

Three new records of *Curcuma* subgen. *Ecomatae* (Zingiberaceae: Zingibereae) for the flora of Laos

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ABSTRACT

Three species of *Curcuma* subgen. *Ecomatae*, *Curcuma bicolor*, *C. nakhonphanomensis* and *C. rubroaurantiaca*, are newly recorded for the flora of Laos. Descriptions and colour plates, as well as notes on ecology and phenology, are provided for all three species. In addition, a key to species of *Curcuma* subgen. *Ecomatae* in Laos is also provided.

KEYWORDS: Khammouane Province, Mekong region, Phou Pha Nang National Protected Area, taxonomy, Vientiane capital.

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INTRODUCTION

Curcuma subgen. *Ecomatae* Škorničk. & Šída f. consists of at least 45 species (Leong-Škorničková *et al.*, 2023; H.T. Nguyen *et al.*, 2023; Saensouk *et al.*, 2023) widely distributed in monsoonal tropics from south China, Myanmar, Thailand, Laos, Cambodia and Vietnam. The hotspot is in Thailand with 32 species recorded, many of which were described recently (Leong-Škorničková *et al.*, 2020, 2023; Leong-Škorničková & Saensouk, 2023; Saensouk *et al.*, 2022, 2023), followed by Vietnam with 14 species (D.D. Nguyen *et al.*, 2022; H.T. Nguyen *et al.*, 2023). So far only four species have been recorded in Laos (see Fig. 1), i.e. *C. corniculata* Škorničk. and *C. flammea* Škorničk. which remain to be endemic to Laos (Leong-Škorničková *et al.*, 2014), and *C. peramoena* Souvann. & Maknoi (Souvannakhoummane & Maknoi, 2014) and *C. singularis* Gagnep. (Newman *et al.*, 2007; Newman *et al.*, 2017–present) which has since been reported from Thailand (Leong-Škorničková & Saensouk, 2023). The flora of Laos greatly overlaps

with that of its neighbouring countries, especially Cambodia, Thailand and Vietnam, with a number of recent new records for Laos formerly described as endemic to these three countries (e.g. Tagane *et al.*, 2017; Vongthavone *et al.*, 2021).

During our botanical explorations in Phou Hin Poun National Protected Area and Nam Sanam - Phou Pha Marn Provincial Protected Area, Khammouane Province, and Phou Pha Nang National Protected Area in Vientiane Capital, three *Curcuma* species unknown from Laos (Newman *et al.*, 2007, 2017–present) were collected and subsequently identified as *Curcuma bicolor*, *C. nakhonphanomensis*, and *C. rubroaurantiaca*. These three species were previously reported as endemic to Thailand (Leong-Škorničková *et al.*, 2023; Mood & Larsen, 2001; Saensouk *et al.*, 2022) and are here reported as new records for the flora of Laos. In this paper, we provide brief descriptions and colour plates based on the Lao's material, along with details on their distribution, ecology, phenology, vernacular names and uses, preliminary

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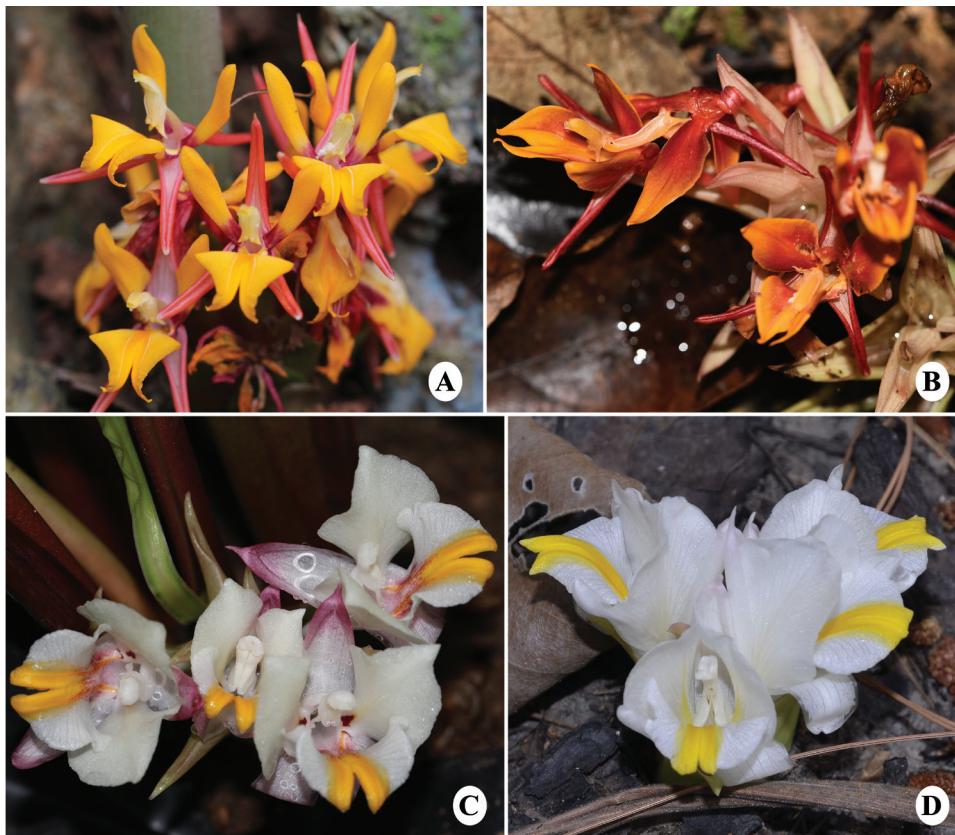


Figure 1. Inflorescences and flowers: A. *Curcuma corniculata* Škorničk.; B. *Curcuma flammea* Škorničk.; C. *Curcuma peramoena* Souvann. & Maknoi; D. *Curcuma singularis* Gagnep. Photographed by K. Phouthavong (A); K. Souvannakhouummane (B–C) and S. Lanorsavanh (D).

conservation status in Laos, and any other appropriate notes. A key to all species of subgen. *Ecomatae* in Laos is also provided.

TAXONOMIC TREATMENT

1. *Curcuma bicolor* Mood & K. Larsen, New Plantsman 8(4): 216. 2001; Sirirugsa *et al.*, Gard. Bull. Singapore 59: 211. 2007; Leong-Škorničková & Saensouk, in Newman & Sangvirojanapat (eds), Fl. Thailand 16(2): 425–426. 2023. Type: Thailand, Mae Hong Son Province, near Pang Mapha, off Route 1095, ca 750 m, 9 Jan. 2000, Mood 97p149 (holotype AAU!). Figs. 2&5.

Rhizomatous perennial herbs 45–80 cm tall. *Main rhizome* 2.5–3.5 × 3–5 cm, ovoid, with numerous fibrous roots, internally white; lateral rhizome

slender, 4–10 mm in diam; root tubers ellipsoid, internally white. *Leafy shoots* composed of 3–5 leaves; leaf sheaths green, pubescent; petioles 10–22 cm long, pubescent; ligules bifid, 4–8 mm long, ciliate on the margin; lamina 25–40 × 10–18 cm, narrowly elliptic to oblong with acuminate apex and cordate base, green on both sides, adaxially sparsely pilose, abaxially densely puberulous. *Inflorescences* lateral, peduncle 3.5–4 cm long, pubescent; thyrses 5–7.5 × 4–6 cm composed of 32–38 fertile bracts, each supporting cincinnus of 1–4 flowers; fertile bracts 3–4 × 1.2–2 cm, ovate to narrowly ovate with acute apex, whitish green to brownish green, abaxially puberulent; bracteoles absent. *Flowers* 4.5–5 cm long, exserted from the bracts; calyx 1.5–2.2 cm long, greenish to pale red, puberulous, apex 3-toothed; floral tube 3.5–4.2 cm long, red, outside

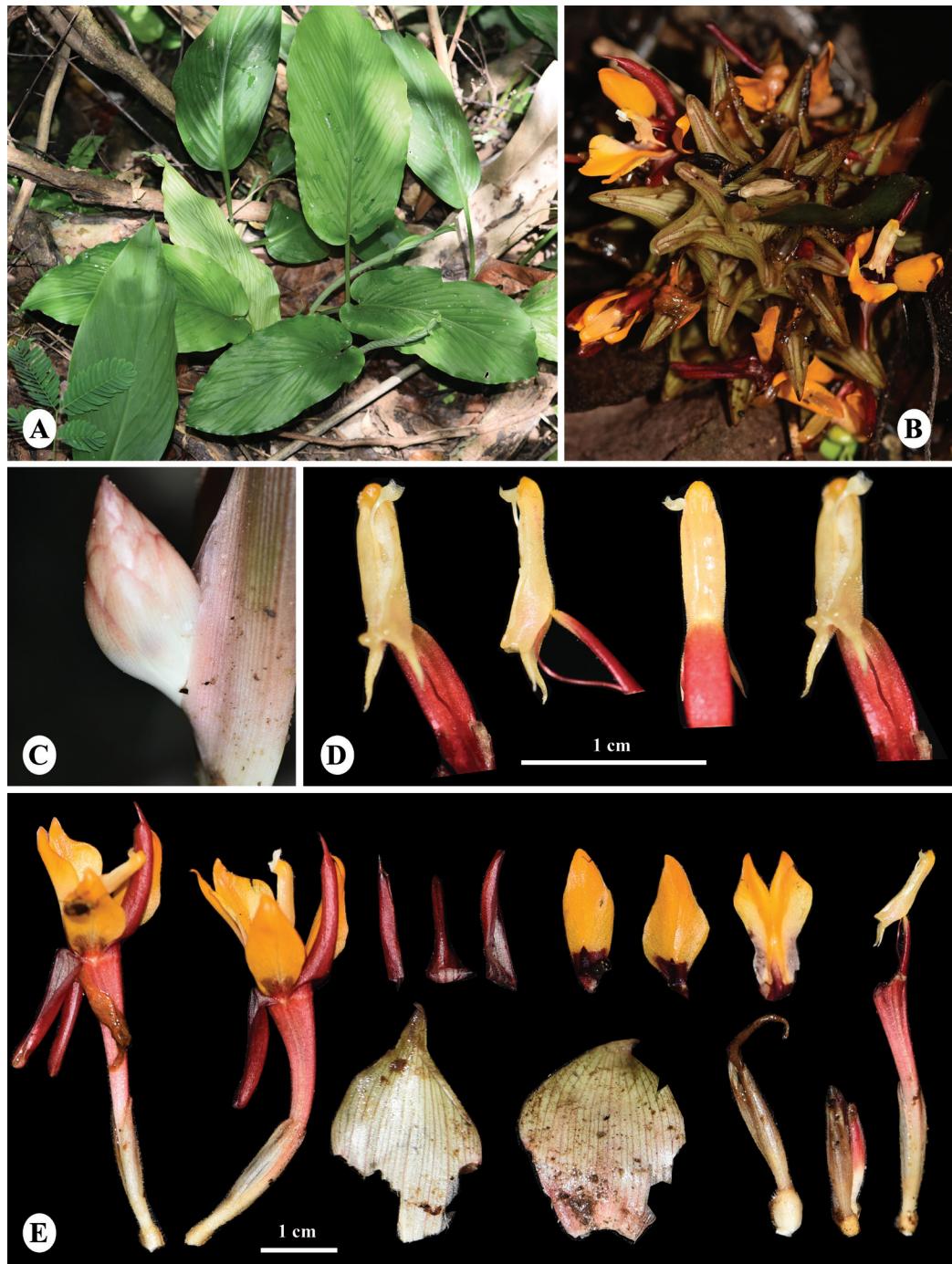


Figure 2. *Curcuma bicolor* Mood & K.Larsen: A. habit; B. inflorescence; C. young inflorescence; D. anthers; E. flowers with dissection. Photographed by K. Souvannakhoummane.

puberulent; dorsal corolla lobe $1.8\text{--}2.2 \times 0.4\text{--}0.6$ cm, triangular ovate with mucronate apex, red, sparsely puberulent; lateral corolla lobes $1.5\text{--}2 \times 0.4\text{--}0.5$ cm, triangular ovate with rounded apex, red, sparsely puberulent; lateral staminodes $1.5\text{--}1.8 \times 0.6\text{--}0.9$ cm, rhombic to ovate, orange with basal deep red patch reaching about $1/4\text{--}1/3$ of length; labellum $1.8\text{--}2 \times 0.8\text{--}1.2$ cm, basally with claw, distally diamond to rhombic with bifid apex (split ca 6 mm), orange with dark orange at the centre with red patch at the base; filament 57 mm long, flat, red, with glandular hairs; anthers $12\text{--}15$ mm long, connective tissue orange, anther crest ca 1×1 mm, rounded, spurs narrowly conical, ca 3.5 mm long, pale orange, with glandular hairs. *Ovary* 3.5–4 mm long, densely puberulous; style red, puberulent to glabrous; stigma pale orange, ciliate; epigynous glands 2, ca 5 mm long, linear. *Young capsules* subglobose to ovoid; fruits not seen.

Additional specimens.— Vientiane Capital [Phou Pha Nang National Protected Area, 298 m asl., 13 July 2023, *Souvannakhoummane & Souvandy PPN07 (HNL, FOF)*].

Distribution.— Laos and Thailand.

Ecology and Phenology.— Found in sandy soil mixed with stone on a mountain slope in humid mixed deciduous forest with bamboos. Flowering from July to September, after leafy shoots grown.

Notes.— This species is distinguished from other species in the subgen. *Ecomatae* by the lateral staminodes being red in the basal half. Our specimen is different from the type populations in Thailand by a few red patches at the base of the labellum.

Vernacular name and uses.— ດອກຫວ້ານສອງສີ [Dok Waan Song Si (Bicolor Curcuma)]. The young inflorescences can be used in various culinary dishes, adding a unique flavor and spice to salads, stir-fries, and bamboo soup. Inflorescences with flowers are used to pray to Buddha for mental clarity.

Preliminary conservation status.— In Laos, *Curcuma bicolor* is known to exist in only one spot close to the edge of Phou Phanang National Protected Area and is considered rare because of habitat disruption and overcollection. The number of mature individuals observed is less than 100, classifying it as regionally Critically Endangered in Laos.

2. *Curcuma nakhonphanomensis* Boonma, Saensouk & P.Saensouk, *Biodiversitas* 23(11): 6041. 2022. Type: Thailand, Nakhon Phanom Province, 158 m asl., 07 Aug. 2021, *Boonma 830* (holotype **KKU**). Figs. 3&5.

Rhizomatous perennial herbs 30–60 cm tall. *Main rhizome* ovoid, 0.8–1.2 cm in diam., multi-branched, internally yellowish cream; rhizome branches creeping, slender, 0.3–0.6 cm in diam., internally white; root tubers ovoid, internally white. *Leafy shoots* composed of 3–4 leaves; leaf sheaths green, pubescent; petioles 8–15 cm long, pale purple to green, pubescent; ligules 0.3–0.6 mm long, bilobed, pubescent; lamina $15\text{--}30 \times 9\text{--}11$ cm, ovate to elliptic with acuminate apex and rounded base, green and pubescent on both sides. *Inflorescences* terminal, peduncle 4–6 cm long, pubescent; thyrses $4\text{--}5 \times 2.5\text{--}3$ cm, composed of 12–16 fertile bracts, each subtending cincinnus of 2–3 flowers; fertile bracts $2.5\text{--}4.5 \times 2\text{--}2.5$ cm, ovate with acute apex, whitish green, abaxially pubescent; bracteoles absent. *Flowers* 4.8–5 cm long, exserted from the bracts; calyx 2–2.5 cm long, greenish white, glabrous, apex 3-toothed; floral tube 3–4 cm long, white, glabrous; dorsal corolla lobe $1.8\text{--}2.5 \times 0.7\text{--}1$ cm, triangular with acute and mucronate apex, white, glabrous; lateral corolla lobes $1.6\text{--}2.2 \times 0.5\text{--}0.8$ cm, white to pinkish, glabrous; lateral staminodes ca 1.5×0.9 cm, elliptic to rhomboid with acute to rounded apex, white with dark red dots at the base; labellum $1.8\text{--}2.4 \times 0.5\text{--}0.7$ cm, basally with claw, distally diamond to rhombic with bifid apex (split ca 7 mm), white at base (claw) with two dark red lines, distally with dark orange median band extending to the apex; filament $0.5\text{--}0.7 \times 0.3\text{--}0.4$ cm, flat, white, with glandular hairs; anther 10–12 mm long, connective tissue white, crest ca 1.5×1.5 mm, spurs short, 1.8–2 mm long, white. *Ovary* ellipsoid, white to cream white, pubescent; style white, glabrous; stigma white, ciliate; epigynous glands 2, ca 8.5 mm long, filiform.

Additional specimens.— Khammouane Province [Thakhek District, Nakhangxang Village, 250 m asl., 26 Sept. 2020, *Lanorsavanh et al. KS2233 (HNL)*].

Distribution.— Laos and Thailand.

Ecology and phenology.— Found in sandy soil on a mountain slope in a foothill limestone forest

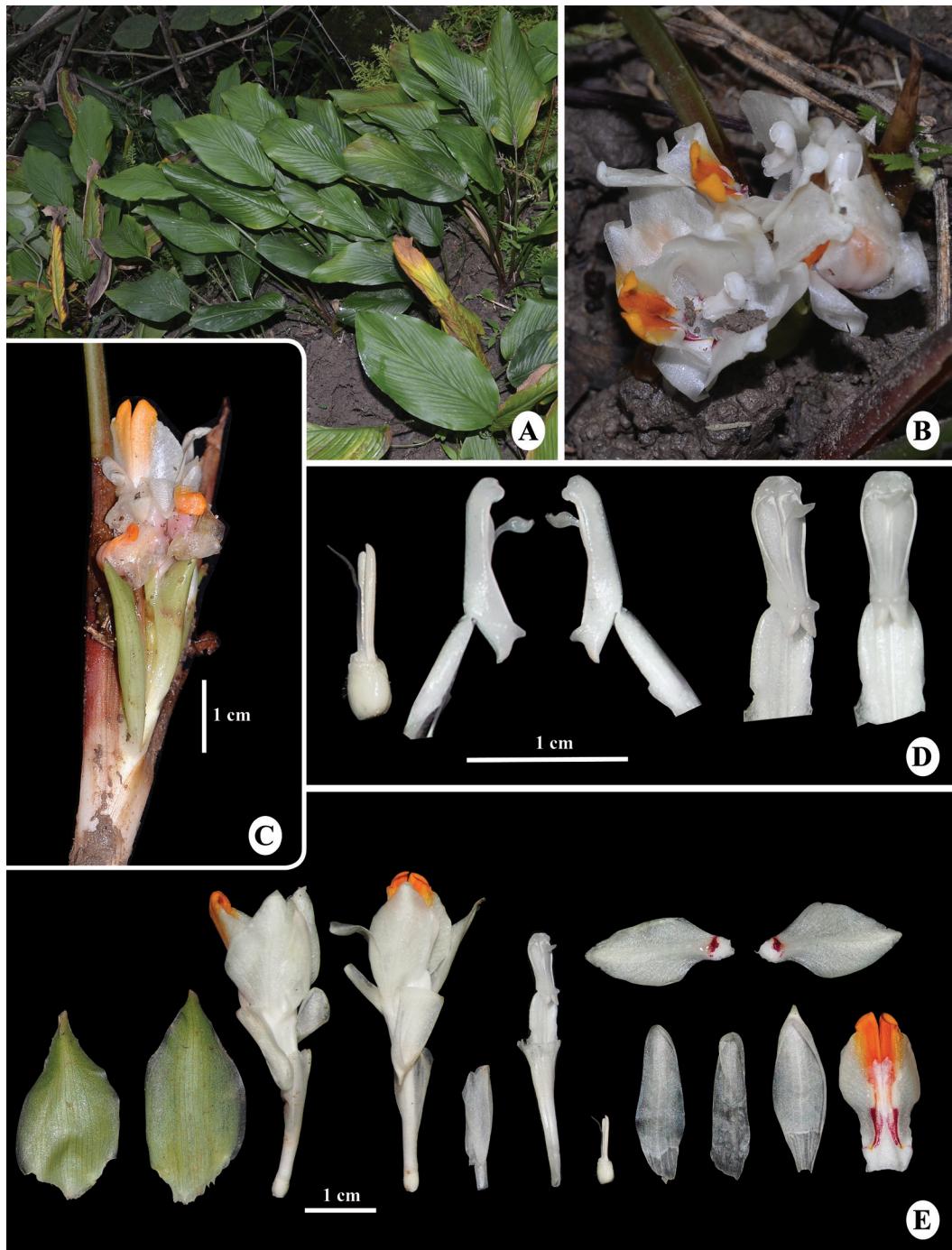


Figure 3. *Curcuma nakhonphanomensis* Boonma, Saensouk & P.Saensouk: A. habit; B-C. inflorescence; D. anthers; E. flowers with dissection. Photographed by S. Lanorsavanh (A-C) & K. Souvannakhoummane (D-E).

mixed with bamboo. It grows with *Nervilia plicata* (Andrews) Schltr. (Orchidaceae) and *Begonia cladotricha* M. Hughes (Begoniaceae), *Adiantum philippense* L. (Pteridaceae) and *Selaginella* sp. (Selaginellaceae). Flowering from last August to September, after leafy shoots have grown.

Notes.— This species is somewhat similar to *Curcuma lampangensis* Saensouk, Maknoi & Rakarcha in the colour and shape of the flowers, but differs by slender and horizontally creeping rhizomes, internally cream (vs more robust rhizome usually pointing straight down, pale yellow internally), narrower lateral staminodes which are white with dark red spots (vs broad staminodes which are white to pale yellow without red basal dots), bracteoles absent (vs bracteoles present) and shorter broadly conical somewhat flattened anther spurs (vs narrowly conical spurs with acute apices in *C. lampangensis*).

Vernacular name and Uses.— ດອກຫວ້ານ-ນະຄອນພະນັມ [Dok Waan Nakhonphanom (Nakhonphanom curcuma)]. These are no uses recorded for this species yet. Future ethnobotanical investigations conducted through interviews with local people are needed to establish any local uses.

Preliminary conservation status.— The type locality of *C. nakhonphanomensis* in Thailand is located across the Mekong River just 30 km away from populations in Laos. It commonly grows near limestone foothills. This species is currently considered Vulnerable in Laos, because it is known only for a single location which is not under any legal protection and the area is affected by habitat loss caused by the human activities such as agriculture, mining and urban development in the area.

3. *Curcuma rubroaurantiaca* Škorničk. & Soonthornk., Phytokeys 235: 243. 2023. Type: Sakon Nakhon Province, Phanna Nikhom District, Na Hua Bo Subdistrict, ca 200 m, 15 July 2023, Soonthornkalump Sutt-242 (holotype BKF!, isotype SING!). Figs. 4&5.

Rhizomatous perennial herbs 50–75 cm tall. *Main rhizome* ovoid, 1.6–2.2 cm in diam., multi-branched, with numerous fibrous roots, internally cream-white; rhizome branches creeping, slender, 0.8–1.2 cm in diam., internally white; root tubers fusiform, internally white. *Leafy shoots* composed

of 4–6 leaves; leaf sheaths brownish-red to green, densely pubescent; petioles 12–40 cm long, green to brownish-red, puberulous; ligules 3.5–4 mm long, bilobed, densely puberulent; lamina 20–40 × 10–16 cm, ovate-elliptic with acuminate apex and cordate base, green on both sides, adaxially glabrous, abaxially densely puberulous. *Inflorescences* lateral and central, peduncle 2–4 cm long, puberulous; thyrses 5–9 × 4–6 cm, composed of 12–16 fertile bracts, each subtending a cincinnus of 2–4 flowers; fertile bracts 2.5–4.5 × 1.5–3.5 cm, ovate with acuminate apex, pale green with red tinge, puberulous on both sides; bracteoles absent. *Flowers* 4.2–5.5 cm long, exserted from the bracts; calyx ca 2.5 cm long, tinged pink-red, puberulous, apex 3-toothed; floral tube 3–4.2 cm long, pale yellowish-orange to orange with red tinge, externally shortly pubescent; dorsal corolla lobe 2.4–2.8 × 0.5–9 cm, ovate-triangular with mucronate apex, red, glabrous; lateral corolla lobes 2–2.5 × 0.4–7 cm, shape with rounded apex, red, glabrous; lateral staminodes 1.8–2.2 × 0.9–1.2 cm, rhomboid with acute to blunt apex, orange; labellum 2–2.5 × 1.2–1.5 cm, with claw at base, rhomboid distally with bifid apex (split ca 8 mm), orange. *Filament* 5–9 mm long, flat, orange, with glandular hairs; anther 15–20 mm long, connective tissue orange, with glandular hairs, crest 2.5–3 × 1.5–2 mm, ovate to oblong, spurs triangular, 2.5–3 mm long, bright orange. *Ovary* ovoid, cream to pale pink, pubescent; style orange, glabrous; stigma yellowish, ostiole ciliate; epigynous glands 2, ca 10 mm long, linear.

Additional specimens.— Khammouane Province [Khounkham District, Nam Sanam - Phou Pha Marn Provincial Protected Area, 380 m asl., 2 July 2022, Souladeth et al. PPM005 (HNL, FOF)].

Distribution.— Laos and Thailand.

Ecology and Phenology.— Found in humid deciduous forests at limestone foothills, growing in sandy soil in rock clefts. It often grows in association with *Zingiber thorelii* Gagnep. (Zingiberaceae) under the shade of dominant trees, i.e., *Sterculia pexa* Pierre (Malvaceae), *Streblus monoicus* Gagnep. (Moraceae), *Glochidion mirabile* (Müll.Arg.) R.W.Bouman (Phyllanthaceae) and *Diospyros* sp. (Ebenaceae). Flowering from last June to August after leafy shoots have grown, and fruiting August to October.

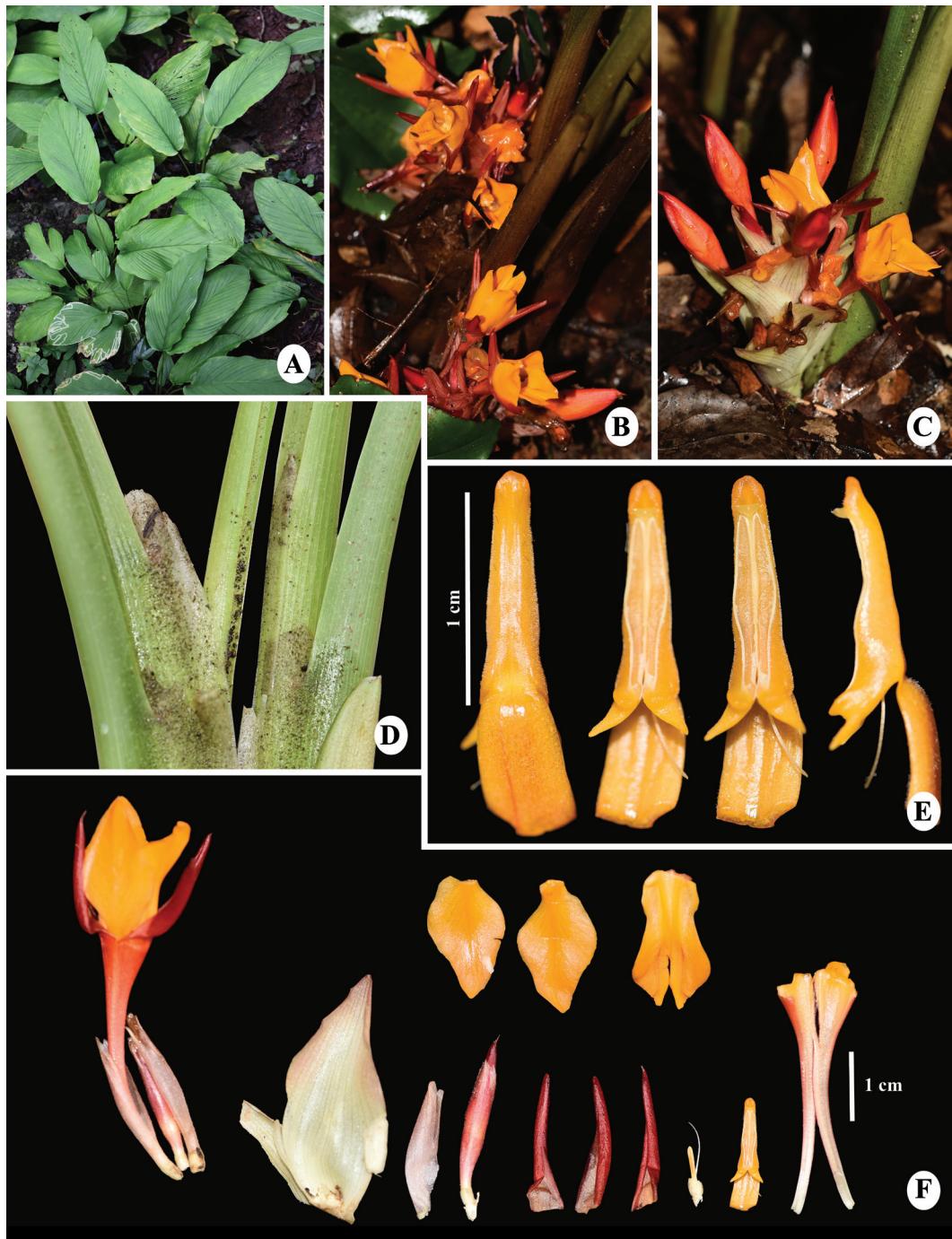


Figure 4. *Curcuma rubroaurantiaca* Škorníčk. & Soonthornk.: A. habit; B–C. inflorescence; C. leaf sheath and ligule; E. anthers; F. flowers with dissection. Photographed by K. Souvannakhoummane.

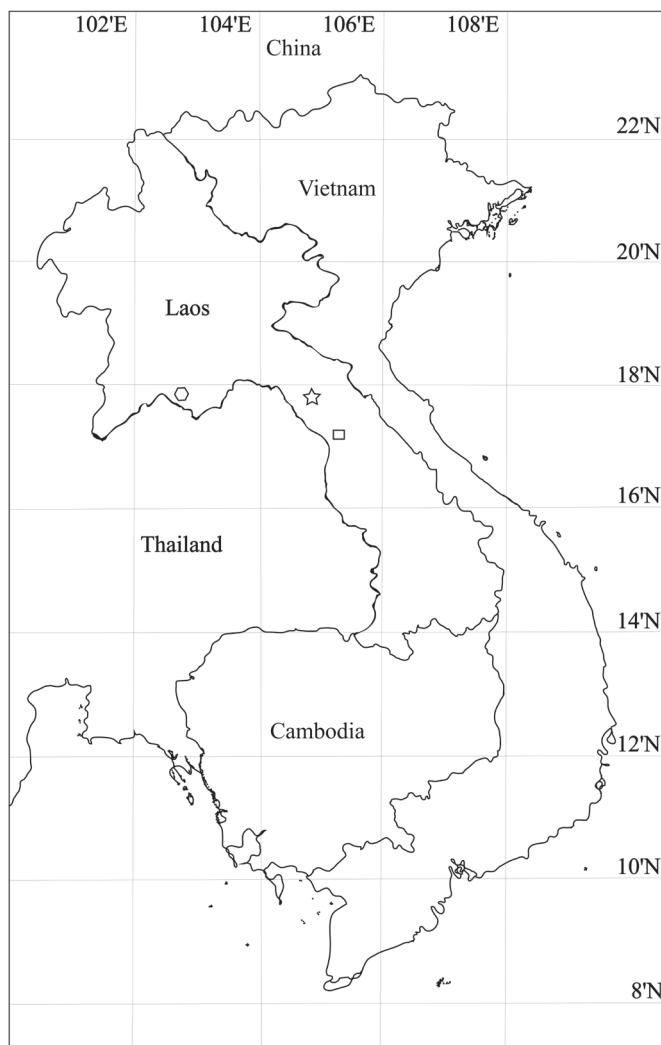


Figure 5. Distribution of *Curcuma bicolor* (hexagon shape), *C. nakhonphanomensis* (square shape) and *C. rubroaurantiaca* (star shape).

Vernacular name and Uses.— ດອກຫວ້ານເພັດແຮງ [Dok Waan Phetdeang (Phetdeang curcuma)]. Locally, this species is used locally as an ornamental, as seen for example, close to the Rock Viewpoint at Phou Pha Marn Area. More thorough ethnobotanical investigations are needed to establish is this species is used as food or a medicinal plant.

Preliminary conservation status.— *C. rubroaurantiaca* is often located at the base of limestone hills and adjacent forests, and along roadsides. The main concern for this species is habitat loss due to

road expansion, and targetted collection by humans as an ornamental. This species is now classified as vulnerable in Laos, because of the rising pressure on its natural habitat loss.

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KEY TO SPECIES OF *CURCUMA* SUBGEN. *ECOMATAE* FOR THE FLORA OF LAOS

1. Corolla lobes white or pink, rest of the flower predominantly white with some yellow/orange and red on the labellum only
 2. Flowering before leafy shoots have grown **C. singularis**
 2. Flowering after leafy shoots have grown
 3. Leaf base cuneate to attenuate, corolla lobes pink, anther spur 2.5–3 mm long **C. peramoena**
 3. Leaf base rounded, corolla lobes white, anther spur 1.8–2 mm long **C. nakhonphanomensis**
 1. Corolla lobes more or less red, rest of the flower predominantly yellow-orange to orange with some red
 4. Apex of labellum lobes strongly recurved, horn-like **C. corniculata**
 4. Apex of labellum lobes otherwise
 5. Lateral staminodes dark red at basal 1/4–1/3, orange distally **C. bicolor**
 5. Lateral staminodes red-orange or orange throughout
 6. Labellum and staminodes orange with plenty of bright red tinge throughout, filament bright red, anther crest round, up to 1.5 mm long **C. flammnea**
 6. Labellum and staminodes plain orange, filament orange, anther crest ovate to oblong, 2.5–3 mm long **C. rubroaurantiaca**

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