Two new taxa of *Curcuma* subgen. *Ecomata* (Zingiberaceae: Zingibereae), from coastal Central Vietnam

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Six Senses Ninh Van Bay. Ninh Ván, Ninh Hòa, Khánh Hòa, Vietnam

**Abstract.** Nguyen DD, Le TA, Hoang QH, Le QT, Nguyen E. 2022. Two new taxa of *Curcuma* subgen. *Ecomata* (Zingiberaceae: Zingibereae), from coastal Central Vietnam. Biodiversitas 23: 2512-2519. *Curcuma sixsensesensis* and *Curcuma vinhlinhensis*, two new species belonging to subgenus *Ecomata* from Coastal Central Vietnam, are described and illustrated in the present articles. The *C. sixsensesensis* easily gets confused with *C. newmannii* Škorníčk., in compact rhizome; short lateral inflorescence composing of a few bracts; white corolla lobes and lateral staminodes; white labellum with a yellow mid-ridge but readily distinguished in rhomboid lateral staminodes (vs. obovate) with apex acuminate (vs. rounded); labellum 3-lobed (vs. emarginate), a mid-ridge band being yellow at apex half, white at the base (vs. yellow throughout); anther crest presented (vs. reduced); oblong (lightly arching) (vs. L.-shaped) anther in side view with slender and inward-pointing (vs. stout and outward-facing) spurs. The second one is similar to *C. pambrosima* Škorníčk. & N. S. Lý in general habit and shape of the spike but differs in reduced ligule ca. 1 (vs. 4-5) mm long; lateral staminodes orange throughout (vs. yellow at apex, white at base), elliptic with round apex (vs. unequally ovate-rhomboid with acute apex); anther spurs elongate into the acute apex, outward-facing (vs. curved inward), ca. 2-3 (vs. ca. 1.5) mm long, anther crest reduced, up to 0.5 mm, 2-lobed (vs. prominent anther crest, ca. 1.5 mm apex round). Data for each described species comprises standard citation of type specimens, description, proposed species epithet etymology, data on ecology and distribution, and short taxonomic notes and morphological comparison of these new species with its allies species, a revised key to species of *Curcuma* subgen. *Ecomata* in Vietnam is included.

**Keywords:** *Curcuma sixsensesensis*, *C. vinhlinhensis*, Khanh Hoa, Quang Tri, Zingiberaceae

**INTRODUCTION**

*Curcuma* L. is one of the largest genus of the family Zingiberaceae occurs dominantly in monsoon tropical and subtropical Asia, and extends to the south with few species in Malesian islands and the North Australian continent. The traditional taxonomy, supposed by Schumann (1904), divides the genus into two subgen. *Hitcheniopsis* (Baker) K. Schum. and *Curcuma* L. (Leong-Škornícková et al. 2020). Recently, the application of molecular analysis to taxonomy resulted in taxonomic changes in the genus, including establishing the third new section, namely *Ecomata* Škorníčk. & Šída f. (Leong-Škornícková et al. 2015b), which differs from the first subgenus by the presence of epigynous glands, anther spurs and inflorescence lacking a conspicuous coma of sterile bracts; from the second one by smaller habit, inflorescence lacking a conspicuous coma of sterile bracts. Additionally, a number of species of the relative genus were transferred within the genus *Curcuma*. Members of *Stabilanthus* Kuntze and *Laosanthus* K.Larsen & Jenjitt. were nested in *Hitcheniopsis*. Whereas genus *Smithatris* W. J. Kress & K. Larsen included within subgen. *Ecomata*.

novelty, compared to the first taxonomic treatment of Gagnepain (1907) in “Flore Generale de l’Indo-Chine” which listed only two species, namely *C. cochinchnesis* Gagnep. and *C. pierreana* Gagnep. (1907:405), which was repeated in a later edition without any new data (Ho Pham Hoang 2003). Additionally, three new species from Laos, namely *C. corniculata* Škorniè.k., *C. flumnea* Škornièk (Leong-Škornièková et al. 2014), *C. peramoena* Souvann. & Maknoi (Souvannakhoumme & Maknoi 2015), and two species from Myanmar, namely *C. kayahensis* Nob. Tanaka & M.M. (Tanaka & Aung 2019) and *C. stolonifera* Nob.Tanaka, K.Armstr. & M.M.Aungure (Tanaka et al. 2020) is described. The checklist of this subgenus as long as genus *Curcuma* in Vietnam is nearly completed. These taxa described in the present article are two of the last interesting specimens collected or captured by nature enthusiasts in all parts of Vietnam.

**MATERIALS AND METHODS**

Fresh flowers were dissected as soon as living plant specimens were collected. Photos of Tuan Anh Le and Six Senses Ninh Van Bay team were photographed using camera Olympus Tough TG6 and camera Canon PowerShot G7 X Mark III, respectively. The measurement used for the description was based on the plant specimens collected from the type locality. Several plant samples were initially preserved in 70% ethanol, then dried and stored at VNMN herbarium. A few flowers were still kept in ethanol for research. The data used for the description is from fieldwork mainly based on measurements of the living plants specimens, combined with dried material and alcohol-treated flowers mentioned above. The morphological characteristics of each specimen were compared to the others of similar species based on protologue and concern documents of all *Curcuma* subgen. *Ecomata* species from Vietnam and neighboring countries, especially Thailand, as long as the high-resolution images of the same dry specimens from herbarium websites (https://plants.jstor.org; https://science.mnhn.fr/)

The general plant terminology used to describe this species follows Beentje (2016) and the previous work of Leong-Škornièková et al. (2020).

**RESULTS AND DISCUSSION**

**Taxonomic treatment**

*Curcuma sixensesensis* D.D. Nguyen & T.A. Le, sp. nov. (Figure 1)

**Diagnosis:** New species is similar to *C. newmani*ii Škornièk, in a compact rhizome, short lateral inflorescence composed of a few bracts, white corolla lobes and lateral staminodes, white labellum with the yellow mid-rib band but readily distinguished in lateral staminodes being rhomboid (vs. obovate) with apex acuminate (vs. rounded); labellum 3-lobed (vs. emarginated), the mid-rib band being yellow at apex half, white at the base (vs. yellow throughout); anther crest presented (vs. reduced); oblong (lightly arching) (vs. L-shaped) anther in side view with slender and inward-pointing (vs. stout and outward-facing) spurs.

**Etymology:** The specific epithet *sixensesensis* is derived from Six Senses Ninh Van Bay resort, the name of an ecology resort where the new species occur around and thanks to the resort management board for supporting our floristic investigation as long as conserving the wild environment around.

**Type:** VIETNAM, Khanh Hao Province, Ninh Hao District, Ninh Hoa Commune, 12°21'38.3''N 109°16'42.0''E, 150–200 m a.s.l., 10 September 2021, – Le Tuan Anh, Hoang Quoc Huy, Le Quoc Thuong, Emmy Nguyen № LTA-1220 (holotype VNMN!)

**Description.** Rhizomatous terrestrial herb to 0.3–0.4 m tall. Rhizome ovoid to narrowly ovoid, 2–3 × 0.5–1.5 cm, with short thin branches pointing downwards, outside light brown, cream white to pale yellow inside (on cross-section); rhizome scales triangular, brown, glabrous; root tubers fusiform, 2.0–3.5 × 1.5–3 cm, light brown, white with translucent white center inside, distant to 8 cm from the rhizome. Leafy shoot 1–3-per plant with 2–5 leaves developing at the same time or shortly after flowering; pseudostem 15–25 cm long, pale green composed of leaf sheaths and sheathing bracts; sheathing bracts 3–5, glabrous, pinkish, becoming papery and decaying with age; leaf sheaths green, glabrous; ligule 2–3 mm long, bi-lobed, hyaline, greenish, glabrous, margin ciliate; petiole 5–20 cm, petioles of basal leaves much shorter than apical, canaliculate, green, glabrous; lamina 20–22 × 5–8 cm, elliptic to lanceolate, obtuse to rounded and slightly oblique at base, attenuate to acuminate apex, lightly plicate, puberulent, adaxially bright green, glabrous, abaxially light green, glabrous; median vein green, glabrous on both sides, axially slightly canaliculate. Inflorescence lateral, with peduncle hidden underground; peduncle 10–20 cm, white; spike 4–5 cm long, 4–5 cm in diameter at the middle, with no obvious coma, composed of 7–12 bracts; bracts 3.0–5.5 × 1.5–4.0 cm, broadly ovate to rhombic (broadest at the base, narrowed to the apex), pure white to greenish-white, margin and apex tinged pink or not, glabrous on both sides, connate in lower 1/4–1/3 portion, cut, reflexed; bracteoles subulate, 2–5 × 0.5–1.0 mm, narrowly triangular, translucent, glabrous, often completely reduced. Flowers 4.5–5.5 cm long, exerted from bracts; calyx 20–23 mm long, 3-toothed, with unilateral incision ca. 5–7 mm long, semi-translucent, white, glabrous; floral tube ca. 2.7–3.0 cm long, narrowly cylindrical at the base above the ovary, funnel-shaped at apex, externally white, puberulent at funnel-shaped part, internally white, glabrous at the base, hairy towards the throat; dorsal corolla lobes 20–23 × 5–7 mm, narrowly triangular ovate, concave, with sides slightly incurved, apex mucronate, micro ca. 1–2 mm, externally white with pink ting at apex, internally white; lateral corolla lobes 18–20 × 5–6 mm, narrowly triangular, apex acute, semi-translucent; labellum 21–23 × 14–16 mm, tri-lobed, narrowly obovate to rhomboid, the apex of mid lobe emarginated to bi-teethed with an incision 5–12 mm long, pure white, mid-rib band yellow at apex half, white at base; lateral staminodes ca. 21–23 × 15–18 mm, rhomboid, pure
white, glabrous both two sides, apex acute. Stamen 15–16
mm long; filament flat, 6–7 mm long, 3–4 mm in diameter at
the base, 1.5–2 mm in diameter at the apex (the point of
attachment to the connective), pure white, puberulent with
glandular hairs; anther 11 mm long (including anther crest
and spurs), oblong (lighting arch) in side view with
prominent round bulge fixed below the thecae and inward-
pointing, ca. 1.5 mm longspurs; connective pure white
throughout, densely puberulent with glandular hairs; anther
crest 1–1.2 mm long, stout, apex rounded; thecae 7–8 ×
0.5–1.3 mm, narrowly obovate, dehiscing along their entire
length; pollen white. Epigynous glands two, 5–6 mm long,
0.6 mm in diameter, white, with blunt apices. Style white,
shiny, hairy, basally placed in a dorsal groove of the floral
tube; stigma capitinate, ca. 1.1 cm in diameter, pale yellow,
with ostiole ciliate, facing forward; ovary ca. 3–5 × 2–4
mm, 3-locular, white, glabrous. Fruits globular to broadly
ellipsoid, 11–12×9–11 mm, cream white, nearly glabrous.
Seeds obovate, 4–5 mm, light brown, shiny, with white
laciniate aril.

**Habitat, ecology and phenology.** Under the canopy of
coastal semi-deciduous forests at elevations 150–200 m.
The flowering period coincides with the beginning of the
rainy season in [Coastal Central Vietnam](#) from August to
October.

**Distribution and IUCN preliminary assessment.** [Curcuma
sexsensesensis](#) is found only in the type locality in the
peninsula of Khanh Hoa Province, Vietnam. Recently,
through flora investigation in Coastal Central, botanists
discovered many [Curcuma](#) subgen. Ecomata distributing
limited. The distance from the type location of the new one
to the nearest type location of [C. pambrosina](#) (from the
north) or [C. carida](#) (from the south) is only about 100 km.
The EOO of type location is currently slightly less than 100
km². In addition, the reproductive parts of [Curcuma
sexsensesensis](#) are sold as vegetables in local markets. It is su-
posed to be locally common but limited in the non-
protected forest being under pressure of deforestation for extension of
urban areas as long as resorts, hence we highly suggest to
protected forest

**Etymology:** The specific epithet *vinhlinhensis* is derived from Vinh Linh District, the hometown of the third
author, where this species was first collected.

**Type:** VIETNAM, Quang Tri Province, Vinh Linh District, Vinh Hien Commune, 17°02’20.6”N 107°04’04.0”E, 150–200 m a.s.l., 10 September 2016, – Le
Tuan Anh № NTA-1221 (holotype VNMN!).

**Description.** [Rhizomatous terrestrial herb](#) to 0.5–0.7 m
tall. Rhizome ovoid to narrowly ovoid, 2.5–5.3 × 0.7–1.1 cm,
with short thin branches pointing downwards, outside light brown, white to pale yellow inside (on cross-
section); rhizome scales triangular, brown, glabrous; root
tubers elliptic, 2.6–3.8 × 1.7–2.2 cm, light brown outside,
white with translucent white center inside, distant to 8 cm
from the rhizome. Leafy shoot 3–7 per plant with 2–5
leaves developing at the same time or shortly after
flowering; pseudostem ca. 15 cm long, pale green
composed of leaf sheaths and sheathing bracts; sheathing
bracts 2–4, glabrous, becoming papery and decaying with
age, pale green, tinged pink at apex; leaf sheaths green,
glabrous; ligule ca. 1 mm long, bi-lobed, hyaline, greenish,
glabrous, with sparsely hairy margin; petiole 5–13 cm,
petioles of basal leaves much shorter than apical,
canaliculate, green, glabrous; leaf lamina 25–40 × 6–8 cm,
lanceolate to elliptic, obtuse and slightly unequal at the
base, attenuate at apex, plicate, adaxially mid-green and
glabrous, abaxially light green, puberulent in median vein,
glabrous on both sides. Inflorescence lateral, with peduncle
hidden underground; peduncle 5–10 cm, white; spike 10–
20 cm long, 5–7 cm in diameter at the middle, with no
obvious comia, composed of 15–25 bracts; bracts 3.5–3.7 ×
1.5–3.0 cm, broadly ovate to rhombic (broader at the base,
narrowed to the apex), pure white to greenish-white,
margin and apex tinged pinkish red, glabrous on both sides,
conнате in lower 1/4–1/3 portion, cute, reflexed; bracteoles
subulate, 2–5 × 0.5–1.0 mm, narrowly triangular, translucent, glabrous, often completely reduced. Flowers
ca. 4.7 cm long, exerted from bracts; calyx ca. 15 mm long,
3-toothed, with unilateral incision ca. 3–5 mm long, semi-
translucent, white tinged pink, glabrous; floral tube 2.1–2.3 cm long, narrowly cylindrical at base for 1.5–1.8 mm in diameter above the ovary, funnel-shaped at apex for 5–6 mm, externally white, puberulent at funnel-shaped part, internally white tinged densely red at middle, lightly at apex, glabrous at base, hairy towards the throat; dorsal corolla lobe 16–17 × 5–6 mm, triangular, concave, with sides slightly incurved, apex mucronate, mucro ca. 1 mm, externally white with pink tinge at apex, internally white; lateral corolla lobes 15–17 × 5–6 mm, triangular, apex broadly acute to obtuse, semi-translucent; labellum 18–19 × 14–15 mm, bi-lobed, obovate, apex emarginated with an incision ca. 3 mm long, yellow at apex-half turning white at base, mid-rib band warm yellow with two lateral thin red lines running throughout half base; lateral staminodes ca. 18–21 × 11–13 mm, elliptic, pure yellow, glabrous both two sides, apex round. Stamen 11–12 mm long; filament 3–4 mm long, 4–4.5 mm in diameter at the base, 2 mm in diameter at the apex (the point of attachment to the connective), white tinged yellow, puberulent with glandular hairs; anther 8–9 mm long, with two blunt yellow knobs fixed below the thecae, weakly L-shaped with spurs elongate into the acute apex, yellow, stout and outward-facing, ca 2 mm long; connective pure white turning yellow at apex and base near spurs, densely puberulent with glandular hairs; anther crest ca. 0.5 mm long, yellow, stout, apex rounded or bi-lobed; thecae 6–8 × 0.5–1 mm, narrowly obovate, dehiscing along their entire length; pollen white. Epigynous glands two, 4–5 mm long, 0.6 mm in diameter, white, with blunt apices. Style white, glabrous, basally placed in a dorsal groove of the floral tube; stigma ca. 1.5 mm in diameter, pale yellow, with ostiole ciliolate, facing forward; ovary ca. 2–3 × 2.5–3 cm, 3-locular, white, puberulent with glandular hairs. Fruits not seen.

Habitat, ecology and phenology. Cultivated on Bazan soil by local people as a source of starch for traditional food in the elevation of about 0-100 m. The flowering period coincides with the beginning of the rainy season in Coastal Central Vietnam from August to October.

Distribution and IUCN preliminary assessment. C. vinhlinhensis is found only from the type locality in cultivation declining because of low yield. We need to conduct more field trips to find out the wild population. Hence we highly suggest assessed as Data Deficient (DD)

Table 1. Comparison of the morphologically vegetative and reproductive characteristics of C. sinesis with four allies. Details showing the difference between each species with the host plant are given in bold

<table>
<thead>
<tr>
<th>Character</th>
<th>C. sinesis</th>
<th>C. singularis</th>
<th>C. newmanii</th>
<th>C. tongii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ligule</td>
<td>2–3 mm, bi-lobed</td>
<td>1–1.5 mm long, bi-lobed</td>
<td>Up to 3 mm long, bi-lobed</td>
<td>4–5 mm long, bi-lobed</td>
</tr>
<tr>
<td>Lamina size (cm)</td>
<td>20–22 × 5–8</td>
<td>10–17 × 2.5–4</td>
<td>Up to 32 × 8 cm</td>
<td>20–26 × 8.5–10 cm</td>
</tr>
<tr>
<td>Lamina shape</td>
<td>Narrowly lanceolate to elliptic, slightly plicate</td>
<td>Narrowly ovate, prominent plicate</td>
<td>Narrowly lanceolate, slightly plicate</td>
<td>Elliptic</td>
</tr>
<tr>
<td>Inflorescent shape</td>
<td>7–12 bracts</td>
<td>7–9 bracts</td>
<td>7–9 bracts</td>
<td>Lateral, composing from 7–9 bracts</td>
</tr>
<tr>
<td>Calyx</td>
<td>Tubular, 20–23 mm long</td>
<td>Tubular, 10–17 mm</td>
<td>Tubular, up to 23 mm long</td>
<td>Lateral, composing from 7–12 (1.5) bracts</td>
</tr>
<tr>
<td>Lateral staminodes</td>
<td>21–23 × 15–16 mm, Rhomboid, apex acute</td>
<td>25–28 × 12–15 mm, Irregularly narrow obovate, apex rounded</td>
<td>26–30 × 16–18 mm, Irregularly obovate, apex rounded</td>
<td>22–23 × 12–13 mm, Irregularly obovate, apex rounded</td>
</tr>
<tr>
<td>Labellum shape and color</td>
<td>Rhomboid, apex tri-lobed of middle lobe emarginated, deeply split to 1/2-the-length</td>
<td>Obovate, apex emarginate, incised 1-1.5 mm long</td>
<td>Obovate, apex emarginate, split up to 5 mm</td>
<td>Obovate, apex bi-lobed with incision 8–9 mm long</td>
</tr>
<tr>
<td>Labellum color</td>
<td>White, median band yellow at apex half, white at base</td>
<td>White, median band yellow, more or less white at apex</td>
<td>White with a bright yellow midrib band running through the centre</td>
<td>White with a bright yellow median band running through the centre</td>
</tr>
<tr>
<td>Labellum size (mm)</td>
<td>21–23 × 14–16</td>
<td>22–25 ×18–21</td>
<td>26 × 20</td>
<td>20–22 ×12–13</td>
</tr>
<tr>
<td>Filament</td>
<td>6–7 mm long</td>
<td>4–5 mm long, 3–4 mm wide at base, 1.5–2 mm wide toward upper 9 mm, L-shaped</td>
<td>2–3 mm long, c. 4 mm wide at base, 2–2.5 mm wide at apex</td>
<td>6–6.5 mm long, L-shaped</td>
</tr>
<tr>
<td>Anther</td>
<td>10–11 mm long, narrowly oblong</td>
<td>3–4 mm long, stout, apex outward-facing</td>
<td>1 mm long, stout, apex facing pointing with two blunt knobs at apex</td>
<td>4–5 mm long, stout, apex outward-facing</td>
</tr>
<tr>
<td>Anther spurs</td>
<td>1–1.5 mm, cylindrical, apex downward-pointing with two blunt knobs below thecae</td>
<td>1.5 mm long, thick, rounded</td>
<td>Absent</td>
<td>1.2–1.5 mm long, thick, bi-lobed</td>
</tr>
<tr>
<td>Anther crest</td>
<td>Absent</td>
<td></td>
<td>Absent</td>
<td></td>
</tr>
</tbody>
</table>
Taxonomic notes

Curcuma vinhlinhensis is similar to C. pambrosima Škorničk. & N.S.Lý, C. cotuana Liu, Škorničk. & H.D.Trân, C. sahuynhensis Škorničk. & N.S.Lý in a general view of habit, the shape of inflorescence, warm yellow to orange flowers and L-shaped anther. The comparison of the new taxa with these three allies is given in Table 2. Details showing the difference between each species with the host plant are given in bold.

Table 2. Comparison of the morphologically vegetative and reproductive characteristics of C. vinhlinhensis with four allies. Details showing the difference between each species with the host plant are given in bold.

<table>
<thead>
<tr>
<th>Character</th>
<th>C. vinhlinhensis</th>
<th>C. pambrosima</th>
<th>C. cotuana</th>
<th>C. sahuynhensis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflorescent Position</td>
<td>Lateral</td>
<td>Lateral</td>
<td>Terminal</td>
<td>Lateral, sometime terminal</td>
</tr>
<tr>
<td>spike</td>
<td>10–20 cm long</td>
<td>10–25 cm long</td>
<td>5–9 cm long</td>
<td>6–15 cm</td>
</tr>
<tr>
<td>Calyx</td>
<td>10–15 mm</td>
<td>Up to 15 mm</td>
<td>20–22 mm</td>
<td>14–19 mm</td>
</tr>
<tr>
<td>Floral tube</td>
<td>2.1–2.3 cm,</td>
<td>2.0–2.2 cm,</td>
<td>Ca. 3.5 mm</td>
<td>1.8–2.8 cm,</td>
</tr>
<tr>
<td></td>
<td>deep purple in</td>
<td>internally white in</td>
<td>internally white</td>
<td>internally white, internally white,</td>
</tr>
<tr>
<td></td>
<td>apical half</td>
<td>basal half turning</td>
<td>basal half</td>
<td>turning pale yellow</td>
</tr>
<tr>
<td></td>
<td>17–18 × 11–13 mm,</td>
<td>12–15 × 8–10 mm,</td>
<td>6–15 cm</td>
<td>15–22 × 10–14 mm,</td>
</tr>
<tr>
<td></td>
<td>- Elliptic, apex</td>
<td>- Unequally ovate-</td>
<td>12.5 mm long</td>
<td>- Unequally ovate</td>
</tr>
<tr>
<td></td>
<td>round</td>
<td>rhomboid with</td>
<td></td>
<td>to rhomboid</td>
</tr>
<tr>
<td></td>
<td>- Warm yellow to</td>
<td>acute apex</td>
<td></td>
<td>- Warm yellow to</td>
</tr>
<tr>
<td></td>
<td>Orange throughout</td>
<td>- Yellow at apex</td>
<td></td>
<td>Orange throughout</td>
</tr>
<tr>
<td></td>
<td>with red spot at</td>
<td>half at base</td>
<td></td>
<td>yellow to Orange</td>
</tr>
<tr>
<td></td>
<td>base</td>
<td>with red spot</td>
<td></td>
<td>throughout</td>
</tr>
<tr>
<td>Labellum shape</td>
<td>Obovate, apex</td>
<td>Orbicular-rhombic,</td>
<td>Rhomboid, apex</td>
<td>Obovate, apex</td>
</tr>
<tr>
<td></td>
<td>emarginated with</td>
<td>apex split 3–8 mm</td>
<td>emarginate,</td>
<td>emarginated,</td>
</tr>
<tr>
<td></td>
<td>incision up to 3 mm long</td>
<td></td>
<td>incision up to 6 mm</td>
<td>incision up to 7 mm long</td>
</tr>
<tr>
<td></td>
<td>Dark yellow to orange,</td>
<td>Yellow at apex turning white at base</td>
<td>Dark yellow to orange midrid band without any dark red lines at the base</td>
<td>Dark yellow to orange with a bright</td>
</tr>
<tr>
<td></td>
<td>midrid band yellow</td>
<td>with two lateral dark red lines at the base</td>
<td></td>
<td>median band</td>
</tr>
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<td></td>
<td>with two lateral</td>
<td></td>
<td></td>
<td>without any dark</td>
</tr>
<tr>
<td></td>
<td>dark red lines at the base</td>
<td></td>
<td></td>
<td>red lines at the base</td>
</tr>
<tr>
<td>Filament size (mm)</td>
<td>18–19 × 14–15</td>
<td>13–16 × 12–14</td>
<td>21–23 × 15–16</td>
<td>15–23 × 12–18</td>
</tr>
<tr>
<td></td>
<td>4–5 mm long</td>
<td>7 mm long</td>
<td>6–7 mm long</td>
<td></td>
</tr>
<tr>
<td>Anther</td>
<td>8–9 mm long</td>
<td>12.5 mm long</td>
<td>8–9 mm long</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with two small blunt knobs below the thecae</td>
<td>with two blunt knobs below the thecae</td>
<td>without knobs below the thecae</td>
<td></td>
</tr>
<tr>
<td>Anther spurs</td>
<td>Ca. 1 mm,</td>
<td>3.5–4 mm long,</td>
<td>3.5–5 mm long,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cylindrical, inward-curving</td>
<td>outward-facing</td>
<td>outward-facing</td>
<td></td>
</tr>
<tr>
<td>Anther crest</td>
<td>Reduced, up to 0.5 mm long, apex emarginate</td>
<td>1.0–1.2 mm, bilobed</td>
<td>Less than 1mm long, apex emarginate</td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. *Curcuma sixsensesensis*: A. habitat; B. and C. inflorescences with opening flowers; D. habit with rhizome and young inflorescence; E. habit with a leafy shoot at late anthesis; F. ligule; G. flower dissection from fresh material; G’: flower dissection from alcohol-treated material; H-H”: detail of anther; I: ovary with epigynous glands; J: detail of calyx apex. Photographed by Six Senses Ninh Van Bay team (A—E, H, G from type specimen LTA-1220); T.A.Le (G’, H’, H”, I, J, F from specimen LTA-1220 treated alcohol)
Figure 2. Curcuma vinhlinhensis: A. habit; B. flower in front view; C. single flower with calyx tube D. Rhizome; E. inflorescence; F. lamia with petiole; G. ligule; H. bracts (from left: bracts at the base to the top of inflorescence); I. flower dissection (from left: calyx, dorsal and lateral corolla lobes, lateral staminode, labellum, a floral tube attached stamen, ovary and epigynous glands). Photographed by T.A. Le
Key to the species of Curcuma subgen. Ecomata in Vietnam

1a. Anther spurs filamentous, hook-shaped ............................... 2
1b. Short inflorescent, rhizome well-elongated ............................ 3
2a. White staminodes with dark purple tips .............................. C. pierreana
2b. White staminodes without dark purple tips .......................... C. cochichinensis
3a. Long inflorescent, rhizome compacted .............................. 4
3b. Cream white bracts, lateral staminodes and labelleum being pure warm yellow .............. C. vitelina
4a. Anther spurs conical or cylindrical ................................. 5
4b. Anther spurs longer than 3 cm, L shaped ............................ 6
5a. White lateral staminodes .............................................. C. singularis
5b. Yellow lateral staminodes ............................................... C. sahyenhensis
6a. Long inflorescent, epignous glands 4–5 mm long .......... C. sabuyenhensis
6b. Short inflorescent, epignous glands 11 mm long .............. C. xanthella
7a. Anther spurs 1–2 mm .................................................. 8
7b. Terminal inflorescent ................................................... 9
8a. Anther spurs outward-facing (weak L-shaped), anther crest bi-lobed .................. C. cotona
8b. Anther spurs inward-pointing, anther crest rounded C. rhomboidea
9a. Anther spurs outward-facing (weak L-shaped), anther crest reduced, short filament 2–3 mm long ......................... C. newmania
9b. Anther spurs outward-facing, anther crest up to 1.5 nm, longer filament 6–7 mm long .... C. sixensesensis

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