

SCROPHULARIACEAE

FIGWORT FAMILY

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Herbs or shrubs. LEAVES simple, alternate or opposite, with or without glands; stipules absent. INFLORESCENCE racemose or cymose or flowers solitary and axillary. FLOWERS perfect, actinomorphic to zygomorphic, ebracteate, hypogynous; sepals 5, united, the lobes equal or unequal and shorter than the tube; petals 5, united, the corolla regular to 2-lipped, the upper lip 2-lobed, external in bud, the lower lip three-lobed; stamens 2–5, all with two well-developed anther sacs, or with staminodes sometimes present, the thecae confluent at the apex; carpels 2, fused, superior; locules 2; placentation axile; style solitary and terminal; stigmas 2-lobed, the lobes distinct or united. FRUIT a 2-valved, septicidal capsule, berry or drupe.—ca. 60 genera, ca. 1800 spp., worldwide.

Many of the 300+ genera in the Scrophulariaceae s.l. are now placed in other families because recent studies show that the family is not monophyletic (APG IV 2016). The families are difficult to separate morphologically and many authors have yet to embrace the taxonomic changes. We use the more narrowly circumscribed family here to be consistent with the treatment in preparation for Flora of North America.

1. Shrubs; inflorescence a compact cyme *Buddleja*
- 1' Herbs; inflorescence a spike, raceme, panicle, or solitary flower.
 2. Plants aquatic or semi-aquatic, acaulescent; flowers solitary in leaf axils *Limosella*
 - 2' Plants terrestrial, caulescent erect; flowers in panicles or racemes.
 3. Leaves alternate; inflorescence a spike or raceme; flowers generally yellow *Verbascum*
 - 3' Leaves opposite; inflorescence a panicle; flowers bi-colored, generally red to purple and green *Scrophularia*

Buddleja L. Butterfly Bush

A genus previously treated as in a separate family. See E. M. Norman (1992; http://www.canotia.org/vpa_volumes/VPA_JANAS_1992_Vol26_1_Norman_Buddlejaceae.pdf).

Limosella L. Mudwort

Rich Crawford

Aquatic to semi-aquatic annual or perennial herbs. STEMS very short, occasionally forming stolons. LEAVES few to many, basal and forming clusters at the

nodes of stolons, petiolate with a hyaline margin at the base; blades linear to spatulate, entire, glabrous, or with sparse minute glandular hairs. FLOWERS small, solitary, pedunculate in leaf axils; calyx campanulate, regular, 5-lobed; corolla actinomorphic or zygomorphic, white to pale pink, glabrous or pubescent on the inner surface, the lobes acute or rounded; stamens 4, +/- equal; style straight or reflexed, persistent or deciduous, the stigma capitate. CAPSULES ovoid; seeds brown, oblong, reticulated with longitudinal grooves. 15 species worldwide.

1. Corolla lobes blunt, style 0.6–1.1 mm long; seeds dark brown.....*L. acaulis*
- 1' Corolla lobes acute, style 0.1–0.6 mm long; seeds light brown.
 2. Inner corolla densely pubescent, plants of Cochise county *L. pubiflora*
 - 2' Inner corolla glabrous, plants mostly distributed N of the Mogollon rim
..... *L. aquatica*

Limosella acaulis Sessé & Moc. (stemless). Owyhee Mudwort.—STEMS none or forming stolons 0–2 cm long. LEAVES linear to linear spatulate, 1–4 cm long; blade 0.25–1.5 mm wide. FLOWERS with peduncle 1.5–8(–12) mm long; calyx 1.5–2.5 mm long; corolla actinomorphic, 1.5–3 mm long, glabrous inside, the limb 0.5–1 mm long; style 0.6–1.1 mm long, persistent. CAPSULES 2–3 mm long; seeds dark brown.—Semi-aquatic habitats near lakes, ponds, and cattle tanks. Apache, Coconino, and Santa Cruz cos., 1920–2606 m (6300–8550 ft), Jun–Oct. AZ, CA, ID, NM, NV, OR.

Limosella aquatica L. (referring to aquatic habit). Water Mudwort.—STEMS none or forming stolons 0–4 cm long. LEAVES linear to ovoid spatulate, 1–8(–20) cm long; blade 0.25–8 mm wide. FLOWERS with peduncle 1.6–10(–25) mm long; calyx 2–3 mm long; corolla actinomorphic or zygomorphic, 2–3 mm long, glabrous inside, the limb 0.5–1 mm long; style 0.1–0.7 mm long, deciduous. CAPSULES 2.5–3 mm long; seeds light brown.—Semi-aquatic and aquatic habitats in and near lakes, ponds, and cattle tanks. Apache, Coconino, and Graham cos., 2060–2925 m (6760–9600 ft), May–Oct. w U.S., circumboreal in the n Hemisphere.

Limosella pubiflora Pennell (pubescent petals). Chiricahua Mudwort.—STEMS none or forming stolons 0–4 cm long. LEAVES linear to ovoid spatulate, 1–8 cm long; blade 0.25–5 mm wide. FLOWERS with peduncle 4–13 mm long; calyx 2–3 mm long; corolla weakly zygomorphic, 2–3 mm long, densely pubescent inside, the limb 0.5–1 mm long; style 0.4–0.6 mm long, deciduous. CAPSULES 2.5–3 mm long; seeds light brown.—In fine silt and mud along small drainages in the Chiricahua Mts., Cochise Co., 1525–1800 m (5000–6000 ft), Feb–May. AZ, NM.

Limosella pubiflora is very similar to *L. aquatica* and may be a regional variant.

Scrophularia L. Figwort

Rich Crawford

Perennial herbs. LEAVES cauline, opposite to decussate, petiolate, lanceolate to ovate, cordate to cuneate; apex acute; margins coarsely and irregularly dentate to finely serrate. INFLORESCENCE paniculate. FLOWERS perfect; pedicels fine or thickened, flexuous to rigid, pendulous to erect; calyx nearly regular, of 5 subequal lobes, the lobes blunt to acute, the margins usually scarious rarely herbaceous; corolla irregular, throat slightly constricted, the upper lip 2-lobed, red, exceeding lower 3 lobes, the lower 3 lobes bicolored, usually red, white and sometimes green; anther-bearing stamens 4, included or exerted; staminode 1, club-shaped or two-lobed; stigma club-shaped, often becoming reflexed after pollination. CAPSULES ovoid; seeds brown, ovoid, ridged. 150–200 species: N. Amer., temperate Asia, Medit. (Latin: associated with the disease scrofula)

1. Corolla 5–8 mm long; pedicels flexuous; plants widespread in AZ *S. parviflora*
 1' Corolla 8–10 mm long; pedicels thickened and straight; plants from ne AZ
 *S. lanceolata*

Scrophularia lanceolata Pursh (for leaf shape). Lanceleaf Figwort.—STEMS erect. LEAVES 4–8.5 cm long, 3.5–5 cm wide, cuneate at the base; margins coarsely irregularly dentate. INFLORESCENCE of sub-opposite, paniculate clusters usually 2 per node diverging at 45° angles. FLOWER pedicels thickened, spreading to erect; calyx 2–3 mm long; corolla 8–9 mm long; staminode lobed. CAPSULES 6–7 mm long.—Moist shady places, Apache Co.; Jul–Sep. Widespread in N Amer. except in the se U.S.

This species is known from one collection (D. Roth 156, NAVA) along Teec Nos Pos Creek in the Carrizo Mts.

Scrophularia parviflora Woot. & Standl. (small-flowered). Pineland Figwort.—STEMS erect becoming decumbent with age. LEAVES 4–15 cm long, 1.5–6.5 cm wide, cordate to cuneate at the base; margins coarsely and irregularly dentate to finely serrate. INFLORESCENCE of loose terminal panicles. FLOWER pedicels fine, flexuous, pendant to erect; calyx 2–3 mm long; corolla 5–8 mm long; staminode narrow, club shaped. CAPSULES ovoid, 5–6 mm long.—Moist shady places, common along riparian corridors above 5000 ft: Cochise, Coconino, Gila, Graham, Greenlee, Mojave, Pima, Pinal, Santa Cruz and Yavapai cos., 950–2750 m (3100–9100 ft); Apr–Oct. AZ and sw NM.

Scrophularia californica was mistakenly included in the Arizona flora (Kearney & Peebles) but we do not believe that it grows in AZ. It is restricted to coastal ranges and moist canyons of interior mountain ranges in CA and OR. It has larger flowers (7–12 mm long) than *S. parviflora* (5–8 mm long).

Verbascum L. Mullein

Katherine Noonan

Biennial herbs, glabrous or sparsely glandular, to densely wooly. STEMS erect, round in cross section. LEAVES simple, alternate, sessile, lanceolate to obovate, clasping or decurrent, rounded, cuneate, entire or toothed, green, glabrous, glandular, to densely wooly, the basal leaves in a rosette, the cauline leaves decreasing in size along the stem. FLOWERS in terminal racemes, pedicellate or subpedicellate; calyx regular, green, glandular-pubescent, 5-lobed, the lobes lanceolate; corolla slightly irregular, rotate, yellow, rarely white, 5-lobed, the upper 2 lobes shorter than lower 3; anther-bearing stamens 5, exserted, the filaments usually villous, or the lower 2 glabrous to sparsely villous, the anthers one-celled; style exserted, the stigmas fused, spherical. CAPSULES ovoid to spherical, glandular to puberulent; seeds oblong, with longitudinal ribs.—Ca. 360 species; Eurasia, 18 species naturalized throughout North America. (Latin for bearded).

1. Leaves entire, wooly; flowers crowded; filaments of stamens glabrous or sparsely villous, yellow *V. thapsus*
- 1' Leaves crenate or dentate, glabrous to sparsely pubescent; flowers diffuse; filaments of stamens densely villous, purple.
 2. Stems glabrous or nearly so; hairs glandular when present, not forked; pedicels 6–17 mm long, longer than calyx *V. blattaria*
 - 2' Stems pubescent, hairs not glandular, forked; pedicels 2–5 mm long, shorter than calyx *V. virgatum*

Verbascum blattaria L. (for control of cockroaches?). Moth Mullein.—STEMS erect, 40–100(–120) cm tall, glabrous below, minutely glandular-puberulent above. LEAVES glabrous; basal leaves oblanceolate to obovate, 4–18 cm long, 1–6 cm wide, the apex acute to rounded, the margins crenate to dentate; cauline leaves oblanceolate to lanceolate, becoming reduced above. FLOWERS pedicellate, the pedicels 6–17 mm; calyx glabrous, 4–8 mm long; corolla 20–30 mm in diameter, yellow or rarely white; filaments 3–5 mm long, purple and white, villous; style 6–9 mm long. CAPSULES subspherical, widest at the base, 7–9 mm long, 6–8 mm wide, glandular-puberulent.—Moderately moist areas, often in drainages or adjacent to farmland or riparian areas: Cochise, Coconino, Yavapai cos., 1020–2165 m (3350–7000 ft); Jun–Oct. In all 50 states, excluding AK, WY, and MN; naturalized from Eurasia, now cosmopolitan.

While not as popular in folk medicine as *Verbascum thapsus*, *V. blattaria* has been shown to exhibit antibacterial properties, and is said to be an effective insecticide (Meurer-Grimes et al. 1996). In Dr. Beal's seed viability experiment, *V. blattaria* seeds germinated after 120 years of dormancy—one of the longest dormancies on record (Telewski and Zeevaart 2002).

Verbascum thapsus L. (From the island of Thapsos). Common mullein.—STEMS erect, 30–200 cm tall, wooly. LEAVES densely white wooly; basal leaves oblanceolate, 8–50 cm long, 2.5–14 cm wide, the apex acute to rounded, the margins entire; cauline leaves oblanceolate to elliptic, reduced above. FLOWERS sessile to subsessile; pedicels less than 2 mm long; calyx densely wooly, 8–12 mm long; corolla 15–30 mm in diameter, yellow or rarely white; filaments 3–8 mm long, the upper 3 villous, the lower 2 glabrous to sparsely villous; style 4–7 mm long. CAPSULES egg shaped, 8–11 mm long, 6–9 mm wide, densely tomentose.—Roadsides, waste places, open meadows, rocky hillsides, burned and disturbed places: Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pina, Yavapai cos., 355–2,895 m (1165–9500 ft); May–Oct. In all 50 states; naturalized from Eurasia, now cosmopolitan.

Verbascum thapsus is listed as a noxious weed in Colorado and Hawaii. This species was intentionally brought to North America by early European settlers, possibly because of its reported medicinal properties. Riaza et al. (2013) review the chemistry and medicinal uses of this species.

In North America, *Verbascum thapsus* displays a wide variety of morphological and life history traits. While usually a monocarpic biennial, populations in the s United States act as annuals, and plants in n latitudes prolong life and delay reproduction until the third year (Reinartz 1984). Morphologically, *V. thapsus* usually produces a single inflorescence stalk, but can sometimes have several lateral branches. These branches develop after the main stem has flowered, and are thought to be a result of infestation by a weevil, *Gymnaetron tetrum* (Naber and Aarseen 1998). The weevil oviposits in the fruit, destroying at least half of the seeds, usually in the early part of the flowering season (Naber and Aarseen 1998). *Verbascum thapsus* individuals in nutrient-rich areas sometimes produce lateral branches, and thus have a greater chance at reproductive success (Naber and Aarssen 1998).

Some *Verbascum thapsus* plants exhibit a rare mutation of the stem tip, called fasciation. The apex of the stem becomes widened, twisted, and markedly large. Fasciation occurs in over 100 plant families, and is perhaps most famous in the crested Saguaro (Ansari and Daehler, 2011). Fasciation can be caused by simple Mendelian inheritance, by a bacterial pathogen, *Rhodococcus fascians*, or by environmental factors, such as overcrowding of roots (Ansari and Daehler 2011). Ansari and Daehler (2011) believe fasciation in *V. thapsus* is most likely due to a combination of environmental conditions and genetics, though the study was unable to investigate which conditions and genes are responsible.

Verbascum virgatum Stokes (twiggy). Wand mullein.—STEMS erect, 60–120 cm tall, pubescent. LEAVES puberulent, with forked hairs; basal leaves oblanceolate to obovate, 8–20 cm long, 1.4–4 cm wide, the apex acute to rounded, the margins crenulate to dentate; cauline leaves lanceolate, becoming reduced above. FLOWERS pedicellate, the pedicels 2–5 mm long; calyx stipitate-glandular, 4–7 mm long; corolla 22–30 mm in diameter, yellow; filaments (3–)5–10 mm long, purple and white, villous; style 6–9 mm long. CAPSULES subspherical to spherical, 5–9 mm long, 6–8 mm wide, glandular-puberulent.—Moderately moist roadsides and waste places:

Apache, Cochise, Coconino, Graham, Maricopa, Santa Cruz, Yavapai cos., 610–2100 m (2000–6900 ft), May–Oct; naturalized from Eurasia.

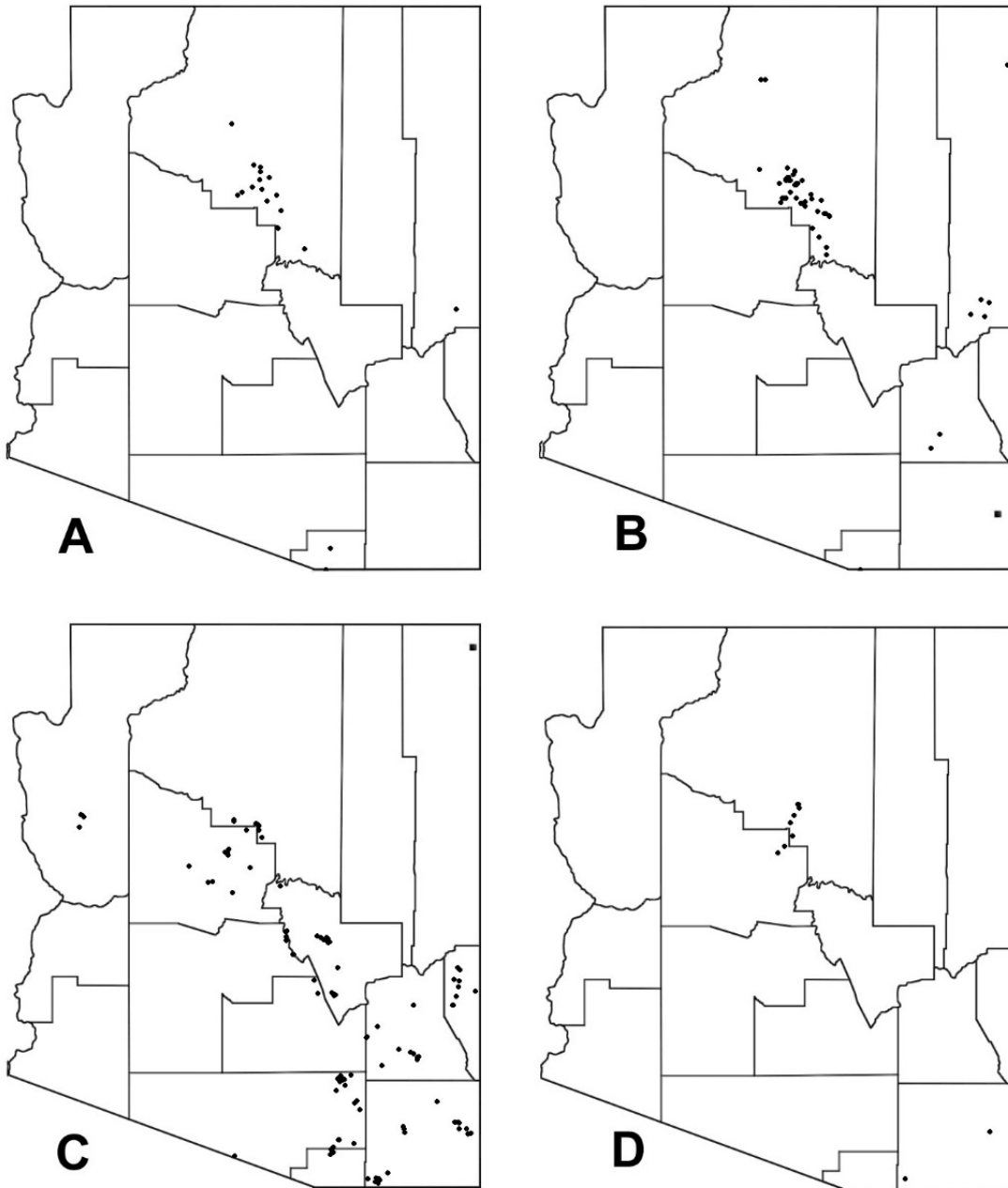
This taxon is far less invasive than *Verbascum thapsus* and *V. blattaria*. It is often confused with *V. blattaria*, but can be distinguished based on a pedicel length of 2–5 mm (vs. 6–17 mm in *V. blattaria*).

ACKNOWLEDGMENTS

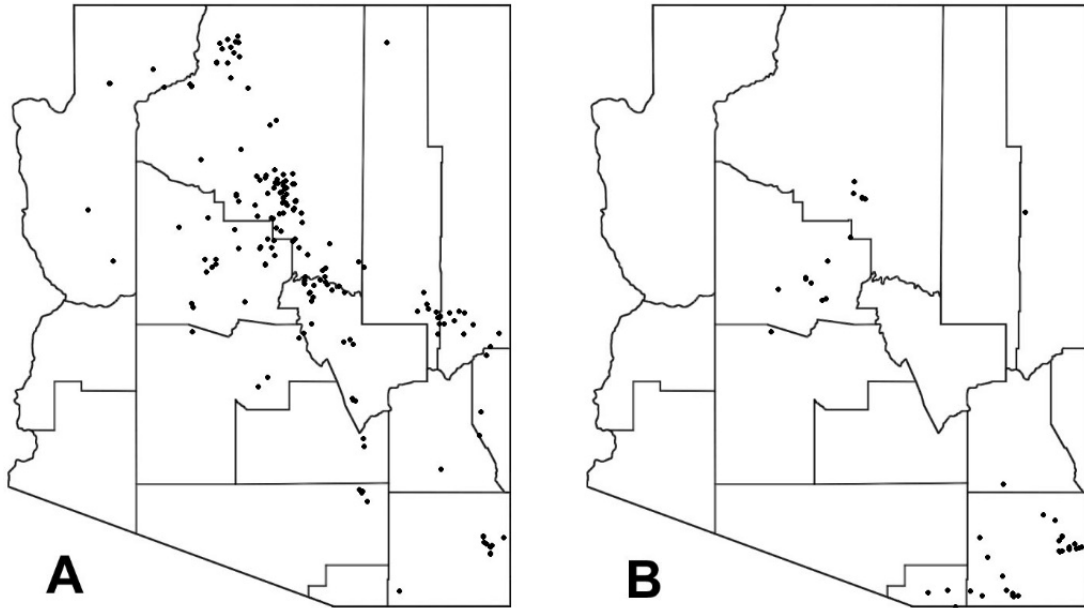
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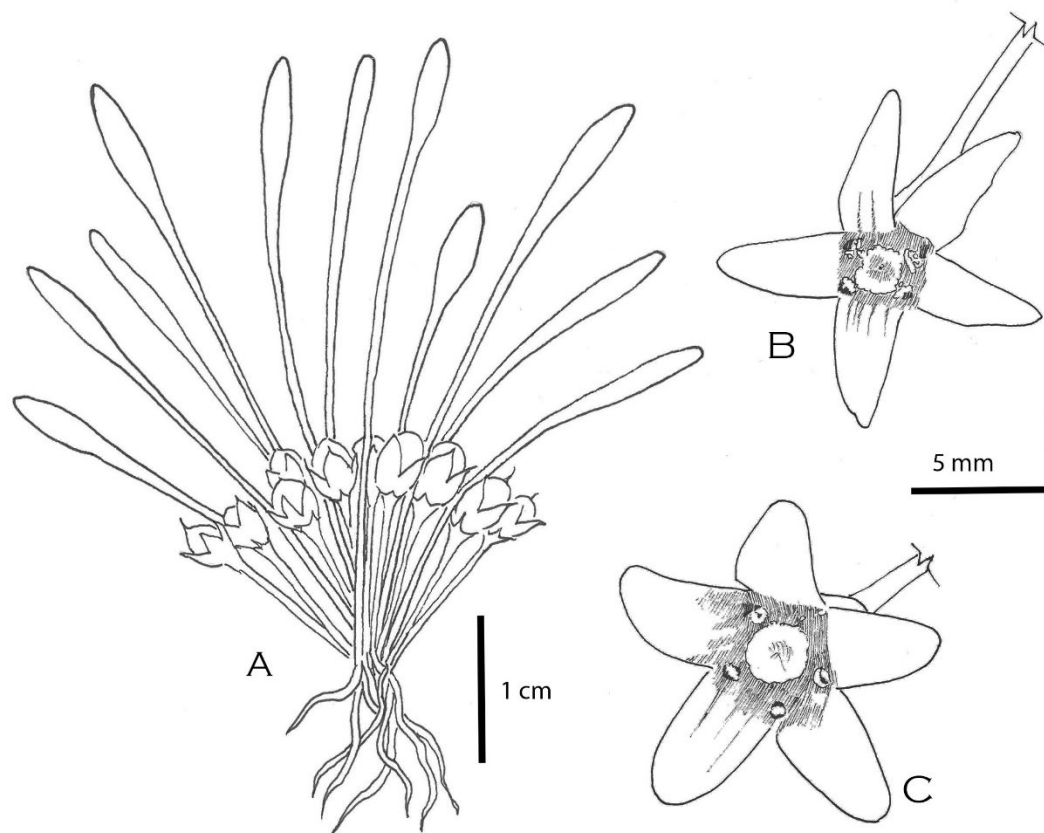
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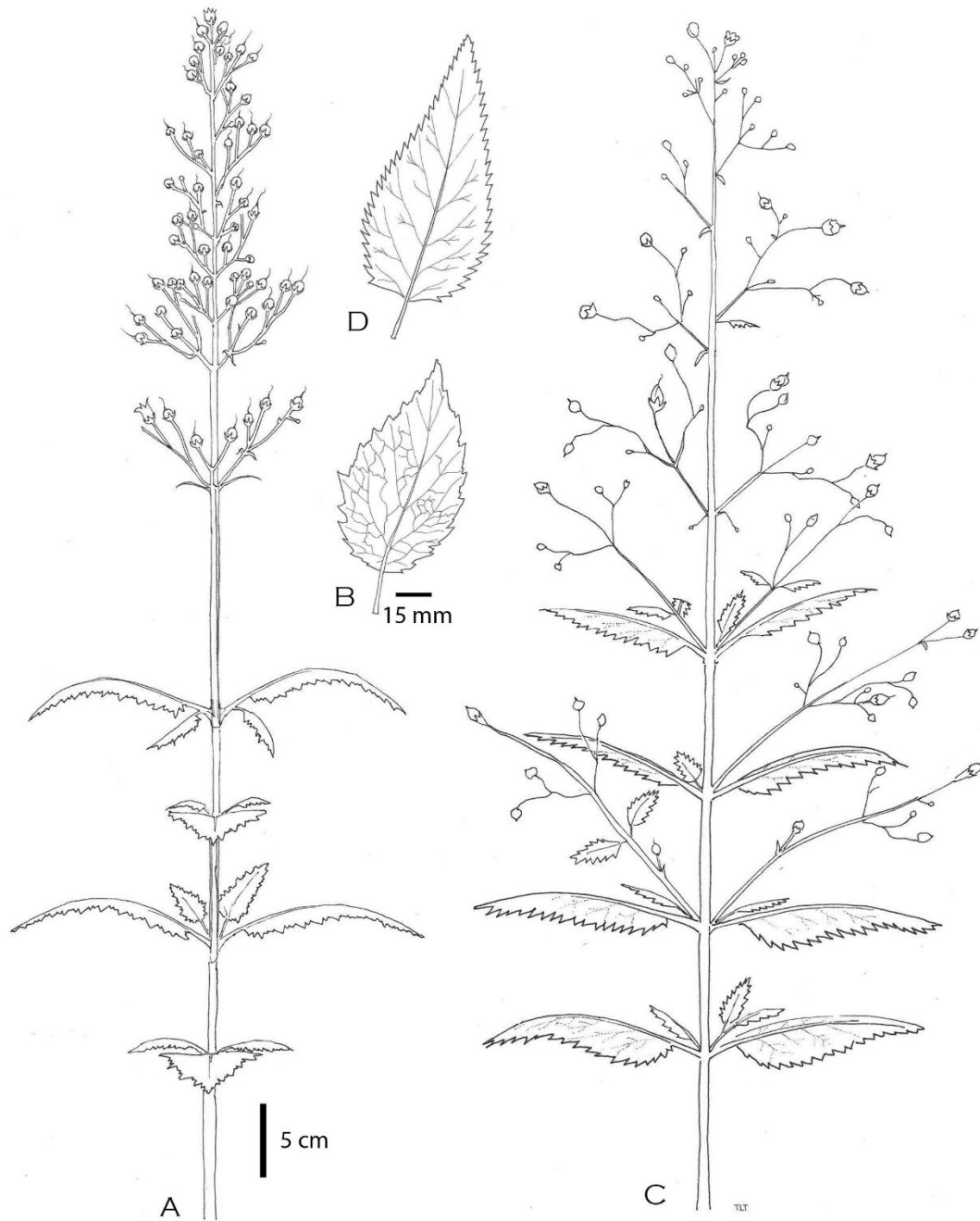
Scrophulariaceae. Figure 1. Distribution of: (A) *Limosella acaulis*; (B) *L. aquatic* (circles) and *L. pubiflora* (square in se corner of AZ); (C) *Scrophularia lanceolata* (square in ne corner of AZ) and *S. parviflora* (circles); (D) *Verbascum blattaria*.



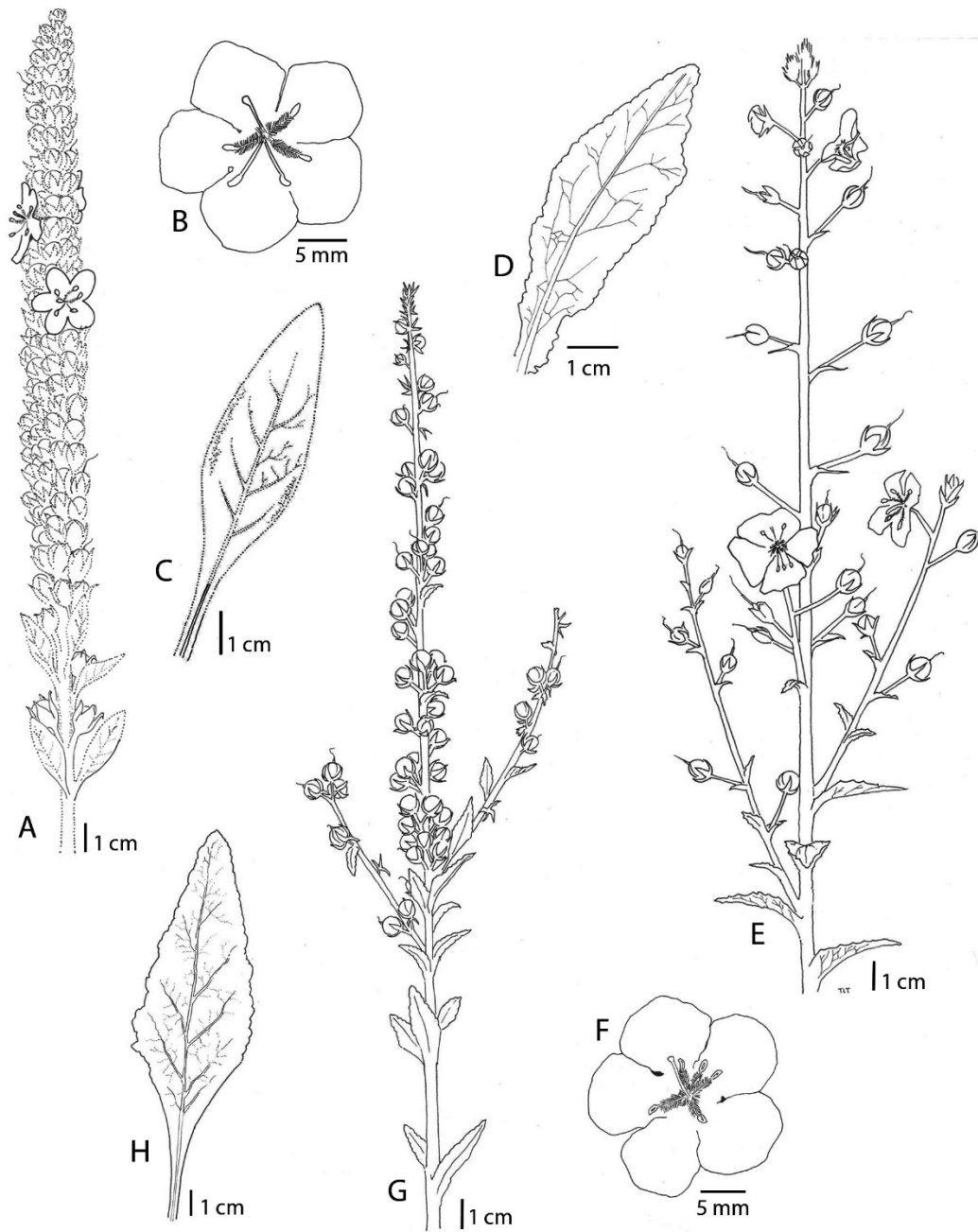
Scrophulariaceae Figure 2. Distribution of: (A) *Verbascum thapsus*; (B) *V. virgatum*.



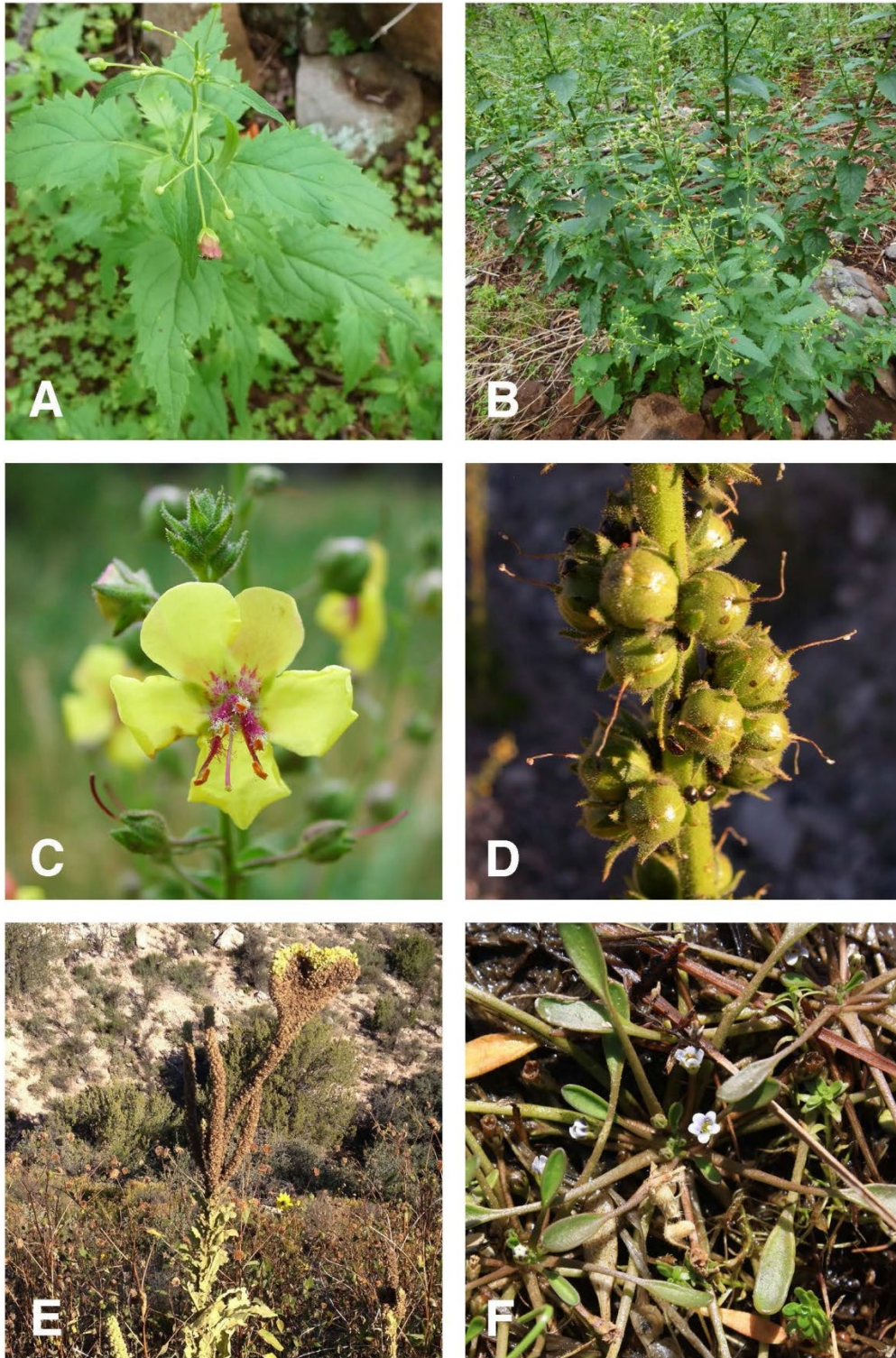
Scrophulariaceae Figure 3. *Limosella*. (A-B) *L. aquatica*; (A) habit; (B) flower; (C) *L. acaulis* flower. Illustration by Tracy Tohanne.



Scrophulariaceae Figure 4. *Scrophularia*. (A-B) *S. lanceolata*; (A) inflorescence; (B) leaf; (C-D) *S. parviflora*; (C) inflorescence; (D) leaf. Illustration by Tracy Tohanne.



Scrophulariaceae Figure 5. *Verbascum*. (A-C) *V. thapsus*; (A) inflorescence; (B) flower; (C) basal leaf; (D-E) *V. blattaria*; (D) basal leaf; (E) inflorescence; (F-H) *V. virgatum*; (F) flower; (G) inflorescence; (H) basal leaf. Illustration by Tracy Tohanne.



Scrophulariaceae Figure 6. (A-B) *Scrophularia parviflora*; (C) *Verbascum blattaria*; (D) *Verbascum virgatum*; (E) *Verbascum thapsus* with a fasciated inflorescence; (F) *Limosella pubiflora*. Photos A-D by Max Licher; E by Kate Noonan; F by Steve Buckley.