souza 174* (CGMS); 16 November 2019, *S.S. Matos 2316* (HCF); On the north side of the urban area, Pantanal of Porto Murtinho, 16 September 2024, *M.C.A. Pestana et al. 150* (DDMS, TUR); *ibid*., *M.C.A. Pestana et al. 151* (DDMS, TUR), *M.C.A. Pestana et al. 153* (DDMS, TUR); Três Barras, on the west side of the urban area, Pantanal of Porto Murtinho, 18 September 2024, *M.C.A. Pestana et al. 159* (DDMS, TUR).

5.3 *Sagittaria planitiana* G.Agostini (1970: 1). **Type:**—VENEZUELA. Portuguesa: Just west of Guanare Portuguesa, August 25 1966, *Steyermark & Rave 96484* (holotype: NY [NY00311499!]; isotypes: US [US00086728!], VEN [VEN70867!]). Figs. 5R; 9N; 12E–H.

Aquatic herbs, emergent, 40–75 cm tall, rhizomatous, glabrous. **Rhizome** to 3.9 cm in diameter. **Leaves** 30.8–58.9 cm long, emergent; **petioles** 16.3–21.5 × 0.9–1.4 cm, irregularly septate, glabrous; basal sheath 7–18 cm long, glabrous; **leaf blades** 7.5–19.4 × 12–19.1 cm, membranaceous, broadly-ovate, base truncate or slightly cordate, apex rounded, margin entire, acrodromous venation pattern, 8–22 veins, impressed on the abaxial surface, reticulate veins inconspicuous, blackened, visible only under intense stereoscopic light; basal lobes absent. **Inflorescence** racemose, emergent, decumbent; **peduncle** 28–46.5 cm long, septate; rachis 14–25.7 cm long, composed of 2–5 whorls, each with 3–4 flowers, internodes between whorls 3.2–12.5 cm long; **staminate bracts** 2.1–3.5 × 0.7–0.9 cm, lanceolate, apex acute, chartaceous, 20–35 veins, longer than pedicels, free at the base; **carpellate bracts** 4.5–5.8 × 1.2–1.7 cm, lanceolate, apex acute, chartaceous, 40–50 veins, longer than pedicels, slightly connate at the base. **Staminate flowers** 2–2.5 cm in diameter; pedicels 18–30 mm long, erect, glabrous; **sepals** 2–2.5 × 0.8–1.2 cm, oblong, apex rounded, 30–35 veins, glabrous, free at the base; **petals** 2–2.5 × 1.5–2 cm, obovate, apex rounded, sessile, with a greenish-yellow spot at base; stamens 14–17, anthers 3.2 × 1 mm, filaments ca. 3 mm long, glabrous. **Carpellate flowers** 2.4–2.6 cm diameter, ring of staminode present; pedicels 25–46 × 8.9–23 mm, erect in anthesis and in fruit, much thickened, glabrous; **sepals** 1.5–2 × 1–1.9 cm, ovate, apex rounded, 18–30 veins, without papillae, free at the base; **petals** 1.3–2 × 0.6–1.3 cm, obovate, apex rounded, sessile, with a yellow spot at the base, short-clawed, the claw ca. 1 mm long; carpels ca. 4 × 1.9 mm. **Achenes** 7–7.5 × 2–2.7 mm, oblanceolate, 2 ribs, 1 gland at the apex of the rib; winged, dorsal wings ca. 7 × 0.5 mm, ventral wings ca. 5 × 0.2 mm; beak lateral, ca. 1 mm long. **Seeds** ca. 2.4 mm long, **testa** tenuous-reticulate, light brown.

Distribution and Habitat:—*Sagittaria planitiana* occurs in Brazil and Venezuela (POWO 2025). In Brazil, it has a distribution in the North (Tocantins), Northeast (Bahia, Ceará), and Central-West (Goiás, Mato Grosso do Sul) regions, occurring in the Caatinga, Cerrado, and Pantanal phytogeographic domains (Matias & Pestana 2025). This study reports a new occurrence of the species for the state of Mato Grosso. In the Pantanal, the species is found in the sub-regions of Abobral, Barão de Melgaço, Nhecolândia, Paraguai, Paiaguás, and Poconé (Fig. 3F). It grows in swamps, circular lagoons, and along the margins of moderately deep lagoons (~15 cm depth), associated with organic-rich clay soils.

Phenology:—It has been recorded with flowers and fruits in February, April–June, September, and December, with peaks in September.

Etymology:—The specific epithet *planitiana* refers to the presumed restriction of the species to the Great Plains of Central Venezuela (Agostini 1970).

Vernacular Name:—Golfe (Portuguese).

Notes:—*Sagittaria planitiana* is characterized by broadly-ovate leaf blades with a truncate base, reaching up to 19.1 cm in width. A distinctive feature of the species is the pedicels of carpellate flowers, which become markedly thick in fruit, reaching up to 23 mm in width *in vivo*. This trait is not observed in any other *Sagittaria* species in Brazil. In the Pantanal, *S. planitiana* may be confused with a morphotype of *S. rhombifolia* (i.e. with ovate leaf blades). However, it differs in the number of floral whorls per inflorescence, typically 2–5 in *S. planitiana* (*vs.* 6–14 in *S. rhombifolia*), and

in fruit length, which is up to 7.5 mm long in *S. planitiana* (*vs.* up to 5.3 mm in *S. rhombifolia*). Notably, the maximum fruit length observed in *S. planitiana* (up to 7.5 mm) is greater than that of any other *Sagittaria* species recorded in the Pantanal (Fig. 9R) and in the tropical Americas (Haynes & Holm-Nielsen 1994).

Specimens Examined:—BRAZIL. **Mato Grosso:** Barão de Melgaço, Lagoa localizada no Pantanal Matogrossense, September 2017, *U.M. Pozzobom s.n.* (UFMT 45296). Cáceres, Reserva do Taiamã, Pantanal Matogrossense, August 1980, *L. Rossi* & *I. Cordeiro s.n* (ICN 84682). Poconé, Fazenda Ipiranga, Transpantaneira, Km 10, 22 June 1992, *M. SchessI 5182* (UFMT); *ibid*., rio Bento Gomes, sub-região de Poconé, 28 February 1996, *V.J. Pott et al. 3018* (CPAP). **Mato Grosso do Sul:** Corumbá, February 1911, *F.C. Hoehne 3887* (R), *ibid*., *F.C. Hoehne 3888* (R); Fazenda Leque (Murundu Alegre), brejão da baía do búfalo, sub-região do Abobral, 05 April 1990, *V.J. Pott et al. 1351* (CPAP); Porto Brete, fazenda Providência, sub-região de Paiaguás, Pantanal, 25 May 1998, *V.J. Pott et al. 3435* (CPAP, CGMS); Paraguai-Mirim; Pantanal, sub-region of Paiaguás, Rio Taquari river system, 26 September 2024, *M.C.A. Pestana et al. 182* (DDMS, TUR).

5.4 *Sagittaria rhombifolia* Chamisso (1835: 219). **Type:**—BRAZIL. s.l, s.d., *F. Sellow s.n*. (lectotype: E [E00319719!], designated by Rataj 1972: 14); isolectotypes: K [K000587167!], LE [LE00000349!]). Figs. 5S; 9O, P; 12I–P.

Aquatic herbs, emergent, amphibious of marshy habitats or rarely rooted-submerged, 40–55 cm tall, rhizomatous, glabrous. **Rhizome** to 2.8 cm in diameter. **Leaves** 29.2–51.5 cm long, emergent; **petioles** 13.5–21.4 × 0.2–0.6 cm, septate, glabrous; basal sheath 7–15 cm long, glabrous; **leaf blades** 8.7–15.1 × 0.5–9.2 cm, chartaceous or membranaceous, lanceolate, linear, or ovate, base rounded, attenuate, or subcordate, apex acute or obtuse, margin entire, acrodromous venation pattern, 4–18 veins, impressed on the abaxial surface, reticulate veins inconspicuous, translucid, visible only under intense stereoscopic light; basal lobes absent or inconspicuous in submerged plants. **Inflorescence** racemose, emergent, decumbent; **peduncle** 16–21 cm long, septate; rachis 8–16.8 cm long, composed of 6–14 whorls, each with 2–3 flowers, internodes between whorls 1.5–5.8 cm long; **staminate bracts** 0.8–2 × 0.2–0.6 cm, lanceolate, apex acute, coriaceous, 10–18 veins, shorter than pedicels, free at the base; **carpellate bracts** 0.9–2.7 × 0.4–0.6 cm, lanceolate, apex acute, chartaceous, 20–35 veins, longer than pedicels, free at the base. **Staminate flowers** 4–7 cm in diameter; pedicels 21.5–43.8 mm long, erect, glabrous; **sepals** 0.3–0.8 × 0.3–0.4 cm, oblong, apex rounded or acute, 18–26 veins, glabrous, free at the base; **petals** 2.9–3.8 × 2.4–3.2 cm, broadly-ovate, apex rounded, with a dark yellow spot at base; stamens 12–23, anthers 2.4 × 0.8 mm, filaments ca. 3.3 mm long, glabrous. **Carpellate flowers** 3.8–6.5 cm diameter, ring of staminode absent; pedicels 7–26 × 2–3 mm long, erect in anthesis and in fruit, glabrous; **sepals** 0.9–1.2 × 0.4–0.6 cm, ovate, apex acute or rounded, 15–20 veins, without papillae, free at base; **petals** 1.7–2.6 × 0.8–1.8 cm, broadly-ovate, apex rounded, with an orange-yellow spot at base; carpels ca. 2 × 0.8 mm. **Achenes** 4.2–5.3 × 2.6–3.3 mm, obovate, with 1 rib following the shape of the fruit, without glands; winged, dorsal wings ca. 5 × 0.3 mm, ventral wings ca. 3 × 0.1 mm; beak horizontal, ca. 0.9 mm long. **Seeds** ca. 2.3 mm long, testa smooth, dark brown.

Distribution and Habitat:—*Sagittaria rhombifolia* is widely distributed throughout the Americas, occurring in Argentina, Bolivia, Brazil, Chile (southern regions), Colombia, Costa Rica, Guyana, Paraguay, Peru, Suriname, and Venezuela (POWO 2025). In Brazil, it is recorded in all regions and nearly all states, except North (Amapá) and Northeast (Rio Grande do Norte), and is found across all phytogeographic domains (Matias & Pestana 2025). In the Pantanal, the species is present in almost all sub-regions of the floodplain (Fig. 3F), except Nabileque and Porto Murtinho. It typically grows in swamps, oxbow lakes, flooded grasslands, and temporary ponds, at depths ranging from 20–40 cm, associated with sandy and hydromorphic soils rich in organic matter. It is often found growing in association with *Pontederia* spp.

Phenology:—The species was collected with flowers and fruits throughout the year.

Etymology:—The specific epithet *rhombifolia* refers to the form of leaf blades, which among other shapes are rhombic.

Vernacular Name:—Golfe (Portuguese), lagartixa (Portuguese—in the Pantanal).

Notes:—One of the morphotypes of *Sagittaria rhombifolia* may be confused with *S. planitiana* due the high plasticity of leaf morphology in the former, as discussed in subsection 5.3. In the Pantanal, *S. rhombifolia* exhibits lanceolate, ovate, and linear leaf blade morphotypes (Fig. 12J–L). The linear form is the most recurrent in herbarium specimens (Fig. 12L), while ovate form with a subcordate base occurs exclusively in submerged specimens (Fig. 12J). Leaves with rhombic blades that inspired the species epithet has not been observed in Pantanal specimens.

The literature also documents notable morphological variability in the leaf blades of *S. rhombifolia* (Bogin 1955, Rataj 1975, 1978, Haynes & Holm-Nielsen 1994, Pansarin & Amaral 2005, Keener 2005, Hall & Gil 2016, Lehtonen 2018, Matias & Nascimento 2022) which may contribute to the 12 synonyms attributed to the taxon (see Keener 2005,

POWO 2025). Despite the variation in leaf shape, all morphotypes analyzed in this study showed consistent diagnostic characteristics, such as inflorescences with numerous floral whorls (Fig. 9O) and obovate, equidimensional fruits (Fig. 5S).

Selected Specimens:—BRAZIL. **Mato Grosso:** Barão de Melgaço, Estrada Fazenda Espírito Santo, RPPN SESC Pantanal, campo de murundum, 22 January 2005, *G.A. Lima-Júnior & E.C. Arruda 556* (UFMT). Cáceres, Estação Ecológica de Taiamã, 05 October 1982, *C.J. Silva 4649* (UFMT); Porto Espiridião, Fazenda Pantanalzinho, 23 November 1984, *Emmerich et al. 5322* (R). Poconé, Rodovia Transpantaneira, Km 65, 15 June 1982, *C.J. Silva 461* (UFMT, SP); Fazenda Ipiranga, 08 May 1993, *A.L. Prado & R.A. Ribeiro 2064* (UEC); Fazenda Ipiranga, Transpantaneira, Km 10, Pantanal, 22 June 1992, *M. SchessI 4533* (UFMT); Pirizal, 01 April 2017, *F.H. Barbosa da Silva 584* (UFMT); Pirizal, próximo à Baia dos Coqueiros, 01 November 2016, *F.H. Barbosa da Silva 124* (UFMT). Santo Antônio do Leverger, Baía Chacororé, Pantanal, 22 April 1993, *V.J. Pott et al. 2073* (CPAP). **Mato Grosso do Sul:** Aquidauana, Fazenda Fazendinha, área rio Negro, Pantanal, 06 February 1991, *A. Pott et al. 5858* (CPAP); Fazenda Salina, 16 August 2005, *V.J. Pott & A. Pott 7910* (CGMS). Corumbá, Fazenda Ipanema, sub-região da Nhecolândia, Pantanal, baía da Sanguessuga, 27 October 1988, *V.J. Pott et al. 720* (CPAP, COR); Fazenda Cáceres, borda de baía, sub-região da Nhecolândia, Pantanal, 12 December 1990, *N.C. Bueno et al. 208* (CPAP); Passo do Lontra, rodovia MS-184, Fazenda São Bento, 11 September 1997, *E.S. Guimarâes et al. 33* (CPAP, CGMS, R); Porto Rolon, margem do Rio Taquari, sub-região de Paiaguás, Pantanal, 13 September 2002, *V.J. Pott & A. Pott 5776* (CGMS); Fazenda Redenção, Parque Estadual do Rio Negro, 21 September 2005, *V.J. Pott & A. Pott 8223* (EVB); 27 September 1993, *V.J. Pott & A. Pott 2766* (CPAP, MO); Paraguai-Mirim, Pantanal, sub-region of Paiaguás, Rio Taquari river system, 25 September 2024, *M.C.A. Pestana et al. 177* (DDMS, TUR); *ibid*., *M.C.A. Pestana et al. 178* (DDMS, TUR), *M.C.A. Pestana et al. 179* (DDMS, TUR); *ibid*., 26 September 2024, *M.C.A. Pestana et al. 180* (DDMS, TUR), *M.C.A. Pestana et al. 181* (DDMS, TUR); *ibid*., 28 September 2024, *M.C.A. Pestana et al. 192* (DDMS, TUR); *ibid*., Fazenda Santa Teresa, 30 September 2024, *M.C.A. Pestana et al. 210* (DDMS, TUR), *M.C.A. Pestana et al. 211* (DDMS, TUR), *M.C.A. Pestana et al. 212* (DDMS, TUR). Coxim, Fazenda Santa Rosa, sub-região do Paiaguás, Pantanal—Leste, 26 February 1987, *A. Pott 2582* (CPAP); 39 km de Coxim, 25 February 1996, *V.J. Pott et al. 2946* (COR, CPAP). Miranda, Estância Caiman, sub-região de Miranda, 04 April 1998, *V.J. Pott et al. 3309* (CPAP). Rio Verde de Mato Grosso, Corixão, próximo à ponte, sub-região de Aquidauana, Pantanal, 28 August 1998, *V.J. Pott et al. 3627* (CPAP, COR).

Additional Specimens Examined:—BRAZIL. Mato Grosso do Sul: Nova Andradina, Road 376 between Pôrto Cristalino and Nova Andradina, 11 October 2024, *M.C.A. Pestana et al. 222* (DDMS, TUR); *ibid*., Dead-end road to a fish farm Pesquiero São Rafael, 11 October 2024, *M.C.A. Pestana et al. 224* (DDMS, TUR).

Final remarks and future perspectives

This study provides the most comprehensive taxonomic study of Alismataceae in the Brazilian Pantanal and is the first to focus exclusively on this family throughout the phytogeographic domain. In terms of the number of species treated, it also represents the most substantial contribution to the group in Brazil since Rataj's (1978) revision. Based on approximately 700 specimens, including recently collected material as well as specimens from national and international herbaria, 19 species representing five genera were confirmed for the Pantanal. Three of these are new records, two for the state of Mato Grosso and one for the Pantanal.

Previous studies provided an important basis for understanding Alismataceae in the region, particularly through extensive fieldwork. Guimarães (1999) documented eight species in the southern Pantanal. All of them are confirmed here, except *Echinodorus* aff. *grandiflorus* and *E. macrophyllus*, now treated as *E. longiscapus* and *E. scaber*, respectively. The works of Pott & Pott (1997, 2000) expanded this list, but some identifications were revised based on our morphological analyses and field observations. For example, their records of *E. lanceolatus*, *E. subalatus*, and *E. grandiflorus* correspond to *E. glaucus*, *E. grisebachii*, and *E. longiscapus*, respectively. Moreover, *E. grisebachii* is now confirmed for the Pantanal in Mato Grosso, previously identified as *E. subalatus* in Pott & Pott (2000).

The most recent compilation by the same authors (Pott & Pott 2021) presents a species composition similar to that adopted here, although some differences remain, such as the inclusion of *E. aschersonianus* Graebner (1911: 433), which is a synonym of *E. uruguayensis* Arechavaleta (1903: 66) and does not occur in the Pantanal, and *E. cylindricus*, already addressed in this study (see topic 1.3). This revision also advances beyond the Flora do Brasil 2020, which recognized 16 species for the domain (Matias 2020). The *species*Link database (CRIA 2023) previously listed over 36 names associated with the family in the Pantanal, many of them synonyms or misidentifications. The list of species presented here provides a more accurate and updated overview of the diversity of Alismataceae in the Brazilian Pantanal.

Considerable morphological variation was recorded in some studied taxa, which highlights the need for further investigation. In *Helanthium tenellum*, variation in plant size and inflorescence structure was observed across subregions of the Pantanal. These patterns are consistent with previous studies suggesting overlooked diversity in the genus (Lehtonen & Myllys 2008, Lehtonen & Falck 2011). In *Sagittaria rhombifolia*, three distinct leaf morphotypes were identified in the study area, from submerged individuals with ovate blades and subcordate bases to emergent plants with narrow, linear leaves. The observed morphological variation reinforces the importance of integrative research to clarify species boundaries and diversity in Alismataceae, both in the Pantanal and across the neotropics.

Acknowledgements

This work is part of the Master's thesis of M.C.A.P. (M.Sc. in Biodiversity and Environment, Universidade Federal da Grande Dourados, Brazil), funded in part by the Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brasil (CAPES)—Finance Code 001. The authors thank the Universidade Federal da Grande Dourados for providing infrastructure, and the Sociedade Botânica do Brasil for supporting botanical illustrations through the *Scientia Amabilis* award. We also thank the staff and curators of the CGMS, COR, CEN, CPAP, ICN, and UFMT herbaria for granting access to their collections. We thank the curators of the herbaria G and HAL for providing access to high-quality online images of the original material of *Sagittaria montevidensis*, and to the Field Museum (FM) for making available the historical photograph of the syntype of this species formerly housed at B. We are especially grateful to Prof. Dr. Uwe Braun for kindly sharing historical information on Schlechtendal's collections and confirming the typification status of the material preserved at HAL. We are grateful to Prof. Dr. Flávio M. Alves (UFMS) and Rafael F. de Oliveira (UFMA) for discussions on nomenclature. We acknowledge the financial support of the Oskar Öflund Foundation, which enabled S.L. and D.F. to participate in the 2024 fieldwork in the Pantanal. Special thanks are extended to Mariana Maciel Monteiro for her assistance during fieldwork in Corumbá and Porto Murtinho; Juliana Leroy and Mauricio Figueira for providing photographs of some of the studied species; Rubenilson dos Santos Soares for producing the botanical illustrations; and Ranielly Gracia for providing the shapefile of the Estrada Parque Pantanal. Finally, we are grateful to the editors and anonymous reviewers for their valuable suggestions on the manuscript.

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APPENDIX 1. List of Alismataceae species occurring in the Brazilian Pantanal and examined specimens. Collections are listed alphabetically by collector. Numbers in parentheses correspond to those in the numerical list of species. For collections with multiple collectors, only the first collector is cited. *s.n.* = without collection number.

Numerical list of species:

1. *Echinodorus cordifolius*
2. *Echinodorus floribundus*
3. *Echinodorus glaucus*
4. *Echinodorus grisebachii*
5. *Echinodorus longipetalus*
6. *Echinodorus longiscapus*
7. *Echinodorus paniculatus*
8. *Echinodorus scaber*
9. *Echinodorus subalatus*
10. *Helanthium bolivianum*
11. *Helanthium tenellum*
12. *Hydrocleys nymphoides*
13. *Hydrocleys parviflora*
14. *Limnocharis flava*
15. *Limnocharis laforestii*
16. *Sagittaria guayanensis*
17. *Sagittaria montevidensis*
18. *Sagittaria planitiana*
19. *Sagittaria rhombifolia*

Index of collectors:

Abdo M.S.A. 1204 (11); 1444 (11). **Acevedo-Rodriguez P.** 16669 (7). **Alino A.M.** 21 (7). **Almeida A.M.** 175 (7); 42 (12). **Amaral M.A.** *s.n.* COR 2474 (7). **Amaral M.E.C.** *s.n.* CPAP 14205 (7); *s.n.* CPAP 14204 (12); *s.n*. UEC 116125 (15); 97/98 (15). **Amaral T.S.** 143 (11). **Amarílio E.B.S.** 7 (7). **Amorim-Neto L.** 14 (16). **Arruda E.C.** *s.n.* UFMT 27378 (11). **Arruda R.S.** 143 (6). **Assis E.M.L.** 20 (7). **Bao F.** 124 (11); 66 (6). **Barbosa D.** 10 (7). **Barbosa da Silva F.H.** 123 (8); 124 (19); 236 (3); 262 (3); 27 (3); 295 (3); 299 (16); 301 (3); 324 (8); 390 (3); 392 (7); 584 (19); 703 (3); 799 (11); 803 (16); 85 (3); 898 (16). **Barbosa S.B.** 91 (7); 92 (7). **Barros A.L.** 15 (8); 3 (8). **Bastos G. & Juracy A.** *s.n.* CGMS 68352 (7), 1 (7). **Bejarano B.** 8 (7). **Bento J.P.S.P.** 52 (6). **Bieski I.G.C. & Rosa S.I.G.** *s.n.* UFMT 27378 (8). **Bisinoto S.S.** 4 (11). **Boff S.V.** 69 (11); 87 (7); 90 (16). **Bove C.P.** 1135 (13); 2400 (1). **Braga J.D.G. & D. S. Giordano L.** 14 (12). **Bueno M.L.** 483 (11). **Bueno N.C.** 167 (11); 208 (19); 292 (6); 557 (13). **C.A Conceição** *s.n.* ICN 133963 (7). **Campos A.S.** 14 (14); 15 (6); 6 (16); 9 (14). **Carniello M.A.** 1067 (3); 1097 (19); 1112 (16); 1683 (8); 1684 (8); 2568 (3); 3501 (3); 352 (7); 3590 (3); 3888 (11); 50 (9); 5090 (3); 6465 (16); 850 (11); 926 (13); 958 (11); 971 (11); *s.n.* UFMT 36655 (11). **Carvalho A.T.** 100 (7); 101 (6). **Carvalho F.S.** 337 (7). **Casari M.B. & Pedrosa D.S.** 1077 (11). **Catian G.** 100 (16); 119 (16); 12 (7); 133 (14); 157 (6); 158 (7); 163 (12); 164 (13); 180 (14); 207 (16); 221 (13); 26 (11); 35 (16); 46 (16); 73 (11); 98 (6); 99 (7). **Caxambú M.G. & Silva A.R.** 1548 (3). **Caxambú M.G.** 1548 (7); 1569 (11); 2314 (3). **Cervi A.C.** 3320 (11); 3245 (16); 3258 (7); 3283 (8); 4209 (11); 4236 (12). **Conceição C.A.** 1277 (7); 2680 (7); 2689 (12); 2719 (12). **Correa T.A.** *s.n.* UFMT 12373 (11). **Costa L.C. & Resende U.M.** 264 (12). **Costa S.C. & Amorim Neto L.** *s.n.* UFMT 24485 (11). **Costa S.C.** 184 (16); 187 (16); *s.n.* UFMT 24160 (19). **Coutinho M.E.** 17 (13). **Crepaldi J.** 66 (6). **Cruz K.B. & Gewehr I.M.** 39 (12). **Cunha C.N.** 2150 (6). **Damasceno-Júnior G.A. & Bezerra M.A.O.** 702 (11). **Damasceno-Junior G.A.** 646 (15); 5176 (7); 5208 (6); 5294 (2). **Daviny L.** 1 (12). **Duarte G.S.V.** 128 (11). **Emmerich M.** 5265 (15); 5322 (19); 5394 (19); 5452 (19). **Falck D.** 252 (11); 253 (11); 256 (11); 257 (11); 258 (12). **Farinaccio M.A.** 1106 (11). **Ferreira C.J.A. & Mattos P.P.** 17 (19). **Ferreira C.J.A.** 25 (7). **Ferreira H.** 1 (8). **Franco D.G.** 106 (7); 88 (7); 98 (12). **Garcia J.S.** 20 (7). **Garcia-Silva R.** 148 (6). **Gasparini M.L.** *s.n.* CPAP 3696 (11). **Grandi T.S.M.** 2783 (12). **Guarim-Neto G.** 134 (11). **Guimarães E.S. & Mamede S.** 104 (7); 67 (7); 65 (17); 72 (7). **Guimarães E.S.** 1 (11); 10 (11); 24 (11); 27 (7); 35 (7); 4 (16); 57 (11); 63 (3); 7 (8); 9 (11); 106 (7); 108 (17); 14 (19); 19 (16); 42 (7); 44 (8); 47 (7); 50 (7); 54 (19); 59 (16); 98 (3); 14 (19); 39 (16); 97 (3); 16 (7); 23 (11); 80 (7); 33 (19); 56 (16); 84 (7). **Hamilton S. & Sippel S.** 14 (19); 33 (8). **Hamilton S.** 22 (12); 23 (14); 24 (19). **Hatschbach G. & Schere P.** 30443 (12). **Hatschbach G.** 49221 (7); 60915 (11); 62398 (7); 62398 (7); 49289 (12). **Hayd R.** 10 (8). **Haynes R.R.** *s.n.* UFMT 23406 (7). **Hoehne F.C.** 1134 (19);

3887 (18); 3888 (18); 4484 (16); 4485 (16); 4637 (16); 23400 (19). **Ishii I.H.** 654 (7). **Kinoshita L.S.** 50 (3). **Kinupp V.F.** 1110 (11). **Kufner D.C.L.** 56 (7). **Lambert M.V.** 30 (7). **Leandro T.H.D.** 87 (7). **Lehtonen S.** 1161 (11). **Leme F.M.** 18 (19); 19 (19). **Leonel B.F.** *s.n.* CGMS 6253 (11); *s.n.* CGMS 613. **Lescano A.** 13 (7); 9 (15); 189 (17); 282 (7). **Lima L.C.P. & Pott A.** 130 (11). **Lima-Júnior G.A. & Arruda E.C.** 553 (3); 556 (19). **Lima-Júnior G.A. & Ferreira H.** 239 (16); 282 (11); 324 (8). **Lima-Júnior G.A.** 199 (3); 556 (19); 637 (3). **Lovo J.** 351 (14). **Macedo F.A.** 2 (7). **Macedo M.** 1325 (11); 1346 (7); 1649 (7); 1808 (7). **Marini A.C.** 1 (7); 2 (8). **Martinelli G.** 18620 (7); 18701 (15). **Matos S.S.** 2316 (17). **Mauro R.A.** 22 (15). **Moraes M.** 20 (15); 26 (12). **Moreira S.N.** 1565 (5). **Morrone L.J. & Morrone T.A.** 7 (7). **Moura S.S. & Souza C.G.** 174 (17). **Nakamura V.** 188 (7). **Navarro W.R.F.M.** 6 (14); 7 (3); 9 (7). **Negrelle R.R.B.** *s.n.* UPCB 50051 (3). **Nogueira A.M.** 1 (7). **Nunes G.P.** 152 (17). **Oliveira A.P.** 3 (11). **Oliveira P.P.** 115 (12); 70 (1). **Oliveira R.N.** 7 (8). **Palmeira S.S.** 2 (14); 9 (7). **Paula J.E. & Conceição C.A.** 1608 (7). **Pereira R.A.C.** 66 (11); 82 (12). **Pereira Z.V.** *s.n.* DDMS 7449 (7). **Pereira-Júnior R.** 2 (7). **Pestana M.C.A.** 139 (11); 140 (7); 141 (7); 142 (7); 143 (7); 144 (7); 150 (17); 151 (17); 153 (17); 154 (14); 156 (12); 159 (17); 160 (7); 166 (11); 168 (11); 169 (11); 170 (7); 171 (7); 172 (7); 173 (8); 174 (12); 175 (3); 176 (11); 177 (19); 178 (19); 179 (19); 180 (19); 181 (19); 182 (18); 183 (8); 184 (8); 185 (8); 186 (3); 192 (19); 194 (3); 195 (3); 196 (3); 197 (3); 198 (3); 199 (8); 200 (11); 201 (3); 202 (3); 203 (3); 204 (3); 210 (19); 211 (19); 212 (19). **Pivari M.O.D. & Boof S.** 400 (12). **Pivari M.O.D.** 289 (7); 374 (12). **Pott A. & Franco A.A.** 6189 (13). **Pott A. & Petzold N.** 4734 (8). **Pott A. & Pott V.J.** 1733 (16); 1947 (12); 4756 (88). **Pott A. & Tavares C.C.F.** 4580 (8). **Pott A.** 16252 (6); 2247 (16); 2876 (7); 3048 (7); 3154 (13); 3160 (6); 3232 (12); 3273 (6); 3274 (3); 3306 (15); 3335 (6); 3336 (3); 3340 (11); 3345 (6); 3461 (3); 3477 (6); 3528 (3); 3576 (6); 3577 (3); 3690 (15); 3925 (3); 3941 (7); 4411 (17); 4642 (14); 4736 (14); 4805 (19); 4867 (1); 4952 (6); 5364 (8); 5843 (3); 5853 (11); 5858 (19); 5894 (12); 6517 (2); 7718 (15); 7720 (13); 7862 (7); 7874 (3); 7876 (3); 8699 (3); 1093 (11); 11820 (12); 1223 (11); 1246 (11); 1471 (12); 2475 (16); 2582 (19); 4540 (19); 4541 (13); 4756 (8); 5132 (7); 5133 (8); 5255 (4); 5521 (16); 060892 (7); 6810 (17). **Pott V.J. & Bueno N.C.** 1328 (15); 1337 (12). **Pott V.J. & Foster R.** 3643 (7); 3698 (11). **Pott V.J. & Heckman C.W.** 1733 (9). **Pott V.J. & Lima L.C.P.** 4506 (17). **Pott V.J. & Pereira A.C.** 1876 (3). **Pott V.J. & Pott A.** 10350 (3); 10558 (8); 11490 (6); 11685 (7); 172 (11); 1990 (16); 2128 (19); 2545 (13); 2765 (18); 2766 (19); 518 (16); 5757 (3); 5763 (7); 5768 (11); 5771 (8); 5776 (19); 5777 (2); 7101 (15); 7794 (1); 7890 (12); 7910 (19); 8223 (19); 8225 (7); 8226 (8); 8357 (3); 8362 (7); 8376 (19); 8377 (3); 8387 (3); 8618 (3); 8630 (3); 8879 (12); 8887 (3); 9280 (3); 9422 (17); 8224 (11). **Pott V.J. & Rego A.** 260 (11). **Pott V.J. & Rodrigues A.** 3978 (12); 3982 (11). **Pott V.J. & Santos M.C.V.** 6147 (8); 6148 (11). **Pott V.J. & Sartori A.L.B.** 4429 (7). **Pott V.J. & Souza P.R.** 11297 (6). **Pott V.J.** 1027 (8); 1036 (8); 1085 (7); 12381 (19); 12835 (6); 1351 (18); 1619 (13); 1683 (12); 1687 (16); 1688 (15); 1703 (13); 1717 (9); 1762 (7); 1781 (14); 1788 (12); 1848 (13); 1850 (15); 1851 (1); 1860 (7); 1893 (19); 1894 (8); 1898 (13); 1942 (12); 205 (7); 2073 (19); 2075 (19); 2076 (8); 2087 (11); 2167 (18); 2356 (8); 2388 (6); 2416 (5); 2466 (6); 2467 (3); 2537 (14); 2649 (16); 2850 (14); 2909 (7); 2946 (19); 2958 (5); 2964 (3); 2965 (19); 2975 (8); 2981 (15); 2982 (13); 3007 (8); 3018 (18); 3029 (7); 3052 (19); 3053 (16); 3056 (14); 3074 (17); 3091 (14); 3116 (12); 3132 (16); 3149 (16); 330 (16); 3308 (6); 3309 (19); 3319 (13); 3320 (14); 3330 (8); 3333 (6); 3339 (3); 3435 (18); 3627 (19); 363 (6); 364 (6); 380 (3); 382 (3); 384 (3); 385 (6); 3860 (3); 3895 (13); 3896 (8); 3897 (16); 402 (3); 406 (3); 407 (3); 4394 (3); 4491 (14); 4512 (12); 475 (7); 4950 (3); 5029 (16); 538 (1); 557 (12); 566 (11); 5794 (6); 600 (7); 6141 (16); 6394 (19); 6395 (12); 6396 (13); 719 (7); 720 (19); 727 (12); 733 (11); 739 (3); 745 (3); 748 (19); 7525 (3); 7526 (3); 7527 (6); 784 (6); 785 (6); 836 (8); 889 (11); 2109 (8); 2110 (3); 2111 (8); 2112 (8); 2113 (8); 2114 (3); 2115 (6); 2116 (3); 232 (12); 2731 (11); 2740 (8); 4923 (19); 4965 (11). **Pozzobom U.M. & Celestino R.S.** *s.n.* UFMT 44304 (7). **Pozzobom U.M.** *s.n.* UFMT 45287 (8); *s.n.* UFMT 45296 (18); 104 (11). **Prado A.L. & Ribeiro R.A.** 2064 (19). **Prado A.L. & Rodrigues L.M.** 3593 (13). **Prado A.L.** 5175 (7); 5500 (7); 5501 (11); 30863 (13). **Prado C.P.A.** 149 (13). **Prance G.T.** 26110 (11); 26281 (12); 26286 (13). **Ramos W.M.** 29 (11); 47 (11). **Rebellato L. & Arruda E.C.** 136 (3). **Rebellato L. & Ferraz L.** 209 (3). **Rebellato L.** 117 (19); 137 (19); 161 (19); 168 (16); 209 (3); 226 (7); 226L (3); 307 (11). **Rego A.** 326 (16); 329 (12); 346 (11); 569 (7); 684 (7); 721 (14); 756 (7); 799 (12); 803 (11); 803a (10); 804 (11); 807 (7); 808 (19); 819 (11); 826 (7); 827 (7); 828 (3); 849 (8); *s.n.* CGMS 2294 (6); *s.n.* CGMS 2293 (10); *s.n.* CGMS 2385 (16); *s.n.* COR 1292 (8); *s.n.* ICN 96503 (3); *s.n.* ICN 98534 (7). **Rego S.** *s.n.* COR 1292, CGMS 2320 (8). **Resende U.M. & Kinupp V.F.** 1680 (8); 1682 (19). **Resende U.M.** 136 (5); 815 (12); 831 (12); 852 (14). **Resende U.M.** 574 (11); 654 (12). **Rieder A.** 6 (11). **Rocha M.** 145 (7); 66 (11); 85 (3). **Rodrigues C.A.P.G.** 64 (11). **Rodrigues L.S.** 7 (11). **Rodrigues R.B.** 114 (7); 32 (7); 77 (12); 80 (12). **Salis S.M.** 1066 (15); 1084 (12); 377 (7); 390 (13); 429 (16); 451 (8); 518 (11); 524 (7); 596 (12); 674 (19); 675 (16); 748 (13); 753 (16). **Sanches A.** 62 (3). **Sanches A.L. & Oliveira M.D.** 62 (7). **Santos J.U. & Rosário C.S.** 585 (3). **Santos M.C.V.** *s.n.* UFMT 23661 (7). **Sazima I. & Machado F.A.** *s.n.* UFMT 21120 (11). **SchessI M.** 2017 (11); 2028 (11); 2123 (7); 2185 (11); 221192233 (3); 2350 (11); 2397 (7); 2399 (3); 270691 (11); 2783 (6); 2785 (7); 2790 (3); 3088 (19); 311091 (11); 3168 (7); 3229 (7); 3327a (8); 3652 (7); 3653 (16);

3654 (19); 4391 (16); 4533 (19); 4629 (7); 4734 (3); 5182 (18); 5301 (7); 60892 (7); 612915721 (3); 80069214411 (3); *s.n.* UFMT 127 (6); 2783 (6); 2790 (3); 4532 (7); *s.n*. UFMT 19648 (16); *s.n.* UFMT 19638 (6); *s.n.* UFMT 19650 (7); *s.n.* UFMT 19721 (7); *s.n.* UFMT 19731 (7). **Schleder E.J.D.** *s.n.* DDMS 14507 (11). **Scremin-Dias E.** 216 (13); 230 (8); 235 (8); 238 (6); 241 (11); 244 (3); 253 (6) 243 (13); 256 (11); 257 (11). **Seher F.A.** 1 (7). **Silva A.D.** *s.n.* CGMS 4925 (8); 31 (8); *s.n.* CGMS 4907 (8); *s.n.* CGMS 4925 (8); *s.n.* CGMS 4919 (11). **Silva C.J.** 102 (3); 150 (7); 151 (7); 164 (19); 183 (7); 184 (7); 189 (7); 204 (19); 209 (7); 226 (16); 228 (16); 234 (8); 296 (19); 320 (8); 324 (11); 336 (7); 350 (7); 359 (11); 362 (7); 365 (7); 383 (7); 394 (11); 411 (3); 419 (19); 442 (7); 448 (19); 460 (7); 461 (19); 4649 (19); 546 (3). **Silva F.C.** 803 (11). **Silva L.J.** 227 (13); 428 (13); 446 (13). **Silva L.M.** 5 (7). **Silva R.H. & Silva R.H.** 70 (7). **Silva S.J.B.** 15 (14); 36 (6). **Silva V.C. & Parizotto C.A.** 2 (8). **Soares V.C.** 26 (6); 27 (3); 28 (7); 29 (13); 3 (11); 30 (15); 4 (3); 48 (7). **Soibetert A.** *s.n.* SJRP 3788 (11). **Souza C.S.** 225 (6); 272 (7); 297 (3). **Souza E.B.** 183 (6); 231 (14); 234 (3); 235 (6); 259 (16); 260 (12). **Souza M.C.** 2804 (14). **Souza-Júnior A.F. & Siqueira C.S.** 32 (14); 36 (7). **Strada C.L.** 1 (8). **Sugiyama M. & Scremin-Dias E.** 715 (7); 716 (11). **Thomas W.W.** 4557 (3); 4587 (7); 6 (13). **Vasconcelos S.T.** *s.n.* CGMS 2386 (7); 16 (7); 17 (16); 23 (12). **Vilhalva D.A.A.** 100 (3); *s.n.* UFMT 23665 (16). **Völtz R.R.** 1746 (37). **Walters T.L.** 3856 (11). **Webster G.L. & Pott A.** 25355 (12).