

ALISMATACEAE

WATERPLANTAIN OR ARROWHEAD FAMILY

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Terrestrial to submerged annual or perennial herbs, usually erect and scapose, monoecious or bisexual, mostly glabrous to stellate pubescent, bearing lactifers in most organs; sap milky. ROOTS fibrous. STEMS cormose, rhizomatous, or stoloniferous, the rhizomes often terminated by tubers. LEAVES basal, submerged, floating or emergent, sessile or petiolate, with a sheathing base, non-auriculate; blades linear, to hastate, with or without pellucid markings of dots or lines; margins entire or undulate; venation reticulate, the primary veins parallel from base of blade to apex, the secondary veins reticulate. INFLORESCENCE scapose, usually erect, rarely floating or decumbent, racemose or paniculate, rarely umbellate, bracteolate. FLOWERS bisexual or occasionally unisexual, hypogynous, subsessile to long pedicellate; perianth imbricate or involute in bud, actinomorphic; sepals 3, usually green, persistent; petals 3, deciduous; stamens 0 to many, free; filaments filiform or dilate flattened; anthers 2-loculed, elongate, basifixed or versatile, dehiscent by longitudinal slits; pistils 0 to many, superior, free or joined at the base, whorled in a ring or spirally arranged on the receptacle; style terminal or lateral, usually persistent; stigma linear; ovary unilocular, ovules 1 or rarely 2; placentation basal. FRUITS achenes or follicles, compressed or terete. SEEDS 1 to few, U-shaped.—12 genera, ca. 80 spp., nearly worldwide. Haynes & Holm-Nielsen (1994); Haynes & Hellquist (2000); Reveal (1977).

Eight species of Alismataceae are known from Arizona, however only three are commonly collected (*Alisma triviale* Pursh; *Sagittaria cuneata* E. Sheld.; *Sagittaria longiloba* J. G. Sm.); three are rarely found (*A. gramineum* Lej.; *Echinodorus berteroi* (Spreng.) Fassett; *Sagittaria montevidensis* Cham. & Schldl. subsp. *calycina* (Engelm.) Bogin) and the final two taxa (*S. graminea* Michx. subsp. *graminea*; *S. latifolia* Willd.) have not been recollected in over 100 years.

- 1. Pistils arranged in a single flattened, circular or triangular whorl; receptacle small, flat; stamens 6. *Alisma*
- 1' Pistils spirally arranged, densely crowded over the entire surface of the large globose receptacle; stamens more than 6.
- 2. Flowers all bisexual; fruiting head bur-like; achenes terete, mostly ribbed with glands between the ribs; leaves with rounded or subcordate bases; stems and petioles angled. *Echinodorus*
- 2' Flowers, at least the proximal, unisexual; fruiting head smooth, not bur-like; achenes flattened, often with curved wings and one or two glands; leaves with sagittate to hastate or tapering bases; stems and petioles smooth or terete..... *Sagittaria*

Alisma L. Waterplantain, Mudplantain

Perennial herbs, emersed or along the margins of wet areas, glabrous. STEMS erect, rhizomes often present. LEAVES sessile or petiolate; blades highly variable in shape and size, even within species; linear to elliptic or lanceolate to ovate, apically acute to rounded; bases attenuate to rounded; margins entire; midvein conspicuous, the lateral veins usually 2 to several usually conspicuous. INFLORESCENCE paniculate, often large and open, often bearing hundreds of flowers, erect or emersed, rarely submersed (usually only due to flooding), inflorescence and floral bracts present. FLOWERS bisexual, pedicellate; floral bracts present; receptacle flattened; sepals erect, green; petals white, rarely pink or purplish, entire or slightly erose, generally larger than the sepals; stamen 6–9, the filaments filiform; pistils distinct, 5–20, in a circular or triangular whorl on a flattened receptacle; style lateral; ovules 1. FRUITS laterally compressed achenes, often with 1 or 2 grooves on the curved back, the beak usually persistent, short, straight or curved. $x = 7$.—9 species; nearly worldwide, but mostly temperate. (Greek: *alisma*, an ancient aquatic plant, adopted by Linnaeus from Dioscorides). Haynes & Hellquist (2000).

The species are extremely difficult to identify without mature fruits.

1. Fruits with 2 grooves on the back of the achene; leaf blades 3–9 times as long as wide; inflorescence generally much shorter to slightly longer than the leaves..... *A. gramineum*
- 1' Fruits usually with 1(–2) groove(s) on the back of the achene (sometimes smooth); leaf blades 2–4 times as long as wide; inflorescence generally much longer or slightly longer than the leaves. *A. triviale*

Alisma gramineum Lej. (grassy, grass-like). Grassleaved Waterplantain; Grasslike Waterplantain; Lanceleaf Waterplantain; Narrowleaf Waterplantain; Geyer Waterplantain.—Submerged or amphibious perennial herbs, 0.5–50 cm tall. STEM generally erect (except when submerged), usually 0.3–4 cm in diam. LEAVES basal, usually erect, often floating; submersed leaves sessile, ribbon-like; floating leaves linear, 15–100 cm long, 0.2–3 cm wide; emergent leaves usually petiolate, 5–6 cm long, 0.4–1.5 cm wide, 3–5-veined, usually much longer than the inflorescence, linear-lanceolate or lanceolate to narrowly elliptic, apically acuminate to acute, the base attenuate; petiole sheathing, 5–15 cm long. INFLORESCENCE 15–50 cm long, usually erect, usually shorter than the leaves, narrowly verticillate paniculate, the rachis branches in 2–5 whorls, each with 3–5 shortened main branches terminating abruptly in umbellate cymes; pedicels stout, 0.5–4.5 cm long, often recurved in fruit. FLOWERS 4–8 mm in diam.; sepals greenish, 1.5–3 mm long, ovate, not obviously gibbous, apically acute to obtuse; petals white, becoming pinkish tinged, 2–4 mm long, obovate to rounded, apically obtuse, the margin entire to slightly erose; stamens 6–9, 1.4–2.5 mm long; filaments 1–2 mm long nearly as wide as long; anthers 0.3–0.6 mm long, ovoid; pistils 5–20, arranged in an obscurely triangulate whorl, the styles lateral, curved, 0.4–0.5 mm long. FRUITS 5–20, achenes, 2–2.7 mm long, orbicular to orbicular-cuneate, with 2 grooves on the curved back, the central ridge raised above the lateral ridges, the beak often becoming curled. $2n = 14, 16$. [*A. geyeri* var. *angustissimum* (DC.) Lunell; *A. gramineum* var. *angustissimum* (DC.) Hendricks; *A.*

plantago var. *angustissimum* DC.; *A. gramineum*, C. C. Gmel.; *A. geyeri* Nicollet; *A. gramineum* var. *geyeri* (Nicollet) G. Samuels].—Completely submerged or in mud of marshy areas and lakes: Apache Co. (not confirmed), Coconino Co. (Lake Mary and Marshall Lake); 2,050–2,150 m (6,800–7,100 ft); fl. May–Sep (fr. Sep–Oct); n temperate N. Amer. and Eurasia.

Alisma triviale Pursh (commonplace, ordinary). Northern Waterplantain—Terrestrial perennial herbs to 1 m tall. STEM erect, 1–4 cm in diam. LEAVES basal, erect, emersed, (rarely submerged or floating during flooding), 5–35 cm long, 3–12 cm wide, 5–7-veined, usually much shorter than the inflorescence, linear-lanceolate or elliptic to ovate, apically sub-obtuse to acute or acuminate, basally cuneate to rounded or subcordate; petiole sheathing, 3–20 cm long. INFLORESCENCE simple or compound, a narrow or sub-spherical panicle, to 1 m tall, to 70 cm in diam., usually much taller than the leaves, with 3–9 whorls, each with 3–6 main branches (these can be much branched), gradually terminating in umbellate cymes; pedicels ascending or erect, 0.5–4 cm long, usually erect in fruit. FLOWERS 7–12 mm in diam.; sepals green, 3–6 mm long, ovate to suborbicular, somewhat gibbous in most, apically acute; petals white becoming purplish tinged, rhombic, 3.5–6 mm long, apically obtuse, the margins entire to slightly erose; stamens 6–9, 2.6–4 mm long; filaments 2–3 mm long, slender; anthers 0.6–1 mm long, ovoid; pistils 5–20, arranged in an obscurely triangulate whorl; styles lateral, straight or slightly curved, 0.4–0.7 mm long. FRUITS 5–20, achenes, 2.1–3 mm long, ovoid, with 1 or 2 grooves (these sometimes shallow), on the curved back, sometimes smooth, often variable in the same head. $2n = 14, 28$. [*Alisma plantago* var. *triviale* (Pursh) Britton, Sterns & Poggenb.; *A. plantago-aquatica* L. var. *americana* Schult. & Schult. f.; *A. plantago-aquatica* L. var. *triviale* (Pursh) Farw.].—In and along the margins of freshwater lakes, ponds, tanks and streams, rarely in deep water: Apache, Coconino, Graham, Navajo and Yavapai cos.; 1,050–2,600 m (3,400–8,500 ft); fl. May–Sep, (fr. Aug–Oct); N. Amer.

Some confusion has occurred in the Arizona flora over the years regarding the true identity of the most common *Alisma* in the state. It is believed now that the name *A. plantago-aquatica* L. refers to a primarily Eurasian species and our material should be referred to as *A. triviale* Pursh (Haynes and Hellquist, 2000: 25).

Echinodorus Rich.

Burhead

Annual or perennial herbs, bisexual, emersed, floating-leaved or rarely submersed, glabrous to stellate pubescent. STEMS with rhizomes present or absent. LEAVES sessile or petiolate; linear to lanceolate to broadly ovate, apically obtuse to acute or acuminate, basally attenuate to cordate, the margins entire or undulating with pellucid markings absent or present as dots or lines; petiole mostly triangular, rarely terete, sheathing at base. INFLORESCENCES erect, racemes, panicles or rarely umbelliform; rachis branches in whorls of 1–18, erect or rarely decumbent; bracts, glabrous, often papillose along the veins. FLOWERS bisexual, subsessile to pedicellate; pedicels often elongating after anthesis, ascending to recurved; sepals persistent, membranaceous coriaceous, reflexed to spreading; petals white, deciduous, larger than sepals, the margins entire; stamens 9–25; filaments linear, glabrous;

anthers versatile or basifixed; pistils distinct, 9 (–250 or more), spirally arranged on convex receptacle, forming a head; style terminal or lateral, persistent; ovule 1 per pistil. FRUITS achenes usually terete, often longitudinally costate, the beak terminal or lateral. [*Helianthium* J. G. Sm.; *Albidella* Pichon].—40–50 spp., native to the New World, but spreading to Eur., Afr. and Asia. (Greek: *echinus* = rough husk + *doros* = leather bottle, referring to the fruit). Haynes & Holm-Nielsen (1994); Haynes & Hellquist (2000).

Echinodorus berteroi (Spreng.) Fassett (for Carlo Giuseppe Bertero, 1789–1831, an Italian physician). Bertero Burhead.—Annual or perennial herbs, to 70 cm tall; glabrous. STEMS rhizomatous. LEAVES petiolate, submerged or emerged; submerged leaves rare, generally narrower; emerged leaves elliptic, lanceolate to ovate, 2.6–15.5 cm long, 0.5–20 cm wide, apically obtuse to acute; base truncate or occasionally cordate to broadly rounded to tapering; margins entire midvein prominent, the secondary veins 3–11, usually prominent; petioles terete to triangular, 2–36 cm long, 1–15 mm in diam., with a basal sheath. INFLORESCENCE racemose, rarely paniculate, erect, 1.5–40 cm long, 1.7–50 cm wide, usually much taller than the leaves, 1–9 whorls, each whorl 1–4-flowered, the rachis triangular; peduncles angled, 3–5-ridged; pedicels spreading to ascending in flower and fruit, cylindrical, 6–28 mm long, 0.4–0.6 mm wide. FLOWERS 6–11 mm in diam.; sepals broadly triangular, 0.9–3.4 mm long, 1.3–2.9 mm wide, spreading to reflexed, with 9–13 veins; petals white to cream or greenish-white, rhombic to orbicular, 2.5–4.8 mm long, 3.5–4.5 mm wide, spreading, clawed, the claw to 0.5 mm long; stamens 9–15; filaments slender, to 7 mm long; anthers versatile, to 8 mm long, apically obtuse; pistils 45–200; styles straight. FRUIT oblanceolate, terete, 0.9–3.2 mm long, 0.6–2.5 mm wide, 3–5-ribbed, the beak terminal, erect, 0.6–1.3 mm long. $2n = 22$. [*Alisma berteroi* Spreng. (as "berterii"); *A. rostratum* Nutt.; *Echinodorus rostratus* (Nutt.) A. Gray].—Streams, ditches, and marshes: Yuma Co., around Yuma, n of Imperial Dam, along the Colorado R.; to 150 m (to 400 ft); IL to TX to s CA and s to Mex., the Caribbean, and C. Amer. and S. Amer., incl. Guyana, Venezuela, Ecuador and Peru.

Sagittaria L. Arrowhead, Sagittaria

Perennial or rarely annual herbs, monoecious or rarely dioecious, glabrous to sparsely pubescent, submerged, floating-leaved, or emerged. ROOTS fibrous. STEMS often rhizomatous, stoloniferous, or cormiferous, often terminated by tubers, the tubers white to brown, smooth. LEAVES submerged, floating, or emerged, sessile or petiolate, the blades present or absent (submersed leaves often with reduced blades) linear to obovate, apically acute to rounded, basally attenuate, often hastate or sagittate with margins entire, without pellucid markings; petioles terete to triangular. INFLORESCENCE erect or often lax, emerged or floating, racemose, paniculate, or rarely umbelliform, with rachis branches in 1–17 whorls, with 2–3-flowers per whorl; bracts smooth to papillose; flowers staminate above, pistillate below. FLOWERS unisexual, pedicellate, rarely sessile; floral bracts present; pedicels elongating after anthesis, ascending to recurved; receptacle convex. STAMINATE FLOWERS with sepals membranaceous to coriaceous often sculptured, greenish, persistent, usually

reflexed; petals white rarely pink or yellowish, sometimes with a basal purple spot, deciduous, the margins entire; stamens 7–30; filament linear, often dilated, glabrous to pubescent; anthers basifixed, linear to orbicular. PISTILLATE FLOWERS with sepals as in the staminate flowers but erect or reflexed; petals as in the staminate flowers; staminodes sometimes present in lower pistillate flowers; pistils to 1500 or more, distinct, spirally arranged; style terminal; ovule 1 per pistil. FRUITS achenes, numerous, laterally compressed, often laterally ribbed or winged, often with a conspicuous dorsal wing, the beak, usually short erect. $x = 11$.—Ca. 30 spp., nearly cosmopolitan. (Latin: *sagitta* = arrow, from the shape of the leaves). Haynes & Holm-Nielsen (1994); Haynes & Hellquist (2000).

1. Pedicels recurved or rarely spreading in fruit; sepals of pistillate flowers usually erect and closely appressed, enclosing the flower or fruiting head; sepals and pedicels generally thickening in fruit. *S. montevidensis*
- 1' Pedicels ascending or spreading in fruit; sepals of pistillate flowers spreading or recurved; sepals and pedicels usually not thickening in fruit.
2. Filaments pubescent or minutely scaly, dilated; leaves linear-elliptic to lanceolate, entire, without basal lobes; bracts of the inflorescence thinly membranous, glabrous, more or less connate, with free tips more than 2 mm long. *S. graminea*
- 2' Filaments glabrous, linear; leaves typically sagittate, with conspicuous basal lobes; bracts of the inflorescence membranous, glabrous or pubescent, with free tips or connate.
3. Basal leaf lobes as much as 2–3 times longer than the terminal lobe; achene beak short and inconspicuous, mostly erect. *S. longiloba*
- 3' Basal leaf lobes shorter or at most subequal to the terminal lobe; achene beak short or long, erect or lateral to retrorse.
4. Terminal leaf lobe sub-equal to slightly longer than the basal lobes; floral bracts united (keeled) or separate, elliptic to lanceolate, 5–10 (–15) mm long, apically rounded to obtuse or broadly acute; achene 2.5–4 mm long, with a conspicuous, lateral, horizontal or retrorse beak, 0.5–1.5 mm long. *S. latifolia*
- 4' Terminal leaf lobe longer (often as much as 2 times) than the basal lobes; floral bracts united at least at base, linear to lanceolate, (5–) 10–30 mm long, apically rounded or sharply pointed; achene 2–2.5 mm long, with an often inconspicuous erect or antrorse beak, 0.2–0.4 mm long. *S. cuneata*

Sagittaria cuneata E. Sheld. (wedge-like). Duck Potato Arrowhead.—Perennial herbs to 110 cm tall, essentially glabrous. STEMS stolons and/or corms. LEAVES submersed, floating and emersed; submersed leaves sessile, linear, phyllodial, 5–45 cm long, 0.5–3 cm wide, 3–7-veined, apically acute; floating leaves petiolate, the petioles triangular, to 100 cm long, with basal sheath, blades cordate or sagittate, rarely linear or ovate, 7.5–9 cm long, 3.5–4 cm wide, 3–9-veined, apically obtuse or acute to acuminate, the basal lobes shorter than the terminal lobe; emersed leaves petiolate, the petioles recurved, triangular, 3.5–51 cm long, 0.5–1 cm wide,

with basal sheath, the blades linear to sagittate, 2.5–17 cm long, 1.5–11 cm wide, the terminal lobe triangular or lanceolate to ovate, often as much as twice as long as the basal lobes, 3–9-veined, apically acute. INFLORESCENCE racemose or rarely paniculate, 14–21 cm long, 2–10 cm wide, rarely branched at the base, usually emersed, the rachis branches in 2–10 whorls, the whorls 3-flowered; peduncles triangular, 10–50 cm long; floral bracts united at least at base, linear to lanceolate, membranaceous, 5–40 mm long, apically rounded to acuminate; pedicels cylindric, ascending in fruit. STAMINATE FLOWERS to 25 mm wide; sepals ovate, recurved to spreading, 4–8 mm long, 3–5 mm wide; petals clawed, 6–10 mm long, 4–5 mm wide, the claws 1–1.5 mm long; stamens 15–24; filaments cylindric, not dilated, 0.8–2 mm long, 0.2–0.3 mm wide, glabrous; anthers linear, 1–2 mm long, 0.5–0.8 mm wide, apically obtuse; with pistillodes. PISTILLATE FLOWERS as in the staminate flowers; sepals not enclosing the flower or fruiting head, 10–15 mm long, 8–10 mm wide; petal clawed, 15–20 mm long, 1–15 mm wide, the claw 0.5–0.8 mm long; staminodes absent. FRUITING HEADS 8–15 mm in diam. FRUITS obovoid 1.8–2.5 mm long, 1.3–2.5 mm wide, the beak 0.2–0.4 mm long, usually keeled, usually without wings. $2n = 22$.—Lakes, ponds, tanks, marshy areas and rivers: Apache, Coconino, Navajo, Pinal cos.; 1800–2150 m (6000–7100 ft); fl. Jun–Sep (fr. Jun–Oct); throughout N. Amer., except the se.

Sagittaria graminea Michx. (grass-like). Grassy Arrowhead.—Annual or perennial herbs to 100 cm tall. STEMS rhizomatous. LEAVES submerged and/or emersed; submerged leaves sessile, linear, phyllodial, 6.4–10 cm long, 0.5–4 cm wide, 3–7-veined apically acute, the basal lobes absent; emersed leaves petiolate, the petioles triangular, 6.5–13.5 cm long, 0.7–1.2 cm wide, with basal sheath; blades linear to linear-oblongate, 2.5–17.4 cm long, 0.2–4 cm wide, 1–3-veined, apically acute, the basal lobes absent. INFLORESCENCE racemose or paniculate, emersed, 2.5–21 cm long, 1–6 cm wide, often branched at the base, the rachis branches in 1–12-whorls, the whorls 3-flowered; peduncles terete, 6.5–29.7 cm long, 0.2–4 cm wide; floral bracts united, broadly subulate to lanceolate, chartaceous, 2–5 cm long, apically acute to obtuse; pedicels cylindrical, spreading in flower and fruit. STAMINATE FLOWERS to 2.3 cm wide; sepals reflexed to spreading, 3–4 mm long, 2–2.5 mm wide; petals without claws, 5–8.5 mm long, 4–5 mm wide; stamens 12–18; filaments cylindric and dilated, 0.1–0.5 mm long, 0.05–0.2 mm wide, shorter than the anthers, pubescent; anthers elliptic, 0.9–1.1 mm long, 0.6–1 mm wide, apically obtuse; pistillodes absent. PISTILLATE FLOWERS as in the staminate flowers; sepals not enclosing the flowers or fruiting head, 3–5 mm long, 1.5–2.5 mm wide; petals 6–8 mm long, 5.7–6.3 mm wide; staminodes absent. FRUITING HEADS 6–10 mm in diam. FRUITS oblanceolate, 1.5–2.8 mm long, 1.1–1.5 mm wide, the beak 0.1–0.4 mm long or obsolete, without faces etuberculate. $2n = 22$.—3 subspp., throughout N. Amer., scattered in the W. Ind.

Subsp. **graminea**. —LEAVES submersed to less than 1 cm wide. INFLORESCENCE racemose; bracts moderately connate, the tips up to 6 mm long. FLOWERS with filaments equal or shorter than the anthers; pistillate flowers pedicellate and ascending, 0.5–3 cm long. [*Sagittaria angustifolia* Lindl.].—Marshy areas: Graham Co.; known from a single collection, *J. Thornber s.n.*; ca. 1350 m

(4400 ft). Throughout most of N. Amer.

Sagittaria latifolia Willd. (broad-leaved). Common Arrowhead, Wapato, Duckpotato.—Perennial herbs to 45 cm tall, glabrous (ours) or pubescent. STEMS stolon and/or corms. LEAVES emersed, petiolate, the petioles erect or ascending, triangular, 6.5–51 cm long, 0.2–0.8 cm wide, with basal sheath, the blades sagittate or rarely hastate, 1.5–30.5 cm long, 2–17 cm wide, 7–13-veined, the terminal and basal lobes essentially equal, or the terminal slightly longer, apically acute or rarely obtuse. INFLORESCENCE a simple raceme or rarely paniculate, emersed, 4.5–28.5 cm long, 4–23 cm wide, rarely branched at the base, the rachis branches in 3–9-whorls, the whorls 3-flowered; peduncles triangular, 10–59 cm long, 0.05–0.07 cm wide; floral bracts united (keeled) or separate, elliptic to lanceolate, membranaceous, 3–8 mm long, apically obtuse; pedicels cylindric, spreading. STAMINATE FLOWERS to 4 cm wide; sepals reflexed to spreading, 5–6 mm long, 3–4.5 mm wide; petals clawed, 6–9 mm long, 4.5–5 mm wide, the claws ca. 1.5 mm long; stamens 16–18; filaments cylindric, not dilated, 1–3 mm long, 0.2–0.3 mm wide, longer than the anthers, glabrous; anthers linear, 1.2–1.9 mm long, 0.5–0.6 mm wide, apically obtuse; without pistillodes. PISTILLATE FLOWERS as in the staminate flowers; sepals reflexed not enclosing the lower or fruiting head, to 10 mm long, to 8 mm wide; petals clawed, to 18 mm long, to 12 mm wide, the claw to 0.5 mm long. FRUITING HEADS 10–17 mm in diam. FRUITS oblanceolate, 2.5–3.5 mm long, to 2 mm wide, the beak 1–2 mm long, without keel, the faces etuberculate. $2n = 22$.—Streams: Pima Co.; ca. 750 m (2500 ft); widespread in the New World. Known from only three J. Thornber collections between 1903 and 1905 from the Rillito R., near Fort Lowell [Tucson].

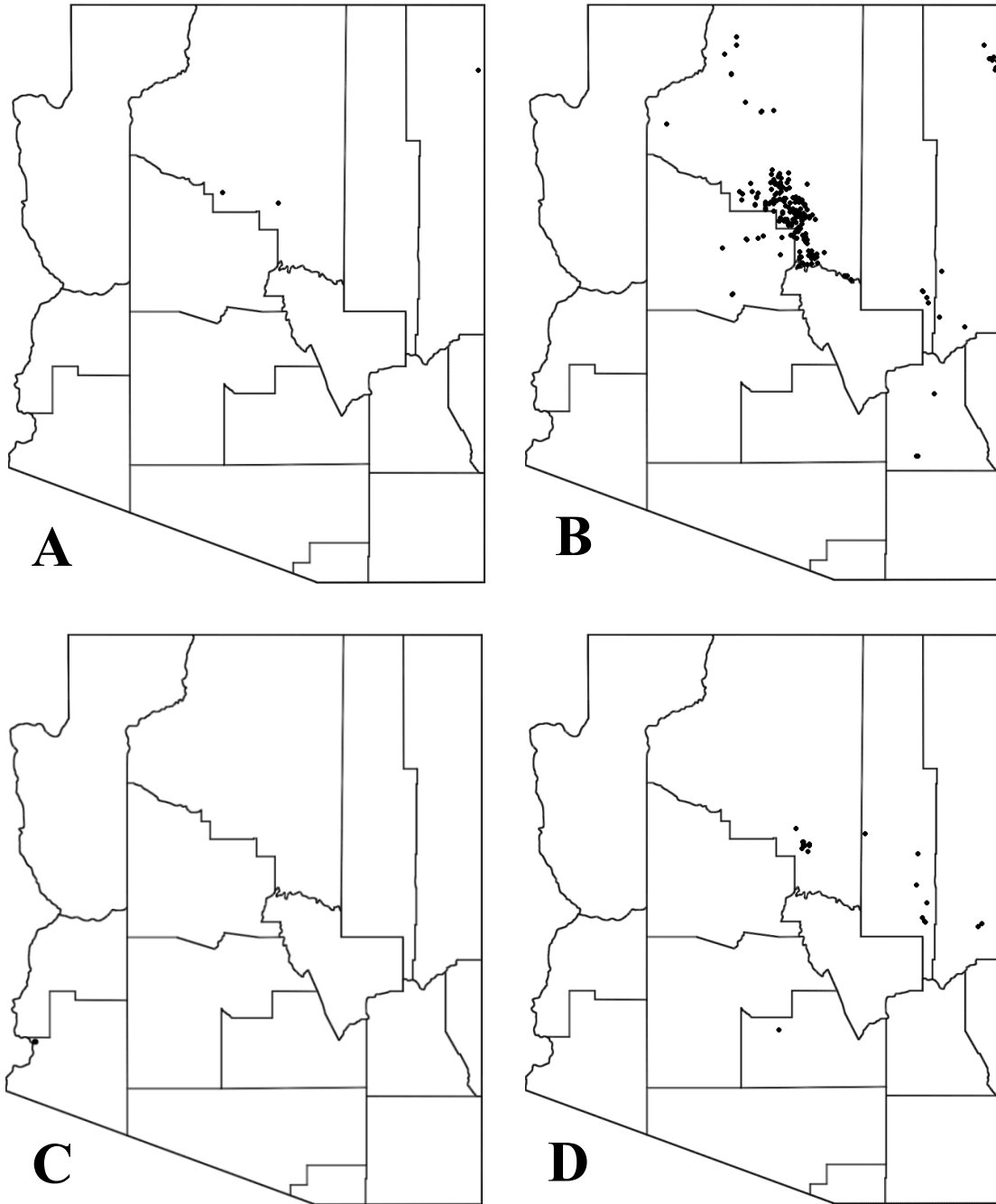
Sagittaria longiloba J. G. Sm. (long lobes, of the leaves). Longbarb Arrowhead.—Perennial herbs to 100 cm tall, essentially glabrous. STEMS stolons and/or corms. LEAVES emersed, petiolate, the petioles erect, flattened, 5-angled, 24.5–60 cm long, 0.2–8 mm wide, with basal sheath, the blades sagittate, 11.5–26.5 cm long, 0.8–15 cm wide, 5–15-veined, the basal lobes always longer, commonly twice as long as the terminal lobe, apically acute to obtuse. INFLORESCENCE a simple raceme or rarely paniculate, emersed, 20–37 cm long, 5–27 cm wide, the rachis branches in 5–7 whorls, the whorls 3-flowered; peduncles terete, 25–96 cm long, 0.2–7.5 mm wide; bracts united at least at base, lanceolate, membranaceous, 1–15 mm long, apically acute; pedicels spreading. STAMINATE FLOWERS to 30 cm wide; sepals reflexed to spreading, 5–9 mm long, 3–6 mm wide; petals clawed, 5–12 mm long, 3.7–14 mm wide, the claws 1.4–3 mm long; stamens 12–16; filaments cylindric, not dilated, 1–3 mm long, to 0.1 mm wide, glabrous; anthers linear, 1.5–2.2 mm long, 0.3–1 mm wide, apically obtuse; pistillodes absent. PISTILLATE FLOWERS as in the staminate; sepals not enclosing the flower and fruiting head, 5.5–7.5 mm long, 2.4–3.5 mm wide; petals clawed, 6–15 mm long, 4–10 mm wide, the claw ca. 2 mm long; staminodes absent. FRUITING HEADS 4–15 mm in diam. FRUITS oblanceolate, 1.2–2.5 mm long, 0.8–1.6 mm wide, the beak 0.1–0.6 mm long, with keel, the faces tuberculate. $2n = 22$.—Ponds, tanks and rivers.: Graham, Pima, and Santa Cruz cos.; 884–1675 m (2900–5500 ft); fl. Apr–Sep (fr. Jun–Oct); mid to w N. Amer, and n Mex.

Sagittaria montevidensis Cham. & Schldl. (from Montevideo, Uruguay). Giant Arrowhead.—Annual or perennial herbs to 100 cm tall. STEMS rhizomes and/or corms. LEAVES submersed and emersed; submersed leaves absent or sessile, linear, phyllodial, to 17 cm long, to 2 cm wide, 1–3-veined, apically rounded to acute, the basal lobes absent; emersed leaves petiolate, the petioles triangular to terete, 21–55 cm long, 0.3–2.5 cm wide, with basal sheath, the blades hastate to sagittate, 2.5–17.5 cm long, 0.6–2.2 cm wide, 7–20-veined, apically acute, the basal lobes longer than or equal to the terminal lobes. INFLORESCENCE racemose or paniculate, floating or emersed, 1.5–28 cm long, 1.5–15 cm wide, often branched at the base, the rachis branches in 1–15 whorls, the whorls 3-flowered; peduncles terete, 15–47 cm long, 0.2–1.3 cm wide; bracts separate or united, lanceolate to elliptic, membranaceous, 0.4–3.4 cm long, apically obtuse to acute; pedicels cylindric, spreading to erect in flower, reflexed and clavate in fruit. STAMINATE FLOWERS 2–5 cm in diam.; sepals ascending in flower, 7.6–12 mm long, 3–6 mm wide; petals clawed, 10–25 mm long, 5–25 mm wide, the claws ca. 4 mm long; stamens 20–30; filaments cylindric, not dilated, 1.2–7.5 mm long, 0.3–0.5 mm wide, longer than the anthers, glabrous or weakly pubescent; anthers linear, 1–2.5 mm long, 0.3–1 mm wide, apically obtuse to round-acute; pistillodes present or absent. PISTILLATE FLOWERS as in the staminate flowers; sepals enclosing the fruiting heads, 3.5–12 mm long, 2–9.5 mm wide; petals clawed, 1.25–2.5 mm long, 0.5–3 mm wide, the claw ca. 2 mm long; with or without purple spot at base; staminodes present or absent. FRUITING HEADS 1.2–2.1 cm in diam. FRUIT oblanceolate, 2–4.3 mm long, 0.7–1.5 mm wide, the beak 0.4–0.8 mm long, without keel, faces etuberculate, narrowly winged. $2n = 22$.

Subsp. **calycina** (Engelm.) Bogin (calyx).—BRACTS free. INFLORESCENCES with bracts separated. STAMINATE FLOWERS with pistillodes present. PISTILLATE FLOWERS with petals lacking a purple spot at base; staminodes present. [*Sagittaria calycina* Engelm.]—Tanks: Cochise Co.; 1250–1550 m (4100–5100 ft); e N. Amer. and n Mex.

LITERATURE CITED

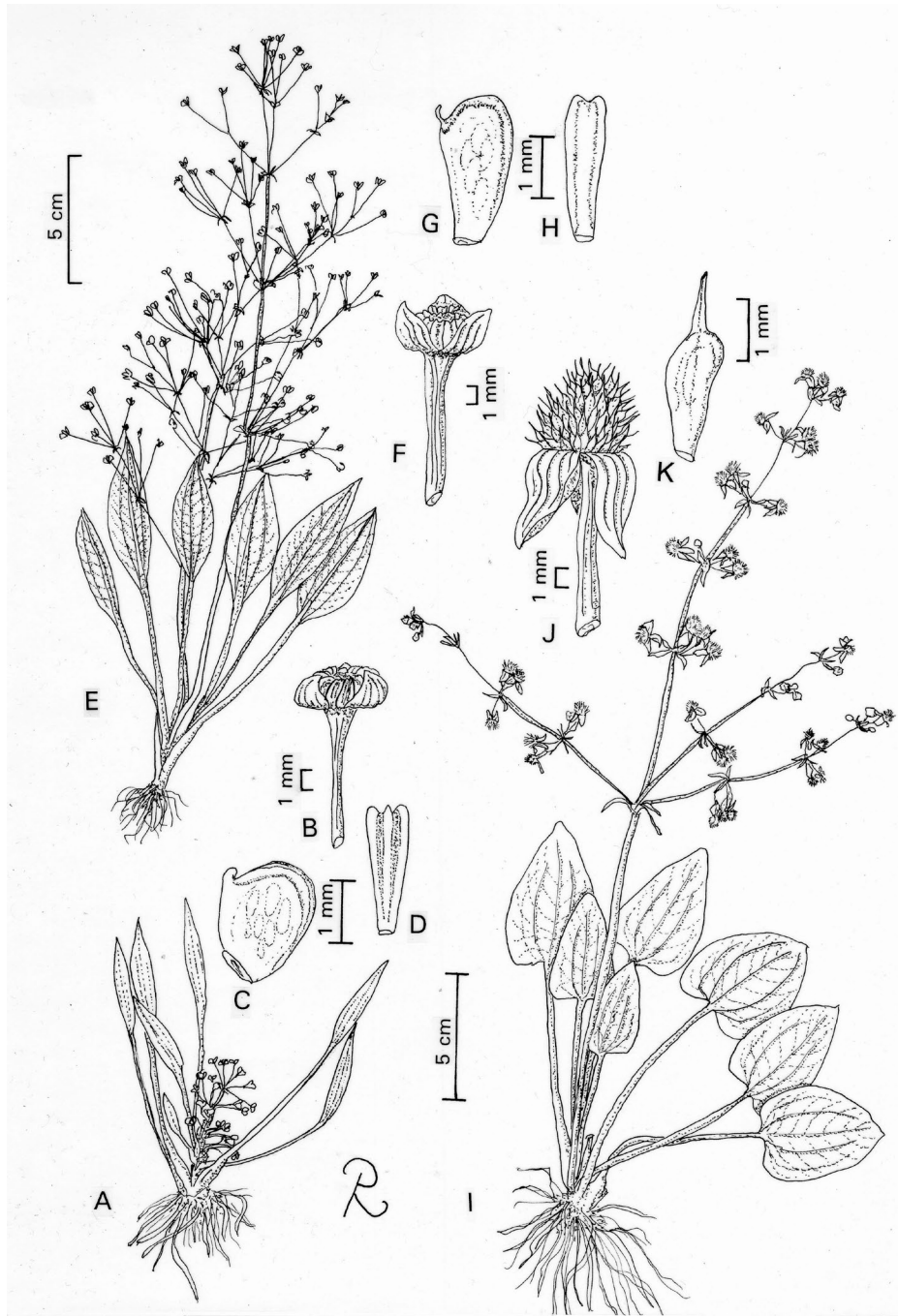
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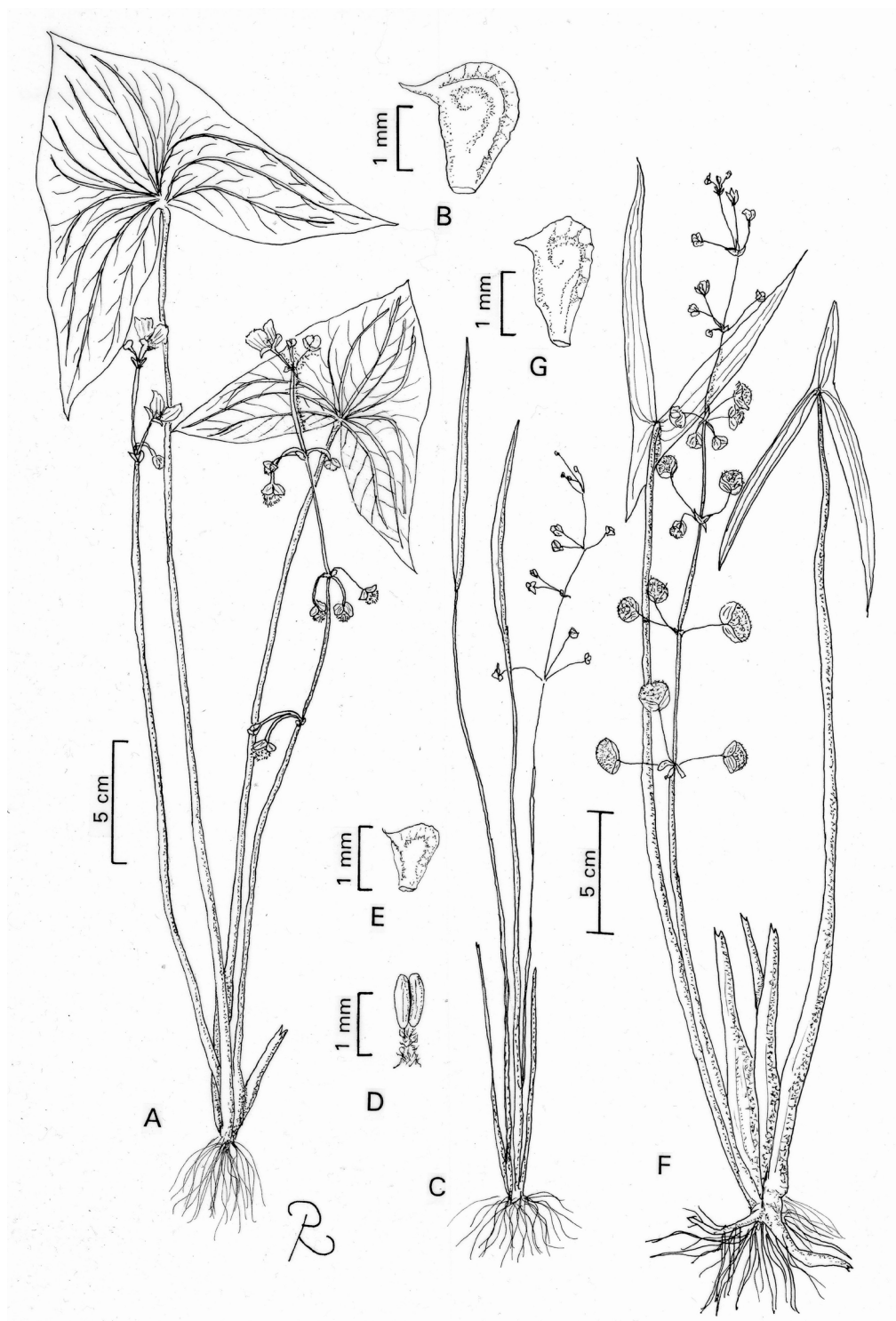
Alismataceae. Figure 1. Distributions: A). *Alisma gramineum*. B). *A. triviale*. (along Colorado River in se AZ) C). *Echinodorus berteroi*. D). *Sagittaria cuneata*.



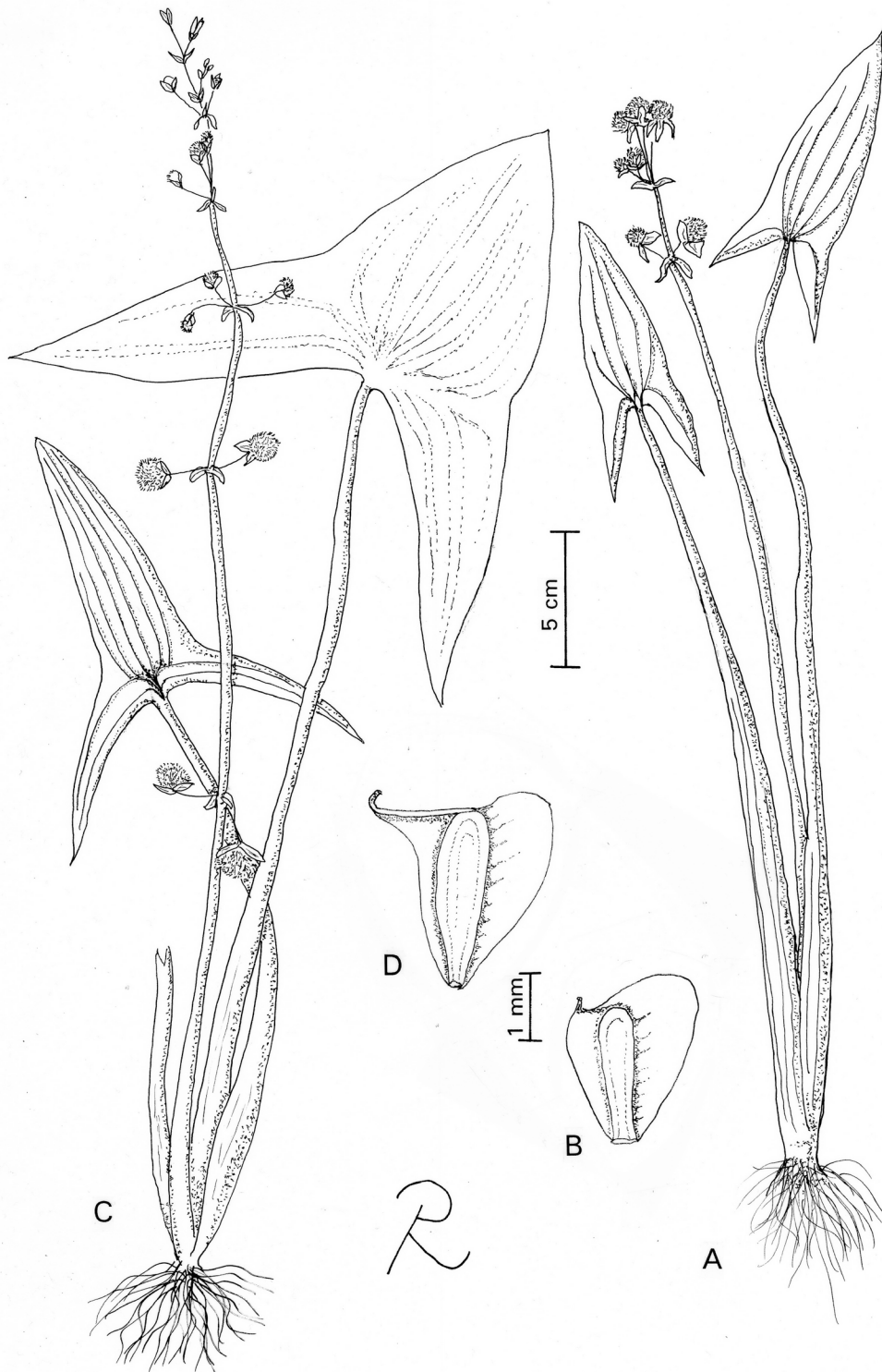
Alismataceae. Figure 2. Distributions: A). *Sagittaria graminea* subsp. *graminea*. B). *S. latifolia*. C). *S. longiloba*. D). *S. montevidensis* subsp. *calycina*



Alismataceae. Figure 3. (*Alisma gramineum*; *A. triviale*; *Echinodorus berteroi*). (A–D) *Alisma gramineum*. A) Habit. B) Fruiting head. C) Seed, side view. D) Seed, dorsal view. (E–H) *Alisma triviale*. E) Habit. F) Fruiting head. G) Seed, side view. H) Seed, dorsal view. (I–K) *Echinodorus berteroi*. I) Habit. J) Fruiting head. K) Seed, side view. [Drawn by Jon Ricketson].



Alismataceae. Figure 4. (*Sagittaria cuneata*; *S. graminea* subsp. *graminea*; *S. latifolia*). (A–B) *Sagittaria cuneata*. A) Habit. B) Seed, side view. (C–E) *Sagittaria graminea* subsp. *graminea*. C) Habit. D) Stamen. E) Seed, side view. (F–G) *Sagittaria latifolia*. F) Habit. G) Seed, side view. [Drawn by Jon Ricketson].



Alismataceae. Figure 5. (*Sagittaria longiloba*; *S. montevidensis* subsp. *calycina*). (A–B) *Sagittaria longiloba*. A) Habit. B) Seed, side view. (C–D) *Sagittaria montevidensis* subsp. *calycina*. C) Habit. D) Seed, side view. [Drawn by Jon Ricketson].