



***Croton lindquistii* (Euphorbiaceae): a new arborescent species from western Mexico**

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Abstract

Croton lindquistii, a new species in *Croton* subg. *Geiseleria* sect. *Eluteria* subsect. *Eluteria*, is described and illustrated. It occurs in the tropical deciduous forests of western Mexico from Sonora to Oaxaca. The species is economically important, and during the past four decades, plants have been extensively harvested for their straight, hard, and durable trunks that are used as fence posts and stakes in agricultural fields. Although the exact affinities of *C. lindquistii* are unknown, it is similar to both *C. niveus* and *C. pseudoniveus*. It differs from the former by having ovate to cordiform leaves, fruiting pedicels less than 3 mm long, and spiciform thyrses that are very compact with the axis obscured by the buds. It differs from the latter by having 15–16 stamens per flower and stellate-pubescent ovaries and fruits. The name *Croton fantzianus* has been misapplied to *Croton lindquistii*. A key is provided that distinguishes the new species from the five other members of *Croton* sect. *Eluteria* subsect. *Eluteria* that have ovaries and fruits with stellate pubescence.

Introduction

The megadiverse genus *Croton* Linnaeus (1753: 1004) occurs extensively throughout tropical regions of both the Old and New Worlds, and Mexico is an important center of diversity with three subgenera (van Ee *et al.* 2011), 14 sections (van Ee *et al.* 2011), and approximately 125 species (Steinmann 2002, Martínez Gordillo *et al.* 2002). In addition to its great floristic value, the genus contains a number of species with medicinal properties, e.g., *C. draco* Schlechtendal & Chamisso (1831: 360), *C. tiglium* Linnaeus (1753: 1004), and *C. urucurana* Baillon (1864: 335). The tropical deciduous forests of western Mexico possess another commercially important group of species, and various taxa of *Croton* subg. *Geiseleria* (Klotzsch 1841: 254) Gray (1856: 391) sect. *Eluteria* Grisebach (1859: 39) are harvested for their trunks, which are used as fence posts and stakes in agricultural fields (Lindquist 1999, 2000, Rendón 2002). Despite their local abundance and economic importance, the species of *Croton* sect. *Eluteria* have not been studied in detail, and the taxonomy of the group is still complicated. One of the problems involves the application of the name *Croton fantzianus* Seymour (1979: 171). This species was initially described from plants collected in Nicaragua, but it has since been reported from western Mexico (Webster 2001a, Lindquist 1999, Lindquist 2000, Martínez Gordillo 2011). However, after careful study and comparison of material from Mexico and Nicaragua, I conclude that plants from these two regions are not conspecific, and the purpose of this article is to formally describe the Mexican plants as new to science.

Taxonomy

The classification of the New World species of *Croton* has benefited from recent molecular studies (Berry *et al.* 2005, van Ee *et al.* 2008, 2011). A number of new infrageneric taxa have been proposed, and others have changed in circumscription. In contrast to the previous classification of Webster (1993), subgenera are used as the first infrageneric category, with these further divided into sections. For the purpose of this article, the classification of van Ee *et al.* (2011) is followed.

Croton lindquistii V.W. Steinm., *sp. nov.* (Fig. 1)

Similar to *C. niveus* but differs by having ovate to cordiform leaves, fruiting pedicels less than 3 mm long, very compact and spiciform thyrses with the distal buds more or less the same size as the proximal buds and the axis obscured by the buds; also similar to *C. pseudoniveus* but differs by having 15–16 stamens per flower and stellate-pubescent ovaries and fruits.

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, Steinmann, Lindquist, Van Devender & Van Devender 93-106 (holotype IEB!, isotypes ARIZ!, DAV!, MEXU!, UCR!).

Shrub or tree 5–7 m tall, drought-deciduous, monoecious. Trunk slender and straight, up to 10 cm in diameter, the wood very hard; bark gray-white, slightly roughened. Branchlets densely covered with lepidote scales 0.2–0.4 mm in diameter, the edges scarios and erosely margined, the center brown and gland-like, stellate trichomes sometimes also present. Leaves alternate; stipules linear-subulate, usually quickly deciduous, but sometimes persistent, lepidote; petioles slender, 0.5–5.0 cm long; blades cordiform to ovate, 3.0–13.0 cm long, 2.0–10.5 cm wide, base mostly cordate, apex acute to obtuse, abaxial surfaces of the young leaves often with a silvery cast, adaxial surface greenish, palmately veined with 5–9 nerves, entire, lepidote with trichomes like in those of the branchlets, stellate hairs sometime also present. Inflorescences axillary, bisexual, spiciform thyrses 1.2–2.4 cm long, each containing 18–30 flowers, the lower 1–3 pistillate, the remainder staminate; axis of the inflorescence lepidote, mostly obscured by the buds or flowers; bract narrowly triangular to ca. 1.5 mm long, bracteoles subulate to narrowly triangular to ca. 1 mm long. Staminate flowers subsessile or with short, stout, lepidote pedicels less than 1 mm long; calyx lobes 5, valvate, triangular, 1.0–2.1 mm long, densely lepidote outside, sparsely villous inside; receptacle villous; petals oblong, 1.3–1.9 mm long, 0.3–0.4 mm wide, ciliate-villous, with scattered lepidote scales on the distal surface, glabrous to villous on the proximal surface; stamens 15–16, the filaments slender, flexuose, 1.6–2.5 mm long, glabrous distally, glabrous to sparsely villous proximally, anthers elliptic, 0.8–1.3 mm long, pustulose on the connective. Pistillate flowers subsessile, the stout, lepidote pedicel ca. 3 mm long or less in fruit; calyx and petals as in the staminate flowers; ovary subglobose, velutinous, densely covered with mostly yellow stellate trichomes, the rays to 0.4 mm long; styles 3, united at the base, glabrous, dark brown, spreading, 1.9–2.3 mm long, mostly 4 or 5 times bifid with 24 or more slender ultimate divisions. Capsules subglobose, stellate-pubescent, 0.6–0.8 cm long, 0.6–0.9 cm wide; columella 5.9–7.8 mm long. Seeds carunculate, 6.5–8.5 mm long, elliptic-oblong, brown to gray, shiny, the caruncle transversely oblong, 0.7–0.8 mm long, 1.6 mm wide.

Distribution, habitat and phenology:—*Croton lindquistii* was first collected in Sinaloa, Mexico, by the renowned botanist Howard Scott Gentry in 1940. Since then numerous additional populations have been found, and it is currently known from southern Sonora to Oaxaca. It is a very common and often dominant tree in the vicinity of Álamos, Sonora, and also occurs extensively in northern Sinaloa. Southward its distribution is sporadic, with disjunct populations in the Bolaños region of northeast Jalisco, the Balsas Depression of central Michoacán, and coastal Oaxaca. It grows in tropical deciduous forest at elevations of 30 to 700 m, where it primarily is found on undisturbed, rocky, relatively dry hillsides. The majority of collections possess inflorescences with only buds, and these apparently remain dormant for extended periods of time. Flowering and fruiting overlap broadly, and reproduction occurs during the dry season from November to May.

Etymology:—*Croton lindquistii* is named in honor of my friend and field companion Dr. Cynthia Anne Stuard Lindquist (1947–2011). She comprehensively studied the ecology and conservation of the species in southern Sonora for her Ph.D. dissertation and provided much important information for its management and preservation. She also assisted with the collection of the type.

Economic importance and conservation:—During the past four decades, populations of *Croton lindquistii* in southern Sonora and northern Sinaloa have been extensively harvested, and plants are valued for their straight, hard and durable trunks that are used as fence posts and stakes in agricultural fields (Lindquist 1999, 2000). As would be expected, over harvesting is having a deleterious effect on many populations of *C. lindquistii*, and in some localities where the species was once common, it is now scarce. Fortunately, however, there are still some areas where the plants are frequent, especially outside of southern Sonora and northern Sinaloa, or where they do not grow densely enough to be a target for harvesters. Also, plants can resprout from the severed base and develop a shrubby habit that is undesirable for further harvesting. Considering its entire distribution, *Croton lindquistii* is apparently under no eminent threat. According to Felger *et al.* (2001), in Sonora it is known locally as "vara blanca", "sejco" (Guarjiro), and "cuta tósari" (Mayo).

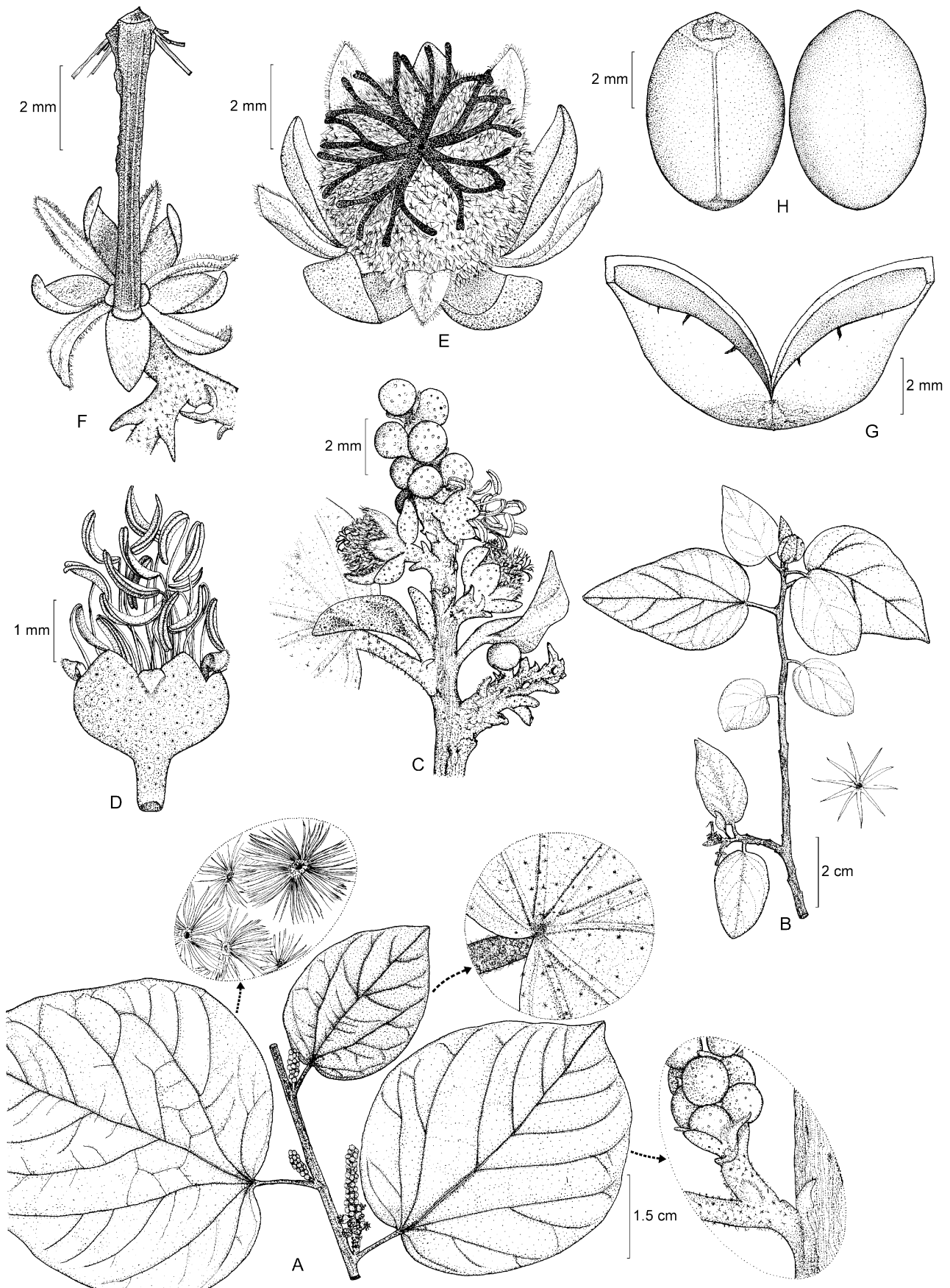


FIGURE 1. *Croton lindquistii*. A) Flowering branchlet; B) Fruiting branchlet; C) Young inflorescence and subtending leaves; D) Staminate flower; E) Pistillate flower; F) Remnants of a fruit and subtending floral parts after dehiscence; G) Dehisced coccus; H) Seed, ventral (left) and dorsal (right) views. A, C–H based on *Steinmann et al. 93-106*; B based on *Steinmann 94-154*. Drawn by José Manuel Ramírez-Amezcuca.

Additional specimens (paratypes) examined:—MEXICO. Jalisco: Mpio. San Martín de Bolaños, 11 NE de Bolaños, *Lott et al. 2108* (MEXU, TEX). Michoacán: 19 km al S de Paso Real o 15 km al N de La Huacana, 31 January 1992, *Rico & 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, 26 January 2002, *Steinmann & Carranza 2282* (ARIZ, IEB, MEXU); Mpio. Múgica, along MEX 37, ca. 10 km (by road) SSW of Gabriel Zamora, 19°05'N, 102°04'15"W, 21 February 2002, *Steinmann et al. 2313* (ARIZ, IEB, MEXU). Oaxaca: Dto. Tehuantepec, Mpio. San Pedro Huamelula, camino a Playa Grande, 100 m al S de la carretera costera #200, 15°52'22.5"N, 95°54'55.1"W, 26 May 2006, *Salas et al. 5951* (IEB, SERO). Sinaloa: Cerro Tecomate, W of Pericos, 27 February 1940, *Gentry 5723* (ARIZ, CAS, MICH); between Culiacán and Tabala, 10 November 1953, *Templeton 7101* (RSA); basaltic hills 8 mi S of Pericos, 17 March 1955, *Wiggins 13145* (SD). Sonora: Mpio. de Álamos, canyon of the Río Cuchujaqui, ca. 3.5 km upstream from the El Guayabo crossing of the Río Cuchujaqui, 2.6 km NE of Sabinito Sur, 14 km (by air) ESE of Álamos, vic. 27°00'05"N, 108°47'08"W, 18 March 1994, *Felger 94-116* (RSA); Cerro Colorado, 17 May 1991, *Jenkins 91-57* (ARIZ); S rim of Cajon of the Cuchujaqui, W (downstream) end, 27°03.0'N, 108°43.7'W, 30 December 1988, *Martin & O'Rourke s.n.* (ARIZ, RSA); NW base of Cerro Las Tatemas (Álamos microwave mtn), near Rancho El Cubajo, 27°06'N, 108°24'W, 25 December 1990, *Martin & O'Rourke s.n.* (ARIZ, RSA); vicinity of Álamos, 5 km N of Tepustete, 1 January 1991, *Martin et al. s.n.* (ARIZ, MEXU, RSA); rd from Álamos NE to Cuchujaqui, 27°01'N, 108°53' W, 29 September 1991, *Martin et al. s.n.* (ARIZ); N of Mocuzari, 4 April 1992, *Martin & O'Rourke s.n.* (ARIZ, RSA, UCR); road between Álamos and the upper crossing of the Río Cuchujaqui, 5–7 mi E of Álamos, ca. 26°59'N, 108°50' W, 14 December 1988, *Sanders 8835* (RSA, UCR); Mpio. Álamos, El Guayabo (upper) crossing of the Río Cuchujaqui, ca. 3 km NE of Sabinito Sur and 15 km (airline) ESE of Álamos 27°00'N, 108°47'W, 12 October 1992, *Sanders 12879* (ARIZ, RSA, UCR); Mpio. Álamos, 3.8 mi N of the Álamos–Navojoa Rd., at a point 5.6 mi W of Álamos (San Bernardo Rd.), ca. 14 km (airline) NW of Álamos, 3 mi N of El Carrizal & E of Cerro La Luna, near 27°07'N, 109°02' W, 17 March 1993, *Sanders 13346* (RSA, UCR); Mpio. Álamos, ca. 14 km (by air) ESE of Álamos, ca. 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, 21 November 1993, *Steinmann 93-353B* (ARIZ); Mpio. Álamos, ca. 14 km (by air) NW of Álamos, Cerro Las Tatemas, along the road less than 50 m before the microwave station (Microondas La Luna), 27°07'N, 109°02'15"W, 31 December 1994, *Steinmann 94-154* (ARIZ, DAV, MEXU, RSA); La Higuera, ca. 7 mi N of Álamos on the San Bernardo Rd, 27°05'N, 108°57'20"W, 29 December 1990, *Van Devender & Van Devender 90-589* (ARIZ); El Guayabo crossing of Río Cuchujaqui, 2.6 km NE of Sabinito Sur, 14 km (by air) ESE of Álamos, 27°00'05"N, 108°47'08"W, 12 October 1992, *Van Devender & Van Devender 92-1264* (ARIZ, RSA, UCR); ca. 6 km N of Álamos–Navojoa road at base of road to Microondas La Luna, W side of Cerro la Calera, 12 km (by air) NW of Álamos, 27°07'N, 109°01'40"W, 16 March 1993, *Van Devender & Van Devender 93-334* (ARIZ, UCR).

Discussion:—*Croton lindquistii* belongs to *Croton* subg. *Geiseleria* sect. *Eluteria* subsect. *Eluteria* (Grisebach 1859: 39) van Ee & Berry (in van Ee *et al.* 2011: 812). This subsection contains approximately 15 New World species and is characterized by a shrubby to arborescent habit, lepidote pubescence, monoecious sexuality, axillary inflorescences, multifid styles, and pistillate flowers with well-developed petals (van Ee *et al.* 2011). All of these features are possessed by *C. lindquistii*. The subsection corresponds to *Croton* sect. *Eluteria sensu stricto* of Webster (1993) and various other authors, e.g., León Enríquez & Martínez-Gordillo (2008) and Martínez Gordillo & Cruz-Duran (2002). The new species possesses the most northerly extension of the Mexican species of *Croton* sect. *Eluteria*.

The exact affinities of *Croton lindquistii* are unknown, and there is no detailed systematic or phylogenetic study of *Croton* subsect. *Eluteria*. The presence of 15–16 stamens per flower and stellate-pubescent ovaries and fruits are features shared with *C. niveus* Jacquin (1760: 32). However, the stout pedicels and generally ovate-cordiform leaves give this species a superficial resemblance to *C. pseudoniveus* Lundell (1940), and vegetatively these two are inseparable. When in flower *C. pseudoniveus* is readily distinguished by the possession of ovaries and fruits with lepidote scales, as well as 9–11 stamens per flower. Croizat (1945:147) implied that the Sonoran representative of *Croton* sect. *Eluteria* is *C. reflexifolius* Kunth (in Humboldt *et al.* 1817: 68), but the capsules of that species are strongly tuberculate and also possess lepidote scales. It is worth mentioning that one Sinaloan collection of *C. lindquistii* (*Gentry 5723*) is a paratype of *C. septemnerivius* McVaugh (1961: 165). However, the holotype of that species (*Palmer 1058* in 1890 (MICH!)) is a specimen of *C. niveus*.

As mentioned in the introduction, the name *Croton fantzianus* has been used for the species herein described, but I believe that this application is incorrect. The type of *C. fantzianus* was collected in the province of Nueva Segovia, Nicaragua, and the protologue states that fruits were present (Seymour 1971: 171). However, the pubescence of these was not described, and none of the type specimens that I have located possess ovaries or fruits. The species was characterized as having ovaries with lepidote scales by Webster (2001b) in the Flora de Nicaragua, and all material from Nicaragua that I have examined that otherwise appears similar to the type of *C. fantzianus* possesses ovaries with lepidote scales. Fruit pubescence is of great systematic value in subsect. *Eluteria*, and the trait is not known to be variable within a species. Given this evidence, I think that there is sufficient justification to treat the plants from western Mexico as distinct from *C. fantzianus*.

Five other species of *Croton* subsect. *Eluteria* possess ovaries and capsules with stellate pubescence: *C. carpostellatus* León Enriquez & Martínez-Gordillo (2008: 189), *C. gomezii* Webster (2005: 12), *C. arboreus* Millspaugh (1896: 303), *C. niveus*, and *C. sousae* Martínez Gordillo & Cruz-Durán (2002: 142). The following key will distinguish *C. lindquistii* from these.

1. Leaves pinnately veined.....*Croton carpostellatus*
- Leaves palmately veined..... 2
2. Stamens 8–11 per flower..... 3
- Stamens 13–17 per flower..... 5
3. Ovaries and fruits echinate with long, slender protuberances that terminate with a stellate hair *Croton gomezii*
- Ovaries and fruits smooth to slightly muricate, lacking long, slender protuberances that terminate with a stellate hair..... 4
4. Leaves coriaceous; stellate hairs of the ovary with the rays all appressed; petals of the pistillate flowers persistent
- *Croton arboreus*
- Leaves membranaceous; stellate hairs of the ovary porrect; petals of the pistillate flowers caducous..... *Croton sousae*
5. Mature leaves ovate to cordiform; thyrses spiciform, very compact, the axis obscured by the buds; the distal buds more or less the same size as the proximal buds; fruiting pedicels ≤ 3 mm long; fruits subglobose..... *Croton lindquistii*
- 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 > 3 mm long; fruits subglobose or oblong..... *Croton niveus*

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