RARE CONVOLVULACEAE IN THE SOUTHWESTERN UNITED STATES[1]

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Abstract

Field and herbarium studies of the Convolvulaceae in the southwestern United States indicate that 17 species are rare in all or part of their ranges. Degree of rarity varies. A few show temperate affinities, while most show tropical relationships. Rare Convolvulaceae vary from being exotics introduced in the area to United States endemics. Those species that are globally endangered to threatened are *Bonamia ovalifolia*, *Calystegia longipes*, *Ipomoea cardiophylla*, *I. tenuiloba*, and *I. thurberi*. Species that are uncommon throughout their ranges, but not in peril are *Bonamia repens* and *I. lindheimeri*. Taxa on the margins of their American ranges are *Calystegia macounii*, *Cressa nudicaulis*, *Cressa truxillensis*, *Dichondra argentea*, *I. dumetorum*, *I.* ×*leucantha*, *I. longifolia*, *I. pubescens*, and *Jacquemontia agrestis*.

Resumen

Estudios de los campos y los herbarios de las Convolvuláceas en el sudoeste de los Estados Unidos indican que hay 17 especies raras. Todas de las especies no están raras en toda de su distribución, y algunas están más raras que las otras. Algunas especies tienen afinidades a las zonas temperadas, pero la mayoría tienen afinidades a las zonas tropicas. Estas especies varían de especies exóticas y introducidas en la región hasta especies endémicas. Las Convolvuláceas raras que se consideran en peligro mundial son *Bonamia ovalifolia*, *Calystegia longipes*, *Ipomoea cardiophylla*, *I. tenuiloba*, y *I. thurberi*. Las especies que no son comúnes en todos sus distribuciónes, pero no están en peligro son *Bonamia repens*, y *I. lindheimeri*. Las especies en las márgenes de sus distribuciónes son *Calystegia macounii*, *Cressa nudicaulis*, *Cressa truxillensis*, *Dichondra argentea*, *I. dumetorum*, *I* ×*leucantha*, *I. longifolia*, *I. pubescens*, y *Jacquemontia agrestis*.

While a few of the most familiar species of the Convolvulaceae are considered weeds and pests, most of the 1,000 or more species in the family are not this common, nor weedy. Indeed, throughout the range of the family there are numerous rare species. During my recent studies of the Convolvulaceae in the southwestern United States (Austin, 1990a, b, 1991, in press), it became obvious that there were 17 rare and poorly known species in the area. For comparison with the total floras of the states, 30 Convolvulaceae species are now known in Arizona (Austin, in press 1991), 23 species in New Mexico (Austin, 1990b), and 58 species in Texas (Correll & Johnston, 1970). California has 22 species (Munz & Keck, 1959) and Colorado, Nevada, and Utah have up to eight species. For the following discussion, species are considered rare if they were found in less than ten of the previously recorded sites for the species.

Field observations of several species are given, while other species, where little is still known, are pointed out for future students of the region. The information given should draw attention to and give some documentation for those that are potential candidates for endangered and threatened status. Not all of these species are rare throughout their range in the United States, and the specimen citation reflects this. Those species that are known

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from just a few specimens are cited with locality data, when available.

Globally Endangered or Threatened Species

Bonamia ovalifolia (Torrey) H. Hallier

This Mexican species is restricted in the United States to a single canyon (Fig. 1) in Big Bend National Park, Texas, and has been discussed elsewhere (Austin, 1988). Specimens serving as the United States' documentation of its rarity are from one locality covering a few square meters. When I studied the plants there were no pollinators seen and no fruits. A single flood or landfall could eliminate the species from the United States. The northern Mexican population apparently has not been relocated since the middle 1800s.

Representative specimens examined. U.S.A. Texas: Brewster Co., Big Bend National Park, near Boquillas, *Webster s.n.* (TEX). Mexico. Coahuila: Río Grande below San Carlos, *Parry s.n.* (GH, NY).

Calystegia longipes (S. Watson) Brummitt

This species is endemic to the southwestern United States. Its range includes southern and southeastern California, southern Nevada, southwestern Utah, and central Arizona (Fig. 2). It will be discussed more fully elsewhere (Austin, in prep.). The species does not seem to be common in any part of its range.

In Arizona this rare species has been collected few times since the 1930s and 1940s. Arizona plants have most recently been found in the Bradshaw Mountains (1985), Mazatzal Mountains (1980, 1990), Sierra Ancha Mountains (1986, 1990), and Weaver Mountains (1980, 1990). (Specimens cited below.)

In my own study of this species in two 20-mile road transects made where the species was known to occur, I found only 13 plants, eight in the Sierra Ancha Mountains and five in the Mazatzal Mountains. Along 11 miles in the Weaver Mountains, I found only one plant. Pase & Johnson (1968) did not find the species in their survey of the entire Sierra Ancha Experimental Forest, nor did Wendy Hodgson (pers. comm.) find new populations in her extensive field survey in the Tonto Basin–Mazatzal Mountains during the spring and early summer of 1990. This low frequency, usually noted on herbarium labels, suggests a rare species with exacting ecological requirements. Except for an herbarium label statement that the plants are most common two years after a burn in chaparral, nothing is known of their growth requirements. Chaparral is the preferred habitat.

Most United States species of Convolvulaceae open as the sun strikes them or they open later in the day. *Calystegia longipes* is unusual in that it is matinal, the flowers opening before the sun strikes them, between 5:00 and 5:30 A.M. On 4 May the flowers closed between 3:30 and 4:00 P.M. in the Sierra Ancha site, but by 31 May they were closing by 2:30–3:00 P.M. Temperatures were near 15°C when the flowers first opened on 5 May in the Sierra Ancha site. The population was visited during the first few hours mostly by the exotic honeybee (*Apis mellifera* L.: Apidae). As the temperatures rose toward 21°C there was a shift in flower visitors from the honeybee to the native bees *Osmia brevis* Cresson (females) and *O. texana* Cresson (males) (Megachilidae).

Flowers were almost absent and fruits were uncommon on the eight plants at the Sierra Ancha site on 31 May 1990 on all the plants. About one fruit had been produced per 30–50 flowers in the population. The flowering season had nearly ended, and one plant studied had four open flowers and one bud to open the following day. This contrasts with the early flowering period when there were 45 flowers open on the same plant (morning of 5 May). During the 1990 season, the flowering period was about four weeks. Thirty-five fruits were examined from the plants, and these had 0–4 seeds each (mean = 3.3; standard deviation = 0.9). Several of the fruits had 2–4 aborted seeds. This low fruit set and the number of aborted seeds may indicate genetic aberrations due to small population size and high degree of self-pollination.

Representative specimens examined. U.S.A. Arizona: Coconino Co., Mormon Lake, *Collom s.n.* (ASU); Gila Co., near Pine, *McDougal s.n.* (US); Sierra Ancha Mountains, S Pueblo Canyon, *Delamater et al. 4192* (DES), *Austin & Austin 7657* (ASU); Mazatzal Mountains, Pigeon Spring Road to El Oso road jct., *Mittleman & Hodgson 695* (DES), *Austin & Austin 7659* (ASU); Maricopa Co., N of Sunflower, *Earle s.n.* (DES); Mohave Co., along road to Cottonwood Spring, *Mason & Phillips 2887* (ARIZ, ASU, NY, UC); Yavapai Co., Stanton–Yarnell road, *Butterwick & Hillyard 6567* (ARIZ, ASU); Bradshaw Mountains, along jeep trail T.9N, R.1E, NW¼ of NW¼ of Sect. 26, *Ramsden, Delamater & Hodgson 3597* (DES, NY).

Ipomoea cardiophylla Gray

Originally thought to be restricted to Texas and New Mexico (U.S.A.), the plants are now known also from Arizona and Mexico (Fig. 5) (Chihuahua, Coahuila, Durango, Oaxaca, Queretaro, and Sonora). The type was collected in Texas (Hudspeth

County: Hueco Mountains, E of El Paso, 13 Oct. 1849, *Wright 1314*, GH) where a population was rediscovered by McDonald (1982).

The species was reported from near Tombstone in Arizona by Mason et al. (1986) and was relocated in 1989 (*Austin & Austin 7608*, ASU). This site is at an altitude of 3,700 ft. in mesquite-creosote bush scrub (Chihuahuan desert scrub sensu Brown & Lowe, 1980), and here the population consists of scattered plants extending along a road for about 0.8 miles. No fruits were present on 7 September 1989; some mature fruits were found on 26 September, but these were heavily parasitized by insects.

Flowers open at 6 A.M. and are mostly wilted by 11 A.M. Neither McDonald (1982) nor I found pollinators on the plants. McDonald found a 90% seed set on cultivated plants. The species may be autogamous.

Widening of the highway could eliminate the species from Arizona. Texas and New Mexico plants may be as rare.

Representative specimens studied. U.S.A. ARIZONA: Cochise Co., S Tombstone, *Walker s.n.* (ARIZ); SW of Mule Mountains N hwy. between Huachuca Terrace and Palominas, *Goodding 206-61* (ARIZ). NEW MEXICO: Doña Ana Co., Organ Mountains, 28 Sep. 1902, *Wooton s.n.* (NMC); 28 Sep. 1980, *Worthington 6655* (TEX); 11 Oct. 1980, *6746* (TEX); 23 Oct. 1975, *Von Loh 687* (UNM); Grant Co., N of Silver City, *Zimmerman & Zimmerman 2006* (SNM fide McDonald, 1982). TEXAS: Brewster Co., W of Study Butte, *Warnock 13184-A* (SRSC fide McDonald, 1982).

IPOMOEA TENUILOBA TORREY

With a narrow range (Fig. 8) in Arizona, New Mexico, the trans-Pecos Mountains in Texas, and also in Chihuahua, Mexico, this species seems to be uncommon throughout its range. This impression of rarity is enhanced because of the matinal flowers (opening after 1:00 A.M. and closing between 7:00 and 8:00 A.M.). Because the flowers close early, the plants are difficult to find. Although the morphology of the flowers indicates adaptation for moth pollination, no moth scales on the stigmas or other evidence of visitation by moths was found in 1989. Perhaps the plants in Arizona are autogamous.

This is a rare species that should be considered threatened throughout its range. Plants grow in the pine–juniper–oak zone in Santa Catalina Mountains and Huachuca Mountains. They are restricted to quartzite in the Huachuca Mountains (F. Reichenbacher, pers. comm.). Both varieties and their intermediates have been discussed by Yatskievych & Mason (1984).

Representative specimens examined. U.S.A. ARIZONA: Cochise Co., Ramsey Canyon, at Bledsoe Cabins, Huachuca Mountains, Nature Conservancy Property, *Tulin 1153* (ARIZ); Natural Bridge Trail, Chiricahua Natl. Monument, *Duramos s.n.* (ARIZ); SE Turkey Creek Ranger Station, *Holler et al. 1170* (ASU, DES); Mule Mountains, Mule Pass, *Reichenbacher 811* (ARIZ); Pima Co., Santa Catalina Mountains, Finger Rock Canyon, *Bertolsen s.n.* (ARIZ); Rincon Mountains, along Rincon Beak Trail, *Bowers & McLaughlin R-538* (ARIZ); Santa Catalina Mountains, Bear Canyon, *Van Devender & Eiber s.n.* (ARIZ); Santa Cruz Co., Sycamore Canyon, *Windam & Yatskievych 81–332* (ARIZ, ASU); Santa Rita Mountains, Madera Canyon, *Reeves 1045* (ASU). NEW MEXICO: Eddy Co., 2 Aug. 1909, *Wooton s.n.* (NMC); Grant Co., *Wagner 3444* (UNM); Hidalgo Co., 15 Sep. 1980, *Todsen s.n.* (NMC). TEXAS: Jeff Davis Co., nr. Davis Mountains Resort Headquarters, *Worthington 5020* (UTEP fide Yatskievych & Mason, 1984).

IPOMOEA THURBERI GRAY

For some time the species was thought to be restricted to the United States. Although not included under this name for Mexico by Matuda (1963–1965), this species occurs (Fig. 8) in Chihuahua, Durango, and Sonora, where it has been passed under the name *I. gentryi* Standley [Field Mus. Nat. Hist. 22: 46. 1940. TYPE: Mexico. Chihuahua: Río Mayo, Sierra Canelo, 30 Aug. 1936, *H. S. Gentry 2497* (holotype, F)].

In the United States the species is presently known from Santa Cruz County. It was found in Cochise (Huachuca Mountains, 1882 to 1894) and Pima counties (Santa Rita Mountains, 1927) in the past, but has not been relocated in either area recently.

Kearney & Peebles (1951) reported corollas of this species to be purple. In fact, the corollas have a pink limb and green throat; they wilt and dry with a green tube and purple limb. Flowers, opening around 6:30 P.M., are visited by sphinx moths (probably *Hyles lineata*). All flowers examined had moth scales on the stigmas, indicating moth pollination. Only 30–50 plants constitute the population studied (Santa Cruz. County: *Austin & Austin 7603*, ASU). The species is rare in the United States and in Mexico (J. A. McDonald, pers. comm.) and should be placed on Arizona's endangered plant list.

Representative specimens examined. U.S.A. ARIZONA: Santa Cruz Co., Peña Blanca Lake, *Johnson 95* (ASC); Patagonia Mountains, Washington, *Kearney & Peebles 10142* (ARIZ); Nogales, *Harrison & Fulton 8163* (ARIZ); Canelo Hills, O'Donnell Canyon, just N of Canipe Cienega, Nature Conservancy Property, *Yatskie-*

vych 80-347 (ARIZ); Nogales–Ruby road at jct. of the Summit Motorway, *Kaiser 49–261* (ARIZ); Santa Rita Mountains, Madera Canyon, *Peebles et al. 4560* (ARIZ).

Species Uncommon throughout Their Ranges

Bonamia repens (I. M. Johnston) Austin & Staples

The species is restricted to Brewster and Terrell Counties, Texas (Fig. 1), where it is rare. Specimen citation has been given earlier (Austin & Staples, 1985). In Mexico it is similarly uncommon (Austin & Pedraza, 1983).

Calystegia macounii (Greene) Brummitt

The taxonomy of our North American *Calystegia* is complex, and the group has been discussed by Brummitt (1980). Shinners (1970) may have confused *C. macounii* with *C. sepium*, and the range of the genus within Texas is uncertain. I have not studied herbarium specimens from Texas. Rare in Arizona and New Mexico, this basically Great Plains (Austin, 1986b) species extends into the Southwest (Fig. 2). The plants were first found in Arizona at Flagstaff (17 June 1887, *Mearns 158*, NY) and were recollected there as recently as 1970 (*Smith s.n.*, ASC). The species was collected in Walnut Canyon east of Flagstaff in 1969 (*Burrall s.n.*, MNA) but does not appear in a checklist of the area (Joyce, 1985). The species had not been collected in Arizona since 1971, when I found it again in the early summer of 1990 (*Austin & Austin 7661*, ASU). I have seen only 10 collections from Arizona and New Mexico.

Plants grow in drainages where prairies are adjacent to wetlands, such as near Lake Rogers southwest of Flagstaff. Plants are scattered among *Iris*, *Lupinus*, *Geranium*, and *Achillea* in depressions. Flowers open near dawn and begin to close by 9:30 A.M., especially during the drought of 1990, which caused stress. Bees (genera not determined) were visiting the flowers. The species is notable for its saccate bracts.

Representative specimens examined. U.S.A. ARIZONA: Apache Co., Canyon de Chelly Natl. Monument, upper Canyon Del Muerto, 12 July 1971, *Halse 485* (ARIZ); Coconino Co., SE Flagstaff, 13 July 1966, N shore of Mormon Lake, *Niles 835*, *Reese 164* (ARIZ); Navajo Co., White Mountains, Lakeside, 10 June 1928, *Harrison 5506* (ARIZ, US). NEW MEXICO: San Miguel Co., Las Vegas, Soldier's Camp, 14 June 1927, *Bro. Arsene 18720* (US).

Ipomoea lindheimeri Gray

This species occurs (Fig. 6) in Arizona, New Mexico, Texas, and adjacent Mexico. In Arizona this is an extremely rare species, and its continued existence there is problematical. Moreover, the specimens cited for Arizona are intermediate between the typical material from Texas and New Mexico and the allied *I. pubescens*.

Representative specimens examined. U.S.A. ARIZONA: Cochise Co., Gleeson, 25 Aug. 1927, *Thornber s.n.* (ARIZ); Bisbee, 30 Sep. 1930, *Thornber s.n.* (ARIZ); Pima Co., reportedly (see Kearney & Peebles, 1951; Kearney et al., 1960), not verified. NEW MEXICO: Doña Ana Co., 19 Sep. 1976, *Todsen s.n.* (NMC); Eddy Co., Carlsbad Caverns, *Degener 5042* (NY); Otero Co., *Gordon & Norris 552* (UNM); County unknown, *Wright 1612* (NY). TEXAS: Brewster Co., *Marsh 214b* (TEX) (in part); Burnett Co., *Lundell 13489* (TEX); Crockett Co., *Warnock & McBryde 15215* (TEX); Culbertson Co., *Correll & Johnston 19189* (TEX); Jeff Davis Co., *Lundell & Lundell 13126* (TEX); Kenny Co., *Correll 30431* (TEX); Llano Co., *Whitehouse s.n.* (TEX); Pecos Co., *Gould 7220* (TEX); Sutton Co., *Cory 37305* (TEX); Terrell Co., *Johnston 6458* (TEX); Travis Co., *Webster 97* (TEX); Uvalde Co., *Smith & Butterwick 67* (TEX); Val Verde Co., *Flyr 795* (TEX).

Species on the Margins of Their Ranges

Cressa nudicaulis Griseb.

The species is restricted to the coastal part of southern Texas and adjacent Mexico (Fig. 3). Because it requires coastal saline habitats, its distribution is limited. The wide range but low number of collections from Mexico suggests that the species is also rare there.

Representative specimens examined. U.S.A. TEXAS: Cameron Co., Loma de la Grulla Sur, *Johnston 249-5* (MSC); Kleberg Co., Riviera Beach, *Correll & Correll 38892* (UC), *Correll & Johnston 17838* (UC); Nueces Co., Corpus Cristi, *Heller 1811* (MSC); Willacy Co., nr. Redfish Bay, *Lundell & Lundell 8775* (UC). MEXICO. TAMAULIPAS: Mesquite, Lag. Madre, *LeSueur 630* (ARIZ, F).

Cressa truxillensis HBK

Perhaps my view of the distribution of this species was distorted by the drought of 1989–1990. Actually, one colleague told me that "thousands and thousands of plants" may be found on certain sites. My limited experience was different. In places where it has been previously considered a common weed (e.g., Yuma, Arizona), the plants were rare (*Austin & Austin 7586*, ASU), and no plants could be found at other localities where the species had formerly been collected in Arizona. No field study was made in other states, although the plants were hunted in New Mexico. Plants may be locally common, but populations are infrequent to rare throughout their range in the southwestern United

States (Fig. 3). Indeed, there are patches of suitable habitat for the species throughout the West as may be seen by the distribution map (Fig. 3). Why the species occurs in some of these islands of habitat and not others that seem equally suitable is unknown.

The herbaceous tips arise from a deep root system. Upper parts of the plants die and disappear during the drought, and when rain falls again, they reappear from the roots.

Representative specimens examined. U.S.A. ARIZONA: Maricopa Co., Komatke, floodplain, *Rea s.n.* (ASU-27419); Tempe, S Stitt's home, *Stitt & McClellan 1208* (ASU); Mohave Co., Chemehuevi Valley, *Jepson 5206* (ARIZ); Navajo Co., SW of Joseph City, SE of Winslow, Hugo Meadows, *Pinkava et al. 13836* (ASU), *13839* (ASU); Pinal Co., E Gila Crossing, *Peebles 13233* (ARIZ); Sacaton Agency, *Gilman 234* (ARIZ); Yuma Co., Roll, *Hamilton s.n.* (ASU- 46383, DES-6563); near Yuma, *Gibby s.n.* (DES-1670), *Thornber s.n.* (ARIZ); 40 mi. E Yuma in Mohawk Valley, *Moody s.n.* (ARIZ). NEW MEXICO: Bernalillo Co., *Dittmer & Clark 7361* (UNM); Chaves Co., *Waterfall 4313* (ARIZ); Doña Ana Co., 12 June 1892, *Wooton s.n.* (NMC); Eddy Co., *Castetter 10683* (UNM); Otero Co., 16 May 1936, *Hershey s.n.* (NMC); Soccoro Co., *Castetter s.n.* (UNM 10619). TEXAS: Culberson Co., N Van Horn, *Peck & Peck 15380* (UC), *Correll & Johnston 18457* (UC); El Paso Co., San Antonio, along Rio Grande, at Fenton Road bridge, *Worthington 14132* (DES); Gonzales Co., *Tharp 249* (UC); Howard Co., Big Springs, *Eggert s.n.* (UC); Kleberg Co., Riviera Beach, *Correll & Correll 38892* (UC); Pecos Co., Fort Stockton, *Cory 51953* (UC); Starr Co., E of El Sauz, *Correll 32310* (UC); Ward Co., Barstow, *Tracy & Earle 23a* (MSC, UC). NEVADA: Washoe Co., N side Peavine Mt., *Heller & Kennedy 8663a* (UC? n.v.); County unknown, Virginia River, *Goodding 726* (UC). UTAH: Juab Co., Fish Springs, *Maguire & Holmgren 21854* (UC); Salt Lake Co., nr. Beck's Hot Springs, *Garrett 870f* (NY), *Clements s.n.* (UC), *Garrett 5005* (UC). Also recorded from Box Elder, Davis, Garfield, Millard, Tooele, Utah, Washington, and Weber counties (Welsh et al., 1987). CALIFORNIA: Riverside Co., N Lakeview, *Jacoby 430-4* (DES); San Bernadino Co., Death Valley Natl. Monument, Saratoga Springs, *Moore s.n.* (DES). Also recorded from Alameda, Colusa, Contra Costa, Glenn, Imperial, Inyo, Kern, Lassen, Los Angeles, Merced, Modoc, Orange, San Benito, San Bernadino, San Diego, Santa Barbara, Santa Clara, Santa Cruz, San Joachin, Sonoma, and Yolo counties (Austin & Staples, unpublished).

DICHONDRA ARGENTEA WILLDENOW

This is a widely distributed species (Fig. 4) in New Mexico, the Trans-Pecos Mountains of Texas, and the Chihuahuan Desert region. The plants are very rare in Arizona and uncommon in New Mexico and Texas. The Arizona collection may have represented a western limit to the range of the species or been introduced into Bisbee during the mining operations. The former is suggested by the similarly disjunct species *I. cardiophylla* and *I. lindheimeri*.

Dichondra argentea often grow on southwestern-facing rocky ridges in Doña Ana and Luna counties, New Mexico. Plants may be locally common.

Representative specimens examined. U.S.A. ARIZONA: Cochise Co., Bisbee, *Harrison 8256* (ARIZ). NEW MEXICO: De Baca Co., 23 Oct. 1904, *Wooton s.n.* (NMC); 25 June 1894, *Wooton s.n.* (NMC); Doña Ana Co., Organ Mountains, *Austin & Austin 7637* (ASU); Grant Co., *Knight 2725* (UNM); Harding Co., *Wooton s.n.* (UNM 18050); Luna Co., *Goodding 3189* (NMC).

DICHONDRA SERICEA SWARTZ

This is a widespread tropical American species, although it is known from only one location in Arizona (Fig. 4). The single Arizona location is Sycamore Canyon, near the Mexican border. It was collected several times between 1936 and 1962 and was relocated in 1989 after a long hiatus (*Austin & Austin 7604*, ASU). Population size has declined from that recorded previously on herbarium labels, being restricted to a strip only a few meters long. The plants could be eliminated from the state by one flood, rockfall, or similar event.

There are few flowers and fruits included in the few collections of this population. Study over several months in 1989–1990 indicated that flowering is uncommon and fruiting may be equally rare. This rarity and apparent decline may be related to shading of these heliophylic plants.

Representative specimens examined. U.S.A. ARIZONA: Santa Cruz Co., Sycamore Canyon, about 200 yds. S of Piñasco Canyon, on E bank, 2–10 ft. above stream, near base of rock face, *Barr 62-863* (ARIZ), *Darrow & Haskell 2217* (ARIZ), *Goodding 6620* (ARIZ), *Keiser s.n.* (ARIZ).

IPOMOEA DUMETORUM WILLD. EX ROEM. & SCHULT.

Martin & Hutchins (1981) do not include this species in their flora of New Mexico. This Mexican, Mesoamerican, and South American (Fig. 5) species was identified and relocated by McDonald (1982, 1984) in New Mexico and Texas. McDonald (1984) cited specimens in addition to those listed here.

Representative specimens examined. U.S.A. NEW MEXICO: Doña Ana Co., Organ Mountains, *McDonald 140* (TEX, fide McDonald, 1982); Lincoln Co., White Mountains, alt. 7,400 ft., 25 Aug. 1907, *Wooton & Standley s.n.* (NMC, US); White Mountains, alt. 2,500 m, *Wooton 630* (MO, fide McDonald, 1982). TEXAS: Jeff Davis Co., Mt. Livermore, alt. 2,700 m, *Warnock 23068*

(SRSC, fide McDonald, 1982); Davis Mountains, Madeira Canyon, near Livermore, *Hinckley s.n.* (ARIZ).

IPOMOEA ×*LEUCANTHA* JACQUIN

This hybrid originated in the southeastern United States (Austin, 1978; Abel & Austin, 1981). From there it has been introduced into various parts of the Americas by seeds (Fig. 5). It was first reported in Arizona under an erroneous identification as *I. triloba* (Kearney & Peebles, 1951) and then as *I. lacunosa* (Shinners, 1965). In Arizona it is known from only six collections. These weeds of agricultural fields are probably not as rare as collections seem to indicate.

This autogamous taxon, known from few collections in the southwest, should not be considered a threatened species but a weed. In the southeastern United States the taxon is occasional and widespread.

Specimens examined. U.S.A. ARIZONA: Maricopa Co., 4 Oct. 1979, *Heathman s.n.* (ARIZ, ASU); Santa Cruz Co., 1884, *Pringle* (ARIZ); Pima Co., 1912, *Thornber s.n.* (ARIZ); 1945, *Goodding & Lusher 128-45* (NY); Yuma Co., 7 Nov. 1985, *Tuttle s.n.* (ARIZ); County unknown, *LeRoy s.n.* (NY).

IPOMOEA LONGIFOLIA BENTHAM

This species is known from Mexico in Sonora south to Durango, Guanajuato, Zacatecas, San Luis Potosí, Aguascalientes, Queretaro, and Jalisco (Fig. 6). In the United States it is restricted to Arizona. These plants, although not rare in their range, are restricted to a small area in southeastern Arizona between the Dragoon (Cochise County) and Pajarito Mountains (Santa Cruz County). Flowers, which open between 3:30 and 4:00 P.M., are pollinated by moths (Austin, 1986a).

The range given by Martin & Hutchins (1981: 1,562) includes the range of *I. shumardiana* (Torrey) Shinners, a distinct Great Plains species. The presence of *I. longifolia* has not been verified for any part of the United States except southeastern Arizona (cf. Austin, 1986a, 1990b).

Representative specimens examined. U.S.A. ARIZONA: Cochise Co., Lochiel, *Cazier & Davidson s.n.* (ASC); NW Bisbee, alt. 5,500 ft., *Deaver 6639* (ARIZ, ASC); NE Coronado Natl. Monument, *Johnson 72-77* (ARIZ, ASC); Whetstone Mountains, Whetstone, *Yatskievych 80-258a* (ARIZ); Santa Cruz Co., Patagonia Mountains, W Sycamore Canyon and Italian Canyon intersection, *Morris et al. 4641* (DES); near jct. of Keno Springs and Duquesne roads, *Delamater et al. 4390* (DES); Arrivaca–Florida Canyon, *Marshall & Blakeley s.n.* (DES-40).

IPOMOEA PUBESCENS LAMARCK

This widespread species has a disjunct distribution from South America to New Mexico, Texas, and adjacent Mexico (south to Durango and San Luis Potosí). It is one of several examples of amphitropical distributions in the family (McDonald, 1984), this reaching its northern limit in the southwestern United States (Fig. 7).

This species was not included by Martin & Hutchins (1981), although they had specimens of it misidentified as *I. lindheimeri* in the UNM herbarium. The species is now extremely rare in Arizona. Of the sites where it was formerly collected (Cochise, Pima, and Santa Cruz counties), plants were relocated in only one (Santa Cruz County: Sycamore Canyon, *Austin & Austin 7605*, ASU). The plants are not common in adjacent Mexico and should be considered endangered in Arizona.

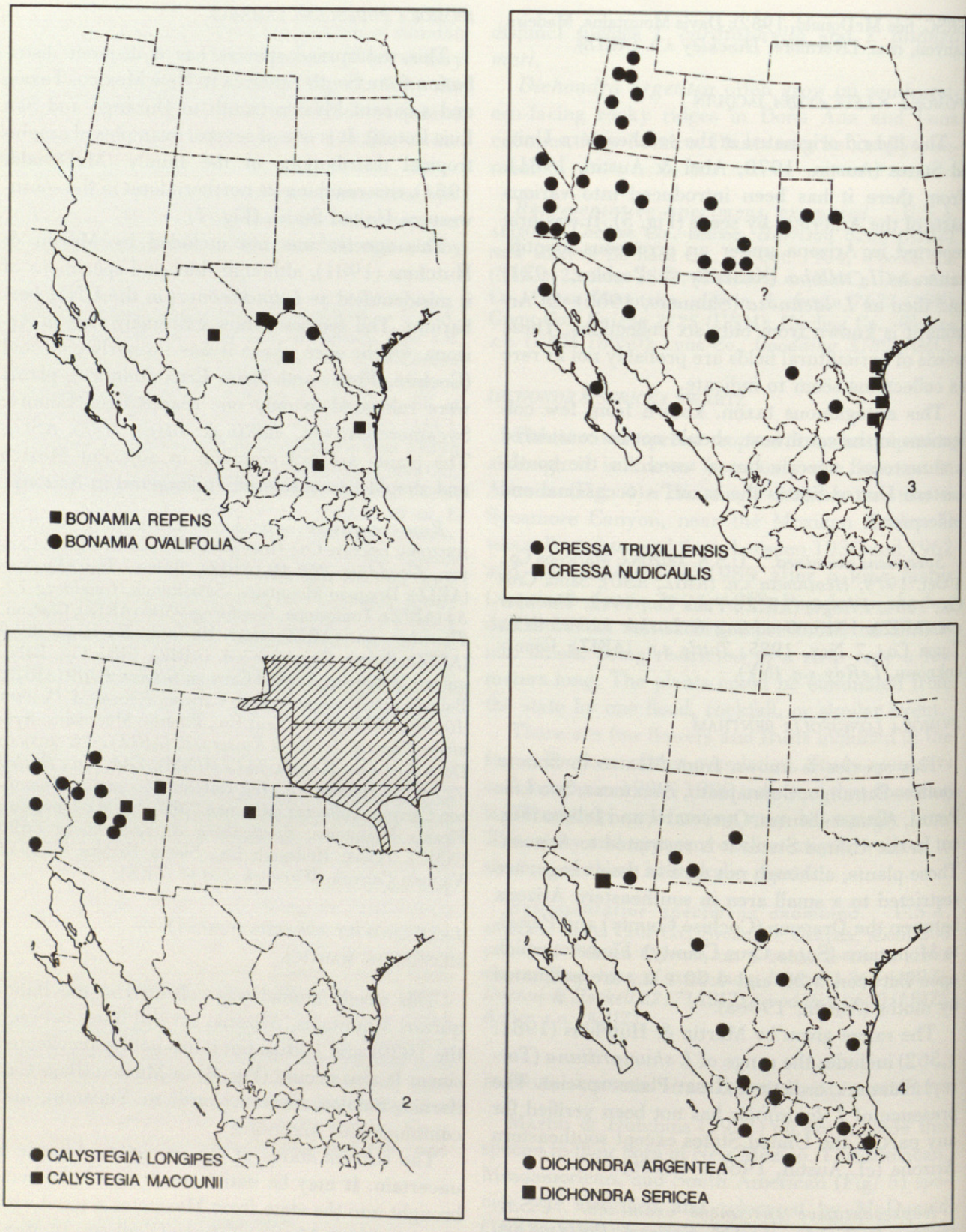
Representative sepcimens examined. U.S.A. ARIZONA: Cochise Co., Huachuca Mountains, Glance Canyon, *Goodding 868-49* (ARIZ); Bisbee, *Thornber s.n.* (ARIZ); Dragoon Mountains, Sala Ranch, *Goodding 72-54* (ARIZ); Tombstone, *Goodding 9506* (ARIZ); Gleeson, *Thornber s.n.* (ARIZ); near Herford, *Harrison 8269* (ARIZ); Bisbee, *Thornber s.n.* (ARIZ); Pima Co., Baboquivari Mountains, Fresnal Canyon, *Gilman B109* (ARIZ); Baboquivari Mountains, Toro Canyon, *Kearny & Peebles 10438* (ARIZ); Santa Cruz Co., Pajarito Mountains, Sycamore Canyon, *Toolin & Kaiser 030* (ARIZ). NEW MEXICO: Doña Ana Co., *Knight 3415* (UNM); Eddy Co., *Bailey 721* (US); Hidalgo Co., Big Hatchet Mountains, Thompson Canyon, *collector unknown 7367* (UNM); Luna Co., Florida Mountains, *Spellenberg & Spellenberg 6626* (NMC). TEXAS: Hudspeth Co., Sierra Diablos, head of Victoria Canyon, *Warnock 11431* (TEX).

JACQUEMONTIA AGRESTIS (CHOISY) MEISNER IN MARTIUS

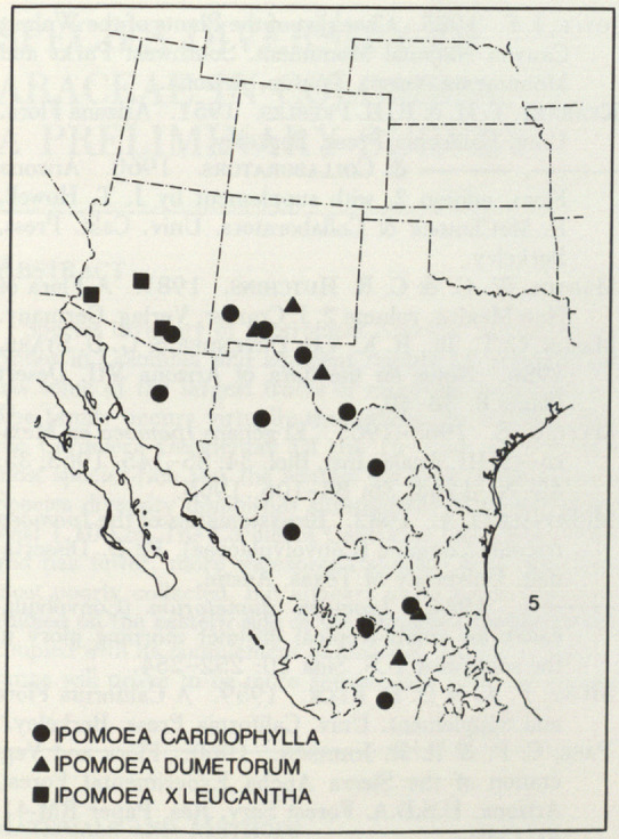
This weedy annual was collected in the Baboquivari Mountains, Arizona, several times between the 1920s and 1940s, but it has not been collected since. It also occurs (Fig. 8) in Mexico (Baja California, Sinaloa, Sonora, south to Yucatan), and continues into Argentina.

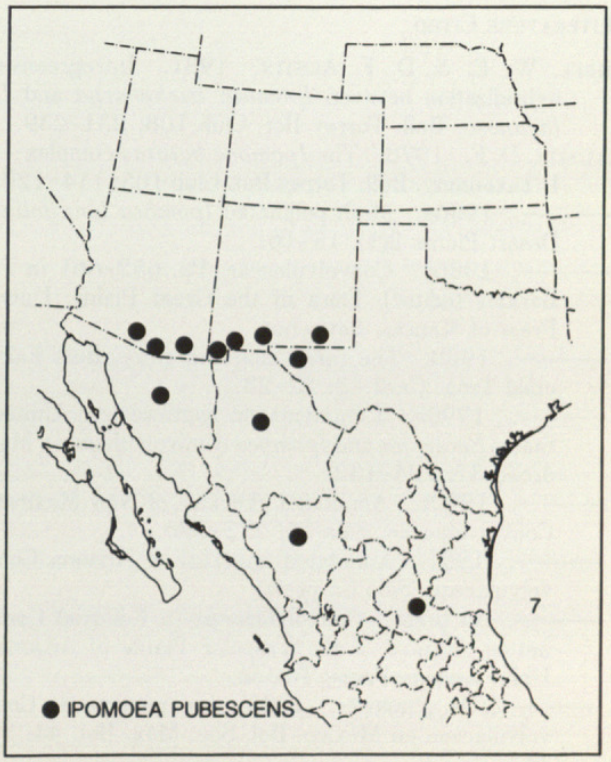
The current status of the species in Arizona is uncertain. It may be native, or it may have been brought into the state from Mexico as a weed with plants cultivated by the Tohono O'odham. In Mexico and elsewhere the species is commonly a weed in maize fields and other cultivated crops.

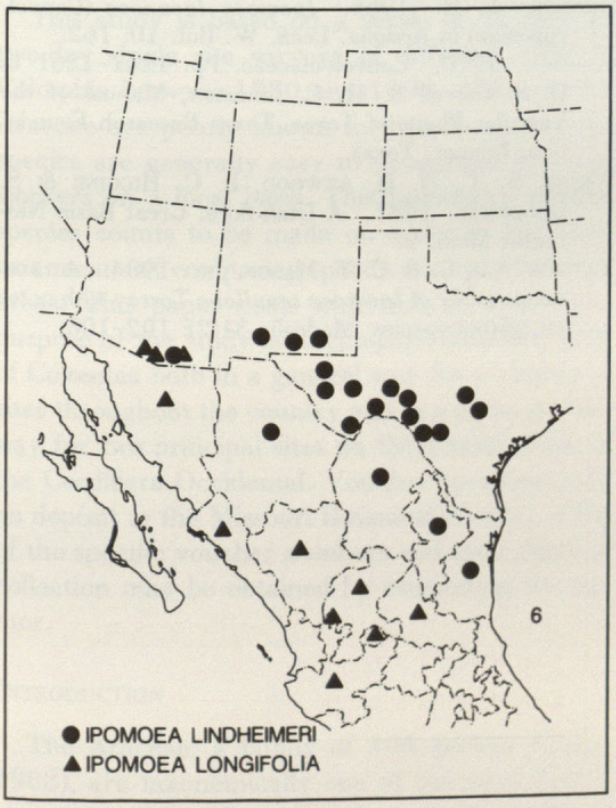
Representative specimens examined. U.S.A. ARIZONA: Pima Co., Baboquivari Mountains, Toro Canyon, *Kearney & Peebles 10389* (ARIZ); Baboquivari Peak, along trail, *Goodding 273-45* (ARIZ); Baboquivari Mountains, Fresnal Canyon, *Gilman B113* (ARIZ).

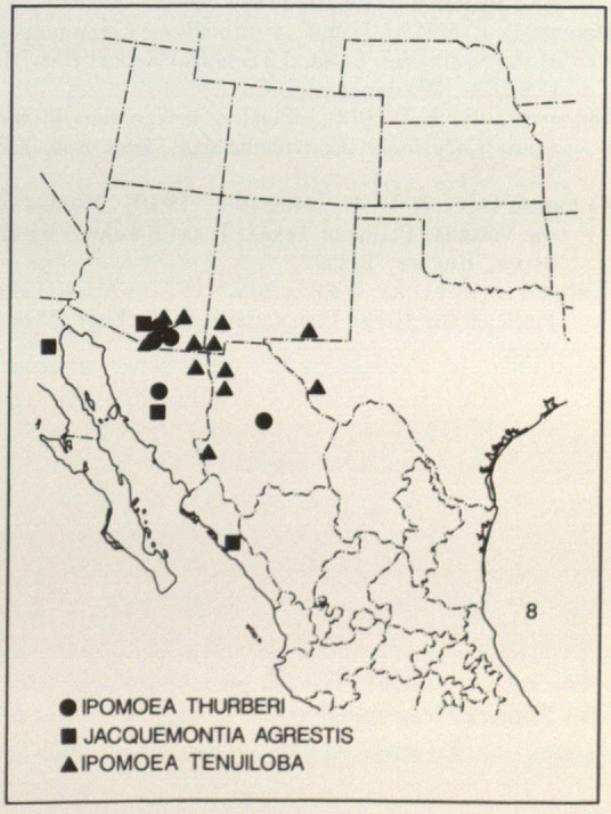


FIGURES 1–4. Distribution maps.—1. *Bonamia ovalifolia* (circle) and *Bonamia repens* (square).—2. *Calystegia longipes* (circle) and *C. macounii* (square and shading). Range in the Great Plains is based on Great Plains Flora Association (1977) and Austin (1986b). The question mark indicates uncertainty about the range and the species in Texas.—3. *Cressa truxillensis* (circle) and *C. nudicaulis* (square). The question mark indicates uncertainty about the range and the species in Texas.—4. *Dichondra argentea* (circle) and *D. sericea* (square). The extensive range of *D. sericea* in tropical America is not indicated.









FIGURES 5–8. Distribution maps.—5. *Ipomoea cardiophylla* (circle), *I. dumetorum* (triangle), and *I.* ×*leucantha* (square).—6. *Ipomoea lindheimeri* (circle) and *I. longifolia* (triangle).—7. *Ipomoea pubescens* in North America.—8. *Ipomoea tenuiloba* (triangle), *I. thurberi* (circle), and *Jacquemontia agrestis* (square) in North America.