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A Synopsis of *Croton* (Euphorbiaceae) in Michoacán, Mexico †

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Abstract: A taxonomic and nomenclatural review of the genus *Croton* (Euphorbiaceae) in the Mexican state of Michoacán is presented. Six sections and 20 species are here reported. The greatest diversity is in the Balsas Depression province, where at least 12 species occur. There is a strong tendency to thrive in tropical deciduous forest. An identification key is provided, and for each species, the following information is included: protologue citation, type information, habit, habitat, and elevation within the state, regional and global distribution, and phenology. Relevant synonyms are listed, as too are herbarium specimens. Lectotypes are designated for *Croton draco*, *C. niveus*, and *C. calvescens*. One species, *Croton rojasii*, is described as new and illustrated with photos. It is known only from tropical deciduous forest in the Zicuirán-Infiernillo Biosphere Reserve, at elevations from 400 to 700 m. It belongs to sect. *Geiseleria* and is remarkable because of the strongly unequal pistillate sepals, the larger of which becoming accrescent and exceeding the fruit.

Keywords: Balsas Depression; new species; Pacific Lowlands; sect. *Geiseleria*; Sierra Madre del Sur; Trans-Mexican Volcanic Belt

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1. Introduction

Croton L. (Euphorbiaceae) contains approximately 1200 species and is one of the most diverse genera of flowering plants [1,2]. It is also among the most diverse genera in Mexico, where 124 to 127 species have been reported [3–5]. There is no comprehensive revision of the genus for the country, although several treatments have been published during the last 30 years [6–12]. It has also been revised for the southern Mexican states of Campeche, Chiapas, Quintana Roo, Tabasco, and Yucatán [13]. Important advances have been made on the understanding of the phylogenetics and classification of the genus, in particular van Ee et al. [2]. These authors recognize three subgenera, 31 sections, and 712 species in the New World, of which all subgenera and 14 sections occur in Mexico. In addition to providing an updated phylogenetically supported classification, noteworthy conclusions of their research regarding the Mexican taxa are the confirmation that the segregate genera *Julocroton* Mart. and *Eremocarpus* Benth. belong within *Croton* and the transfer of the widespread *Croton lobatus* L. to *Astraea* Klotzsch, as *A. lobata* (L.) Klotzsch.

Michoacán is the 16th largest state in Mexico (Figure 1) and the sixth most diverse for angiosperms [5]. Elevations range from sea level along the Pacific coast to 3840 m at the summit of Cerro Tancítaro. Vegetation includes tropical deciduous forest, oak woodlands, coniferous forest, xerophytic scrub, cloud forest, and subperennial tropical forests [14]. Four biogeographic provinces transverse the state: the Sierra Madre del Sur, the Pacific Lowlands, the Trans-Mexican Volcanic Belt, and the Balsas Depression [15]. The northern part of Michoacán forms part of the area of the *Flora del Bajío y de Regiones Adyacentes*, and the western portion was treated by the inactive *Flora Novo-Galiciana* and is now included within the *Flora de Jalisco y Áreas Colindantes*. However, much of the state is not covered by any floristic projects, and many un-botanized areas remain. These includes large expanses of the low-lying "tierra caliente" of central Michoacán and most of the mountainous Sierra Madre del Sur. In order to advance the understanding of the flora of Michoacán, in

particular the members of *Croton*, the current contribution provides a synopsis of the genus in the state, including the description of a new species.

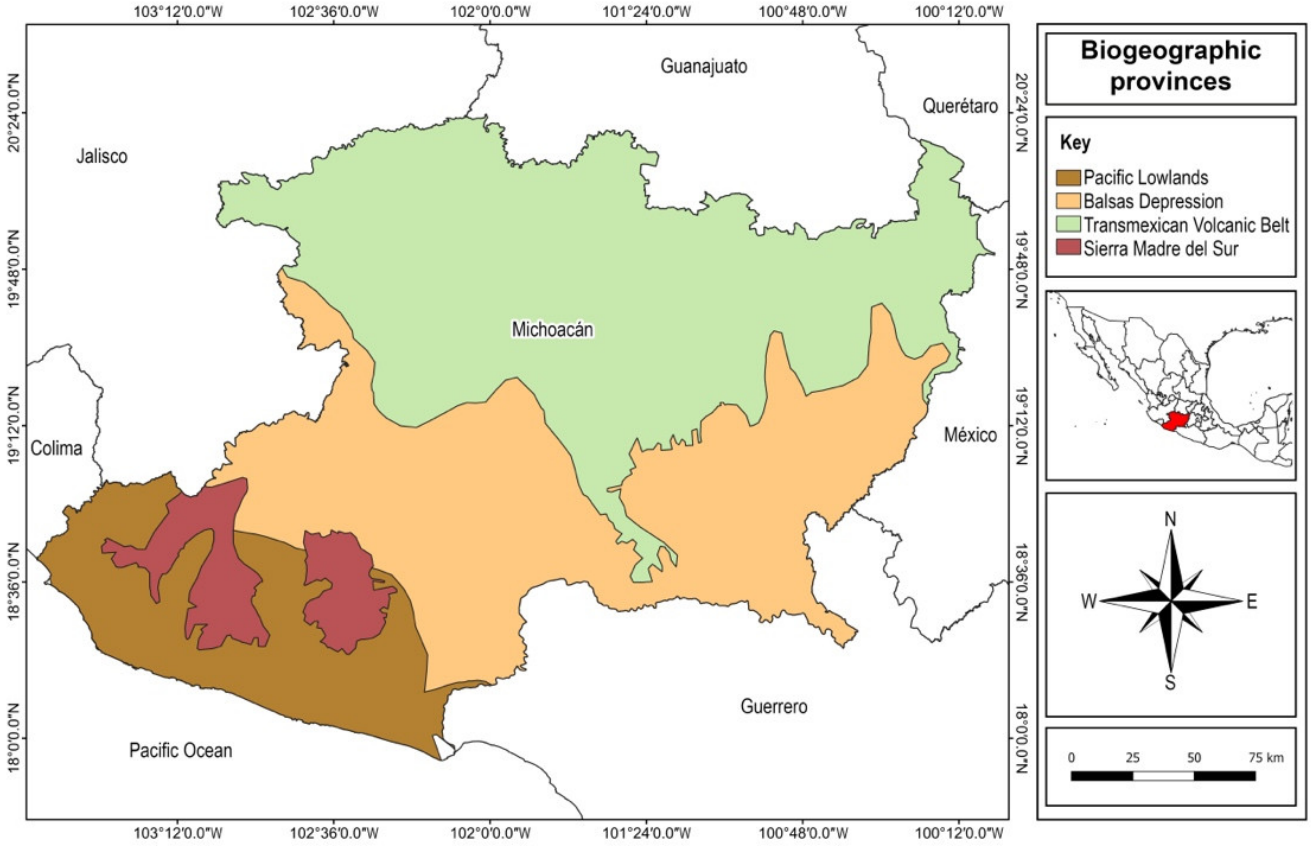

Figure 1. Map of Michoacán, Mexico.

2. Materials and Methods

This study is based on the examination of approximately 350 herbarium specimens housed in ARIZ, CIMI, EBUM, ENCB, IEB, MEXU, MICH, QMEX, and RSA, acronyms according to Thiers [16]. The collections at the Laboratorio Ecología y Sistemática Vegetal, Instituto de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México were also examined, and these are cited as "herb. Inst. Invest. Ecos. Sust." in the text because this herbarium is not formally registered in Index Herbariorum [16]. The 95 observations on iNaturalist (www.inaturalist.org, accessed on 15 November 2021) were consulted. Starting in 2001, fieldwork was conducted to observe living plants, collect herbarium specimens, and take photographs using a Nikon D-series digital camera with an AF-S MICRO 105 ED lens and a SIGMA EM 140 ring flash. Protologues of all the species and type specimens of all the species, except *Croton ciliatoglandulifer*, were consulted to insure proper use of names. Most of the types were examined through JSTOR Global Plants (plants.jstor.org, accessed on 15 September 2021), but in some instances, the physical specimens were examined. The description of the new species and the application of names follow the rules provided in the current International Code of Nomenclature for Algae, Fungi, and Plants [17]. The identification key was constructed using morphological features observable to the naked eye or with a stereoscope. The use of the terms extrafloral nectary and colleter follow Vitrarelli et al. [18]. Accepted names are listed in alphabetical order. For each species, the following information is provided: protologue citation, type information, common names registered within the state, habit, habitat, and elevation within the state, regional and global distribution, and phenology. Synonyms are only included for names that have been reported from Michoacán or were described

from an adjacent state. For species with five specimens or fewer, all collections are listed; for those with more than five specimens, only five representative specimens are provided. Finally, species that have previously been reported but not verified in this study are listed as excluded species. Taxonomic comments and/or other pertinent additional information are provided when necessary. Photos of the species are shown, of live plants in the field or herbarium specimens.

3. Results

Six sections and 20 species are reported from Michoacán (Table 1). These are shown in Appendix A, Figures A1–A20. One species is determined to be new to science and herein described: *Croton rojasii*. Two species are endemic to the state: *C. rojasii* and *C. atrostellatus*. Eight additional species are endemic to Mexico: *C. alamosanus*, *C. flavescens*, *C. lindquistii*, *C. roxanae*, *C. sphaerocarpus*, *C. suberosus*, *C. tenuilobus*, and *C. ynesae*. The remainder extend out of Mexico, mostly to Central and South America. Only *C. glandulosus* and *C. incanus* enter the United States.

Table 1. Sections and species of *Croton* present in Michoacán.

Section	Species
Adenophylli Griseb.	*C. adspersus*, *C. ciliatoglandulifer*, *C. flavescens*, *C. incanus*, *C. roxanae*, *C. sphaerocarpus*, *C. suberosus*, *C. xalapensis*, *C. ynesae*
Cyclostigma Griseb.	*C. draco*
Eluteria Griseb.	*C. lindquistii*, *C. niveus*
Geiseleria (A. Gray) Baill.	*C. glandulosus*, *C. hirtus*, *C. rojasii*, *C. repens*, *C.* aff. *ramillatus*
Lasiogyne (Klotzsch) Baill.	*C. alamosanus*, *C. atrostellatus*
Pedicellati B.W. van Ee and P.E. Berry	*C. tenuilobus*

The diversity in Michoacán is lower than that of the adjacent states of Guerrero and Jalisco, where 24 and 29 species are present respectively [6,8,19]. However, the Sierra Madre del Sur de Michoacán is much less explored and likely more species occur there than are currently documented. Nine species grow to both the south and north of Michoacán but have yet to be found in the state: *Croton acapulcensis* Martínez Gordillo and J. Jiménez-Ram., *C. argenteus* L., *C. billbergianus* Müll. Arg., *C. chamelensis* E.J. Lott, *C. conspurcatus* Schltdl., *C. guatemalensis* Lotsy, *C. pseudoniveus* Lundell, *C. reflexifolius* H.B.K., and *C. schiedeanus* Schltdl.

In Michoacán, the greatest diversity of *Croton* is in the Balsas Depression, where at least 12 species occur. *Croton* is a tropical genus, and within the state, there is a strong tendency to thrive in tropical deciduous forest. However, most of the different vegetation types house at least one species of *Croton*, except for aquatic vegetation. Only three species occur at elevations above 2000 m, with the upper elevational limit being reached by *C. adspersus* at 2400 m. In contrast, 14 species occur below 1000 m. It is worth mentioning that approximately 60% of the specimens are either *C. adspersus* or *C. sphaerocarpus*, and there is a strong bias of collections from the Bajío region of northern Michoacán. In contrast, there are few collections from the Sierra Madre del Sur and Pacific Lowlands, despite these areas being more diverse. Most species are reproductive during the rainy season from June to October, and only a small number flower at other times of the year.

4. Discussion (Taxonomic Synopsis)

Croton L., Sp. Pl. 1004. 1753. TYPE: *Croton tiglium* L. (lectotype designated by Britton [20])

The Michoacán species of *Croton* are herbs, shrubs, or small trees to 12 m tall; mostly aromatic with a pungent odor; drought deciduous or evergreen; monoecious or rarely dioecious (e.g., *C. alamosanus*); with latex; pubescence of stellate, lepidote, or dendritic trichomes. Leaves alternate, rarely appearing whorled below the inflorescence (e.g., *C. adspersus*), with

or without lateral stipules at the base, petiolate, entire, dentate, serrate, or serrulate to denticulate, often with extrafloral nectaries or colleters at the base of the blade or apex of the petiole, blades of deciduous species often turning yellowish or orangish at the start of the dry season. Inflorescences terminal or axillary thyrses, sometimes appearing spicate or racemose, unisexual or bisexual, the flowers solitary or in unisexual or bisexual (e.g., *C. draco*) cymules. Staminate flowers pedicellate, with 5 sepals distinct or united at the base, disc glandular, petals 5, free, stamens 8–45, filaments inflexed in bud, free, anthers basifixed, longitudinally dehiscent. Pistillate flowers sessile or pedicellate, with 5 sepals distinct or united at the base, equal or unequal, disc glandular, petals mostly absent, rarely 5 (e.g., *C. lindquistii* and *C. niveus*), free, ovary 3-locular, uniovulate, styles 3, bifid or multifid. Fruit capsular, dehiscing to leave a narrow columella, with 1 seed per locule. Seeds mostly smooth, carunculate.

Key to the species of *Croton* in Michoacán

1. Stipules, leaf margins, and pistillate sepals beset with numerous long, stipitate glands (colleters). *C. ciliatoglandulifer*
1. Stipules, leaf margins, and pistillate sepals lacking long, stipitate glands.
    2. Leaves linear, narrowly lanceolate or narrowly ovate, strictly entire, lacking extrafloral nectaries. *C. tenuilobus*
    2. Leaves ovate, elliptic or oblong, toothed, possessing extrafloral nectaries.
        3. Annual or perennial herbs, generally less than 50 cm tall but rarely robust individuals reaching to 1 m tall.
            4. Colleters subtending the bracts situated at the ends of long slender stipes. *C. hirtus*
            4. Colleters subtending the bracts sessile.
                5. Annuals; leaves smooth to the touch. *C. glandulosus*
                5. Perennial herbs; leaves asperous to the touch. *C. repens*
        3. Shrubs or trees, mostly more than 1 m tall or in the case of *C. adspersus* sometimes 0.5 m tall.
            6. Extrafloral nectaries present at the base of the leaf blade near the junction with the petiole or at the petiole just below its junction with the leaf blade.
                7. Leaves ovate to lanceolate, more than 7 cm long; inflorescences more than 10 cm long.
                    8. Lower nodes of the inflorescence with both staminate and pistillate flowers. *C. draco*
                    8. Lower nodes of the inflorescence with only pistillate flowers. *C. xalapensis*
                7. Leaves elliptic, less than 7 cm long; inflorescences less than 10 cm long.
                    9. Sepals of the pistillate flowers strongly unequal, the larger more than 6 mm long, accrescent and exceeding the fruit. *C. rojasii*
                    9. Sepals of the pistillate flowers slightly unequal, the larger less than 6 mm long, not accrescent and shorter than the fruit. *C.* aff. *ramillatus*
            6. Extrafloral nectaries lacking from the leaf blade and petiole.
                10. Pubescence at least in part of lepidote trichomes; pistillate flowers with well-developed petals.
                    11. Mature leaves ovate to cordiform; thyrses spiciform, very compact; the distal buds essentially the same size as the proximal buds, the axis obscured by the buds; fruiting pedicels less than 3 mm long; fruits subglobose. *C. lindquistii*
                    11. Mature leaves mostly lanceolate to narrowly ovate; thyrses racemiform, relatively loose, the axis visible; the distal buds much smaller than the proximal buds; fruiting pedicel more than 3 mm long; fruits subglobose or oblong. *C. niveus*
                10. Pubescence entirely of stellate trichomes, lepidote trichomes lacking; pistillate flowers lacking petals or these sometimes present in *C. atrostellatus*.
                    12. Styles multifid, with 12 or more terminal tips.
                        13. Herbage without black trichomes; leaves entire; inflorescences axillary; sepals of the pistillate flowers not reduplicate. Known from central and southern Michoacán in the Balsas Depression and along the Pacific Lowlands below 500 m. *C. alamosanus*

13. Herbage with scattered to dense black trichomes; leaves serrulate-denticulate; inflorescences terminal; sepals of the pistillate flowers reduplicate (folded in the middle towards the base and extending outwards). Known from the Trans-Mexican Volcanic Belt of northern Michoacán above 1800 m. *C. atrostellatus*

12. Styles bifid, with 6 terminal tips.

14. Leaves, at least most of them, serrate to dentate.

15. Twigs densely stellate pubescent to stellate tomentose; leaves serrulate to denticulate; stamens 10 or 11; styles 4–6 mm long, glabrous. *C. adspersus*
15. Twigs glabrous or sparsely stellate pubescent; leaves coarsely serrate to dentate; stamens 13–15; styles ca. 3 cm long, sparsely stellate pubescent. *C. ynesae*

14. Leaves entire.

16. Leaves oblong to elliptic, generally widest towards the middle. *C. incanus*
16. Leaves ovate, widest in the proximal half.

17. Stems and inflorescences scruffy with dendritic hairs.

18. Lower stems not becoming furrowed and corky; stipules 1–4 mm long; petioles 1–4.5 cm long; styles 2–2.5 mm long. *C. sphaerocarpus*
18. Lower stems often becoming furrowed and corky with age; stipules 8–20 mm long; petioles 3–11 cm long; styles 7–9 mm long. *C. suberosus*

17. Stems and inflorescences lacking stellate hairs, these sometimes stalked.

19. Leaves grayish, densely stellate-tomentose, the blade obscured or mostly obscured by the hairs; plants reproductive during the dry season, November–May. *C. adspersus*
19. Leaves greenish, stellate-pubescent, the blade clearly visible between the hairs; plants reproductive during the rainy season, June–October.

20. Capsules strongly keeled. *C. flavescens*
20. Capsules rounded. *C. roxanae*

1. *Croton adspersus* Benth., Pl. Hartwegianae 51. 1840. TYPE: Mexico. Michoacán. Morelia, July 1838, *T. Hartweg 389* (holotype: K(ex Herbarium Benthamianum)-000186006!; isotypes: E-00346736!, FI-011657!, G-00434418!, K(ex Herbarium Hookerianum)-000186005!, LD-1228929!, P-00623666!).

Croton calvescens S. Watson, Proc. Amer. Acad. Arts 26: 147. 1891. TYPE: Mexico. Jalisco: Chapala, October–November 1886, *E. Palmer* 706 (lectotype: GH-00047087!, here designated).

Shrubs 0.5–2(4) m tall; reproductive primarily during the rainy season from June to October but sporadically flowering throughout the year in response to moisture. Mostly in the understory and secondary vegetation of oak and pine oak forests, but also subtropical scrub, common across the Trans-Mexican Volcanic Belt (but see below); 1600–2400 m. Northern Mexico (Sinaloa) to Guatemala. *Peralillo*. Figures A1 and A17.

Representative specimens. mpio. Angamacutiro, along the road from Panindícuaro to Villachuato, 18 km NE of the Guadalajara-México Autopista and 4.5 km NE of Pueblo Nuevo, 20°06′35″ N, 101°41′05″ W, *V.W. Steinmann 1680* (ARIZ, IEB); mpio. Morelia, along Highway 15, ca. 20 km east of Moralia, 19°40′53″ N, 101°00′37″ W, *V.W. Steinmann* et al. *766* (ARIZ, IEB, MEXU); mpio. Uruapan, Uruapan, *C.G. Pringle 13605* (MICH); mpio. Zamora, B. los Guayabos, Chaparaco, *J.N. Labat 1313* (MEXU); mpio. Maravatío, La Nopalera, 12 km al SE de Maravatío, sobre la carretera a Tlalpujahua, *J. Rzedowski 51008* (IEB, MEXU).

This species is distinctive due to its dimorphic foliage. During the rainy season, the leaves are large and green. However, during the dry season from November to May, there are smaller, grayish, stellate-tomentose leaves. Although generally occurring above 1600 m, there is a single collection from the tropical deciduous forest of the Balsas Depression at approximately 500 m (*Soto Núñez* and *Ramos 807*, MEXU). Oddly enough, it is described as

a vine with yellow flowers, and almost certainly, there was a mix-up between the plant and the label.

Most of the type specimens of *Croton adspersus* do not include the date of collection and no date is provided in the protologue. The holotype gives the year as "1839" and the isotype at G gives it as "1837." The isotype at LD provides more precise information, stating "July" and "1838." According to McVaugh [21], Hartweg was in Morelia during the summer of 1838, so it is likely that the date from the LD specimen is correct.

Two collections are cited in the protologue of *Croton calvescens*: *Pringle 3346* and *Palmer 706.* Neither is designated as type. The *Palmer 706* specimen at GH was annotated by Leon Croizat as the holotype, and Webster [8] states that it is the holotype. Since Webster's publication is after 1 January, 2001, it cannot be considered an inadvertent lectotypification since the word lectotype was not used. In order to follow these euphorbiologists' intention, the specimen is here formally designated as lectotype.

2. *Croton alamosanus* [as *alamosanum*] Rose, Contr. U.S. Natl. Herb. 1: 111. 1891. TYPE: Mexico. Sonora: near Álamos, 16–30 September 1890, *E. Palmer 742* (lectotype: US-00851334!, designated by Webster ([8], p. 362); isolectotypes: K-000186017!, GH-00047078!).

Shrubs 1–4 m tall; reproductive from June to November. Tropical deciduous forest along the Pacific Lowlands and Balsas Depression; near sea level to 500 m. Endemic to Mexico, ranging from southern Sonora to Oaxaca and Puebla. Figure A2.

Representative specimens: mpio. Aquila, a 3 km al W de Puente Palos María, carr. Tecomán-Playa Azul, *E.J. Lott* et al. *1985* (MEXU); mpio. Apatzingán, Old lava flows 4 miles northwest of Apatzingán, *R. McVaugh 17935* (MEXU); VWS 3197 (IEB, MEXU, MICH); mpio. Churumuco, Ejido Llano Ojo de Agua, 18°42′15″ N, 101°38′54″ W, *G. Ibarra Manríquez 6823* (MEXU); mpio. Arteaga, 7 km al N de Morelos de Infiernillo, 18°21′ N, 101°54′ W, *I. Trejo 1430* (MEXU).

3. *Croton atrostellatus* V.W. Steinm., Contr. Univ. Michigan Herb. 24: 173(–175); Figure 1. 2005. TYPE: Michoacán: municipio de Angamacutiro, along the road from Panindícuaro to Villachuato, 18 km NE of the Guadalajara-México Autopista and 4.5 km NE of Pueblo Nuevo, 20°06′35″ N, 101°41′05″ W, ca. 1800 m, 19 June, 2001, *V.W. Steinmann 1681* (holotype: IEB-243595!; isotypes: DAV-154686!, DAV-160002!).

Shrubs, sometimes arborescent, 2–5 m tall; reproductive June to September. Subtropical scrub of northern Michoacán in the Bajío region of the Trans-Mexican Volcanic Belt; 1790–1950 m. Apparently endemic to Michoacán, although it may also occur in Guanajuato which is only about 15 km from its nearest known locality. Figure A4.

Additional specimens examined. mpio. Panindícuaro, Cerro La Cantera, *J.N. Labat 1112* (MEXU); mpio. Angamacutiro, vertiente S del Cerro Tres Reyes, cerca de Angamacutiro, *Rzedowski 52696* (IEB); mpio. Angamacutiro, sobre la carretera de Panindícuaro a Villachuato, 11.2 km al NE de la Autopista Guadalajara-México, 20°03′05″ N, 101°43′00″ W, *V.W. Steinmann* and *Y. Ramírez-Amezcua 8479* (QMEX).

The dimorphic stipules and black trichomes are distinctive features not present in any other species occurring in Michoacán.

4. *Croton ciliatoglandulifer* [as *ciliato-glanduliferum*] Ortega, Nov. Rar. Pl. Descr. Dec. 51. 1797. TYPE: based on living material cultivated at the Madrid Botanical Garden from seed sent by Sessé.—[MEXICO] "Nueva Espana", *Sessé* and *Mociño s.n.* (neotype: G-Barbey-Boissier, not seen, designated by Webster ([8], p. 373)).

Shrubs 0.5–3 m tall; reproductive at least from June to November. Mostly tropical deciduous forest and subtropical scrub but rarely in pine oak forest; widespread and often "weedy" in the Trans-Mexican Volcanic Belt and also known from the Sierra Madre del Sur in the vicinity of Coalcomán and Villa Victoria, but likely elsewhere; 1000–2100 m. Southwest United States to Central America and the Antilles. *Dominguilla*. Figure A3.

Representative specimens. mpio. Villamar, 1 km al E de Villamar, carr. Jiquilpan-Zamora, *J.C. Soto Núñez* and *R.T. Colín 2899* (MEXU); mpio. Coalcomán, Coalcomán, *G.B. Hinton* et al. 13879 (MICH); mpio. Huandacareo, 4 km al NW de Huandacareo, sobre la carr. a Villa Moreles, *S. Zamudio 4437* (IEB); mpio. de Santa Ana Maya, Manga Las Moras lomerio, 3 km al W de Santa Ana Maya, *J. Santos Martínez 1653* (ENCB, IEB, MEXU); 8 km S of Pátzcuaro, *V. Siplivinsky* et al. *4101* (COLO, MEXU).

The aptly named *Croton ciliatoglandulifer* is unmistakable among our species by possessing stipitate glands (colleters) along the leaf margin, stipules, and pistillate sepals.

5. *Croton draco* Schltdl. and Cham., Linnaea 6: 360. 1831. TYPE: Mexico. Veracruz: "in silvaticis Papantlam", February 1829, *F. Deppe* and *C.J.W. Schiede 1127* (lectotype: HAL-0098599!, here designated; isolectotype: HAL-0107558!).

Shrubs or trees 3–12 m tall; reproductive at least from July to October. Tropical deciduous and subdeciduous forests, oak woodland, and pine oak forest in the western portion of the Sierra Madre del Sur; 1100–1350 m. Northwestern Mexico (Sinaloa) to Panama. Figures A6 and A18.

Specimens examined. mpio. Chinicuila, 36 km al SO de Coalcomán, camino a Villa Victoria, *E.J. Lott* et al. *1907* (MEXU); 15 Km al SO de Coalcomán, camino a Villa Victoria, *J.C. Soto Núñez* et al. *11025* (MEXU); mpio. Chinicuila, 4 Km al NO de Tehuantepec, camino Coalcomán-Villa Victoria, *J.C. Soto Núñez* et al. *9415* (MEXU); mpio. Coalcomán, a 14 km al SW de Coalcomán, carr. a Coahuayana, *J.C. Soto Núñez* and *L. Cortés A. 2507* (MEXU); mpio. de Coalcomán, 22 km al S de Coalcomán y 5.5 km al S de Los Ocotes sobre el camino a San José de la Montaña, 18°38′39″ N, 103°09′05″ W, *V.W. Steinmann* et al. *6307* (QMEX).

The protologue states that this species is based Deppe and Schiede 1127 from Papantla, and Webster [8] indicates that the holotype is at HAL. However, there are two sheets at HAL, both annotated by von Chamisso, and the type status has not been indicated for either of them. One is sterile, and the other has flowers. The flowering sheet is here designated the lectotype. Although authorship of *C. draco* is often attributed to only Schlechtendal, the title page of the article in which it was published lists both Schlechtendal and Chamisso as the authors [22], and there is no subsequent indication that the species was described only by Schlechtendal.

The plants from Michoacán belong to *C. draco* subsp. *draco* characterized by possessing large, relatively broad stipules.

6. *Croton flavescens* Greenm., Proc. Amer. Acad. Arts 39: 81. 1903. TYPE: Mexico. Michoacán: Monte Leon Station [Monteleón, municipio de Yurécuaro], volcanic hills, 5000 ft, 29 August 1902, *C.G. Pringle* 8667 (holotype: GH-00047097!; isotypes: CM-1259!, E-00346725!, E-00346726!, E-00346727!, G-00434415!, GOET-003346!, HBG-516437!, K-000186022!, M-0242088!, MEXU-00017408!, MIN-1000742!, NY-00246463!, P-00623187!, P-00623188!, RSA-0002663!, S-07-14586!, UC-110598!, US-00109556!, US-00109557).

Croton flavescens var. *brandegeeanus* Croizat, J. Arnold Arbor. 26: 187. 1945. TYPE: Mexico. Sonora: 4 mi N of Nácori, between Mazapan and Matapé, 8 September, 1941, *I.L. Wiggins* and *R.C. Rollins 391* (holotype: A-00047098!; isotypes: ARIZ-BOT-0004186!, CAS-0002141!, LL-00031082!, MO-266522,! UC-721729!, US-00109558!).

Shrubs 1–4 m tall; reproductive from June to September. Tropical deciduous forest mostly along the Pacific Lowlands and the Balsas Depression; 200–800 m. Endemic to western Mexico from Sonora to Oaxaca. Figure A7.

Representative specimens. mpio. Múgica, 5.8 km al NNO de la salida a Nueva Italia, sobre un sendero que va de la Autopista Morelia-Lázaro Cárdenas al Río Marqués, 19°02′01″ N, 102°02′54″ W, *V.W. Steinmann 7081* (MEXU); mpio. Arteaga, along MEX 37, ca. 75 km (by road) N of Arteaga and 1 km S of El Descansadero, 18°38′41″ N, 101°58′10″ W, *V.W. Steinmann* et al. *1809* (IEB, MEXU, MICH); mpio. Los Reyes, barranca de Los Chorros de Varal, parte baja cerca del río, *I. García* et al. *8365* (CIMI); mpio. Huetamo, a 2 km al W de las Juntas de Sicangio, *J.C. Soto Núñez* and *E.M. Martínez 4182* (MEXU); mpio. Aguililla,

22 km al S de El Aguaje, camino Apatzingán-Aguililla, *J.C. Soto Núñez* et al. *9178* (MEXU); a 28 km de Tepalcatepec, carr. Tepalcatepec-Coalcomán, *J.C. Soto Núñez* and *L. Cortés A. 2494* (MEXU).

Croton flavescens is a distinctive taxon because of its keeled ovaries, and this feature distinguishes it from congeners in Michoacán. Martínez Gordillo [6] and Steinmann and Felger [7], recognized it as a distinct species, whereas Webster [8] reduced it to a synonym of *Croton morifolius* var. *brandegeeanus*. In the same publication, Webster treated *C. sphaerocarpus* as *C. morifolius* var. *sphaerocarpus*. According to Webster, the typical variety was described from material collected by Humboldt and Bonpland in Venezuela (holotype B-W-17854!) and is delimited as a widespread, neotropical lowland species ranging from Mexico (Nayarit and Veracruz) to Venezuela. Although not known from Michoacán, var. *morifolius* has been reported from adjacent Jalisco and Colima. Webster mentions "indications of intergradation" among the varieties. However, I have never seen any intermediates, and the varieties have distinct morphologies, distributions, and ecological preferences. As such, I think that they are distinct species.

7. *Croton glandulosus* L., Syst. Nat., ed. 10. 2: 1275. 1759. TYPE: Jamaica. *P. Browne 1* (lectotype: LINN-1140.7!, designated by Fawcett and Rendle ([23], p. 285)).

Annuals 0.2–0.5(1) m tall; reproductive at least in July to September and December to January and possibly throughout the year under favorable conditions of humidity. Tropical subdeciduous coastal forest along the Pacific Lowlands and oak woodlands of the Balsas Depression, often in disturbed areas; near sea level to 1050 m. Southeastern United States to Argentina and the Antilles and adventive in the Old World. Figure A9.

Specimens examined. mpio. de Tzitzio, along the road from Tzitzio to El Limón, ca. 1 km (by road) west of El Devanador, hillside south of the road, 19°23′14″ N, 100°50′10″ W, *V.W. Steinmann* and *S. Zamudio 4507* (IEB, MICH); mpio. Lázaro Cárdenas, Rancho El Malacate, ±2 km al sur de Solera de Agua, 18°00′16.4″ N, 102°26′00.5″ W, *V.W. Steinmann* and *Y. Ramírez-Amezcua 6536* (IEB), *8537* (QMEX).

Croton glandulosus is among the most widespread Neotropical species of the genus and is adventive in the Old World. It is morphologically variable, with more than 30 varieties having been described. van Ee et al. [24] conducted a detailed study of the taxon in the southeastern United States and concluded that five varieties are present in the region. Following their circumscription, our plants belong to var. *glandulosus*, which ranges from Mexico and the Antilles to South America. However, a critical infraspecific review outside of the United States is lacking.

8. *Croton hirtus* L'Hér., Strip. Nov. 17. 1785. *Croton glandulosus* var. *hirtus* (L'Hér.) Müll.Arg. in A.P. de Candolle, Prodr. 15(2.2): 684. 1866. *Croton glandulosus* subsp. *hirtus* (L'Hér.) Croizat, Bull. Torrey Bot. Club. 75: 401. 1948. TYPE: French Guiana. without a date or a precise locality, *L.C. Richard s.n.* (holotype: P-623551!; isotype: P-623550!).

Annuals 0.2–0.5 m tall; the known collections were flowering and fruiting in August, but its period of reproduction certainly is longer. Tropical deciduous and subdeciduous forests, oak woodland, and pine oak forest of the Balsas Depression and along the Pacific Lowlands, often in secondary vegetation; near sea level to 1300 m. Widespread and ruderal throughout the neotropics and adventive in the Old World. Figure A10.

Specimens examined. mpio. de Taretan, approximately 2 km al NE de Taretan, base SO del Cerro El Cobrero, 19°20′45″ N, 101°54′00″ W, *V.W. Steinmann* and *Y. Ramírez-Amezcua 8339* (QMEX); mpio. de Tzitzio, along the road from Tzitzio to El Limón, ca. 1 km (by road) W of El Devanador, hillside S of the road, 19°23′14″ N, 100°50′10″ W, *V.W. Steinmann* and *S. Zamudio 4506* (IEB, MEXU); Buena vista, 38 km al N de Playa Azul, *J.C. Soto Núñez 10208* (MEXU).

This widespread, "weedy" species is distinctive in having long-stipitate colleters subtending the flowers, and this feature separates it from its congeners in Michoacán.

9. *Croton incanus* H.B.K., Nov. Gen. Sp. 2: 73(–74) [quarto], 58(–59) [folio]. 1817. TYPE: Mexico. Hidalgo: "montium juxta Los Organos de Actopan", May 1803, *A.J.A. Bonpland* and *F.W.H.A. von Humboldt s.n.* (holotype: P-Bonpl-00669859!).

Croton torreyanus Müll. Arg. in A.P. de Candolle, Prodr. 15(2.2): 579. 1866. TYPE: United States. [Texas: Val Verde Co.], rocky hills at Painted Caves, 8 July 1852, *C. Wright 1802* (holotype: G-DC-00311997!; isotypes: F-303095!, GH-00267503!, NY-00246441!, US-00109780!, US-00109779!).

Shrubs 1–2 m tall; collected with flowers in July. Known in Michoacán from a single collection made in 1975 from a heavily cultivated area with some arborescent cacti; ±1600 m. This widespread species characteristic of the Chihuahuan Desert ranges from central Mexico to southern Texas, USA. The collection from Michoacán is disjunct from the nearest populations in Querétaro and Guanajuato. Figure A16D.

Specimen examined. E of Zamora along Hwy 15, *K. Torke* et al. *159* (MEXU).

Although the type of *Croton torreyanus* was listed as being from "Novo Mexico", the collection was made in Texas, and the species is not known from New Mexico.

10. *Croton lindquistii* V.W. Steinm., Phytotaxa 166(3): 236. 2014. TYPE: Mexico. Sonora: Mpio. Álamos, ca. 14 km (by air) ESE of Álamos, 2.6 km NE of Sabinito Sur, side canyon less than 0.5 km upstream from the El Guayabo crossing of the Río Cuchujaqui, 27°00′ N, 108°47′30″ W, 350 m, 12 March 1993, *V.W. Steinmann, C. Lindquist, T.R. Van Devender* and *R. Van Devender 93–106* (holotype: IEB!).

Shrub or small tree 3–7 m tall; reproductive in the dry season, at least from January to February, but plants often with dormant floral buds during much of the year. Tropical deciduous forest; 130–1000 m. Documented from the Balsas Depression in the central portion of the state, but expected also along the Pacific Lowlands. Endemic to Mexico, ranging from southern Sonora to Oaxaca. Figures A8 and A20.

Specimens examined. 19 km al S de Paso Real o 15 km al N de La Huacana, *L. Rico* and *E. Martínez 897* (IEB); probably Mpio. Gabriel Zamora, 15 km south of Taretán by the Morelia–Lázaro Cárdenas autopista, arroyo below the highway, ca. 19°14′20″ N, 101°53′W, *V.W. Steinmann* and *E. Carranza 2282* (ARIZ, IEB, MEXU); mpio. Los Reyes, barranca de Los Chorros de Varal, parte baja cerca del río, *I. García* et al. *7135* (CIMI); mpio. Múgica, along MEX 37, ca. 10 km (by road) SSW of Gabriel Zamora, 19°05′ N, 102°04′15″ W, *V.W. Steinmann* et al. *2313* (ARIZ, IEB, MEXU); mpio. de La Huacana, ca. 0.5 km NE of Los Ranchos, western base of Cerro El Barril, 18°42′20″ N, 102°00′30″ W, *V.W. Steinmann 3204* (QMEX).

This species is known as *vara blanca* in northwestern Mexico, where it is extensively harvested for its straight, durable trunks, which are used as fence posts and stakes in agricultural fields.

11. *Croton niveus* [as *niveum*] Jacq., Enum. Syst. Pl. 32. 1760. TYPE: [Colombia. Cartagena], *N.J. Jacquin s.n.* (lectotype BM-000947381!, here designated).

Croton septemnervius McVaugh, Brittonia 13: 165; Figure 13. 1961. TYPE: Mexico. Colima: Manzanillo, 1–31 December 1890, *E. Palmer 1058* (holotype: MICH-1104816!; isotypes: ARIZ-BOT-0004189!, F-707690!, GH-00047138, US-00109684!)

Shrubs or small trees 3–7 m tall; reproductive at least from August to October. Tropical deciduous and subdeciduous forest in the Pacific Lowlands of western Michoacán; 30–80 m. Widespread through western Mexico to Colombia and Venezuela, as well as the Lesser Antilles. Figure A16E.

Specimens examined. mpio. Aquila, sobre MEX 200, 4 km al O de La Placita, 18°33′41″ N, 103°36′43″ W, *Y. Ramírez-Amezcua* et al. *803B* (QMEX); mpio. Coahuayana, a ca. 4 km al SE de San Juan de Lima por la carr. Tecomán, Col.–Playa Azul, *E.J. Lott* et al. *et al. 1954* (MEXU); mpio. Aquila, a 7 km al E de La Placita, carr. Tecomán, Col.-Playa Azul, lomas que dan hacía el mar, *E.J. Lott* et al. *1957* (MEXU).

This was one of the first species of *Croton* described, and the protologue [25] provides little to reveal the identity of the species, stating only: *Foliis ovato-cordatis, serrulatis, dorso*

tomentosis. However, a more complete description with the type locality was given three years later, and a leaf was illustrated [26]. Webster [8] neotypified the name choosing the specimen *A. Schott s.n.*, from Cartagena, Colombia (MO-1905037). He did not discuss why neotypification was necessary or his decision to designate the Schott specimen. A neotypification is warranted when original material cannot be found [17]. However, in the case of *Croton niveus*, the original material includes a specimen at BM from Jacquin's herbarium. The specimen consists of a single leaf, and it is certainly the basis for Jacquin's illustration. This collection, although consisting of only one leaf, appears sufficient to allow its identification as *C. niveus*, especially considering that its origin is known. It is here designated as the lectotype.

12. *Croton repens* Schltdl., Linnaea 19: 237(–238). 1846. TYPE: Mexico. Veracruz: Hacienda de la Laguna, July 1929, *C.J.W. Schiede* (40) (lectotype: HAL-0098379!, designated by Webster ([8], p. 362).

Low perennial herbs 0.2–0.5 m tall; reproductive at least from July to September. Pine oak forests as well as oak woodland and its transition to tropical deciduous forest of the Balsas Depression; 800–1300 m. Widespread from Sinaloa and Tamaulipas to Central America (El Salvador and Honduras). Figure A12.

Specimens examined. mpio. de Arteaga, 3 km al NE de Puerto San Salvador por MEX 37 (libre), unos 300 m al NO de la carretera; 18°25′59″ N, 102°06′28″ W, *V.W. Steinmann* et al. *7751* (QMEX); mpio. Taretan, along the Morelia-Lázaro Cárdenas autopista, 2 km south of the exit for Taretan, gently sloping hillside E of the highway, ca. 19°20′00″ N, 101°54′00″ W, *V.W. Steinmann 4569* (IEB); mpio. de Tzitzio, along the road from Tzitzio to El Limón, ca. 1 km (by road) W of El Devanador, rocky hillside south of the road, 19°23′14″ N, 100°50′10″ W, *V.W. Steinmann* and *S. Zamudio 4501* (IEB).

In the protologue, Schlechtendal mentions Schiede n. 40. and three collections by F.E. Leibold. Webster ([8], p. 362) lectotypified the name by "Schiede 40" at "HAL." Although, the collection number is not given on the sheet at HAL, the rest of the information on the label corresponds to his designation.

13. *Croton rojasii* sp. nov. TYPE: Mexico. Michoacán: mpio. Churumuco, La Barranca, Ejido Llano de Ojo de Agua, 18°42′33″ N, 101°40′07″ W, [426 m], 10 July 2014, *M. Rojas 85* (holotype: QMEX!; isotype: herb. Inst. Invest. Ecos. Sust.). Figure A13.

Shrubs to 2 m tall, monoecious; bark of terminal branches dark brown, smooth; stems stellate-pubescent, trichomes adpressed-rotate or sometimes stellate-porrect with an erect central radius 0.9–1.2 mm long. Leaves alternate; stipules linear to filiform, sparsely stellate pubescent, 2.7–5.8 mm long, 0.3 mm wide; petiole 0.4–0.8 cm long, stellate-pubescent with hairs like those of the stem, but the radii often ascending, 2(4) lateral stipitate-infundibuliform extrafloral nectaries just below the junction with the blade, these are 0.4–1.0 mm long, 0.2–0.3 mm wide at the opening, yellowish, sometimes also with 1–4 dark conical colleters 0.1–0.2 mm long; blade elliptic, 2.5–5 cm long, 0.7–2.2 cm wide, apex acute to obtuse, base attenuate, margin entire or sometimes inconspicuously serrulate, the teeth terminating in an inconspicuous minute colleter, both surfaces stellate-pubescent, pinnate with 3–6 pairs of secondary veins. Inflorescences terminal, bisexual or staminate, rachis stellate-tomentose; the staminate 1.4–2.8 cm long, including a peduncle 6–8 mm long, with 12–20 flowers; the bisexual 1.4–2.4 mm long, without a well-defined peduncle, with 12–15 pistillate flowers at the base and 7–17 staminate flowers distally; bracts similar in size and shape to the stipules, each side at the base with 2–4 bottle-shaped dark or yellow colleters 0.2 mm long. Staminate flowers on a slender stellate-pilose pedicel 1.1–3.1 mm long; sepals 5, united at the base, deltoid to ovate, 1.8–2.2 mm long, stellate-pubescent, petals 5, strap-shaped, 1.7–2.2 mm long, 0.3–0.4 mm wide, villose, stamens 8–10, filaments 2.0–2.4 mm long, filiform, villous at base, glabrous above, anthers oblong to elliptic, 0.6–0.7 mm long. Pistillate flowers subsessile or on a stout stellate-hirsute pedicel to 2.0 mm long; sepals 5, free, strongly unequal, the 2 or 3 larger sepals accrescent in fruit, much longer than the ovary and fruit, lanceolate to elliptic, (6)9–12 mm long, 1–3 mm wide,

conduplicate–cucullate, acute, outer surface stellate-hirsute towards the base, inner surface stellate-pubescent, the 2 or 3 reduced sepals linear to subulate, 1.5–5 mm long, 0.2–0.5 mm wide, stellate pubescent; petals absent; ovary globose, stellate-hirsute, styles 3, bifid to the base, the divisions filiform, 3.2–3.6 mm long, recurved at the apex, stellate-pubescent and microscopically papillose. Capsules (young) subglobose, lightly 3-lobed, stellate-pubescent, some of the trichomes long porrect. Seeds not seen.

Paratypes. mpio. Churumuco, Llano de Ojo de Agua, 18°41′45″ N, 101°39′33″ W, [448 m], 28 July 2003, *S. Rangel-Landa 884* (QMEX); Ejido Llano de Ojo de Agua, 18°42′58.903″ N, 101°40′19.519″ W, 690 m, 4 July 2013, *K.B. Hernández Esquivel* et al. *24* (QMEX).

Endemic to Michoacán and known only from the tropical deciduous forest of the Zicuirán-Infiernillo Biosphere Reserve; 400–700 m. It flowers from June to August. The species is known locally as *oreganillo*, a name that is also applied in the region to the sympatric *Croton alamosanus*.

Croton rojasii is named in honor of Misael Rojas López, a naturalist from the community of Llano de Ojo de Agua, municipio de Churumuco, Michoacán. It is in recognition of his significant contributions to the biota of this area, including the co-authorship of a floristic checklist of the region [27]. He also collected the type specimen.

Croton rojasii belongs to sect. *Geiseleria*, as defined by van Ee et al. [2] and Riina et al. [12], on the basis of having stellate pubescence, a sometimes serrulate leaf margin, stipitate-infundibuliform extrafloral nectaries at the apex of the petiole, and bisexual inflorescences with unisexual cymules. The distinctly unequal sepals of the pistillate flowers indicate its placement in subsection *Geiseleria* (A. Gray) B.W. van Ee and P.E. Berry. It is similar to *Croton ramillatus* Croizat, from which it differs by possessing strongly unequal pistillate sepals, the larger of which are conduplicate–cucullate, more than twice as long as the smaller, and accrescent and greatly exceeding the fruit. The pistillate sepals of *C. ramillatus* are slightly unequal, merely curved, nearly equal in length, and non-accrescent. A specimen from Oaxaca (*King 1231*, MICH) also appears to possess the distinctive pistillate sepals of *C. rojasii*, but more study is necessary to determine if it is conspecific.

The following sterile specimen from nearby Michoacán may also belong here, but it is unusual in possessing glabrous herbage. Reproductive material is needed to determine its identity: mpio. La Huacana, El Lindero, Rancho Las Pilas, fondo de cañada, 27 August, 2004, *X. Madrigal Sánchez* and *S. Ontiveras Alvarado 77* (QMEX).

14. *Croton roxanae* Croizat, J. Arnold. Arbor. 21: 81(–82). 1940. TYPE: Mexico. Nayarit: Tres María Islands, María Madre, woods just south of the Penal colony, 22 October 1925, *R.S. Ferris* 5601 (holotype: A-00047136!; isotypes: DS-145716!, US-00109676!).

Shrubs 2–3 m tall; reproductive July to September. Tropical deciduous and subdeciduous forests along the Pacific Lowlands, Sierra Madre del Sur, and Balsas Depression; near sea level to 1700 m. Endemic to Mexico, from southern Sinaloa to Oaxaca. Figures A11 and A19.

Representative specimens. mpio. Tzitzio, along the road from Tzitzio to El Limón, ca. 8.6 km (by road) SE of the turnoff to Tafetán and 2.6 km SE of Puente La Magdalena, 19°23′04″ N, 100°51′36″ W, *V.W. Steinmann 4435* (IEB, MICH); mpio. La Huacana, Sierra Las Cruces, ca. 6.5 km west of Los Ranchos, near Los Cueramos, 18°42′45″ N, 102°04′57″ W, *V.W. Steinmann 4346* (QMEX); mpio. Aquila, 2 mi N of La Placita, *B.L. Turner 2085* (MICH); mpio. de Coalcomán, 10.5 km al O-SO de Coalcomán, sobre la carretera a Aquila, 18°43′58″ N, 103°14′04″ W, *V.W. Steinmann* and *Y. Ramírez-Amezcua* 7098 (IEB); Zitácuaro-La Florida, *G.B. Hinton* et al. *11978* (MICH); mpio. Los Reyes, barranca de Los Chorros de Varal, parte baja cerca del río, *I. García* et al. *8364* (CIMI); mpio. de Villa Madero, sobre el camino de Villa Madero a San Diego Curucupatzeo, 7.5 km al ESE de La Cumbre, 19°20′27″ N, 101°10′55″ W, *Y. Ramírez-Amezcua* and *V.W. Steinmann 1393* (QMEX).

Webster [8] characterized *C. roxanae* as having glabrous staminate pedicels and sepals, but some of our plants, otherwise appearing to belong to the taxon and without observable differences, have stellate-pubescent staminate pedicels and sepals, e.g., *Y. Ramírez-Amezcua* and *V.W. Steinmann 1393*.

15. *Croton sphaerocarpus* H.B.K., Nov. Gen. Sp. 2: 84 [quarto], 67 [folio]; Table 105. 1817. *Croton morifolius* Willd. var. *sphaerocarpus* (H.B.K.) Müll.Arg., Linnaea 34(1):125. 1865. TYPE. Mexico. Michoacán: "montis ignivomi Jorullo", September 1803, *A.J.A. Bonpland* and *F.W.H.A. von Humboldt s.n.* (holotype: P-Bonpl-00669883!; isotypes A-00107065!, A-00277549!, P-00129829!).

Shrub to 3 m tall; reproductive mostly during the rainy season from June to October, but occasionally with flowers in January. Mostly subtropical scrub though also in pine oak forest and oak woodlands of the Trans-Mexican Volcanic Belt and the upper slopes of the Balsas Depression. 1450–2350 m. Central Mexico from Nayarit and Zacatecas to Puebla and Morelos.

Representative specimens. mpio. Erongarícuaro, cerca de Oponguio, *J. Rzedowski 39083* (ENCB, IEB, MEXU); mpio. Aguililla, 17.6 km (por el camino) al OSO de La Paz rumbo a Dos Aguas, 18°46′00″ N, 102°50′45″ W, *V.W. Steinmann* et al. *4014* (IEB, MICH); mpio. Huaniqueo, ca. 0.5 km al SO de Tendeparacua, el pedregal pequeño, 19°53′42″ N, 101°26′22″ W, *V.W. Steinmann* et al. *4295* (IEB, MICH); mpio. Jiquilpan, Cerro Santa María, 8–10 km SW of Jiquilpan and ca. 5 km NE of Quitupan, Jalisco, *C. Feddema 241* (MEXU, MICH); mpio. Contepec, El Tambor, approximately 3 km al E de Tepuxtepec, *S. Zamudio* and *R. Murillo* 4975 (IEB, MEXU).

This species and *C. flavescens* have been treated as varieties of *C. morifolius* by Webster [8], but as discussed under the former, the varieties are here treated as distinct species. *Croton sphaerocarpus* is distinguished from *C. morifolius* by having a dense indumentum of dendritic trichomes and smaller stipules, as well as a distinct range that is restricted higher elevations in central Mexico. In comparison, *C. morifolius* is a mostly lowland species distributed along the Pacific slope of Mexico to northern South America [8].

16. *Croton suberosus* H.B.K., Nov. Gen. Sp. 2: 86 [quarto], 68 [folio]. 1817. TYPE: Mexico. Guerrero: "prope Acapulco ad litora Oceani Pacifici", 1803, *A.J.A. Bonpland* and *F.W.H.A. von Humboldt 3862* (holotype: P-Bonpl-00669886!; isotype: P-00129826!).

Shrubs 1–2 m tall; flowering throughout the year under favorable conditions of humidity. Tropical deciduous and subdeciduous forest, often secondary vegetation, along the Pacific Lowlands and the Infiernillo region of the Balsas Depression; near sea level to 800 m. Endemic to Mexico mostly along the Pacific Lowlands from Sinaloa to Oaxaca. *Oreja de tigre*. Figure A5.

Representative specimens. mpio. Aquila, 5 km de Paso de Noria, carretera a Cachán, 18°15′14″ N, 103°16′46″ W, *E. Carranza 6891* (IEB, MEXU); along the highway S from Cuatro Caminos, 40 mi N of Arteaga, *R. McVaugh 22533* (MICH); mpio. Arteaga, along the rd to Infiernillo, 14 km (by rd) SE of the junction with MEX 37, 18°26′08″ N, 101°57′51″ W, *V.W. Steinmann* and *P.I. Steinmann 1658* (IEB, MEXU, MICH); mpio. Chinicuila, a 11 km al SO de Villa Victoria, *J.C. Soto Núñez 9471* (MEXU); mpio. Lázaro Cárdenas, en Caleta de Campos *J.C. Soto Núñez* and *G. Silva R. 4512* (MEXU).

17. *Croton tenuilobus* S. Watson, Proc. Amer. Acad. Arts 21: 439. 1886. Mexico. Chihuahua: Hacienda San José, S of Batopilas, August 1885, *E. Palmer 29* (holotype: GH-00047155!; isotypes: G-00434654!; K-000186030!; MEXU-00017211!; NY-00246494!, NY-00246495!, PH-0007336!; US-00109774!, VT-026649!).

Annual or perennial herbs 0.3–1 m tall, sometimes becoming woody at the base; the two known collections from the state were both made with flowers and fruits in November, but it is probably reproductive from August to November. Dry grassy hills and *Dodonea* scrub in the western portion of the Sierra Madre del Sur; 750–1100 m. Endemic to western Mexico from Sonora to the state of México. Figure A16C.

Specimens examined. mpio. Coalcomán, Coalcomán, *G.B. Hinton* et al. *12690* (MEXU, MICH); mpio. Aquila, terracería a la mina "Varicosta", 13 km al N de la carr. costera, *S.D. Koch* and *P. A. Fryxell 83185* (MEXU, MICH).

Various authors have synonymized this species with the South American *Croton pedicellatus* H.B.K. [7,8,28]. I follow van Ee and Berry [9,10] in treating it as a distinct species

distinguished from *C. pedicellatus* by a shorter, abruptly recurved pedicel. Molecular evidence also supports its recognition.

18. *Croton xalapensis* H.B.K., Nov. Gen. Sp. 2: 85 [quarto], 67(–68) [folio]. 1817. TYPE: Mexico. Veracruz: "prope Xalapa", February 1804, *A.J.A. Bonpland* and *F.W.H.A. von Humboldt 4459* (holotype: P-Bonpl-00669885!; isotype: P-00129825!).

Shrubs or trees 1–8 m tall; collected with flowers and fruits in April. "Woods" [probably tropical deciduous or subdeciduous forest] in the Sierra Madre del Sur near Coalcomán; 700 m. Central Mexico (Michoacán and Veracruz) south to at least Costa Rica in Central America, and reported from Colombia [29]; the plants in Michoacán are disjunct more than 300 km from the nearest populations in Oaxaca. Figure A16A.

Specimen examined. mpio. Coalcomán, San Pedro, *G.B. Hinton* et al. *15899* (MICH).

19. *Croton ynesae* Croizat, J. Arnold. Arbor. 21: 83. 1940. TYPE: Mexico. Jalisco: Santa Cruz de Vallarta, 300 m, 10 December 1926, *Y. Mexia 1279* (holotype: A-00047160!; isotypes: CAS-157246!; DS-182750!; F-682118!; MICH-1104811!; US-00109795!).

Shrubs 2–4 m tall; reproductive during September and October and probably also other months of the rainy season. Pine oak forest and tropical subdeciduous forest in the Coalcomán region of the Sierra Madre del Sur; ca. 1500 m. Endemic to the Pacific slope of Mexico from Nayarit to at least Michoacán. It was reported from Guerrero by Webster [8], but not included by Martinez [6] in her revision. Figure A16B.

Specimens examined. 25 Km al SO de Coalcomán, por el camino a Villa Victoria, *J.C. Soto Núñez* et al. *11071* (MEXU); mpio. Coalcomán, 22 km al SO de Coalcomán, por la terracería a Villa Victoria, *S.D. Koch* et al. *87171* (MICH).

20. *Croton* aff. *ramillatus* Croizat

Shrubs 3 m tall; flowering from June to July, with fruits in August. Tropical deciduous and subdeciduous forest; ±800 m. Figure A14.

Specimens examined. mpio. La Huacana, Sierra Las Cruces, ca. 6.5 km W of Los Ranchos, near Los Cueramos, 18°42′45″ N, 102°04′57″ W, *V.W. Steinmann 4345* (QMEX); Mpio. La Huacana, Sierra Las Cruces, 7.5 km (en línea recta) al OSO de Los Ranchos, alrededores de la Ciénega del Plátano, 18°41′15″ N, 102°05′07″ W, *V.W. Steinmann 5138* (QMEX); Mpio. La Huacana, Sierra Las Cruces, 7.5 km (en línea recta) al SO de Los Ranchos, sobre la vereda a la Mesa del General, 18°40′15″ N, 102°04′30″ W, *V.W. Steinmann 5193* (QMEX).

This enigmatic species is currently known from the Zicuirán-Infiernillo Biosphere Reserve in the Balsas Depression. It is most similar to *Croton ramillatus*, of which it may be a variant. Until a more detailed study of the variable *C. ramillatus* is conducted, I hesitate to put a name on it.

Excluded Species

Croton fragilis H.B.K. This species was reported as *Croton* aff. *fragilis* by Rodríguez and Espinosa [30], but the specimen cited (*King 4884*, MEXU) is *Croton flavescens*.

Croton morifolius Willd. This species was reported by Villaseñor [5], but no specimens were cited. It may be present, but the report likely corresponds to *C. sphaerocarpus* or *C. flavescens*, both of which are common in the state and have been treated as varieties of *C. morifolius*.

Croton pedicellatus H.B.K. This species was reported by Webster [8] and Rodríguez and Espinoza [30], but the specimens cited are *Croton tenuilobus*, which had been treated as a synonym of *C. pedicellatus*. See van Ee and Berry [9,10] for a detailed discussion about the resurrection of *C. tenuilobus*.

Croton lobatus L. This species was reported by Webster [8] and Rodríguez and Espinoza [30], but it is now treated as *Astraea lobata* (L.) Klotzsch [2,31].

Croton fantzianus F. Seym. This species was reported by Villaseñor (2016). Although no specimens were cited, it almost certainly refers to *C. lindquistii*, to which the name has been misapplied [32].

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Data Availability Statement: Not applicable.

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Conflicts of Interest: The author declares no conflict of interest.

Appendix A

Photographs and illustrations of the *Croton* species occurring in Michoacán, Mexico. All photos are by V.W. Steinmann unless otherwise indicated.

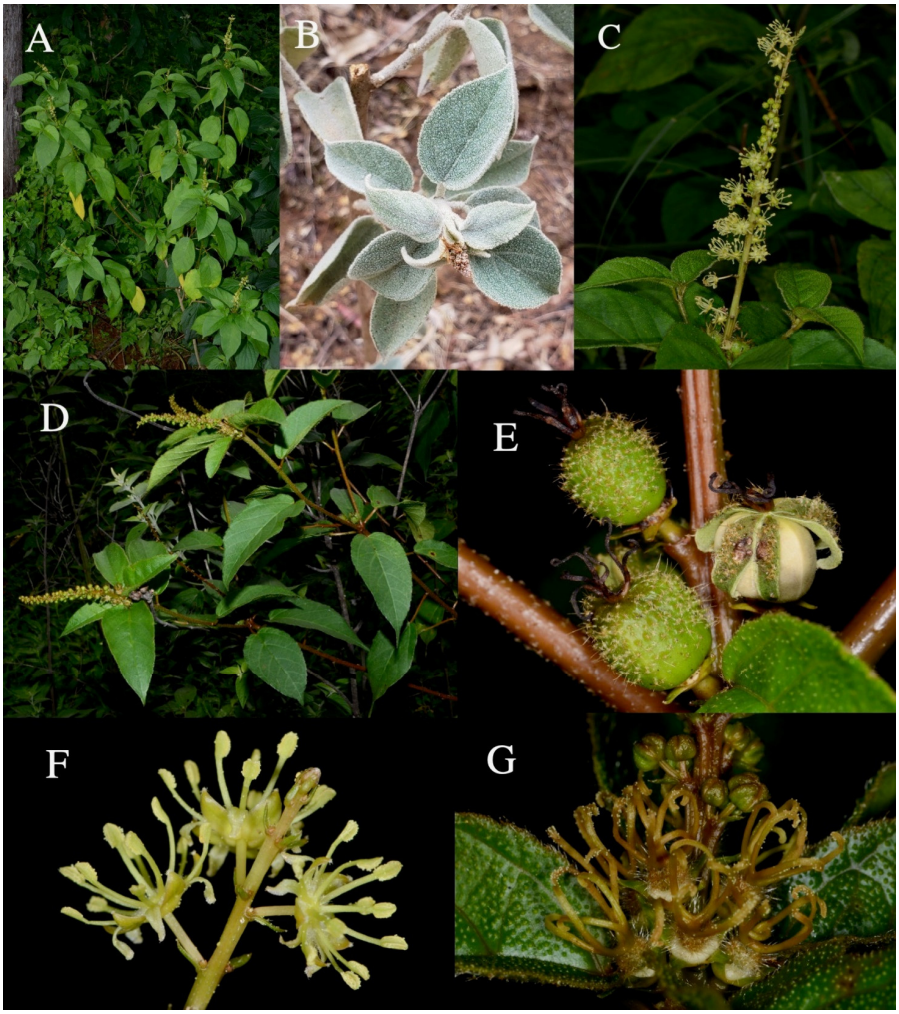

Figure A1. *Croton adspersus.* (**A**) Habit. (**B**) Dry season leaves and young inflorescence. (**C**) Inflorescence. (**D**) Flowering branches. (**E**) Fruits. (**F**) Staminate flowers. (**G**) Pistillate flowers. B photographed by Ignacio Torres and used with permission.

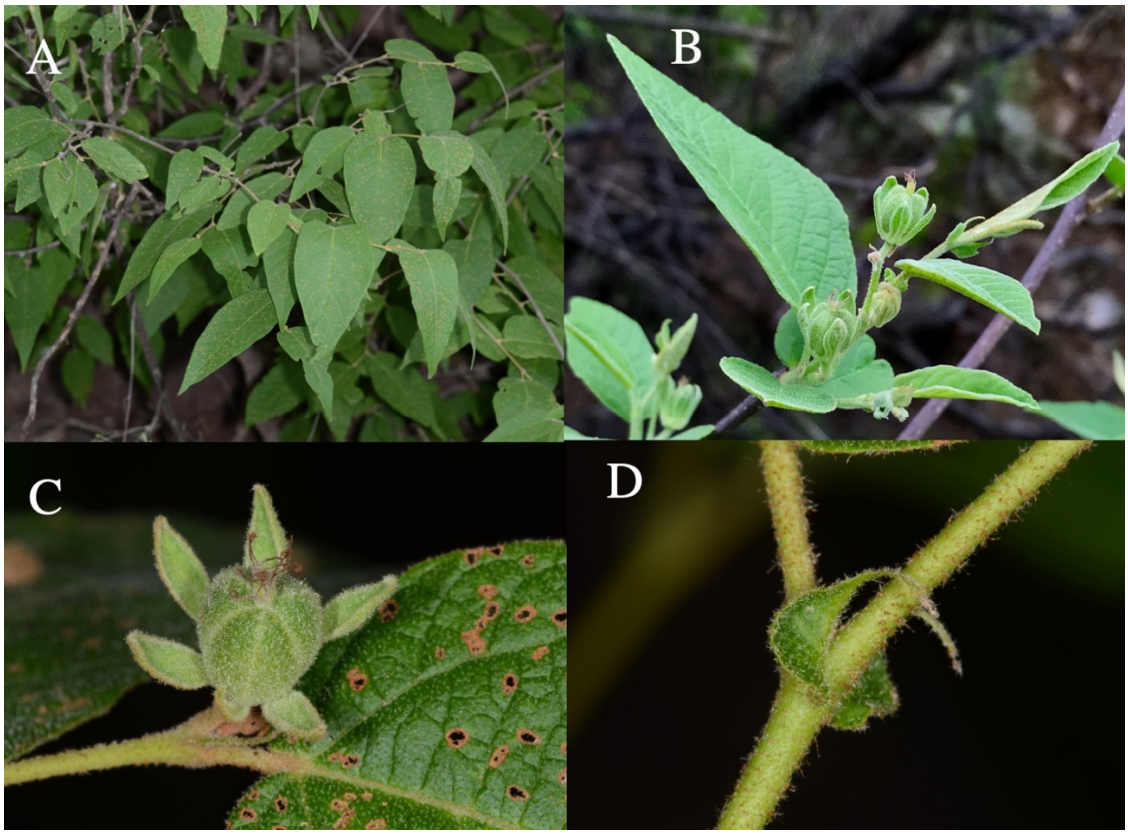

Figure A2. *Croton alamosanus.* (**A**) Leafy branches. (**B**) Branch with pistillate flowers. (**C**) Young fruit. (**D**) Stipules.

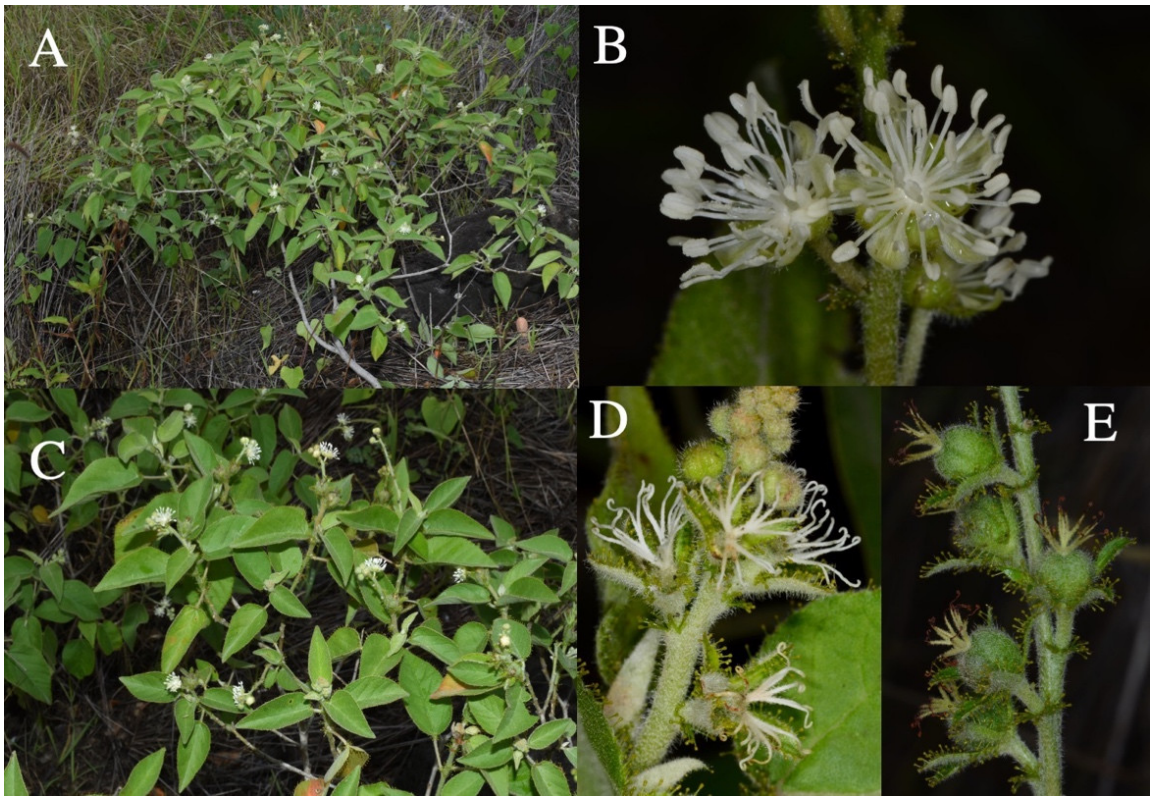

Figure A3. *Croton ciliatoglandulifer.* (**A**) Habit. (**B**) Staminate flowers. (**C**) Flowering branches. (**D**) Inflorescence with open pistillate flowers and staminate buds. (**E**) Young fruits.

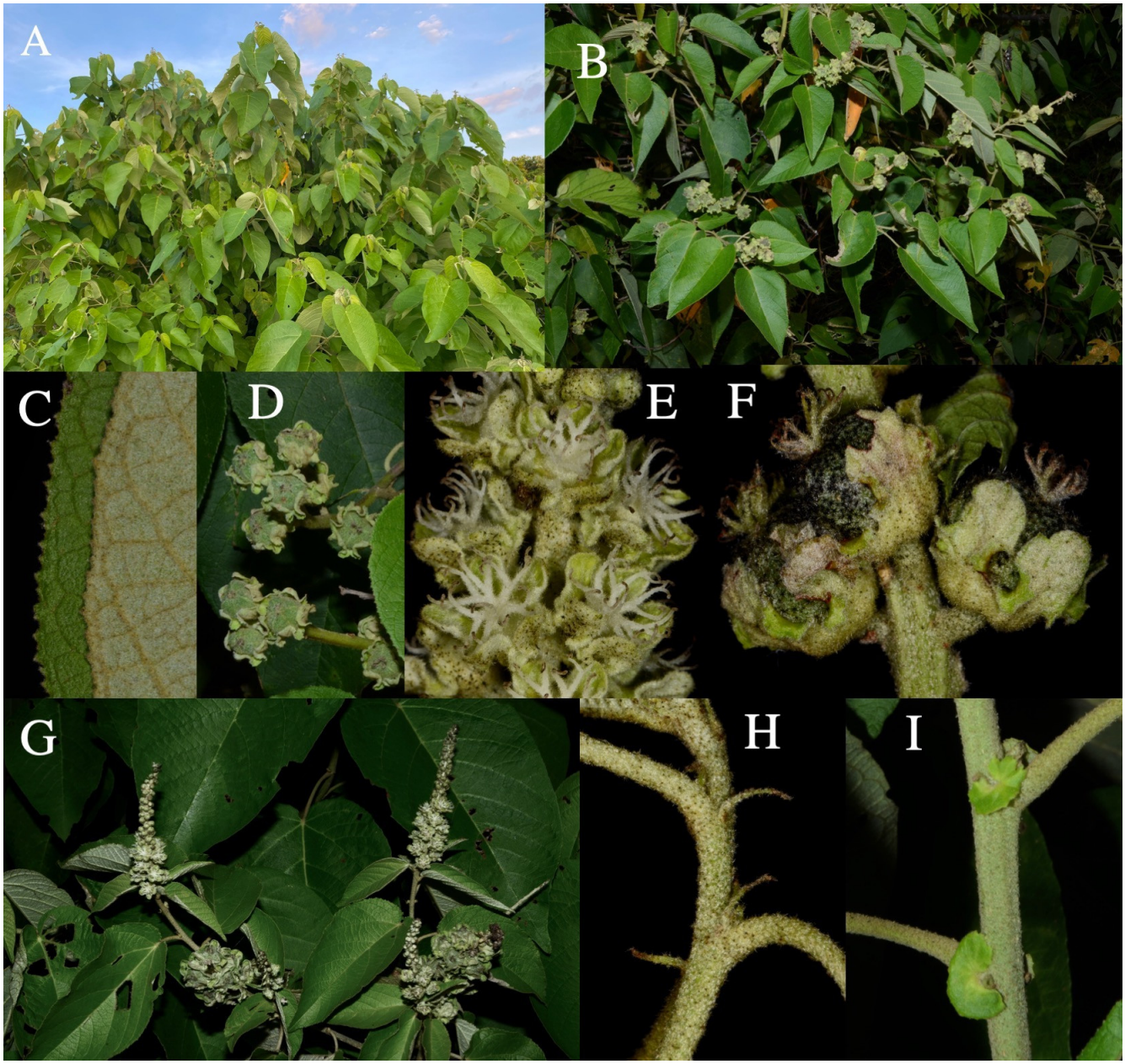

Figure A4. *Croton atrostellatus.* (**A**) Habit. (**B**,**G**) Flowering and fruiting branches. (**C**) Upper (left) and lower (right) leaf surfaces. (**D**,**F**) Fruits. (**E**) Pistillate flowers. (**H**) Subulate stipules. (**I**) Foliaceous stipules.

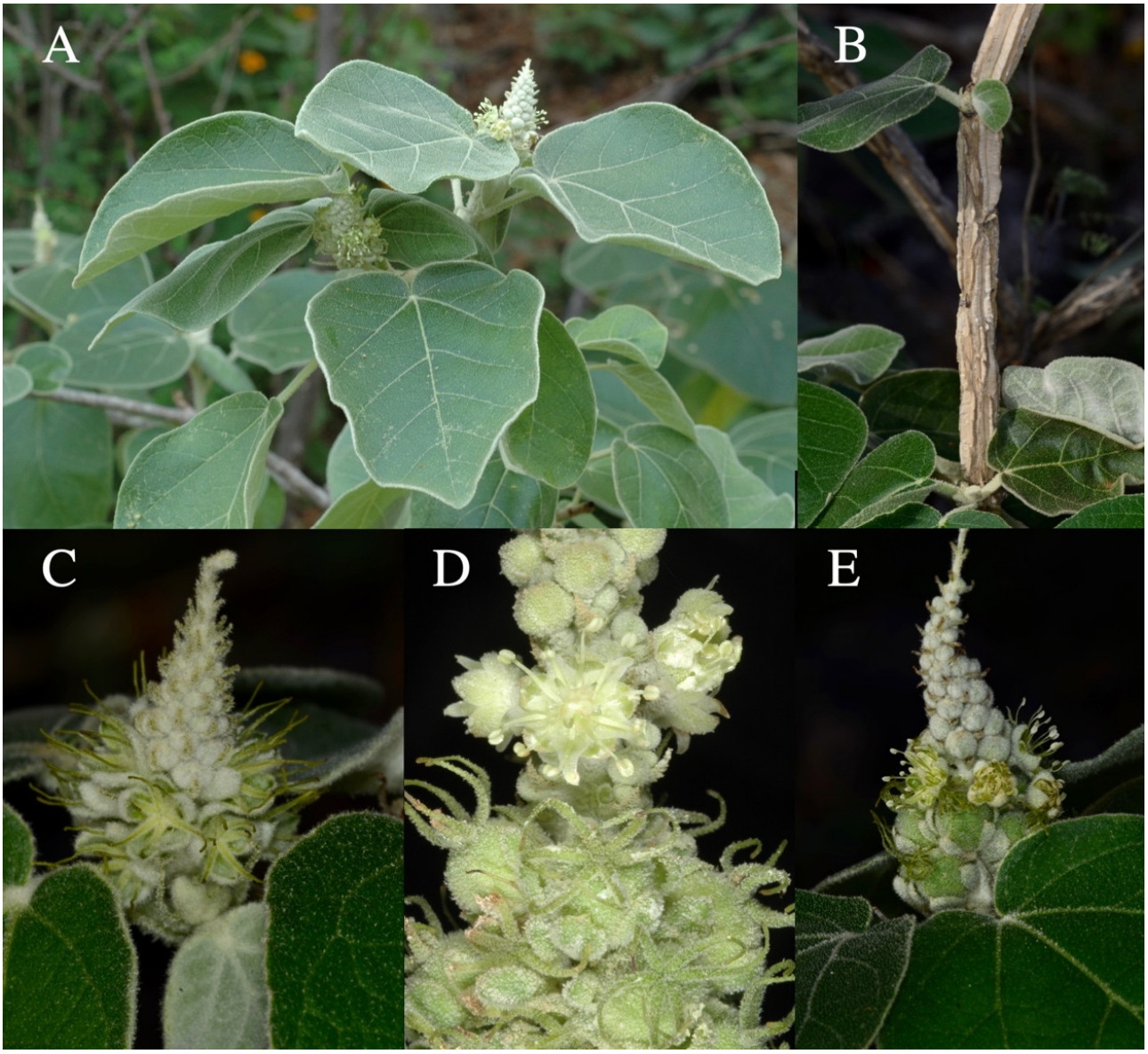

Figure A5. *Croton suberosus.* (**A**) Flowering branches. (**B**) Cocky lower stem. (**C**–**E**) Inflorescences.

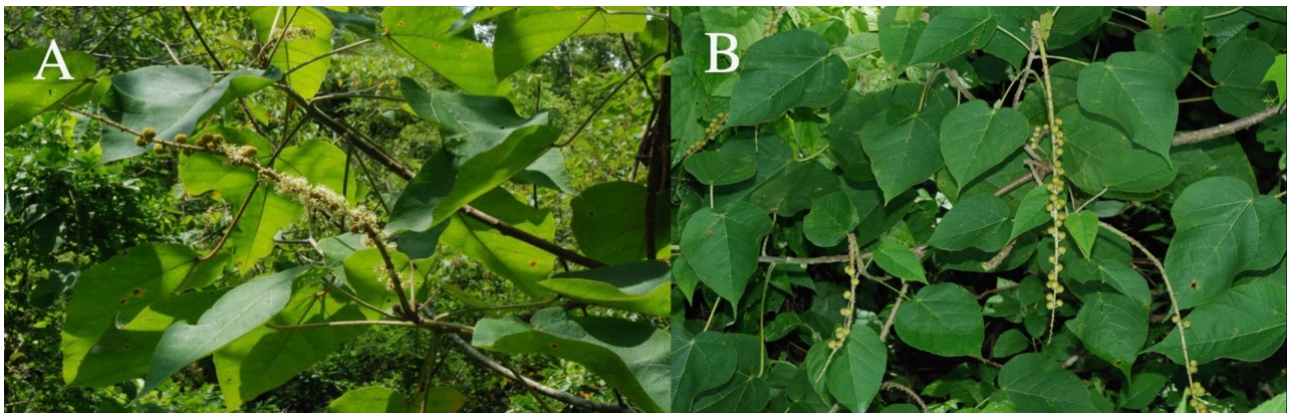

Figure A6. *Croton draco.* (**A**) Branch with flowers and fruits. (**B**) Branches with fruits.

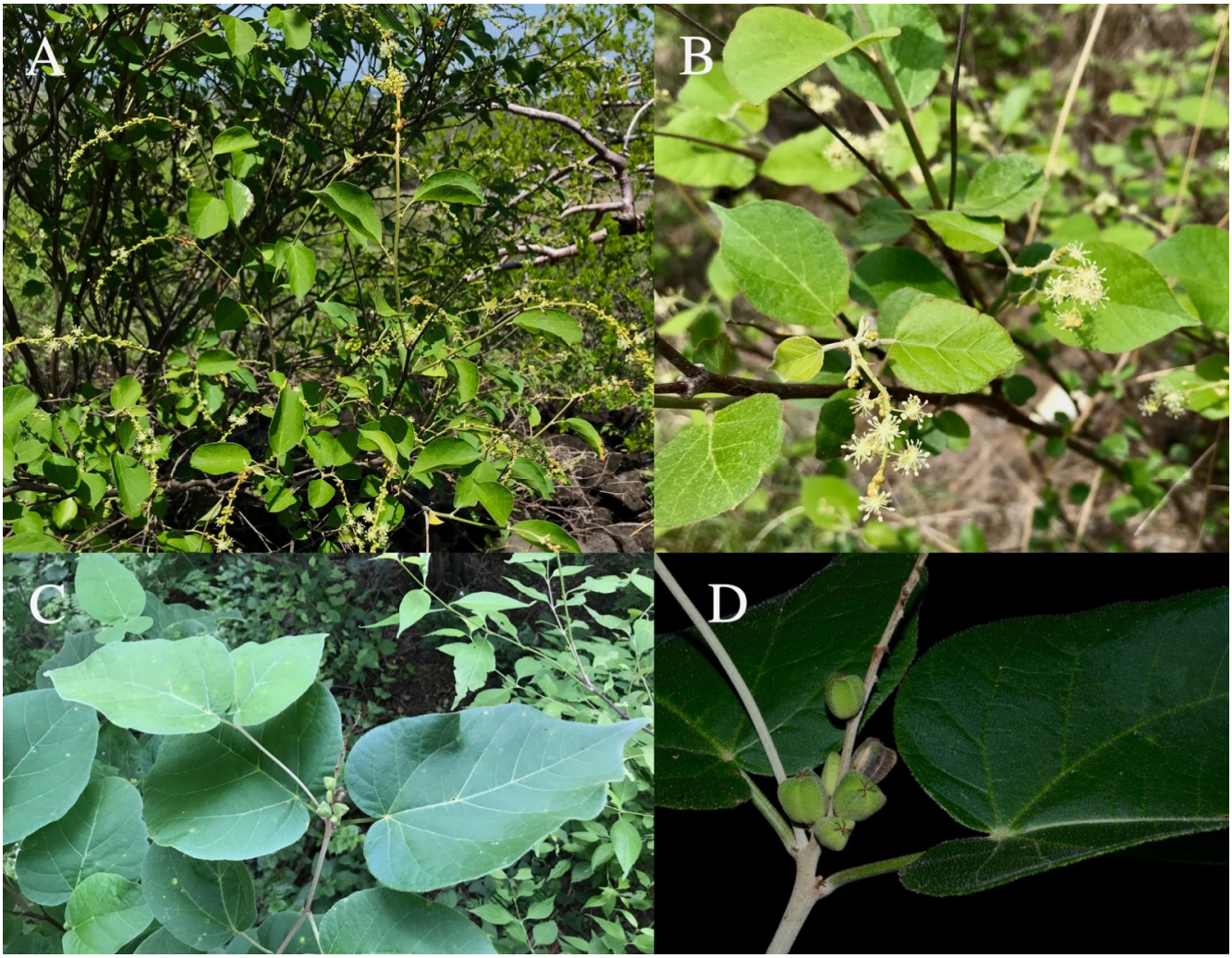

Figure A7. *Croton flavescens.* (**A**,**B**) Flowering branches. (**C**,**D**) Branches with fruits.

Figure A8. *Croton lindquistii.* (**A**) Branch with flower buds. (**B**) Branch with flowers and fruits. B photographed by Ignacio Ruiz and used with permission.

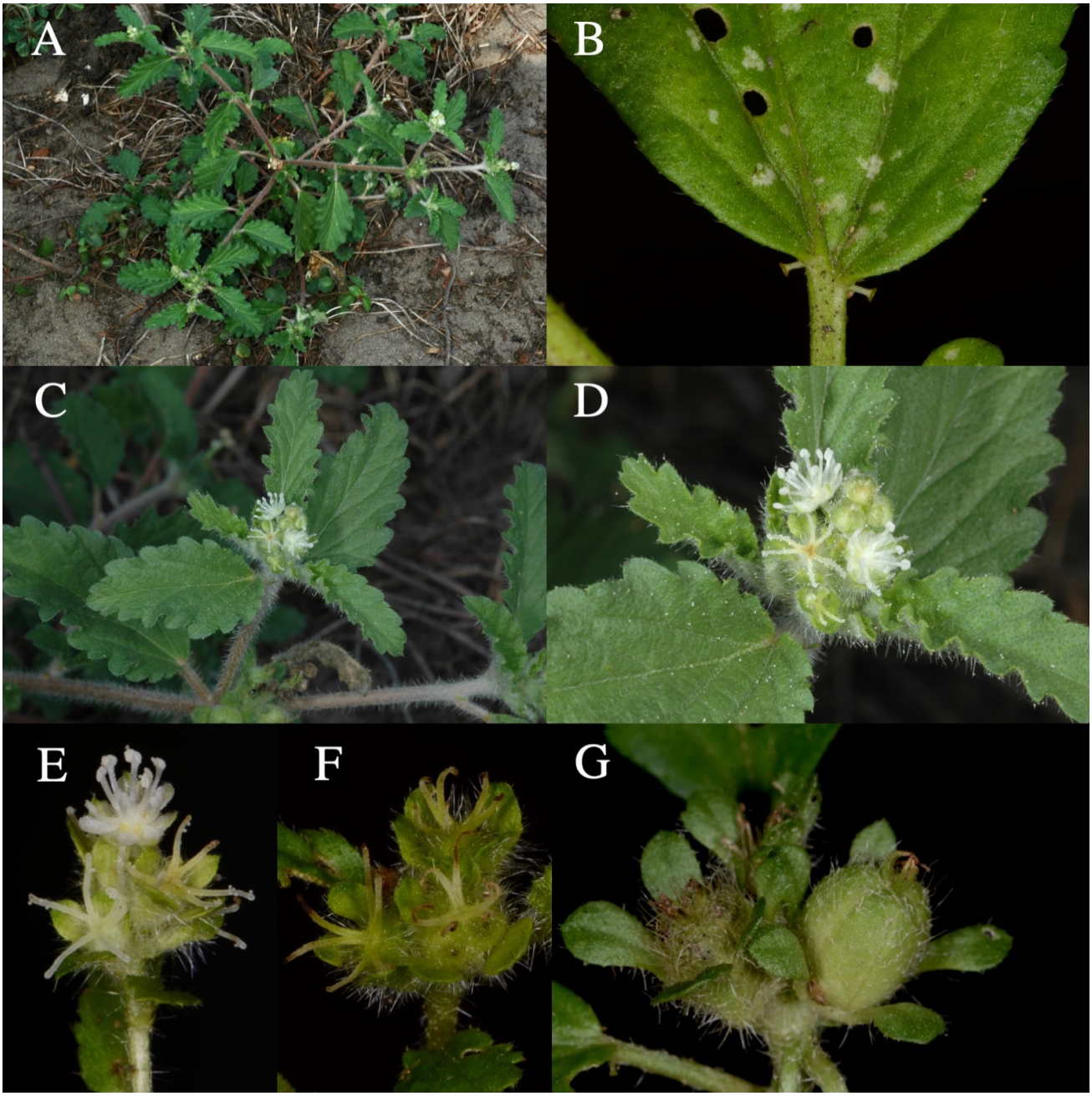

Figure A9. *Croton glandulosus* (**A**) Habit. (**B**) Petiole and leaf base showing extrafloral nectaries. (**C**,**D**) Flowering branch tips. (**E**) Inflorescence. (**F**) Pistillate flowers. (**G**) Fruits.

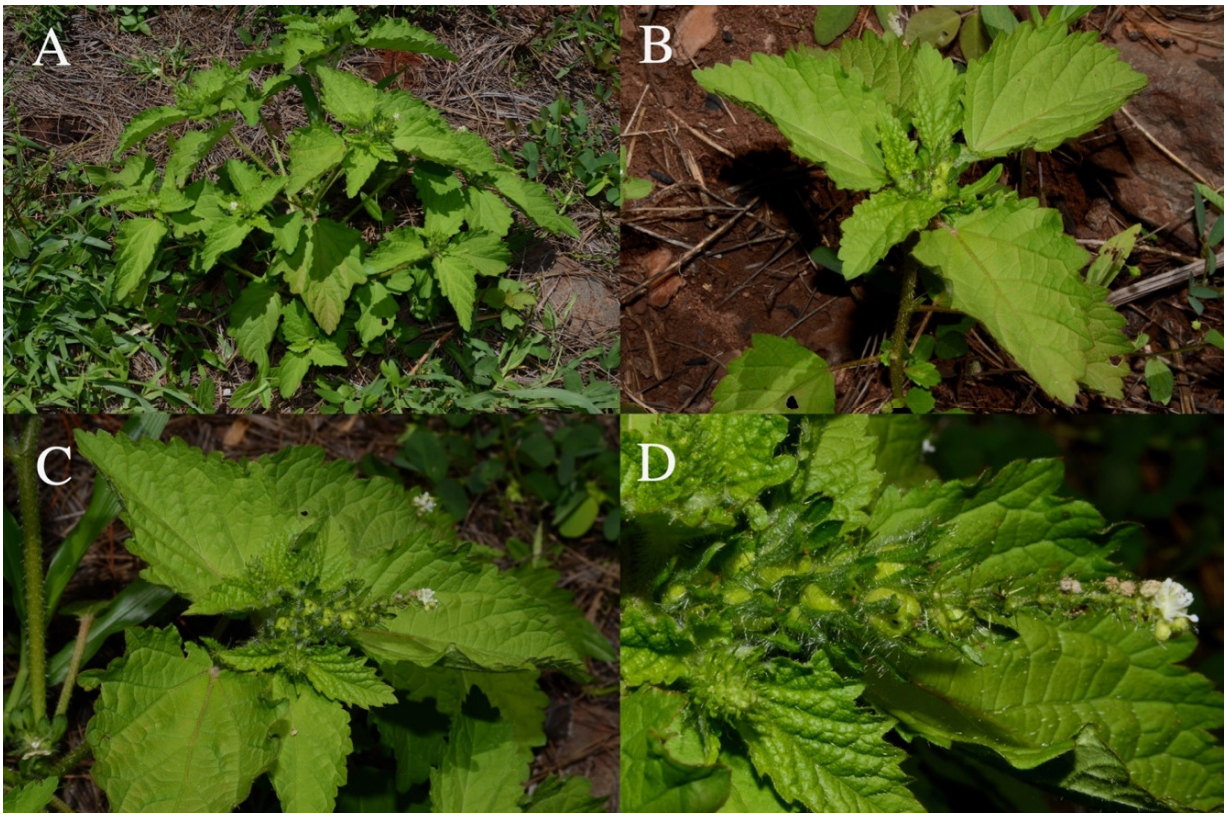

Figure A10. *Croton hirtus.* (**A**,**B**) Habit. (**C**) Flowering branch. (**D**) Inflorescence.

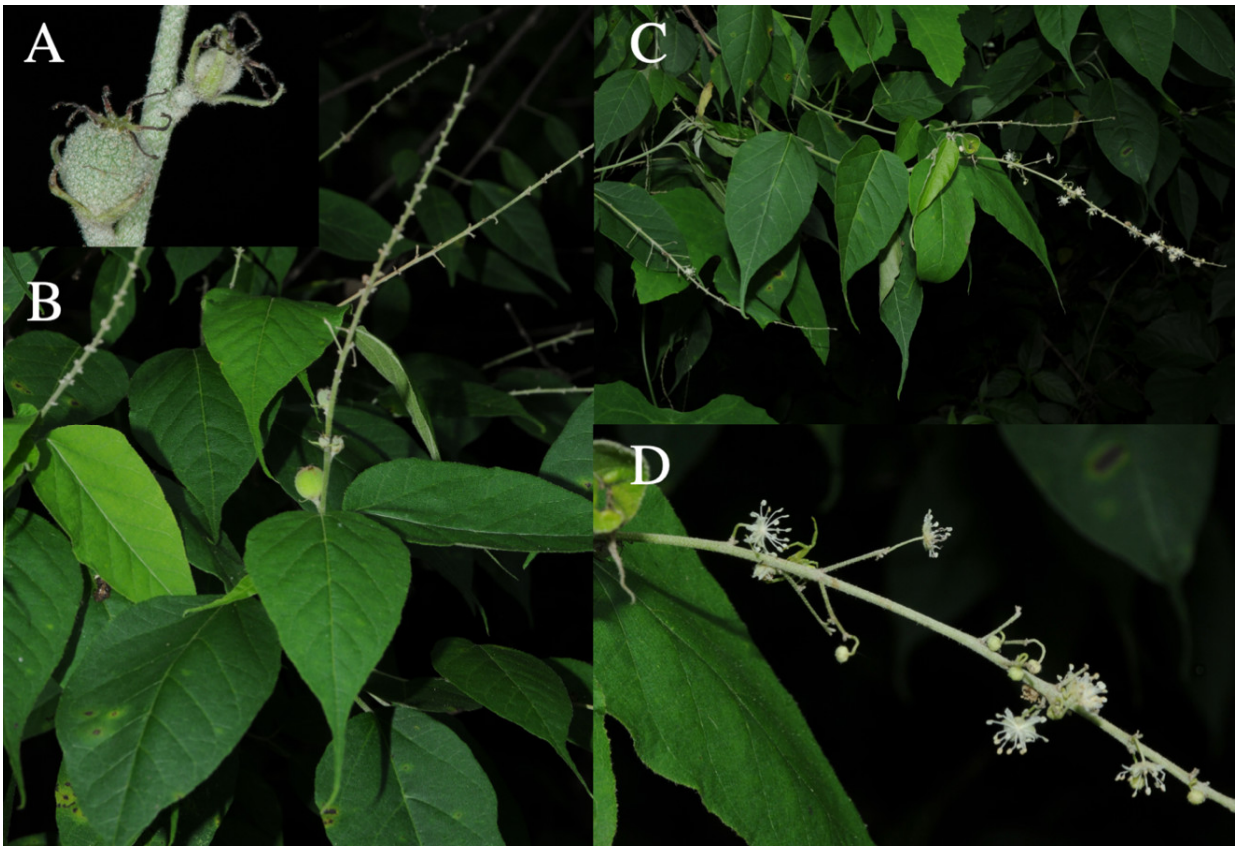

Figure A11. *Croton roxanae.* (**A**) Pistillate flowers. (**B**,**C**) Flowering branches. (**D**) Staminate portion of an inflorescence.

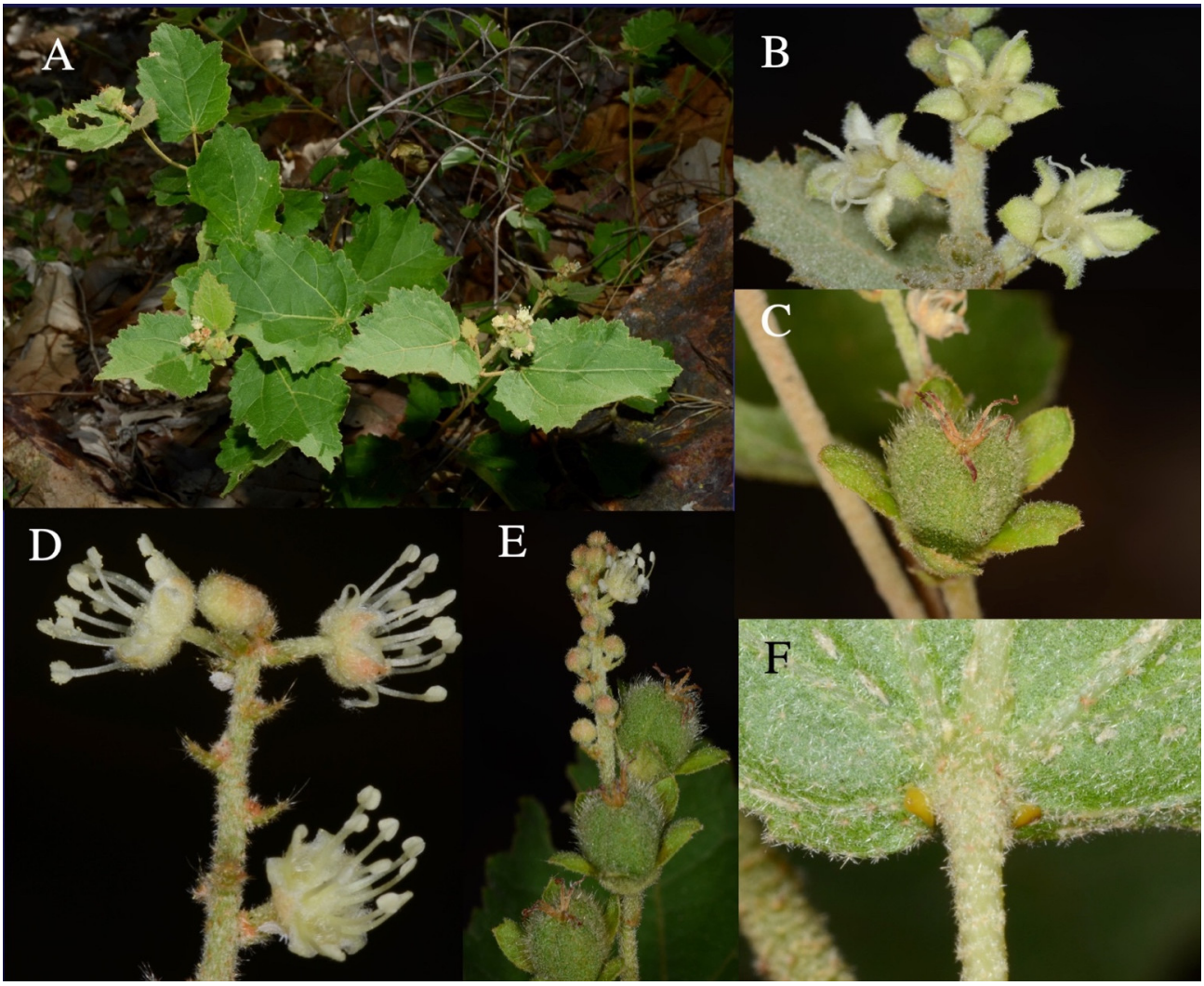

Figure A12. *Croton repens.* (**A**) Habit. (**B**) Pistillate flowers. (**C**) Fruit. (**D**) Staminate flowers. (**E**) Fruits and staminate flowers. (**F**) Underside of the lower leaf blade showing extrafloral nectaries.

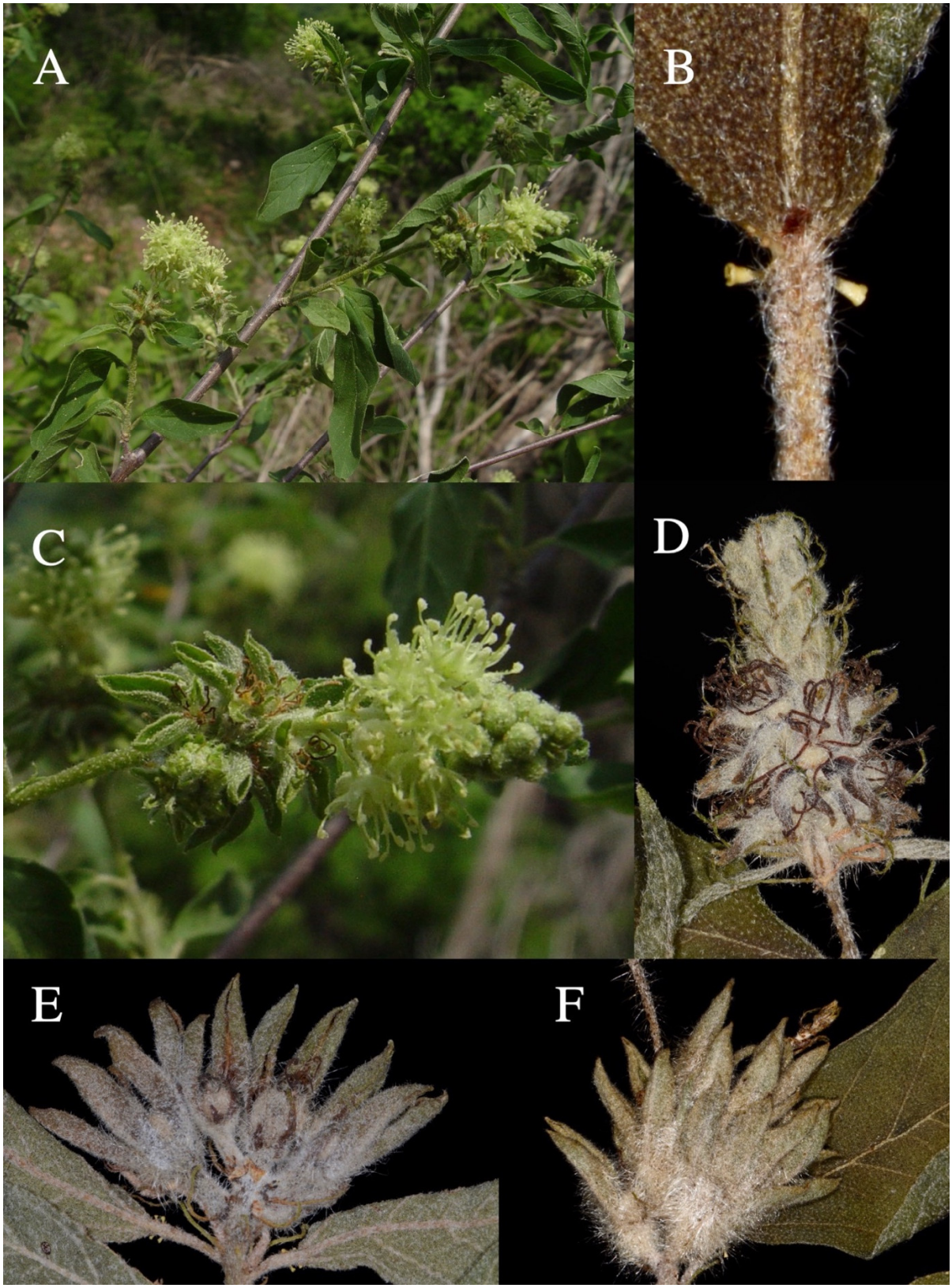

Figure A13. *Croton rojasii* sp. nov. (**A**,**B**). Flowering branches. (**C**) Petiole and lower leaf blade showing extrafloral nectaries. (**D**) Inflorescence with open pistillate flowers. (**E**) Young fruits with accrescent sepals; note petioles with four extrafloral nectaries. (**F**) Infructescence with large accrescent pistillate sepals. A and C photographed by Guillermo Ibarra and used with permission; B and D from *Hernández Esquivel* et al. *24*; E from *Rangel-Landa 884*; F from *Rojas 85*.

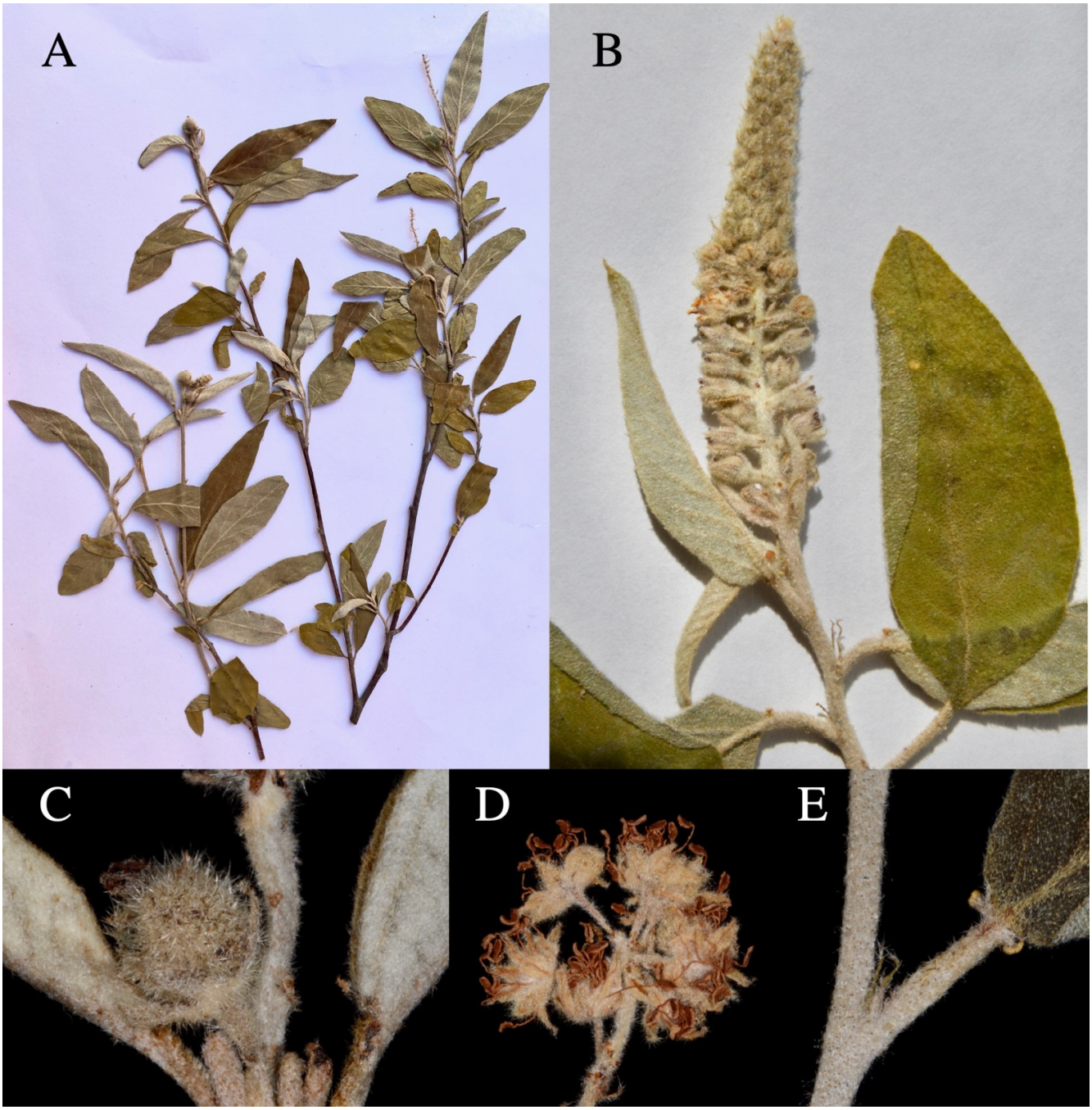

Figure A14. *Croton* aff. *ramillatus*. (**A**). Fruiting branches. (**B**) Branch with inflorescence. (**C**) Young fruit. (**D**) Staminate flowers. (**E**) Lower leaf blade and extrafloral nectaries. (**A**), (**B**), and (**D**) from *Steinmann 5193*; (**C**) and (**E**) from *Steinmann 4345*.

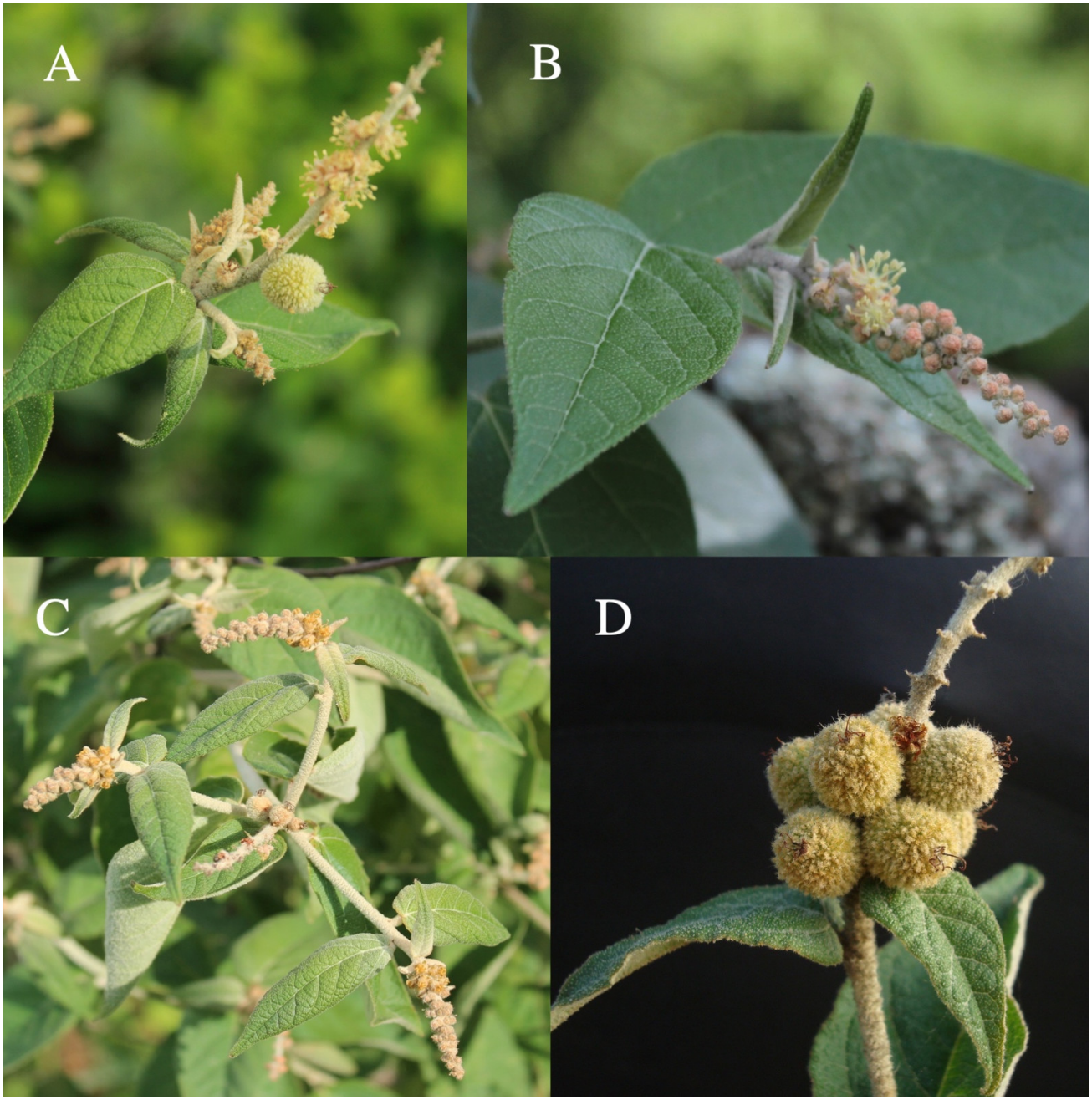

Figure A15. *Croton sphaerocarpus.* (**A**–**C**) Branchlets with inflorescences. (**D**) Fruits. (**A**–**C**) photographed by Nancy Izquierdo and used with permission; (**D**) photographed by Guadalupe Cornejo and used with permission.

Figure A16. Herbarium specimens from the University of Michigan Herbarium (MICH) website (quod.lib.umich.edu/h/herb00ic): (**A**) *Croton xalapensis*. (**B**) *Croton ynesae*. (**C**). *Croton tenuilobus;* Herbarium specimens from the Universidad Nacional Autónoma de México Herbarium (MEXU) website (datosabiertos.unam.mx/biodiversidad/): (**D**) *Croton incanus*. (**E**) *Croton niveus*.

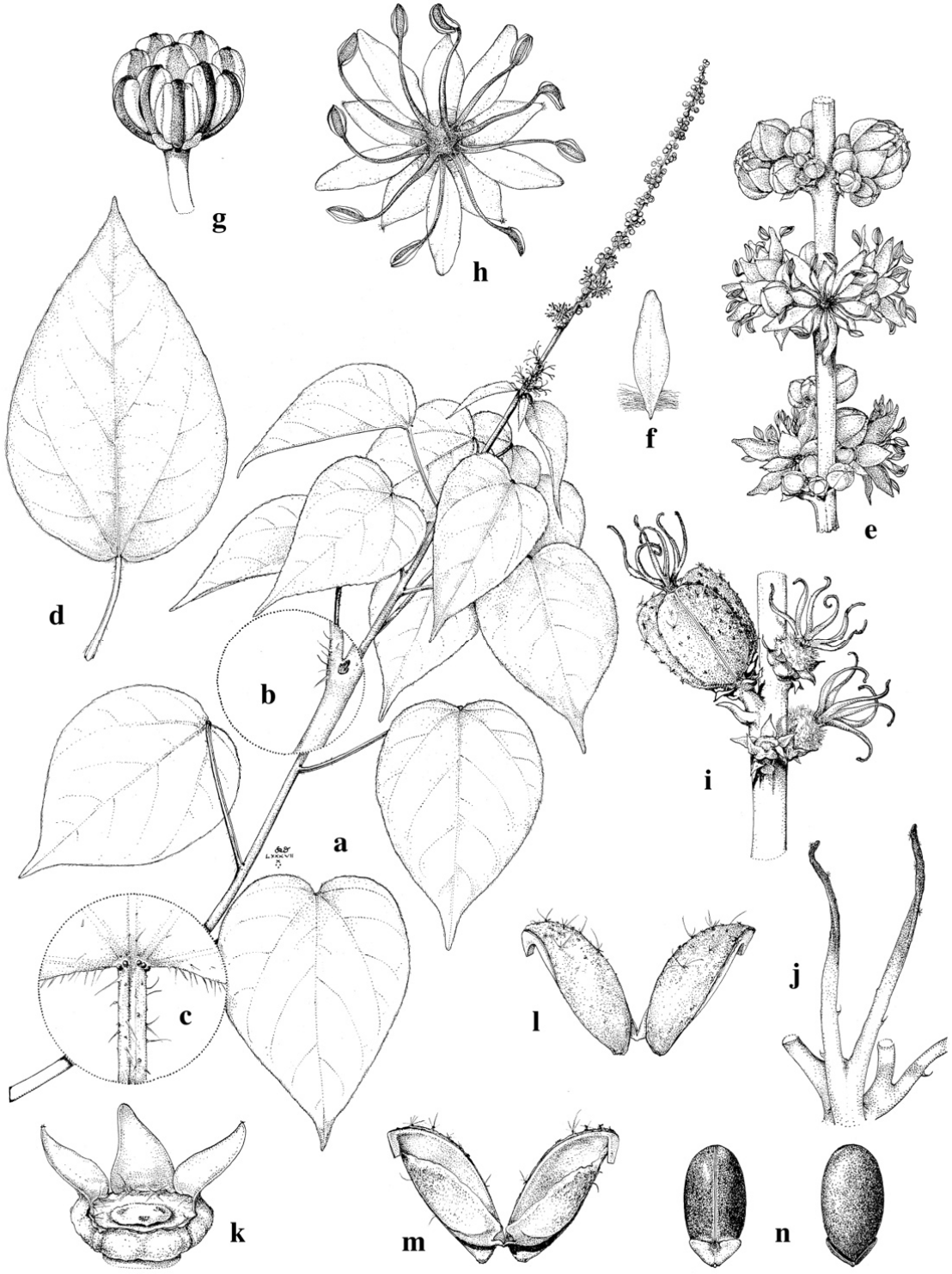

Figure A17. *Croton adspersus* (**a**) Flowering branch. (**b**) Stipule. (**c**) Leaf base and distal portion of the petiole showing small colleters. (**d**) Leaf. (**e**) Staminate portion of the inflorescence. (**f**) Petal. (**g**) Inflexed stamens with sepals and petals removed. (**h**) Staminate flower. (**i**) Pistillate portion of the inflorescence. (**j**) Divided styles. (**k**) Base of the female flower with the ovary and two sepals removed. (**l**,**m**) Dehisced fruit cocci. (**n**) Seed, ventral (left) and dorsal (right) views. Illustrated by Karen Douthit for Flora Novo-Galiciana. ©The University of Michigan Herbarium (MICH) and used here with their permission.

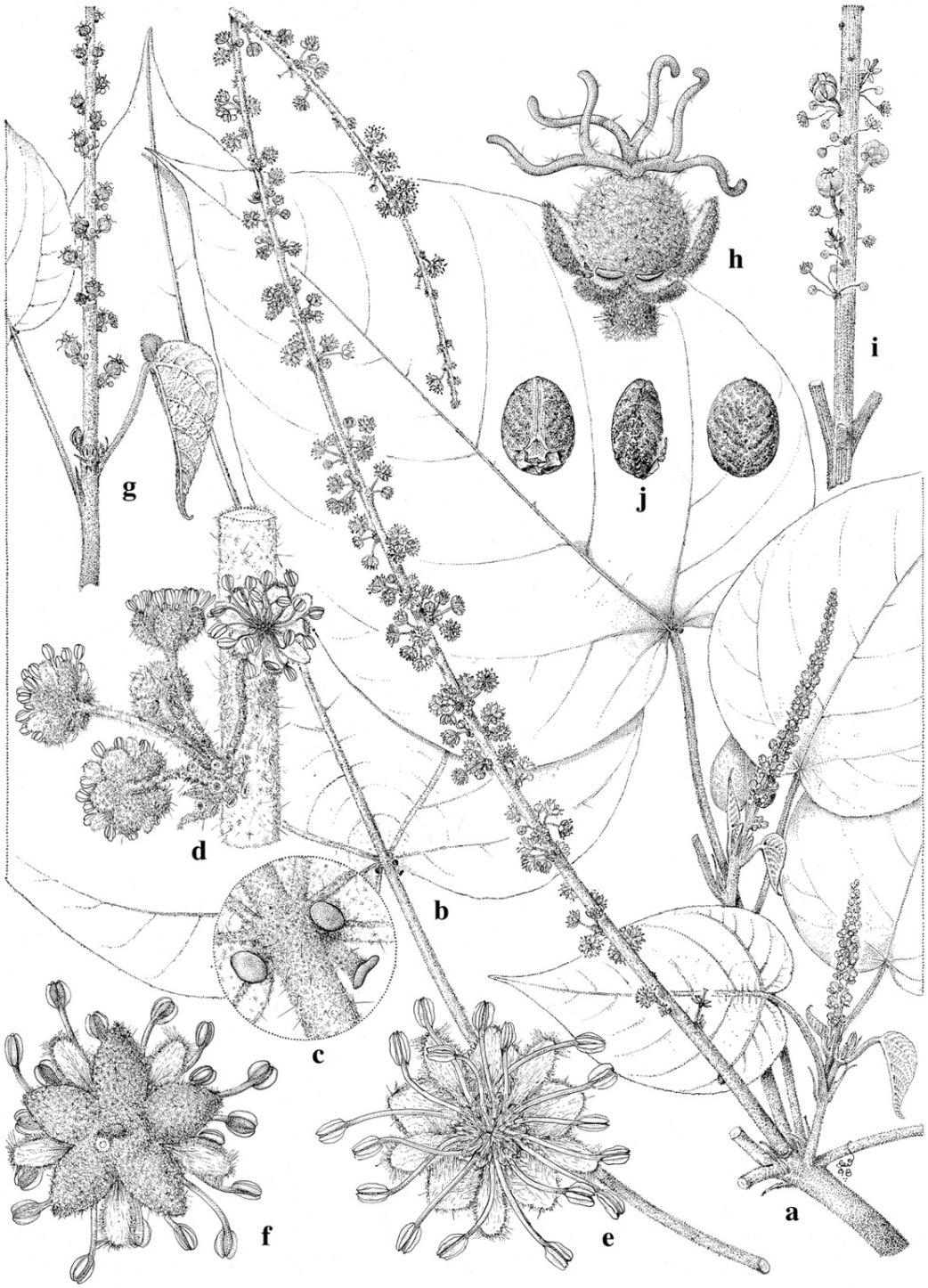

Figure A18. *Croton draco* (**a**) Flowering branch. (**b**) Leaf base. (**c**) Close-up of extrafloral nectaries at the base of the leaf blade. (**d**) Staminate cymule. (**e**) Staminate flower from above. (**f**) Staminate flower from below. (**g**,**i**) Inflorescences. (**h**) Pistillate flower with two sepals removed. (**j**) Seed, ventral (left), lateral (center), and dorsal (right) views. Illustrated by Karen Douthit for Flora Novo-Galiciana. ©The University of Michigan Herbarium (MICH) and used here with their permission.

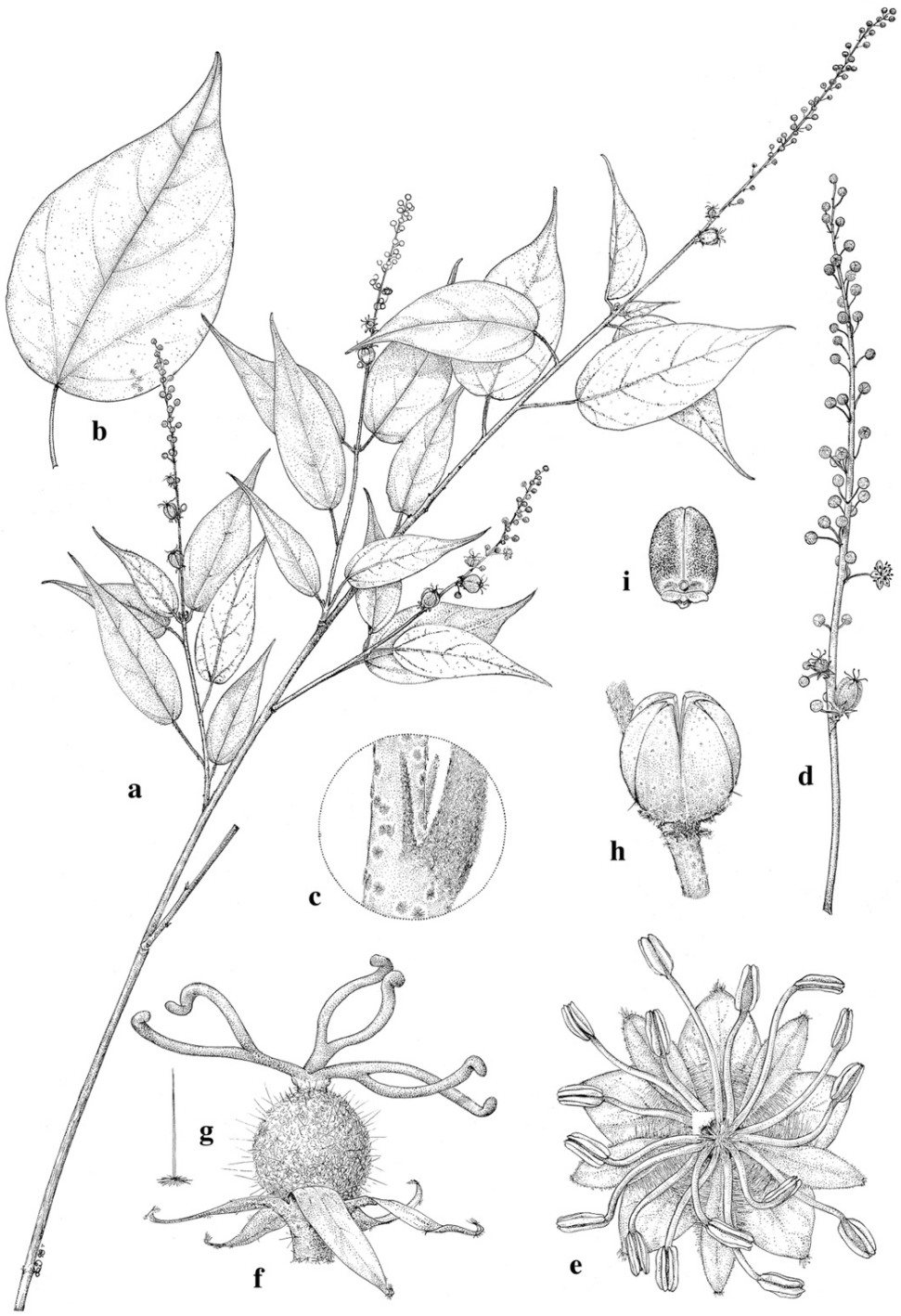

Figure A19. *Croton roxanae* (**a**) Flowering branch. (**b**) Leaf. (**c**) Close-up of stipules. (**d**) Inflorescence. (**e**) Staminate flower from above. (**f**) Pistillate flower. (**g**) Stellate-porrect trichome of the ovary. (**h**) Fruit. (**i**) Seed ventral view. Illustrated by Karen Douthit for Flora Novo-Galiciana. ©The University of Michigan Herbarium (MICH) and used here with their permission.

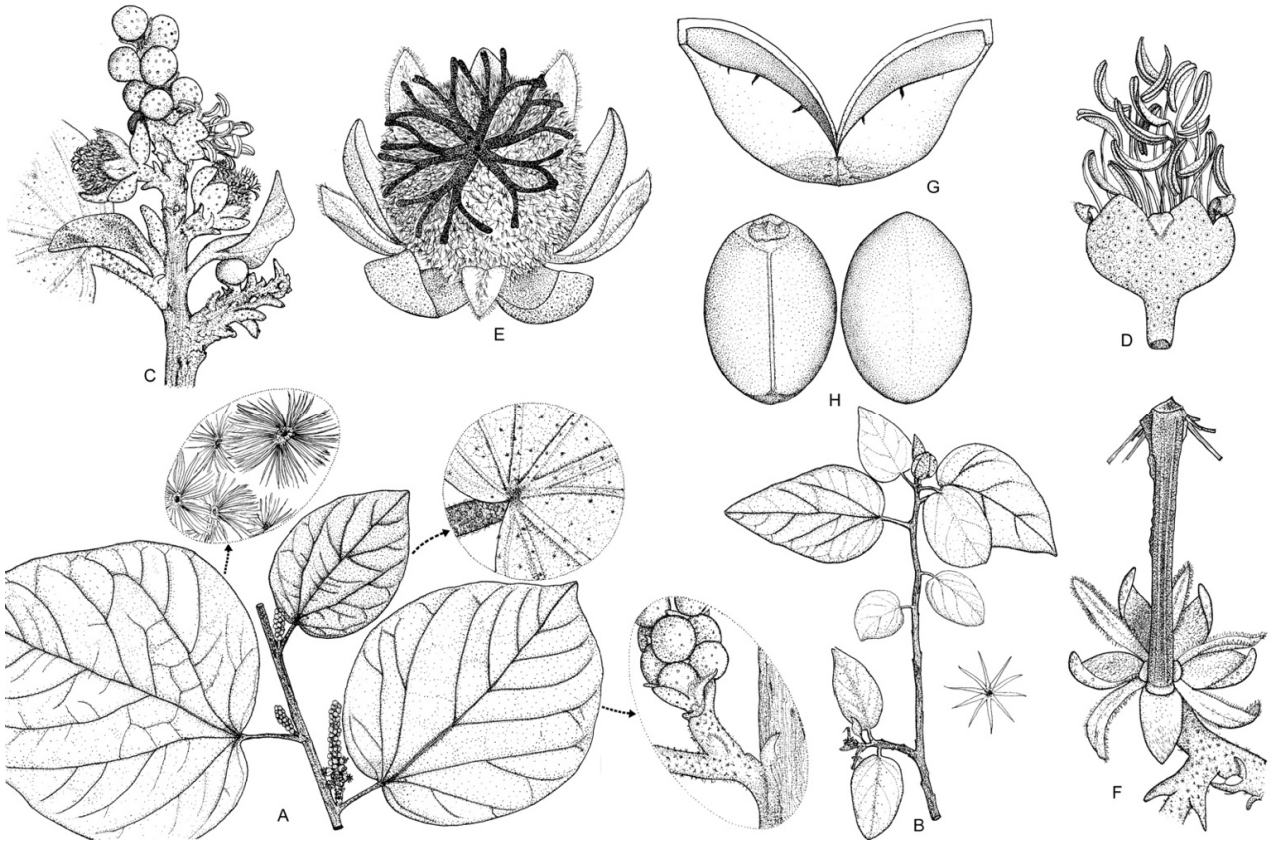

Figure A20. *Croton lindquistii* (**A**) Flowering branchlet. (**B**) Fruiting branchlet. (**C**) Young inflorescence and subtending leaves. (**D**) Staminate flower. (**E**) Pistillate flower. (**F**) Remnants of a fruit and subtending floral parts after dehiscence. (**G**) Dehisced coccus. (**H**) Seed, ventral (left) and dorsal (right) views. Illustrated by Manuel Ramírez Amezcua and reproduced from *V.W. Steinmann*, Phytotaxa 166(3): 237.

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