

Research article

***Croton sertanejus*, a new species from Seasonally Dry Tropical Forest in Brazil, and redescription of *C. echioides* (Euphorbiaceae)**Rodolfo Carneiro SODR  ^{1,*} & Marcos Jos  da SILVA ²¹Universidade Estadual Paulista “J lio de Mesquita Filho”, Cx. Postal 510,
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Abstract. During a taxonomic study of the species of *Croton* sect. *Adenophylli* occurring in Brazil, approximately 140 collections usually identified as *Croton echioides*, *C. rhamnifolius* or *C. rhamnifolioides* caught our attention due to the distinct morphology of vegetative and reproductive organs. After the analysis of these collections, we concluded that they represent a new species, *C. sertanejus* Sodr  & M.J.Silva sp. nov., which was also corroborated by an anatomical study of their leaves. This new species can be differentiated by pseudomonopodial branching, leaves with petioles up to 1.7 cm long, 4–6 subsessile nectary glands and indumentum of sessile trichomes on both surfaces. Detailed descriptions, including details of leaf anatomy, are provided for *C. sertanejus* sp. nov. and *C. echioides*, its closely related species. We also formalize the synonymization of *C. kalkmannii* under *C. echioides* and re-evaluate the typification of these names, in order to better clarify their taxonomic status.

Keywords. Crotonae, diversity, endemism, flora, taxonomy.

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Introduction

Croton L. is a monophyletic genus and includes about 1300 tropical species, of which 300 occur in Brazil (van Ee *et al.* 2011; Caruzo *et al.* 2020). It is recognized worldwide specially by having stellate or lepidote trichomes on the vegetative and reproductive parts, leaves usually entire with nectary glands at the apex of the petiole or base of the leaf blade, inflexed stamens in bud, flowers in thyrses, the pistillate flowers commonly in basal cymules and monochlamydeous, or if dichlamydeous then with reduced petals, and dichlamydeous staminate flowers in the distal cymules (Webster 1993; Berry *et al.* 2005; van Ee *et al.* 2011). This genus, although well delimited morphologically and phylogenetically, has several species with difficult taxonomy or with circumscription problems (Lima & Pirani 2003; Sodr  & Silva 2020).

In Brazil, species of *Croton* occur in several habitats, although they are mostly represented in dry areas, such as the Caatinga Seasonally Dry Tropical Forest (SDTF), from where about 70 ‘marmeleiros’ or

‘velames’ (vernacular names for *Croton*) are reported (Carneiro-Torres 2009; Caruzo *et al.* 2020). During a taxonomic study of *Croton* sect. *Adenophylli* Griseb. occurring in Brazil, hundreds of collections from Caatinga identified as *C. echioides* Baill., *C. rhamnifolius* Kunth. or *C. rhamnifolioides* Pax & K.Hoffm. caught our attention because they were very variable in terms of the pattern of the branches and the shape, number and position of leaf nectary glands. The analysis of these collections, including types of all aforementioned species, indicated the discovery of a new species. Here, we describe and illustrate this new species, which we name *Croton sertanejus* sp. nov., and also provide updated descriptions, illustrations and comments for *Croton echioides*. In addition to macromorphological characters, which are very similar between these two related species, we added leaf anatomical characters, which have been shown to be useful in separating species in the genus (Soares 2013; Barbosa *et al.* 2018; Feio *et al.* 2018, Sodr  *et al.* 2019b, 2022; Sodr  & Silva 2020; Rosa *et al.* 2021).

Material and methods

Croton echioides and *C. sertanejus* sp. nov. are described based on an analysis of 90 physical specimens and 145 herbarium scans, including types, deposited in 38 Brazilian herbaria (ALCB, ASE, BHCB, BOTU, CEN, CEPEC, CSTR, EAC, ESA, HST, HRCB, HUFU, HUEFS, HUEM, HUESB, HUNEB, HURB, HVASF, HTSA, INPA, IPA, JPB, MAC, MBM, MG, PEUFR, RB, RON, SP, SPF, TEPB, UB, UEC, UESC, UFG, UFP, UFRN and VIES), and 14 foreign herbaria (A, BR, C, CTES, G, K, L, MEL, MO, NY, P, U, US and W). Acronyms of herbaria follow Index Herbariorum (Thiers continuously updated), except for the following repositories:

CSTR = Herbarium Rita Baltazar de Lima, Federal University of Campina Grande, Para ba, Brazil
HTSA = Herbarium Tropical Semi-arid, Embrapa Tropical Semi-arid, Petrolina, Pernambuco, Brazil
HST = Herbarium Sergio Tavares, Department of Forest Science, Federal Rural University of Pernambuco, Pernambuco, Brazil

When physical specimens were not available, their digital images were obtained from GBIF (<https://www.gbif.org/>), Reflora (<http://reflora.jbrj.gov.br/reflora/herbarioVirtual/>), Specieslink (<http://www.splink.org.br/>) or Jstor Global Plants (<https://plants.jstor.org/>). All localities are given verbatim from the specimen labels. All measurements and morphological comparison between *C. sertanejus* sp. nov. and related species are based on an examination of the mentioned specimens. The terminologies used follow the specialized literature of the genus (e.g., Webster *et al.* 1996; Kainulainen *et al.* 2017; Sodr  *et al.* 2019a), as well as the works of Radford *et al.* (1974) and Harris & Harris (2001), with the exception of the term pseudomonopodial, used to refer to a growth pattern with an elongated main stem with usually shortened secondary branches that gives the plant a monopodial growth aspect. Information about the types of vegetation, soil, altitude where the species was found, and their vernacular names were taken from the labels of the specimens, while the flowering and fruiting was inferred from the presence of flowers and/or fruits in fertile materials and observation of the month in which they were collected.

The geographical distribution map was created using the software QGIS Geographic Information System (ver. 3.12; [QGIS.org](https://qgis.org/)) with the coordinates from the labels of the exsiccatae listed here; for those without georeferencing data, we used the coordinates of the municipality where the specimen was collected. This same geographic coordinate dataset of the species was used to estimate the extent of occurrence (EOO) and area of occupancy (AOO) with the Geospatial Conservation Assessment Tool (GeoCAT; Bachman *et al.* 2011) using a cell width of 8 km. The conservation status of the species was then evaluated according to IUCN (2017). A digital line drawing was made in a drawing table and then processed in image processing applications.

For the anatomical study, three samples of each species were fixed in FAA (formaldehyde, acetic acid, and 50% ethanol; 1:1:18, v/v) for 48 h, and later stored in 70% ethanol (Johansen 1940). Freehand sections were made from the median part of the petiole and the leaves. Sections were bleached with a 20% sodium

hypochlorite solution, washed in distilled water, stained with aqueous solutions of 1% Astra Blue and 1% Safranin (Bukatsch 1972), and mounted on slides in glycerin : distilled water (1:1 v/v) solution. The sections were examined under an optical light microscope attached to a microscope camera. Description of the leaf anatomy follows usual terminology in anatomical studies (Metcalf & Chalk 1979, 1983; Evert 2006) and terminology consulted in previous studies of the genus (Feio *et al.* 2018; Sodr  *et al.* 2019b; Sodr  & Silva 2020).

Results

Taxonomy

Class Magnoliopsida Brongn.
Order Malpighiales Mart.
Family Euphorbiaceae Juss.
Genus *Croton* L.

Croton sertanejus Sodr  & M.J.Silva sp. nov.

[urn:lsid:ipni.org:names:77305496-1](https://nomenclature.ipni.org/names/77305496-1)

Figs 1–2

Diagnosis

Croton sertanejus sp. nov. differs from *C. echioides* due to pseudomonopodial branching, with an elongated main stem with shortened secondary branches in an alternate arrangement (vs di- or trichotomous branching in *C. echioides*), petiole 0.4–1.7(–2) cm long (vs (1.8–)3–8.1 cm), leaf blade base with 4–6 subsessile nectary glands facing both surfaces (vs with 2 stipitate nectary glands facing the abaxial surface), equal pistillate sepals (vs subequal or strongly unequal), and styles 2–3 mm long (vs 4–5.5 mm).

Etymology

‘*Sertanejo*’, in Portuguese, refers to people native to the Caatinga region, also known as ‘*sert o*’, that extends to all the states of northeast Brazil and the northern Minas Gerais.

Material examined

Type

BRAZIL • Bahia, Oliveira dos Brejinhos, 6 km ao Sul da cidade pela vicinal “Corredor da Barra”; 12°22′02.7″ S, 42°54′14.3″ W; 884 m a.s.l.; 20 Dec. 2017; fl.; R.C. Sodr , A.O. Souza & U.S. Amaral 3350; holotype: BOTU; isotypes: CEPEC, NY, TEPB, UFG.

Paratypes

BRAZIL – Bahia • Barra, Conglomerado BA-360; 10°58′48″ S, 44°33′36″ W; 20 Dec. 2017; fl.; A.S. Soares 401; RB, UB • Barra do Mendes, Carret o, estrada para Canarina; 11°49′33″ S, 42°3′17″ W; 750 m a.s.l.; 15 Dec. 2009; fl.; E. Melo, F. Fran a & B.M. Silva 7505; ALCB, HUEFS • *ibid.*; E. Melo, F. Fran a & B.M. Silva 7507; HUEFS • ca 10 km na estrada de terra para Seabra; 11°53′41″ S, 42°2′53″ W; 750 m a.s.l.; 16 Dec. 2009; fl.; E. Melo, F. Fran a & B.M. Silva 7539; HUEFS • *ibid.*; E. Melo, F. Fran a & B.M. Silva 7541; ALCB, HUEFS • ca 16.5 km na estrada de terra para Seabra, Lagoa do Peixe; 11°56′22″ S, 42°2′3″ W; 743 m a.s.l.; 16 Dec. 2009; fl.; E. Melo *et al.* 7563; HUEFS • ca 27 km na estrada de terra para Seabra; 12°1′13″ S, 41°59′58″ W; 750 m a.s.l.; 16 Dec. 2009; fl.; E. Melo, F. Fran a & B.M. Silva 7580; ALCB, HUEFS • Brotas de Maca bas, estrada para a BR-242; 12°17′7″ S, 42°34′7″ W; 519 m a.s.l.; 30 Jan. 2008; fl.; J.L. Ferreira, E. Melo & B.M. Silva 266; HUEFS • *ibid.*; J.L. Ferreira, E. Melo & B.M. Silva 268; HUEFS • Brumado; 28 Oct. 1965; fl.; A.P. Duarte 9544; HUEFS, NY, RB, SPF • Caetit ; 15 Jan. 1983; fl.; M.L. Guedes *et al.* 2787; ALCB • ramal a 29 km na estrada Caetit /Brumado, ca 3 km

ramal adentro; 19 Feb. 1992; fr.; *A.M. Carvalho et al.* 3784; CEPEC, NY • Campo Formoso; 21 Apr. 1981; fr.; *W.N. Fonseca* 386; RB • Canudos, Bedengó, Ramal a 5 km da BR-115, sentido Euclides da Cunha; 10°4'42" S, 39°7'46" W; 560 m a.s.l.; 24 Jun. 2005; no fl. or fr.; *D.S. Carneiro-Torres et al.* 514; HUEFS • Carfanaum, entre Lapa Cercada e Lapa da Igreja, proximidades do povoado de Cercadinho; 11°44'17.71" S, 41°27'20.55" W; 748 m a.s.l.; 19 Mar. 2016; fl. and fr.; *P.H.A. Melo & F.F. Pezzini* 4885; HUEFS • *ibid.*; 11°44'2.4" S, 41°27'41.7" W; 731 m a.s.l.; 9 Apr. 2017; fl.; *P.H.A. Melo & L.C.A. Gonçalves* 6744; HUEFS • *ibid.*; *P.H.A. Melo & L.C.A. Gonçalves* 6752; HRCB • margem esquerda da BR-122, a 22 km de Cafarnaum, sentido Morro do Chapéu; 11°31'58.7" S, 41°23'12.2" W; 737 m a.s.l.; 10 Apr. 2017; fl.; *P.H.A. Melo & L.C.A. Gonçalves* 6783; HRCB, HUEFS • *ibid.*; *P.H.A. Melo & L.C.A. Gonçalves* 6792; HRCB, HUEFS • *ibid.*; *P.H.A. Melo & L.C.A. Gonçalves* 6794; HRCB, HUEFS • Contendas do Sincorá, estrada entre Sussuarana e Contendas do Sincorá; 13°48'56" S, 41°3'57" W; 404 m a.s.l.; 15 Mar. 2015; fr.; *A.G. Azevedo-Neto et al.* 14; HUEFS • Curaçá, Comunidade de Patamuté; 9°25'19" S, 39°28'13" W; 420 m a.s.l.; 23 Mar. 2012; fl.; *E. Melo et al.* 11078; HUEFS • Glória, Complexo Itaparica, margem do lago; 9°4'11" S, 38°24'13" W; 333 m a.s.l.; 14 Jun. 2007; fl.; *M. Oliveira et al.* 2831; MAC, UFP • Iaçú, Fazenda Lapa, Lagedo Alto; Apr. 1974; fl.; *G.C.P. Pinto* 42272; ALCB • rodovia Itaberaba/Milagres, entre Iaçú e Milagres, a 10–20 km a E de Iaçú, 400–500 m a.s.l.; 25 Dec. 1979; fl.; *S.A. Mori & F.P. Benton* 13243; CEPEC, NY • BA-046, trecho entre Milagres e Iaçú, a 25 km ao SE de Iaçú, 300 m a.s.l.; 28 Feb. 1980; fl. and fr.; *S.A. Mori* 13272; CEPEC, NY • Fazenda Lapa; 12°42' S, 39°56'1 W; 26 Feb. 1983; fl. and fr.; *H.P. Bautista* 716; HUEFS • Fazenda Suíbra, Morro do Gado Bravo; 12°43' S, 40°7' W; 14 Mar. 1985; fl. and fr.; *L.R. Noblick* 3687; CEPEC, HUEFS • rodovia Iaçú/Milagres (BA-046) km 13, coletas no início do ramal para as fazendas Suíbra e Morros; 12°49' S, 40°10' W; 240 m a.s.l.; 22 Mar. 1988; fl.; *S. Ginzburg, L.A. Mattos-Silva & H.S. Brito* 803; CEPEC, NY • Morro da Garrafa; 12°45'18" S, 39°51'0" W; 250 m a.s.l.; 23 Feb. 1997; fr.; *E. Melo et al.* 2116; HUEFS, HUESB, SP • Ibipeba, estrada para Ibititá; 11°37'6" S, 42°0'3" W; 742 m a.s.l.; 25 Oct. 2009; fr.; *E. Melo et al.* 6881; ALCB, HUEFS • Irecê, Lapão, Morro Pelado; 11°24'22" S, 41°49'22" W; 787 m a.s.l.; 27 Oct. 2009; fr.; *M.L. Guedes et al.* 16178; ALCB, HUEFS • Área do CETEP; 11°19'0" S, 41°49'49" W; 22 Feb. 2016; fl. and fr.; *G. Costa & A.C.S. Moraes* 1656; ALCB, HUEFS, HURB • 11°19'0" S, 41°49'42" W; 25 Feb. 2016; fr.; *G. Costa & A.C.S. Moraes* 1742; ALCB, HUEFS, HURB • *ibid.*; *G. Costa & A.C.S. Moraes* 1746; ALCB, HUEFS, HURB • Itatim, Morro do Agenor; 12°43' S, 39°46' W; 310–430 m a.s.l.; 25 Feb. 1996; fl.; *E. Melo et al.* 1483; CEN, HUEFS, MAC • Morro da Quixaba; 12.7119° S, 39.6981° W; 410 m a.s.l.; 14 Dec. 1996; fl.; *E. Melo et al.* 1889; HUEFS, SP, VIES • Morro do Bastião; 12°45'12" S, 39°46'59" W; 282 m a.s.l.; 25 Jan. 1997; fl.; *E. Melo et al.* 1919; HUEFS, HUESB, UEC • *ibid.*; 24 May 1997; fl.; *V.M. Monteiro, C. Aguiar & J. Resende* 68; HUEFS • Itiúba, Serra de Itiúba, about 6 km E of Itiúba; 10°41' S, 39°48' W; 500 m a.s.l.; 19 Feb. 1974; fl.; *R.M. Harley* 16214; RB • Fazenda Experimental da EPABA; 10°43' S, 39°48' W; 27 May 1983; fl. and fr.; *G.C.P. Pinto & H.P. Bautista* 109/83; CEPEC, K, NY • 10 km da cidade de Itiúba; 10°41'14" S, 39°48'17" W; 24 Jun. 2005; no fl. or fr.; *D.S. Carneiro-Torres et al.* 531; HUEFS • Ituaçu, Morro da Mangabeira; 22 Dec. 1983; fl.; *E.P. Gouveia* 60/83; ALCB • *ibid.*; *E.P. Gouveia s.n.*; ALCB[51564] • Jacobina; 8 Apr. 1991; fr.; *M. Andrade Neto s.n.*; EAC[17121], K[001184431], NY[01281082] • Jaguari, Fazenda Pé de Laje, próximo ao povoado de Gameleira; 10°12'52.4" S, 40°8'8.2" W; 644 m a.s.l.; 18 Apr. 2017; fl.; *E.D.S. Almeida & J.G.B. Silva* 81; HVASF, HUEFS • Jeremoabo, estrada de chão sentido Canudos; 10°4'7" S, 38°28'21" W; 297 m a.s.l.; 30 Jun. 2007; no fl. or fr.; *D.S. Carneiro-Torres et al.* 981; HUEFS • Jequié, estrada da Barragem de Pedra; 5 Apr. 1987; fl.; *V. Pereira* 99; HUEFS • Juazeiro, Serra do Mulato; 9°44'40" S, 40°40'39" W; 26 Mar. 2000; fl.; *N.G. Jesus et al.* 880; ALCB, SPF • Lagoa Real; 565 m a.s.l.; 17 Dec. 2008; fl.; *C. Novello 1*; HUEFS, HUEM • *ibid.*; *C. Novello 2*; HUEFS, HUEM • Lajedinho, proximidade do povoado de Simpatia; 12°27'7.36" S, 41°0'41.52" W; 593 m a.s.l.; 17 Mar. 2016; fl.; *P.H.A. Melo & F.F. Pezzini* 4833A; HRCB • 12°27'18.9" S, 41°0'33.3" W; 591 m a.s.l.; 8 Apr. 2017; fl.; *P.H.A. Melo & L.C.A. Gonçalves* 6691; HUEFS • *ibid.*; *P.H.A. Melo & L.C.A. Gonçalves* 6734; HRCB, HUEFS • Livramento do Brumado, 3–5 km da cidade, na estrada para Rio de Contas; 13°38' S, 41°50' W; 580–600 m a.s.l.; 12 Dec. 1988; fl.; *R.M. Harley et al.* 27140; CEPEC • *ibid.*; *R.M. Harley et al.* 27141; K, NY, SPF • Manoel Vitorino,

estrada que liga Manoel Vitorino com Caatingal, a 5 km da BR-116; 350 m a.s.l.; 10 Mar. 1980; fr.; *S. Mori 13448*; CEPEC, NY • Maracás, estrada para Marcionílio Souza, ca 12.6 km da cidade; 13°14'20" S, 40°34'15" W; 395 m a.s.l.; 3 Nov. 2011; fl.; *E. Melo et al. 10603*; HUEFS • Marcionílio Souza, 8 km ao S de Marcionílio Souza na estrada para Maracás; 13°5' S, 40°30' W; 22 Mar. 1988; fl.; *S. Ginzburg, L.A. Mattos-Silva & H.S. Brito 816*; NY • Monte Santo; 10°26' S, 39°19' W; 11 Jan. 2006; fl.; *M.L. Guedes et al. 12037*; ALCB • *ibid.*; 22 Jan. 2016; fl.; *F.A. Silva 18*; HURB • Morpará; 11°35'50" S, 43°17'4" W; 16 Dec. 2007; fl.; *A.A. Conceição et al. 2652*; HUEFS • estrada para Morpará, beira do Rio Paramirim; 11°42'11" S, 43°14'2" W; 444 m a.s.l.; 16 Dec. 2007; fl.; *A.A. Conceição et al. 2682*; HUEFS • *ibid.*; *A.A. Conceição et al. 2686*; HUEFS • Morro do Chapéu, ca 2 km da Comunidade Gruta dos Brejões; 11°0'53" S, 40°24'19" W; 650 m a.s.l.; 4 May 2007; no fl. or fr.; *D. Cardoso & R.M. Santos 1820*; HUEFS • estrada para Cafarnaum; 11°29'50" S, 41°21'34" W; 728 m a.s.l.; 1 Feb. 2008; fl.; *F.B.L. Silva & F. França 78*; HUEFS • Oliveira dos Brejinhos, estrada para Água Quente; 12°20'11" S, 42°54'29" W; 673 m a.s.l.; 18 Dec. 2007; fl.; *A.A. Conceição et al. 2759*; HUEFS • 6 km ao Sul da cidade pela vicinal "Corredor da Barra"; 12°22'02.7" S, 42°54'14.3" W; 884 m a.s.l.; 20 Dec. 2017; fl.; *R.C. Sodr  et al. 3347*; BOTU, UFG • *ibid.*; *R.C. Sodr  et al. 3348*; BOTU, UFG • *ibid.*; *R.C. Sodr  et al. 3349*; BOTU, UFG • Palmeiras, 12°26'48" S, 41°31'6" W; 697 m a.s.l.; 1 Dec. 2011; fl.; *S.P.S. Neves 393*; HUEFS • subida para a Serra Negra; 12°32' S, 41°35' W; 740 m a.s.l.; 29 Jan. 2015; fl.; *D.S. Carneiro-Torres et al. 1288*; HUEFS • 12°31'51.6" S, 41°35'17.4" W; 736 m a.s.l.; 19 Dec. 2017; fl.; *R.C. Sodr  et al. 3341*; UFG • Paulo Afonso; 12 Apr. 1952; fl.; *Labouriau 941*; RB, SPF • Piat , Chapada Diamantina, subida da Capela Nossa Senhora Santana; 13°9'2" S, 41°45'0" W; 15 Jun. 2014; fl.; *M.L. Guedes et al. 21918*; ALCB • Piemonte da Diamantina, Miguel Calmon, entorno do Parque de Sete Passagens; 11°22'25" S, 40°35'14" W; 546 m a.s.l.; 23 Dec. 2006; fl.; *M.L. Guedes et al. 13215*; ALCB • Jo o Dourada, Ponto 7; 11°19'51" S, 41°44'14" W; 363 m a.s.l.; 10 Apr. 2013; fl.; *M.L. Guedes et al. 20656*; ALCB • Pil o Arcado, sentido Brejo de Zacarias; 9°58'31" S, 42°49'12" W; 6 Sep. 2005; no fl. or fr.; *D.S. Carneiro-Torres et al. 593*; HUEFS • sentido I  Grande – Pil o Arcado Dunas, Barra do I ; 10°1'25" S, 42°48'15" W; 18 Mar. 2006; fr.; *D.S. Carneiro-Torres et al. 621*; HUEFS • Quijingue, fazenda Urubu, a ca de 3 km E do povoado Quixaba do Mandacaru; 10°55'1" S, 39°3'49" W; 270 m a.s.l.; 14 May 2005; fr.; *D. Cardoso 515*; HUEFS, NY • Remanso, ca 18 km de Remanso, entrada a direita no sentido Remanso; 9°29'20" S, 42°14'54" W; 457 m a.s.l.; 28 Dec. 2001; fl.; *T.S. Nunes et al. 690*; HUEFS • Rio de Contas, 10 km do Rio de Contas na estrada para Marcolino Moura; 13°36' S, 41°43' W; 500–600 m a.s.l.; 15 Nov. 1988; fl.; *R.M. Harley, D.J.N. Hind & T.B. Cavalcanti 26445*; K, NY, RB, SPF, U • caminho para Lagoa Nova; 13°47'42" S, 41°46'44" W; 490 m a.s.l.; 5 Feb. 1997; fr.; *E. Saar et al. PCD 5093*; ALCB, K, SPF • *ibid.*; fl. and fr.; *L. Passos et al. PCD 5109*; ALCB, CEPEC, K, SPF • S o Gabriel, fazenda Boa Sorte; 11°1' S, 41°39' W; 798–800 m a.s.l.; 3 Apr. 2009; fl.; *R.F. Machado, F.F. Rocha & A.F. Rocha 138*; HUEFS • estrada para Jussara; 11°9'54" S, 41°56'34" W; 770 m a.s.l.; 25 Oct. 2009; fl. and fr.; *E. Melo et al. 6956*; ALCB, HUEFS • Senhor do Bonfim, Fazenda Rancharia; 24 Mar. 2007; fl.; *L.P. Felix 11562*; HUEFS • *ibid.*; *L.P. Felix 11581*; HUEFS • Sento S , base do Morro da Mina; 9°51'39" S, 42°3'23" W; 930 m a.s.l.; 19 Dec. 2007; fl. and fr.; *J.G. Carvalho-Sobrinho & C.T. Lima 1728*; HST, HUEFS • Umburanas, Ourol ndia, estrada para Umburanas, estrada de ch o para Pedreira Araras; 10°56'57" S, 41°4'38" W; 682 m a.s.l.; 26 Jan. 2008; fl.; *M.M. Silva-Castro et al. 1435*; HUEFS • Parque Nacional Boqueir o da On a, rio Murim; 10°30'16.9" S, 41°19'52.4" W; 744 m a.s.l.; 29 Jan. 2010; fr.; *A.P. Fontana et al. 6426*; HUEFS, HVASF • Xique-Xique, 15 km S de Xique-Xique, camino a Santo In cio; 10°58' S, 42°41' W; 400–500 m a.s.l.; 19 Feb. 1997; fr.; *M.M. Arbo et al. 7519*; CEPEC, CTES, NY. – **Cear ** • Aiuaba; 6.3712° S, 40.0923° W; 478 m a.s.l.; 21 Feb. 2014; fl.; *A.L.B. Sartori et al. 1153*; EAC • Campos Sales, V rzea da Vaca; Feb. 1839; fl.; *G. Gardner 2441*; K[001184426], K[001184427], L[0146109] • Piquet Carneiro, Ibicu , Miguel Calmon; 17 Apr. 1909; no fl. or fr.; *A. Ducke s.n.*; MG[2202], RB[187679] • Saboeiro, entre Saboeiro e Aiuaba, no entroncamento da estrada do Algod o; 21 Mar. 1984; fl.; *E. Nunes s.n.*; EAC[12357], HUEFS[111120] • Tau , Fazenda Angico; 29 Apr. 1981; fr.; *E. Nunes & M.A. Figueiredo s.n.*; EAC[10110], HUEFS[106374]. – **Minas Gerais** • Mato Verde, S o Jo o do Bonito, estrada para as lavras na Serra Geral, 2.5 km de S o Jo o do Bonito, 12.5 km da rodovia Mato Verde – Monte Azul

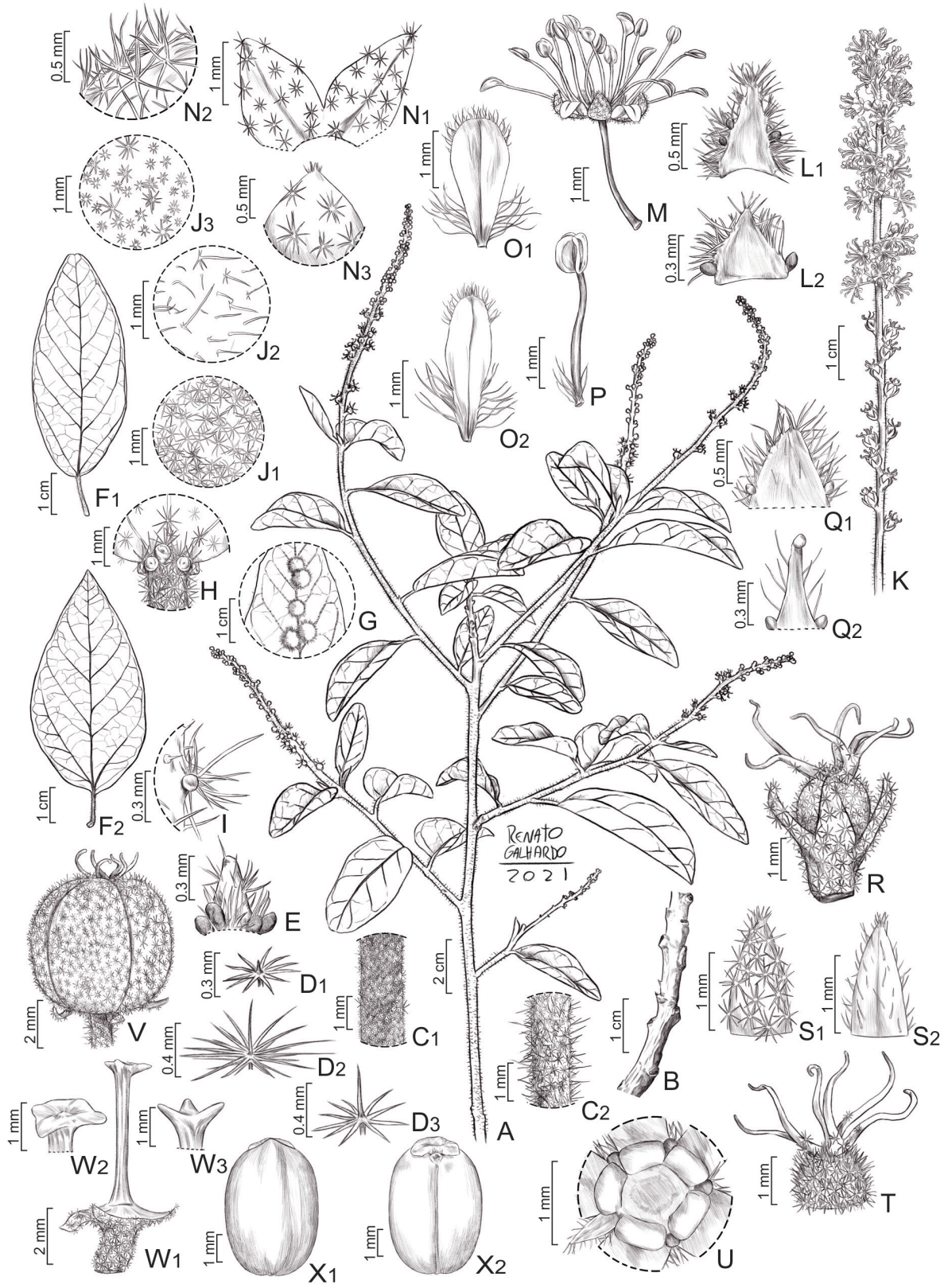
(BR-122), próximo ao Córrego do Pé da Serra; 15°18'21" S, 42°49'37" W; 580 m a.s.l.; 7 Apr. 2004; fl. and fr.; *J.R. Pirani et al. 5466*; SPF. – **Paraíba** • Itaporanga, Fazenda Cafula; 7°13'52" S, 38°9'21.6" W; 540 m a.s.l.; 2 Nov. 2015; fl.; *P.F. Souza 107*; CSTR, EAC • São José dos Cordeiros, RPPN-Fazenda Almas; 7°28'15" S, 36°53'51" W; 645 m a.s.l.; 24 Jan. 2003; fl.; *Z.G. Quirino & J.R. Lima 3*; HUEFS • *ibid.*; *Z.G. Quirino & J.R. Lima 15*; HUEFS • Manga geral, Área I, Laje do Cara; 7°29'21" S, 36°55'36" W; 16 Feb. 2003; fl.; *M.R. Barbosa et al. 2686*; HUEFS, JPB • *ibid.*; *M.R. Barbosa et al. 2715*; HUEFS, JPB • Taperoá, 5 km após a entrada da estrada para Taperoá; 4 Mar. 1994; fl. and fr.; *S.I. da Silva s.n.*; PEUFR, SPF[137104]. – **Pernambuco** • Afogados da Ingazeira, estrada para Afogados da Ingazeira, km 35 da BR-292; 10 Feb. 1993; fl.; *S.I. da Silva 64*; PEUFR, SPF • Betânia, Vale dos Navios; 20 Apr. 1955; fl.; *A. Guerra 5528*; SPF • Vale do Pajéu; 5 Apr. 2002; fr.; *S.M. Freitas Neto et al. 1*; HUEFS • Bodocó, arredores da cidade; 12 Feb. 1991; fl.; *P. Lisboa & C. Silva 4515-34*; EAC • Buíque, fazenda Laranjeiras; 8°37'30" S, 37°9'15" W; 799 m a.s.l.; 22 Feb. 1996; fl.; *K. Andrade et al. 306*; NY, PEUFR • Custódia, proximidades do Reservatório Copiti, Projeto de Transposição do Rio São Francisco; 8°14'53.9" S, 37°41'33.3" W; 526 m a.s.l.; 18 Feb. 2009; fl.; *M. Oliveira & J. Cardoso Junior 3763*; HVASF, HUEFS • estrada formada pela área de influência da linha de transmissão de alta tensão que acompanha o canal do PISF; 8°12'16.48" S, 37°41'52.1" W; 434 m a.s.l.; 14 May 2013; fr.; *V.M. Cotarelli & J. Silva 2530*; HVASF, HUEFS • *ibid.*; 8°9'55.6" S, 37°33'20.32" W; 513 m a.s.l.; 15 Mar. 2016; fl. and fr.; *M. Oliveira, A.P. Fontana & A.C.P. Oliveira 6407*; RB • Lagoa Grande, Sertão, Fazenda Planaltino, Rodovia PE-574; 8°59' S, 40°16' W; 10 Jan. 2018; fl.; *M.L. Guedes 30231*; ALCB • Petrolândia, trecho do canal da transposição; 8°41'32.6" S, 38°16'28.3" W; 391 m a.s.l.; 29 Jan. 2009; fl. and fr.; *V.D. Silva et al. 87*; HUEFS, HVASF • Petrolina, limite sul do CPATSA; 9°7.5' S, 40°31.11' W; 13 Jan. 1983; fl.; *G. Fotius 3304*; HTSA, RB • *ibid.*; 24 Jan. 1983; fl.; *G. Fotius 3310*; HTSA, RB • área da CODEVASF; 9°9.17' S, 40°29.44' W; 4 Feb. 1983; fl.; *G. Fotius 3333*; HTSA, RB • CPATSA; 3 Mar. 1993; fl.; *S.I. da Silva 114*; PEUFR, SPF • Salgueiro; 9 Mar. 2007; fr.; *E.R. Silveira s.n.*; EAC[39845] • *ibid.*; 8°7' S, 39°7' W; 3 Mar. 2014; fr.; *E.R. Silveira & F.C.L. Pinto s.n.*; ALCB[122233] • Santa Maria da Boa Vista, margem da PE 4 em direção à Jutai; 29 Apr. 1971; fr.; *Academia Brasileira de Ciências 406*; HUEFS, IPA • Serra Talhada, Estação Experimental do IPA, Pimenteira; 25 Mar. 1995; fl.; *A.M. Miranda et al. 2192*; MAC, PEUFR, SPF • *ibid.*; 7.59° S, 38.1916° W; 30 Jan. 1996; fl.; *M.L. Gomes 129*; IPA, HUEFS • 3 km SW of road from Serra Talhada to Lagoinha, around permanent plot and flux tower; 7°58'5" S, 38°23'3" W; 17 Mar. 2017; fl.; *P.W. Moonlight & T. Sarkinen 419*; HUEFS • *ibid.*; 18 Mar. 2017; fl.; *P.W. Moonlight & T. Sarkinen 430*; HUEFS • Sertânia, Centro da Caprino-ovinocultura do IPA, Pimenteira; 8°4'25" S, 37°12'24" W; 160 m a.s.l.; 6 Apr. 2001; fl. and fr.; *R.M. Harley & A.M. Giuliatti 54177*; HUEFS, K • Caroyalina, Sítio do Sr. Sibas; Jul. 2003; fl.; *L. Melo & J. Sampaio 34*; IPA, HUEFS • Verdejante, Vila Produtiva Rural de Pilões; 7°52'57.23" S, 39°2'16.13" W; 534 m a.s.l.; 21 Feb. 2013; fl.; *F.F.S. Silva 751*; HUEFS, HVASF. – **Piauí** • São João do Piauí, Porfírio; 8°21' S, 42°14' W; 222 m a.s.l.; 14 Feb. 1995; fl. and fr.; *F.G. Alcoforado Filho 477*; HUEFS, IPA, K, TEPB • *ibid.*; 14 Apr. 1995; fl. and fr.; *F.G. Alcoforado Filho & J.H. Carvalho 484*; IPA, K, TEPB • Embrapa Meio Norte; 8°20'44" S, 42°19'34" W; 24 Mar. 2015; fl. and fr.; *K.N.C. Castro & J.B.A. Souza 471*; CEN • São Raimundo Nonato, Humaitá – São Raimundo Nonato; 15 Dec. 1978; fl.; *F.M.T. Freire 11*; EAC • Barreirinhas – São Raimundo Nonato; 18 Dec. 1978; fl.; *A. Fernandes et al. s.n.*; EAC[5151] • fazenda Joá; 27 Jan. 1984; fl.; *L. Emperaire 2180a*; RB • Parque Nacional Serra da Capivara; 8°25' S, 42°20' W; 8 Dec. 2017; fl.; *M. Mizushima, P. Rodrigues & R.M. Santos 218*; HUEFS. – **Sergipe** • Poço Verde, Fazenda Santa Maria da Lage; 10°42'30" S, 38°11'0" W; 16 Nov. 2010; no fl. or fr.; *E.V.R. Ferreira et al. 213*; ASE • Assentamento Santa Maria da Lage; 22 Jul. 2015; fr.; *E.V.S. Oliveira 563*; ASE, HUEFS • locality unknown [caatingas arbustivo-arbórea e arbórea]; Apr. 1989; fl. and fr.; *E.L. Araújo s.n.*; SPF[137105].

Description

Shrubs or trees, (1–)1.5–5(–7) m tall, erect, pseudomonopodial branching, with main stem extended bearing lateral alternate branches, frequently with galls; latex scarce, clear; sweetish odor; stems very rigid, cylindrical, straight or tortuous, striated or smooth in young branches; whitish, yellowish, or slightly

ferruginous tomentose indumentum of multiradiate or stellate-porrect trichomes with stipe 0.05–0.1 mm long, stellate-porrect trichomes with one-plane whorl of 8–12 free lateral rays and multiradiate trichomes with two or three whorls of 16–30 free lateral rays, in both trichomes lateral rays 0.15–0.7 mm long and central ray 0.15–0.25(–0.7) mm long. Leaves alternate, leaf blades (3–)4–8 times as long as petioles; stipules 0.5–0.8 × 0.15–0.3 mm, triangular, lanceolate or linear, with 4 sessile ovoid glands at base and/or one subglobose gland at apex, with stellate-porrect trichomes on both surfaces; petioles 0.4–1.7(–2) cm long; leaf blades 2.2–8.9 × 1.2–4.7 cm, oval-elliptic, elliptic, ovate or oval-lanceolate, sometimes lanceolate or narrowly elliptic, membranaceous, base obtuse or rounded, sometimes slightly cordate or truncate with 4–6 patelliform nectary glands 0.2–0.7 mm diam., subsessile with stipe 0.1–0.2 mm long, at least two facing adaxial surface and other two facing abaxial surface; apex acute, obtuse, mucronate or apiculate, sometimes slightly emarginate or acuminate; margin entire or less commonly serrulate with globose sessile glands (colleters); venation brochidodromous with 4–8 pairs of secondary veins impressed on adaxial surface and slightly prominent on abaxial surface; discolorous, adaxial surface dark green with hirtellous indumentum of simple, 2–4-radiate or stellate-porrect trichomes, stellate-porrect trichomes with 6–11 lateral rays, sessile, lateral rays 0.2–0.5 mm long, porrect ray up to 1 mm long; abaxial surface light green with shortly tomentose indumentum of stellate-porrect trichomes with 6–8 lateral rays or multiradiate trichomes with 11–16 lateral rays, both sessile, lateral rays 0.2–0.7 mm long, central ray 0.2–0.8 mm long. Thyrses 2.8–16 cm long, peduncle 0.4–2.5 cm long, terminal, bisexual with 4–10 solitary pistillate flowers sparsely, rarely densely, distributed on $\frac{1}{4}$ – $\frac{1}{2}$ of inflorescence axis, or thyrses unisexual staminate, less commonly unisexual pistillate; staminate cymules with 2–4 flowers, staminate flower bracts 0.4–1 × 0.4–0.7 mm, triangular, oval or oblong, margin entire, with 2 or 3 subglobose sessile glands at base, indumentum of stellate-porrect trichomes on external surface and hirsute indumentum of simple trichomes on margin, glabrous internally; 2 staminate flower bracteoles per cymule, 0.3–0.7 × 0.15–0.3 mm, triangular or ovate, with glands and indumentum similar to those of bracts; pistillate flower bracts 0.5–1(–2.2) × 0.3–0.8(–1) mm, triangular, margin entire, with ovoid or subglobose sessile glands, with sessile stellate-porrect trichomes externally, glabrous or glabrescent internally; 2 bracteoles per pistillate flower, 0.3–0.8 × 0.1–0.4 mm, linear or triangular, with subglobose glands at base. Staminate flowers 5–8 mm long; pedicels 1.6–4.7 mm long, glabrous, glabrescent, pubescent or tomentose; calyces 5(6)-partite, greenish with whitish indumentum, lobes 1.4–2 × 0.9–1.3 mm, ovate or largely ovate, united in $\frac{1}{6}$ – $\frac{1}{4}$ of length, apex obtuse or acute, dorsal surface with shortly tomentose indumentum of

Fig. 1. *Croton sertanejus* Sodré & M.J.Silva sp. nov. **A.** Flowering branch. **B.** Detail of older portion of stem with leaf scars. **C₁–C₂.** Indumentum of the stems. **C₁.** Tomentose indumentum. **C₂.** Hirsute indumentum. **D₁–D₃.** Trichomes of the stems. **D₁.** Stellate trichome. **D₂.** Multiradiate-porrect trichome. **D₃.** Stellate-porrect trichome. **E.** Stipule, ventral surface. **F₁–F₂.** Leaves. **F₁.** Elliptic leaf blade. **F₂.** Ovate leaf blade. **G.** Detail of the galls on the leaf blade. **H.** Extrafloral nectaries of leaf base in adaxial view. **I.** Colleters of leaf margin in adaxial view. **J₁–J₃.** Indumentum of leaf blades. **J₁.** Tomentose indumentum of abaxial surface. **J₂.** Sparse indumentum of simple, stellate-porrect or 2-radiate trichomes of adaxial surface. **J₃.** Sparse indumentum of stellate trichomes of adaxial surface. **K.** Inflorescence. **L₁.** Staminate flower bract, ventral surface. **L₂.** Staminate flower bracteole, ventral surface. **M.** Staminate flower. **N₁–N₃.** Lobes of staminate flower calyx in dorsal view. **N₁.** Two lobes showing the union of the calyx. **N₂.** Dense indumentum of stellate-porrect trichomes. **N₃.** Sparse indumentum of stellate-porrect trichomes. **O₁–O₂.** Pistillate flower petals in dorsal view. **O₁.** Obovate petal. **O₂.** Oblanceolate petal. **P.** Stamen. **Q₁.** Pistillate flower bract, ventral surface. **Q₂.** Pistillate flower bracteole, ventral surface. **R.** Pistillate flower. **S₁–S₂.** Pistillate flower sepal. **S₁.** Dorsal view. **S₂.** Ventral view. **T.** Gynoecium. **U.** Nectary disk and reduced petals of the pistillate flowers (cut out sepals and gynoecium removed). **V.** Fruit. **W₁.** Fruit columella. **W₂.** Apex of columella with irregular and plane tips. **W₃.** Apex of columella with three slightly ascending tips. **X₁.** Seed, dorsal side. **X₂.** Seed, ventral side. Drawing by Renato Galhardo: A–U = R.C. Sodré et al. 3350, holotype (BOTU); V–X₂ = K.N.C. Castro & J.B.A. Souza 471 (CEN).



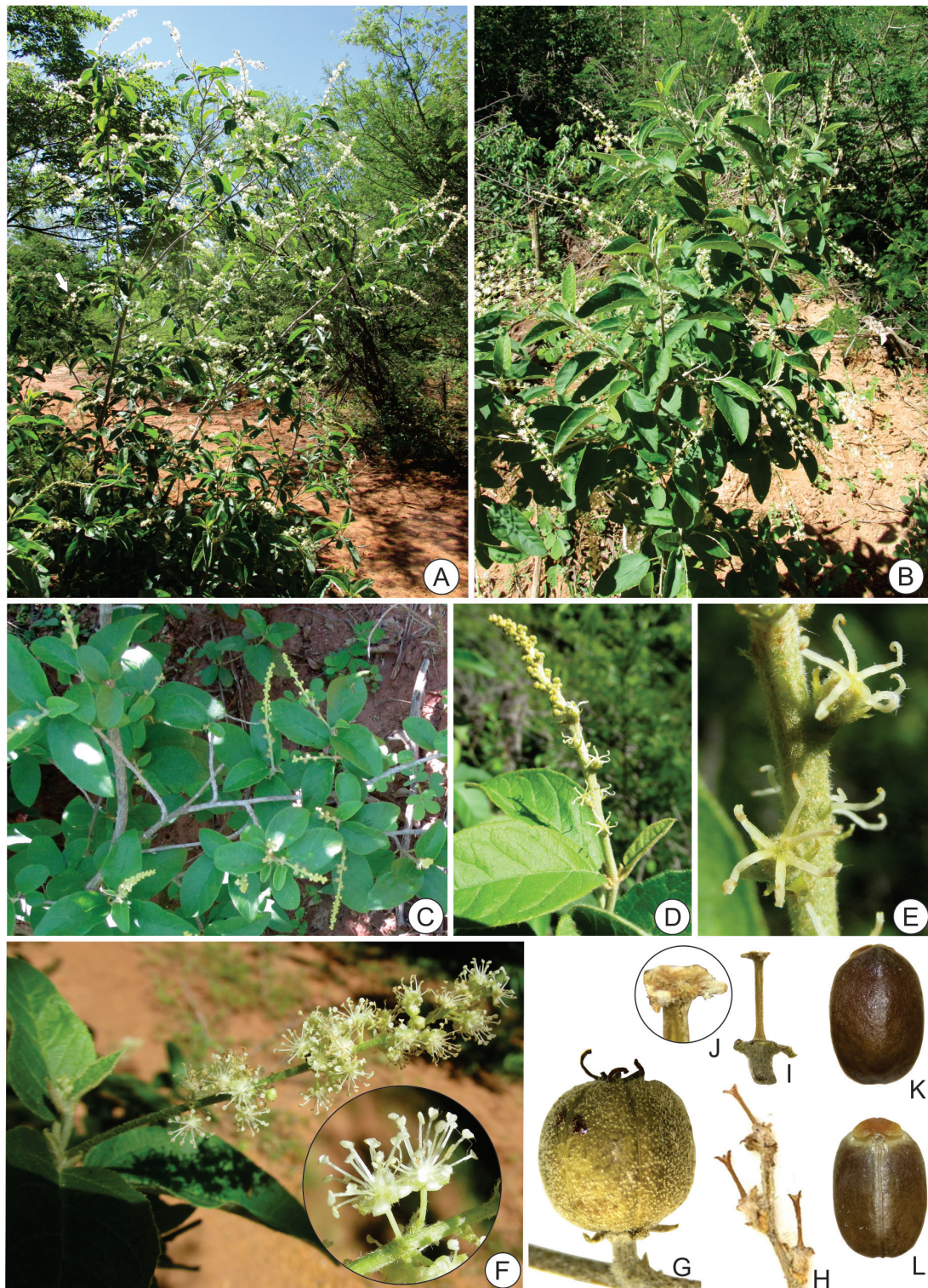


Fig. 2. *Croton sertanejus* Sodr  & M.J.Silva sp. nov. A–B. Habit. C. Flowering branch showing ramifying in alternate branches. D. Inflorescence showing pistillate flowers and staminate buds. E. Pistillate flowers. F. Unisexual staminate inflorescence. G. Fruit. H–I. Fruit columella. J. Apex of columella with irregular and plane tips. K. Seed, dorsal side. L. Seed, ventral surface. A–F = Population from Oliveira dos Brejinhos, Bahia (R.C. Sodr  et al. 3350, holotype; BOTU); G–L = K.N.C. Castro & J.B.A. Souza 471 (CEN). Photographs: R.C. Sodr .

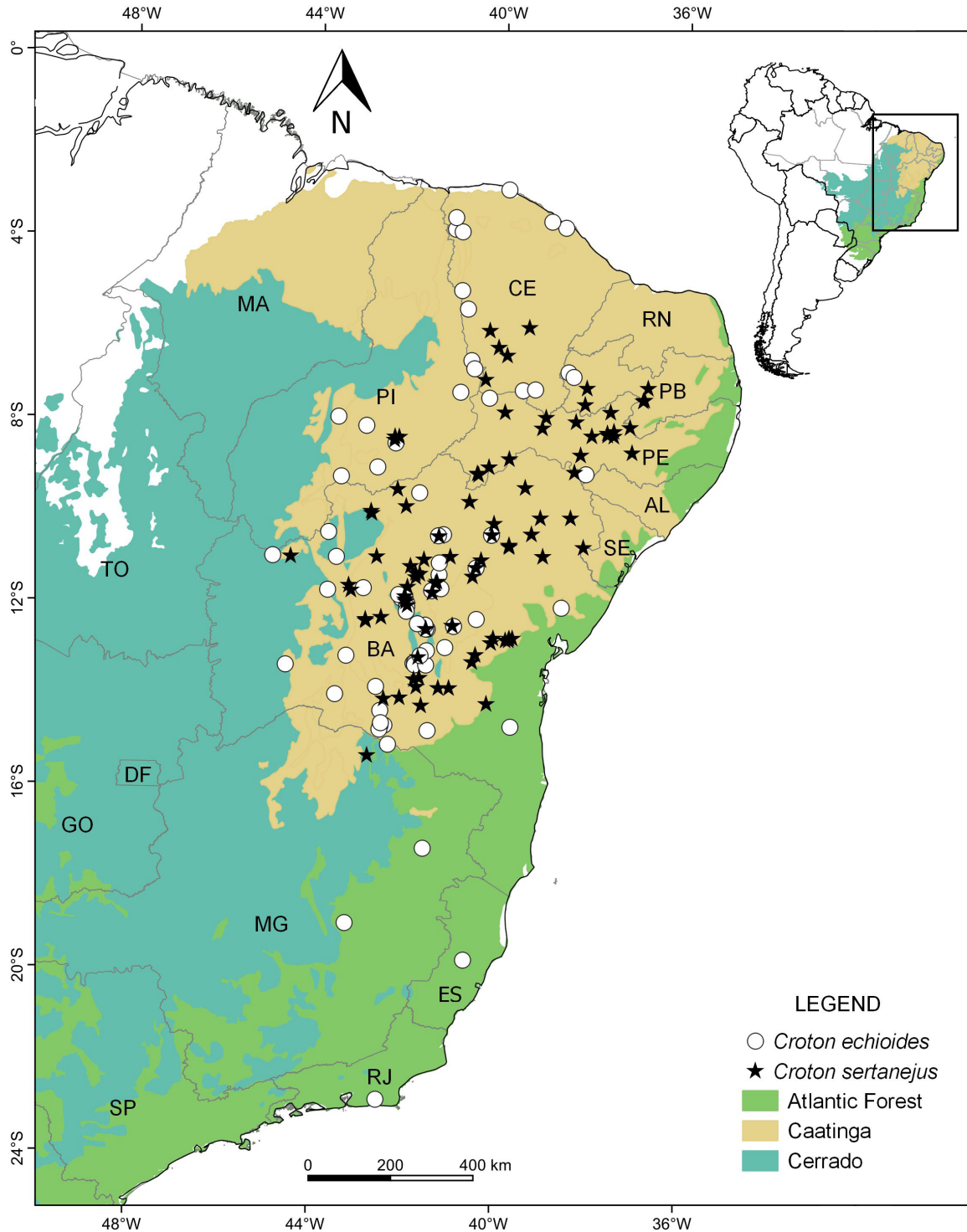


Fig. 3. Geographical distribution of *Croton echioides* Baill. and *C. sertanejus* Sodr  & M.J.Silva sp. nov. Ecoregions classified according to Dinerstein *et al.* (2017) (available at <https://ecoregions2017.appspot.com>). Abbreviations for Brazilian States: AL = Alagoas; BA = Bahia; CE = Cear ; ES = Espirito Santo; DF = Federal District; GO = Goi s; MA = Maranh o; MG = Minas Gerais; PB = Para ba; PE = Pernambuco; PI = Piaul ; RJ = Rio de Janeiro; RN = Rio Grande do Norte; SE = Sergipe; SP = S o Paulo; TO = Tocantins.

stellate-porrect sessile trichomes, villous at the apex, glabrous ventrally; petals 5(6), 2–2.9 × 0.6–1.2 mm, obovate or oblanceolate, apex rounded or obtuse, villous basally along margins at 1/3–1/2 of length; stamens 15–25(–27), 2.5–3.5 mm long, filaments 2–3 mm long, glabrous or villous only basally, anthers 0.5–0.7 × 0.4–0.7 mm, suborbicular or largely ellipsoid; nectary disks 5-segmented, segments transversely oblong, whitish, receptacle villous. Pistillate flowers 3.5–5.3 mm long, pedicels 0.8–1.5 mm long; sepals 5, 1–1.7 × 0.6–0.8 mm, equal, ovate or triangular, apex acute, margin entire, without glands, externally with pubescent or tomentose indumentum of stellate-porrect or multiradiate sessile trichomes, internally sparsely pubescent or glabrescent; petals globose 0.1–0.2 mm diam. or laminar 0.5–1.3 × 0.05–0.4 mm, linear or triangular, glabrous or with stellate trichomes externally; ovaries 1.2–1.4 × 1.3–1.8 mm, subglobose, with whitish tomentose indumentum of stellate-porrect shortly stipitate trichomes; styles 3, 2–3 mm long, united in 1/6–1/3 of length, then branching into 6 terminal tips, externally with glabrescent or pubescent indumentum of stellate trichomes basally; nectary disks 5-segmented or 5-lobed, segments or lobes transversely oblong, whitish. Capsules 5.7–6 mm diam., globose, greenish, pedicel 1.2–2.5(–4) mm long, columella with three flattened or slightly ascending tips; seeds 4.8–4.9 × 3–3.1 mm, ellipsoid, brownish, with smooth surface, slightly foveolate, caruncle hat-shaped, 1.8–2.2 mm large, whitish.

Distribution, habitat and phenology

Croton sertanejus sp. nov. is endemic to the Caatinga, a Brazilian Seasonally Dry Tropical Forest, with records for the states of Bahia, Ceará, Minas Gerais, Paraíba, Pernambuco, Piauí and Sergipe (Fig. 3). It grows amid the shrubby or arboreal physiognomies of scrub/forest vegetation, close or not to water courses, sometimes associated with rocky outcrops and on sandy or clay soils, between 160 and 930 m of elevation. This species was found with flowers from December to April and fruits from January to May.

Vernacular names

The new species is popularly known as ‘Caatinga-branca’ (Pernambuco), ‘Cassatinga’ (Bahia), ‘Cassutinga’ (Bahia), ‘Marmeleiro’ (Bahia), ‘Marmeleiro-de-folha-miúda’ (Paraíba), ‘Marmeleiro-preto’ (Piauí), ‘Quebra-faca’ (Bahia, Ceará, Pernambuco, Piauí) or ‘Quebra-facão’ (Bahia, Pernambuco, Piauí).

Preliminary conservation status

This species has an Extent of Occurrence estimated to be 494 273 km² and Area of Occupancy of 5696 km² and is known from more than 100 different locations in seven states, many of them recently collected. Therefore, its conservation status was provisionally assessed as Least Concern. Despite this, the frequent use of its wood for firewood or fences and its leaves and bark in popular medicine or as food for goats may affect the conservation of their natural populations in the near future.

Croton echioides Baill.

Figs 4–5

Adansonia 4: 34 (Baillon 1864). – *Croton jacobinensis* Müll. Arg., *Linnaea* 34: 91 (Müller Argoviensis 1865, nom. illeg.). – **Type:** BRAZIL • Bahia, Jacobina; s.d.; *J.S. Blanchet 3718*; lectotype: P[P00623146]!, designated by Caruzo *et al.* 2016; isoelectotypes: A[A00257921]!, BR[BR0000008767158]!, C[C10011166]!, G-DC[G-DC00311429]!, G[G00434487]!, K[K000185989]!, MO[MO1370258]!, NY[NY00246538]!, P[P00623145]!, P[P00623147]!, US[US00109547]!, US[US1905658]!, W[W0051203]!.

Croton kalkmannii Müll. Arg., *Prodromus Systematis Naturalis Regni Vegetabilis* 15 (2): 612 (Müller Argoviensis 1866), **syn. nov.** – **Type:** BRAZIL • Ceará; Feb. 1863; *Kalkmann 145*; lectotype: MEL[MEL2337251]!, **here designated**; isoelectotypes: G[G00138454]!, MEL[MEL2337250]! • *ibid.*; *Kalkmann 146*; remaining syntype: MEL[MEL2337249]!.

Croton macrobotryis var. *microbotryis* Glaz., *Mémoires de la Société Botanique de France* 59 (3g): 615–616 (Glaziou 1913, nom. nud.)

Material examined

BRAZIL – Bahia • Abaíra, arredores de Catolés; 13°17' S, 41°51' W; 1000–1200 m a.s.l.; 22 Nov. 1991; fl.; V.C. Souza & C.M. Sakuragui H50256; NY, SPF • ibid.; 24 Dec. 1991; fl.; R.M. Harley et al. H50312; NY, MO, SPF • estrada de engenho entre Catolés e Abaíra; 13°18' S, 41°49' W; 1100 m a.s.l.; 31 Jan. 1992; fl. and fr.; J.R. Pirani et al. H51381; SPF, UB • Mendonça de Daniel Abreu; 13°16' S, 41°49' W; 1050 m a.s.l.; 24 Feb. 1992; fl. and fr.; B. Stannard et al. H51568; HUEFS, MBM, NY, RB, SPF • estrada Catolés-Abaíra, 7 km de Catolés, Mata do Criminoso; 13°19' S, 41°48' W; 1000 m a.s.l.; 26 Feb. 1992; fr.; B. Stannard et al. H51621; SPF • Morro do Zabumba, Engenho de Baixo; 13°18' S, 41°48' W; 850 m a.s.l.; 13 Mar. 1992; fr.; B. Stannard et al. H51937; NY, SPF • estrada Catolés-Abaíra, ca 5 km de Catolés, Mata do Engenho; 13°19' S, 41°49' W; 1000 m a.s.l.; 24 Nov. 1992; fl.; W. Ganev 1547; HUEFS, HUFU, NY, SP, SPF • 13°18' S, 41°49' W; 930 m a.s.l.; 22 Jan. 1994; fl.; W. Ganev 2856; HUEFS, NY, SPF, UESC • Serra do Atalho, Complexo Serra da Tromba, 18 Apr. 1994; fr.; E. Melo et al. 992; HUEFS • estrada de chão sentido Cascavel; 13°19'0" S, 41°34'24" W; 767 m a.s.l.; 18 Nov. 2015; fl.; B.R.L. Barbosa et al. 1404; HUEFS • estrada Abaíra-Catolés; 13°19' S, 41°47' W; 17 Dec. 2017; fl.; R.C. Sodr  et al. 3314; UFG • Almadina, rodovia de Almadina para Ibitup , ca 20 km, Fazenda S o Roque, ca 10 km da entrada do ramal; 14°38'27" S, 39°42'47" W; 12 Mar. 2005; fr.; P. Fiaschi et al. 2754; CEPEC, SPF, NY • Barra, Serra do Estreito, 5 Nov. 2009; no fl. or fr.; A.P. Prata et al. 1724; ASE • 10°58'48" S, 43°33'36" W; 20 Dec. 2017; fl.; A.S. Soares 404; RB, UB • Barra do Mendes, estrada do Mendes; 11°52' S, 42°8' W; 27 Nov. 1977; fl.; C.A. Miranda 11; RB • estrada para Canarina, localidade Carret o; 11°49'33" S, 42°3'17" W; 750 m a.s.l.; 15 Dec. 2009; fl. and fr.; E. Melo et al. 7514; ALCB, HUEFS • ca 21.5 km na estrada de terra para Seabra; 11°58'25" S, 42°0'38" W; 775 m a.s.l.; 16 Dec. 2009; fl.; E. Melo et al. 7571; ALCB, HUEFS • ca 32 km na estrada de terra para Seabra; 12°3'7" S, 42°0'33" W; 828 m a.s.l.; 16 Dec. 2009; fl.; E. Melo et al. 7591; ALCB, HUEFS • ibid.; fl. and fr.; E. Melo et al. 7597; ALCB, HUEFS • estrada para Canarina; 12°9'3" S, 42°1'3" W; 1038 m a.s.l.; 16 Dec. 2009; fl.; E. Melo et al. 7621; ALCB, HUEFS • ibid.; E. Melo et al. 7634; ALCB, HUEFS • estrada para Iupuiara; 11°47'16" S, 42°11'25" W; 850 m a.s.l.; 17 Dec. 2009; fl.; E. Melo et al. 7679; ALCB, HUEFS • Bom Jesus da Lapa, ca 18 km NE de Bom Jesus da Lapa na estrada para Ibotirama; 13°7'55" S, 43°18'59" W; 326 m a.s.l.; 8 Feb. 2000; fr.; L.P. Queiroz et al. 5745; ALCB, CEPEC, HUEFS • Buritirama; 10°26'23" S, 43°44'24" W; 15 Jan. 2018; fl.; O. Neto 974; UB • Caetit , Caetit /Bom Jesus da Lapa, ca 10 km de Caetit ; 13°58'31" S, 42°32'54" W; 950 m a.s.l.; 6 Dec. 1999; fl.; E. Melo & F. Fran a 3222; HUEFS • Regi o de Brejinho das Ametistas,  rea da Bahia Minera o; 14°19'24" S, 42°33'25" W; 980 m a.s.l.; Aug. 2008; fr.; M.S. Mendes et al. 371; BHCB, RON • Cafarnaum, Propriedade do Sr. C cero Pereira Lima, 14 Jan. 2012; fl.; J.G. Carvalho-Sobrinho et al. 3237; HUEFS • Campo Formoso; 10°28' S, 41°14' W; 29 Apr. 1981; fl.; R.P. Orlandi 377; HUEFS, RB • Casa Nova, margem do lago do Sobradinho; 9°33'43" S, 41°46'6" W; 415 m a.s.l.; 29 Feb. 2008; fl.; C. Correia et al. 424; HST, HUEFS, UEC • Correntina, rio Correntina; 17 Mar. 1995; fl. and fr.; G. Hatschbach et al. 62009; MBM • Delfino, estrada Delfino – Mimoso de Minas, 20 km de Delfino; 10°29'31" S, 41°20'35" W; 826 m a.s.l.; 7 Mar. 1997; fr.; P. Gasson et al. PCD6118; ALCB, CEPEC, HUEFS, SPF • Formosa do Rio Preto, Esta o; 10°58' S, 44°57' W; 24 Feb. 2005; fr.; M.L. Guedes & A.B. Xavier 11631; ALCB, CEPEC • Ibiquera, Gruta da Lapinha; 12°27'51" S, 40°58'47" W; 610–710 m a.s.l.; 1 May 2004; fr.; F. Fran a et al. 4960; HUEFS, HUESB • Igaror , ca 3 km ap s Igaror  em dire o a Caetit ; 13°48'1.5" S, 42°39'30" W; 1010 m a.s.l.; 15 Dec. 2017; fl.; R.C. Sodr  et al. 3284; UFG • Itaet , estrada para Itaet , ca 8.7 km do entroncamento com a estrada Mucug  – Andara ; 12°55'40" S, 41°9'52" W; 440–460 m a.s.l.; 13 Jul. 2003; fl.; F. Fran a et al. 4786; HUEFS • Lic nio de Almeida, Rodovia Cacul /Lic nio de Almeida, 38.3 km; 14°38'29" S, 42°27'41" W; 850 m a.s.l.; 30 Mar. 2001; fl. and fr.; J.G. Jardim et al. 3231; ALCB, HUEFS, SP • estrada para Urandi, 7 km de Lic nio de Almeida; 14°44'43" S, 42°31'2" W; 750 m a.s.l.; 9 Dec. 2009; fl.; E. Melo et al. 7369; ALCB, HUEFS • Serra Geral, Mata do Xax ; 14°39'6" S, 42°32'48" W; 930 m a.s.l.; 22 Jan. 2013; fl.;

F. Hurbath 452; ALCB, HUEFS, MBM • Serra Geral, Saco da Onça, Trilha Fazenda Serrana; 14°43'53" S, 42°34'10" W; 1103 m a.s.l.; 5 Apr. 2013; fr.; *F. Hurbath et al. 507*; ALCB • Riacho Fundo; 14°35'28" S, 42°32'18" W; 840 m a.s.l.; 5 Nov. 2013; fl.; *F. Hurbath et al. 600*; ALCB • Morro do Chapéu, entre 25 e 26 km de Morro do Chapéu, estrada vicinal próximo à estrada do feijão, próximo ao Ventura; 11°39'7" S, 40°57'42" W; 765–800 m a.s.l.; 18 Nov. 1989; fl.; *E. Melo et al. 3188*; HUEFS • Parque Estadual de Morro do Chapéu; 11°20'43" S, 41°18'56" W; 1000 m a.s.l.; 2 Feb. 2008; fl.; *F.B.L. Silva & F. França 103*; HUEFS • Buraco do Possidônio; 11°38'47" S, 41°16'11" W; 960 m a.s.l.; 17 Apr. 2008; fl. and fr.; *E. Melo et al. 5511*; HUEFS • Buraco da Duda ou Buracão; 19 Apr. 2008; fr.; *E. Melo et al. 5656*; HUEFS • divisa com o município de Várzea Nova, Serra da Babilônia, Fazenda Bom Jesus, futura área de implantação do Parque Eólico da Serra da Babilônia; 11°5'4" S, 41°18'51" W; 966 m a.s.l.; 14 Apr. 2016; fl.; *L.J.T. Cardoso et al. 1613*; RB • Mucugê, Fazenda Pedra Grande, estrada para Boninal; 13°0'20" S, 41°33'48" W; 990 m a.s.l.; 17 Feb. 1997; fr.; *B. Stannard et al. PCD 5813*; ALCB, SPF • Palmeiras, caminho para Conceição dos Gatos; 12°31'59" S, 41°33'11" W; 21 Mar. 2003; fr.; *E. Melo et al. 3564*; HUEFS • caminho para Serra Preta; 12°31'55" S, 41°35'14" W; 28 Mar. 2003; fr.; *E. Melo et al. 3633*; HUEFS • *ibid.*; 12°26'48" S, 41°36'6" W; 697 m a.s.l.; 25 Mar. 2010; fl.; *S.P.S. Neves 329*; HUEFS • *ibid.*; fl. and fr.; *S.P.S. Neves 330*; HUEFS • Piatã, estrada de terra para a mineração; 13°6'45" S, 41°41'56" W; 1112 m a.s.l.; 18 Apr. 2014; fr.; *E. Melo et al. 12574*; HUEFS • Ruy Barbosa, Serra do Orobó, trilha para o pátio das orquídeas; 12°18'9" S, 40°29'15" W; 521 m a.s.l.; 19 Dec. 2004; fl.; *L.P. Queiroz et al. 9961*; HUEFS • Seabra, Serra da Água de Rega, ca 28 km N of Seabra road to Água de Rega; ca 1000 m a.s.l.; 27 Feb. 1971; fl. and fr.; *H.S. Irwin et al. 31178*; RB • Senhor do Bonfim, Serra de Santana; 7 Feb. 2003; fl.; *V.J. Santos et al. 266*; HUEFS, HUNEB • Tucano, Fazenda Boqueirão; 12°1'33" S, 38°38'22" W; 258 m a.s.l.; 5 Jan. 2006; fl.; *D. Cardoso 929*; HUEFS, SPF • Wanderley; 11°42'0" S, 43°44'24" W; 24 Jan. 2018; fl.; *T.M. Moraes 1402*; RB. – **Ceará** • Aiuaba; 6°39'36" S, 40°40'48" W; 8 Apr. 2014; fl.; *W. Batista 353*; EAC • Caucaia; 11 Mar. 2007; fl.; *A.S.F. Castro 1921*; EAC • Crateús, RPPN Serra das Almas, 6 Apr. 2001; fr.; *M.S. Sobrinho & M.M.A. Bruno 36*; EAC • *ibid.*; *M.S. Sobrinho & M.M.A. Bruno 40*; EAC, PEUFR • *ibid.*; 16 Feb. 2002; fl.; *F.S. Araújo & L.C. Girão 1316*; HUEFS • *ibid.*; 5°8.166' S, 40°54.545' W; 25 Feb. 2002; fl. and fr.; *F.S. Araújo 1453*; HUEFS • 20 May 2002; fr.; *F.S. Araújo & J.R. Lima 1454*; EAC • *ibid.*; 25 May 2005; fr.; *J.R. Lima 81*; EAC • Itarema, margem da rodovia para Acaraú; 21 Apr. 2003; fl.; *A.S.F. Castro s.n.*; EAC[32597] • Novo Oriente, Planalto de Ibiapaba, Baixa Fria; 16 Feb. 1991; fr.; *F.S. Araújo s.n.*; EAC[19451] • São Gonçalo do Amarante, Varjota/Pecém; 13 Mar. 2011; fl. and fr.; *A.S.F. Castro 2454*; EAC • Tianguá; 3°48' S, 41°4' W; 550 m a.s.l.; 15 Mar. 1978; fl.; *O.A. Salgado 39*; RB • Chapada da Ibiapaba; 23 Mar. 1979; fl. and fr.; *A. Fernandes & F.J.A. Matos s.n.*; EAC[5729], UFRN[2348] • *ibid.*; 16 Feb. 1981; fl.; *A. Fernandes & F.J.A. Matos s.n.*; EAC[9696] • Ubajara, Planalto de Ibiapaba, Sul do Distrito de Jaburuna; 21 Feb. 1995; fl.; *F.S. Araújo 1119*; EAC • *ibid.*; *F.S. Araújo 1120*; EAC, UFRN • *ibid.*; 27 Jan. 1996; fl.; *F.S. Araújo 1171*; EAC • *ibid.*; *F.S. Araújo s.n.*; EAC[23595]. – **Espírito Santo** • São Roque do Canaã, Pedra do Pionte (São Bento), propriedade do Pionte; 750 m a.s.l.; 28 Feb. 2004; fl. and fr.; *A.P. Fontana et al. 762*; MBM. – **Minas Gerais** • Dom Joaquim, São Domingos, près de Conceição, dans le bois; Nov. or Dec.; fl.; *A.F.M. Glaziou 13180*; P • Montezuma, ca 23 km NE da cidade, em direção a Montugaba (BA); 15°3'28" S, 42°22'32" W; 900–1000 m a.s.l.; 14 Mar. 1994; fl. and fr.; *V.C. Souza et al. 5495*; ESA, SPF • Ninheira, sudoeste de Ninheira; 17°18'45" S, 41°34'45" W; 776 m a.s.l.; 13 Jan. 2014; fl.; *D.M. Neves 1613*; HUEFS, RB • without further locality; s.d.; fl.; *A.F.M. Glaziou 11513*; P. – **Paraíba** • Cajazeiras, Engenheiro Ávidos, Serra de Santa Catarina; 11 May 2008; fr.; *P.C. Gadelha Neto 2238*; HUEFS, JPB • São José de Piranhas, topo da serra a direita da Barragem de Engenheiro Ávidos, ca de 2 km a SE da localidade Engenheiro Ávidos; 6°59'17.55" S, 38°26'47.43" W; 592 m a.s.l.; 15 Jan. 2015; fl.; *J.L. Costa-Lima & L.S. Lima 2023*; HUEFS. – **Pernambuco** • Exu, BR-122 sentido Crato/Exu, depois da divisa CE/PE; 7°17'52" S, 39°32'53" W; 927 m a.s.l.; 13 Feb. 2007; fl.; *D.S. Carneiro-Torres et al. 874*; HUEFS, INPA • Ipubi, Serrolândia, Chapada do Araripe, 3 km Serra Branca; 15 Feb. 1984; fl.; *G. Fotius 3761*; HUEFS, IPA • Moreilândia, Sítio dos Moreiras; 22 Feb. 1994; fl. and fr.; *M. Andrade-Neto s.n.*; EAC[20390], HUEFS[111103] • Ponta da Serra; 4 Mar. 1995; fl.; *E. Silveira s.n.*; EAC[21992], HUEFS[111106] • *ibid.*;

11 Mar. 1997; fl.; *F.S. Cavalcanti & E. Silveira s.n.*; EAC[24710] • Zé de Belina; 10 May 2000; fr.; *F.S. Cavalcanti 763*; EAC • Serra do Catolé, Refúgio das Abelhas Professor Paulo Nogueira Neto; 7.2751° S, 39.28132° W; 880 m a.s.l.; 8 Mar. 2015; fl.; *V.M. Mascena C88*; EAC • Tacaratu; 21 Jun. 2013; fl. and fr.; *P. Bohrer s.n.*; MBM[394421]. – **Piauí** • Canto do Buriti, Fazenda Itauera; 500 m a.s.l.; 9 Jan. 1995; fl.; *I. Pinto & E. Alves s.n.*; EAC[22098] • *ibid.*; *I. Pinto & E. Alves s.n.*; EAC[22114], HUEFS[111108] • Caracol, área do entorno dos cálices rochosos; 9°13'15" S, 43°28'56" W; 681 m a.s.l.; 26 Feb. 2011; fr.; *E. Melo 9251*; HUEFS • Cocal, Jacarandá; 3°32'44.3" S, 41°3'54.6" W; 340 m a.s.l.; 22 Feb. 2003; fl.; *E.M.F. Chaves et al. 125*; TEPB • *ibid.*; 3°32'43" S, 41°3'51" W; 340 m a.s.l.; 18 Feb. 2003; fr.; *E.M.F. Chaves & E.M. Sérgio Júnior 346*; HUEFS • Eliseu Martins; 7°55'12" S, 43°33'36" W; 6 Aug. 2017; no fl. or fr.; *M.S. Gomes 241*; UB • Padre Marcos, Serra Velha, km 2 da vicinal para Alagoinha; 420 m a.s.l.; 17 Jun. 1993; no fl. or fr.; *M.E. Alencar & A.J. Castro s.n.*; EAC[19687] • *ibid.*; 24 Jan. 1994; fl.; *M.E. Alencar s.n.*; EAC[20717] • *ibid.*; 10 Mar. 1994; no fl. or fr.; *M.E. Alencar s.n.*; EAC[20718] • Pio IX, Cova Donga; 11 Feb. 1982; fl.; *M.A. Figueiredo s.n.*; EAC[11105] • São João do Piauí, BR-420, São Raimundo Nonato sentido São João do Piauí; 8°28'57S, 42°18'17" W; 354 m a.s.l.; 6 Feb. 2007; fl.; *D.S. Carneiro-Torres et al. 797*; HUESB, INPA, HUEFS • São Raimundo Nonato, Chapada da Serra Branca; 7 Feb. 1984; fl.; *L. Empereire 2420*; P, RB • without municipality, Serra Branca; Jan. 1907; fl.; *E. Ule 7454*; L. – **Rio de Janeiro** • Entre Rio Bonito et Araruama; Oct.; fl.; *A. Glaziou 10039*; P.

Description

Subshrubs or shrubs, 0.6–2(–3) m tall, erect, usually few-branched with tender, cylindrical, straight, smooth (not striate) branches ramifying in di- or trichotomies, sometimes with galls throughout plant; latex abundant, orange or reddish; odoriferous (but not sweetish); whitish or ferruginous indumentum of stellate-rotate, stellate-lepidote or stellate-porrect trichomes, all with (5–)8–18 lateral rays in single-plane whorl, each ray 0.2–0.6 mm long, free or united up to 10–30% of their length, central ray 0.1–0.3(–0.5) mm long, stipe 0.1–0.2 mm long. Leaves alternate, or sometimes subopposite or subwhorled near the inflorescences, leaf blades as long as petioles or up to 3 times as long as petioles; stipules 1–3.5 × 0.45–0.6 mm, triangular or lanceolate, without conspicuous glands or with 2 very short globose glands, with hirtellous or glabrescent indumentum of simple trichomes ventrally and dense to sparse indumentum of stellate-porrect trichomes dorsally; petioles (1.8–)3–8.1 cm long; leaf blades 4.3–13.6 × 2.7–8.2 cm,

Fig. 4. *Croton echiioides* Baill. **A.** Flowering branch. **B.** Detail of the indumentum of the stems and stipule. **C**₁–**C**₂. Trichomes of the stems. **C**₁. Stellate-rotate trichome. **C**₂. Stellate-porrect trichome. **D**₁–**D**₂. Stipules. **D**₁. Surface. **D**₂. Ventral surface. **E**₁–**E**₃. Leaves, note the variation in the shape of the leaf blades and in the length of the petioles. **F**₁–**F**₃. Extrafloral nectaries of leaf base in abaxial view. **F**₁. Stipitate-patelliform. **F**₂. Obconic. **F**₃. Cylindric. **G.** Colleters of leaf margin in adaxial view. **H**₁. Leaf indumentum of the abaxial surface. **H**₂. Leaf indumentum of the adaxial surface. **I.** Inflorescence. **J**₁. Staminate flower bract, ventral surface. **J**₂. Staminate flower bracteole, ventral surface. **K.** Staminate flower. **L**₁–**L**₂. Lobes of staminate flower calyces in dorsal view. **L**₁. Dense indumentum. **L**₂. Sparse indumentum. **M**₁–**M**₂. Staminate flower petals in dorsal view. **M**₁. Obovate petal. **M**₂. Oboval-oblancheolate petal. **N.** Stamen. **O**₁. Pistillate flower bract, ventral surface. **O**₂–**O**₃. Pistillate flower bracteoles, ventral surface. **P.** Pistillate flower. **Q.** Pistillate flower in upper view showing ventral surface of the sepals, disk and reduced petals (gynoecium removed), note the unequal sepals. **R**₁–**R**₂. Indumentum of ventral surface of the pistillate flower sepals. **S.** Pistillate flower in lower view showing dorsal surface of sepals. **T.** Indumentum of dorsal surface of the pistillate flower sepals. **U.** Gynoecium. **V.** Nectary disk and reduced petals of the pistillate flowers (cut out sepals and gynoecium removed). **W.** Fruit. **X**₁. Fruit columella. **X**₂. Apex of columella with plane tips. **X**₃. Apex of columella with three slightly ascending tips. **Y**₁. Seed, dorsal side. **Y**₂. Seed, ventral side. Drawing by Renato Galhardo: A, **E**₂, **F**₁ = *E. Melo et al. 7571* (HUEFS); **E**₁, **F**₃, **O**₁–**V** = *R.C. Sodré et al. 3284* (BOTU); **B**–**D**₂, **G**–**N** = *R.C. Sodré et al. 3314* (BOTU); **E**₃, **F**₂, **W**–**Y**₂ = *V.C. Souza et al. 5495* (ESA).



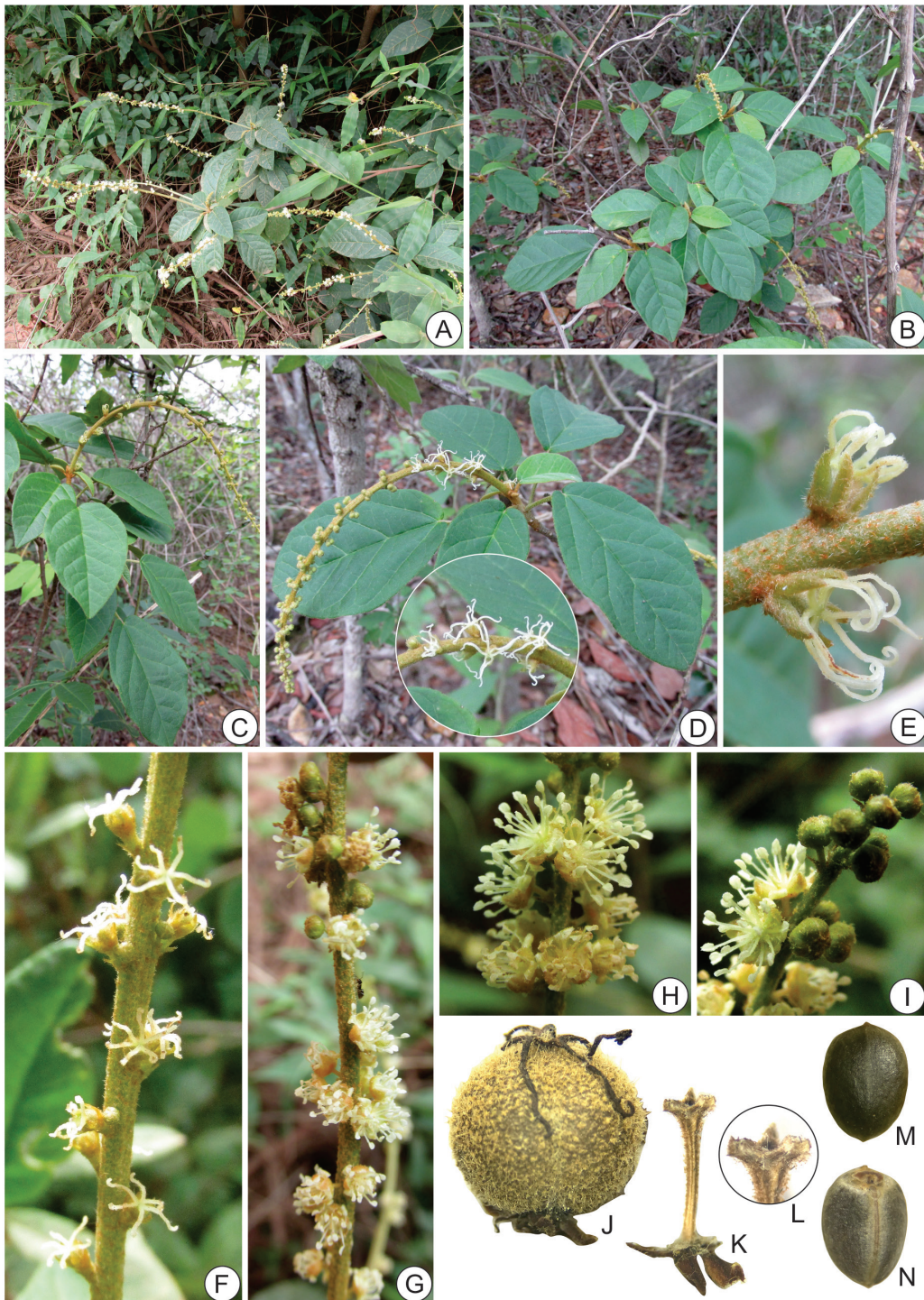


Fig. 5. *Croton echioides* Baill. **A–B.** Habit. **C.** Flowering branch. **D.** Inflorescence showing pistillate flowers and staminate buds, detail of the pistillate flowers in the insert. **E.** Pistillate flowers. **F.** Median portion of an inflorescence with bisexual cymules containing one pistillate flower and one staminate bud. **G.** Detail of the staminate inflorescence. **H.** Staminate flowers. **I.** Staminate flowers and buds. **J.** Fruit. **K.** Fruit columella. **L.** Apex of columella with three slightly ascending tips. **M.** Seed, dorsal side. **N.** Seed, ventral side. **A, F–I.** = Population from Igaporã, Bahia (R.C. Sodré et al. 3284; BOTU); **B–E.** = Population from Abaíra, Bahia (R.C. Sodré et al. 3314; BOTU); **J–N.** = V.C. Souza et al. 5495 (ESA). Photographs: R.C. Sodré.

ovate, elliptic, largely ovate, largely or narrowly elliptic, oblong or lanceolate, membranaceous, base slightly cordate or cordate, less commonly rounded, truncate or obtuse, with 2(3) stipitate-patelliform, cylindrical or obconic nectary glands 0.3–0.7 mm diam., stipe 0.5–1.4 mm long, with stellate trichomes, facing abaxial surface; apex acute, obtuse, acuminate, mucronate or apiculate; margin entire with globose sessile glands; venation brochidodromous with 6–10 pairs of secondary veins slightly prominent on both surfaces; discolorous, adaxial surface dark green, glabrous or with sparse indumentum of simple, 2–4-radiate trichomes and sessile stellate-porrect (6–10 lateral rays) trichomes, lateral rays 0.2–0.6 mm long, porrect ray 0.2–0.8 mm long, abaxial surface light green or whitish with shortly tomentose, pubescent or glabrescent indumentum of stellate-porrect or stellate-rotate trichomes, sometimes multiradiate, all with 8–16 lateral rays usually in single-plane whorl, or two-plane whorls in multiradiate trichomes, lateral rays 0.4–1.2 mm long, central ray 0.05–0.8 mm long, stipe 0.1–0.3 mm long. Thyrses 10.4–34.6 cm long, peduncles 1.5–4.5 cm long, terminal, bisexual with 2–18 solitary pistillate flowers sparsely distributed on $\frac{1}{8}$ – $\frac{1}{2}$ of inflorescence axis and staminate cymules with 3–6 flowers, less commonly with bisexual cymules in median portion of rachis, or thyrses unisexual staminate; staminate flower bracts 0.7–1.2 × 0.4–0.7 mm, triangular or ovate, margin entire, sometimes with 2 ovoid sessile glands (colleters) at base, with pubescent, hirtellous or glabrescent indumentum of simple trichomes ventrally and hirtellous indumentum of stellate-porrect trichomes dorsally, mainly on margin, 2 or more staminate flower bracteoles per cymule 0.5–0.6 × 0.2–0.3 mm, lanceolate or triangular, with glands and indumentum similar to those of bracts; pistillate flower bracts 0.9–1.1 × 0.7–1 mm, triangular or largely ovate, margin entire, apex acute or acuminate, with two ovoid or subglobose sessile glands (colleters) at base and one at apex, with glabrescent or hirsute-tomentose indumentum of stipitate stellate-porrect or 4-radiate trichomes on both surfaces, 2 pistillate flower bracteoles 0.2–0.6 × 0.15–0.3 mm, triangular, with glands and indumentum similar to those of bracts. Staminate flowers 3.5–6.5(–8) mm long; pedicels 0.8–3(–5.7) mm long, glabrous, glabrescent, or sometimes pubescent; calyces 5-partite, yellow-orange or slightly reddish with hyaline indumentum, lobes 1.6–2.1 × 0.9–1.3 mm, ovate, united in $\frac{1}{6}$ – $\frac{1}{5}$ of length, apex obtuse, dorsal surface with densely to sparsely pubescent or hirtellous indumentum of stellate-porrect sessile trichomes, villous at apex, glabrous internally; petals 5, 1.9–3 × 0.75–0.9 mm, obovate or oboval-oblancheolate, apex obtuse, truncate or rounded, villous basally along margins at $\frac{1}{4}$ of length and shortly villous at apex; stamens 16–19, 2.3–3.8 mm long, filaments 1.6–3 mm long, glabrous, anthers 0.6–0.8 × 0.4–0.5 mm, ellipsoid or oblongoid; nectary disks 5-segmented, segments transversely oblong or suborbicular, orange, receptacle villous. Pistillate flowers 3–5 mm long, sessile or pedicels 0.1–1(–1.2) mm long, tomentose; sepals 5(6), 1.3–3 × 0.6–1.3 mm, subequal or strongly unequal, ovate, narrowly triangular, oval-oblong or oval-lanceolate, apex acute, margin entire, without glands, dorsally with sparsely to densely pubescent or tomentose indumentum of stellate-porrect trichomes, margin with hirsute indumentum of simple trichomes and ventrally with glabrescent, pubescent or hirtellous indumentum of simple and fasciculate trichomes; petals globose ca 0.2 mm diam. or laminar 0.6–1.3 × 0.25–0.35(–0.4) mm, lanceolate, glabrous or pubescent; ovary 0.8–1.1 × 0.9–1.6 mm, with subglobose, hirtellous or tomentose indumentum of stellate-porrect shortly stipitate trichomes; styles 3, (2.8–)4–5.5 mm long, united along lower $\frac{1}{10}$ of their length, then branching into 6 terminal tips, externally with hirsute, hirtellous or pubescent indumentum of stellate-porrect or simple trichomes along less than $\frac{1}{2}$ of their length; nectary disks 5-segmented, segments transversely oblong, yellowish. Capsules 4.8–5.5 × 5.5–6 mm, compressed-globose, greenish, pedicels 0.5–1.5 mm long, columella with three flattened or slightly ascending tips; seeds 4.2–4.8 × 3.1–3.5 mm, largely ellipsoid, grayish, smooth surface, slightly foveolate, caruncle hat-shaped 1–2 mm large.

Distribution, habitat and phenology

Croton echinoides has been cited by Carneiro-Torres (2009), Silva *et al.* (2010) and Caruzo *et al.* (2020) as a species endemic to Brazil distributed in areas of Caatinga and Caatinga-Cerrado transition in the states of Alagoas, Bahia, Ceará, Minas Gerais, Paraíba, Pernambuco, Piauí and Rio Grande do Norte. We confirm occurrence of the species in the states mentioned above, except for Alagoas and Rio Grande do Norte, and provid the first record for the states of Espírito Santo and Rio de Janeiro. This species was

found in seasonal dry forest, humid forest, caatinga, in transition areas between caatinga and cerrado, ‘carrasco’ or ‘tabuleiro litorâneo’ growing preferentially on sandy soils, sometimes with outcrops of quartzite, and stony or sandy-clay soils between 30 and 1200 meters a.s.l. It was usually found with flowers from November to April, and with fruits from December to June.

Vernacular names

‘Velame’ (Ceará), ‘Velame-da-serra’ (Pernambuco), ‘Velame-branco’ (Piauí).

Preliminary conservation status

Croton echioides has an Extent of Occurrence estimated to be 910 000 km² comprising at least 80 subpopulations and has an estimated Area of Occupancy of 4544 km² (based on an 8 km² cell size) and is therefore provisionally assessed as Least Concern. However, it is worth noting that only three of these known subpopulations occur within protected areas (Experimental Station of the IPA, Serra Talhada, Pernambuco; RPPN Serra das Almas, Cratêus, Ceará; and Morro do Chapéu State Park, Bahia), all the others are in non-protected areas, which may have implications for the conservation of the species in the future.

Leaf anatomy notes

In general, the anatomy of the leaf blades and petiole of *Croton echioides* and *C. sertanejus* sp. nov. is relatively similar. Both species have hypostomatic leaves, with stomata on the same level as the other cells of the epidermis, which is unistratified and composed of cells of varying sizes, rectangular or rounded, and has a thin cuticle. The mesophyll in both species is dorsoventral, with a layer of palisade parenchyma and another layer of spongy parenchyma, both with druses (Fig. 6 F, H, L). The leaf margins have rounded outlines and the mesophyll and epidermis are not differentiated from the rest (Fig. 6I, M). The vascular bundles are collateral, surrounded by a conspicuous parenchyma sheath in the smaller vascular bundles and with annular (Fig. 6 E) or angular collenchyma cells adjacent to the phloem on the abaxial surface (Fig. 6J). The primary veins of both species have a convex ventral side with 5 to 6 layers of angular collenchyma cells (Fig. 6P, T). The dorsal side is rounded with 4 layers of angular collenchyma cells in subepidermal position (Fig. 6U) followed by a variable number of layers of ground parenchyma (Fig. 6N, R). The primary vein has a collateral vascular cylinder (Fig. 6O, S) with druses in the phloem. The petiole of the two species has a circular dorsal side and truncated or slightly concave ventral side in cross section. The cortex is composed of angular collenchyma and ground parenchyma. The vascular cylinder is collateral with united bundles, and there are also two accessory vascular cylinders on the ventral side (Fig. 7A, F). The pericycle is always associated with gelatinous fibers (Fig. 7C–E, I–J), which also surround the accessory vascular bundles (Fig. 7B, G). Druses are associated with phloematic parenchyma (Fig. 7D–E, I–J), as in primary veins.

Despite the similar anatomical characteristics mentioned above, which are to be expected from morphologically and geographically related species, important anatomical characteristics differentiate *C. sertanejus* sp. nov. from *C. echioides*. Leaf trichomes are stipitate in *C. echioides*, with stipe 50–300 µm long (Figs 6A, 7A), and the leaf blade is often glabrous on the adaxial face (Fig. 6A), whereas in *C. sertanejus* the trichomes occur on both faces and are sessile (Fig. 6B–C), or with a stipe up to 30 µm (Fig. 7F) or just with a set of cells at the base forming a cushion (Fig. 6D). The leaf blade of *C. sertanejus* also has subglobose unicellular idioblasts on the abaxial surface (Fig. 6K), which were not observed in *C. echioides*. In the primary veins, *C. echioides* presents the U-shaped vascular cylinder (or open arch) and the palisade parenchyma is continuous between the two faces of the leaf blade (Fig. 6N), as can also be seen in the smaller vascular bundles of the leaf blades (Fig. 6E). In *C. sertanejus*, however, the vascular cylinder of primary veins is circular (or closed arch), and the palisade parenchyma is discontinuous between the two faces of the leaf blade (Fig. 6R). In the petiole, the accessory vascular cylinders are

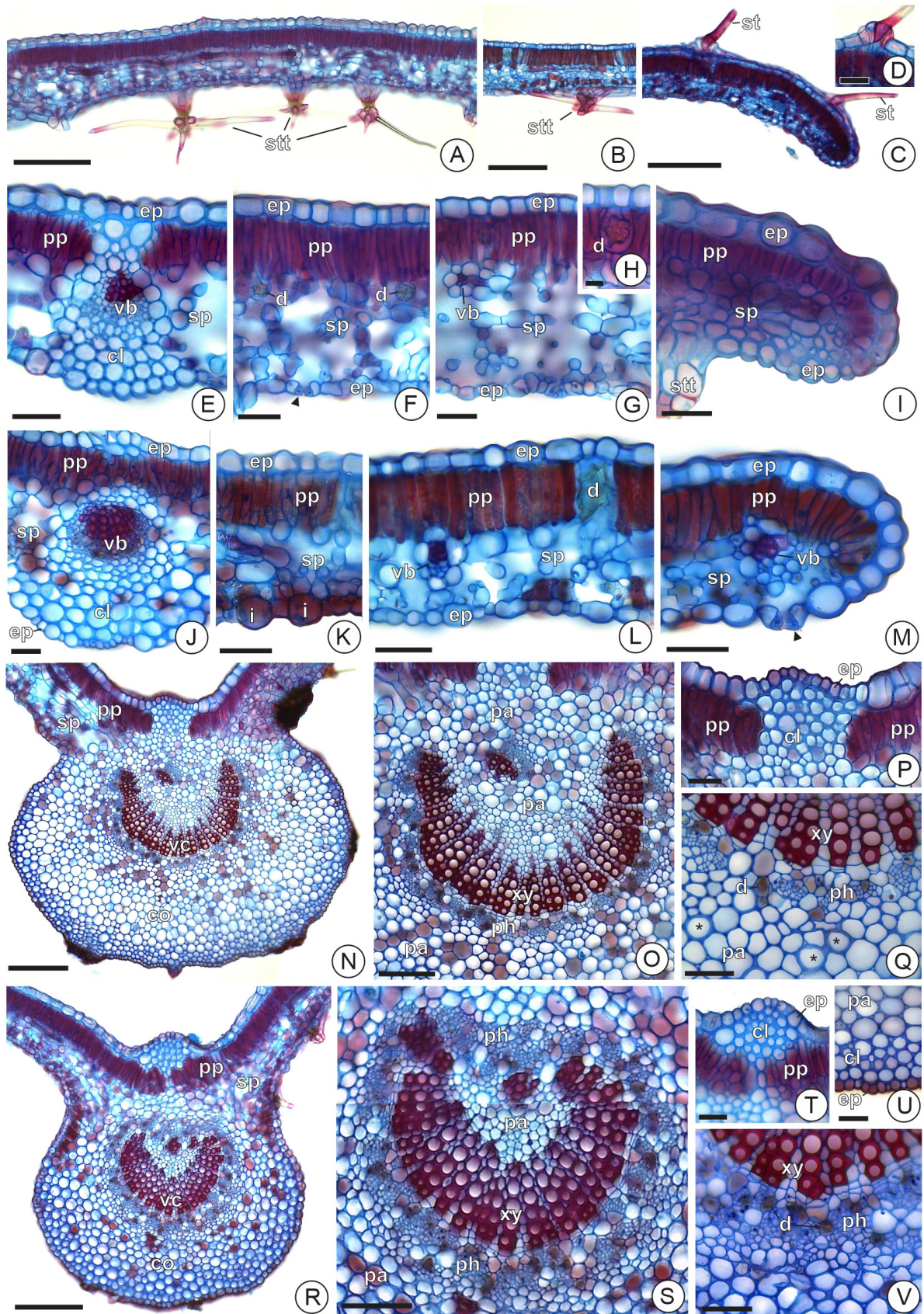
semi-lunar (open arch) and the pith has approximately 10 to 12 layers of cells in *C. echioides*, while in *C. sertanejus* the accessory vascular cylinders are circular (closed arch) and the pith has only 4 to 6 layers. In addition, the cortex of the primary vein and petiole of *C. echioides* have evident and numerous laticifers close to the phloem; while in *C. sertanejus* the laticifers were not observed or are not evident.

Discussion

Although *Croton sertanejus* sp. nov. is described here as a new species, it has previously been collected 129 times in seven Brazilian states. The oldest specimen was collected in 1839 in the state of Ceará by the British botanist and explorer George Gardner. This specimen is deposited on two sheets in Herbarium K and was annotated by Leon Croizat as *Croton* cf. *grewiaefolius*, a species from Mexico, or Croizat may have confused it with *C. grewioides* Baill. due to the similarity of the epithets. The latter species has a morphology and distribution similar to *C. sertanejus*. However, *C. sertanejus* can easily be differentiated from *C. grewioides* by its entire leaf margin without nectary glands, pistillate flowers with a short pedicel (0.8–1.5 mm long), and staminate flowers with 15–25(–27) stamens. *Croton grewioides* has serrate, crenate or serrulate leaf margins with nectary glands in the sinuses, pistillate flowers with pedicel 2–3 mm long and staminate flowers with 11(–15) stamens.

Specimens of *Croton sertanejus* sp. nov. were also identified as *C. echioides* by Carneiro-Torres (2009), to which it is similar by its usually shrubby habit, ovate or elliptic leaf blades with entire margin and nectary glands at the base, inflorescences with sparse flowers and short bracts, and pistillate flowers with usually globose reduced petals and bifid styles. Both species are also endemic to eastern Brazil, occurring mainly in the Seasonally Dry Tropical Forest – Caatinga (Fig. 3). However, *Croton sertanejus* has pseudomonopodial branching with an extended main stem bearing alternate lateral branches, Figs 1A, 2C (vs di- or trichotomous branching in *C. echioides*, Fig. 4A); petioles 0.4–1.7(–2) cm long, Fig. 1F₁–F₂ (vs (1.8–)3–8.1 cm long, Fig. 4E₁–E₃); obtuse or rounded leaf base with 4–6 nectary glands with stipe 0.1–0.2 mm long, facing the both surfaces, Fig. 1F₁–F₂, H (vs cordate or slightly cordate leaf blade base with 2(3) nectary glands with stipe 0.5–1.4 mm long, facing the abaxial surface, Fig. 4E₁–E₃, F₁–F₃); indumentum of sessile trichomes on both surfaces of leaf blades, Fig. 1J₁–J₃ (vs stipitate trichomes on abaxial surface of leaf blades, Fig. 4H₁, and glabrous or glabrescent on adaxial surface); equal pistillate flower sepals 1–1.7 × 0.6–0.8 mm, Fig. 1S₁–S₂ (vs subequal or unequal sepals, 1.3–3 ×

Fig. 6. Cross sections of the leaf blade of *C. echioides* Baill. (A, E–I, N–Q) and *C. sertanejus* Sodré & M.J.Silva sp. nov. (B–D, J–M, R–V). **A.** Median portion of the leaf blade of *C. echioides*, note the stipitate trichomes of abaxial surface in lateral view. **B.** Median portion of the leaf blade of *C. sertanejus*, note the sessile trichomes of abaxial surface in lateral view. **C.** Leaf margin of *C. sertanejus*, note simple trichomes of adaxial surface. **D.** Base of the trichome of adaxial surface of *C. sertanejus*. **E.** Vascular bundle of *C. echioides*. **F–H.** Median portion of the leaf blade of *C. echioides*. **I.** Leaf margin of *C. echioides*. **J.** Vascular bundle of *C. sertanejus*. **K–L.** Median portion of the leaf blade of *C. sertanejus*. **M.** Leaf margin of *C. sertanejus*. **N.** Primary vein of *C. echioides*. **O.** Detail of vascular cylinder of *C. echioides* primary vein. **P.** Collenchyma in adaxial surface of *C. echioides* primary vein. **Q.** Detail of the vascular bundle, note xylem, phloem, laticifer and druse. **R.** Primary vein of *C. sertanejus*. **S.** Detail of vascular cylinder of *C. sertanejus* primary vein. **T.** Collenchyma in adaxial surface of *C. echioides* primary vein. **U.** Detail of the epidermis and cortex of *C. echioides* primary vein. **V.** Detail of the vascular bundle, note xylem, phloem and druse. Arrowheads indicate stomata; asterisks indicate laticifers. Abbreviations: cl = collenchyma; co = cortex; d = druses; ep = epidermis; i = idioblasts; pa = ground parenchyma; ph = phloem; pp = palisade parenchyma; sp = spongy parenchyma; st = simple trichome; stt = stellate trichome; vb = vascular bundle; vc = vascular cylinder; xy = xylem. A, E–I, N–Q = *R.C. Sodré et al. 3284* (BOTU); B–D, J–M, R–V = *R.C. Sodré et al. 3350*, holotype (BOTU). Scale bars: A–C, N, R = 200 µm; D–G, I–M, P–Q, T–V = 50 µm; H = 20 µm; O, S = 100 µm.



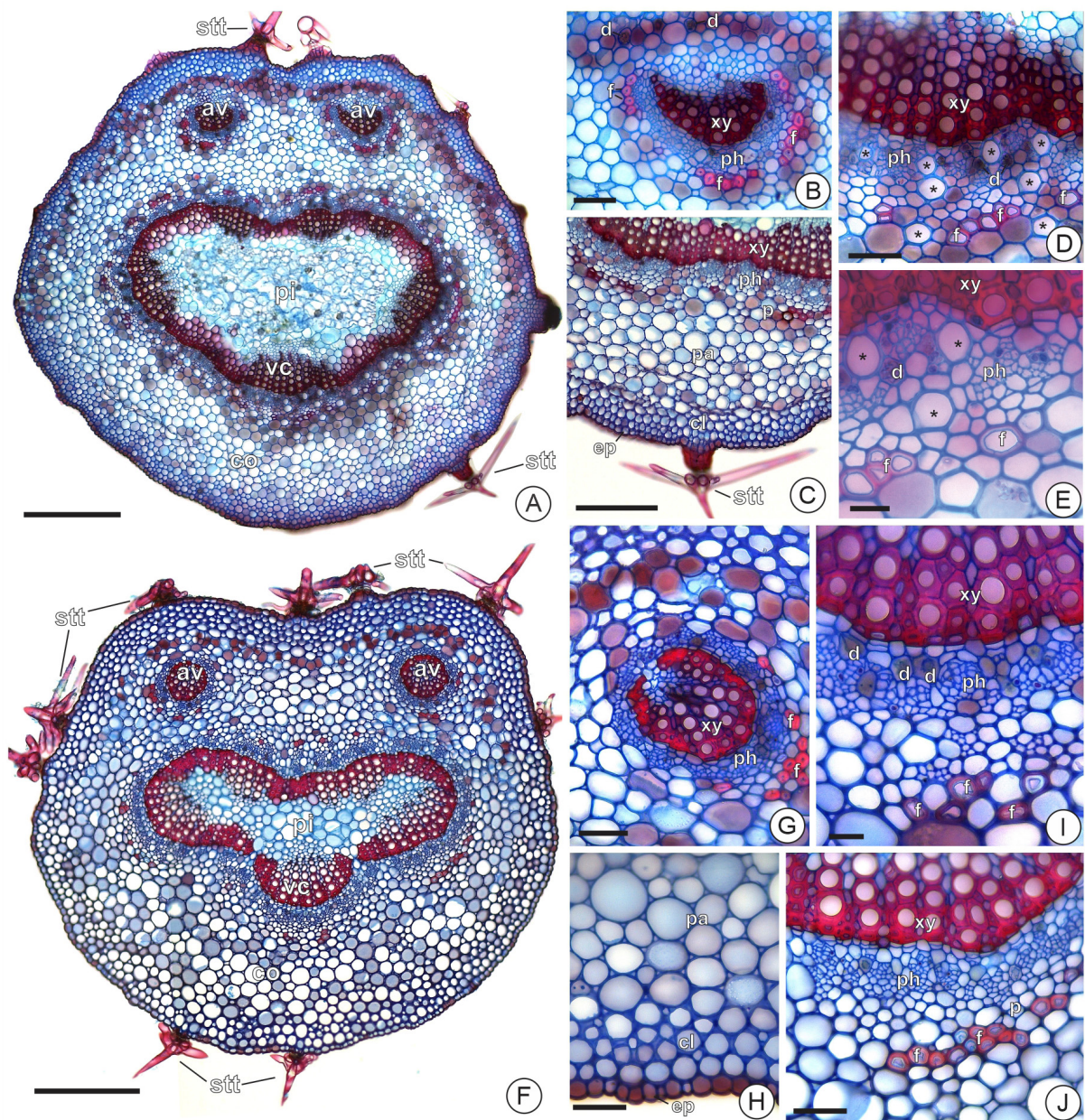


Fig. 7. Cross sections of the petiole of *Croton echiooides* Baill. and *C. sertanejus* Sodré & M.J.Silva sp. nov. **A–E.** *Croton echiooides*. **A.** Median portion of the petiole. **B.** Detail of accessory vascular bundles. **C.** Detail of the epidermis, cortex and vascular cylinder. **D–E.** Detail of vascular cylinder, laticifers, gelatinous fibers and druses. **F–J.** *C. sertanejus* sp. nov. **F.** Median portion of the petiole. **G.** Detail of accessory vascular bundles. **H.** Detail of the epidermis and cortex. **I–J.** Detail of vascular cylinder, gelatinous fibers and druses. Asterisks indicate laticifers. Abbreviations: av = accessory vascular bundles; cl = collenchyma; co = cortex; d = druses; ep = epidermis; f = gelatinous fibers; p = pericycle; pa = ground parenchyma; ph = phloem; pi = pith; stt = stellate trichome; vc = vascular cylinder; xy = xylem. A–E = R.C. Sodré et al. 3284 (BOTU); F–J = R.C. Sodré et al. 3350, holotype (BOTU). Scale bars: A, F = 300 µm; B–D, G–H, J = 50 µm; C = 200 µm; E, I = 20 µm.

0.6–1.3 mm, Fig. 4Q, S) and styles 2–3 mm long, Figs 1T, 2E (vs styles 4–5.5 mm long, Figs 4P, U, 5D–E). Additionally, *C. sertanejus* is up to 7 meters tall with the arborescent habit frequently mentioned for the species (Fig. 2A–B); has stems, leaves and flowers with a pleasant sweet odor; branches with indumentum of multiradiate or stellate-porrect trichomes (Fig. 1D₁–D₃); scarce clear latex; inconspicuous stipules (0.5–0.8 × 0.15–0.3 mm); thyrses 2.8–16 cm long (Figs 1K, 2B–D, F); globose capsules 5.7–6 × 5.8–6 mm with pedicel 1.2–2.5(–4) mm long (Figs 1V, 2G) and ellipsoid seeds 4.8–4.9 × 3–3.1 mm (Figs 1X₁–X₂, 2K–L). *Croton echioides* is always shrubby, up to 2.6 m tall (Fig. 5A–B); with or without odor, never sweetish; has branches with stellate-rotate, stellate-lepidote or stellate-porrect trichomes (Fig. 4C₁–C₂); orange, yellow or reddish abundant latex; conspicuous stipules, 1–3.5 × 0.45–0.6 mm (Fig. 4B, D₁–D₂); thyrses 10.4–34.6 cm long (Figs 4A, I, 5A, C–D); compressed-globose capsules 4.8–5.5 × 5.5–6 mm with pedicel 0.5–1.5 mm long (Figs 4W, 5J) and seeds largely elliptical 4.2–4.8 × 3.1–3.5 mm (Figs 4Y₁–Y₂, 5M–N).

Eventually, specimens of *C. sertanejus* sp. nov. have also been identified as *C. conduplicatus* Kunth (F.A. Silva 18), *C. rhamnifolius* Kunth (Guerra 5528; Fotius 3310; Labouriau 941), *C. rhamnifolioides* Pax & K. Hoffm. (Fotius 3304, 3333; Bautista 716; Pereira 99; Saar PCD 509; Passos PCD 5109; P.F. Souza 107; G. Pinto 42272) or *C. heliotropiifolius* Kunth. (Neves 393), all conspecific (Govaerts *et al.* 2000; Sodré & Silva unpublished), having as valid name *C. heliotropiifolius*. However, *Croton sertanejus* differs by a pseudomonopodial branching, with an extended main stem bearing alternate lateral branches (vs di- or trichotomous branching in *C. heliotropiifolius*), leaves with nectary glands at the base of the blade (vs absent), globose fruits (vs oblong) and fruit columella with three not inflated, flattened or slightly ascending lobes at the apex (vs three inflated and ascending lobes).

Among the sections of *Croton*, the new species here described should be positioned in *Croton* sect. *Adenophylli* Griseb. for being monoecious, shrubby or arborescent, presenting leaf blades with nectary glands at the base (Fig. 1H) and entire margin without nectary glands (only with glands similar to colleters, Fig. 1I), inflorescences with unisexual cymules (Figs 1K, 2E), free, eglandular, valvate sepals of pistillate flowers, and bifid styles (Fig. 1R, S₁–S₂, T). *Croton sertanejus* sp. nov., however, presents fruit columella with a slightly trifurcate apex, with irregular, flat or slightly ascending tips, usually amorphous and not inflated (Figs 1W₁–W₃, 2H–J), unlike most species of *Croton* sect. *Adenophylli* that have a columella with three ascending and inflated lobes at the apex. This distinct columella found in *C. sertanejus* was also seen in *C. echioides* (Figs 4X₁–X₃, 5K–L), a species that already had its systematic position confirmed in *Croton* sect. *Adenophylli* in recent phylogenies (Sodré *et al.* 2022). *Croton chimboracensis* P.E. Berry & Riina, a species described and presented as sister to *Croton* sect. *Adenophylli* in a phylogeny by Riina & Berry (2010), also presents a similar columella. Van Ee *et al.* (2011) placed *C. chimboracensis* in *C.* sect. *Adenophylli*, however, without sampling it in the phylogeny, and even today the systematic positioning of the species remains unresolved (van Ee & Berry 2021).

Baillon (1864) described *Croton echioides* based on specimen *Banchet 3718* from Jacobina in the old province of Bahia, and according to the protologue deposited in the “herb. Museum” (Herbarium P) and “herb. Delessert” (Herbarium G). The following year, Müller Argoviensis (1865) described the same specimen collected by Blanchet as *C. jacobinensis*, without mentioning the herbarium. Müller Argoviensis’s name is, therefore, a homotypical synonym of *C. echioides* and an illegitimate posterior homonym, since Baillon (1864) had already used the binomial *C. jacobinensis* for another species from Bahia. In another work, Müller Argoviensis (1866) described *C. kalkmannii* based on the collections *Kalkmann 145* and *Kalkmann 146*, both deposited in the “herb. Sond.” (currently in the Herbarium MEL). *Croton kalkmannii* is here synonymized with *C. echioides* because they have indistinct branching patterns (in bifurcation or trifurcation), trichomes in the branches (stellate-rotate, stellate-lepidote or stellate-porrect), length of petioles ((1.8–)3–8.1 cm long), leaf blade bases (cordate or slightly cordate with a pair of stipitate nectary glands on abaxial surface), and length of pedicels of the pistillate flowers (0.1–1 mm long). We chose *Kalkmann 145* [MEL2337250] as lectotype of *C. kalkmannii* because it is the most complete collection, with fully developed leaves, inflorescences with pistillate flowers, staminate flowers and buds and fruits. The notation “Herb. Sond.” in the protologue, in reference to the Sonder Herbarium,

which is housed in the Herbarium MEL, also justifies our choice. Carneiro-Torres (2009) in her doctoral thesis about the diversity of *Croton* in the Caatinga proposed the lectotypification and synonymization of *C. kalkmannii* under *C. echioides*, however, such adjustments were never formally published. Recently, Caruzo *et al.* (2016) propose an acceptable lectotypification for *C. echioides*, choosing the collection of Herbarium P [P00623146], among the 14 sheets deposited in 11 different herbaria.

Anatomical characters have been used in the differentiation of species in *Croton* by Soares (2013), Barbosa *et al.* (2018), Feio *et al.* (2018), Sodr e *et al.* (2019b), Sodr e & Silva (2020) and Rosa *et al.* (2021). These authors pointed out that useful anatomical characters are the type of trichomes, as well as the length and number of rays, and the length of the stipe, the presence of idioblasts, the stomata position on the leaf blade, the type of mesophyll, the presence of the continuous palisade parenchyma in the midrib and the margins of the blade, the outline of the petiole in cross section, the conformation of the vascular bundles of the midribs and petioles and the presence and number of accessory vascular bundles in the petiole. Although the leaves of *C. echioides* and *C. sertanejus* sp. nov. are anatomically similar, as mentioned in the results, some of the characters already used in previous works to separate species of *Croton* have also proved useful in differentiating these two species. They are the presence of the stipe in the trichomes, the form and type of the vascular cylinder of the primary veins, the continuous or discontinuous palisade parenchyma in the primary vein, the number of layers in the pith of the petiole, the type of accessory vascular cylinders of the petiole and the presence of evident laticifers in the primary vein and petiole.

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