

SOLANACEAE PART THREE:

LYCIUM L. WOLF BERRY, DESERT THORN

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Shrubs or small trees, usually thorny. LEAVES alternate, simple, usually in fascicles, more or less succulent. FLOWERS in leaf axils, solitary or in groups of 2–6, pedicellate; calyx tubular to campanulate, generally ruptured by growing fruit, sometimes slightly accrescent, 2–6-lobed, the lobes deltate to linear or ovate; corolla white to greenish (sometimes tinged with lavender) to purple, tubular to funnelliform or narrowly campanulate, with 4–6 spreading or reflexed lobes; stamens 4–6, included or exserted; filaments filiform, subequal or unequal, adnate to corolla tube proximally, often pubescent near base of free portion, sometimes enlarged and glandular at the base; anthers oval, dorsifixed, longitudinally dehiscent; style slender; stigma shortly 2-lobed; ovary 2-loculed, the locules with 1 to many ovules. FRUITS berries (sometimes with hardened endocarps and thus drupe-like), fleshy to dry; seeds 2–many, flattened, minutely pitted, sometimes enclosed in a hardened endocarp. —ca. 80–90 (10 in AZ) species in tropical and subtropical regions of the world (Hitchcock 1932 & 1981, Chiang-Cabrera 1981).

Species of *Lycium* seem to present various degrees of dioecy and sometimes have quite different forms of flowers on different plants (e.g., pin and thrum flowers on different individuals in *L. exsertum* and *L. fremontii*; Miller & Venable 2000). *Lycium californicum* has been found to have diploid populations with hermaphroditic flowers and tetraploid populations with sexually dimorphic flowers (Yeung et al. 2005).

The fruits of *Lycium* are often edible and have been widely used by Native Americans and others in the Southwest (Hodgson 2001).

1. Calyx lobes 2.5–6 mm long (before tearing between the lobes), about 1/3 as long as the calyx-tube to longer than the calyx-tube; corolla lavender, white to cream or green 2
 2. Calyx generally truncate at base; corolla-lobes reflexed; sides of corolla nearly straight; stamens generally not exceeding corolla tube; fruit constricted laterally at about the middle or somewhat below; fruit with hardened endocarp enclosing seeds 3
 3. Calyx-lobes about as long as calyx-tube or up to 2 times as long as the tube; calyx sparsely pubescent *L. macrodon*
 - 3' Calyx-lobes shorter than calyx-tube; calyx moderately pubescent *L. cooperi*
 - 2' Calyx rounded to attenuate at base; corolla-lobes spreading to erect; sides of corolla tube curved outward; stamens exceeding the corolla tube; fruit subglobose to pyriform, not constricted; fruits without hardened endocarp 4
 4. Flowers 8–12 mm long; corolla tube narrowly campanulate to narrowly obconic; leaves glandular-pubescent *L. parishii*
 - 4' Flowers 15–25 mm long; corolla tube elongate-funnelform, conspicuously expanded at the top; leaves glabrous *L. pallidum*
- 1' Calyx lobes 0.5–2.5 mm long (before tearing between the lobes), usually less than 1/3 as long as the calyx-tube; corolla white, lavender to dark purple 5
 5. Plants glabrous or nearly so 6
 6. Flowers about 4–7 mm long, the calyx about half as long as flower 7
 7. Flowers appearing in early spring, 4-merous; leaves subglobose, to oblong, terete in cross section when fresh; twig bark gray to whitish; low desert, often with *Atriplex polycarpa* *L. californicum*
 - 7' Flowers appearing mainly with monsoon rains in summer and fall, (4-)5-merous; leaves much wider than thick, flat in cross section; twig bark often dark reddish brown; usually in upland Sonoran Desert *L. berlandieri*
 - 6' Flowers usually over 7 mm long, the calyx about 1/4 as long as the flower 8
 8. Corolla-lobes lanate-ciliate at margin *L. torreyi*
 - 8' Corolla-lobes glabrous *L. andersonii*
 - 5' Plants glandular-pubescent 9
 9. Flowers mainly whitish with little blue or purple, mainly pendant; stamens often exerted; filaments densely pubescent; usually growing in upland habitats; seeds 25–35 *L. exsertum*
 - 9' Flowers mainly dark purple, tending to be erect; stamens usually not exerted; filaments glabrous or sparsely pubescent; usually growing in low, often salty areas; seeds 40–60 *L. fremontii*

Lycium andersonii A. Gray (for C. L. Anderson, collector of the type).

—Shrub 0.5–3 m tall, densely branched, rounded, thorny, glabrous or essentially so in ours; young branches flexuous, silvery-white to tan, the older branches with silvery-tan to dark brown bark. LEAVES linear-terete, linear-spatulate, spatulate, or obovate, more or less succulent, 3–35 mm long, 1–8 mm wide, sessile or with a petiole 1–3 mm long; apex rounded to acute; base attenuate. FLOWERS with pedicels 1–10 mm long, borne singly or in pairs in the leaf fascicles, white to pale purple (Fig. 2C); calyx cup-shaped, 1.5–3 mm long, 4–5-lobed or sometimes irregularly 2-lipped, the lobes triangular, about 1/4 the length of the calyx-tube, the margins sparsely ciliate; corolla 4–16 mm long, tubular or very narrowly funnelform, the lobes 4–5, ovate, 1.5–2 mm long, ciliolate, spreading; stamens

hardly exerted to exerted 2–3 mm; filaments adnate to lower corolla-tube, their bases glabrous or sparsely hairy; style varying in length, from shorter than to as long as or longer than the stamens. FRUITS red or orange-red, 3–9 mm long, ovoid or ellipsoid, many-seeded. $n = 12$. —Deserts, usually along washes: all cos. except Apache and Greenlee (Fig. 1A); 250–1700 m (800–5600 ft); mainly Jan–Mar, but occasionally at other times; s CA, NV, UT, w NM; n Mex.

A variable species of perhaps four varieties, three of which occur in AZ and intermix: *L. a.* var. *wrightii* with 4-lobed flowers 4–8 mm long, *L. a.* var. *andersonii* with 4–5-lobed flowers 8–16 mm long and leaves 3–16 mm long, and *L. a.* var. *deserticola* with 4–5-lobed flowers 8–16 mm long and leaves 20–35 mm long.

Lycium berlandieri Dunal (for J.-L. Berlandier, collector of the type). —Shrub 0.7–2.5 m tall, rather sparingly branched, with few thorns at the end of branches, or practically unarmed; branches somewhat crooked, decumbent or flexuous, tan to silvery-gray, the older stems often dark reddish brown. LEAVES glabrous, linear to spatulate-obovate, 1.5–6(–15) mm long, 1–2.5(–4.5) mm wide, rounded, sometimes acute or emarginate at the apex, fascicled. FLOWERS solitary or in groups of 2–3 in the leaf fascicles; pedicels 3–20 mm long; calyx cup-shaped, 1–3 mm long, 3–5-lobed, the lobes deltoid, about one third as long as the tube, equal or unequal, the calyx frequently splitting to the base on one side, with a small tuft of hair at the tip of each lobe; corolla white or pale lavender, obconic-funnelform, constricted immediately above the ovary, 4–9 mm long, the lobes 4–5, 1/6–1/3 the length of the tube, usually reflexed; stamens unequal or subequal, included to long-exserted; filaments adnate to a point between 1/3 and nearly 1/2 the length of the corolla-tube, hairy for the first third of their free portion, adjacent corolla-tube hairy, the portion below the insertion of the filaments from almost glabrous to densely hairy; style equaling the stamens in length or surpassing them. FRUITS globose, 5 mm in diameter, many-seeded (Fig. 2J). —Sonoran Desert, along washes: La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos. (Fig. 1B); 350–900 m (1200–3000 ft); mainly Jul–Sep, but occasionally at other times; s CA to TX, OK; s to Tamps., S.L.P., Hgo., and Baja C. Sur, Mex.

Lycium californicum Nutt. ex Gray (of California). —Shrub, usually no more than 0.5 m tall in ours, intricately branched, decumbent or spreading, the branchlets usually tipped with short blunt thorns, otherwise unarmed. LEAVES glabrous, fleshy, subterete, ovoid or spatuloid, 2–25 mm long, 1–3 mm wide, 2–8 in a fascicle, subsessile. FLOWERS 1–3 in the axils, on pedicels 1–5 mm long (Fig. 2F); calyx campanulate, 2–2.5 mm long, 2–4-lobed, the lobes about 1/3 the length of the tube, broadly triangular, puberulent, usually ciliolate, or calyx laterally compressed, with 2 well-developed keeled lobes and 2 obsolete ones; calyx not keeled, with 4 subequal lobes, much shorter than length of the tube; corolla white to pale purple, the tube 2–4.5 mm long, the lobes 4, oblong-ovate, about as long as the tube or slightly shorter than it, spreading or reflexed, sparsely ciliolate; stamens 4, exerted; filaments adnate a little above the middle of the corolla-tube, the base of the free portion and adjacent corolla-tube densely hairy; style usually surpassing the stamens. FRUITS ovoid, 2–4 mm long, orange-red or red, with thin succulent

exocarps, endocarps much hardened, the carpels separating rather readily at maturity, each carpel 1-seeded. $n = 12, 18, 24$. —Low sparse desert with apparently poor drainage and hard saline soils, often associated with *L. fremontii* and *Atriplex polycarpa* (Fig. 3A): Maricopa, Pima, Pinal cos. (Fig. 1C); 350–450 m (1200–1500 ft); Jan–Mar; CA; n Mex.

A species of four varieties; in AZ only *L. c.* var. *arizonicum* A. Gray is found, which differs from other varieties in its extremely fleshy globular to pyriform leaves and uncompressed calyx with subequal calyx-lobes.

Lycium cooperi A. Gray (for J. G. Cooper, collector of the type). —Shrub 0.6–2 m tall, stout, densely branched, thorny, the branches thick and rigid, silvery to purplish or tan to reddish when old, minutely glandular-puberulent when young. LEAVES 3–10 in fascicles, spatulate, oblanceolate, or obovate-spatulate to broadly obovate, 1–3.5 cm long, 0.4–1.3(–2.3) cm wide, densely glandular-pubescent or hispidulous to glabrescent; apex rounded to truncate; base attenuate; midvein and some of the lateral veins distinct. FLOWERS numerous, pendant, 1–3 in a fascicle, the pedicels about the same length as the calyx or shorter, glandular-pubescent; calyx bowl-shaped or oblong-campanulate, 4–14 mm long, glabrate or glandular-pubescent, expanding and usually rupturing with the growth of the fruit (Fig. 2E); corolla greenish white with purple veins, broadly funnelform to nearly cylindric, slightly expanded at top, densely pubescent to glabrous externally, the tube 8–15 mm long, the lobes 5, 1/4 to 1/5 the length of the tube, triangular-ovate, spreading or reflexed, with margins usually ciliate; stamens about equalling the corolla-tube or slightly included; filaments subequal, adnate from about middle of corolla-tube to about 3/4 the length; vascular strands leading to filaments very sparsely pilose at the base, the free portion of filaments glabrous; style shorter than filaments or equalling them. FRUITS ovoid, greenish yellow, 5–10 mm long, constricted at about the middle or above; seeds 1–2 in upper portion, several (5–8) in lower half. $n = 12$. —Mohave Desert in AZ, in washes, flats and slopes in rocky to sandy soils: La Paz, Mohave, (perhaps Yuma) cos. (Fig. 1C); 400–1400 m (1300–4600 ft); Mar–Apr; s CA, NV, and UT.

Lycium exsertum A. Gray (presumably for exserted stamens). —Shrub 1–4 m tall, openly branched, sparingly armed, the branches rigid, densely pubescent when young, the bark dark gray or brown to reddish brown. LEAVES spatulate to obovate, 5–25 mm long, 3–8 mm wide, obtuse or rounded at the apex, rarely acute, densely glandular-pubescent, attenuate to a petiole 3–5 mm long, densely glandular-puberulent. FLOWERS pendant, single or in groups of 2–3 (Fig. 2A); pedicels 3–6 mm long; calyx tubular-campanulate, 2.5–6 mm long, densely pubescent; lobes 5, 1/4 to 1/2 the length of the tube, equal, or the calyx irregularly lobed and more or less two-lipped, then some lobes as long as the tube; corolla funnelform, slightly narrowed just above ovary, 7–14 mm long, whitish, greenish, or tinged with purple and brown, glabrous externally; lobes 5, broadly ovate or obovate, pale lavender, spreading, 1–2 mm long, with sparsely ciliolate or glabrous edges; stamens 5, subequal, from slightly to 2–3 mm exserted from the corolla-tube; filaments adnate to a point between a little below the middle of the corolla-tube, densely pilose on the

lower 2/3 of their free portion; corolla-tube densely hairy from the base to the point of adnation of the filaments, then less densely hairy up to the point where the filaments cease to be hairy; anthers 1–2 mm long; style usually slightly shorter than the stamens, and only slightly exerted but sometimes long-exserted. FRUITS ovoid, 6–8 mm long, 20–35-seeded. $n = 24$. —Upper Sonoran Desert in AZ, in washes and on mountain slopes: Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai cos. (Fig. 1D); 300–1400 m (1000–4600 ft); Jan–Apr; s to Baja C. Sur, Son., and Sin., Mex.

The distinction between *Lycium exsertum* and *L. fremontii* is usually not difficult in living plants but often so with dried specimens as habitat and flower color are important. The species are compared directly in lead 9 of the key.

Lycium fremontii A. Gray (for J. C. Frémont). Frémont's wolf-berry. —Shrub, stout, intricately branched, 1–3 m tall, sparingly armed or unarmed, with densely glandular-puberulent foliage, rarely almost glabrous; bark tan to dark gray or brown. LEAVES spatulate, oblanceolate or obovate, 8–35 mm long, 2–15 mm wide, acute to rounded at apex, in fascicles of 3–6, single in young branches. FLOWERS pedicels 4–25 mm long, glandular-puberulent (Fig. 2B); calyx tubular (2–)4–8(–10) mm long, 5-lobed, the lobes triangular, mostly less than 1 mm long, rarely 2 mm; corolla tubular to funnellform, deep lavender or violet to white with purple veins, 8–15(–20) mm long, the lobes orbicular to broadly obovate, glabrous to puberulous on adaxial surface, 1/4 to 2/5 the length of the tube, spreading, the margins smooth to densely ciliate; stamens unequal, usually included within the tube or slightly protruding from it; filament-adnation variable, from about middle of corolla-tube to about 1/3 from the base, the filaments glabrous to densely pilose at base of the free portion, the adjacent corolla-tube glabrous or very sparsely pubescent; style about equaling the corolla-tube or slightly exceeding it, sometimes much shorter than the stamens. FRUITS oblong-ovoid, 5–9 mm long, red, 40–60-seeded. $n = 48, 60$. —Lower Sonoran Desert in AZ, in washes and in flats, often in saline soils: all cos. except Coconino, Navajo and Santa Cruz (Fig. 1E); 100–1300 m (300–4300 ft); mainly Jan–Apr, occasionally at other times; CA; Baja C., Baja C. Sur, Son., Mex.

Lycium macrodon A. Gray (large toothed, for large calyx-lobes). —Shrub 1–3 m tall, rigidly branching, thorny; young branches silvery gray, scarcely to densely glandular-pubescent; old branches dark brown to black, glabrescent; thorns straight. LEAVES linear-spatulate to obovate or oblong-lanceolate, 5–30(–35) mm long, 2–5(–12) mm wide, acute to rounded at apex, tapering to a petiole 1–2 mm long or sessile, bright green, glabrous or minutely puberulent, sometimes with white veins, fascicled in groups of 3–6. FLOWERS pendant, solitary or in pairs at the leaf fascicles (Fig. 2D); pedicels minutely puberulent, 1–7 mm long; calyx campanulate, 4–9 mm long, minutely glandular-puberulent; calyx-lobes 5, as long as the calyx tube or up to 2 times as long as the tube, subulate to linear-lanceolate, acute; corolla-tube greenish white, 6–12 mm long, glabrous to sparsely puberulent externally; lobes 5, greenish white to pale lilac with dark veins, ovate to oblong, sparsely to densely ciliolate, 2–5 mm long, rotate to reflexed; stamens subequal, barely exerted

to exerted 2–4 mm; filaments adnate to corolla-tube from base to a little below the middle, pilose from near base of the corolla to 4 mm on free portion, or almost glabrous; style included or 1–4 mm longer than the stamens. FRUITS constricted below the middle, yellowish to brownish when ripe, 6–10 mm long, notched at the apex; upper part of each locule bearing 1–2 seeds enclosed in an indurated endocarp; lower part fleshy, bearing 1–5 abortive ovules. $n = 12$. —Lower Sonoran Desert in AZ, in washes and in flats: La Paz, Maricopa, Pima, Pinal, Yuma cos. (Fig. 1F); 250–750 m (800–2500 ft); mainly Feb–Apr, occasionally at other times; Son. Mex.

Lycium pallidum Miers (pallid, pale, for the glaucous green foliage). —Shrub 1–2 m tall, dense, intricately branched, thorny; branches often flexuous, yellowish, gray, or reddish to purplish black, glabrous or very sparsely puberulent; thorns slender and sharp. LEAVES 1–5 cm long, 3–15 mm wide, glaucous green, glabrous, oblong-spatulate or oblanceolate to broadly elliptic; apex acute or rounded; base attenuate into a short petiole, the midvein and primary lateral veins usually visible. FLOWERS pendulous, borne singly or in groups of 2–3 (Fig. 2G); pedicels slender, 4–16 mm long; calyx cup-shaped to campanulate, blue-glaucous, glabrous, 5–8 mm long, 5-lobed, the lobes lanceolate to ovate or elliptic, equalling or exceeding the tube in length, their margins sometimes sparsely pubescent; corolla-tube elongate-funnel form, 12–25 mm long, expanded conspicuously at the top, from white to lavender purple, most commonly greenish with purple veins, the 5 lobes oval or rhombic, 1/5 to 1/3 the length of the tube, their margins commonly remotely ciliolate; stamens exerted; filaments adnate to a little below the middle of the corolla-tube, the free base of the filaments and the adjacent corolla-tube pilose, or the filaments densely hairy nearly to top of corolla-tube; style varying in length from about equal to stamens to surpassing them. FRUITS red or reddish blue due to glaucescence, ovoid, about 1 cm or slightly less in diameter, 4–50-seeded. $n = 12$. —Desert grassland, riparian areas, chaparral, pinyon-juniper woodland: all cos. except La Paz, Maricopa, Santa Cruz, Yuma (Fig. 1G); 800–2250 m (2500–7400 ft); Mar–Jun, occasionally at other times; CA to TX, n to UT and CO; Coah., N.L., S.L.P., Mex.

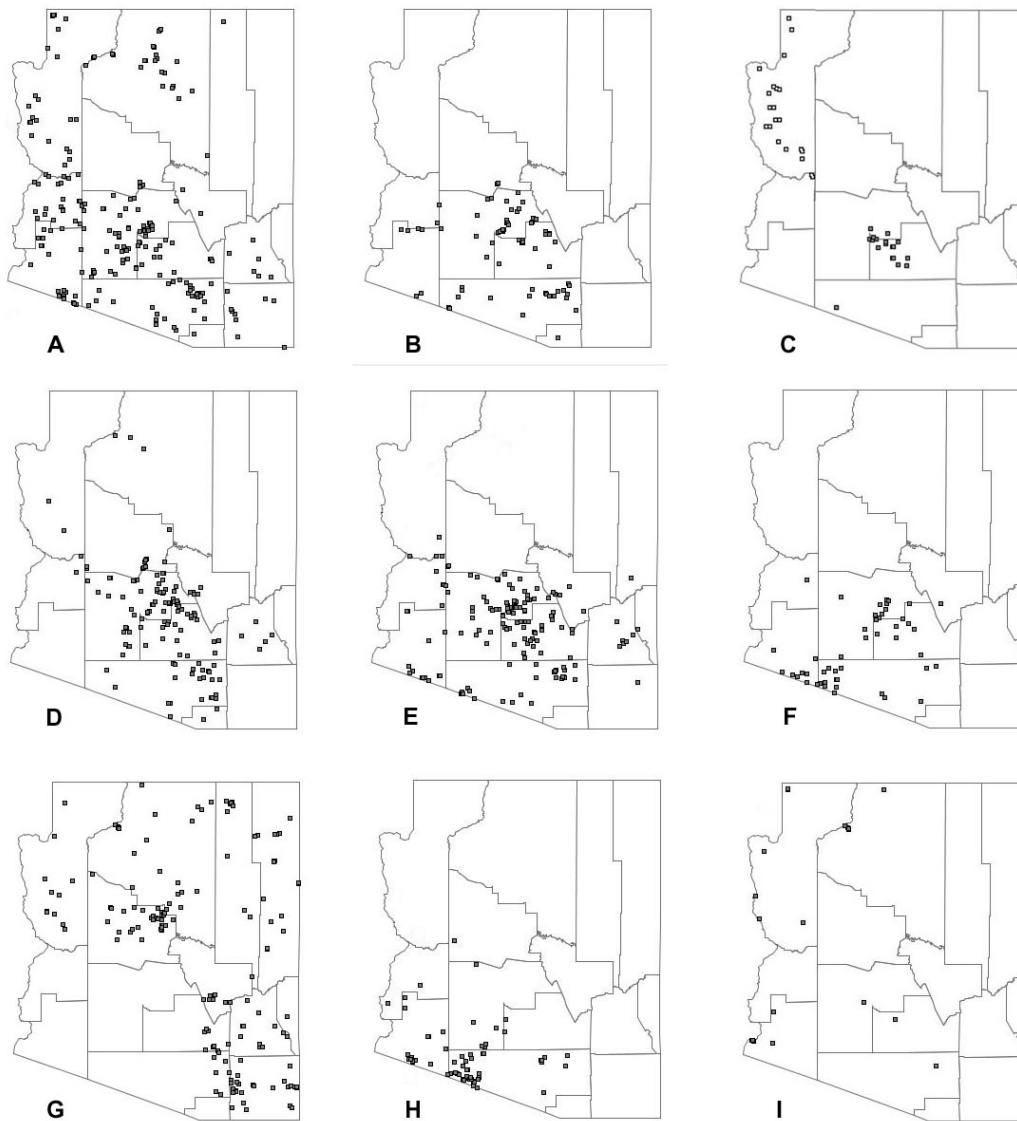
Lycium parishii A. Gray (for S. B. and W. F. Parish, collectors of the type). —Shrub, profusely branched, thorny, 1–3.5 m tall, with glandular pubescence and silvery to dark gray or brown bark. LEAVES obovate-spatulate or elliptic, 1–4 in a fascicle, 3–12 mm long, 1–5 mm wide, rounded to obtuse at apex; petiole indistinguishable from the lamina, densely pubescent, sometimes cinereous. FLOWERS erect, borne singly or in pairs, pedicels 2–10 mm long, pubescent; calyx campanulate, densely pubescent, tube 2–3 mm long, lobes 5, elliptic or oblong-oval, apex rounded to acute, half as long as or longer than the tube; corolla with greenish purple throat externally, tube narrowly campanulate to narrowly obconic, contracted above the ovary, 6–10 mm long, 2–3.5 mm broad at the throat, lobes 5, pale lavender, with darker lavender marks, spreading, ovate, 2–3 mm long, with ciliolate margins; stamens exerted due to spreading of the corolla-lobes, about equalling them in length; filaments adnate to lower half of corolla-tube, densely pilose on lower fourth of free portion; style equalling stamens. FRUITS red, ovoid, 4–7 mm

long, 3–5 mm thick, 7–15-seeded (Fig. 2I). $n = 12$. —Washes, alluvial fans in Sonoran Desert; La Paz, Maricopa, Mohave, Pima, Pinal, Yavapai, Yuma cos. (Fig. 1H); 250–1200 m (800–3900 ft); Feb–Sep; CA, NV; Son., Baja C., Mex.

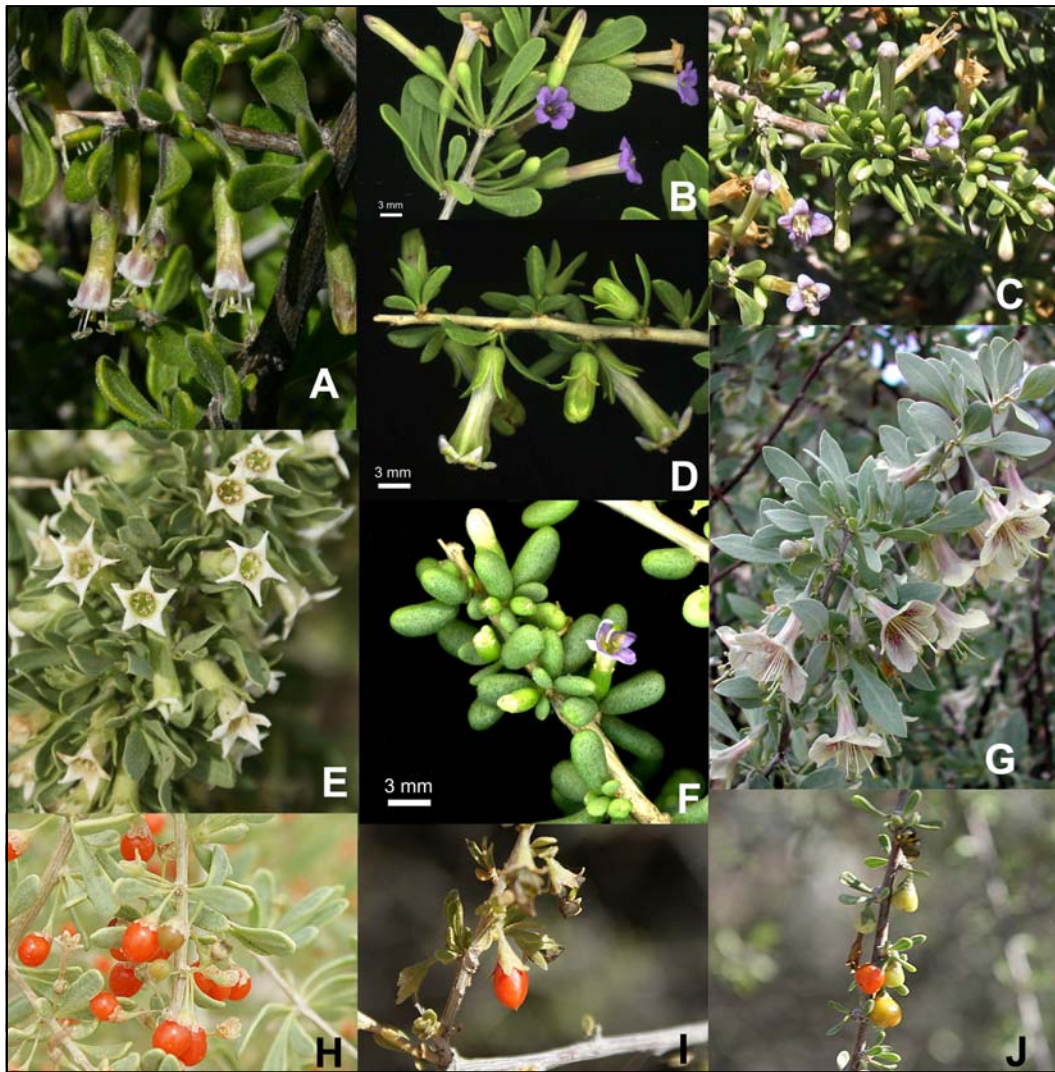
Lycium torreyi A. Gray (for J. Torrey). —Shrub 1–3 m tall, much branched, spreading, with yellowish tan to brownish bark, unarmed or with few thorns. LEAVES pale green, somewhat succulent, spatulate to oblanceolate or obovate, acute or obtuse at the apex, 1–3(–5) cm long, 0.3–1(–1.5) cm wide, attenuate at base to a petiole 2–4 mm long. FLOWERS abundant, in groups of 1–6(–8), on slender pedicels 5–20 mm long; calyx cup-shaped to tubular, 2.5–6 mm long, glabrous to sparsely pubescent, the lobes 5, triangular, 1/4 to 1/2 the length of the tube, their margins lanate-ciliate, glabrescent with age; corolla-tube narrowly obconic, 8–15 mm long, constricted at top of ovary and flared slightly at summit, 1.5–2 mm diameter at base, 3–4 mm diameter at top, greenish lavender or whitish, usually glabrous externally but sometimes with few scattered hairs, the lobes 5(4), rounded to oval or lanceolate, 2–4 mm long, spreading, densely ciliate-lanate with branched hairs which are apparent to the naked eye as a tiny white fringe; stamens unequal to subequal, usually exserted; filaments adnate to about the middle of the corolla-tube, from rather densely to sparsely hairy on basal 1.5 mm of their free portion, adjacent corolla-tube also hairy; style longer than the stamens, usually exserted 2–3 mm. FRUITS ovoid, 6–12 mm long, bright red, 8–30-seeded (Fig. 2H). $n = 12$. —River bottoms and alluvial flats in deserts of the Southwest (Fig. 3B): Coconino, Maricopa, Mohave, Pima, Pinal, Yuma cos. (Fig. 1I); 50–1000 m (100–3300 ft); Mar–May; s CA to TX, NV, UT; n Mex.

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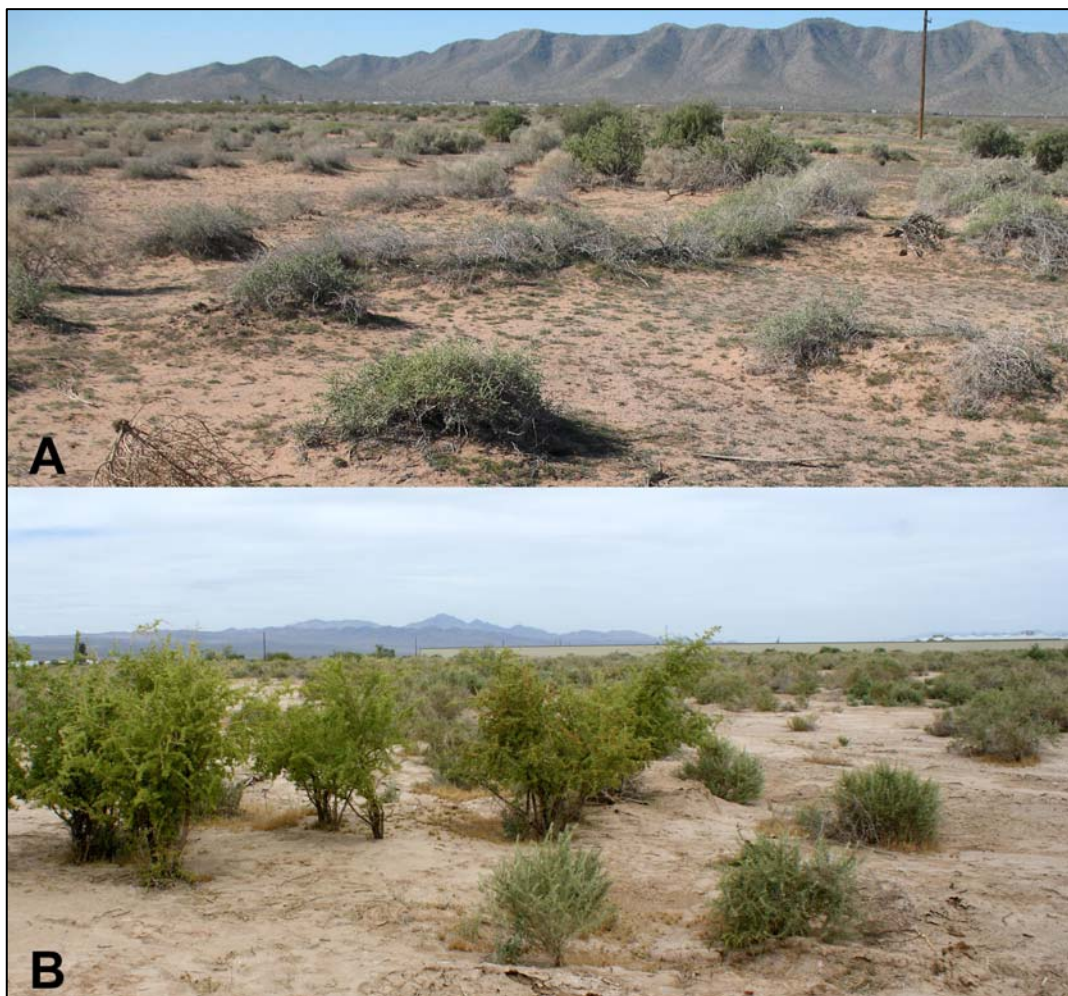
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Solanaceae Figure 1. Distributions of: (A) *Lycium andersonii*; (B) *Lycium berlandieri*; (C) *Lycium californicum* (closed squares in sc AZ), *Lycium cooperi* (open squares in nw AZ); (D) *Lycium exsertum*; (E) *Lycium fremontii*; (F) *Lycium macrodon*; (G) *Lycium pallidum*; (H) *Lycium prishii*; (I) *Lycium torreyi*.



Solanaceae Figure 2. *Lycium* flowers and fruits: (A) *L. exsertum* (photo by E. Makings); (B) *L. fremontii*; (C) *L. andersonii*; (D) *L. macrodon*; (E) *L. cooperi*; (F) *L. californicum*; (G) *L. pallidum* (photo by M. Licher); (H) *L. torreyi*; (I) *L. parishii*; (J) *L. berlandieri* - (all photos by L. R. Landrum unless otherwise indicated).



Solonaceae Figure 3. Habitats of *Lycium*: (A) *L. californicum* near Casa Grande; (B) *L. torreyi* in a flood plain of the Colorado River near Bullhead City.