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A new species of dragon's blood *Croton* (Euphorbiaceae) from South America with singular inflorescences

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Croton amentiformis, a new species of Euphorbiaceae from western South America, is described and illustrated. Morphological evidence and data from leaf anatomy indicate that the new species belongs to the dragon's blood group (*Croton* section *Cyclostigma*). The dense and congested inflorescence is unusual within the genus. This singular dragon's blood species is dedicated to the Florence Tropical Herbarium (FT) on the occasion of its 100th Anniversary celebrated in 2014.

Keywords: *Croton*; Crotonaeae; section *Cyclostigma*; Ecuador; Euphorbiaceae; Peru; taxonomy

Introduction

Recent studies in Neotropical *Croton* L. continue to recognize taxonomic novelties in different sections of the genus (e.g. Caruzo et al. 2008, 2010; Carneiro et al. 2011; Secco et al. 2012; Berry and Galdames 2013; Silva et al. 2014). In this paper we describe the morphology and leaf anatomy of a new arborescent species, *Croton amentiformis*, occurring in a remote area near the border between Ecuador and Peru. The German botanist Hermann Karsten made the first collection of this plant in 1854, when he travelled from Colombia to Ecuador (Diaz-Piedrahita 1996), but the species remained undescribed for more than 160 years. The new species is dedicated to the Florence Tropical Herbarium (FT) on the occasion of its 100th Anniversary celebrated in 2014.

Material and methods

Comparative morphological study of the new species was conducted using collections from the following herbaria: COL, CPUN, F, GUAY, HA, HUTPL, LOJA, MA, MICH, MO, NY, Q, QAP, QCA, QCNE and W (acronyms according to Thiers 2015 and onwards). The protologue and type specimens of similar arborescent *Croton* from Ecuador and Peru were studied and compared with the new species. Morphological characters used in recent species treatments of arborescent *Croton* (Riina et al. 2010, 2014) were examined and described. Trichome terminology followed Webster et al. (1996). Information about habit, habitat and distribution was taken from specimen labels and recent field observations. The conservation status was evaluated using IUCN criteria (IUCN

2001). Leaf samples from *C. amentiformis* (herbarium specimens Jorgensen et al. 97, Cumbicus 1925, 2072, 2074) were prepared for light and scanning electron microscopy examination following the methods described in similar studies (Bozzola and Russel 1992; Meira and Martins 2003).

Croton amentiformis Riina, sp. nov. (Figures 1, 2)

Diagnosis

Monoecious trees, 6–12 m high; young branches with a dense to sparse indumentum of stellate porrect trichomes; older apical branches smooth and shiny; petiole scars prominent; latex clear or light orange to reddish. Stipules subulate, 6–7.3 mm long, covered by sparse stellate trichomes, with colleters on upper margin and apex. Leaf blade lanceolate to ovate-lanceolate, discolorous, 9–18 × 2.8–6 cm; base rounded to slightly cuneate (cordate in young plants), sometimes slightly asymmetrical; apex acute; margin entire, slightly revolute, old colleters present on the margin; venation pinnate, brochidodromous; primary and secondary veins raised on the abaxial side; adaxial leaf side almost glabrous, with a few scattered stellate trichomes mostly along the midrib (densely hairy in young leaves); abaxial side densely covered with stellate porrect trichomes; petiolar glands 3–6, stipitate, apex convex, attached to the petiole on the adaxial side; petiole 3–6 cm long, with a dense to scattered indumentum of stellate trichomes. Inflorescences terminal, erect when young, usually pendant in full anthesis, 5–10 cm long; cymules densely congested along the inflorescence

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Figure 1. *Croton amentiformis*: (A) Flowering branch. (B) Stipule. (C) Detail of the stipule apex. (D) Leaf base, adaxial side. (E) Leaf base, abaxial side. (F) Detail of the leaf indumentum. (G) Male bract. (H) Male bract with incurved apex. (I) Staminate flower. (J) Petal of the staminate flower. (K) Stamen, abaxial side. (L) Anther insertion, lateral view. (M) Female bract. (N) Pistillate flower. (O) Young pistillate flower with glandular filaments instead of petals, calyx removed. (P) Pistillate flower, calyx removed. (Q) Cross section of ovary. Based on Cumbicus 2072 (MA).

axis with pistillate flowers at the base and the staminate ones on the mid and upper part of the axis; bracts on the female portion of the axis $3.8\text{--}5 \times 1.8\text{--}2.5$ mm, lanceolate to spatulate, margin sometimes irregularly dissected; bracts on the male portion of the axis $2\text{--}4 \times 1\text{--}2.2$ mm, lanceolate acute to rhomboid with apex sometimes incurved, margin entire. Staminate flowers sessile, sepals 5, ovate with acute apex, $3\text{--}3.4 \times 1.3\text{--}1.5$ mm, partially fused at the base, indumentum of simple trichomes present only on the apical margin; petals spatulate with acute apex, $3\text{--}3.2 \times 0.2\text{--}1.2$ mm, with simple trichomes along the margin, the apical portion with a denser indument; stamens 13–15, filaments 1.7–2 mm long, slightly pilose, anthers $0.6\text{--}0.8 \times 0.3\text{--}0.4$ mm. Pistillate flowers sessile, sepals 5, valvate or slightly imbricate, narrowly ovate to elliptic, $4.8\text{--}5.2 \times 1.5\text{--}1.8$ mm, abaxial surface with sparse to dense stellate trichomes, adaxial surface glabrous; glandular filaments present in the position of the petals, ovary slightly pyriform, 2.7–3.2 mm long, densely covered by stellate porrect trichomes; immature fruit 3.5–4.5 mm long, with sparse stellate trichomes; one of the three locules reduced in size probably by ovule abortion; styles 3, 3–4-bifid, united at the base, with sparse stellate trichomes. Mature fruits and seeds unknown. Common name: “Palo blanco” (Peru, Sánchez Vega 5304).

Type: Ecuador: Loja, Cerro Célica, Célica-Guachanamá, km 2.7, $04^{\circ}05'46''$ S, $79^{\circ}56'45''$ W, 2250 m, 12 April 1994, P. Jørgensen, C. Ulloa, H. Vargas and G. Abendaño 97 [holo, QCA; iso, LOJA, MA, MICH, MO, QCNE].

Distribution and habitat

The species occurs as a medium-sized tree in southwestern Ecuador (Loja) and northwestern Peru (Piura). It grows in more or less dense populations along roads, stream sides and forest edges in montane cloud forest, at elevations of 2200–2750 m.

Phenology

From the specimens examined, the species is known to flower from June to January.

Etymology

The specific epithet refers to the dense and compact inflorescences, resembling aments, which become pendant in anthesis (Figure 2B, C).

Figure 2. *Croton amentiformis*: (A) Adult individual in its natural habitat. (B) Flowering branch with young inflorescences. (C) Flowering branches with mature, pendant inflorescences. (D) Detail of inflorescence. (E) Part of trunk with a bark cut. (F) Young individual with deeply cordate leaves. (G) Young leaf of juvenile plant showing dense indumentum on the adaxial side, and petiolar glands. (H) Young branches showing indumentum and stipules. Photographs by CER, NC, and RR.

Conservation Status

The geographical range of *C. amentiformis* covers a relatively large area between southern Ecuador and northern Peru; however, forest vegetation in this region is fragmented by human activities. As with many *Croton* species, *C. amentiformis* behaves as an early successional species, so forest perturbations promote its expansion. In some of the recently sampled localities in southern Ecuador, we found numerous individuals, including juveniles. For these reasons, we consider this species as LC (“least concern”) according to the IUCN Red List criteria (IUCN 2001).

Additional material examined (paratypes)

ECUADOR: Llano del Amazonas, s.d., *H. Karsten s.n.* (LE); Loja: Cantón Céllica, Parroquia Céllica, Cerro Wayra Pungo, 04°04'29" S, 79°55'44" W, 2450 m, 28 June 2014, *C.E. Cerón 74212* (QAP, QCNE, QCA, Q, COL), *74214* (QAP, QCNE, COL), *74219* (QAP, QCNE, QCA, Q, LOJA, GUAY, COL); Cantón Paltas, Parroquia Guanchanmá, Cerro Pucará, 04°03'09" S, 79°52'08" W, 2600 m, 29 June 2014, *C.E. Cerón 74255* (QAP, QCNE, QCA, Q, HA, COL); via Céllica, Cerro Guachanamá, 17615966-9547676, 2255 m, 22 November 2013, *N. Cumbicus, F. Tinitana, O. Cabrera and C. Naranjo 1925, 2074* (HUTPL, MA), 24 January 2014, *N. Cumbicus 2072* (HUTPL, MA); s.d., *H. Karsent s.n.* (LE); s.d., *H. Karsten 23* (W). Peru. Piura: Prov. Huancabamba, entre Huancabamba y el Cuello del Indio (11 km), 2550 m, 4 May 1990, *I. Sánchez Vega 5304* (CPUN, F, HUT); Prov. Morropón, Chalaco, carretera hacia Las Pircas, 2200–2750 m, 17 October 1988, *C. Díaz and R. Vásquez 2984* (F, MO, NY).

Leaf anatomy

The hypostomatic leaf blade presents abaxial epidermis with sinuous anticlinal walls and adaxial epidermis with straight walls (Figure 3A). Non-glandular, stipitate-stellate trichomes with a longer porrect central ray are also present (Figure 3B), predominating on the abaxial side along with paracytic stomata (Figure 3A). The petiole has a circular outline, with unistratified epidermis followed by two or three layers of angular-annular collenchyma and the collateral vascular system arranged as a ring with two smaller accessory bundles on the adaxial side (Figure 3C). The biconvex midrib presents five to ten layers of angular-annular collenchyma interrupted by palisade parenchyma, and the vascular system is composed of collateral bundles (Figure 3D). The mesophyll is dorsiventral with palisade parenchyma thicker than the spongy parenchyma (Figure 3E). The epidermis is unistratified with a thickened cuticle and a single-layered hypodermis present on the adaxial side (Figure 3E). The margin is revolute, with discontinuous palisade parenchyma (Figure 3F). Extrafloral nectaries are observed

both in basilaminar and acropetiolar positions (Figure 3G, H) and standard type colleters occur on the teeth along the margin (Figure 3I, J). The stipitate extrafloral nectaries present a convex surface with the secretory palisade-like epidermis covered by a thin cuticle and the subepidermal parenchyma portion vascularized mainly by phloem. Druse crystals (Figure 3K) and secretory idoblasts (Figure 3L) as well as non-articulated ramified laticifers (associated with phloem and colleters) (Figure 3M) occur both in apical meristems and mature leaves.

Discussion

Morphology and taxonomy

This species is unique within *Croton* because of its peculiar pendant inflorescence with congested flowers and dimorphic bracts. The species is placed in section *Cyclostigma* (Riina et al. 2009; van Ee et al. 2011) based on morphology and leaf anatomy. Besides the anatomical features discussed below, *C. amentiformis* shares several morphological characters with members of this section, i.e. arborescent habit, presence of orange to reddish latex, stellate indumentum, well-developed stipules and conspicuous petiolar glands or extrafloral nectaries. *Croton amentiformis* is similar to *Croton rimbachii* Croizat, which has similar habitat (cloud forest) and geographic distribution (Bolivia, Ecuador and Peru). However, they are easily distinguished by the inflorescence morphology (densely flowered and pendant versus sparsely flowered and erect), flower pedicels (sessile versus long-pedicellate), and number of styles branches (multifid versus bifid).

Leaf anatomy

Croton amentiformis presents leaf anatomical features that are similar to the pattern reported for some species in the genus (Solereder 1908; Metcalfe & Chalk 1983; Webster et al. 1996; Freitas et al. 2001; Sá-Haiad et al. 2009; Vitarelli et al. Forthcoming), and more specifically for members of section *Cyclostigma* (Feio et al. Forthcoming). A distinctive character was the presence of single-layered hypodermis, which has never been described for *Croton* (Metcalfe & Chalk 1983), and was observed in some species of section *Cyclostigma*, namely *Croton bogotanus* Cuatrec., *Croton coriaceus* Kunth, *Croton floccosus* B.A.Sm. and *Croton rimbachii* Croizat (Feio pers.com.). The hypodermis is considered a common structure for the storage of water, also playing an important role in heat economy (Madison 1977). Espírito Santo and Pugialli (1998) attribute its presence to a greater exposure of the leaves to light. *Croton amentiformis* occurs along mountain creeks, cloud forest edges and along roads. Despite the high humidity present in montane cloud forests, the species is exposed to high luminosity, which can also explain the presence of the thickened cuticle, besides the well-developed palisade

Figure 3. Leaf anatomy of *Croton amentiformis*: (A, B, H) Details of the leaf surface. (C–F) Cross sections. (G, J, L, M) Longitudinal sections. (A) Abaxial epidermis with sinuous anticlinal walls and paracytic stomata. The inset shows the adaxial epidermis with straight walls. (B) Scanning electron micrograph showing the non-glandular stipitate-stellate trichomes with a longer porrect central ray. (C) Arrangement of vascular system with two smaller accessory bundles on the adaxial side (arrows). (D) General view of the midrib. (E) Details of mesophyll showing single-layered hypodermis on the adaxial side (arrow), palisade parenchyma (PP), and spongy parenchyma (SP). (F) General view of the revolute margin. (G, H) Stipitate extrafloral nectaries showing their convex apical surface. (I) Marginal colleter, inactive stage, on diaphanized mature leaf; (J) Marginal colleter, active stage, on apical meristem, note the presence of laticifers intensely stained in the central axis of parenchyma cells. (K) Polarized-light image of druse idioblasts. (L) Portion of extrafloral nectarie stipite showing secretory idioblasts (arrows) above the epidermal cells. (M) Non-articulated ramified laticifer in the apical meristem. Bars: (A) = 70 μm ; (inset) and (H) = 200 μm ; (B) and (K) = 100 μm ; (C), (D) and (G) = 900 μm ; (E), (J), (L) and (M) = 150 μm ; (F) and (I) = 300 μm .

parenchyma as xeromorphic features (Fahn 1990). The occurrence of only colleters along the leaf margin distinguishes the species of this section from *Croton* groups where such structures alternate with extrafloral nectaries along the leaf margin, as in section *Cupreati* (Feio et al. Forthcoming) and section *Cuneati* (Riina et al. 2010, their fig. 3F). The colleters are active in young leaves and apical meristems, whereas they may be persistent (old and inactive) or absent (caducous) in mature leaves.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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References

- Berry PE, Galdames C. 2013. *Croton cerroazulensis* (Euphorbiaceae), a new species from Cerro Azul (Panama). *Webbia*. 68:17–19.
- Bozzola JJ, Russel LD. 1992. *Electron microscopy*. Boston, MA: Jones and Bartlett Publishers.
- Carneiro-Torres D, Cordeiro I, Giulietti AM, Berry PE, Riina R. 2011. Three new species of *Croton* (Euphorbiaceae s.s.) from the Brazilian Caatinga. *Brittonia*. 63:122–132.
- Caruzo MBR, Riina R, Cordeiro I, Berry PE. 2008. *Croton campanulatus* (Euphorbiaceae s.s.), a new species from the Brazilian Atlantic rain forest. *Brittonia*. 60:261–264.
- Caruzo MBR, Cordeiro I, Berry PE, Riina R. 2010. A new species of *Croton* section *Cleodora* (Euphorbiaceae s.s.) from Minas Gerais, Brazil. *Phytotaxa*. 3:27–33.
- Díaz-Piedrahíta S. 1996. *José Jerónimo Triana: naturalista multifacético*. Fondo FEN, Bogotá, Colombia.
- van Ee BW, Riina R, Berry PE. 2011. A revised synopsis and molecular phylogeny of the new world sections of *Croton* (Euphorbiaceae). *Taxon*. 60:791–823.
- Espírito Santo do A, Pugliali HRL. 1998. Estudo da plasticidade anatômica foliar de *Stromanthe thalia* (Vell.) J.M.A. Braga (Marantaceae) em dois ambientes de Mata Atlântica. *Rodriguesia*. 50:107–122.
- Fahn A. 1990. *Plant Anatomy*. 4th ed. Oxford: Pergamon Press.
- Freitas L, Bernardello G, Galetto L, Paoli AAS. 2001. Nectaries and reproductive biology of *Croton sarcopetalus* (Euphorbiaceae). *Botanical J Linnean Soc.* 136:267–277.
- IUCN 2001. IUCN red list categories and criteria version 3.1. Available from: <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria>
- Madison M. 1977. Vascular epiphytes: their systematic occurrence and salient features. *Selbyana*. 2:1–13.
- Meira RMSA, Martins FM. 2003. Inclusão de material herborizado em metacrilato para estudos de anatomia vegetal. *Revista Árvore*. 27:109–112.
- Metcalf CR, Chalk L. 1983. *Anatomy of the dicotyledons*. Vol. 2. 2nd ed. Oxford: Clarendon Press.
- Riina R, Berry PE, van Ee BW. 2009. Molecular phylogenetics of the dragon's blood *Croton* section *Cyclostigma* (Euphorbiaceae): a polyphyletic assemblage unraveled. *Syst Bot.* 34:360–374.
- Riina R, van Ee BW, Wiedenhoeft AC, Cardozo A, Berry PE. 2010. Sectional rearrangement of arborescent clades of *Croton* (Euphorbiaceae) in South America: evolution of arillate seeds and a new species, *Croton domatifer*. *Taxon*. 59:1147–1160.
- Riina R, Vigo MA, Ceron CE. 2014. *Croton condorensis*: an enigmatic new species of Euphorbiaceae from southern Ecuador. *Phytotaxa*. 164:154–158.
- Sá-Haiad B, Serpa-Ribeiro ACC, Barbosa NC, Pizzini D, Leal D, Senna-Valle L, Santiago-Fernandes LDR. 2009. Leaf structure of species from three closely related genera from tribe Crotonae Dumort. (Euphorbiaceae s.s., Malpighiales). *Plant Syst Evol.* 283:179–202.
- Secco R, Do Rosario AS, Berry PE. 2012. *Croton campinarenensis* (Euphorbiaceae), a new species from eastern Amazonian Brazil. *Phytotaxa*. 49:1–5.
- Silva MJD, Sodré RC, Sales MFD. 2014. A new species of *Croton* L. (Euphorbiaceae s.s.) from the Brazilian Cerrado. *Syst Bot.* 39:216–221.
- Solereder H. 1908. *Systematic anatomy of the dicotyledons*. Vol. 1. Oxford: Clarendon Press.
- Thiers B. 2015 and onwards. Index herbariorum: a global directory of public herbaria and associated staff. The New York Botanical Garden, New York. Available from: <http://sweetgum.nybg.org/ih/> (accessed 28 January 2015).
- Webster GL, Del-Arco-Aguilar MJ, Smith BA. 1996. Systematic distribution of foliar trichome types in *Croton* (Euphorbiaceae). *Botanical J Linnean Soc.* 121:41–57.