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Croton nagaoi, a new species of Euphorbiaceae from southern Laos

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Abstract

Croton nagaoi (Euphorbiaceae) is described based on a specimen collected from the basin of the Bolaven Plateau, southern Laos. It is most similar to *Croton thorelii* Gagnep. of Laos, Cambodia, Thailand and Vietnam in size and shape of lamina, short petioles less than 1 cm long, and basal glands lateral on the abaxial midrib base, but different in having densely stellate hairy lower leaf surface (vs. very sparsely pubescent and glabrescent in *C. thorelii*), smaller sepals and petals of staminate flowers (sepals and petals ca. 2.2 mm long vs. 3 mm long and 2.5 mm long, respectively), and the presence of petals in pistillate flowers (vs. absent). Morphological descriptions, photographs, vernacular name, and preliminary conservation status are provided for *C. nagaoi.*

Keywords: Angiosperms, flora of Laos, Indochina, Malpighiales, taxonomy

Introduction

Croton Linnaeus (1753: 1004) (Euphorbiaceae) is a large genus of flowering plant, with 1200–1300 species distributed in the tropics and subtropics worldwide (Webster 1993, Govaerts *et al.* 2000). The genus is readily recognized by stellate or scale-like trichomes, a pair of glands on the upper or lower base of the blade or midrib or on the petiole apex, (sub)terminal inflorescences usually consisting of pistillate flowers at the basal part and staminate flowers at the apical part (or sometimes consisted of completely pistillate or staminate), stamens inclinate in bud, and senescent leaves that turn orange before dehiscing (Berry *et al.* 2005, Esser 2005).

In Laos, Gagnepain & Beille (1925) documented 12 species in the country. Since then, several species have been recorded based on the subsequent botanical inventories and accumulation of the herbarium collections (e.g. Newman *et al.* 2007, Tagane *et al.* 2018), and the number of species recorded in Laos to date is 14 (WCSP 2022) or 19 (Newman *et al.* 2017 onwards).

During our field survey of the Bolaven Plateau and its vicinities in 2018 (Fig. 1), we collected an unknown *Croton* species. After a careful examination referring to taxonomic literature (Gagnepain 1921, 1925, Whitmore 1972, Forster 2003, Hô 2003, Esser 2005, 2010, Thin 2007, Li & Esser 2008, Tagane *et al.* 2015), herbarium specimens at FOF and KAG, as well as digital specimen images available on online resources (e.g., JSTOR Global Plants https://plants.jstor.org), we are convinced that it is a new species and here describe it.

Taxonomic treatment

***Croton nagaoi* Tagane, Soulad. & Souvann.,** *sp. nov.* (Figs. 2 & 3)

TYPE:—LAOS. Champasak Province: Ba Chieng Chlernsouk, 15°06′44.56″N, 105°58′46.8″E, 231 m., 15 December 2018, *Tagane, Nagahama, Souladeth & Pisuttimarn L2459* (holotype KAG [KAG128559!], isotype FOF [FOF0005791!]).

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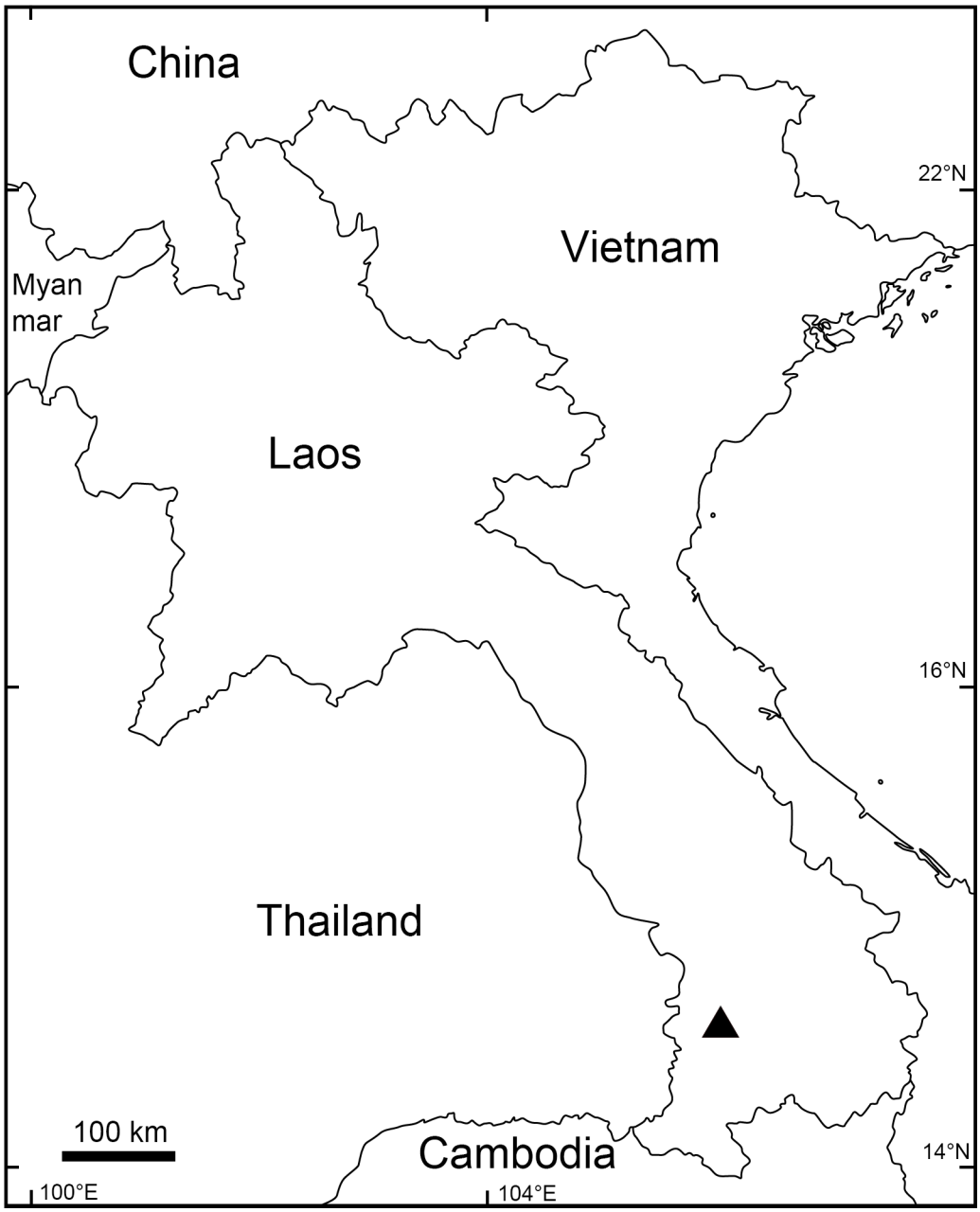

FIGURE 1. Type locality of *Croton nagaoi* Tagane, Soulad. & Souvann. (closed triangle).

Most similar to *Croton thorelii* Gagnepain (1921: 560) of Laos, Cambodia, Thailand and Vietnam in size and shape of lamina, short petioles less than 1 cm long, and basal glands lateral on the abaxial midrib base, but distinguished from it by its lower leaf surface densely covered with persistent yellowish-cream stellate hairs (vs. very sparsely pubescent and glabrescent in *C. thorelii*) (Fig. 4), and the presence of petals in pistillate flowers (vs. absence).

Shrubs to 1.5 m tall. Young branches densely covered with stellate hairs, these persistent, yellowish-cream, 0.3–0.5 mm in diam., with (14–)18–24 free or only basally fused radii. Stipules narrowly lanceolate, 1.5–2 mm long, glabrous adaxially, stellate hairy abaxially. **Leaves** pseudo-verticillate, seemingly 3–5 leaves at nodes; petiole 0.3–0.6 cm long, densely pubescent; blade oblanceolate to obovate-elliptic, (3.3–)5.5–17.6 × (1.1–)2.4–6.3 cm, thinly coriaceous, apex shortly acuminate, base rounded-subcordate, margin serrate, teeth 3–9 mm apart, grayish green to light yellowish brown adaxially, glabrous except midrib adaxially, light yellowish brown, densely covered with yellowish-cream stellate hairs abaxially; basal glands 2, sessile, elevated, lateral on the abaxial midrib base, marginal glands absent; midrib prominent on both surfaces, secondary veins 9–15 pairs, not triplinerved, prominent abaxially, tertiary veins indistinct. **Inflorescence** (sub)terminal, solitary, 2.7–5.9 cm long, stellate-hairy throughout, with 1–5 pistillate flowers,

sometimes completely staminate; bracts caducous, not seen, bracteoles lanceolate, ca. 3 mm long, densely pubescent outside, glabrous inside. **Staminate flowers**: pedicel ca. 1 mm long; bracteoles narrowly triangular, ca. 2.2 mm long, pubescent outside, glabrous inside, sepals ovate-triangular, ca. 2 × 2 mm, covered with yellowish-cream stellate hairs, glabrous inside, apex acute, margin ciliate; petals ovate-elliptic, ca. 2.2 × 1.2 mm, pubescent outside, glabrous inside, apex obtuse; stamens 12 in 4 whorls, ca. 2.3 mm long, filament 1.4–2 mm long, pubescent, anthers ca. 0.7 mm long. **Pistillate flowers**: pedicel ca. 1 mm long, densely stellate hairy; sepals ovate-triangular, ca 3.5–4 × 2 mm, dense stellate-hairy outside, glabrous inside; petals ovate-elliptic, ca. 3 × 1.5 mm, covered with simple hairs only, apex acute, margin ciliate; ovary ca. 3.5 mm in diam., with densely stellate hairs; style column absent, stigmas ca. 3.5 mm long, bifid at ca. 1 mm from base. **Fruits** subglobose, ca. 0.8 cm in diam., sulcate, covered with stellate hairs. **Seeds** 1–3, ca. 6.5 mm long, pale brown.

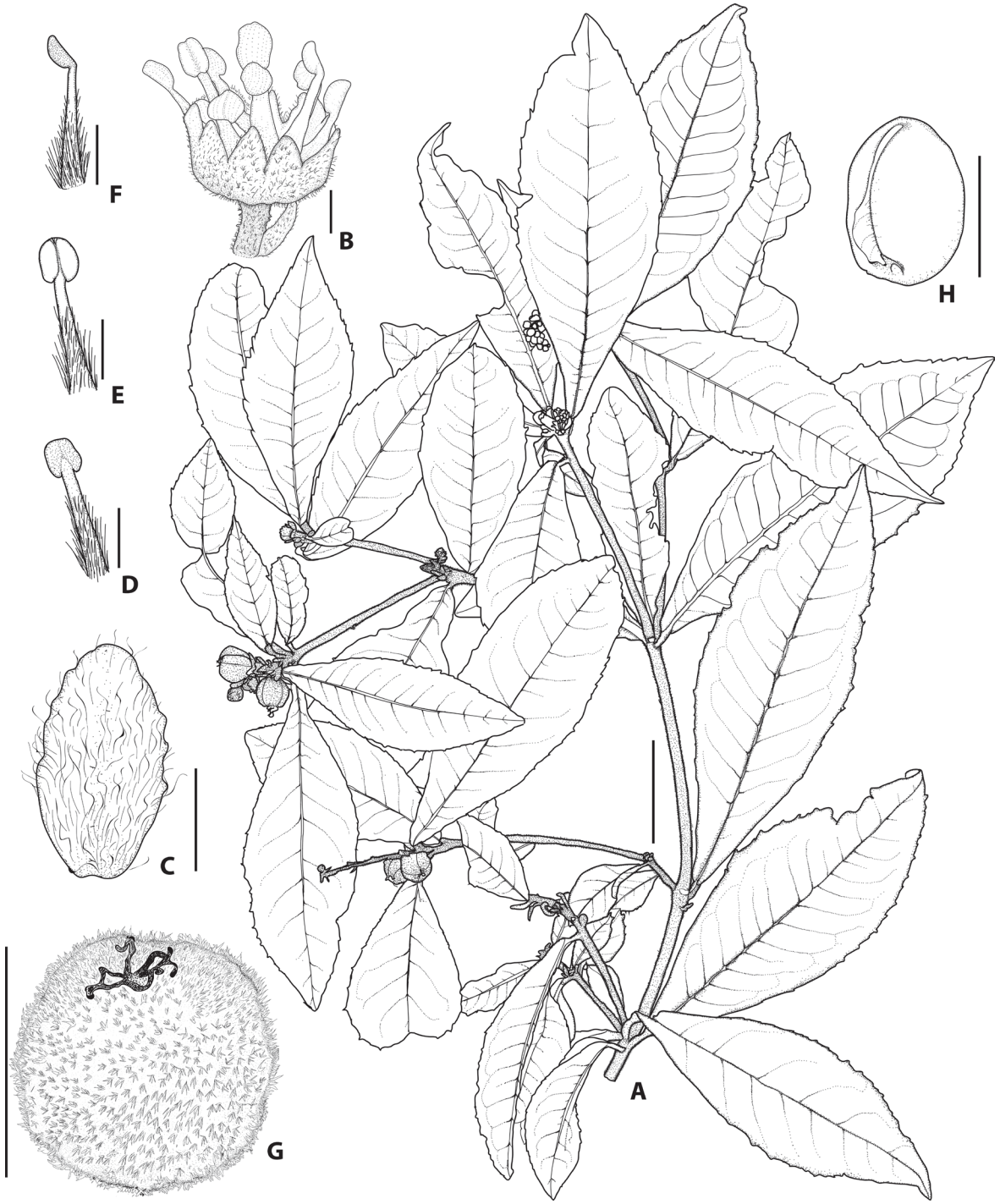

FIGURE 2. *Croton nagaoi* Tagane, Soulad. & Souvann. A. branches; B. staminate flower with a bracteole; C. petals (outside); D. stamens, back view; E. stamen, front view; F. stamen, lateral view; G. fruit; H. seed. All from *Tagane et al. L2459* (KAG [KAG128559]). Scale bars: A = 3 cm, B–F = 1 mm, G = 8 mm, H = 5 mm. Line drawing by K. Souvannakhoummane.

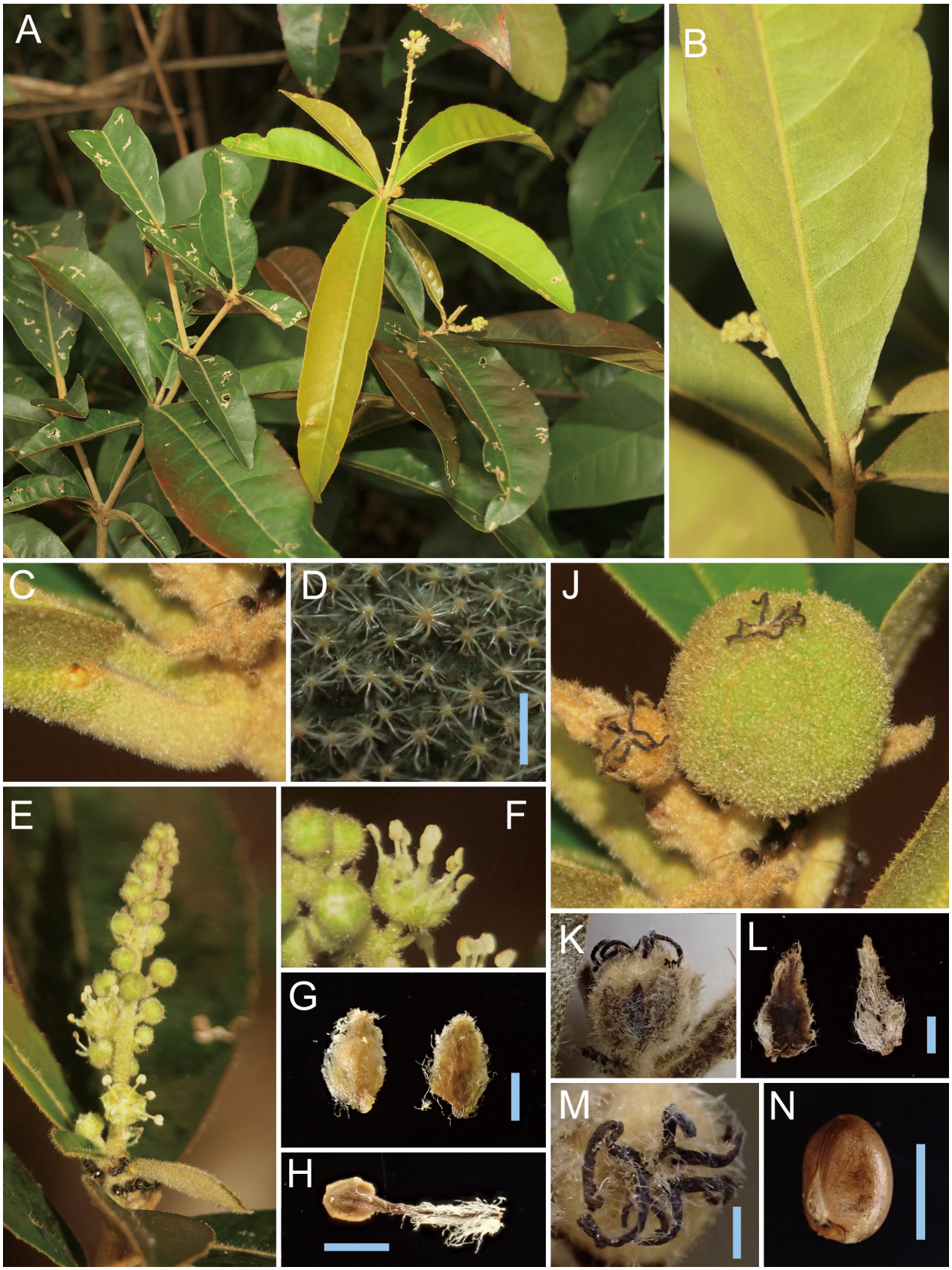

FIGURE 3. *Croton nagaoi* Tagane, Soulad. & Souvann. A. Flowering branch; B. portion of abaxial leaf surface; C. base of leaf showing basal gland lateral on base of midrib; D. stellate hairs on lower leaf surface; E. inflorescence consisting of staminate flowers; F. staminate flower; G. petal of staminate flower; H. stamen; J. fruit; K. pistillate flower, lateral view, showing sepals and petals; L. petals of pistillate flower; M. stigma; N. seed. All from *Tagane et al. L2459*. Scale bars: D = 0.5 mm, G, H, L, M = 1 mm, N = 5 mm. Photographs by S. Tagane.

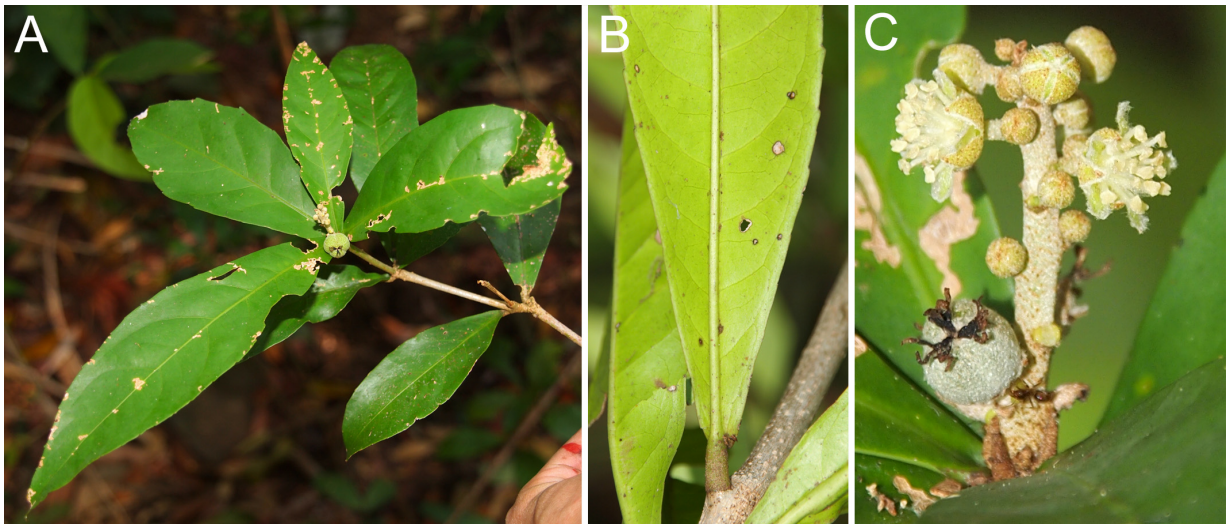

FIGURE 4. *Croton thorelii* Gagnep. A & C from *Tagane et al. 6796* (FU), B from *Tagane et al. 6798* (FU). Photographs by S. Tagane.

Distribution:—Laos (so far known only from the type locality).

Habitat:—In area of seasonal dry evergreen forest, roadside thickets; at an elevation of 231 m.

Phenology:—Flowering and fruiting in December.

Etymology:—The species epithet is dedicated to the excellent Nagao Natural Environment Foundation (http://www.nagaofoundation.or.jp/e/) that has promoted nature conservation in Asia-Pacific countries since its establishment in 1989. Thanks to their support, we could have intensive field surveys on the Bolaven Plateau, which resulted in a better understanding of the flora of Bolaven and the discovery of more than 18 new species including the new species of *Croton* described in this study and 65 new country records (e.g. Souladeth *et al.* 2020, Tagane *et al.* 2020, Souvannakhoummane *et al.* 2021, Vongthavone *et al.* 2021).

Vernacular name:—Pao Dong (ເປົ້າດົ່ງ) (suggested here; 'Pao' refers to the genus *Croton* and 'Dong' refers to the forest area).

Preliminary conservation assessment:—Critically Endangered (CR). During our five field surveys in Bolaven Plateau in 2018–2020, we found only a small population with ca. 10 individuals of *Croton nagaoi* in the type locality. Therefore, the most appropriate initial assessment of the IUCN conservation status for this species is Critically Endangered (CR) under criteria D (IUCN 2012). We collected this species in the roadside thickets beside a rubber plantation field, and this species might be locally common in such disturbed areas. However, surrounding areas of the type locality have been converted to rubber plantation at large scale, implying that much of the habitat was already lost. We need to collect further information on its distribution and number of individuals/populations to accurately assess the conservation status.

Note:—*Croton nagaoi* is characterized by the indumentum of dense, persistent yellowish-cream stellate hairs on the young twigs, lower leaf surface, inflorescences and fruits, pseudo-verticillate leaves in seemingly 3–5 at nodes, short petioles 0.3–0.6 cm long, oblanceolate to obovate-elliptic lamina (3.3–)5.5–17.6 × (1.1–)2.4–6.3 cm, and pinnate secondary veins of 9–15 on each side, by which combination it is clearly distinguished from the other species of *Croton* in Laos and its surrounding countries. *Croton nagaoi* is most similar to *C. thorelii,* and the two species might be close relatives. However, in addition to the diagnosis mentioned above, *C. nagaoi* is distinguishable from *C. thorelii* in its larger stellate hairs (0.3–0.5 mm in diam. in *C. nagaoi* vs. 0.2–0.3 mm in diam. in *C. thorelii*), longer stipules (1.5–2 mm vs. 1 mm long), smaller sepals and petals of staminate flowers (sepals and petals ca. 2.2 mm long vs. 3 mm long and 2.5 mm long, respectively), and longer bifid styles ca. 3.5 mm long (vs. 1.5–2 mm long and often quadrifid; Esser 2005). Further phylogenetic work will be necessary to understand their relationship and evolutionary history. The specimens of *C. thorelii* we examined in this study are shown in the Appendix.

Acknowledgments

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Appendix

Specimens of *Croton thorelii* Gagnep. examined:

CAMBODIA. Mondulkiri Prov.: Virachay National Park, Nong Sa Mek, South of Ban Mac Pheung, 17 December 2005, *Thomas et al. 94* (L [L2212412], image!); Seima Protected Forest, 23 January 2015, *Tagane et al. 6796* (FU!), *6798* (FU!). Stang Treng Prov.: Bassin du Bassin du Sè-Moun, 1875, *Harmand 122* (BM [BM000551500], image!).

LAOS. Champasak Prov., Pathumphon District, Xe Pian NBCA, 31 January 1997, *Klackenberg 1152* (P [P00937416], image!). Savannakhet Prov.: 20 km N from Savannakhet, 19 January 1925, *Poilane 11661* (P [P05508767] image!).

THAILAND. Buriram Prov.: Nang Rawng, 3 January 1924, *Kerr 8208* (L [L2212421], image!). Chonburi Prov.: Sriracha, Nawng Nam Keo, 5 April 1920, *Kerr 4168* (L [L2212420], image!); Bahn Beung District, Kow Chompoo, 24 October 1976, *Maxwell 76-702* (L [L2212416], image!). Prachin Buri Prov.: Khao Yai National Park, Kaeng Hin Phaeng Ranger Unit, 12 Febuary 2006, *Poopath et al. RP6209* (L [L3784721], image!). Ranong Prov.: Ngao Waterfall National Park, 2006, *Middleton 3860* (L [L2212413], image!). Surin Prov.: Sangka, 12 January 1924, *Kerr 8269* (L [L2212418], P [P05508764] images!). Province unknown: Tungpo Krabin, 1 January 1920, *Kerr 9808* (L [L2212419], image!).

VIETNAM. Baria Vungtau Prov. Mt. Dinh, April 1867, *Pierre 6226* (E [E00200631], GH [GH00105610], images!). 'Cochinchine', 1862–1866, *Thorel s.n.* (K [K000959194], image!).