

NAJADACEAE

WATER-NYMPH FAMILY

Jon M. Ricketson
Missouri Botanical Garden
4344 Shaw Blvd., St. Louis, MO 63110
jon.ricketson@mobot.org

Submerged aquatic annual or rarely perennial herbs, glabrous, monoecious or dioecious. ROOTS fibrous, adventitious at lower nodes. STEMS slender, usually profusely branched distally, the internodes armed with spinulose prickles or unarmed. LEAVES subopposite or appearing verticillate, linear, sessile, 1-veined, the apex acute to acuminate, the margins entire, minutely serrulate; midvein sometimes dorsally armed with spines; sheath deciduous. INFLORESCENCES axillary, solitary, or few flowered cymes, sessile or short-pedunculate, often with an involucrel spathe. STAMINATE INFLORESCENCES: floral bracts absent; peduncles elongating at anthesis. PISTILLATE INFLORESCENCES: floral bracts absent or rarely present, sessile. FLOWERS unisexual. STAMINATE FLOWERS: perianth absent; stamen 1; anther sessile, 1–4-celled, dehiscing irregularly. PISTILLATE FLOWERS: perianth absent; pistil 1, 1-loculed; ovule 1, the placentation basal; styles short, the stigmas 2–4-lobed. FRUITS achene-like, dehiscing by decay, with thin walls, 1-seeded, the seeds fusiform to obovate, often asymmetrical, the testa smooth or with 15 to 60 regular or irregular rows of areolas.—A monogeneric family, ca. 40 spp., nearly worldwide. Haynes (1979, 2000); Lowden (1986).

Najas L. Water-Nymph, Bushy-Pondweed

Characters of the family. – (Greek: *naias* = a water-nymph).

Sterile collections are difficult to determine. However, mature fertile collections are quite easy to separate based on seed architecture.

- 1. Staminate and pistillate flowers on different plants; leaves and internodes spinulose*N. marina*
- 1' Staminate and pistillate flowers on same plants; leaves and internodes without spines.
 - 2. Testa smooth, but finely reticulate, glossy; seeds obovoid, yellow to brown; anthers 1-celled.*N. flexilis*
 - 2' Testa reticulate to pitted, dull; seeds fusiform to ellipsoid, yellowish white to greenish or reddish-brown or with a purple tinge; anthers 1–4-celled.....
.....*N. guadalupensis*

Najas flexilis (Willd.) Rostk. & Schmidt (flexible). Slender Water-Nymph.—Plants monoecious. STEMS flaccid, 2.5–5 cm long, 0.2–0.6 mm wide, unarmed. LEAVES narrowly linear, 0.2–3.6 cm long, 0.2–2.6 mm wide; apex acute to long acuminate, with 1 to 2 minute unicellular terminal teeth; margins serrulate with

35 to 80 minute unicellular teeth per side; midvein unarmed; basal sheath 2–3 mm long, 0.7–1.6 mm wide, the apex rounded, usually with scattered minute unicellular teeth, the margins otherwise entire. INFLORESCENCES with 1 or 2 flowers per leaf axil; involucre beaks 0.7–1.2 mm long, 3-lobed. STAMINATE FLOWERS above the pistillate flowers, 1.1–2.7 mm long; anthers 1.1–2.7 mm long, 1-celled. PISTILLATE FLOWERS below the staminate flowers, 2.5–4.7 mm long; styles 1.5–1.7 mm long; stigmas 3-lobed. SEEDS deep brown to yellow, obovoid, 1.2–3.7 mm long, 0.2–1.2 mm wide; testa glossy, smooth but finely reticulate, the areolas regularly arranged in ca. 50 longitudinal rows. $2n = 12, 24$. [*Caulinia flexilis* Willd.].—Ponds: Yavapai Co.; ca. 1100 m (3600 ft.); flowers and fruits summer-fall; N. Amer., Eurasia.

Both *Najas flexilis* and *N. guadalupensis* subsp. *guadalupensis* have been collected in the Page Springs Fish Hatchery at Cornville in Yavapai County.

Najas guadalupensis (Spreng.) Mangus (from Guadalupe). Common Water-Nymph.—Plants monoecious. STEMS flaccid, 11–90 cm long, 0.1–2 mm wide, unarmed. LEAVES narrowly linear, 0.3–3.3 cm long, 0.2–2.1 mm wide; apex obtuse to acute, with 1 to 3 minute unicellular terminal teeth; margins serrulate with 18 to 100 minute unicellular teeth per side; midvein unarmed; basal sheath 3–5 mm long, 1–3.4 mm wide, the apex rounded to truncate, the margins usually with a few teeth, sometimes entire. INFLORESCENCES with 1 to 3 flowers per leaf axil; involucre beaks 0.2–1.3 mm long, 4-lobed. STAMINATE FLOWERS above the pistillate flowers, 1.5–3 mm long; anthers 1–1.7 mm long, 1- to 4-celled. PISTILLATE FLOWERS below the staminate flowers, 1.5–4 mm long; styles 0.3–1.5 mm long; stigmas 4-lobed. SEEDS whitish yellow with purple tinge, fusiform to ellipsoid, 1.2–3.8 mm long, 0.4–0.8 mm wide; testa dull, reticulate to pitted, the areolas regularly arranged in 20 to 60 longitudinal rows. $2n = 12, 36, 42, 48, 54, 60$. [*Caulinia guadalupensis* Spreng.].—4 subsp. New World.

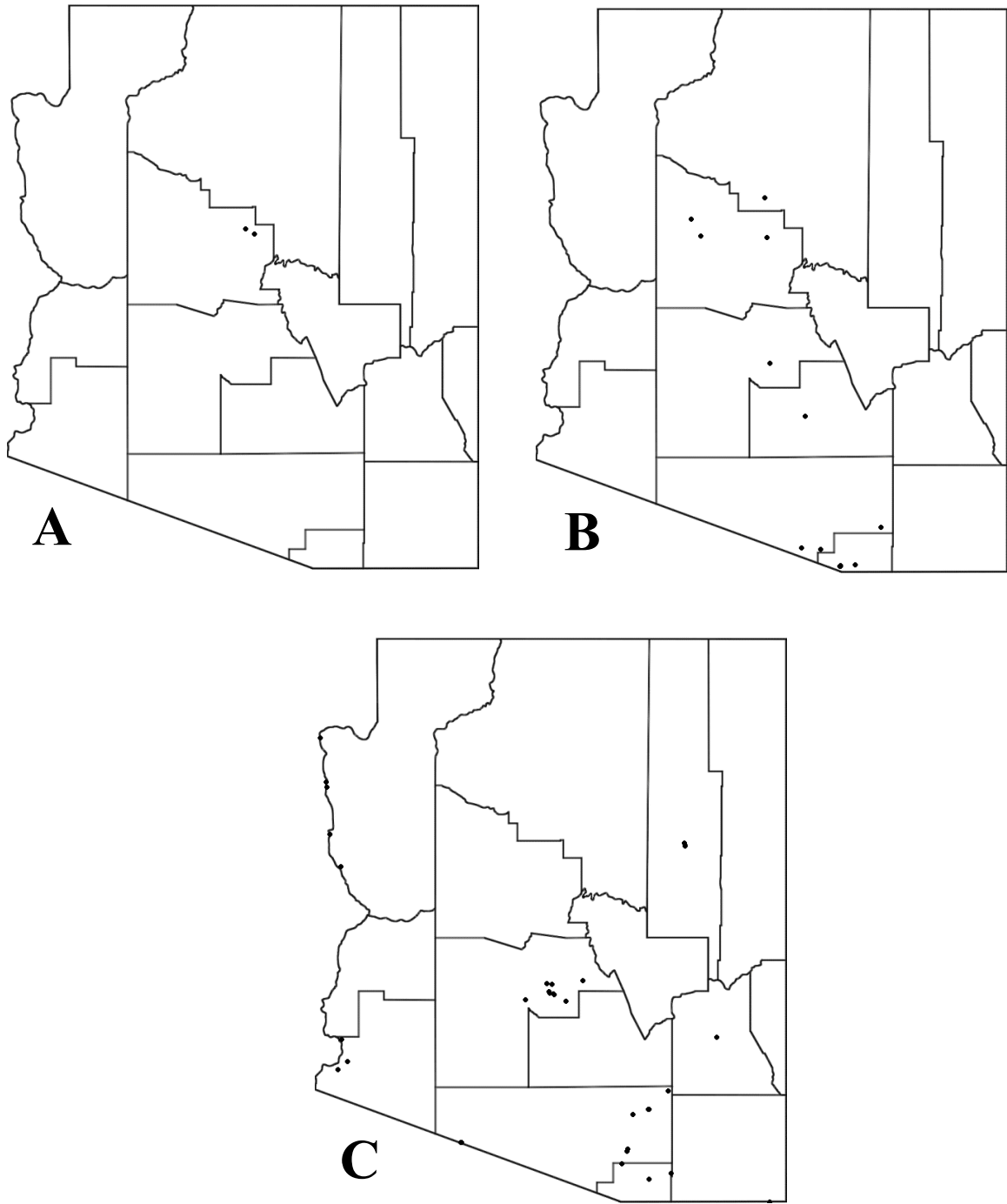
Subsp. ***guadalupensis***.—STEMS 11–75 cm long, 0.1–0.8 mm wide. LEAVES 0.3–2.8 mm long, 0.2–1.8 mm wide; apex acute to mucronate; margins with 50 to 100 minute unicellular teeth per side that are invisible to unaided eye. STAMINATE FLOWERS 1.5–2.4 mm long; anthers 4-celled. PISTILLATE FLOWERS 1.5–2 mm long. SEEDS 1.2–2.5 mm long, 0.4–0.6 mm wide, the areolas in 20 longitudinal rows. $2n = 24$.—Lakes and tanks: Coconino, Maricopa, Pima, Pinal, Santa Cruz and Yavapai cos.; 1100–1500 m (3600–5000 ft.); flowers and fruits summer-fall; throughout New World.

Najas marina L. (of the sea). Holly-Leaved Water-Nymph.—Plants dioecious. STEMS stout, 6–45 cm long, 0.4–5 mm wide, usually armed with spinulose prickles. LEAVES narrowly linear, 0.5–3.9 cm long, 0.4–4.5 mm wide; apex acute, with a terminal spinulose prickles; margins coarsely serrate with 8 to 13 stiff multicellular teeth tapering to a sharp spiny point; midvein armed abaxially with spinulose prickles; basal sheath 5–6 mm long, 2–4.4 mm wide, the apex acute to rounded, the margins entire or with a few teeth. INFLORESCENCES with 1 flower per leaf axil; involucre beaks 0.3–0.7 mm long, 2-lobed. STAMINATE FLOWERS scattered throughout, 1.7–3 mm long; anthers 1.7–3 mm long, 4-celled. PISTILLATE FLOWERS scattered throughout, 2.5–5.7 mm long; styles 1.2–1.7 mm long; stigmas 3-lobed. SEEDS

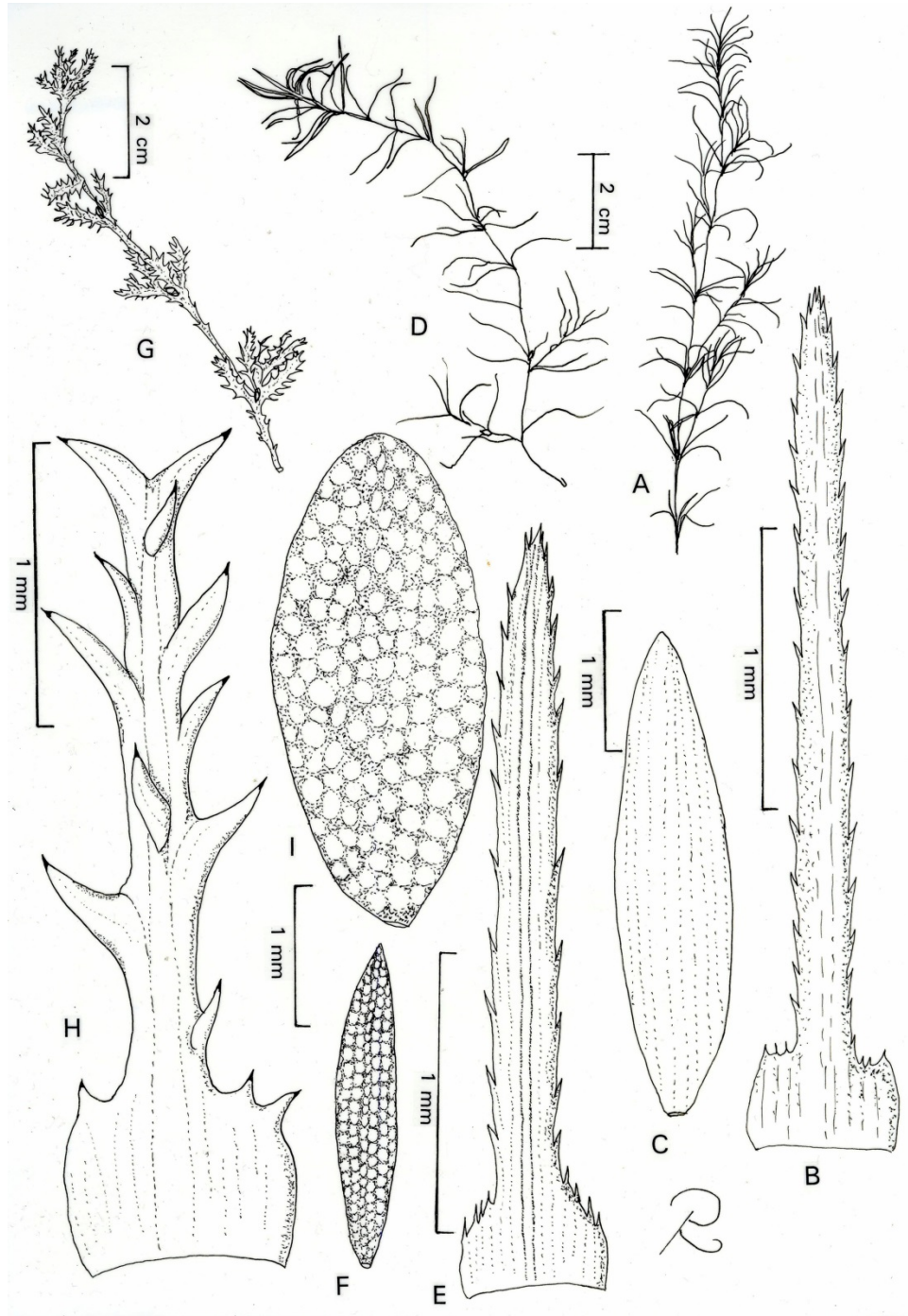
reddish-brown, ovoid, 2.2–4.5 mm long, 1.2–2.2 mm wide; testa dull, pitted, the areoles irregularly arranged, not in distinct rows. $2n = 12$. [*N. gracilis* Morong].—Lakes, ponds, springs, ditches, streams and rivers; Cochise, Graham, Maricopa, Mohave, Navajo, Pima, Santa Cruz and Yuma cos.; 300–1550 m (1000–5000 ft.); flowers and fruits summer-fall; throughout New World and Eurasia.

LITERATURE CITED

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Najadaceae. Figure 1. Distribution maps. A) *Najas flexilis*. B) *Najas guadalupensis* subsp. *guadalupensis*. C) *Najas marina*.



Najadaceae. Figure 2. *Najas*. (A–C) *N. flexilis*. A) Flowering branch. B) Leaf. C) Seed. (D–F) *N. guadalupensis* subsp. *guadalupensis*. D) Flowering branch. E) Leaf. F) Seed. (G–I) *N. marina*. G) Flowering branch. H) Leaf. I) Seed. [Drawn by Jon Ricketson].