

HYDROCHARITACEAE

FROG'S BIT FAMILY, TAPE-GRASS FAMILY

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Aquatic annual or perennial, submerged, fresh (ours) and salt water herbs, glabrous or pubescent, monoecious or dioecious or polygamous. ROOTS simple, adventitious, anchored or floating. STEMS cormose, rhizomatous, stoloniferous or erect, simple or branched. LEAVES submerged, rarely floating, basal or cauline and alternate, opposite or whorled, sessile or petiolate; stipules rarely present. INFLORESCENCES axillary, terminal or scapose, 1- to many-flowered, solitary or cymose, sessile or pedunculated, spathate, with 2 wholly or partly connate bracts. FLOWERS usually imperfect, epigynous, actinomorphic or rarely zygomorphic, sessile or born on scape-like peduncles, these usually spirally twisted, the staminate flowers numerous, the pistillate flowers solitary; perianth sessile or on a long slender pedicel-like hypanthium, usually reaching the water surface, the perianth with (2–) 3 tepals per whorl, the tepals free, the outer tepals (1–2 whorls, sepal-like) usually green or white, usually reflexed, valvate, the inner tepals (petal-like) usually showy, sometimes reflexed, imbricate; stamens 0 to many, free, in 1 or more whorls, the inner ones often staminodial; a rudimentary ovary often present in the staminate flowers; staminodes often present on the pistillate flowers; ovary inferior, of 2 to 16 united carpels, unilocular, the placentation parietal, the style terminal, the stigmas 2–15, entire or 2–3-lobed. FRUIT berrylike, sometimes beaked, with the remains of the perianth tube, usually irregularly dehiscent; seeds many, fusiform, ellipsoid, ovoid or spheric, glabrous, papillose or echinate.—17 genera, 76 spp., nearly worldwide. Haynes (2000).

1. Leaves ribbon-like, more than 15 cm long, from a basal rosette; stem shorter than leaves; staminate flowers minute, breaking off before anthesis; inner tepals rudimentary, much smaller than the outer tepals *Vallisneria*
- 1' Leaves not ribbon-like, less than 5 cm long, cauline, opposite or in whorls; stem longer than leaves; staminate flowers larger; inner tepals minute or larger, sometimes showy, usually similar in size and shape to the outer tepals 2
2. Leaf margins sparsely serrulate-denticulate, the tips usually spinose; leaves often with teeth along the dorsal surface of the midrib; tubers present; inner tepals minute, as long as or shorter than the outer tepals; staminate spathe spiny *Hydrilla*
- 2' Leaf margins appearing entire or serrulate to denticulate, with minute single celled teeth; leaves smooth along the dorsal surface of the midrib; tubers lacking; inner tepals larger, showy, as large as or larger than the outer tepals; staminate spathe smooth 3.
3. Middle and upper leaves in whorls of 4 or 6, 1.2–4.0 cm long; staminate spathe 2–4-flowered; inner tepals about 8 mm wide, about 3 times as long as the outer tepals *Egeria*
- 3' Middle and upper leaves opposite or in whorls of 3 (rarely 4 or more), 0.6–1.7 cm long; staminate spathe 1-flowered; inner tepals about 1.5 mm wide or less, similar in size to the outer tepals *Elodea*

EGERIA Planch. South American Elodea

Fresh water perennials, dioecious. STEMS elongate, to 3 m long or more, irregularly branched. LEAVES cauline, scale-like prophylls or elongate foliage leaves; prophylls borne at base of stems and branches, opposite, delicate, the apex acute, the base sessile, transparent to pale green; foliage leaves borne at upper portions of stems and branches, in whorls of 5 or more at each node, flaccid, linear to narrowly oblong, often recurved, the midrib often bearing unicellular spines, the apex sub-obtuse to acute or acuminate, terminating in a single celled spine, the base sessile, the margins appearing entire or serrulate to denticulate, with minute single celled teeth. INFLORESCENCES sessile, with a single flower. FLOWERS unisexual, sessile or on long pedicels (the slender, elongated floral tube or hypanthium pedicel-like), opening above water surface 1(–2) at a time. STAMINATE FLOWERS pedicellate, actinomorphic; outer tepals 3, distinct, green, ovate to suborbicular; inner tepals 3, distinct, shining white, widely elliptic to orbicular, with both surfaces papillose; stamens 9, distinct, the filaments elongate, white or yellow, the anthers basifixed, linear, deep yellow to orange. PISTILLATE FLOWERS with tepals as in the staminate flowers but usually somewhat smaller; staminodia 3, distinct, orange to orange-red, papillose; ovary widely ovoid, 1-locular, the ovules 3–9 the styles 3. FRUIT an ovoid capsule, irregularly dehiscent. SEEDS ellipsoidal or fusiform, mucilaginous. $2n = 46$.—2 spp.; worldwide in warmer regions. (Latin: *egeri*, a nymph, in reference to aquatic habitat). Cook & Urmi-König (1984).

Egeria densa Planch. (dense, in reference to the density of the leaves along the stems). Waterweed.—STEMS 1–3 mm diam., internodes usually 2.5–24 mm long. FOLIAGE LEAVES usually densely whorled along the stem, 1–4 cm long, 1.5–4.5 mm wide. STAMINATE FLOWERS 2–5 in each spathe; spathes 7.5–12 mm long, 1.2–4 mm wide; pedicels to 8 cm long, 0.6–0.8 mm wide; sepals 2.2–4.4 mm long, 1.1–4 mm wide; inner tepals 4.9–10.5 mm long, 3.3–8 mm wide; filaments 0.8–4.5 mm long, 0.3–0.6 mm wide, clavate, densely papillose above, yellow. PISTILLATE FLOWERS 1 or 2 in each spathe, the spathes 9–14 mm long, 2–4 mm wide; outer tepals 3–4 mm long, 1.6–3 mm wide; inner tepals 4–8.5 mm long, 4–7 mm wide; staminodia clavate, 0.9–2.4 mm long, golden yellow to reddish-orange, densely papillose; hypanthium to 4 cm long, 0.6–0.7 mm wide; ovary at anthesis 2–3 mm long, 1.1–2.2 mm wide, the ovules 6–7, the styles 2.4–3.8 mm long, divided at least $\frac{2}{3}$ of their length, white to pale yellow. FRUITS sessile, fusiform, 11.5–14.5 mm long, 4–5.5 mm wide. SEEDS 5.5–7.2 mm long, 1–2 mm wide, the beak 3–3.7 mm long. $2n = 46$. [*Anacharis densa* (Planch.) Vict.; *Elodea densa* (Planch.) Casp.].—Still water 1–2 m deep, less common in shallow water and flowing water: Cochise, Maricopa, Pima, Santa Cruz cos.; 350–1,500 m (1,150–5,000 ft.); flowering and fruiting summer to fall; warm-temperate and cool subtropical regions, native to e S. Amer., naturalized worldwide. Commonly used as an aquarium plant.

ELODEA Michx. Waterweed, Ditchmoss

Fresh water perennials, dioecious or rarely monoecious. STEMS usually erect, terete, to 4 m long, usually highly branched near water surface. LEAVES cauline, either prophylls or foliage; prophylls paired, deltate to ovate or narrowly ovate, the apex acute to apiculate,

transparent or pale green; foliage leaves usually paired below, usually in whorls of 3–7 above, ovate to linear or narrowly oblong, spreading or recurved, 1-nerved, the apex obtuse to acute or shortly acuminate, usually bearing more than one minute single celled terminal spine, the base sessile, the margins appearing entire or serrulate to denticulate, with minute single celled teeth. INFLORESCENCES sessile, with a single flower. FLOWERS unisexual, sessile or on long pedicels, (the slender, elongated floral tube or hypanthium pedicel-like) opening above water surface 1 or rarely 2 at a time. STAMINATE FLOWERS sessile to long-pedicellate, remaining attached or becoming free-floating, actinomorphic; outer tepals 3, distinct, green, with lilac to purple stripes or patches of purple, suborbicular to narrowly oblong or narrowly elliptic; inner tepals 3, distinct, very thin and flimsy, deliquescent, whitish-translucent sometimes with a purple vein or tip, rudimentary or usually somewhat longer and distinctly narrower than the outer tepals; stamens usually 9 (or in bisexual flowers usually 3); filaments very short, the inner at least usually united at base forming a column; anther basifixed, oval; pistillodia usually absent, occasionally rudimentary; pollen single or in tetrads. PISTILLATE FLOWERS with outer tepals and inner tepals as in the staminate flowers but usually somewhat smaller; staminodia 3, distinct, filiform, rarely exceeding 2 mm long, greenish white below, lilac above, papillose, usually persisting after the styles have withered; ovary cylindrical 1-locular, with 3–10 ovules, the styles 3. BISEXUAL FLOWERS similar. FRUIT ellipsoidal to ovoid, irregularly dehiscent. SEEDS fusiform, with beak, glabrous to hirsute. [*Anacharis* Rich.].—5 spp., temperate N. Amer. and temperate to subtropical S. Amer. Absent from C. Amer and tropical S. Amer. Widely introduced and naturalized in Eurasia and Australasia. (Greek: *helodes* = marshy, for the habitat). Cook & Urmi-König (1985).

Elodea canadensis is unknown from Arizona, but here included in the key because of historic confusion and possible future introduction. In addition, collections labeled as *E. nuttallii* are mis-identified and not included in our flora, the native range of this species lies well outside our borders.

1. Upper leaves usually not imbricate somewhat irregular and spreading, usually linear, parallel-sided, often paired. Staminate flowers with anthers at least in center of flower 4 mm or more long, the pollen released as single grains and pedicels remaining a short time after anthesis. Pistillate flowers with outer tepals rarely more than 2.5 mm long; inner tepals rarely more than 1 mm wide; seeds up to 4 mm long, densely hirsute.....*Elodea bifoliata*
- 1' Upper leaves usually imbricate in regular rows and lying along the stem, often oblong or ovate, rarely paired, usually whorled in threes. Staminate flowers with anthers rarely more than 3 mm long, the pollen usually released in tetrads and pedicels detaching before or during anthesis. Pistillate flowers with outer tepals usually more than 2.5 mm long; inner tepals usually more than 1 mm wide; seeds up to 7.5 mm long, glabrous or rarely sparsely hairy.....
.....*Elodea canadensis*

Elodea bifoliata H. St. John (two leaved). Two-leaved Waterweed.—LEAVES: prophylls to 2 mm long, to 1 mm wide; foliage leaves often paired, with internodes often longer than the leaves; upper leaves not imbricate, linear to narrowly elliptic or rarely lanceolate, 4.7–25 mm long, 0.8–4.3 mm wide, usually pale green, flat and spreading, the apex acute, the margins mostly straight and parallel. PEDUNCLES to 7 cm long, 0.6 mm wide, usually reaching the water surface, white, flaccid, becoming detached before anthesis. STAMINATE FLOWERS

with outer tepals 2.3–6.1 mm long, 1.2–2.4 mm wide; inner tepals narrowly oblong or oblanceolate 2.7–6.2 mm long, 0.6–1 mm wide; stamens usually 7–9, the inner 3 filaments connate, up to 1.5 mm long; anthers 1.5–4.5 mm long, the pollen in monads. PISTILLATE FLOWERS with outer tepals 1.8–2.7 mm long, 0.8–2.9 mm wide; inner tepals narrowly elliptic or oblanceolate, 2.1–2.8 mm long, 0.6–1 mm wide; staminodia 0.8–1.4 mm long; styles linear, 2.3–3 mm long, bifid for 1/4–2/3 of their length. FRUIT mostly ovate, 6.5–8.0 mm long, 2.3–4.5 mm wide, beak up to 20 mm long. SEEDS narrowly ellipsoidal, 2.8–3.0 mm long, 0.9–1 mm wide, densely covered in white unicellular hairs, 0.5–1 mm long. [*Elodea longivaginata* H. St. John; *E. nevadensis* H. St. John]. $2n = 24$.—Lakes, ponds and tanks: Apache, Coconino, Greenlee, Navajo, Yavapai cos.; 950–3,050 m (3,200–10,000 ft.); flowering and fruiting summer to fall; higher elevations from Alberta & Saskatchewan s to AZ and NM.

In our area, *Elodea bifoliata* is extremely easy to identify with its hairy seeds. The type of *Elodea bifoliata* is from Lake Mary, Coconino County.

HYDRILLA Rich.

Water Serpent

Annuals or perennials of fresh or brackish water, monoecious or rarely dioecious. ROOTS long and simple, adventitious, arising at nodes. STEMS erect, elongate, rhizomatous or stoloniferous, branched or unbranched. LEAVES cauline, sessile, whorled, 3 to 12 per node, linear to lanceolate, rarely widely-ovate or elliptic, 5–20 mm long, 1.2–4 mm wide, with or without reddish brown spots or stripes, the midrib distinct and often bearing unicellular spines on the abaxial surface, the apex acute and terminating with a single spine, the margins usually sparsely serrulate-denticulate, with the teeth usually visible, often spinose. INFLORESCENCES 1-flowered. FLOWERS unisexual, developing within spathes. STAMINATE FLOWERS released underwater as globose buds which open in the air on the surface of the water, the pedicels 0.2–0.5 mm long; outer tepals 3, distinct, imbricate, 1–3 mm long, 1–2 mm wide, whitish-red or brown; inner tepals 3, distinct, linear or spatulate, 1–2 mm long, whitish or reddish; stamens 3, the filaments oblique, 0.25–0.75 mm long, the anthers erect, 4-locular, explosively dehiscent; pistillodes absent. PISTILLATE FLOWERS with a filiform hypanthium, 0.55–1.0 cm long; outer tepals 3, distinct, oblong-ovate, 1–4 mm long, hyaline, streaked with red or white; inner tepals 3, distinct, 1–3.5 mm long, transparent, occasionally with reddish streaks; staminodes 3, minute or absent, transparent; ovary unilocular, cylindrical, the style 1, the stigmas 3. FRUIT indehiscent, cylindrical, 5–15 mm long, smooth or spiny, the spines lateral, to 3 mm long. SEEDS rarely more than 5, cylindrical, 1.5–2.5 mm long, smooth, glabrous.—A monotypic genus. Cosmopolitan in warmer regions. Cook & Lüönd (1982).

Hydrilla verticillata (L. f.) Royal (whorled or verticillate leaves). Water Serpent.—Characteristics of the genus. [*Elodea verticillata* (L. f.) F. Muell.; *Vallisneria verticillata* (L. f.) Roxb.]. $2n = 16, 24, 32$.—A great number of habitats, but typically in shallow, slow moving water, rarely in swiftly-flowing water or shady areas: Maricopa Co.; 300–350 m (1,000–1,100 ft.); flowering material unknown in AZ. Readily reproduces vegetatively and has become a pest in many areas by restricting water flow in irrigation systems.

Vallesneria L. Wildcelery, Tapegrass, Eelgrass

Perennial herbs of fresh (ours) or salt water, dioecious. ROOTS fibrous. STEMS erect, short, rhizomes and stolons present. LEAVES basal, linear, sessile, strap-shaped, with coloration appearing 3-zoned (a lighter center and darker zones on each end), 3–5-nerved, the apex obtuse to apiculate, the margins entire to finely-toothed. INFLORESCENCES cymose, long-pedunculate. FLOWERS unisexual, developing within spathes, zygomorphic. STAMINATE FLOWERS sessile, released underwater and opening on the surface of the water, the outer tepals 3, the inner tepal 1, minute; stamens 3 (1 staminodia and 2 fertile), the filaments distinct, rarely connate and appearing as one; anthers spheric; pollen in monads. PISTILLATE FLOWERS solitary, pedicellate, floating, the outer tepals 3, the inner tepals 3, minute, transparent; staminodia 3; ovary 1-locular, the styles 1, short or highly reduced, the stigmas 3; ovules numerous. FRUITS cylindrical to ellipsoid, ridged, irregularly dehiscent. SEEDS numerous, ellipsoid, glabrous. $2n = 20$.—2 species, 4 varieties, cosmopolitan. (Named for the Italian naturalist, Antonio Vallisneri, 1661–1730). Lowden (1982); Jacobs & Franks (1997); Les et al. (2008).

Vallisneria americana Michx. (of America). American wild celery, Tape-grass, Eelgrass.—INFLORESCENCES solitary flowers, racemes or umbellate, the scapes 3–16 cm long, 1.5–5 mm wide. STAMINATE FLOWERS 1–1.4 mm in diam., upright, the stamens with united filaments, with inconspicuous transparent hairs at base. PISTILLATE FLOWERS: outer tepals 3.5–9.5 mm long; staminodia large, conspicuous, the stigmas with reduced styles or adnate to a fused style base, the stigmatic lobes equal.—2 subsp. Amer., e and se Asia, Japan, Oceania and Australia.

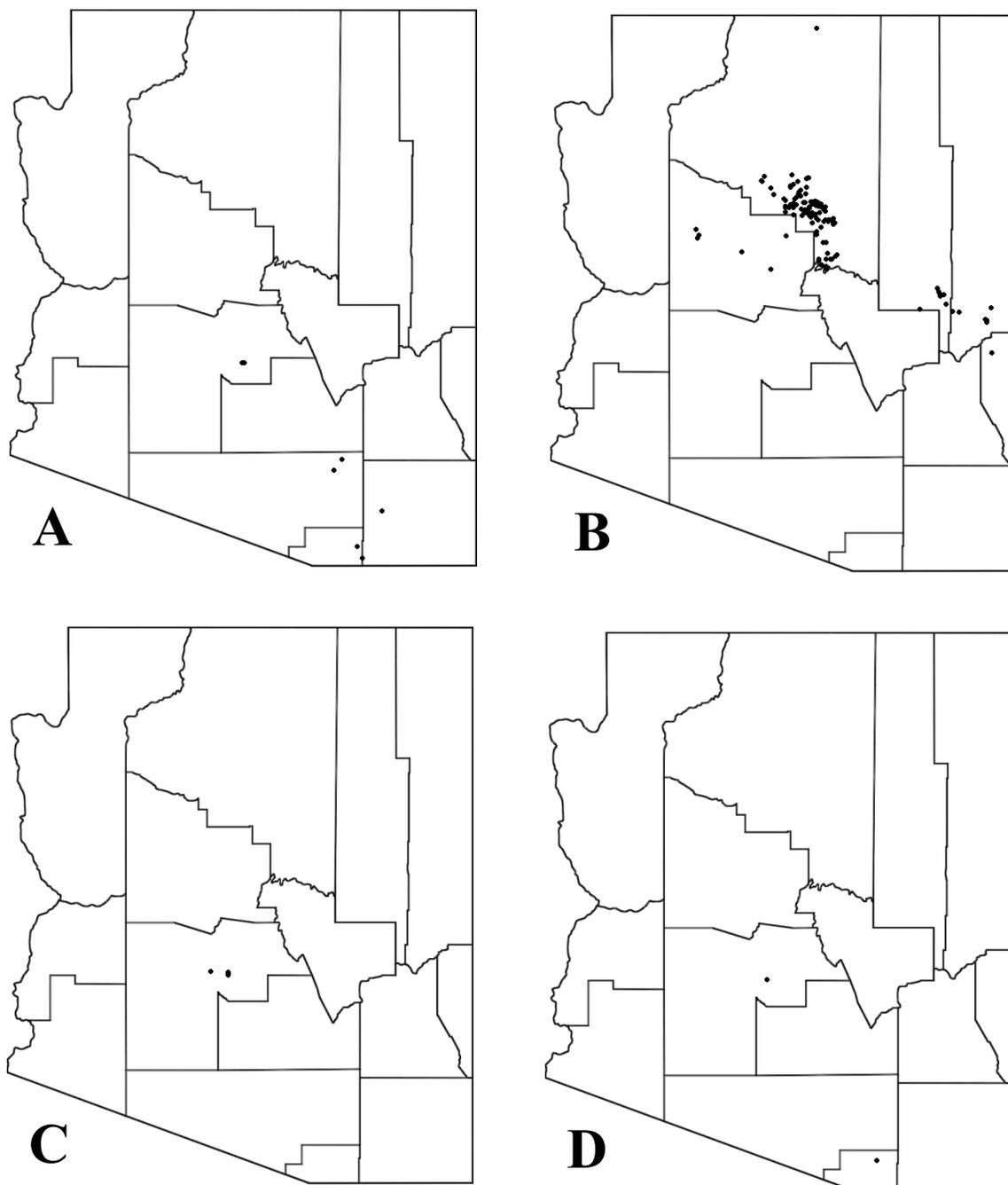
Subsp. **americana**.—LEAVES 30–150 cm long, 4–10 mm wide, 3–5-nerved, the margins sub-entire to slightly serrated with minute teeth. STAMINATE FLOWERS with the spathe 1.8–2 cm long; peduncles 3–16 cm long; outer tepals 0.8–1 cm long; filaments partially connate, with a few transparent hairs at base of androecium. PISTILLATE FLOWERS solitary or rarely in a 3–60-flowered umbel to spike-like inflorescence, with regular to irregular flowers; spathe 1.8–2 cm long; peduncles 0.5–2 cm long; outer tepals 4–6 mm long; inner tepals 0.6–0.7 mm long; staminodia 0.4–0.5 mm long, adnate to styles, not to stigmas; style 0.8–1 mm long, the stigma 3–4 mm long. [*Vallisneria asiatica* Miki; *V. neotropicalis* Vict.; *V. spiralis* var. *americana* (Michx.) Torr.].—Still to flowing water, usually up to 1 m or more deep, common in irrigation canals where it hinders water flow: Maricopa, Santa Cruz cos.; 300–1,350 m (1,000–4,400 ft.); fl. unknown in AZ.; throughout N. Amer.; Cuba, Caribbean Mex., Guatemala, Belize and Honduras, to e and se Asia, Oceania and Australia. Cultivated as decorative aquarium plant.

The Arizona collections are from an irrigation canal in Phoenix and Monkey Springs in Santa Cruz County. Flowering collections are unknown in Arizona; however, the species is an aggressive vegetative reproducer.

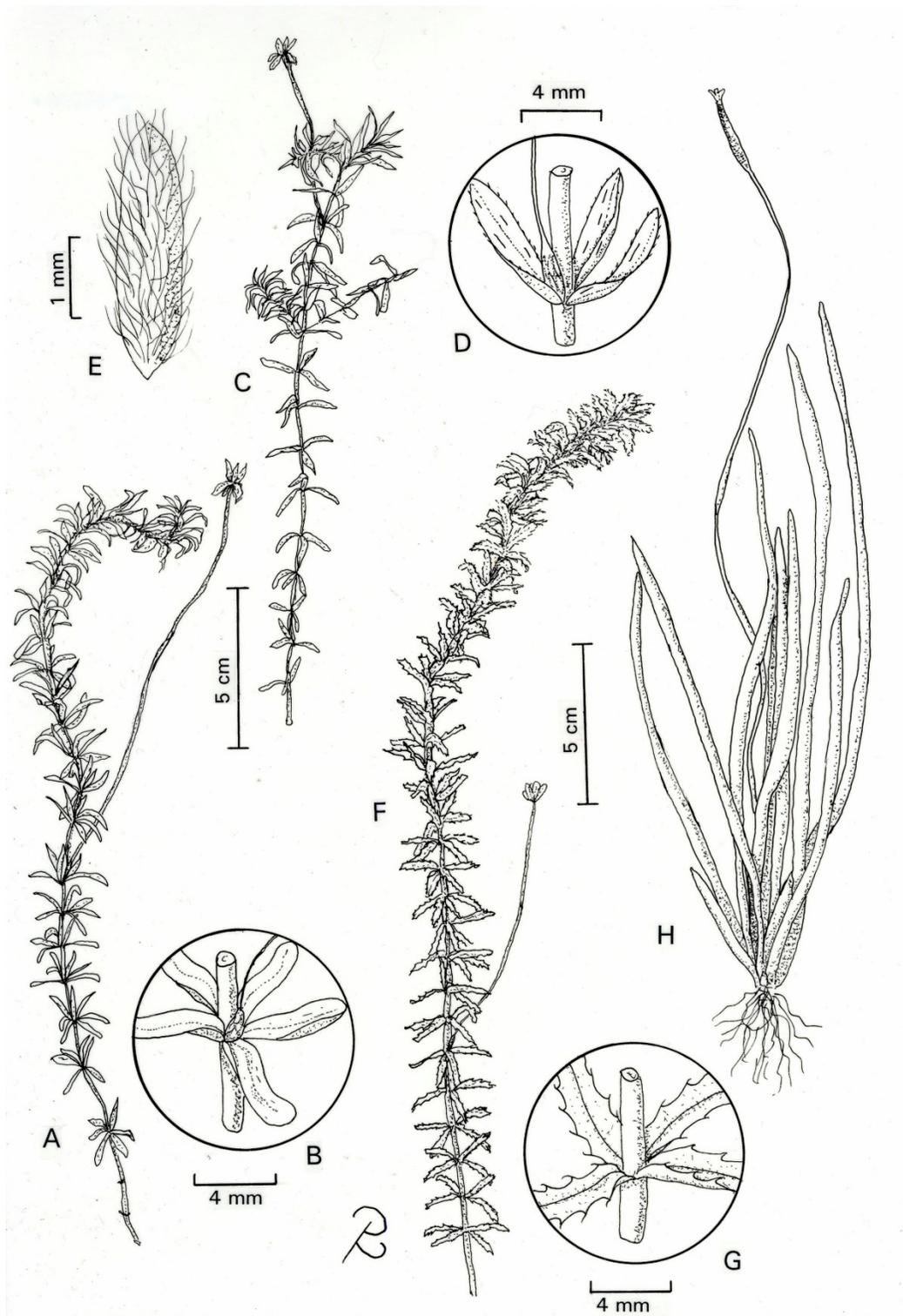
Les et al. (2008) have been working on *Vallisneria*, resurrecting a few names and describing as many as 6 new species, primary from Australia and Eurasia. However, a comprehensive revision of the entire genus is still needed. Although, it is certain that the material in AZ will remain as *V. americana*, the future subspecies or varietal names may in fact change in time and the above description (based on current understanding of the taxa) may require refining at a later date.

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Hydrocharitaceae. Figure 1. Distributions maps. A). *Egeria densa*. B). *Elodea bifoliata*. C). *Hydrilla verticillata*. D). *Vallisneria americana* subsp. *americana*.



Hydrocharitaceae. Figure 2. (A–B) *Egeria densa*. A. Habit. B. Detail of stem and leaf whorl arrangement. (C–E) *Elodea bifoliata*. C. Habit. D. Detail of stem and leaf whorl arrangement. E. Seed. (F–G) *Hydrilla verticillata*. F. Habit. G. Detail of stem and leaf whorl arrangement. (H) *Vallesneria americana* subsp. *americana*. H. Habit. [Drawn by Jon Ricketson].