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REVISION OF THE GENUS *ANODA* (MALVACEAE)

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ABSTRACT

A revision of the genus *Anoda* is presented that recognizes 23 species, of which ten are described as new. The genus includes annual herbs, subshrubs, and occasionally shrubs and occurs from the southern United States to Bolivia, Argentina, and Chile. Most of this distributional range, however, is accounted for by a single species, *A. cristata*, which also occurs as an adventive in a few other parts of the world. The genus is principally Mexican, all of the species occurring within that country. *Anoda* is closely allied to the genus *Periptera*, also a Mexican genus, and the two genera share features of fruit structure. The two genera together seem to occupy a relatively isolated position within the family. *Anoda* is subdivided into six sections, and keys to the sections and to the species are presented.

Key words: *Anoda*, Malvaceae, Mexico, Neotropics, revision, taxonomy.

INTRODUCTION

The genus *Anoda* is principally Mexican in its distribution and its diversity, but it may be found from the southern United States to Bolivia, Argentina, and Chile. All of the species occur in Mexico, and only six of the 23 species occur outside of Mexico. Three species are common weeds, and one of these, *A. cristata* (L.) Schlechtendal, accounts for the entire breadth of distribution of the genus from the United States to Argentina and sometimes to other parts of the world (e.g., Mitchell 1982).

The genus has been studied taxonomically by Schlechtendal (1837), Gray (1887), Baker (1892), Garcke (1896), and Hochreutiner (1916), and the genus has been treated in various regional floras such as Kearney and Peebles (1942), Shreve and Wiggins (1964), Correll and Johnston (1970), and Wiggins (1980). The most recent comprehensive study is that of Hochreutiner (1916), whose study, however, was based on only a limited number of specimens (42 cited specimens, distributed among 14 species and 5 varieties). Numerous subsequent collections have revealed additional species or have clarified our understanding of species already known. Therefore, it is considered appropriate to present a revision of *Anoda* at this time. Ten species are described as new in the present work, and 23 species are recognized. A cytological study by Bates (1987) complements the present study.

TAXONOMY

ANODA Cavanilles, Diss. 1:38. 1785.

Lectotype: Anoda hastata Cavanilles. Gray (1887) reduced the three species of Cavanilles to a single species, for which he chose to use the name *A. hastata*, giving the other names as synonyms. This choice constitutes a lectotypification of the genus.

Cavanillea Medikus, Malv.-Fam. 19. 1787.—Type: *Anoda hastata* Cav.

Sidanoda (A. Gray) Wooton & Standley, Contr. U.S. Natl. Herb. 19: 427. 1915.—Based on: *Anoda* sect. *Sidanoda* A. Gray, Proc. Amer. Acad. Arts 22: 299. 1887.—Lectotype: *Anoda pentaschista* A. Gray.—Note: The assertion by Hochreutiner (1916, p. 39) that sect. *Sidanoda* is monotypic and based on *Anoda abutiloides* A. Gray is incorrect. When Wooton and Standley elevated sect. *Sidanoda* to generic rank, they narrowed Gray's concept of the taxon to the single species, *Anoda pentaschista*, an action that serves as the choice of a lectotype.

Annual or perennial herbs, subshrubs, or shrubs, erect or decumbent, hispid or stellate-pubescent or -puberulent (sometimes viscid) to glabrate. Leaves linear, lanceolate, ovate, cordate, hastately lobed or palmately parted, crenate or dentate to subentire, usually green, sometimes with an irregular purplish blotch along the midrib, sometimes canescent beneath. Flowers solitary in the axils or aggregated into open terminal racemes or panicles; involucels absent; calyces gamosepalous, 5-lobed, sometimes accrescent in fruit, rounded basally, usually 5- or 10-nerved; petals yellow, whitish, lavender, or purple; androecia shorter than to equaling the petals, usually yellowish, the columns often pubescent, the anthers sometimes lavender; pollen grains (Hashmi 1970; Heusser 1971; Sánchez 1982) with 30+ apertures (except 4–5 apertures in *A. pentaschista*); styles slender, 5–20 with the stigmas usually abruptly capitate and glabrous. Fruits (Fig. 1) oblate or disciform, schizocarpic, puberulent, tomentose, or hispid (sometimes subglabrous); mericarps 5–20, each often with (or sometimes without) a spur or spine on the dorsal angle, the lateral walls usually disintegrating at maturity; seeds usually glabrous, sometimes obscurely pubescent, solitary, sometimes enclosed in a persistent reticulate endocarp (Fig. 2). Base chromosome number: $x = 15$ (cf. Bates 1987).

One of the characteristic features of *Anoda* is that leaf form is highly variable within individual plants (e.g., Fig. 6, 7). Basal leaves, mid-stem leaves, and leaves immediately below and in the inflorescence may be very different from one another in size and form on an individual plant. It is therefore appropriate to speak of a "leaf spectrum" in relation to these plants and to keep this fact in mind when interpreting the descriptions or identifying an unknown plant. Generally, the leaves become smaller and narrower upward. This phenomenon, of course, occurs in many other genera, but its expression is relatively marked in *Anoda*.

Another characteristic feature of *Anoda* concerns its distribution. Certain species are found in the field in relatively large populations (e.g., *A. palmata* Fryx., or the weedy species such as *A. cristata* and *A. pentaschista*). Other species, on the other hand, occur as widely scattered individuals, and collectors may see only one or two individuals at a given site. The collector is thus faced with the choice of making a unicate collection or no collection at all and often opts for the latter, unless he or she has a particular interest in the genus. Thus, some of the species of *Anoda* are probably under-represented in herbaria as a result of this characteristic of scattered distribution.

The name *Anoda* is derived from the vernacular Ceylonese name "anoda" given to a species of *Abutilon*, a name that was noted by Burman (*Thesaurus Zeylanica*) and adopted by Cavanilles.

Schlechtendal (1837) divided the species of *Anoda* into two sections, but he did not give the sections names. Various subsequent authors (Gray 1887; Baker 1892; Hochreutiner 1916) have also divided *Anoda* into sections. More recently, Kearney (1951) noted the practical difficulties of applying the distinctions among these

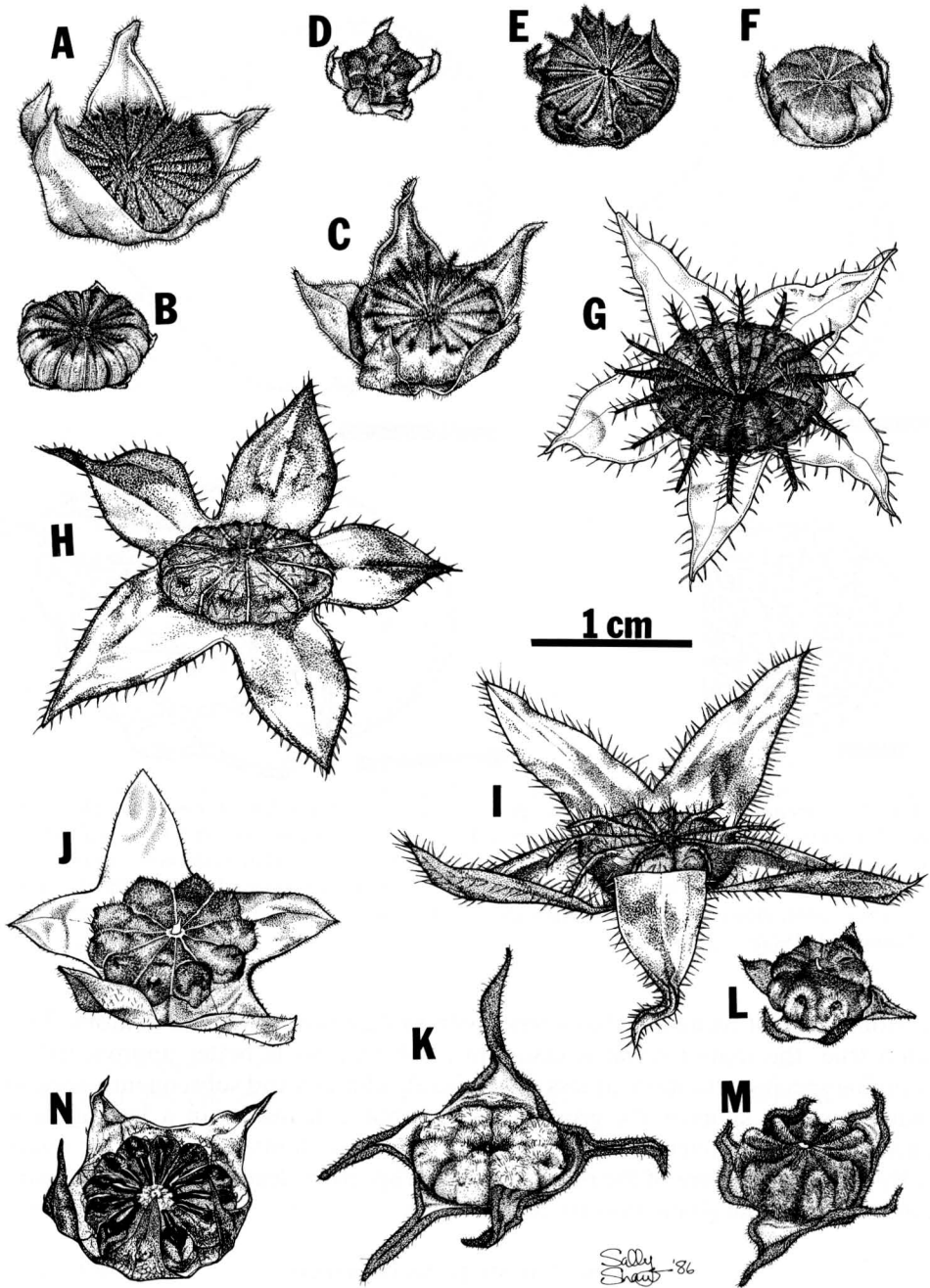


Fig. 1. Fruits of representative species of *Anoda*.—A. *A. polygyna* (Breedlove 19033).—B. *A. leonensis* (Fryxell et al. 1697).—C. *A. paniculata* (Koch and Fryxell 82247).—D. *A. pentaschista* (Waterfall 6210).—E. *A. pedunculosa* (Hernández et al. 734).—F. *A. reticulata* (White 3618).—G. *A. cristata* (Gentry 1829).—H. *A. zuccagnii* (Hinton 11632).—I. *A. lanceolata* (Pringle 5454).—J. *A. guatemalensis* (Nelson 3169).—K. *A. pubescens* (Pringle 6969).—L. *A. thurberi* (Pringle 6536).—M. *A. hintoniorum* (Hinton 7229).—N. *A. pristina* (Breedlove 7546).

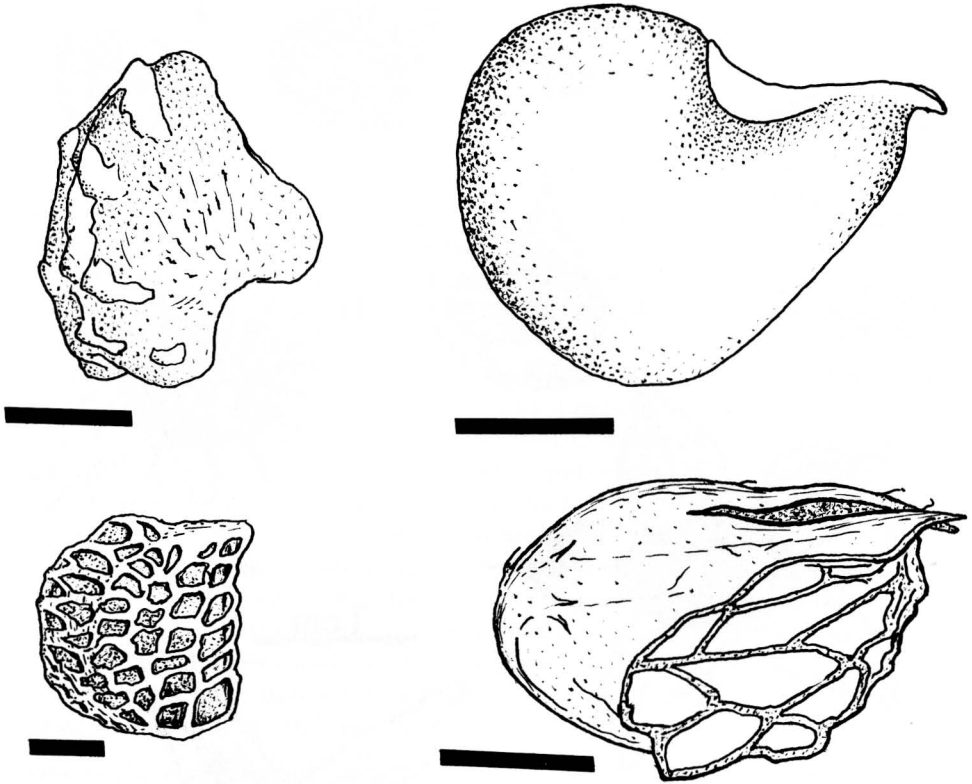


Fig. 2. Disseminules of representative species of *Anoda*.—Upper left: *A. lanceolata* (Koch and Fryxell 83148), showing seed completely enclosed by ornate endocarp.—Lower left: *A. pedunculosa* (Koch and Fryxell 78326), showing seed completely enclosed by reticulate endocarp.—Upper right: *A. cristata* (Rosas 2), showing naked seed lacking an enclosing endocarp.—Lower right: *A. pristina* (Breedlove 7546), showing entire mesocarp with zone of dehiscence (above) and persisting reticulations of lateral wall. (Scale = 1 mm)

sections, at least using the characters given as diagnostic by these authors. As is often true, the matter of such taxonomic subdivision is better approached by grouping species with more or less clear overall affinities and subsequently seeking characters that support the grouping. This approach results in a less artificial imposition of characters on taxa and more natural sections, in spite of the essentially subjective nature of the process. Such an approach leads me to the following subdivision of the genus into six sections.

KEY TO THE SECTIONS OF *ANODA*

- A. Mericarps apically dehiscent, the lateral walls a coarse reticulum at maturity (Fig. 2) *A. sect. Pseudanoda*
- A. Mericarps not apically dehiscent, the lateral walls evanescent at maturity.
 - B. Pollen grains with 4–5 apertures; calyces 3–4 mm long; fruits 4–5 mm in diam; leaves coriaceous *A. sect. Sidanoda*
 - B. Pollen grains with 30 or more apertures; calyces usually >5 mm long; fruits 6–10 mm in diam; leaves membranous.

- C. Endocarp absent (i.e., seeds naked); plants perennial *A. sect. Liberanoda*
- C. Endocarp usually present, enclosing the seed (Fig. 2); plants usually annual.
 - D. Fruits hispid, often with radiating spines; endocarp weakly developed (sometimes absent) *A. sect. Anoda*
 - D. Fruits tomentose, with short spurs or these suppressed.
 - E. Petals 5–12(–15) mm long; carpels 8–13; plants usually <1.5 m tall
..... *A. sect. Cleistanoda*
 - E. Petals (8–)10–20 mm long; carpels 11–20; plants usually >2 m tall
..... *A. sect. Clausanoda*

Sect. Pseudanoda Fryxell, sect. nov.

Anoda fructibus disciformibus, mericarpis apice dehiscentibus, parietibus lateralibus fatiscensibus praeter reticulum grossum persistentem.

Type: Anoda pristina Fryxell.

Included species: A. pristina, A. succulenta Fryxell.

Distinctive characters: mericarps with apical dehiscence; lateral walls with persistent reticulum; endocarp not enclosing the seed; plants more or less glabrous.

Sect. SIDANODA A. Gray

Lectotype: Anoda pentaschista.

Included species: A. pentaschista.

Distinctive characters: calyx and fruits small with 5–8 carpels; foliage coriaceous; pollen grains with 4–5 apertures (Hashmi 1970); endocarp surrounding the seed absent.

Sect. Liberanoda Fryxell, sect. nov.

Anoda perennis, fructibus minute tomentosis, mericarpis 6–10, parietibus lateralibus evanescentibus, seminibus liberis endocarpis persistentibus carentibus.

Type: Anoda pubescens Schlechtendal.

Included species: A. pubescens, A. henricksonii M. C. Johnston, *A. speciosa* Fryxell, *A. hintoniorum* Fryxell, *A. guatemalensis* Fryxell, *A. abutiloides, A. thurberi* A. Gray.

Distinctive characters: fruits minutely tomentose with 6–10 carpels; endocarp surrounding the seed absent; plants perennial, sometimes shrubby.

Sect. ANODA

Lectotype: Anoda hastata Cavanilles.

Included species: A. cristata, A. zuccagnii (Sprengel) Fryxell, *A. lanceolata* W. J. Hooker and Arnott, *A. albiflora* Fryxell, *A. hirta* Fryxell.

Distinctive characters: fruits in the form of disks with radiating spines; hispid fruits; endocarp sometimes poorly developed or absent; plants often annual (?).

Sect. CLEISTANODA A. Gray

Lectotype: Anoda parviflora Cavanilles.

Included species: A. pedunculosa Hochr., *A. crenatiflora* Ortega, *A. maculata* Fryxell, *A. reticulata* S. Watson, *A. palmata*.

Distinctive characters: corollas relatively small; fruits minutely tomentose with 8–13 mericarps; seeds included in a persistent endocarp; plants annual (?), often less than 1.5 m tall.

Sect. Clausanoda Fryxell, sect. nov.

Anoda fructibus plerumque pluricarpis, seminibus in endocarpis reticulatis persistentibus includentibus.

Type: Anoda leonensis Fryxell.

Included species: A. leonensis, A. paniculata Hochr., *A. polygyna* Fryxell.

Distinctive characters: carpels 11–20; seeds included in a persistent endocarp; plants large, often 2 m tall or more.

Baker (1892) proposed *Anoda* sect. *Pseudosida* E. G. Baker to include *Anoda denudata* (Nees & Martius) Schumann, but this species belongs in the genus *Briquetia*, not in *Anoda*.

The species that constitute the sections *Pseudanoda* and *Sidanoda* are sufficiently distinctive from the rest of the genus that they are clearly set apart and have no close allies. The inclusion of *A. succulenta* in section *Pseudanoda* is tentative, pending the acquisition of fruiting specimens.

Section *Liberanoda* has two clear subgroups: the one including *A. pubescens*, *A. henricksonii*, and *A. speciosa*; the other *A. hintoniorum* and *A. guatemalensis*. The affiliations of the other two species, *A. abutiloides* and *A. thurberi*, are less clear. On the basis of the cytological evidence (Bates 1987), another disposition for *A. thurberi* may be necessary.

Sect. *Cleistanoda*, as here interpreted, seems to be a very natural group. On the other hand, sect. *Clausanoda* seems less coherent and may be a heterogeneous group. In any case, all of the sections here proposed are presented in the belief that they are a reasonable interpretation of the genus, with the hope that this interpretation will provide a frame of reference (and a set of hypotheses concerning relationships) for studies in other areas, such as cytology and crossing behavior.

The genus most closely affiliated with *Anoda* is the genus *Periptera* (Fryxell 1974; Bates 1987). The two genera form an isolated group within the family (Bates and Blanchard 1970), apparently without close allies. They share various similarities, especially concerning pollen characters (Sánchez 1982), fruit structure, and plant habit. In both cases the fruits are oblate disciform schizocarps, each mericarp often with a spur (or spine) on the dorsal angle and with the lateral walls evanescent at maturity. The seeds are solitary, and in some species (at least of *Anoda*) the seeds are completely enclosed in a persisting reticulate endocarp, a feature not known elsewhere in the Malvaceae. In those species with a persisting endocarp, the dispersal unit is the seed and enclosing endocarp; in those species lacking the endocarp, the seed alone is the dispersal unit.

Anoda and *Periptera* are distinguished principally on chromosome number (Bates 1987) and floral characters. In *Anoda* the corollas are purplish to pale lavender, white, or yellow, and the disposition of the petals is campanulate to rotate. In *Periptera*, on the other hand, the petals are usually some shade of red (or orange-red), and the petals are erect and often narrowly spatulate, forming a tubular corolla similar to that of *Malvaviscus*, though on a smaller scale. In addition, the genitalia are included within the corolla in *Anoda*, but are manifestly exerted in *Periptera*. The two genera apparently also differ in the form of the stigmas, which are abruptly capitate in *Anoda* (with the possible exception of *A. thurberi*) and more or less clavate in *Periptera*. Cytologically, *Anoda* is characterized by a base number of $x = 15$ (with the exception of *A. thurberi*) and *Periptera* by $x = 13$.

Future studies may indicate the desirability of combining these two genera, but for the present they are maintained as distinct because of their different chromosome number, stigma structure, and floral aspect, the latter presumably related to pollinator adaptation. Even if *Anoda* and *Periptera* were to be combined, it would still be appropriate to distinguish them in subgeneric or sectional rank, so that the question becomes one of the level at which to distinguish them. There does not appear to be any advantage to recognizing the distinction between these two groups in infra-generic rank rather than generic rank, and so no such change is proposed here.

The following key to the species of *Anoda* is an artificial key that does not follow the sectional breakdown previously discussed but is presented to facilitate the identification of specimens. In the subsequent treatment of individual species, specimens are cited according to the conventional herbarium acronyms with the exception of the lower-case "pf," which refers to the author's herbarium.

KEY TO THE SPECIES OF *ANODA*

- A. Petals pale to bright yellow.
 - B. Mericarps (and styles and stigmas) 5–8; endocarp absent; corolla yellow but sometimes fading pale reddish.
 - C. Calyces 3–5 mm long; mericarps 5–8; fruits 4–5 mm in diam; leaves coriaceous, discolorous, often narrowly linear 15. *A. pentaschista*
 - C. Calyces 5–7 mm long; mericarps 5; fruits 6 mm in diam; leaves membranous, concolorous, broadly ovate-acuminate 1. *A. abutiloides*
 - B. Mericarps (and styles and stigmas) 8–15; endocarp usually present; corollas drying yellowish.
 - D. Endocarp absent; stems and petioles notably hirsute 8. *A. hirta*
 - D. Endocarp present (unknown in *A. succulenta*); stems and petioles tomentose or puberulent to subglabrous.
 - E. Stems and petioles nearly glabrous; stems succulent 21. *A. succulenta*
 - E. Stems and petioles tomentose or puberulent; stems not succulent.
 - F. Mericarps (and styles and stigmas) 8–13; midstem leaves palmately lobed 12. *A. palmata*
 - F. Mericarps (and styles and stigmas) 10–16; midstem leaves ovate to hastate.
 - G. Upper leaf surfaces with simple appressed hairs; endocarp usually well developed with marked excrescences; fruits with radiating spines (Fig. 11); mericarps 10–12 9. *A. lanceolata*
 - G. Upper leaf surfaces sparsely stellate-pubescent to glabrate; reticulate endocarp lacking excrescences; mericarps crested or with short spurs.
 - H. Petals 8–12(–20) mm long, bright yellow; mericarps 12–16, crested but spurs virtually absent (Fig. 1B); plants 1–2 m tall 10. *A. leonensis*

- H. Petals 6–8 mm long, pale yellow; mericarps 10–14, with spurs 1–2 mm long; plants seldom more than 1 m tall.
- I. Corollas with dark center, the androecium reddish or purplish; hairs at base of calyx to 1 mm long 11. *A. maculata*
- I. Corollas without dark center, the androecium pallid; hairs at base of calyx 0.1–0.3 mm long 3. *A. crenatiflora*
- A. Petals purplish or pale lavender to white.
- J. Petals 4–7 mm long (barely exceeding calyx), blue-purple.
- K. Mericarps 6–8, with spurs to 1 mm long (Fig. 1L); leaves ovate to hastate to triangular; endocarp absent 22. *A. thurberi*
- K. Mericarps 10–11, with rounded dorsum, the spurs completely absent (Fig. 1F); climax leaves with 3 narrow linear lobes; endocarp present 19. *A. reticulata*
- J. Petals 8–28 mm long, purplish to pale lavender to white.
- L. Androecium subequal to petals; endocarp absent.
- M. Flowering calyces 12–15 mm long; petals 22–28 mm long; staminal columns ca. 20 mm long 20. *A. speciosa*
- M. Flowering calyces 6–12 mm long; petals 7–17 mm long; staminal columns 7–15 mm long.
- N. Petals 7–14 mm long, uniformly lavender, except where whitish on claw; dorsal spur of mericarp up to 0.5 mm long 18. *A. pubescens*
- N. Petals 11–17 mm long, lavender, often with microscopic purple lines distally; dorsal spurs of mericarp ca. 1.5 mm long 6. *A. henricksonii*
- L. Androecium shorter than the petals; endocarp present or absent.
- O. Upper leaf surface stellate-pubescent.
- P. Mericarps ca. 10; endocarp absent; calyx 7 mm long in flower, accrescent to 10 mm in fruit 5. *A. guatemalensis*
- P. Mericarps 12–20; reticulate endocarp present; calyx not accrescent.
- Q. Mericarps 12–13 (Fig. 1E); calyx 4–6 mm long; petals 6–15 mm long, pale lavender to white; leaves sparsely pubescent 14. *A. pedunculosa*
- Q. Mericarps 17–20 (Fig. 1A); calyx 9–11 mm long; petals 15–23 mm long, pale lavender; leaves densely pubescent 16. *A. polygyna*
- O. Upper leaf surface with appressed simple hairs or glabrate.
- R. Mericarps 12–13, apically dehiscent (Fig. 1N), with persisting lateral reticulations (Fig. 2) 17. *A. pristina*
- R. Mericarps 7–18, indehiscent but the lateral walls disintegrating at maturity.
- S. Plants erect, sometimes shrubby; corollas white or lavender.
- T. Upper leaf surface glabrate; endocarp present 13. *A. paniculata*
- T. Upper leaf surface with appressed simple hairs; endocarp absent.
- U. Petals white, 20–25 mm long; mericarps ca. 15 2. *A. albiflora*
- U. Petals pink or lavender, 14–18 mm long; mericarps 8–10 7. *A. hintoniorum*
- S. Plants frequently decumbent, herbaceous; corolla usually purplish.
- V. Mericarps 10–19, with a horizontal dorsal spine 1.5–4 mm long (Fig. 1G), the suture between the mericarps depressed; lower leaves frequently triangular or hastate 4. *A. cristata*
- V. Mericarps 7–11, the dorsal spur absent or vestigial, rarely to 1.5 mm long (Fig. 1H), the suture between the mericarps not depressed, the fruits therefore seemingly inflated; lower leaves frequently ovate to palmately lobed 23. *A. zuccagnii*

1. ANODA ABUTILOIDES A. Gray, Proc. Amer. Acad. Arts 22:300. 1887.

Type: UNITED STATES. ARIZONA: Santa Catalina Mountains, 7 June 1882, Pringle s.n. (holotype: GH; isotypes: CM, F, MO, NY, PENN, US, VT, WIS). This binomial is incorrectly attributed to S. Watson in *Index Kewensis*.

Sida caudatifolia Robinson & Greenman, Proc. Amer. Acad. Arts 29:382. 1894.—*Type*: MEXICO. JALISCO: Barranca of Tequila, Pringle 5445 (ARIZ, CAS, F, GH, K, MEXU, MICH, MO, NY, RM,

SMU, UC, VT).—*Anoda caudatifolia* (Robinson and Greenman) Robinson and Greenman, Contr. U.S. Natl. Herb. 5:172. 1899.

Anoda urophylla Riley, Kew Bull. 110. 1923.—Type: MEXICO. SINALOA: El Rincón de la Casafera, 670 m, May 1921, *González-Ortega 888* (holotype: K; isotype: MEXU).

Erect subshrubs ca. 1 m tall, branching principally in the inflorescence, the stems with simple spreading hairs 0.5–1 mm long and with shorter more or less glandular hairs. Leaves long-petiolate, orbicular-ovate, cordate, dentate, caudate-acuminate, to 12 cm long, gradually reduced and much narrower upward, minutely and softly tomentose, essentially concolorous. Flowers sometimes solitary in the leaf axils but usually in open terminal panicles; pedicels 1–5 cm long, without articulation, with pubescence like that of the stem; calyces 5–7 mm long, the lobes broadly triangular, more or less acuminate, shorter than the tube, with the midrib dark-pigmented; petals pale yellow (drying rose), ca. 1 cm long, prominently bearded on the claw; staminal columns ca. 6 mm long, with recurved hairs, the filaments 3–4 mm long; styles 5, slender, slightly exceeding the androecium, subequal to the petals, pallid, the stigmas abruptly capitate, sometimes reddish. Fruits obovate, ca. 6 mm in diam, minutely pubescent; mericarps 5, dorsally rounded; seeds solitary, 3 mm long, with minute appressed hairs, lacking an endocarp surrounding the seed. Chromosome number: $2n = 30$ (Bates 1987).

Specimens examined.—UNITED STATES. ARIZONA: Santa Catalina Mts., 17 May 1881, *Pringle s.n.* (F, GH, NY), 7 Jun. 1882, *Pringle s.n.* (CM, F, GH, MO, NY, PENN, US, VT, WIS), 17 Jun. 1884, *Pringle s.n.* (MO, NY); Baboquivari Mts., *Gooding 4718* (ARIZ), *Jones 24927* (NY), *Kearney and Peebles 14950* (ARIZ), *Kearney 10378* (ARIZ, MICH), *Kearney 10414* (ARIZ, MICH), *Gould et al. 2711* (ARIZ, NY), *Clark 12556* (OKL); Sabino Canyon, *Kearney 10339* (UC); Sycamore Canyon near Ruby, *Darrow and Haskell 2224* (ARIZ, MO, UC); Sycamore Canyon, Pajarito (Atascosa) Mts., *Toolin 1688* (ARIZ); Holden Canyon, 0.6 mi NNW of Bartlett Mt., 29 Oct. 1981, *VanDevender and Toolin s.n.* (ARIZ, ASU); base of Rincón Mts., Saguaro Nat. Mon., *Turner 75-96* (ARIZ, SD); Fresnal, Papago Country, *Thackery 2010* (ARIZ).—MEXICO. SONORA: N end of the Sierra de la Cebollita, 1.2 mi NW of Nuri, *Sanders et al. 2690* (UCR, pf); Cañon de la Gallina, región Río de Bavispe, *White 3518* (MICH); Canyon Sapopa, Río Mayo, *Gentry 1083* (DES, F, GH, MO, WIS); Quiricoba, Distr. Alamos, *Gentry 821* (MICH).—CHIHUAHUA: Barranca de Batopilas, near La Bufa, *Bye 10054* (COLO, MEXU, pf); Sierra de las Papas (Son.-Chih. border), *Gentry 660* (MICH).—SINALOA: El Rincón de la Casafera, *González-Ortega 888* (K, MEXU), *González-Ortega 706* (MEXU); Río del Fuerte, 22 km E of Agua Caliente, *Moran 7594* (SD, pf).—JALISCO: Barranca of Tequila, *Pringle 5445* (ARIZ, CAS, F, GH, K, MEXU, MICH, MO, NY, RM, SMU, UC, VT), *Fryxell and Bates 2136* (BH, pf).

Distinctive characters of *Anoda abutiloides* include the uniformly 5-carpelled fruits and the leaves with caudate apices. The pollen grains of this species have been described by Sánchez (1982, as *A. urophylla*).

2. *Anoda albiflora* Fryxell, sp. nov.

Type: MEXICO. JALISCO: Jocotepec, cultivated; half-shrubby 2 m high; flowers white; said to be native, Jan 1978, *Lape s.n.* (holotype: MICH; isotype: pf).

Herbae erectae, caulibus foliisque sparsim pubescentibus, pilis praecipue simplicibus, foliis infra late ovatis sursum gradatim parvioribus angustioribusque; calycibus 8–10 mm longis; petalis albis, 20–25 mm longis; fructibus disciformibus hispidis, radiatim spiniferis; mericarpiis ca. 15, endocarpiis reticulatis destitutis.

Herbs or subshrubs up to 2 m tall, the stems sparsely hirsute (the hairs simple, spreading, 1–2 mm long) to glabrate. Leaf blades broadly ovate below (3–7 cm long), smaller and narrower upward, sometimes hastately lobed, basally truncate

or cuneate, crenate-dentate, acute, sparsely hirsute on the upper surface (the hairs principally simple, appressed, ca. 1 mm long), the pubescence on the lower surface similar but denser, especially on the nerves; petioles half as long as the blades or less, with pubescence like that of the stems; stipules subulate, 3–5 mm long, hirsute, persistent. Pedicels solitary in the leaf axils with pubescence like that of the stems, slender, 1.5–6.5 cm long (equaling or exceeding the subtending leaves), more or less aggregated apically, where the subtending leaves are greatly reduced; calyces 8–10 mm long, prominently hirsute especially on the nerves (the hairs 1–2 mm long), more than half-divided, the lobes ovate to narrowly lanceolate, acute or acuminate; petals 2–2.5 cm long, 1–1.5(–2) cm wide, white, prominently hirsute on the margins of the claw, otherwise glabrous; staminal columns ca. 4 mm long, pallid, glabrous basally, hirsute distally, with filaments arising apically; filaments 2–3 mm long, the anthers and pollen pallid; styles ca. 15, slender, pallid, glabrous, the stigmas abruptly capitate, ultimately exceeding the androecium. Fruits oblate, disciform with radiating spines; mericarps ca. 15, sparsely hispid, with a spine on the dorsal angle 1.5 mm long, the lateral walls evanescent, the seed not enclosed in a reticulate endocarp; seeds solitary, 2.6–2.8 mm long, minutely warty, otherwise glabrous.

Paratype examined.—MEXICO. CHIHUAHUA: Ciudad de Chihuahua, Col. Mirador, ornamental en jardín, alt. 1500 m, 30 Oct. 1974, *Valdés 838* (pf).

Anoda albiflora is currently known only as a garden plant. It may some day be found in nature, but as yet this has not been reported.

3. ANODA CRENATIFLORA Ortega, Nov. Rar. Pl. Hort. Matrit. Dec. 8:96. 1798.

Type: in Madrid Botanical Garden (holotype: MA).—*Sida crenatiflora* (Ortega) Persoon, Syn. Pl. 2:247. 1807.—*Anoda ortegae* Sprengel, Nachtr. I. Bot. G. Halle 11. 1801.—*Sida ortegae* Steudel, Nom. ed. ii. 2:578. 1841.

Anoda parviflora Cavanilles, Icon. 5: 19. t.431. 1799.—*Type:* MEXICO, *Pavón s.n.* (G, P; as photo F-23684).—*Sida parviflora* (Cavanilles) Willdenow, Enum. Pl. 726. 1809 (non Sessé & Mocino 1894).

Anoda crenatiflora Ortega var. *glabrata* Rose, Contr. U.S. Natl. Herb. 5:172. 1899.—*Type:* MEXICO. ZACATECAS: near San Juan Capistrano, 20 Aug. 1897, *Rose 2444* (lectotype, here designated: US; isolectotypes: BM, GH).

Annual erect herbs to 1 m tall with few ascending branches, the stems with minute stellate hairs 0.1–0.3 mm long. Leaves petiolate, 3–9 cm long, ovate or hastate, narrowly so upwards, truncate to cordate, coarsely crenate-dentate or subentire, acute, minutely pubescent to glabrate, the margins hispid-ciliate, the lower surface with stellate hairs, the upper surface with simple, bifurcate, or stellate hairs. Flowers in terminal racemes or panicles; peduncles 2–7 cm long, articulated 0.5–1 cm below the flower; calyces 3–7 mm long in flower, accrescent to 6–8 mm long in fruit, densely short-tomentose, the lobes 1-nerved; petals pale yellow, 6–8 mm long, ciliate on claw (hairs 0.5–1 mm long); staminal columns ca. 2 mm long, pallid, glabrous or with a few hairs apically, the anthers few (up to 10), yellowish, subsessile; styles and stigmas slightly exceeding the androecium, the stigmas abruptly capitate. Fruits 7–9 mm in diam, densely stellate-pubescent; mericarps 10–13, with a dorsal spur 1–2 mm long, the lateral walls evanescent;

seeds solitary, completely enclosed in a persistent reticulate endocarp. Chromosome number: $2n = 60$ (Bates 1987).

Specimens examined.—UNITED STATES. ARIZONA: near Tumacacori Mission, *Harrison and Fulton 8146* (ARIZ, CAS, F); Santa Cruz County, Sycamore Canyon, *Keil et al. 10007* (ASU).—TEXAS: Jeff Davis Co., Fern Canyon, N of Alpine, *Warnock 839* (GH); Presidio Co., 2 mi E of Love Ranch HQ, *Hinckley 3659* (GH); Brewster Co., North Sunny Glen, 22 Sep. 1940, *Sperry T840* (TAES); Below San Estebán Lake, Marfa, *Hinckley 1363* (F, GH, MICH, NY).—MEXICO. BAJA CALIFORNIA: 1.5 mi SE of San Antonio, *Gould 12163a* (MICH); Comondú, 4 Mar. 1889, *Brandegees s.n.* (GH).—SONORA: in woods and mountains W of Alamos, *Drouet and Richards 3946* (F, MICH-2, UC); San Bernardo, Río Mayo, *Gentry 1091* (DES, F, GH, MO); Sierra Batuc, 8 mi NE of Matape, *Wiggins and Rollins 421* (DS, GH, MICH, MO, NY); along Río Magdalena, 8 mi E of junction with Cananea road, *Wiggins 7057* (DS), *Wiggins 7046* (MICH); Cañon de Bavispe, *Phillips 556* (GH).—SINALOA: Culiacán, 1 Oct. 1904, *Brandegees s.n.* (GH, UC); Cofradia, 25 Oct. 1904, *Brandegees s.n.* (UC); near Cosalá, *Howe 4398* (SD).—CHIHUAHUA: Hacienda San Miguel, near Batopilas, *Palmer 128* (GH, MICH, MO, NY-2, PH); hills near Chihuahua, *Pringle 1073* (G, MIN, MO, NY, UC, VT), *Pringle 562* (GH, VT).—COAHUILA: 10 mi SE of San José, western Coahuila, *Johnston and Muller 975* (GH, MICH); Cañon de Tinaja Blanca, E slope of Sierra de las Cruces, W of Santa Elena Mines *Stewart 1135* (F, GH); S end of Maderas del Carmen, 3 mi NE of Rancho San Isidro, *Henrickson 15052* (TEX).—ZACATECAS: near San Juan Capistrano, *Rose 2444* (BM, GH, US).—NUEVO LEÓN: ca. 31 km W of Linares, *Fryxell et al. 1701* (BH, pf); above Cola de Caballo waterfall, S of Monterrey, *Fryxell et al. 1707* (BH, pf).—TAMAULIPAS: between Palmillas and Miquihuana, *Fryxell et al. 1693* (BH, pf), *Fryxell 1115* (pf).—GUANAJUATO: collines de Guanajuato, Sep 1897, *Dugès s.n.* (GH).—JALISCO: hills near Guadalajara, *Pringle 2963* (GH); Bolaños, *Rose 2916* (MEXU, NY, US); Barranca of Río Verde, ca. 20 mi N of Tepatitlán, *McVaugh 17347* (MICH).—SAN LUIS POTOSÍ: cerca de Morales, *Schaffner 158* (GH, MEXU); 25 mi NE of San Luis Potosí, *Waterfall 15704* (OKLA).—HIDALGO: Tepeji del Río, *Fryxell and Bates 2177* (BH, pf); near Progreso, between Tula and Actopan, *Fryxell and Bates 2180* (BH, pf); El Salto, *Rose and Painter 7075* (GH).—MORELOS: *Vázquez 880* (MEXU).—GUERRERO: Jaripo, Distr. Coyuca, *Hinton 6923* (US); 6.5 km al N of Chilpancingo, *Koch et al. 79119* (pf-unicate).—PUEBLA: vicinity of San Luis Tultitlanapa, *Purpus 3256* (F, MO, UC).—OAXACA: Tomellin Canyon, *Rose and Rose 11325* (NY); Santa Catarina Cañon, *Conzatti and González 1212* (GH); 7 km SW of Totoloapan (88 km SW of Oaxaca), *Fryxell 2571* (BH, CTES, CHAPA, MEXU, pf); 5 km al E de Teotitlán del Camino, *Rzedowski 37079* (ENCB, MEXU, pf); El Parián, Distr. de Nochixtlán, 1000 m, 28 Jul. 1907, *Conzatti 1932* (F).—CHIAPAS: near Berriozabal, *Breedlove 52347* (CAS, pf); 2.7 mi NE of Motozintla, *Fryxell and Lott 3323* (pf); Mpio. of Amatenango, 22 km S of Frontera Comalapa, 860 m, *Breedlove and Strother 46137* (CAS).

Anoda crenatiflora is a relatively common, widely distributed species. Its relatively small flowers, minute stellate pubescence, and persistent endocarp are distinctive.

4. ANODA CRISTATA (L.) Schlechtendal, *Linnaea* 11:210. 1837. Fig. 1G, 2

Basionym: *Sida cristata* L., *Sp. Pl.* 685. 1753.—*Type:* Linnean herb (holotype: LINN-866.31).—*Anoda lavateroides* Medikus, *Malv.-Fam.* 19. 1787.

Anoda hastata Cavanilles, *Diss.* 1:38. *t.11.f.2.* 1785.—*Type:* ex herb. Cavanilles (MA; as photo F-29757).—*Sida hastata* (Cavanilles) Willdenow, *Sp. Pl.* 764. 1801 (non St.-Hilaire, 1827).

Anoda dilleniana Cavanilles, *Diss.* 1:40. *t.11.f.1.* 1785.—*Type:* Dill. Hort. Elth. *t.2.f.2.* 1732.—*Sida dilleniana* (Cavanilles) Willdenow, *Sp. Pl.* 763. 1801.

Anoda triloba Cavanilles, *Diss.* 1:39. *t.10.f.3.* 1785.—*Type:* MEXICO, *Trigueros s.n.* (MA as photo F-29759, P-LA).—*Sida quinqueangulata* D. Dietrich, *Syn. Pl.* 4:857. 1847.

Sida mexicana Scopoli, *Delic. Flor. Insub.* 1:22. *t.9.* 1786.—*Type:* plate 9, loc. cit.

Sida deltoidea Hornemann, *Enum. Pl. Hort. Hafn.* 36. 1807.—*Type:* unknown.

Sida triangularis Willdenow, *Enum. Pl. Hort. Berol.* 725. 1809.—*Type:* *Humboldt and Bonpland s.n.* (B-herb. Willdenow no. 12722).—*Anoda triangularis* (Willd.) DC. *Prodr.* 1:459. 1824.

Anoda brachyantha Reichenbach, Iconogr. Bot. Exot. 1:24. t.34. 1824.—Type: plate 34, loc. cit.—*Anoda cristata* (L.) Schldl. var. *brachyantha* (Reichenbach) Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 20:47. 1916.

Sida centrota Sprengel, Syst. 4:259. 1827.—Type: Hort. Hal., 1826 (HAL?).

Anoda populifolia Philippi, Linnaea 28:613. 1856.—Type: Chile, cerca de Quillota, *Germaine 41048* (holotype: SGO; isotype: W as photo F-32643).

Anoda arizonica A. Gray, Proc. Amer. Acad. Arts 22:298. 1887.—Holotype: Arizona, *Lemmon 599* (GH).

Anoda acerifolia (Zuccagni in Roemer) DC. var. *minoriflora* Hochreutiner, Annuaire Conserv. Jard. Bot. Genève 20:51. 1916.—Type: Bolivia, Cotañi ad Illimani, 2450 m, *Buchtien 207* (GH).

Erect or decumbent, annual or perennial herbs, the stems usually hispid, the hairs spreading or retrorse. Leaves variable, ovate, hastate, or palmately lobed, crenate to subentire, acute, sparsely pubescent above and beneath, the hairs principally simple and appressed, often with a purple blotch along the midrib, sometimes also on the margins, the petioles hispid. Flowers solitary in the leaf axils with long peduncles; calyces 5–10 mm long in flower, accrescent to 12–20 mm long in fruit, hispid; petals lavender or purple, rarely white or white with purple veins, 8–26(–30) mm long; androecia included, the columns pubescent. Fruits (Fig. 1G) in the form of a flattened disk, 8–11 mm in diameter (excluding the spines), densely hispid; mericarps (8–)10–19, indehiscent, with radiating spines, 1.5–4 mm long on the dorsal angle, the lateral walls evanescent; seeds glabrous, 3 mm long, usually naked (Fig. 2) or sometimes with an endocarp surrounding the seed (or sometimes with only a coarse reticulum persisting). Chromosome number: $2n = 30, 60, 90$ (Bates 1987).

Representative specimens.—UNITED STATES. ILLINOIS: Athens, cult., *Hall s.n.* (F); Fountaindale, Winnebago Co., cult., *Bebb s.n.* (F); spontaneous, Augusta, 1842, *Mead s.n.* (F); Hancock Co., 1860, *Mead s.n.* (F).—KANSAS: Neosho Co., *Brooks and Holland 15771* (NY).—MISSOURI: McDonald Co., near Noel, *Palmer 19069* (MO, NY).—KENTUCKY: Lexington, *McFarland et al. 61* (F, MO, UC); Bracken Co., 2.5 mi E of Augusta, *Buddell and Thieret 2379* (NY).—VIRGINIA: Wight Co., W of Old Fort Boykin, *Fernald and Long 13690* (GH, MO, NY).—CALIFORNIA: Stockton, 1903, *Jepson and Sanford s.n.* (UC); Barrett Ranch, Eldorado Co., 23 Sep. 1920, *Kennedy s.n.* (UC).—ARIZONA: Tucson, June 1880, *Lemmon s.n.* (F); near Tucson, 19 Jun. 1881, *Pringle s.n.* (F, MICH, NY-2, VT); Apache Pass, Chiricahua Mts., 1881, *Lemmon s.n.* (UC); Camp Crittenden, 5200 ft, 1874, *Rothrock 666* (F); Yavapai Co., Granite Basin Lake, *Keil 3781* (ASU); ca. 5 mi SW of Jerome, *Keil and Pinkava 16358* (ASU); Gila Co., NE of Payson at the E Verde crossing, *Taylor and Pinkava 4398b* (ASU, DES); Workman Creek Canyon, Sierra Ancha Mts., *Gould 3937* (UC); Ft. Lowell, *Thorner 44* (ASU, MO, POM, UC); Santa Cruz Co., Calabasas Canyon Camp Ground, *Pinkava et al. 769* (ASU); Santa Cruz Co., 3 mi W of Sonoita, N end of Canelo Hills, *Reeves 1090* (ASU); Navajo Co., “Geronimo Cave,” 5.9 mi E of White River, *Lehto 14000* (ASU); Cochise Co., ca. 17 mi E of Douglas, *Daniel 1802* (ASU); Hereford, Ariz., 10 Oct. 1947, *Jones s.n.* (SD).—NEW MEXICO: Lincoln Co., Gray, *Skehan 117* (GH, MO, GH, MO, NY, UC); Pinos Altos Mts., 8 Sep. 1880, *Greene s.n.* (F, MICH, NY, POM); Grant Co., 2 mi N of Silver City, *Hess 1486* (OKL); Grant Co., Ft. Bayard, *Medina 126* (ASU); Sierra Co., Kingston, *Metcalfe 1341* (F, GH, NY); McKinley Co., NE of Mescalero, *Martin 33273* (TAES).—TEXAS: Jeff Davis Co., 16 mi S of Kent, *Fryxell 3098* (BR, CTES, ENCB, MEXU, pf); El Paso, *Jones 475* (POM); Presidio Co., Marfa, *Eggleston 17358* (MICH); 1 mi from Ft. Davis along Limpia Creek, *Correll 33928* (OKLA, UC).—LOUISIANA: East Carroll Parish, N of Lake Providence, *Thomas 76794* (F).—MISSISSIPPI: Forrest Co., ca. 6 mi N of Hattiesburg, *Rogers 8605-D* (MO).—MEXICO. BAJA CALIFORNIA: Cañon Hondo, 9 Oct. 1893, *Brandegees s.n.* (UC); El Taste, 14 Sep. 1893, *Brandegees s.n.* (NY, UC); El Picacho Peak, ca. 5 mi above Las Animas Ranch in Sierra Laguna, *Hammerly 399* (CAS).—SONORA: Cañon de Huepari, N of Aribabi, *White 2627* (GH, MEXU, MICH); near Cucurpé, *Whitehead M70* (ARIZ); Distr. Alamos, Canyon Estrella, *Gentry 428* (DS, MICH); 31 mi S of Nogales, *Shreve 6604* (OKLA); 11 mi NE of Colorado, road to Mazatan, *Wiggins and Rollins 339* (DS).—CHIHUAHUA: Valley near Chihuahua, *Pringle 1041* (F, MIN, NY, VT); Guasaremos, Río Mayo, *Gentry*

1829 (ARIZ, DES, F, GH, WIS); Cusarare, S of Creel, *Bye 4863* (ASU, COLO); 35 km N of Cd. Chihuahua, *Weber and Charette 11634* (COLO, UC); half mi W of Cuauhtémoc, *Powell and Edmondson 997* (F, MICH); Mpio. Casas Grandes, 20 km al S de Colonia Juárez, *Tenorio 1623* (MEXU).—COAHUILA: 1 km NE of El Pino, *Stewart 1775* (GH); Múzquiz-La Mariposa, *Marsh 1039* (F, GH, OKLA).—SINALOA: Ocurahui, Sierra Surotató, *Gentry 6282* (DES, GH, MICH, MO); La Noria, *Mexia 301* (CAS, MO, UC); 6 mi NW of Hornos along road from Mocorito to Surotató, *Breedlove and Thorne 18172* (RSA); Mazatlán, *González-Ortega 5712* (CAS).—DURANGO: vic. of city of Durango, *Palmer 581* (F, MO-2, UC); Camino de Durango a Sta. Cruz, *Langman 2957* (MEXU).—NUEVO LEÓN: Loma La Bandera, 4.1 mi S of Iturbide, *Dorr 2576* (MEXU, TEX, pf); 18 mi W of Linares, *Dorr et al. 2026* (MEXU).—TAMAULIPAS: near Miquihuana, *Stanford et al. 804* (ARIZ, GH, MO); San Vicente-Jaumave, *von Rozynski 212* (F, MICH, UC).—NAYARIT: between Tepic and Jalcoctán, *Croat 45152* (MO); Tepic, *Palmer 203* (US), *Jones 22866* (POM); vicinity of San Blas, *Ferris 5470* (DS).—GUANAJUATO: Guanajuato, *Dugès 287bis* (GH); Cienaguita, afuera de San Miguel Allende, *Kishler 471* (MEXU); 14 mi SE of León, *Waterfall 13887* (OKLA).—AGUASCALIENTES: S of Aguascalientes, *Manning and Manning 531232* (GH).—ZACATECAS: El Plateado, *Rose 3632* (US).—JALISCO: Sierra del Tigre, 2 mi NE of Mazamitla, *McVaugh 13131* (MEXU, MICH); Santa Cruz de la Flores, *McVaugh 16304* (MEXU, MICH, NY, TEX, US); Km 57, Guadalajara-Autlán, *Langman 3137* (MEXU, PH); near Lake Chapala, 2 mi W of Tizapan, *Waterfall 16396* (OKLA); 3–5 km N of San Juan Cozalá, *McVaugh 23807* (MICH).—COLIMA: 3 km S of Michoacán-Colima border on hwy 110, *Burch 5136* (USF, pf).—MICHOACÁN: Zitácuaro-San José, *Hinton et al. 13205* (ARIZ, GH, MICH, NY); 2 mi W of San Luis Soyatlán, *Fryxell 556* (BH, CTES, US); Morelia, *Arsène 2844* (MEXU); 8 km S of Uruapan, *King and Soderstrom 4706* (MEXU, MICH, NY, UC); 22 mi S of Jiquilpán, *King and Soderstrom 4629* (MEXU, MICH, NY, UC).—Edo. MÉXICO: Lomas de Atzipán y Chiluca, *Ventura 3667* (ENCB, MEXU, pf); Vallée de México, *Bourgeau 560* (P, US, pf); Calera, Distr. Temascaltepec, *Hinton et al. 6987* (ASU, DES, LL, MEXU, pf); between Tenancingo and Ixtapan, *Fryxell 1130* (BH, CTES, DS, GH, L, MICH, NY, UC, pf); Chimalhuacán, *Matuda 19526* (MEXU, UC); Texcaltitlán, Distr. Sul-tepec, *Hinton et al. 7464* (ASU, DES); Mpio. de Villa Nicolás Romero, Colonia Libertad, *Ventura 3357* (ASU, ENCB, MEXU); Mpio. de Tepetlaoxtoc, 8.5 km al NE de Texcoco, alt. 2350 m, *Koch 76221* (CAS, CHAPA, MEXU); Mpio. San Andres Chiautla, Santa Catarina, *Ventura 3797* (CAS, ENCB, MEXU).—DISTRITO FEDERAL: *Pringle 7316* (F, VT); Ciudad de México, Colonia Prado Churubusco, *Rzedowski 16286* (DS, ENCB, MEXU); Tlacoquemeca, *Arsène 8717* (F).—MORELOS: prope Axayapictla, *Seler 309* (GH); Municipio de Cuautla, Tepetitla, *Sánchez 2146* (CHAPA, OKL); Atlatlahuacán, *Vázquez 2323* (MEXU).—HIDALGO: 6 km al E de Zimapán, *García et al. 1064* (CHAPA, MEXU, pf); Cerro San Isidro, Mpio. de Tlanalapa, *Ventura 217* (ENCB, MEXU, SD, pf); valley near Tula, *Pringle 7988* (F, MO).—GUERRERO: Placeres-Camarón, Distr. Mina, *Hinton et al. 9524* (LL, MICH, pf); Atoyac, Distr. Galeana, *Hinton et al. 14597* (ARIZ, GH, NY); Santo Tomás, N bank of Río Balsas, *Mexia 8922* (F, GH, MO, UC); Internado de San Gabrielito, 2 km de Tepeacuilco, *Parra 33* (ASU, ENCB, MICH).—PUEBLA: Cholula, *Arsène 1658* (MEXU); 5 mi SE of Tehuacán, *Fryxell and Bates 923* (GH, CTES, pf); Matamoros, *Miranda 2215* (MEXU); SE of Izucar de Matamoros, *Fryxell 1134* (GH, CTES, pf); Río Verde, Mpio. de Tenapulco, *Ventura 1221* (ENCB, pf).—SAN LUIS POTOSÍ: near San Luis Potosí, *Parry and Palmer 77* (GH, MO); 25 mi NE of San Luis Potosí, *Waterfall 15703* (OKLA); 20 mi NE of Tamazunchale, *Waterfall 14276* (OKLA); vic. El Salto above El Naranjo, *Duke M3659* (MEXU, MO).—QUERÉTARO: km 6, camino a San Luis Potosí, *Arguelles 540* (MEXU); camino a Celaya, pasando a Balvanera, *Arguelles 555* (MEXU).—VERACRUZ: Teocelo, *Ventura 8892* (CHAPA, ENCB, MEXU, pf); El Esquilón, Mpio. de Jilotepec, *Ventura 9186* (CHAPA, ENCB, MEXU, pf); Mpio. de Tlapacoyán, Tomata, *Ventura 549* (ENCB, MICH, SD); Chiltoyac, Xalapa, *Zolá 777* (CAS, F, MEXU, XAL, pf); 1 km de Cosamaloapan, *Martínez-Calderón 1033* (CAS, F, MEXU, MO, XAL, pf); Córdoba, *Orcutt 3341* (F, GH); Jardín Botánico Fco. Javier Clavijero, *Ortega 1297* (F, XAL); Jilotepec, carr. Xalapa-Naolinco, *Hernández et al. 99* (XAL); Alrededores de La Laguna de La Mancha, Actopan, *Acosta and Dorantes 660* (F, MEXU, XAL); Rafael Delgado al SE de Orizaba, *Rosas 734* (A, F, MEXU, MO, XAL, pf); Playa Escondida (N of Catemaco), *Cochrane and Cochrane 8606* (F, RSA, WIS).—OAXACA: 4 km NO de Huajuapán, carr. a Acatlán, *Koch et al. 73161* (CHAPA, MEXU, pf); Mpio. Cuilapan de Guerrero, San Juan, *Solano and Vara 153* (CHAPA, F, OKL); Santa Catarina Cañon, *Pringle and Conzatti 275* (GH); Juárez Hill, near Oaxaca, *Kenoyer 1501* (GH); Mpio. Tuxtepec, Valle Nacional, *Cortes 45* (XAL, pf); San José Mogote, *Smith and Kitchen 4778* (ASU, MEXU).—TABASCO: Cárdenas, *Cowan 1958* (CAS, CHAPA, CSAT, ENCB, IBUG, MEXU, NY, XAL).—CHIAPAS: San Cristóbal, *Breedlove 52647* (CAS, pf); 5 mi N of Bochil, between Ixtapa and Pichucalco, *Croat 47697* (MO, pf); 3 km NW of Teopisca, *Cruden 1198* (DS, MICH, UC);

Amatenango del Valle, *Breedlove 14467* (DS, MICH); near Berriozábal, *Breedlove 52378* (CAS); Mpio. de Tenejapa, near Paraje Kulak'tik, *Breedlove 53062* (CAS)—GUATEMALA. Santa Rosa, *Heyde and Lux 3950* (GH); Cobán, *von Türckheim II-631* (F, GH, NY); Lake Petén Itza, San Miguel, *Contreras 7285* (LL, pf); near Antigua, *Standley 64729* (F).—EL SALVADOR. Volcán de San Salvador, *Carlson 382* (F, UC); vicinity of San Salvador, *Standley 23567* (GH).—HONDURAS. Dept. Morazón, drainage of the Río Yeguaré (ca. 87°W, 14°N), alt. 2650 ft, pedregal, *Glassman 2020* (F, OKL); near El Zamorana, *Standley 22382* (F); Dept. Lempira, entre Guatán y Cuábanos, *Molina 12948* (F); near Ceiba, *Yuncker et al. 8412* (MICH, NY).—NICARAGUA. Depto. Estelí, "Los Cerritos," 5 km al NE de Estelí, *Moreno 15358* (HNMN, MO, pf); Depto. Matagalpa, near San Simón de Palcila, *Stevens 18561* (MO, pf); Depto. de Jinotega, Laguna Miraflores (1300 m), *Henrich and Stevens 346* (MO, pf).—COSTA RICA. Cartago, *Cooper 5721* (F); El Alto, Prov. San José, *Weston et al. 2994* (UC); city of San José, *Burger 3853* (F).—PANAMÁ. Ancon, *Greenman and Greenman 5016* (GH, MO, UC).—PUERTO RICO. prope Mayaguez, *Sintenis 2b* (GH, NY, UC); near Juana Díaz, *Heller 6314* (NY).—HISPANIOLA. San Domingo, *Millspaugh 861* (F).—CUBA. Santa Clara Prov., vic. of Soledad, *Hodge and Howard 4236* (GH, NY); Santiago Prov., vic. of San Luis, *Pollard and Palmer 293* (F, GH, MO); Santiago de las Vegas, *Baker and Wilson 526* (F, RSA); Guanajay, *Curtiss 634* (F, GH, MO).—VENEZUELA. Edo. Falcón, Sierra de San Luis, arriba de La Chapa, *Fryxell et al. 4302* (CTES, pf); Maracay, *Cárdenas de Guevara 56* (MY, pf); Ocumare del Tuy, Miranda, *Williams 12438* (F); Caracas, *Fendler 86* (MO, NY).—COLOMBIA. Near Matanza, Dept. Santander, *Langenheim 3212* (UC); Popoyán, *Liebmann 5992* (F, GH); Dep. Cundinamarca, entre El Salto y El Colegio, *Cuatrecasas 8214* (F).—ECUADOR. Tungurahua, Río Verde, *Harling et al. 10169* (F, GB, pf); Loja, Vilcabamba-Yangana, *Harling and Andersson 13602* (GB, pf); Mera, Prov. Napo-Pastaza, *Asplund 18561* (F, UC); near Huigra, *Camp 3002* (GH).—PERÚ. Chachapoyas, Dept. Amazonas, *Wolfe and Dobson 688* (RSA); alrededores de San Juan, *Sánchez 1960* (CPUN, pf); E of Olmos on Rioja road, *Hutchison and Wright 3897* (BH, F, MO, NY, UC, US, USM); Cajamarca, Prov. Cutervo, Sucse River Valley W of Socota, *Stork and Horton 10100* (F, UC); Spurimac, Prov. Andahuaylas, 3 km S of Chincheros, *Stork and Horton 10779* (F, MO, UC); Cuzco, Anta, *Vargas 219* (UC).—BOLIVIA. 5 km N of Tarija, *Solomon 10605* (MO, pf); Prov. Vallegrande, Dept. Santa Cruz, Samaipata, *Steinbach 3730* (UC); Cochabamba, Prov. Mizque, ca. 1 km NW of Vilavila, *Eyerdam 24973* (F, UC); ca. 5 km SE of Cochabamba, *Eyerdam 24926* (F, UC); Coripati, Yungas, *Bang 2073* (MICH); Cotañi ad Illimani, *Buchtien 207* (GH).—BRAZIL. Rio Grande do Sul, Porto Alegre, xii 1898, *Reineck s.n.* (GH).—URUGUAY. Montevideo, *Herter 254* (MO, NY, UC).—ARGENTINA. Prov. Salta, Depto. Chicoana, La Zanja, *Krapovickas and Schinini 36090* (CTES, pf); Prov. Córdoba, Depto. Río Segundo, Estación Exper. INTA, *Krapovickas 33755* (CTES, F, pf).—CHILE. Tacna-Arica region, *Shepard 286* (GH); Cerca de Quillota, *Germaine 41048* (SGO, W; as photo F-32643).—AUSTRALIA. QUEENSLAND. Moreton Distr. O'Reilly's Weir, Lowood, *Oxenham s.n.* (CANB); Burnett Distr., Kingarcy, *Lisle s.n.* (CANB, pf); Darling Downs, *Denning s.n.* (CANB).

Anoda cristata is the most common and widely distributed species of the genus, being a notorious weed (cf. Beckner 1968; Chandler and Oliver 1979) in many areas. It is reported as an occasional adventive in Malesia (Borssum Waalkes 1966) and elsewhere. The pollen grains of this species have been described by Hashmi (1970) and Sánchez (1982). The distinction between this species and *A. zuccagnii* is sometimes problematical and is discussed under the latter species.

5. *Anoda guatemalensis* Fryxell, sp. nov.

Fig. 1J, 3

Type: GUATEMALA. Los Robles bridge, border of Sololá and Chimaltenango Depts., alt. 1800 m, common in forest clearing, fls. purple, "malvilla," 21 Sep. 1971, *Molina and Molina 26698* (holotype: ENCB; isotypes: EAP, F, MICH).

Herbae erectae, caulibus sparsim scabrellis, foliis palmatis 3-lobatis sparsim stellato-pubescentibus; calycibus 7–10 mm longis; petalis lavandulis, 11–14 mm longis; fructibus oblati, stellato-pubescentibus; mericarpiis ca. 10, dorsaliter calcaratis, endocarpiis reticulatis destitutis.

Erect herbs ca. 1 m tall, the stems scabridulous, the older stems sparsely so, the hairs ca. 0.2–0.4 mm long, some stellate and some simple, the simple hairs robust and conical and apparently liquid-filled. Leaf blades basally cordate, from

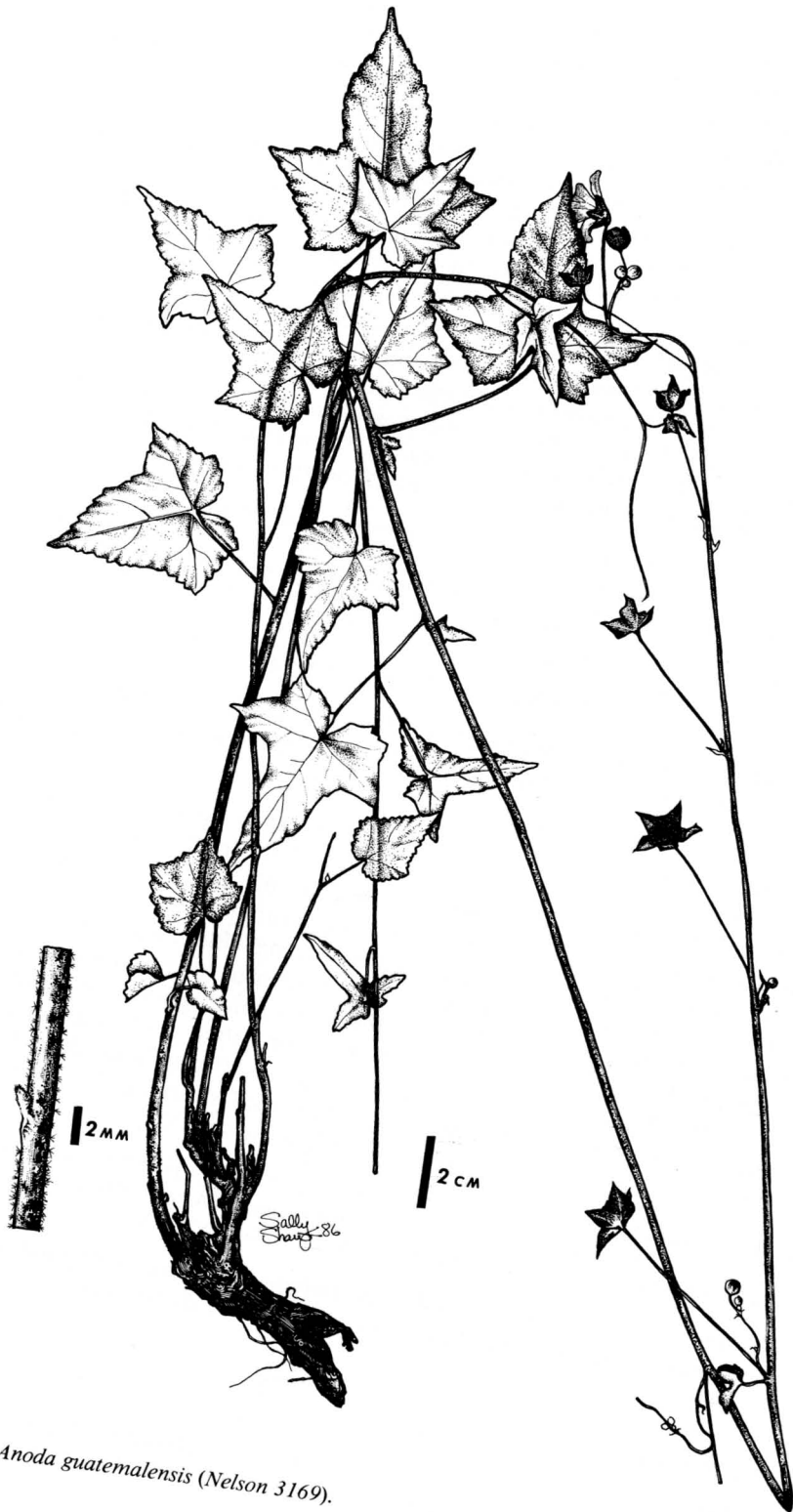


Fig. 3. *Anoda guatemalensis* (Nelson 3169).

palmately 3-lobed to pedately 5-lobed, with the central lobe the largest, lanceolate-ovate, crenate, acute to acuminate, concolorous, uniformly, sparsely, and minutely pubescent with stellate hairs on both surfaces or with simple hairs above; petioles half as long as to subequal to the leaf blades, with pubescence like that of the stem. Flowers in the leaf axils or somewhat aggregated apically; pedicels 2–3 cm long in flower, increasing to 4–13 cm long in fruit, sometimes equaling or exceeding the subtending leaf, obscurely articulated 4–10 mm below the flower, scabridulous like the stem; calyces 7 mm long in flower to 10 mm long in fruit, obscurely 10-nerved, minutely and uniformly pubescent with stellate hairs, half-divided or more, the lobes rounded-apiculate with evident midribs; petals 11–14 mm long, ca. 6 mm wide, obovate, lavender or purple; staminal columns 7 mm tall, pallid, densely hispid throughout the column, the filaments 1.5 mm long, the anthers ca. 30, sometimes purplish, with yellow-orange pollen; styles 10, glabrous, the stigmas abruptly capitate, rounded. Fruits (Fig. 1J) oblate, with stellate hairs 0.5–0.9 mm long; mericarps 10, each with a dorsal spur ca. 0.5 mm long, the lateral walls evanescent; seeds solitary, 3 mm long, without an endocarp surrounding the seeds.

Paratypes examined.—MEXICO. CHIAPAS: along road between Tenejapa and Yajalon, 3000–5000 ft, 13 Oct. 1895, *Nelson 1466* (US); near San Cristóbal, alt. 7000–8000 ft, 18 Sep. 1895, *Nelson 3169* (GH, US); Sierra de Salsipuedes, S side of valley of San Cristóbal de las Casas, *Breedlove 41257* (CAS, MO).—OAXACA: Santa Inez del Monte, 8000 ft, 27 Oct. 1894, *Pringle 5646* (GH, VT); Valley of Oaxaca, 20 Sep. 1894, *Nelson s.n.* (GH-fragment).

6. *ANODA HENRICKSONII* M. C. Johnston, *Phytologia* 53:451. 1983.

Type: MEXICO. ZACATECAS: Sierra de Astillero (24°37'N, 101°08'W) in small ravine NW of summit, alt. 2000 m, 22 Sep. 1973, *Henrickson 13305* (holotype: LL).

Erect branched herbs ca. 0.5 m tall, the stems densely pubescent (becoming sparsely pubescent), the hairs principally stellate, 0.2–0.5 mm long. Leaf blades hastate-deltate below to hastate-lanceolate above, deeply cordate, serrate, acute, somewhat discolorous, stellate-pubescent; petioles with pubescence like that of the stems. Pedicels 2–4 cm long in flower, accrescent to 6 cm long in fruit, slender, articulated ca. 5 mm below the flower; calyces 9–12 mm long, densely and minutely stellate-tomentose, deeply 5-lobed, the lobes lance-oblong, more or less apiculate; petals 11–17 mm long, rose or lavender (often with microscopical purplish lines distally); androecia subequal to the petals. Fruit oblate, densely and minutely stellate-pubescent; mericarps 10, with dorsal spurs ca. 1.5 mm long; seeds solitary, lacking (?) an endocarp surrounding the seed.

Specimens examined.—MEXICO. ZACATECAS: Pico de Teyra (24°34'N, 102°11'W), northwest slope in ravine, alt. 2050 m, 23 Sep. 1978, *Henrickson 13405b* (LL); Sierra de Astillero (24°37'N, 101°08'W), *Henrickson 13305* (LL); near Concepción del Oro, *Palmer 377* (GH, NY, US).

Anoda henricksonii is closely allied to *A. pubescens*, being distinguished from it by the characters given in the key and by geographic distribution. Both occur at relatively high elevations.

7. *Anoda hintoniorum* Fryxell, sp. nov.

Fig. 1M, 4

Type: MEXICO. MICHOACÁN: S. Torricillas, Distr. Coalcomán, 2500 m, 17 Dec. 1938, *Hinton et al. 12778* (holotype: US; isotypes: BM, BR, DS, GH, K, MICH, NY, RSA, UC, pf).



Fig. 4. *Anoda hintoniorum* (Hinton 12778).

Frutices erecti, caulibus sparsim stellato-pubescentibus vel glabratiss, saepe purpurascens; foliis anguste triangularibus, supra pilis simplicibus, infra pilis stellatis; calycibus 7–11 mm longis, interdum apice purpurascens; petalis lavandulis, 14–18 mm longis; fructibus oblatiss, stellato-puberulis et pilis glandulosis; mericarpiis 10–12, dorsaliter calcaratis, endocarpiis reticulatis destitutiss.

Erect shrubs 0.5–2.5(–4) m tall, the stems sparsely and minutely stellate-pubescent or glabrate and often with purplish pigmentation. Leaf blades narrowly ovate-lanceolate or triangular, sometimes weakly 3-lobed and 2–3 times as long as wide, mostly 4–8 cm long, basally truncate or subcordate, crenate-serrate, narrowly acute, palmately 5–7-nerved, with appressed simple hairs 0.4–0.5 mm long above and stellate hairs ca. 0.3 mm long beneath, almost concolorous; petioles less than half the length of the blade, minutely pubescent, often purplish; stipules subulate, inconspicuous, early caducous. Flowers solitary in the leaf axils but usually aggregated apically or at the tips of short lateral branches 5–10 cm long forming dense inflorescences of a few to a dozen flowers; pedicels (1–)2–3.5(–7) cm long, slender, sparsely and minutely stellate-pubescent, articulated 2–4 mm below the flower; calyces 7–11 mm long, uniformly pubescent with a mixture of stellate and glandular hairs, half-divided, the lobes with evident midribs, acuminate, sometimes purplish; petals lavender, 14–18 mm long, hirsute on the claws and with a few glandular hairs on the distal margins, otherwise glabrous; staminal columns pallid, ca. 4 mm long, apically pubescent, the filaments 3 mm long, apically inserted, the anthers yellow; styles ca. 10, lavender (in contrast to the pallid filaments), glabrous, the stigmas rotund-capitate, subequal to the anthers. Fruits (Fig. 1M) 8–9 mm in diam, oblate, minutely stellate- and glandular-puberulent; mericarps 10–12, with a short (0.5 mm) dorsal spur, the lateral walls evanescent; seeds solitary, 2.5 mm long, minutely scabridulous, lacking a reticulate endocarp.

Paratypes examined.—MEXICO. MICHOCÁN: Distr. Zitácuaro, Zitácuaro-C. Aguila, Hinton *et al.* 13554 (GH, K, NY, US); 2 mi W of Las Peras (ca. 22 mi E of Morelia), Frye and Frye 3098 (GH).—Edo. MÉXICO: Distr. Temascaltepec, Los Hornos, 10 Feb 1935, Hinton *et al.* 7229 (ARIZ, ASU-2, BM, CAS, DES, F, GH, K, LL, NY, US, pf); Cajones, Hinton *et al.* 3036 (BM, F, GH, K, NY).—MORELOS: km 6–7, supercarretera Cuautla, Vázquez 1843 (MEXU).

A majority of the specimens of this species have annotations saying *Anoda pubescens*, from which it is clearly distinct. *Anoda hintoniorum* is found principally between elevations of 2500–2800 m. Since it is known principally from collections of “Hinton *et al.*,” it is therefore appropriate to dedicate this species to George and James Hinton, father and son, whose contributions to our knowledge of Mexican botany have been great (Hinton and Rzedowski 1972, 1975).

8. *Anoda hirta* Fryxell, sp. nov.

Type: MEXICO. TAMAULIPAS: 27 km SE of Miquihuana on road to Palmillas, varied vegetation of large shrubs, small trees, and herbs. Fls. orange, elev. 2025 m (23°37'N, 99°39'W), 13 Aug. 1941, Stanford, Retherford, and Northcraft 878 (holotype: MO; isotypes: ARIZ, DS, NY, UC).

Herbae vel suffrutices erecti, caulibus valde hirsutiss, foliis triangularibus vel hastatis pilis simplicibus adpressis supra et pilis stellatis infra; calycibus 5–7 mm longis; petalis flavidis 8–9 mm longis; fructibus oblatiss dense pubescentibus, mericarpiis ca. 13, dorsaliter spiniferis, endocarpiis reticulatis vix evolutiss.

Erect herbs or subshrubs of unknown height, the stems green, the young stems

densely yellowish hirsute becoming sparsely hirsute late, the hairs polymorphic, including simple slender hairs 2–4 mm long, rigid scabrid hairs ca. 1 mm long (on younger stems), with understory pubescence of short stellate hairs and a few glandular hairs. Leaf blades triangular or hastate, to 8 cm long, basally truncate, obscurely crenate, acute, slightly discoloured, with appressed simple hairs 0.5–1 mm long above, uniformly and minutely stellate-pubescent beneath, the pubescence denser and yellowish on the nerves; petioles almost as long as the blades, with pubescence like that of the stems; stipules filiform, 5–6 mm long, hirsute. Pedicels 2–3 cm long in flower, accrescent to 6–8 cm long in fruit, with pubescence like that of the stem, solitary in the leaf axils, more or less aggregated apically; calyces 5–7 mm long in flower, accrescent to 7–9 mm long in fruit, 10-ribbed, densely yellowish pubescent, approximately half-divided; petals 8–9 mm long, pale yellow when dry (orange according to collectors' notes), prominently hirsute on margins of claw, otherwise glabrous; staminal columns ca. 4.5 mm long, pallid, densely hirsute, the anthers ca. 20, the filaments 1–1.5 mm long; styles glabrous, the stigmas capitate. Fruits oblate, 9–11 mm in diam, densely pubescent; mericarps 13–16, with a dorsal spur ca. 1 mm long, the lateral walls evanescent, the reticulate endocarp poorly developed and not enclosing the seed; seeds glabrous, ca. 2.3 mm long.

Paratypes examined.—MEXICO. BAJA CALIFORNIA: Saucito, 14 Oct. 1890, *Brandege s.n.* (UC).—UNITED STATES. ILLINOIS: Fountaindale, *Bebb s.n.* (in cultivation) (F).—MISSOURI: M.B.G. [Missouri Botanical Garden] no. 27/10/10, Aug. 1911, *Craig s.n.* (in cultivation) (MO).

The disjunction between the two Mexican specimens cited is notable and remains to be explained, but the two collections appear to represent the same species and are so dealt with here. Future collections may reveal a continuous distribution across northern Mexico. The provenience of the cultivated specimens of *M. S. Bebb* (1833–1895) or of Moses Craig (1859–1913) is unknown.

9. ANODA LANCEOLATA. W. J. Hooker & Arnott, Bot. Beech. Voy. 411. 1838.

Fig. 11, 2

Type: [MEXICO. NAYARIT:] Tepic to San Blas [1828, *Lay s.n.*] (holotype: K).—*Sida unidentata* D. Dietrich, Syn. Pl. 4:858. 1847.

Anoda wrightii A. Gray, Smiths, Contr. Knowl. 5 (Pl. Wright. 2):22. 1853.—*Type:* UNITED STATES. NEW MEXICO: on the summit of mountains near the copper mines, Oct. 1851, *Wright 894* (holotype: GH; isotypes: BM, K, MO, NY, PH, US).

Erect herbs, minutely and roughly pubescent. Leaf blades mostly 3–7(–12) cm long, variable in form, the lower leaves triangular, smaller and narrower upward, lanceolate, truncate, or cuneate basally, obscurely dentate or subentire, more or less discoloured, with simple appressed hairs (0.3–1 mm long) above, with short stellate hairs beneath; petioles with pubescence like that of stem, to 10.5 cm long on lower leaves but usually less than 1 cm long; stipules inconspicuous. Pedicels solitary in the leaf axils (up to 6.5 cm long, subequal to the subtending leaves) or more commonly aggregated apically into leafless racemes, articulated 5 mm below the flowers; calyces 6 mm long in flower, accrescent to 8 mm in fruit, minutely stellate-pubescent, approximately half-divided, the lobes with prominent midribs, triangular in flower, the margins somewhat recurved in fruit; corollas yellow (sometimes reddish at base), 8–16 mm long, the petals densely ciliate on the

margins of the claws; staminal columns densely pubescent, the hairs stellate, more or less retrorse. Fruits (Fig. 1I) obovate, 9–11 mm in diam, densely stellate-pubescent, the hairs 0.5–1 mm long; mericarps 10–12, each with a dorsal spur ca. 1 mm long, the lateral walls evanescent; seeds solitary, minutely verruculate, 3 mm long, the endocarp usually well developed with excrescences on the margin (Fig. 2).

Specimens examined.—UNITED STATES. NEW MEXICO: mountains near the copper mines, *Wright 894* (BM, GH, K, MO, NY, PH, US); Mogollon Mts., *Rusby 52* (F, MO).—TEXAS: El Paso, *Jones 4343* (ARIZ, F, NY, UC).—MEXICO. BAJA CALIFORNIA: Sierra San Francisquito, 1 Oct. 1899, *Brandegee s.n.* (NY, UC); San Francisquito Mts., *Brandegee 48* (UC).—SINALOA: Mpio. de Sinaloa y Vela, Sierrito Surutató at El Alamo, along road from Mocorito to Surutató, *Breedlove and Thorne 17903* (CAS, RSA, pf).—CHIHUAHUA: N end of San Luis Mts. (extreme NW corner of state), *Spellenberg 6859* (COLO, MEXU, NMC, NY, pf); Carretas, *White 912* (ARIZ, MICH).—COAHUILA: without locality, *Purpus 5014* (UC).—NAYARIT: Tepic, *Palmer 2021* (BM, GH, NY, US), *Jones 22854* (CAS, NY, WIS); Tepic to San Blas, Mina Esperanza a Rosa Morada, *González-Ortega 6678* (CAS, US), *Lay s.n.* (K).—MICHOACÁN: 4 mi W of Apatzingán, *Leavenworth and Hoogstraal 1368* (F, MICH); Aguaje, Distr. Apatzingán, *Hinton et al. 15328* (TEX, pf); 4 mi W of Apatzingán, *McVaugh 17899* (MICH).—JALISCO: Mpio. de La Huerta, Estac. Biol. Chamela, Vereda Tejón, *Lott 1425* (MEXU, pf); mts. near Lake Chapala, *Pringle 4352* (COLO, DS, F, GH, MEXU, MIN, MO, NY, PH, US, VT, WIS); Ocotlán, *Cervantes s.n.* (IBUG). Barranca of Tequila, *Pringle 5454* (GH, MEXU, VT).—SAN LUIS POTOSÍ: Sierra de San Miguelito, cañon arriba de Terrero, alt. 2100 m, *Rzedowski 4387* (ENCB).—GUERRERO: Mpio. de Petatlán, terracería a El Camalote, 2 km al NE del entronque con la carr. Petatlán-Zihuatanejo, *Koch and Fryxell 83148* (BH, CHAPA, ENCB, F, MEXU, pf); Pungarabato, Distr. Coyuca, *Hinton 7113* (GH).

Anoda lanceolata has a superficial resemblance to *A. cristata*, but differs most notably in its yellow corolla and in the elaborately developed endocarp surrounding the seeds. The pollen grains of this species have been described by Hashmi (1970).

10. *Anoda leonensis* Fryxell, sp. nov.

Fig. 1B, 5

Type: MEXICO. Nuevo León: between Linares and Iturbide, near K36, by large bas-relief on cliffside, alt. 4000 ft, 15 Oct. 1969, *Fryxell 1207* (holotype: MEXU; isotypes: BH, CTES, MICH, US, pf).

Herbae erectae, caulibus foliisque sparsim stellato-pubescentibus vel glabratis, laminis foliorum ovatis vel hastatis, sursum deminutis; calycibus 5–8 mm longis; petalis luteis, 8–12(–20) mm longis; fructibus obovatis hirsutis; mericarpiis 12–16, calcaribus dorsalibus vestigialibus, endocarpiis reticulatis persistentibus semen solitarium involventibus.

Erect herbs 1–2 m tall with spreading branches, the stems minutely stellate-pubescent, the hairs 0.1 mm long. Leaves long-petiolate, mostly 4–9 cm long, somewhat heteromorphic, the lower leaves more or less ovate-cordate but the leaves commonly hastate or hastately 3-lobed, reduced upwards, minutely stellate-pubescent on the veins, sparsely pubescent to glabrate above and beneath, concolorous or slightly discolorous, coarsely crenate. Inflorescences of racemes or open panicles; pedicels slender, 2–6.5 cm long, articulated 4–11 mm below the flower, with pubescence like that of the stems; calyces 5–6(–8) mm long, obscurely 10-nerved, densely and minutely yellowish pubescent, approximately half-divided; petals 8–12(–20) mm long, yellow or orange-yellow, prominently ciliate on the claws, otherwise glabrous; staminal columns 2–3(–5) mm long, pallid, with setae 0.5–1 mm long disposed in 5 vertical rows; filaments 1–2(–4) mm long, the anthers yellowish; styles 12–16, slender, glabrous, pallid, slightly exceeding the

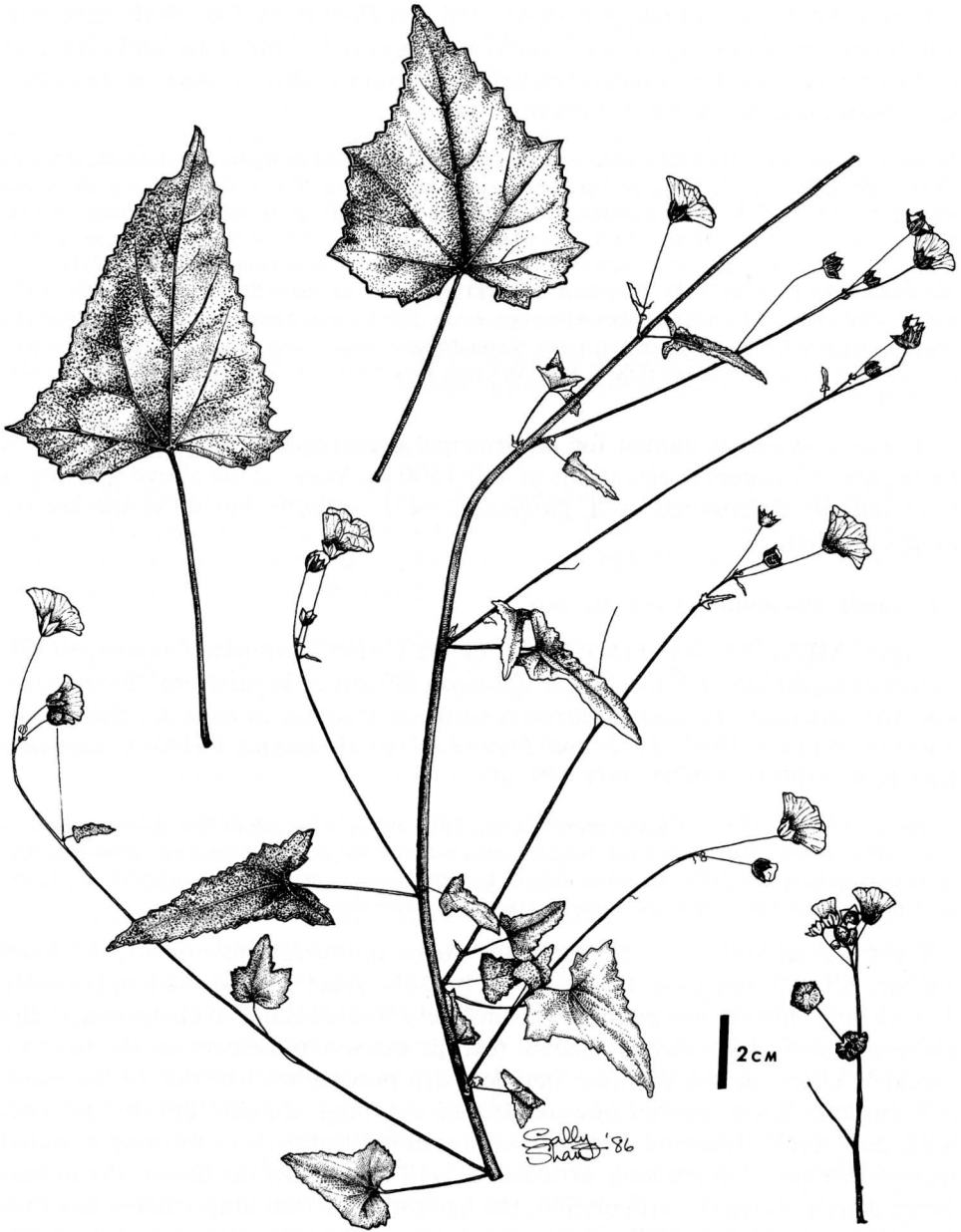


Fig. 5. *Anoda leonensis* (Fryxell 1207).

androecium, the stigmas abruptly capitate, glabrous, pallid or reddish (?). Fruits (Fig. 1B) oblate, 8–9 mm in diam, densely hirsute (the hairs 0.3–0.7 mm long, the longest hairs at the apex); mericarps 12–16, dorsally rounded (crested but lacking spurs), the central rib or crest with dark pigmentation in the immature fruit, the lateral walls evanescent; seeds solitary, each with a persistent reticulate endocarp surrounding the seed 2.5 mm long. Chromosome number: $2n = 30$ (Bates 1987).

Larger flowers are found on *Pringle 3016* and *Dorr et al. 1999* with calyces to 8 mm long, petals to 20 mm long, staminal columns 4–5 mm long, and filaments to 4 mm long. In other respects (including geography) they conform to the other specimens cited below for *A. leonensis*.

Paratypes examined.—MEXICO. NUEVO LEÓN: between Linares and Iturbide, near K32, alt. 2800 ft, 15 Oct. 1969, *Fryxell 1212* (pf); 28 km W of Linares, alt. 2000 ft, 20 Oct. 1970, *Fryxell, Bates and Blanchard 1697* (BH, K, pf); Cascada Cola de Caballo (Horsetail Falls), SE of Monterrey, 22 Oct. 1981, *Dorr et al. 1999* (MEXU, TEX, pf); Cañon El Novillo, ca. 10 km S of Iturbide on road to Cuevas, 27 Oct. 1982, *Dorr et al. 2606* (MEXU, TEX, pf); 6.9 mi W of Linares on Hwy. 58 (Linares-San Roberto Jct.), 23 Oct. 1981, *Dorr et al. 2035* (TEX); in canyon above El Diente, Monterrey, 4000 ft, Oct. 1961. *Smith M580* (TEX); Los Alamillos, *Lacás 520* (F); near Monterrey, *Pringle 3016* (GH), *Mueller and Mueller 76* (GH).—TAMAULIPAS: Sierra de San Carlos, Cerro de los Armadillos near San José, alt. 3100 ft, *Bartlett 10168* (DS, F, MICH); Cerro Tres Vetas near San José, alt. 2700 ft, *Bartlett 10378* (F, MICH).

Anoda leonensis is named for its principal occurrence in the state of Nuevo León, where it occurs at elevations of 500–1500 m. Many of the above specimens were initially determined as *A. paniculata* or *A. wrightii*, but these species are amply distinct.

11. *Anoda maculata* Fryxell, sp. nov.

Types: MEXICO. GUERRERO: Mpio. de La Unión, carretera Zihuatanejo-Cd. Altamirano, 40 km de Vallecitos de Zaragoza (89 km de la carretera Zihuatanejo-Lázaro Cárdenas). Orilla de la carretera bajo construcción en zona de sabana. Alt. 1300 m, 25 Oct. 1982, *Koch and Fryxell 82191* (holotype: CHAPA; isotypes: ENCB, F, MEXU, MICH, MO, US, pf).

Herbae erectae, caulibus stellato-puberulentibus, foliis ovatis vel angulatis fere glabris, praeter in marginibus ciliatis; calycibus 6–8 mm longis; petalis 6–8 mm longis, cremeis maculis atro-sanguineis ad basim; androecis rubellis; fructibus oblatiis, hirsutis, radiatim spiniferis; mericarpiis ca. 10, endocarpiis reticulatis persistentibus semen solitarium involventibus.

Erect annual herbs to 1.5 m tall, the stems uniformly puberulent, the hairs stellate, 0.1–0.2 mm long. Lower leaves broadly ovate (as wide as long), mostly 3–7 cm long, more or less palmately to hastately 3(–5)-lobed; leaf blades essentially glabrous above, subglabrous beneath (except sparsely pubescent on the nerves), minutely ciliate on the margins; petioles with pubescence like that of the stem, to 6 cm long below, shorter upwards (to 0.5 cm long); stipules filiform, 2–5 mm long, pubescent, caducous. Pedicels solitary in the leaf axils or forming terminal leafless racemes, 2–8 cm long, articulated 5–10 mm below the flower, the pubescence denser above the articulation, the hairs up to 1 mm long; calyces 6–8 mm long, approximately half-divided, prominently stellate-hirsute, especially on the veins and the margins, and lobes ovate with a prominent midrib; corollas 6–10 mm long, cream-colored with a red center, the petals densely ciliate on the claws, otherwise glabrous; staminal columns ca. 2 mm long, prominently ribbed, reddish, glabrous (except with a few hairs at the apex), the filaments purplish, the anthers 20–25, reddish, the pollen yellow-orange; styles slender, pallid, glabrous, the stigmas abruptly capitate, yellowish. Fruits oblate, 7–8 mm in diam, hirsute, with radiating spurs; mericarps ca. 10, the lateral walls disintegrating, the dorsal spurs ca. 1 mm long; seeds totally enclosed in a reticulate indurate endocarp ca. 3 mm long.

Paratypes examined.—MEXICO. GUERRERO: Mpio. de La Unión, carretera Zihuatanejo-Cd. Altamirano, 84 km al N del entronque con carr. Zihuatanejo-Lázaro-Cárdenas. Bosque sabanoide de encino con elementos tropicales; suelo franco. Alt. 1550 m, 23 Oct. 1982, *Koch and Fryxell 82161* (CHAPA, ENCB, MEXU, US, pf).—DURANGO: 12 mi E of Cd. Durango, *Shreve 9164* (ARIZ, GH).—PUEBLA: just W of Acatlán de Osorio, in road-cut on Hwy 190, 31 Jul. 1979, *J. Fryxell 189* (ENCB, MEXU, pf); SE of Izucar de Matamoros, *Fryxell 1137* (BH, CTES, DS, GH, MICH, NY, UC, US, pf).—QUERÉTARO: camino arriba de la Cañada, unos 30 kms, alt. 1950 m, 17 Aug. 1980, *Arguelles 1434* (ENCB, MEXU).—JALISCO: Barranca de Tequila, *Pringle 4575* (ARIZ, ASU, CM, COLO, F, GH, LL, MEXU, MICH, OKLA, NY, UC, US, VT, pf); 1.5 mi W of Atotonilco El Alto, *McVaugh 17333* (MICH).

Anoda maculata, as the specific epithet indicates, is distinctive for the dark center of the flower. It is similar to *A. crenatiflora* in many particulars, but the two species may be distinguished by pubescence (especially that of the calyces and pedicels), perhaps by leaf shape and anther number, and by other characters.

12. *Anoda palmata* Fryxell, sp. nov.

Fig. 6

Type: MEXICO. GUERRERO: Mpio. de Coahuayutla de Guerrero, 44–45 km al W de La Unión, terracería a Coahuayutla, alt. 570 m, en bosque caducifolio, 14 Nov. 1983, *Koch and Fryxell 83144* (holotype: CHAPA; isotypes: BM, CTES, ENCB, F, MEXU, MICH, MO, pf).

Herbae erectae, late effusae, caulibus stellato-pubescentibus et interdum pilis longis simplicibus; superficiebus infernis foliorum stellato-pubescentibus, superficiebus superis foliorum pilis stellatis et pilis simplicibus adpressis, laminis palmatim 3–5-lobatis, latitudinibus loborum sursum decrescentibus; calycibus 5–8 mm longis; petalis flavis, 6–12 mm longis; fructibus oblatis, dense stellato-pubescentibus, mericarpiis 8–13, dorsaliter calcaratis, temporibus maturationibus parietibus lateralibus evanescentibus sed endocarpiis reticulatis persistentibus semen solitarium involventibus.

Erect annual herbs 1–1.5 m tall, freely branched, the stems with stellate hairs, 0.2–0.5 mm long and a few very short glandular hairs and sometimes also with long simple hairs 2–3 mm long. Leaf blades mostly 3–8(–10) cm long, the young leaves ovate or slightly lobed, truncate or cordate, coarsely dentate, upwards deeply palmately 5-lobed and ultimately 3-lobed, the lobes becoming narrowly linear-lanceolate, obscurely dentate to entire, acute, essentially concolorous, with stellate hairs 0.5–2 mm long and sometimes also appressed simple hairs above, with 6–8-rayed stellate hairs ca. 0.5 mm in diam uniformly distributed beneath, rarely with irregular purplish blotch along midvein; petioles to 8 cm long (half the length of the blade to equaling the blade), with pubescence like that of the stems; stipules filiform, 3–5 mm long, caducous. Flowers solitary in the leaf axils, forming open terminal racemes more or less exceeding the leaves; pedicels 2–5 cm long, slender, minutely stellate-pubescent, articulated 5–8 mm below the flowers; calyces 5–8 mm long (not accrescent), basally rounded and yellowish or brownish, densely covered with stellate and glandular hairs, half or more divided, the lobes ovate-apiculate, 1-ribbed, with lanate margins; petals yellow, 6–12 mm long, ciliate on the margins of the claws, otherwise glabrous, staminal columns 2–3 mm long, pallid, basally glabrous, prominently hirsute apically (the hairs 0.5 mm long), the filaments 1–2 mm long, the anthers and pollen yellow; styles slender, pallid, glabrous, slightly exceeding the androecium, the stigmas abruptly capitate, 0.3–0.5 mm in diam (at least 3 times the diameter of the style). Fruits oblate, 8–9 mm in diam, densely stellate-pubescent (the hairs 0.5–1 mm long); mericarps 8–13, each with a dorsal spur 0.5–1 mm long, the lateral walls disintegrating at

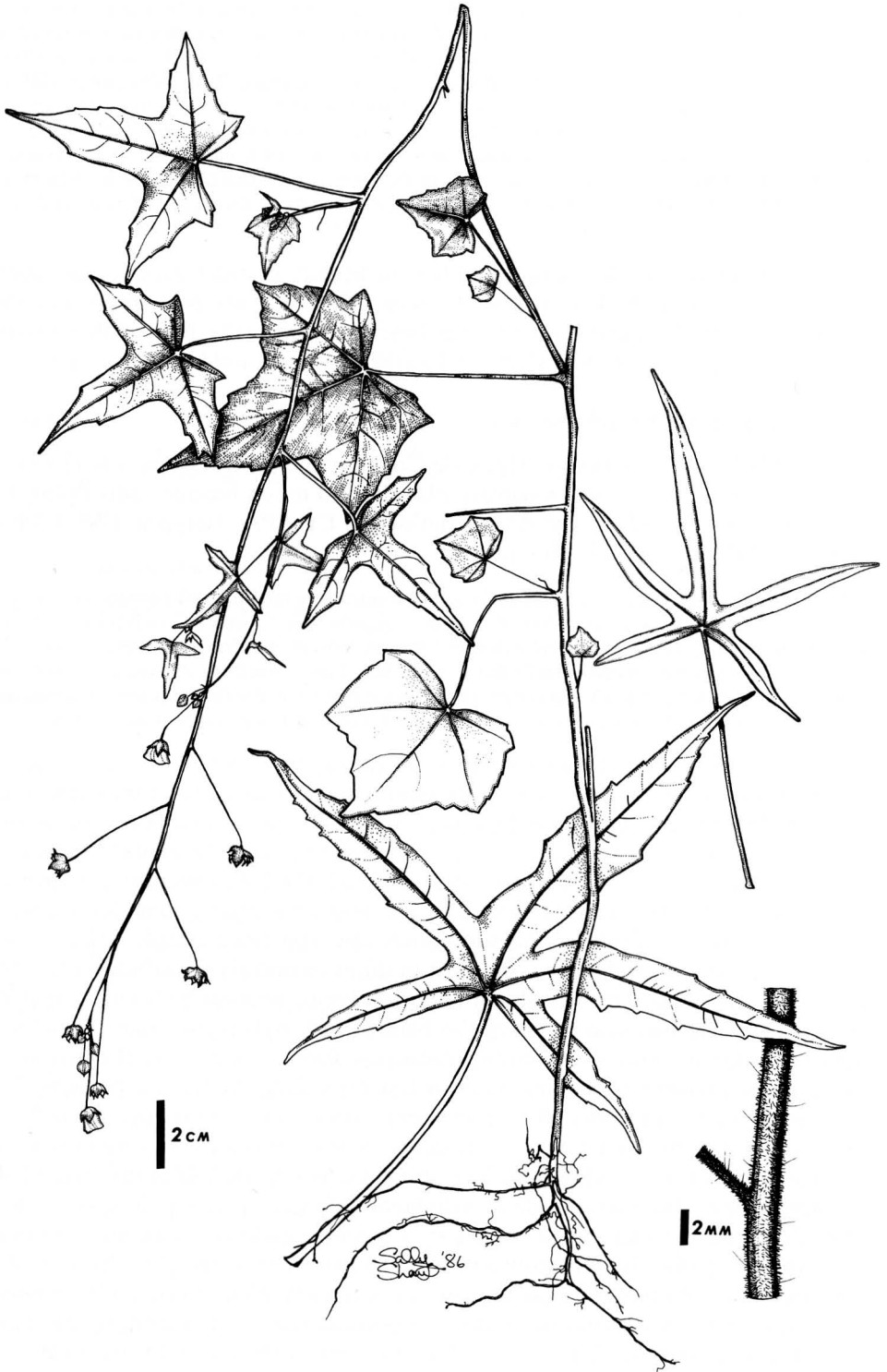


Fig. 6. *Anoda palmata* (plant: Koch et al. 79278; larger separate leaf: Koch and Fryxell 83144; smaller separate leaf: Fryxell et al. 1631).

maturity, leaving a black reticulate endocarp 2.5–3 mm long completely enclosing the solitary seeds. Chromosome number: $2n = 30$ (Bates 1987).

Paratypes examined.—MEXICO. BAJA CALIFORNIA: 28.7 km N of Cabo San Lucas on road to Todos Santos (near 23°5'N, 110°5'W), alt. 500 ft, 16 Dec. 1982, *Sanders et al.* 3437 (UCR, pf); arroyo near the sea, about 10 mi S of Mission Dolores near 25°0'N, 110°47'W, 5 Dec. 1959, *Wiggins, Carter, and Ernst* 315 (DS, MICH, US); Arroyo de León, N of road to Los Planes, 22 mi SE of La Paz, elev. ca. 1560 ft, 11 Dec. 1959, *Wiggins, Carter and Ernst* 502 (DS, MEXU, US, pf); “El Pulpito” del Arroyo de las Parras, W of Loreto, *Carter and Kellogg* 3160 (CAS, DS); Arroyo Quisapol, E of La Presa along trail to Laguna Caquihui, *Wiggins* 15571 (CAS, DS); Cape Region, *Purpus* 338 (UC); Cape Region, ca. 4.5 km of road W from La Palmilla, *Moran* 7064 (CAS, DS, GH, SD); Cape Region, 11 km N of Santa Anita, *Moran* 6924 (DS, SD); Cape Region, 1 km E of Arroyo de los Pozos, *Moran* 6892 (DS, SD); 15 mi SE of La Paz, *Wiggins* 15658 (CAS, DS); San José del Cabo, 4 Oct 1890, *Brandege* 49 (GH, PH, UC).—NAYARIT: near Jesús María, elev. 600–700 m, *Feddema* 1228 (MICH).—JALISCO: 7 mi SW of Unión de Tula, alt. 4200 ft, on roadside and rocky hillsides, *Fryxell, Bates and Blanchard* 1598 (BH, pf, + 6 additional duplicates to be distributed).—MICHOCÁN: Puente Marqués, in Cañon del Marqués, ca. 7 mi S of Gabriel Zamora, alt. 1600 ft, 13 Oct. 1970, *Fryxell, Bates and Blanchard* 1631 (BH, pf); Mpio. de La Huacana, 0.5 km al S de la Presa Zicuiran, 32 km al E de Nueva Italia, por la carretera a Ario de Rosales, alt 250 m, 13 Nov. 1977, *Koch and Fryxell* 77520 (CHAPA, pf); Mpio. de Tuzantla, 27 km al S de Tuzantla por la carr. a Huetamo, puente “Las Pilas,” alt. 540 m, 9 Nov. 1983, *Koch and Fryxell* 8375 (CHAPA, ENCB, F, MEXU, XAL, pf); Mpio. de Huetamo, en Opecuaro, 10 km al NW de Santiago Conguripo, *Soto-Núñez and Silva* 3220 (MEXU); Mpio. de Arteaga, 0.5 km al N de Las Juntas, 16 km al N de Arteaga por la carr. a Nueva Italia, alt. 560 m, 20 Nov. 1983, *Koch and Fryxell* 83215 (CHAPA, MEXU, MICH, MO, RSA, pf); Mpio. de Aquila, a 10 km al E de Maruata, alt. 120 m, *Soto-Núñez, García, and Vidal* 11256 (MEXU, pf).—GUERRERO: Mpio. de Petatlán, carretera Acapulco-Zihuatanejo, 28 km al SO de Zihuatanejo, alt. 35 m, 22 Oct. 1982, *Koch and Fryxell* 82151 (BM, CHAPA, CTES, ENCB, MEXU, MICH, MO, TEX, pf).

Anoda palmata is characterized by notably lobed leaves, as the specific epithet indicates, and bright yellow flowers. It is a plant relatively common in Guerrero, Michoacán, Jalisco, Nayarit, and Baja California, at times growing in large populations. It occurs from sea level to 1500 m elevation.

13. ANODA PANICULATA Hochreutiner, *Annuaire Conserv. Jard. Bot. Genève* 20: 53. 1916. Fig. 1C

Type: MEXICO. GUERRERO: Iguala Canyon, 3000 ft, 13 Oct 1906, *Pringle* 10323 (holotype: G; isotypes: BM, CM, DS [fragment], F, GH, K, MEXU, MIN, MO, NY, PH, UC, US, VT).

Robust erect herbs to 2 m tall, the stems little branched, minutely and uniformly tomentose. Leaf blades variable, the lower leaves more or less simple, angled or slightly lobed, mostly 6–8 cm long, as wide as long, basally cordate or truncate, coarsely serrate or undulate to entire, acute, scabridulous on the margins and the veins beneath, otherwise glabrous, essentially concolorous, sometimes with an irregular purplish blotch along the midrib, the upper leaves becoming more deeply palmately lobed (the sinuses rounded) and finally narrowly hastately lobed; petioles minutely pubescent like the stem (the hairs 0.1–0.2 mm long), one-third as long as blade to equaling the blade. Inflorescences of open terminal racemes; pedicels 1–3.5(–6.5) cm long, with pubescence like that of stem, articulated 3–10 mm below the flower; calyces 6–9 mm long in flower, accrescent to 12 mm long in fruit, 10-ribbed, minutely and densely yellowish stellate-pubescent, ca. half-divided; petals 10–19 mm long, prominently ciliate on the claws with hairs ca. 1 mm long, otherwise glabrous, white or rose drying to pale rose or purple with the claws remaining white; staminal columns whitish, 3–5 mm long, glabrous basally, prominently hirsute apically with hairs ca. 1 mm long, the filaments 3–4 mm

long, the anthers and pollen yellowish; styles slender, pallid glabrous, the stigmas abruptly capitate. Fruits (Fig. 1C) obovate, 8–9 mm in diam, stellate-tomentose; mericarps 11–15, with dorsal spurs 0.5–1 mm long, the lateral walls disintegrating; seeds solitary, each totally enclosed in a persistent black reticulate endocarp 2.5–3 mm long.

Specimens examined.—MEXICO. MICHOACÁN: Mpio. Benito Juárez, 39 km al S de Zitácuaro por la carr. a Huetamo, alt. 1120 m, 8 Nov. 1983, *Koch and Fryxell 8357* (CHAPA, F, MEXU, pf).—Edo. MÉXICO: Mpio. de Tejupilco, 0.5 km al SO de la desv. a Luviano (13 km al SO de Tejupilco), carr. Cd. Altamirano-Tejupilco, alt. 1150 m, 30 Oct. 1982, *Koch and Fryxell 82247* (CHAPA, CTES, ENCB, MEXU, MICH, MO, TEX, US, pf); El Zapote, carr. Tejupilco-Bejucos, alt. 1000 m, 20 Oct. 1978, *Guizar 249* (ENCB); Tejupilco, Distr. Temascaltepec, 1340 m, 30 Sept. 1932, *Hinton 1926* (F, MEXU); Cañitas, Distr. Temascaltepec, *Hinton 5025* (GH, NY).—GUERRERO: Mpio. de Acapulahuaya, 32 km al O de Teloloapan por la carr. a Arcelia, alt. 1150 m, 29 Oct. 1982, *Koch and Fryxell 82238* (CHAPA, CTES, ENCB, MEXU, MICH, MO, TEX, US, pf); Río Balsas, *Pringle 13694* (GH, MICH, US, VT-2); Distr. Aldama, Temisco, Barranca de la Julia, 320–350 m, 1 Nov 1937, *Mexia 8726* (ARIZ, CAS, F, GH, LL, MO, NY, UC, US); Iguala Canyon, *Pringle 10323* (BM, CM, F, G, GH, K, MEXU, MO, NY, PH, UC, US, VT), *Pringle 13691* (GH).

Anoda paniculata is found in the Río Balsas Depression from northern Guerrero to the southern part of the state of México, at elevations of 300–1300 m. It is a robust plant with glabrous foliage and a variable corolla color—the petals may be white, lavender, or rose, generally drying to lavender or purple, with the claws remaining white.

14. ANODA PEDUNCULOSA Hochreutiner, *Annuaire Conserv. Jard. Bot. Genève* 20:60. 1916 Fig. 1E, 2

Type: MEXICO. HILDALGO: near Tula, 5 Oct. 1896, *Pringle 6541* (CAS, CM, F, GH, K, MASS, MEXU, MICH, MIN, MO, NY, PH, UC, VT, WIS).

Erect annual herbs or subshrubs 0.5–1.5 m tall, the stems minutely and uniformly stellate-pubescent. Leaf blades 3–7 cm long (often smaller), ovate (young leaves) to hastately 3-lobed, becoming narrower upwards, obscurely crenate, acute, minutely and sparsely stellate-pubescent, sometimes with an irregular purple blotch along the midrib. Flowers solitary in the leaf axils, long-pedunculate, often grouped apically in terminal racemes or panicles more or less exceeding the leaves; calyces 4–6 mm long, not accrescent, puberulent, half-divided; petals whitish or lavender, 6–15 mm long, prominently ciliate on the margins of the claws; androecium included, the columns pallid, with long transparent hairs apically; anthers and pollen yellow; styles glabrous, 12–13, sometimes reddish, the stigmas abruptly capitate. Fruits (Fig. 1E) obovate, 8–9 mm in diameter, whitish-pubescent, the 12–13 mericarps each with a short dorsal spur, the lateral walls disintegrating at maturity; seeds solitary, each completely enclosed in a blackish reticulate endocarp (Fig. 2). Chromosome number: $2n = 30$ (Bates and Blanchard 1970, as *A. reticulata*; Bates 1987).

Specimens examined.—MEXICO. TAMAULIPAS: 5 mi E of Nuevo Morelos, alt. 1600 ft, *Fryxell and Bates 946* (BH, pf); 4 mi E of Nuevo Morelos, alt. 1500 ft, *Fryxell and Bates 948* (BH, CTES, pf); 1 mi W of El Abra, below Bat Cave, 1000 m, *Johnston and Graham 4557* (MEXU, MICH, TEX); 2.2 km SW of El Abra, alt. 450 m, *Nee 22248* (F).—HILDALGO: near Tula, 7000 ft, 5 Oct. 1896, *Pringle 6541* (CAS, CM, F, GH, K, MASS, MEXU, MICH, MO, NY, PH, UC, VT, WIS).—SAN LUIS POTOSÍ: Mpio. de Cd. Valles, Rancho Tinaja, 5.5 mi S of Cd. Valles, alt. 130 m, 22 May 1981, *Fryxell and Anderson 3539* (MICH, pf), *Rzedowski 7020* (ENCB); 9 mi E of Cd. Valles, 10 Feb. 1961, *McGregor 16328* (LL, US).—VERACRUZ: Buena Vista, 6 km al NE de Rinconado, *Dorantes et al. 1709* (ENCB,

F, TAES, MEXU, XAL); en la Cañada de Palo Gacho, Mpio. E. Zapata, alt. 400 m, *Cházaro and Justo 1436* (F, XAL, pf); Cerro Gordo, E. Zapata, *Dorantes et al. 1731* (ENCB, F, MEXU, XAL); El Carrizal, alt. 1600 ft, *Dorr, Elisens and Poole 1989* (MEXU, TEX, pf); Mpio. de Zapata, La Laja, alt. 900 m, *Fryxell 2551* (BH, MEXU, pf); 2 km S of Rinconada, 54 km SE of Jalapa, alt. 200 m, *Judziewicz 3187* (WIS, pf); Actopan, *Ortega 437* (F, MEXU, MO, XAL); cerca de los Idolos, entre Jalapa y Veracruz, *Paray 2883* (ENCB, MEXU); Zacuapán and vic., *Purpus 1948* (F, GH, MO, NY, UC); Mpio. de Dos Ríos, Plan del Río, alt. 300 m, *Ventura 2665* (ENCB, LL, MICH, pf); Mpio. de Puente Nacional, Tamarindo, alt. 150 m, *Ventura 11765* (ENCB, MEXU, pf); 1 km E de La Bocana, Actopan, *Dorantes et al. 1806* (MEXU, XAL)—OAXACA: 13 km NW of Tehuantepec, on side road to Paso Alicia, alt. 1300 ft, *Fryxell 1152* (BH, CTES, DS, GH, MICH, NY, UC, pf); Mpio. Jalapa del Marqués, 2 km al N de la carretera Tehuantepec-Oaxaca, sobre la terrecería a la Presa Benito Juárez (28 km al O de Tehuantepec) alt. 210 m, *Koch and Fryxell 78326* (CHAPA, ENCB, pf).

Anoda pedunculosa is characterized by having pale lavender (almost white) corollas, small calyces, and stellate-tomentose fruits. It occurs at elevations of 100–1000(–2000) m. The pollen grains of this species have been described by Sánchez (1982, as *A. parviflora*).

15. ANODA PENTASCHISTA A. Gray, *Smiths. Contr. Knowl.* 5 (Pl. Wright. 2):22. 1853. Fig. 1D

Type: UNITED STATES. NEW MEXICO: valley between Ojo de Gavilan and Condé's Camp, Aug. 1851, *Wright 893* (holotype: GH; isotypes: BM, K, MO, NY, UC, US).—*Sidanoda pentaschista* (A. Gray) Wootton and Standley, *Contr. U.S. Natl. Herb.* 19: 427. 1915.

Sida integrifolia Sessé & Mociño, *Fl. Mex. ed. ii.* 171. 1894 (non Montrouzier, 1860).—*Type*: In agris de Guanabacoa (specimen unknown).

Sida palmeri J. G. Smith, *Rept. Missouri Bot. Gard.* 6: 113. *t.*48. 1895 (non E. G. Baker, 1892).—*Type*: UNITED STATES. TEXAS: Corpus Christi, 1894, *Nealley s.n.* (F, GH, US).—*Anoda pentaschista* A. Gray var. *obtusior* Robinson in A. Gray, *Syn. Fl.* 1 (2):320. 1897.

Anoda extrema Hochreutiner, *Annuaire Conserv. Jard. Bot. Genève* 20:64. 1916.—*Type*: Nueva España, 1827, *Pavón s.n.* "sub nomine *Sida heterophyllae*" (G as photo F-23687).

Erect annual subshrubs 0.5–2 m tall, freely branched, the stems stellate-scarbidulous. Leaf blades highly variable in form: early (juvenile) leaves relatively broad, triangular-ovate to weakly hastately lobed or rarely suborbicular, later leaves usually narrowly linear, 1-nerved, often much longer than wide, short-petiolate, discolorous, subentire, minutely stellate-pubescent beneath. Inflorescences of openly branched terminal panicles, the pedicels slender, 1–4 cm long, often scabridulous and somewhat viscid above; calyces 3–4 mm long, minutely pubescent, half-divided, the lobes 1-nerved, apiculate; petals 8–10 mm long, yellow, sometimes drying pale lavender, ciliate on the margins of the claws; androecium pallid, glabrous or sparsely scabridulous apically, the anthers yellowish, sometimes only 5; styles 5–8, pallid, glabrous, the stigmas capitate. Fruits (Fig. 1D) oblate, 4–5 mm in diam, more or less pubescent, 5–8-angled; mericarps 5–8, each with a dorsal spur; seeds solitary, without a persistent endocarp surrounding the seed, but the seeds sometimes adnate to the dorsal wall. Chromosome number: $2n = 30$ (Bates and Blanchard 1970; Bates 1987).

Specimens examined.—UNITED STATES. ARIZONA: Tucson Mtns., *Thornber 157* (ASU, TAES); SE of Clifton, Greenlee County, *Ripley and Barneby 5116* (CAS, NY); San Xavier Indian Reservation, 20 Jul. 1913, *Thornber s.n.* (CAS, TAES); Willcox, 19 Aug. 1947, *Jones s.n.* (CAS); 1 mi E of Willcox, *Parker 8088* (RSA); Santa Catalina, Aug. 1883, *Lemmon s.n.* (UC); Graham Co., Deer Valley Road, E of Galiuro Mts., *Pinkava et al. 15204* (ASU); Pinal Co., near Blackwater, *Rea 522b* (SD); Douglas,

10 Sep. 1926, *Murphy s.n.* (SD).—NEW MEXICO: between Ojo de Gavilan and Condé's Camp, *Wright 893* (BM, GH, K, NY, UC, US). Gray, Lincoln Co., 6000 ft, *Greene 117* (POM).—TEXAS: Hudspeth Co., below Indian Hot Springs, *Waterfall 6210* (GH, MO, OKLA, SMU); near San Antonio, *Parks 18293* (SMU); San Patricio Co., Welder Wildlife Refuge, sect. 58, *Williges 204* (LL, SMU); Nueces Co., Corpus Christi, *Tharp, Johnson, and Webster 48-87* (OKLA, TEX), *Nealley s.n.* (F, GH, MO, US); Hidalgo Co., Santa Ana Refuge, *Fleetwood 8004* (TEX); Cameron Co., 5 airline mi SE of Brownsville, *Cory 51438* (DS, GH, MICH, NY, SMU, UC); 1 mi E of Olmito, *Johnston 542214* (OKLA, SMU, TAES, TEX).—MEXICO. BAJA CALIFORNIA: 24 mi W of Santa Rosalia, *Wiggins 11375* (CAS, DS, GH, MO, UC); 6 mi W of Canipole, *Wiggins 11442* (CAS, DS, GH, UC); Purissima, 1889, *Brandegee s.n.* (UC); Cerro Mechudo and vic., *Moran 18864* (MEXU, S, UCD); Sierra de La Giganta, Cerro de Barreno, S side of Valle de los Encinos, *Carter and Moran 5352* (UC, pf); near summit of Cerro Teombó, N of Portezuelo, *Carter 5067* (UC, pf); NW of Puerto Escondido, Portezuelo de Ultimo Agua, *Carter and Moran 5532* (UC, pf).—SONORA: near Rinconcillo, Sept. 1851, *Thurber s.n.* (F); San José de Guaymas, *Palmer 265* (US, pf), *Palmer 661* (GH, UC); Ciudad Obregón, *Gentry 306* (DS, MICH); 4 mi S of Navojoa, alt. 200 ft, *Gentry et al. 19250* (DES, LL); 18 mi W of Hermosillo, *Wiggins and Rollins 192* (DS, GH, MICH, NY, UC); 11 mi S of Ciudad Obregón, *Norris et al. 20071* (CAS, MEXU, MO); Mpio. de Hutabampo, 5 mi N of Estación Don, *Breedlove and Thorne 18625* (CAS); Agiabampo, *Palmer 780* (GH, MICH, NY).—SINALOA: 6.5 mi S of Los Mochis junction, *Wiggins 13141* (DS, SD); Topolobampo, *Palmer 198* (MICH); 28 km N of Mazatlán (4 km N of Tropic of Cancer), *Fryxell and Bates 2100* (BH, pf); near Culiacán, *Gentry 7120* (DS, GH).—DURANGO: Mpio. de Gómez-Palacios, La Gavia 15 km de Gómez-Palacios, alt. 1150 m, *Rodríguez et al. 1179* (CHAPA, pf).—ZACATECAS: San Juan Capistrano, *Rose 3762* (F, GH, US).—JALISCO: mountainside above southern shores of Lake Chapala, *Rowell [Barkley] 7632* (F, MEXU, TEX); 3 km al SE de Juchitlán, *Cobián s.n.* (IBUG).—COLIMA: ca. 5 mi S of Colima, alt. 1200 ft, *Fryxell, Bates and Blanchard 161* (BH, pf); 2 km al S de San Miguel el Seco camino a Tecomán, *Martínez, Lott and Solís 4432* (MEXU, pf).—GUERRERO: Llano, Pungarabato, Distr. Coyuca, *Hinton et al. 6697* (DES, F, GH, LL, MEXU, pf); Coyuca-Animas, *Hinton 5857* (GH).—MICHOCÁN: valley near Zamora, 5000 ft, *Pringle 8505* (CM, F, GH, LL, MEXU, MICH, MIN, MO, NY, POM, UC, US, VT, pf); just S of Gabriel Zamora, alt. 2000 ft, *Fryxell and Bates 2155* (BH, pf).—MORELOS: Yauatepec, *Rose and Painter 6603* (NY); Oaxtepec, 1450 m, *Vázquez 3300* (MEXU).—TAMAULIPAS: 6 mi S of Santander Jiménez, *Johnston and Graham 4391* (MEXU, TEX); 11 mi N of Manuel toward Aldama, elev. 850 ft, *Johnston 4935B* (TEX).—OAXACA: 4 km NE of Tehuantepec, *Fryxell 752* (CAS, CTES, ENCB, MARY, NA, TEX, pf); 10 km NE of Tehuantepec, *King 860* (MICH, pf); 7 mi W of Nilotepc, *Fryxell and Bates 907* (BH, pf).—VERACRUZ: 20 mi W of Tampico, *Fryxell 716* (pf).

Anoda pentaschista occurs widely through many parts of Mexico and extends into the southern parts of Texas, New Mexico, and Arizona. It sometimes becomes weedy in agricultural fields, roadsides, and disturbed ground. The pollen grains of this species have been described by Hashmi (1970).

16. *Anoda polygyna* Fryxell, sp. nov.

Fig. 1A, 7

Type: MEXICO. SINALOA: Mpio. de Sinaloa y Vela, Sierra Surutató at El Alamo, along road from Mocorito to Surutató, at mouth of Cañon de Tarahumares, alt. 1500 ft, 3 Mar. 1971, *Breedlove 19033* (holotype: CAS; isotypes: ENCB, pf).

Herbae vel suffrutices erecti, caulibus folisque dense stellato-pubescentibus, laminis angulatis ovatis vel hastatis vel palmatis lobatis; calycibus 9–11 mm longis; fructibus oblatis, dense hirsutis, mericarpiis 17–20, dorsalter calcaratis endocarpiis reticulatis persistentibus semen solitarium involventibus.

Erect annual herbs or subshrubs, little branched, the stems densely yellowish tomentose with stellate hairs 0.5 mm long and also with glandular hairs. Leaf blades 3–6 cm long, angularly ovate to hastately or palmately 3-lobed, basally truncate or cordate, obscurely serrate or subentire, sometimes with reddish margins, usually acute, up to 6 cm long, somewhat discolored, stellate-pubescent

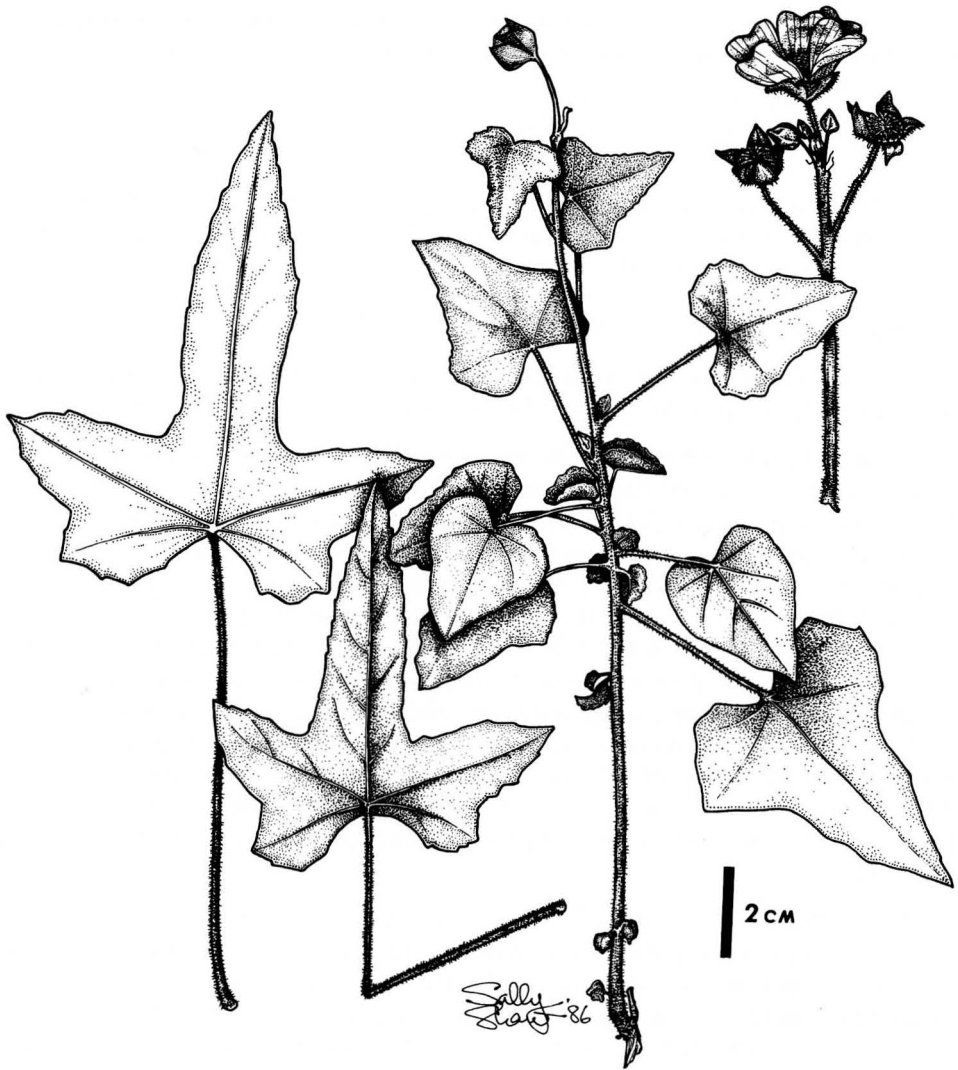


Fig. 7. *Anoda polygyna* (Breedlove 19033).

above and beneath, densely so beneath; petioles shorter than to longer than the blade, with pubescence like that of the stems; stipules filiform, pubescent, 3–4 mm long, caducous. Inflorescences more or less leafless terminal racemes; pedicels 2–5.5 cm long, ascending, with pubescence like that of stems, articulated 2–6 mm below the flower; calyces 9–11 mm long, not accrescent, densely yellowish tomentose and also with glandular hairs, half-divided, the lobes 1-nerved; petals pale lavender, 15–23 mm long, sometimes apically notched, densely ciliate on the claw, the hairs 1 mm long, otherwise glabrous; staminal columns ca. 5 mm long, pallid, prominently hirsute, the hairs simple, ca. 1 mm long, somewhat retrorse; filament 3–4 mm long; anthers yellowish; styles 17–20, pallid, glabrous, the stigmas abruptly capitate, reddish, glabrous. Fruits (Fig. 1A) oblate, 8–9 mm in diam, densely hirsute (the hairs to 1 mm long); mericarps 17–20, each with a

dorsal spur 0.5–1 mm long, the lateral walls evanescent at maturity; seeds solitary, glabrous, with a black reticulate endocarp completely enclosing the seed.

Paratypes examined.—MEXICO. SONORA: Cañon Salitrero, Río Mayo, *Gentry 1234* (MICH, SMU).—DURANGO: 20 mi W of Laguna del Progreso (120 mi W of Durango), gorge of Río Ventana, *Hurd 56* (MICH).

Anoda polygyna is characterized by having the greatest carpel number (17–20) of any species of the genus (as the specific epithet indicates), by having relatively dense stellate pubescence, and by having relatively large flowers.

17. *ANODA PRISTINA* Fryxell, *Syst. Bot.* 4:253, Fig. 1. 1979. Fig. 1N, 2

Type: MEXICO. CHIAPAS: Mpio. de Tenejapa, paraje de Kulak'tik, in the barrio of Chana', alt. 4800 ft, *Breedlove 7546* (holotype: DS; isotype: MICH).

Perennial herbs or subshrubs, the stems hollow (?), reddish, with short pungent hairs and a few glandular hairs, becoming glabrate. Leaf blades 7 cm long, 10 cm wide (smaller upwards), palmately 3(–5)-lobed, subentire, acute, glabrate except where appressed-ciliate on the margins, discoloured; petioles to 5 cm long, with antrorse hairs; stipules filiform, 2–3 mm long. Pedicels solitary in the leaf axils, articulated 5–8 mm below the flower, uniformly hispid, the hairs 0.5–1 mm long, more or less antrorse; calyces 5–6 mm long in flower, accrescent to 12–14 mm long in fruit, almost glabrous, with 10 relatively prominent nerves, half-divided; petals purplish, 7–9 mm long, glabrous; androecia pallid, ca. 4 mm long, the filaments more or less grouped in 5 fascicles; styles slender, the stigmas capitate. Fruits (Fig. 1N) oblate, 10–13 mm in diam, subglabrous; mericarps (Fig. 2) 12–13, apically dehiscent, the lateral walls evanescent but with a coarse reticulum persisting; seeds solitary, 3 mm long, with short appressed pubescence (appearing glabrous).

The distinctive characters of mericarp structure set *A. pristina* apart from all other members of the genus: mericarps that are apically dehiscent and that have a persisting reticulum in the lateral walls. In overall habit, the plant shows some resemblance to the common *A. cristata* but may prove to be allied to *A. succulenta* when both are better known. At present *A. pristina* is known only from the type collection.

18. *ANODA PUBESCENS* Schlechtendal, *Linnaea* 11:218. 1837 Fig. 1K

Type: MEXICO. HIDALGO: Mineral del Monte, *Ehrenberg s.n.* (HAL?).

Pteriptera grandiflora Fryxell, *Bol. Soc. Bot. México* 33:42. 1974. *Type:* MEXICO. Edo. MÉXICO: Mpio. de Texcoco, Cerro de Purificación, 11 Nov. 1951, *Gold s.n.* (holotype: MEXU).

Perennial herbs 0.5–1.5 m tall, the stems sparsely scabridulous, the hairs stellate, 0.2–0.4 mm long. Leaf blades broadly ovate below to narrowly triangular or hastately 3-lobed above, deeply cordate, 3–8 cm long, serrate, acute or acuminate, minutely and sparsely stellate-pubescent above and beneath, essentially concoloured; petioles with pubescence like that of the stems, to 6 cm long but shorter upwards. Pedicels 1–5 cm long in flower, somewhat longer in fruit, articulated 2–4 mm below the flowers; calyces 6–12 mm long, densely stellate-tomentose, deeply 5-lobed, the lobes lanceolate-oblong, 1-nerved, more or less apiculate; petals 7–

14 mm long, lavender (whitish on the claw), ciliate on the margins of the claws, otherwise glabrous; staminal columns whitish, ca. 7 mm long, stellate-pubescent apically, the filaments ca. 2 mm long, the anthers lavender, subequal to the petals, the pollen yellow; styles slender, the stigmas capitate. Fruits (Fig. 1K) obovate, 7–8 mm in diam, densely and minutely stellate-pubescent; mericarps 8–10, each with a dorsal spur up to 0.5 mm long, the lateral walls evanescent; seeds solitary, glabrous, 3 mm long, not enclosed in an endocarp. Chromosome number: $2n = 30$ (Bates 1987).

Specimens examined.—MEXICO. SAN LUIS POTOSÍ: Parry and Palmer 78 (GH, MO-2, NY); Sierra de San Miguelito, cerca de El Capulin, alt. 1400 m, Rzedowski 3991 (ENCB).—HIDALGO: 5.5 km N of Pachuca, 8100 ft, Fryxell, Bates and Blanchard 1675 (BH, pf); near Pachuca, 8000 ft, Pringle 6969 (CM, F, GH, MASS, MEXU, MIN, MO, NY, UC, US, VT, WIS, pf); Ixmiquilpán, Aug. 1905, Purpus s.n. (UC). 6 km W de Pachuca, 2450 m, Rzedowski 22952 (ARIZ, ENCB, LL, MICH, pf); 20 km al NE de Zimapán, alt. 2100 m, Rzedowski 23321 (ENCB, pf); 6 km al NE de Pachuca, alt. 2700 m, Rzedowski 26848 (ENCB, LL, pf); Cerro Grande, 2 km al WNW de Epazoyucan, alt. 2550 m, Rzedowski 29472 (ENCB, pf); extremo NW de Pachuca, 2600 m, Medina 1808 (ENCB, MEXU, MICH, pf); Mpio. de Tolcayuca, Valle de El Borrego, alt. 2500 m, Ventura 3671 (ENCB, MEXU, pf); Mpio. de Tepeapulco Cerro Xihuingo, alt. 2700 m, Ventura 360 (ENCB, MEXU, SD, pf); Mpio. de Tlalnalapa, Cerro de Tepan, alt. 2600 m, Ventura 266 (ENCB, MEXU, pf); Pachuca, Purpus 1685 (F, GH, MO, NY, RSA, UC); Hacienda Pitayas, 10 km al SW de Pachuca, alt. 2350 m, Rzedowski 24278 (ENCB).—Edo. MÉXICO: Cerro de Purificación, Gold s.n. (MEXU).—PUEBLA: Cerros near San Luis Tultitlanapa, Purpus 2610 (F, GH-2, MO-2, NY-2, UC, pf).

Anoda pubescens is clearly allied to *A. henricksonii*, from which it differs morphologically (see key) and geographically. Fresh flowers show a slightly geniculate staminal column, but this feature is poorly if at all preserved in a dried specimen, so it does not enter into the preceding description. The pollen grains of this species have been described by Sánchez (1982).

19. ANODA RETICULATA S. Watson, Proc. Amer. Acad. arts 17:368. 1882.

Fig. 1F

Type: UNITED STATES. ARIZONA: Santa Catalina Mountains, May 1881, Lemmon and Pringle s.n. (holotype: GH).—*Note:* Pringle 284 (GH) and Pringle s.n. 16 May 1881 (VT) were presumably collected at the same time and place as the type.

Erect herbs ca. 1 m tall, the stems scabridulous (the hairs <0.5 mm long, rigid, simple, bifurcate, or stellate) and with some glandular hairs. Leaves petiolate, ovate when young but later leaves deeply 3-lobed (rarely 5-lobed), the lobes narrowly linear, 1–5 mm wide, the central lobe mostly 3–6 cm long, the lateral lobes 2–4 cm long, reduced upwards to filiform leaves and ultimately in the inflorescences to stipuliform bracts; the larger leaves serrate to subentire, with an irregular purple blotch along the midrib, minutely stellate-pubescent above and beneath, more densely so beneath. Pedicels solitary in the leaf axils or forming terminal (essentially leafless) racemes, slender, up to 8.5 cm long, articulated 4–8 mm below the flowers, with pubescence like that of the stems, the hairs scabridulous and often somewhat antrorse; calyces ca. 5 mm long (not accrescent), densely stellate-pubescent, half-divided, the lobes with prominent midribs, apiculate; petals 5–8 mm long (slightly longer than the calyces), lavender or purple, ciliate on the claws; staminal columns ca. 2 mm long, pallid, glabrous or with a few hairs, the filaments purplish, the anthers yellowish; styles and stigmas clavate,

yellowish, recurved. Fruits (Fig. 1F) obovate, 6–7 mm in diam, 3–4 mm tall, stellate-pubescent (the hairs ca. 0.5 mm long); mericarps 10–11, the dorsum of each rounded (the spur totally absent), the lateral walls evanescent, the solitary seeds completely enclosed in a black reticulate endocarp 2.5 mm long.

Specimens examined.—UNITED STATES. ARIZONA: Santa Cruz Co., Sycamore Canyon near Ruby, elev. 3500–3700 ft, 24 Sept. 1939, “petals dull purplish red,” *Kearney and Peebles 14453* (ARIZ-fragment); Santa Catalina Mtns., May 1881, *Lemmon and Pringle s.n.* (GH), 16 May 1881, *Pringle s.n.* (VT), *Pringle 284* (GH).—MEXICO. SONORA: San Bernardo, Río Mayo, 26 Feb. 1935, *Gentry 1355* (ARIZ, F, MICH, MO, WIS); 21 mi NE of Ures, *Drouet and Richards 3728* (F); 15 mi from Ures on road to Baviácara, elev 2860 [ft], 21 Sept. 1934, *Wiggins 7373A* (DS); Quiricoba, Distr. Alamos, palm-oak assoc., 14 Nov. 1933, *Gentry 818* (DS, MICH); Cañon Estrella, Distr. Alamos, *Gentry 433* (MICH); región de Bavispe, Cañon del Agua Amarga, *White 3618* (GH, MICH, US); about La Nopalera, Mpio. de Nacore Chico, *Muller 3674* (GH).—SINALOA: Cerro Colorado, 5 Nov. 1904, *Brandegee s.n.* (UC).

The distinctive features of *A. reticulata* are the total absence of spurs on the fruits and the distinctive trilobed leaves with linear lobes, at least on well-grown mid-stem leaves. It is sometimes confused with *A. thurberi* because of the similar small, bluish flowers, but these two species differ markedly in fruit characters (cf. Figs. 1F and 1L) and in leaf shape. The pollen grains of this species have been described by Sánchez (1982, as *A. thurberi*).

20. *Anoda speciosa* Fryxell, sp. nov.

Fig. 8

Type: MEXICO. Edo. MÉXICO: hills [N of] Toluca, 9000 ft, 23 Sept. 1900, *Pringle 9249* (holotype: VT; isotypes: GH, US).

Herbae vel suffrutices erecti, caulibus uniformiter stellato-scabridiusculis; foliis hastato-trilobis, profunde cordatis ad basem, minute stellato-pubescentibus; calycibus 12–15 mm longis; petalis lavandulis, 22–28 mm longis; columna staminali 20 mm longi, fere glabri; fructibus ignotis.

Herbs or subshrubs of unknown height, the stems uniformly scabridulous (the hairs stellate), sometimes purplish on one side. Leaf blades hastately 3-lobed, deeply cordate at the base, crenate-dentate or subentire, to 10 cm long (smaller and narrower upwards), acute or acuminate, somewhat discoloured, minutely stellate-pubescent throughout; petioles to 6.5 cm long, $\frac{1}{4}$ – $\frac{3}{4}$ as long as the blade, with pubescence like that of the stems; stipules 6–9 mm long, filiform. Pedicels solitary in the leaf axils, usually exceeding the subtending petioles, up to 5.5 cm long, more or less aggregated apically into racemiform inflorescences, with pubescence like that of the stems; calyces in flower 12–15 mm long, minutely stellate-pubescent, $\frac{2}{3}$ -divided, the lobes lanceolate-acuminate, 1-nerved; petals 22–28 mm long, 15–18 mm wide apically, tapered to a narrow claw, ciliate on the margins of the claws; staminal columns ca. 20 mm long, essentially glabrous but with a few minute hairs, pallid, bearing filaments apically; filaments 3–5 mm long, the anthers ca. 40, lavender (?), the pollen yellow-orange; styles and stigmas not seen. Fruits unknown.

The specific epithet is chosen in reference to the large and showy flowers. This species is characterized by an androecium subequal to the corolla (in common with *A. pubescens* and *A. henricksonii*), but with a larger corolla and larger staminal column than in these species. All three occur at relatively high elevations.

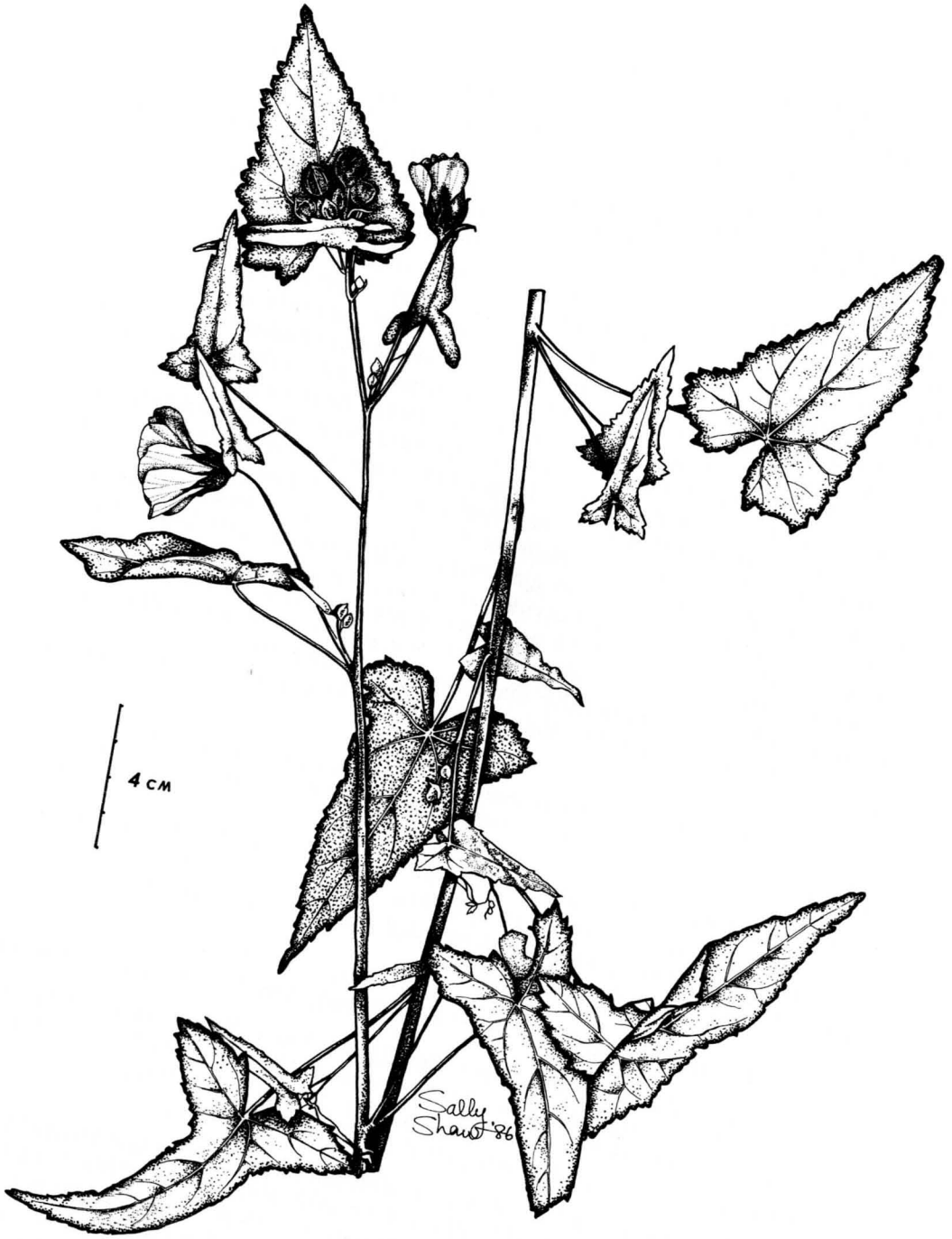


Fig. 8. *Anoda speciosa* (Pringle 9249).

21. *Anoda succulenta* Fryxell, sp. nov.

Type: MEXICO. CHIHUAHUA: La Cienegita, Río Mayo, canyon, Upper Sonoran, flower yellow, 10 Sep. 1936, *Gentry 2638* (holotype: DES).

Herbae erectae caulibus succulentis, fere glabris sed in petiolis pedicellisque seriebus angustis pilorum debilium et aliquot pilis pungentibus; foliis palmatim lobatis sinibus rotundatis prominentibus; pedicellis solitariis, folium consociatum subaequantibus; calycibus 10–12 mm longis, glabris vel in marginibus pilis perpaucis pungentibus; petalis 15–16 mm longis luteolis; fructibus ignotis.

Erect succulent herbs, 1.5 m tall, with thick hollow stems that are essentially glabrous. Leaf blades palmately 3–5-lobed, palmately 7-nerved, up to 11.5 cm long, about as wide, basally cordate-hastate (the sinus narrowly acute), entire, acute, the central lobe broadly ovate, narrowed at the base making the sinuses characteristically rounded, glabrous above and beneath and on the margins; petioles subequal to the blades, with a narrow line of weak hairs on the adaxial side and a few spinescent hairs 0.5–1 mm long, otherwise glabrous, sometimes purplish on the adaxial side; stipules 5–7 mm long, ciliate, caducous. Pedicels in the leaf axils, to 13 cm long (subequal to the subtending leaves at anthesis), with a narrow line of hairs and sometimes purplish on the adaxial side, otherwise glabrous; calyces 10–12 mm long, externally glabrous or with a few pungent hairs on the margins, internally woolly, half-divided or more, the lobes lanceolate, acute, 1-nerved; petals yellowish, 15–16 mm long, densely bearded on the margins of the claws (hairs 1 mm long), otherwise glabrous; staminal columns pallid, ca. 3 mm long, with a few hairs apically; filaments 2–3 mm long, the anthers yellowish, numerous; styles slender, pallid, the stigmas capitate (of uncertain number). Fruits unknown.

Paratypes examined.—MEXICO. SINALOA: Sierra Surotató, Quebrada de Mansana, oak forest, 4000–4500 ft, in rocky clearing, succulent hollow-stemmed herb 1.5 m high, fls. yellow, 10–11 Sep. 1941, *Gentry 6518* (DES).

As the specific epithet indicates, *Anoda succulenta* is distinctive (indeed apparently unique in the genus) for its hollow, succulent stems. It also has a leaf form (palmately lobed, with broad rounded sinuses) that is distinct within the genus. It may be allied to *A. pristina*.

22. *ANODA THURBERI* A. Gray, Proc. Amer. Acad. Arts 22:299. 1887. Fig. 1L

Lectotype: MEXICO. CHIHUAHUA: Sta. Eulalia Mtns., “along the railroad, just below Sta. Eulalia Station,” 3 Oct. 1885, *Pringle 283* (lectotype: GH; isolectotypes: BM, BR, COLO, DS-2, F, K, MASS, MO, NY-2, PENN, PH, RSA, UC, US, VT, WIS, pf). The lectotype was designated by Hochreutiner (1916).

Erect herbs ca. 1 m tall, the stems minutely pubescent with stellate and glandular hairs 0.2–0.4 mm long. Leaf blades 5–8 cm long, heteromorphic (the lowermost leaves ovate-cordate, mid-stem leaves hastately 3-lobed, the uppermost narrowly hastate or triangular), sometimes with an irregular purple blotch along the midrib and sometimes also with purple margins, obscurely or manifestly serrate, moderately or sparsely pubescent above and beneath, the hairs minute and stellate or rarely simple on upper surface; petioles half length of blade to subequal to the blade. Flowers solitary in the leaf axils or more commonly forming terminal racemes or open panicles more or less exceeding the leaves, the pedicels slender,

1–3 cm long, articulated 1–4 mm below the flower, with pubescence like that of the stems; calyces 3.5–6 mm long in flower, accrescent to 6–8 mm long in fruit, stellate-pubescent, half-divided or more, the lobes with a pronounced midrib, acute or apiculate, somewhat revolute in fruit; corollas 4–7 mm long, bluish lavender, often with dark centers, ciliate on the claws, otherwise glabrous; staminal columns 1.5–2(–4) mm long, stellate-pubescent, pallid or lavender, the filaments < 1 mm long, the anthers few (10–20), lavender, the pollen orangish; styles and stigmas barely exceeding the androecium, minutely clavate, yellowish. Fruits (Fig. 1L) obovate, 6–8 mm in diam, minutely pubescent (the stellate and glandular hairs to 0.5 mm long); mericarps 6–8, with dorsal spurs very short (or up to 1 mm long), the lateral walls evanescent; seeds solitary, 2–2.5 mm long, glabrous, the endocarp incomplete and fragile or absent. Chromosome number: $2n = 26, 28$ (Bates 1987).

Specimens examined.—UNITED STATES. ARIZONA: Chiricahua Mtns., Paradise, 5500 ft, 28 Sept. 1907, *Blumer 1670* (ARIZ, F, NY), *Blumer 1730* (ARIZ, DS, F, GH, MO, NY); Cochise Co., S of Tombstone (Hwy 80), 4200 ft, 24 Sept. 1940, *Grimes s.n.* (ARIZ); plain near Ft. Huachuca, 23 Oct. 1926, *Peebles, Harrison and Kearney 3381* (ARIZ); near Ft. Bowie, *Lemmon 515* (GH, UC); 2.9 mi SW of Bisbee city limits, 4600 ft, *Sanders et al. 5175* (UCR, pf).—MEXICO. SONORA: Bisore, *Lloyd 372* (GH).—CHIHUAHUA: Sta. Eulalia Mts., *Pringle 2349* (MO), *Pringle 283* (BM, BR, COLO DS-2, F, GH, K, MASS, NY-2, PENN, PH, RSA, UC, US, VT, WIS, pf); 10 km S of Progreso, just W of Coahuilan border, along Sierra Seca, *Stewart 2296* (GH, LL); Arroyo de Fierro, 35 mi SE of Camargo, 4600 ft, 24 Sept. 1938, *Shreve 8869* (ARIZ, GH, UC)—COAHUILA: ca. 26 air mi SE of Torreón in Sierra de Jimulco, 5800 ft [25°12'N, 103°16'W], *Henrickson 13245* (LL); cerca de Piedras Negras, *Paray 2558* (ENCB); Sierra del Pino, ca. 25 km NW of La Noria, *Stewart 1261* (GH).—DURANGO: ca. 20 km SW of Torreón near village of Chocolate, *Fryxell and Bates 2066* (BH, pf); 87 mi NE of Durango between Guadalupe Victoria and Cuencame, 6000 ft, *Rollins and Tryon 58286* (LL).—AGUASCALIENTES: near city of Aguascalientes, 9 Oct. 1903, *Rose and Painter 7744* (US).—GUANAJUATO: Taboada, cerca de Balneario, *Arguelles 1997* (MEXU, pf).—TAMAULIPAS: between Palmillas and Mi-quihuana, alt. 5000 ft, *Fryxell, Bates and Blanchard 1694* (BH, pf).—SAN LUIS POTOSÍ: Los Amoles, Mpio. de Guadalupe, alt. 1650 m, *Rzedowski 6768* (ENCB); 15 km al NW de Ciudad del Maíz, alt. 1200 m, *Rzedowski 9442* (ENCB).—QUERÉTARO: km 11, carretera a Celaya, *Arguelles 832* (CAS, MEXU); Camino a Celaya, pasando a Balvandra, *Arguelles 548* (MEXU).—HIDALGO: near Tula “vicinity of Dublin Station,” 6800 ft, *Pringle 6536* (CAS, CM, F, GH, MASS, MICH, MIN, MO, NY, US, VT, WIS, pf).—JALISCO: ca. 10 km NW of Huejuquilla El Alto, *Dieterle 3076* (MICH).—MICHOACÁN: Mpio, Benito Juárez, 43 km al S de Zitácuaro por la carr. a Huetamo, alt. 910 m, *Koch and Fryxell 8356* (CHAPA, MEXU, pf).—MORELOS: Cerro Acatlipa, *Vázquez 2067* (MEXU).—GUERRERO: Mpio. de Buena Vista de Cuellar, 8 km al N de Iguala, alt. 890 m, *Koch, Fryxell and Wendt 7983* (pf); between Taxco and Iguala, alt. 4700 ft, *Fryxell and Bates 2164* (BM, pf).—PUEBLA: SE of Izucar de Matamoros, alt. 4200 ft, *Fryxell 1138* (BH, CTES, pf); near San Luis Tultitlanapa, *Purpus 4187* (F, GH, MO, NY, UC).—OAXACA: Monte Albán, near Oaxaca City, *Smith 641* (F, MO, NY).

Anoda thurberi is a widespread species that is distinct for its small, blue-purple flowers, a characteristic it shares with *A. reticulata*, with which it is sometimes confused. These two species are clearly distinguished by leaf shape and fruit characters, however, and need not be confused. Bates (1987) has shown cytogenetic affinity of *A. thurberi* with *Periptera punicea*. Further study is needed to clarify the generic relations of *Anoda* and *Periptera* and the placement of *A. thurberi*.

23. *Anoda zuccagnii* (Sprengel) Fryxell, comb. nov.

Fig. 1H

Basionym: *Sida zuccagnii* Sprengel, Syst. 3:121. 1826, based on: *Sida acerifolia* Zuccagni in Roemer, Collect. 148. 1809 [non (Cavanilles) Medikus, 1787].—*Type:*

in cultivation from seeds from J. Bianchi, *Zuccagni s.n.* (FI-lost).—*Anoda acerifolia* (Zuccagni in Roemer) DC. Prodr. 1:459. 1824.—*Sida quinqueloba* DC. Prodr. 1:459. 1824, pro syn.

Annual or perennial herbs or subshrubs, erect or decumbent to prostrate, the stems prominently or obscurely hispid with the hairs spreading and retrorse, or almost glabrous. Leaves petiolate, palmately lobed below to narrowly hastate above, subentire, acute, sparsely pubescent to glabrate, sometimes with an irregular purple blotch along the midrib and sometimes also purple-margined. Flowers solitary in the leaf axils, with long peduncles; calyces 6–11 mm long in flower, accrescent to 10–15 mm long in fruit, often more or less hispid; petals purple or lavender, 12–18 mm long; androecia included, the staminal columns apically hispid, basally glabrous. Fruits (Fig. 1H) oblate, 8–11 mm in diam, without spines or with short spurs, densely hispid; mericarps 7–11, gibbous, indehiscent, the lateral walls evanescent; seeds solitary, glabrous, 2.5 mm long, lacking an endocarp surrounding each seed. Chromosome number: $2n = 30$ (Bates 1987).

Specimens examined.—MEXICO. BAJA CALIFORNIA: NW edge of Todos Santos, *Moran 6991* (DS, GH, SD); Comondú, *Wiggins 5493* (GH, MICH, NY, UC); floor of canyon above San José de Comondú, *Carter et al. 2111* (MEXU, UC).—SONORA: 16 mi S of Hermosillo, road to La Palma, *Wiggins and Rollins 196* (DS, GH, NY).—CHIHUAHUA: Southwestern Chihuahua, *Palmer 234* (GH, MICH, NY, US, pf).—SINALOA: ca. 20 mi SE of Villa Unión on rt. 54, *Lehto 24168* (ASU, pf); San Pedro, between Culiacán and Navolato, *Fryxell 3042* (BH, CTES, pf); near Mazatlán, *González-Ortega 5993* (POM); El Roble, Villa Unión, *González-Ortega 6530* (GH); Cerro Tecomate, W of Pericos, *Gentry 5774* (ARIZ, DES, MO); Mazatlán, *Wright 1205* (F, GH, UC); vic. Culiacán, *Rose et al. 14848* (F, GH, MO).—DURANGO: La Bajada, Tamazula, *González-Ortega 576* (MEXU).—TAMAULIPAS: Mpio. de Gómez-Farías, Ejido “Las Libertad,” 4 km al W de “El Encino,” *Romo 3* (pf).—NAYARIT: La Bahada, SE of San Blas, *Lehto 24246* (ASU, pf); 10 mi S of Las Varas between Tepic and Puerto Vallarta, *Croat 45395* (MO, pf); Tepic, *Ferris 5770* (US); 11 mi W of Compostela, *Graber 24c* (MICH).—JALISCO: 11 mi SW of Autlán toward La Huerta, *Spellenberg 6417* (MEXU, NMC, pf); 2 km al S de Venustiano Carranza, camino a Tolimán, *Lott and Magallanes 327* (MEXU, pf); Cocula, *Oliva 46* (IBUG); 20 mi NE of Autlán, *Rinehart 7060* (OKL); 5 mi E of Autlán, *Wilbur and Wilbur 2221* (MEXU, MICH); 2 km N of Puerto Vallarta, *Dieterle 3102a* (MICH).—COLIMA: Manzanillo, *Palmer 909* (GH, MICH, UC, US); S of Colima, 15 mi NE of Tecomán junction, *Fryxell, Bates and Blanchard 1614* (BH, pf); 1 km W of city of Colima, *Gilly et al. 69* (MICH).—SAN LUIS POTOSÍ: 6 mi NE of Xilitla, *King 4246* (F, MICH, UC); Tamazunchale, *Cottam 10535* (RSA).—MICHOACÁN: Coalcomán, *Hinton et al. 13663* (GH, NY, US, pf), *Hinton 12847* (MICH, UC), *Hinton 12523* (GH, MICH); 4 mi NW of Apatzingán, *McVaugh 17915* (MICH); 8 km SW of Neuva Italia, *Feddema 1716* (MICH).—MORELOS: Tehuixtla, *Duncan 69* (SMU, pf).—GUERRERO: 38 km al S de Chilpancingo, *Koch, Fryxell and Wendt 79126* (BH, CAS, CHAPA, ENCB, MEXU, NY, WIS, pf); 2 mi E of Acapulco above Hornita Beach, *Barkley 14175* (GH, POM, TAES); a orillas de la carr. Zihuatanejo-Ixtla, *Germán et al. 234* (MEXU, UC); Vallecitos, Montes de Oca, *Hinton 11632* (GH).—VERACRUZ: Mpio. de Jaltipan, 16 km al E de Acayucan, *Koch, Fryxell and Cowan 78209* (CHAPA, pf); La Granja, *Sousa 1336* (MEXU); Montepio, 19 km al E de Catemaco, *González-Quintero 2214* (MEXU).—OAXACA: Chiltepec and vic., *Martínez-Calderón 442* (UC); 1 km E of Yolox on road between Yolox and Comaltepec, alt. 1800 m, *Martin 351* (MEXU).—CHIAPAS: 3 km NW of Pueblo Nuevo Solistahuacán, *Thorne and Lathrop 41044* (DS); Mpio. La Independencia, 6–10 km NNE of La Soledad, 1600 m, *Breedlove 33488* (DS).—YUCATÁN: Dzibilchaltun, on roadside, *Bradburn and Darwin 1229* (NO, pf); Kancabxanot, *Gaumer 23549* (GH); Chichén Itzá, *Schwabe s.n.* (MEXU, pf); San Anselmo, *Gaumer 1611* (F, GH).—GUATEMALA. Champerico, Dept. Retalhuleu, *Standley 66650* (F).—HONDURAS: Zamorano, *Valerio 2189* (F); Río Yaguare, Dept. Morazán, *Williams and Molina 11248* (MICH), *11280* (F).—ECUADOR: Galápagos, Indefatigable Island, *Fosberg 44802* (MO-2, RSA); Charles Island, *Snodgrass and Heller 449* (GH).

Anoda zuccagnii and *A. cristata* are almost impossible to distinguish without fruits. Even with mature fruits, the distinction is sometimes problematical. The

two species are recognized as distinct in this study because there appear to be two distinct morphological modes (cf. distinctions given in key and Fig. 1G and Fig. 1H), although some overlap of certain character expressions exists, and a few individuals show intermediate expressions. For example, the number of carpels in *A. zuccagnii* varies between 7 and 11 with a modal value of 9; for *A. cristata* the range is 10 to 18 with a modal value of 13. Nevertheless, I recognize that genetic, cytological, and other studies may find that the recognition of two species cannot be supported. For the present, however, they appear distinct.

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APPENDIX

Names of doubtful identity, possible synonyms, and names of species excluded from *Anoda*.

<i>Anoda angustifolia</i> Sprengel	species dubia
<i>Anoda arenariaeflora</i> Hort. ex Steudel	= <i>Anoda crenatiflora</i> Ortega, fide Hochreutiner (1916)
<i>Anoda decumbens</i> (St.-Hil. & Naudin) Hochreutiner	= <i>Sida jussieana</i> DC.
<i>Anoda denudata</i> (Nees & Mart.) K. Schumann	= <i>Briquetia denudata</i> (Nees & Martius) Chodat & Hassler
<i>Anoda fernandeziana</i> Steudel	= <i>Anoda hastata</i> Cav., fide Reiche (1895)
<i>Anoda hirsuta</i> Philippi	= <i>Abutilon hirsutum</i> (Phil.) Reiche, fide Reiche (1895) [non (Vellozo) Schumann, 1891]
<i>Anoda incarnata</i> H.B.K.	= <i>Pteriptera punicea</i> (Lagasca) DC.
<i>Anoda ochsenii</i> Philippi	= <i>Corynabutilon ochsenii</i> (Phil.) Kearney
<i>Anoda ovata</i> Meyen	= <i>Sida fallax</i> Walpers, fide Hochreutiner (1916)
<i>Anoda periptera</i> (Sims) Hochr.	= <i>Pteriptera punicea</i> (Lagasca) DC.
<i>Anoda punicea</i> Lagasca	= <i>Pteriptera punicea</i> (Lagasca) DC.
<i>Anoda pygmaea</i> Correll	= <i>Fryxellia pygmaea</i> (Correll) Bates
<i>Anoda rubra</i> Tenore ex Hochr.	= <i>Pteriptera punicea</i> (Lagasca) DC.
<i>Anoda strictiflora</i> Steudel	= <i>Modiola caroliniana</i> (L.) G. Don
<i>Anoda waltherifolia</i> (Link) Schum.	= <i>Malvastrum tomentosum</i> (L.) S. R. Hill
