

## Two new species of *Curcuma* subgen. *Ecomata* (Zingiberaceae) from southern Vietnam

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**ABSTRACT.** Two new species of *Curcuma* subgenus *Ecomata* (Zingiberaceae) from southern Vietnam, *C. newmanii* Škorničk. and *C. xanthella* Škorničk., are described and illustrated here. Their similarities and differences from their closest allies in the subgenus *Ecomata*, *C. singularis* Gagnep. and *C. flaviflora* S.Q.Tong, are discussed.

**Keywords.** *Curcuma flaviflora*, *Curcuma newmanii*, *Curcuma singularis*, *Curcuma xanthella*, Zingibereae, Zingiberoideae

### Introduction

The Indochinese region is one of the diversity hotspots for the Zingiberaceae. With the last comprehensive account over a century old (Gagnepain 1908), the ginger flora is not well known. During our extensive explorations of the family for the Flora of Cambodia, Laos and Vietnam, numerous interesting ginger species have been recently described including a new genus *Newmania* from Vietnam (Lý et al. 2010; Leong-Škorničková et al. 2011; Lamxay & Newman 2012; Nguyen & Leong-Škorničková 2012; etc.) and six *Curcuma* species. Four of the *Curcuma* species are from the subgenus *Ecomata* Škorničk. & Šída f. (Záveská et al. 2012)—*C. vitellina* Škorničk. & H.Đ. Trần (Leong-Škorničková et al. 2010b), *C. pambrosima* Škorničk. & Lý (Leong-Škorničková & Lý 2010), *C. corniculata* Škorničk. ined. and *C. flammea* Škorničk. ined. (Leong-Škorničková et al., submitted), while two others are from the subgenus *Hitcheniopsis*—*C. pygmaea* Škorničk. & Šída f. ined. (Leong-Škorničková et al., in press) and *C. leonidii* Škorničk. & Luru (Leong-Škorničková & Luru 2013).

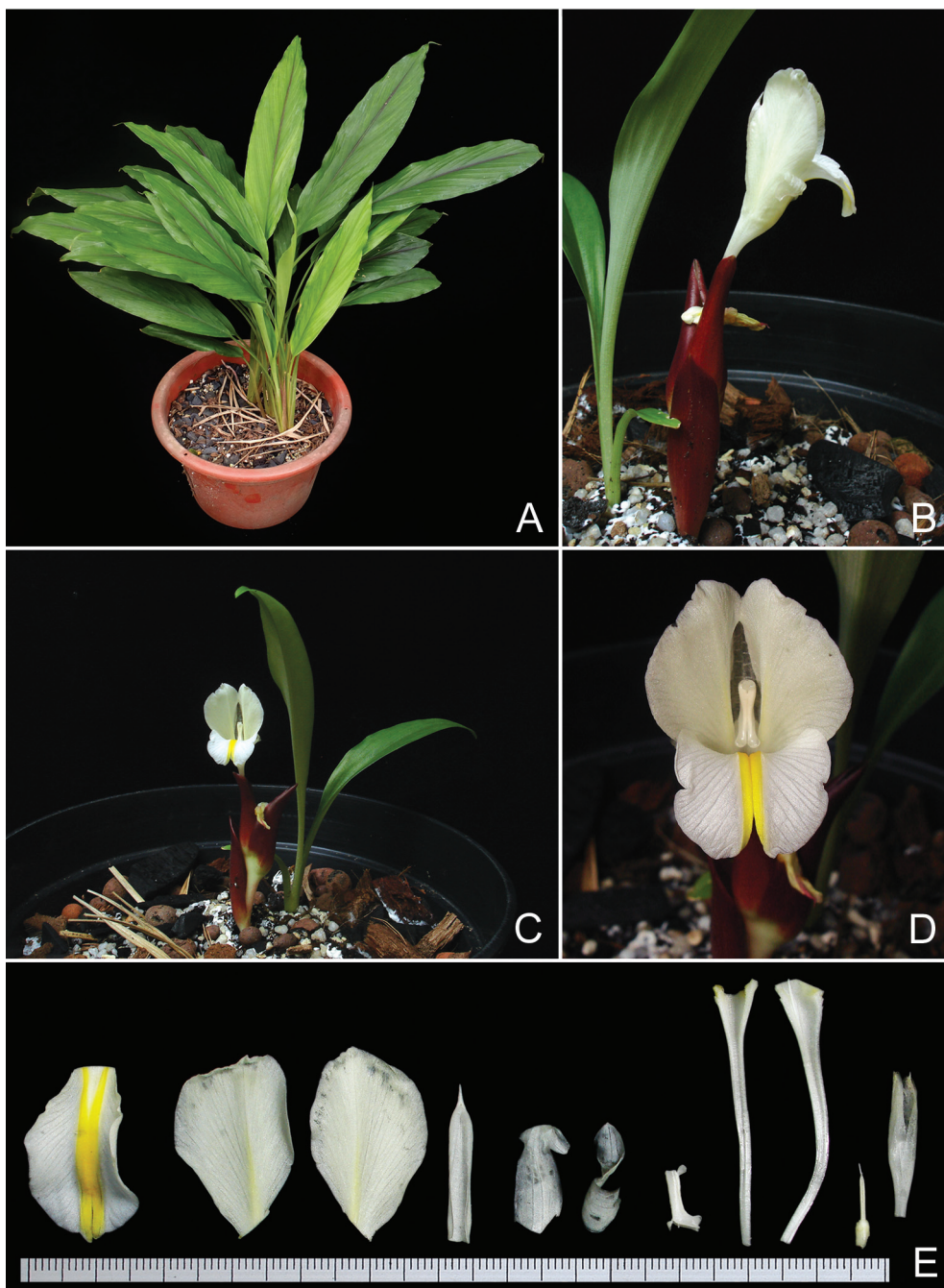
With the progressing revision of the genus *Curcuma* for Indochina, another two species from the subgenus *Ecomata* were found to be new and are described and illustrated below (Fig. 1, 2, 3 & 5). The terminology follows Beentje (2012). The new species, *C. newmanii* and *C. xanthella*, are morphologically close to *C. singularis* Gagnep. and *C. flaviflora* S.Q.Tong (Fig 4.) and for this reason they are compared to them here. The recent molecular phylogeny of the genus *Curcuma* (Záveská et al. 2012) showed that *C. newmanii* and *C. xanthella* cluster with other Vietnamese species from the the subgenus *Ecomata* and that they are distinct from *C. singularis* & *C. flaviflora*.

***Curcuma newmanii* Škorničk., sp. nov.**

Similar to *Curcuma singularis* Gagnep., but differs by its unique shape of anther characterised by short anther spurs with two blunt knobs at apex (forming a heart-shaped structure in front view) and longer, more prominent lateral staminodes.

TYPE: *Trần 204*, Vietnam, Đắk Lắk Prov., Bản Đôn village, 12°55'11.07"N 107°49'16.32"E, alt. 205 m, 27 April 2010 (holo SING; iso VNM). Fig. 1.

Rhizomatous herb to 0.8 m tall. **Rhizome** ovoid, 2–4 × 1–1.5 cm, light brown externally, cream white internally; *root tubers* not seen, likely to be well distanced from the rhizome. **Leafy shoot** with 3–6 leaves, developing at the same time or shortly after flowering; *pseudostem* to 30 cm long, green, composed of leaf sheaths; *sheathing bracts* 1–3, tinged with dark red-purple, fast drying out and decaying; *leaf sheaths* green, with red-purple tinge especially towards the basal part, puberulent; *ligule* up to 3 mm long, bilobed, hyaline, greenish white, translucent, externally puberulent; *petiole* up to 11 cm long (petiole of outermost leaf shortest, innermost leaves longest), canaliculate, green, puberulent; *lamina* slightly unequal, narrowly lanceolate (sensu Lindley), up to 32 × 8 cm (possibly larger later in the season), slightly plicate, adaxially medium to dark green with a dark red band running along the midrib across the entire lamina length, glabrous, abaxially lighter green, puberulent; base obtuse, slightly oblique; apex caudate, puberulent. **Inflorescence** lateral, peduncle and often also base of the spike subterranean; *peduncle* c. 3 cm long, up to 5 mm diam., cream-white, with up to 4 sheathing bracts; *spike* 4–6 cm long, c. 2–3 cm diam. in the middle, wider apically, coma absent; *fertile bracts* 3–8 per inflorescence, bract 4.5 × 4 cm (larger at the base of the inflorescence, inner ones gradually smaller and narrower), broadly ovate to ovate with acute apex, whitish at base, green with various degree of deep red tinge towards the apex, both sides puberulent, connate in the lower 1/3–1/4, apex narrowly acute, reflexed; *cincinni* with 2–3 flowers at the base of the inflorescence, 1 flower at the top; *bracteoles* rudimentary, thread-like and irregularly curled, 1–3 × 0.5–1 mm (outer ones larger, inner ones are gradually smaller), hyaline, translucent white, glabrous. **Flower** c. 8 cm long, much exerted from the bracts; *calyx* up to 23 mm long, 3-toothed, with unilateral incision c. 10 mm, translucent white, sparsely puberulous; *floral tube* 3.5–4.5 cm long, externally white, densely puberulous throughout, internally white, glabrous at basal half, densely puberulous in apical half, with dorsal groove holding the style; *dorsal corolla lobe* c. 25 × 10 mm, triangular ovate, concave, glabrous, pure white, apex mucronate, mucro c. 2 mm long, puberulous; *lateral corolla lobes* c. 20 × 9 mm, triangular ovate, concave, glabrous, pure white; *labellum* c. 26 × 20 mm, obovate, apex emarginate, incised up to 5 mm, white except a bright yellow median band, puberulent with glandular hairs; *lateral staminodes* c. 26–30 × 16–18 mm, irregularly obovate, white with short glandular hairs on the adaxial side. **Stamen** 10–11 mm long; *filament* 2–3 mm long, white, c. 4 mm broad at base, 2–2.5 mm broad at apex (the point of attachment to the connective), covered with short glandular hairs; *anther* c. 10 mm long (measured along side view with spurs unmanipulated), spurred; *connective* white, densely covered with short glandular hairs; *anther spurs* c. 1 mm long, with two blunt knobs at apex (forming a heart-shaped structure in front view);



**Fig. 1.** *Curcuma newmanii* A. Habit (after flowering, late stage in the season). B. Inflorescence with flower (side view). C. Habit (flowering stage, beginning of the season). D. Flower (front view). E. Flower dissection (from left): Labellum, two lateral staminodes, dorsal corolla lobe, two lateral corolla lobes, anther in side view, floral tube dissected, ovary with epigynous glands, and calyx. A–E: *Trần 204*, Đắk Lắk Prov., Bàn Đôn village, from cultivation. (Photos: J. Leong-Škorničková)

*anther crest* not obvious; *anther thecae* 7–8 mm, dehiscing along the entire length. **Epigynous glands** two, c. 5–7 mm long, c. 0.5 mm in diam, cream-white. **Style** thin, white, glabrous, placed in the groove in dorsal side of floral tube; *stigma* c. 1.5 mm long, 1.75 mm wide, white; *ostiole* shortly ciliate, facing forward. **Ovary** 4 × 2 mm, trilocular, densely puberulent. **Fruit** not seen.

*Habitat.* Grows in lowland, deciduous dipterocarp forests.

*Phenology.* The inflorescences appear and the first flowers open from April to May, just before the leaves, with leafy shoots appearing shortly after.

*Distribution.* So far known only from southern Vietnam, Đắk Lắk Province, in the vicinity of Bản Đôn village.

*Etymology.* Named after Dr. Mark Fleming Newman, a ginger specialist from the Royal Botanic Garden Edinburgh.

*Other specimens examined:* VIETNAM. **Đắk Lắk.** Bản Đôn village, 12°54'37.0" N 107°50'19.3"E, 223 m, 25 June 2008, *Trần et al.* s.n. (collected from cultivation, 21 May 2009, *JLS* 365) (SING incl. spirit); ibidem, 12°55'11.07"N 107°49'16.32"E, 205 m, 27 April 2010, *Trần* 204 (collected from cultivation 25 April 2013, *GRC* 142) (SING incl. spirit).

*Notes:* *Curcuma newmanii* has a unique anther shape (Fig. 5A) by which it is readily recognised from the otherwise similar *C. singularis* (fig. 5B). This species was discovered in the vicinity of Buôn Ma Thuột during the Sud Expert Plantes (SEP 350) expedition led by Dr. Mark Newman in June 2008. At that time, the plant was past its flowering stage and its identity could not be confirmed from old sterile inflorescences. Only after this particular collection flowered in cultivation, did it become clear that it represents a new taxon. The species has been re-collected from the same locality in April 2010 by the second author.

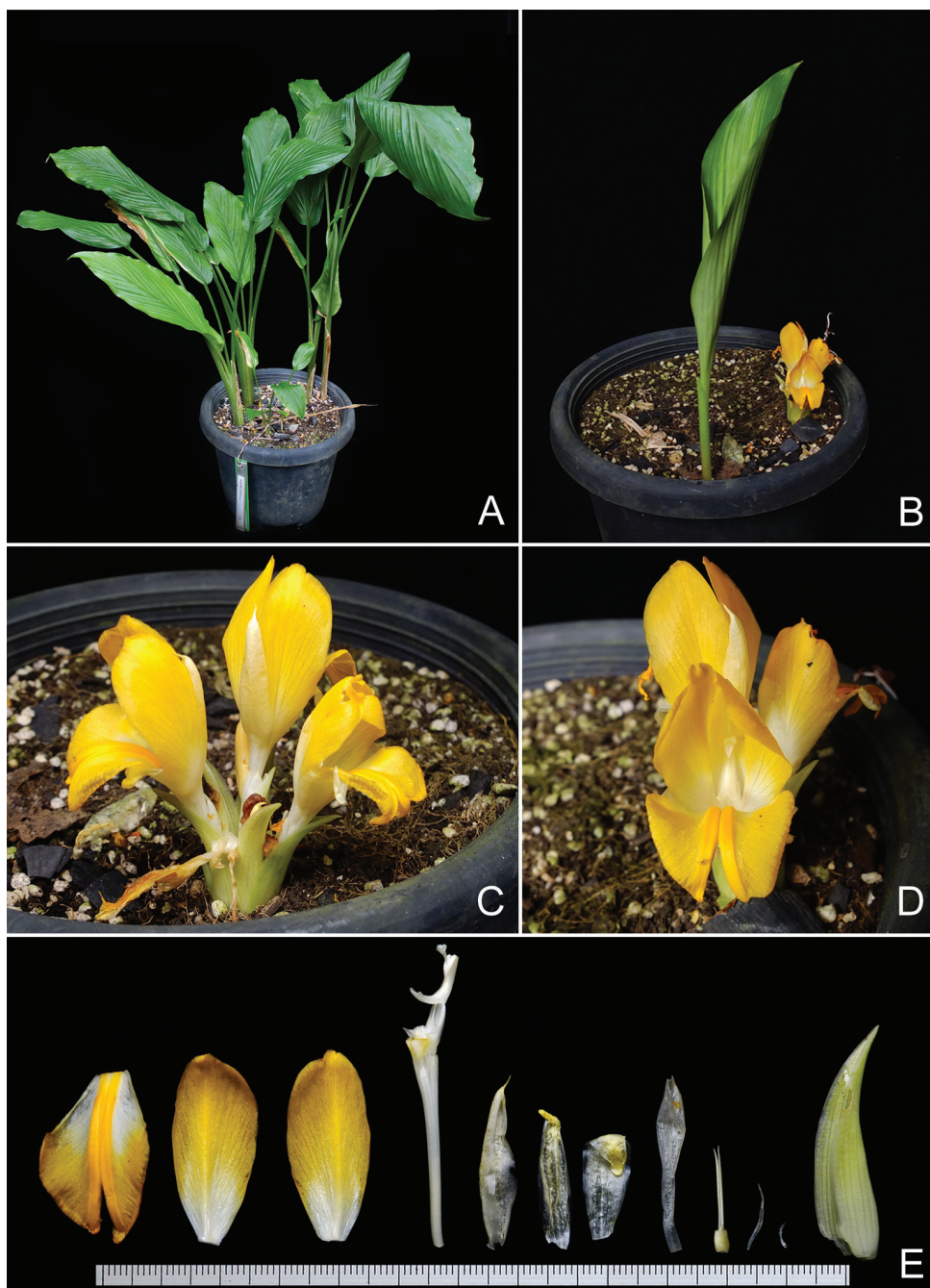
While *C. singularis* seems to be a widespread species occurring from Thailand through Cambodia and Laos to Vietnam, *C. newmanii* is so far known only from the type locality.

### ***Curcuma xanthella* Škorničk., sp. nov.**

Similar to *Curcuma flaviflora* S.Q.Tong, but differs by thinner and prominently plicate leaf blades with rounded to cordate base and longer, more prominent lateral staminodes. **TYPE:** *Lý* 348, Vietnam, Bình Thuận Prov., Hàm Thuận Nam Distr., Tà Kóu Nature Reserve, alt. 145 m, 10°48'51"N 107°54'45"E, 11 June 2009 (holo SING; iso E, VNM). Fig. 2 & 3.

Small rhizomatous herb to 0.6 m tall. **Rhizome** ovoid, c. 1.5–3 × 1–2 cm, with thin branches (c. 3–6 mm in diam.), light brown externally, light yellow internally, slightly



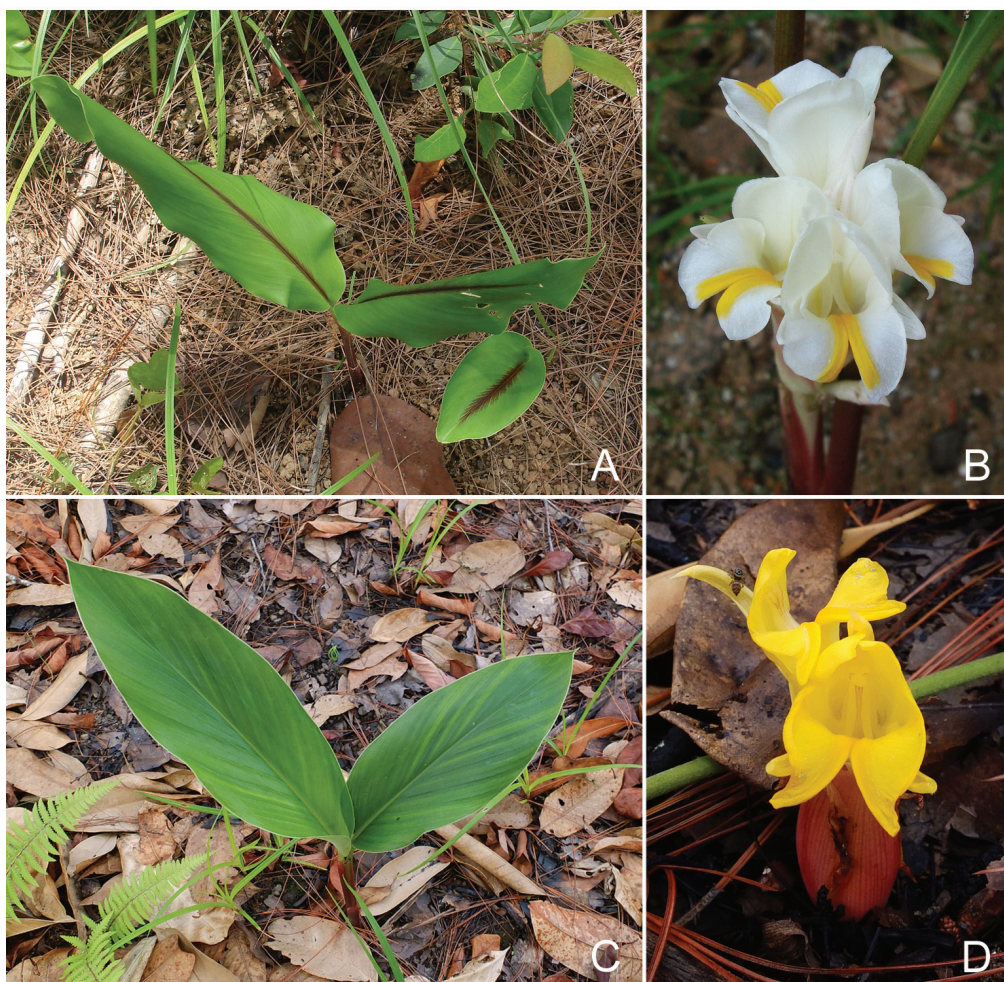


**Fig. 2.** *Curcuma xanthella* **A.** Habit (after flowering, late stage in the season). **B.** Habit (flowering stage, beginning of the season). **C.** Inflorescence with flowers in side and back view. **D.** Flower (front view). **E.** Flower dissection (from left): Labellum, two lateral staminodes, floral tube with stamen in side view, dorsal corolla lobe, two lateral corolla lobes, calyx, ovary with epigynous glands, bracteoles (two sizes), and fertile bract. A–E: *Trần et al. s.n.*, Bảo Lộc Pass, from cultivation. (Photos: J. Leong-Škorničková)



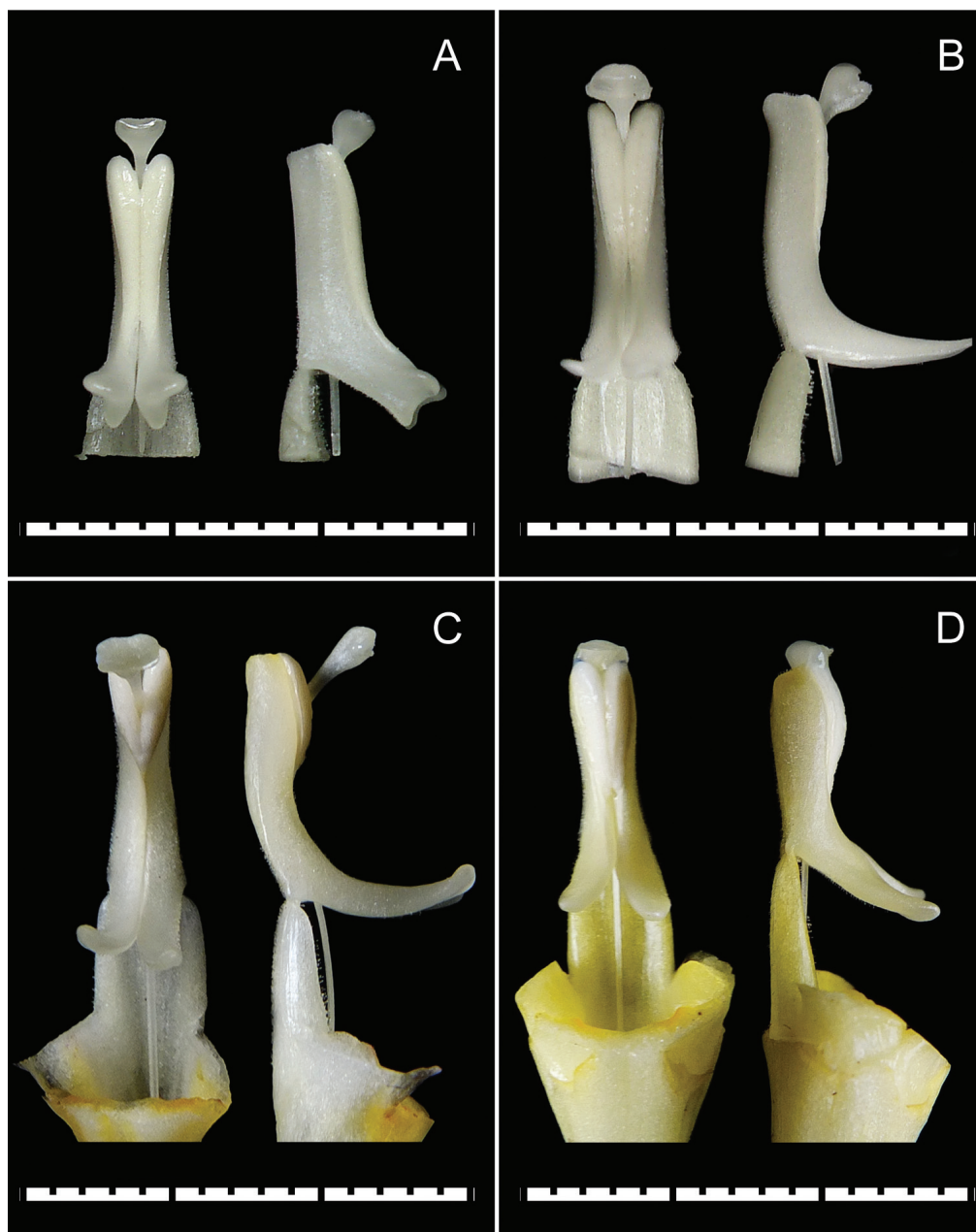
**Fig. 3.** Water colour painting of *Curcuma xanthella* at the Paris Herbarium library. (Photo: J. Leong-Škorničková)





**Fig. 4.** Two closest allies from the subgenus *Hitcheniopsis*. **A & B.** *Curcuma singularis* (Newman *et al.* MFN 2413, Cambodia). **C & D.** *C. flaviflora* (Leong-Škorničková & Suksathan JLS 2220, N. Thailand). (Photos: J. Leong-Škorničková)

aromatic with bitter almond-like scent, bitter to taste; *root tubers* elliptic, 2–3 cm long, light brown externally, cream white internally, developing some distance from the rhizome. **Leafy shoot** with 3–6 leaves, developing at the same time or shortly after flowering; *pseudostem* to 15(–30) cm long, green, composed of sheathing bracts and leaf sheaths; *sheathing bracts* 1–3, tinged with light purple when young, fast drying out and decaying; *leaf sheaths* green, glabrous; *ligule* up to 3 mm long, bilobed, hyaline, greenish white, translucent, glabrous; *petiole* up to 23 cm long (petiole of outermost leaf shortest, innermost leaves longest), canaliculate, green, glabrous; *lamina* slightly unequal, elliptic lanceolate (fide Lindley), to 32 × 9.5 cm, prominently plicate, adaxially bright green, glabrous, abaxially lighter green, glabrous; midrib green, glabrous on both sides; base rounded to cordate; apex acuminate, puberulent.



**Fig. 5.** Comparison of anthers of the two newly described species and their closest allies. **A.** *C. newmanii* (Trần 204, Vietnam). **B.** *C. singularis* (Newman et al. MFN 2413, Cambodia). **C.** *C. xanthella* (Trần et al. s.n., Vietnam). **D.** *C. flaviflora* (Leong-Škorničková & Suksathan JLS 2220, N. Thailand). (Photos: J. Leong-Škorničková)



**Inflorescence** lateral, peduncle and often also base of the spike subterranean; *peduncle* to c. 15 cm long, to 6 mm diam., cream-white, with up to 5 sheathing bracts; *spike* 4–5 cm long, c. 1.5–2 cm diam. in the middle, wider apically, coma absent; *fertile bracts* 4–8 per inflorescence, bract  $4.5 \times 2.1$  cm (larger at the base of the inflorescence), ovate to narrowly ovate, smaller and ovate at the apex, whitish at base to light green or with varying degree of deep rusty-red to purple at apices, both sides puberulent, connate in the lower 1/4, apex narrowly acute, reflexed; *cincinni* with 2 flowers at the base of the inflorescence, 1 flower at the top; *bracteoles* one per flower, narrowly triangular,  $2-8 \times 1-1.5$  mm (outer ones larger, inner ones are gradually smaller), hyaline, translucent white, glabrous, but shortly hairy on apex. **Flower** c. 7.5 cm long, much exerted from the bracts, *calyx* up to 30 mm long, 3-toothed, with unilateral incision c. 11 mm, translucent white, sparsely puberulous; *floral tube* c. 3.5 cm long, externally white and almost glabrous in the basal part, yellowish and shortly densely hairy internally and externally in the apical part (upper 2/3), with dorsal groove holding the style; *dorsal corolla lobe*  $30-34 \times 10-12$  mm, triangular ovate, concave, glabrous, whitish at base, yellowish towards the apex, apex mucronate, mucro 2–3 mm long, sometimes with a few short hairs; *lateral corolla lobes*  $27-28 \times 9-10$  mm, triangular ovate, concave, glabrous, whitish at base, yellowish towards the apex; *labellum*  $32-35 \times 22-25$  mm, obovate, apex emarginate, incision to 12 mm, base of the labellum white to light yellow, middle and apical part warm yellow, with two yellow-orange swollen bars running across the centre (forming a median band), densely puberulent with glandular hairs; *lateral staminodes* c.  $32-35 \times 15-16$  mm, irregularly oblong, bright warm yellow with short glandular hairs on the adaxial side. **Stamen** 12–13 mm long; *filament* 4–9 mm long, cream white, c. 4 mm broad at base, 2–2.5 mm broad at apex (the point of attachment to the connective), covered with short, glandular hairs; *anther* c. 8–9 mm long (measured in side view with spurs unmanipulated), spurred; *connective* cream white, densely covered with short glandular hairs; *anther spurs* c. 6 mm long, narrowly acute, pointing outwards (making the anther appear as L-shaped); *anther crest* not obvious; *anther thecae* 3–4 mm, heart-shaped, placed apically, dehiscing along the entire length. **Epigynous glands** two, c. 15 mm long, 0.5–0.75 mm in diam., cream-white. **Style** thin, white, glabrous, placed in the groove in dorsal side of floral tube; *stigma* c. 1.5 mm long, 1.75 mm wide, white; *ostiole* ciliate, facing forward. **Ovary**  $4 \times 2.5$  mm, trilocular, densely puberulent. **Fruit** a globular trilocular capsule, c. 1–1.5 cm in diam., white, puberulent; *seeds* irregularly obovoid, c. 4 mm long, light brown, shiny, enclosed in a translucent white, lacinate aril.

**Habitat.** Occurs in mixed broad-leaved semi-deciduous forests (Tà Kóu Nature Reserve) as well as in evergreen mountain forest (Bảo Lộc Pass).

**Phenology.** Flowering starts by end of April and continues throughout May and June, fruiting occurs at the end of May and in June and likely continues until July.

*Distribution.* So far recorded from two places in southern Vietnam, in Bình Thuận province, Tà Kóu mountain, and Lâm Đồng Province, Bảo Lộc pass. The distance between the two localities is about 80 km. The plants growing in Bảo Lộc at a higher elevation (c. 550 m) exhibit narrower leaves compared to those from lowland in Tà Kóu (c. 150 m), but there are no obvious differences in floral features.

*Etymology:* The specific epithet derived from the Greek refers to the yellow colour of the flowers.

*Other specimens examined:* Vietnam, **Bình Thuận Prov.:** Tà Kóu mountain, 30 May 2009, Nguyễn Thiện Tịch (under Trần collection number), *Trần-158* (E, SING, incl. spirit). **Lâm Đồng Prov.:** Bảo Lộc Pass, 22 June 2008, *Trần et al.* s.n. (collected from cultivation, 6 May 2013), *GRC-147* (SING, incl. spirit)

*Notes:* With its spike composed of a few bracts, yellow flowers and L-shaped anthers, *C. xanthella* is somewhat similar to *C. flaviflora*, but *C. flaviflora* is a high-elevation species known to occur in Pine forests in mountains of northern Thailand and southern China and differs from *C. xanthella* by the fairly leathery leaves with no prominent plication, and different shape and proportions of various flower parts. Especially, the staminodes are particularly large and prominent in *C. xanthella* (compare Fig. 2 and 4 C, D). The shape of the anther is also different (compare Fig. 5C and 5D).

It is also similar to *C. singularis* in that the flowers are well-exserted from the bracts and the L-shaped anthers, but *C. xanthella* differs by its yellow flowers (vs. pure white flowers with yellow median band) and bright green, thin, plicate leaf blades with a rounded to cordate base (vs. thicker, dull, darker leaf blades with no prominent plication and an attenuate to obtuse base) and longer, more prominent lateral staminodes. The anther thecae in *C. xanthella* are short, almost heart-shaped and positioned at the top, while those in *C. singularis* are much longer (compare Fig. 5B and 5C). While the occurrence of white and yellow variation of flower parts of staminodial origin (labellum, lateral staminodes and anthers) within a single species (and withing same population) has been previously reported from India for certain species in the subgenus *Curcuma*, e.g., *C. kannanorensis* R. Ansari, V.J. Nair & N.C. Nair (Leong-Škorničková et al. 2010a), it has so far not been observed in members of the subgenus *Ecomata*.

*Curcuma xanthella* was first discovered a century ago by A. Krempf and painted by Truong Ngoc Giu; the colour painting is found in the Icon collection of the Paris Herbarium Library (Fig. 3). On the reverse side of this painting the date is given as 18 June 1908, however it is not clear if this date refers to the date of plant collection or the date of presentation of the painting to the Library. There is no locality given, but it is likely to be southern Vietnam as Krempf is known to have collected in Annam. We have encountered this species several times around the Bảo Lộc pass area during the Sud Expert Plantes (SEP 350) expedition. However the plants were not flowering at the time. Subsequently, our collections have repeatedly flowered in cultivation since

2009, but also new collections have been made in the Tà Kóu Nature Reserve around the same time by Mr. Lý Ngọc Sâm and by Mr. Nguyễn Thiện Tịch and Dr. Lưu Hồng Trường (SGN); all of them have provided us with additional photographs or herbarium specimens. We have chosen the most complete collection *Lý 348* as the type.

The colour of the bracts in *C. xanthella* may be light green (as seen in Fig 2C) or cream with various degrees of purple red tinge (as seen in Fig 3).

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