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Recent Studies on the Genus *Elettariopsis* Baker (*Zingiberaceae*) in Thailand – Descriptions of Three New Species

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Ten taxa of the genus *Elettariopsis* Baker (*Zingiberaceae*) are currently accounted for Thailand, including three new species; *Elettariopsis limiana* Picheans. & Yupparach, *E. poonsakiana* Picheans. & Yupparach and *E. ranongensis* Picheans. & Yupparach. These new species are described here with full illustrations. Relationships with other closely related taxa are also discussed. Key to the species accounted for Thailand is also provided.

Key words: *Elettariopsis limiana*, *Elettariopsis poonsakiana*, *Elettariopsis ranongensis,* new species, Thailand, *Zingiberaceae*.

The main objective of our taxonomic studies on the medicinal plant family *Zingiberaceae* is to set up the baseline information for other related research, especially drug development. These efforts have led to the clarification of some previously taxonomically-unknown medicinal plants of the family. Resulting from our work on the genus *Elettariopsis* Baker, four ethnobotanically important taxa in Thailand: Wan Kambang (ว่านกำบัง), Krachai Langkong (กระชายหลังโกง), Pud Sing (ปุดสิงห์) and Wan Dokthong (ว่านดอกทอง) were recently elucidated as *E. chayaniana* Yupparach, *E. smithiae* Y. K. Kam, *E. slahmong* C. K. Lim and *E. wandokthong* Picheans. & Yupparach, respectively (Picheansoonthon and Yupparach 2007, 2010, Yupparach 2008).

The genus *Elettariopsis* Baker is one of the least known plant groups in the family *Zingiberaceae*, not only for Thailand, but also for the rest of its distribution range. From our intensive field and herbarium work throughout Thailand, Laos, Penninsular Malaysia and Singapore, eight species were enumerated for Thailand: *E. chayaniana* Yupparach, *E. elan* C. K. Lim, *E. exerta* (Scort.) Bak., *E. monophylla* (Gagnep.) Loes., *E. slahmong* C. K. Lim, *E. smithiae* Y. K. Kam, *E. triloba* (Gagnep.) Loes. and *E. wandokthong* Picheans. & Yupparach. (Picheansoonthon & Yupparach 2010). Taxonomic history, including information on ethnobotany, chemical constituents, and biological activities of some members the genus was recently discussed (Picheansoonthon and Yupparach 2007).

In this paper, the following three new species are described with full illustrations. Key to all species (10 taxa) currently known for Thailand is provided.

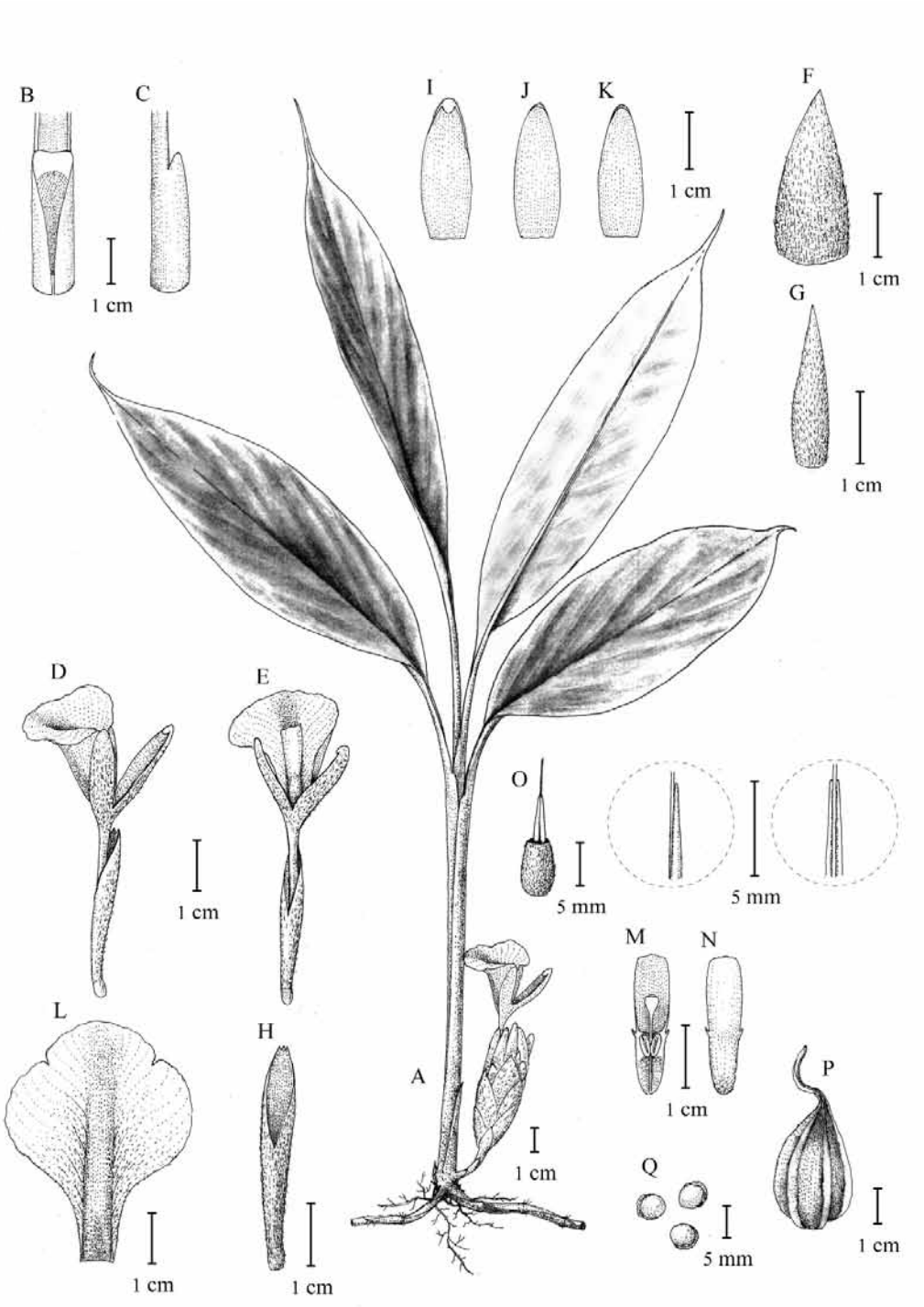

Fig 1. *Elettariopsis limiana* Picheans. & Yupparach. A. Plant with inflorescence. B, C. Lower part of leaf showing a ligule (B, front view and C, side view). D, E. Flower (D, side view and E, front view). F. Bract. G. Bracteole. H. Calyx tube. I. Dorsal corolla lobe. J, K. Lateral corolla lobes. L. Labellum. M. Upper part of a stamen showing anther, anther crest, style and stigma. N. Upper part of stamen (rear view). O. Ovary with stylodial glands and lower part of the style. P. Fruit. Q. Seeds. Drawn by Chalermchoke Boonchit.

Taxonomic treatment

1. ***Elettariopsis limiana*** Picheans. & Yupparach, sp. nov. [Figs. 1–2]

Elettariopsidi trilobae similis, ligula pubescenti apice bilobato, bracteis bracetolisque pubescentibus, labello ovato vitta magna mediana aureolutea, calycis tubo ovarioque villoso differt.

Type: THAILAND. Changwat Sakhon Nakhon, Phu Phan National Park, 16°49.629′N 103°53.986′E, alt. 364–473 m, 18 April 2008, C. Picheansoonthon & P. Yupparach 007 (BKF–holotype).

Perennial slender herbs. Rhizome creeping, slender, bearing, pseudostem at intervals. Pseudostem 22.1–44.4 cm long, leaf sheath hairy, bladeless leaf/leaves 1–2. Leaves 3–6; ligule 2–5 mm long, hairy, apex 2-lobed; petiole 3.2–9.5 cm long, glabrous, channeled; blades lanceolate or elliptic, 15.2–21.5 × 2.9–5.1 cm, base attenuate, apex acuminate to caudate, margin entire to slightly undulate, both sides glabrous, lower surface glaucous. Inflorescence arising from base of pseudostem, with flowers in a compact head, peduncle 0.6–3.3 cm long; bracts ovate, hairy, apex acute, 1.9–3.5 cm × 1.1–1.9 cm; bracteole lanceolate, 1.3–1.9 cm × 4–8 mm, white, apex acute. Flower white with large yellowish to orange median band; calyx tubular, 3–3.8 cm, villose; corolla tube slender, 3.1–3.4 cm long, villose, lobes 3; dorsal lobe oblong, 2.1–2.4 cm × 6–8 mm, villose, apex hooded; lateral lobes oblong, 2.3–2.4 cm × 6–7 mm, villose, apex slightly hooded; labellum obovate, 2.2–3 × 2.7–2.9 cm, white with large golden-yellow median band, base clawed, distal part 3-lobed, median lobe crenate or slightly emarginated; filament 2–4 × 2–3 mm, upper half white, lower half pinkish; anther 4–5 × 2–3 mm, connective appendages, 9–12 × 6–8 mm, apex obtuse to truncate, some with a small (ca. 1 mm long) tooth-like lobe at the base on each side; ovary ovate, 3–4 × 2 mm, villose; stylodes 2, slender, ca. 4 × ca. 2 mm, not surrounding the style. Fruit capsule, ovate, with 6–8 longitudinal ridges, green (when young) or reddish (when ripe). Flowering March–April, fruiting April–June.

Other specimens studied: Thailand. Type location, 18 April 2008, C. Picheansoonthon & P. Yupparach 010 (BKF).

Distribution: Thailand, so far known only from the type location.

Ecology: The new species grows under the shade of dry dipterocarp forest, at an altitude of 364–473 m.

Vernacular names: Wan Dokthong Phupan (ว่านดอกทองภูพาน)

Etymology: This new taxon is named to honor Datuk Seri Lim Chong Keat, a distinguished Malaysian architect and botanist, in recognition of his contribution on palm and ginger research. He encouraged us to study in the genus *Elettariopsis*. He has also shown us the type location of several Malaysian taxa and donated us several specimens for DNA analysis. His initiation on the use of olfactory sense to differentiate several species of *Elettariopsis* is very useful, particularly for preliminary identification.

Note: Members of the genus *Elettariopsis* Baker in Thailand can, so far, be divided into two groups, i.e., the group with a clustered-head inflorescence, and the group with an elongated scape. This new species, together with *E. chayaniana* Yupparach, *E. wandokthong* Picheans. & Yupparach, *E. slahmong* C. K. Lim and *E. triloba* (Gagnep.) Loes., belongs to the prior group. Among the latter four taxa, *E. limiana* is morphologically closest to *E. chayaniana*. However, this new taxon can be differentiated from *E. chayaniana* by its hairy ligules with bilobed apex; hairy bracts and bracteoles, and yellowish labella.

2. ***Elettariopsis poonsakiana*** Picheans. & Yupparach, sp. nov. [Figs. 3–4]

Elettariopsidi exerta similis, ligula pubescenti, laminis oblanceolatis ad elliptico-ovatis infra pubescentibus, ovario pubescenti

Table 1. Morphological comparison of four species in the *Elettariopsis triloba* group

Character	*E. triloba*	*E. chayaniana*	*E. wandokthong*	*E. limiana*
Plant height (cm)	35–80	26.2–52.3	28.6–33.8	22.1–44.4
Number of leaves	1–5	2–4	2–4	3–6
Ligule	ca. 2 mm long, glabrous	ca. 4 mm long, glabrous	1–2 mm long, pubescent	2–5 mm long, hairy
Petiole (cm)	1–10	2.6–11.8	9.1–18.3	3.2–9.5
Leaf shape	lanceolate	lanceolate-oblong to elliptic	lanceolate-oblong to elliptic	lanceolate-elliptic
Leaf apex	caudate	acuminate to shortly caudate	acuminate to caudate	acuminate to shortly caudate
Leaf base	acute to attenuate	obliquely acute	attenuate	attenuate
Bract	triangular, greenish, glabrous, apex acute	ovate, light brownish, glabrous, apex acuminate	ovate to lanceolate, pinkish, glabrous, apex acuminate	ovate, greenish, hairy, apex acute
Bracteole	lanceolate, glabrous	lanceolate, glabrous	lanceolate, glabrous	lanceolate, hairy
Calyx tube	shorter than corolla tube, or as long as corolla tube, glabrous	longer than corolla tube, glabrous	longer than corolla tube, glabrous	as long as corolla tube, or longer than corolla tube, villous
Inflorescence	compact	erect, dense	compact	compact
Stylodes	3 mm, not surrounding	3–4 mm, surrounding	5–6 mm, not surrounding	4 mm, not surrounding
Ovary	glabrous	glabrous	pubescent	villous
Fruit	–	ovoid, pinkish brown, 7-ridged	–	ovoid, green or reddish, 6–8-ridged

glandibus duabus stylidialibus stylum non cingentibus, fructu ovato cristis longitudinalibus 6 vel 7 differt.

Type: THAILAND. Changwat-Kanchanaburi, Thong Pha Pum National Park, 14°56.624′N 093°40.362′E, alt. 293–303 m, 29 April 2007, C. Picheansoonthon & P. Yupparach 015 (BKF– holotype).

Perennial slender herbs. Rhizome creeping, slender, bearing, pseudostem at intervals. Pseudostem 17.8–58.7 cm; bladeless leaves 1–2. Leaves 1–5; ligule 2–4 mm long, hairy, apex 2-lobed; petiole 4.3–18.4 cm, glabrous, channeled; blades oblanceolate or elliptic-oblong, 17.9–77.8 × 4.6–9.9 cm, base attenuate, apex acute, margin entire to slightly undulate, lower surface pubescent. Inflorescence arising from base of pseudostem, with flowers in an elongate prostate scape, peduncle 1.5–5.2 cm long; bract ovate, 1.4–1.6 × 0.5–1 cm, brownish, margin hairy; bracteole lanceolate, 1.2–1.8 cm × 5–6 mm, margin hairy. Flower white with median yellow band, calyx tubular, 4.2–5.1 cm, glabrous, apex 2-toothed; corolla tube slender, 6.2–12.2 cm long, white; lobes 3; dorsal lobe oblong, 1.6–2 cm × 6–7 mm, apex hooded; lateral lobes oblong, 1.8–2.2 cm × 4–5 mm; labellum obovate, 2–2.6 × 1.6–2 cm, white with reddish base and yellow median band; base clawed, claw 4–5 mm, distal part 3-lobe,

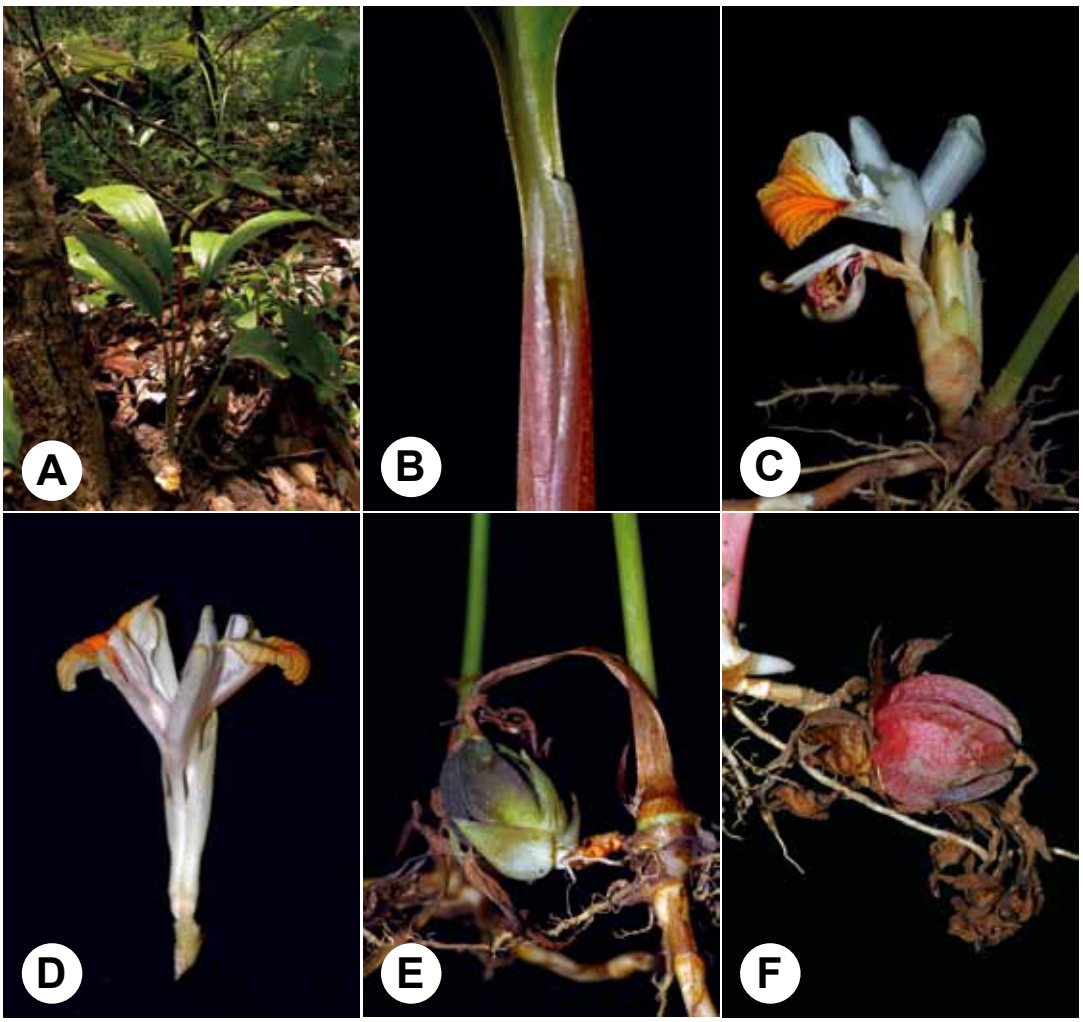

Fig. 2. *Elettariopsis limiana* Picheans. & Yupparach. A. Plant habit (at the type locality). B. Lower part of leaf blade showing a ligule. C. Inflorescence. D. Flowers. E. Young fruit. F. Matured fruit. Photographed by Chayan Picheansoonthon.

median lobe crenate or slightly emarginate; filament 3–5 × 2–3 mm, pink; anther 5–6 × 2–3 mm; connective appendage ovate, 4–7 × 4–5 mm, apex obtuse; ovary ovate, 4–5 × 3–4 mm, pubescent; stylodes 2, slender, 6–10 × 1–2 mm, not surrounding the style. Fruit capsule, ovate, 2.5–4.2 × 1.7–2.2 cm, with 6–7 longitudinal ridges, pinkish (when young), brownish (when ripe). Flowering April–May, fruiting May–late June.

Other specimens studied: THAILAND. Type location, 18 May 2007, C. Picheansoonthon & P. Yupparach 040 (BKF).

Distribution: Thailand. This new species can be found in several locations in Changwat Kanchanaburi (Amphurs Thong Phapum and Sanglkaburi).

Ecology: This new species grows under the shade of dry deciduous forest, at an altitude of 293–303 m.

Etymology: This new species is named after Mr. Poonsak Watcharakorn, a Thai horticulturist and plant collector. He had donated his living specimen collection of this genus for our study

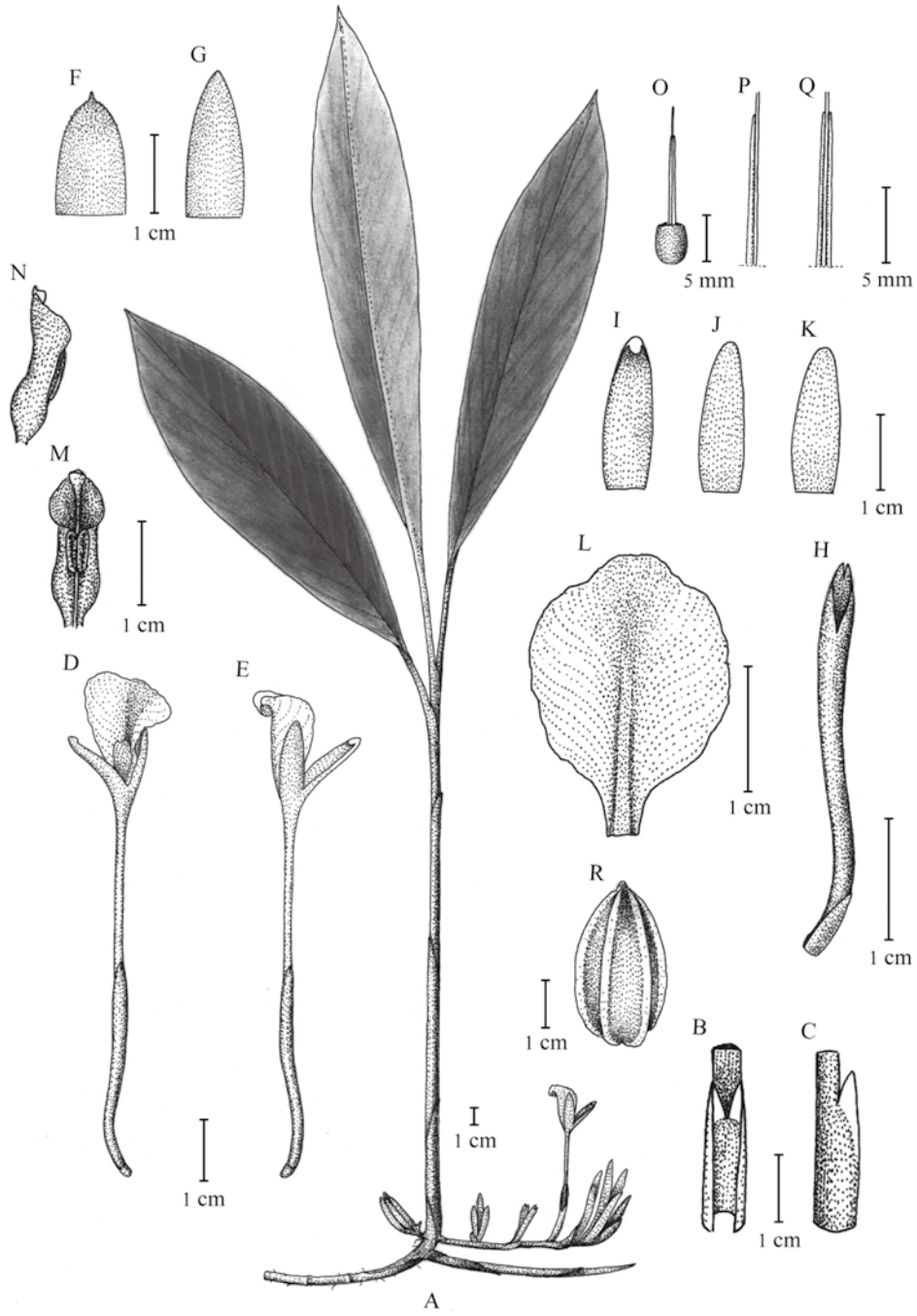

Fig. 3. *Elettariopsis poonsakiana* Picheans. & Yupparach. A. Habit showing rhizomes, leafy stems, and inflorescences. B, C. Ligule (B, front view and C, side view). D, E. Flower (D, oblique view and E, side view). F. Bract. G. Bracteole. H. Calyx tube. I. Dorsal corolla lobe. J, K. Lateral corolla lobes. L. Labellum. M, N. Anthers, anther crest and stigma (M, front view and N, side view). O. Ovary with stylodial glands and lower part of the style. P, Q. Stylodial glands (P, side view and Q, front view). R. Fruit. Drawn by Chalermchoke Boonchit.

Table 2. Morphological comparison between *Elettariopsis exerta* (Scort.) Baker and *E. poonsakiana* Picheans. & Yupparach

Character	*E. exerta*	*E. poonsakiana*
Plnat height (cm)	34.7–60.4	17.8–58.7
Number of leaves	1–3	1–5
Ligule	3–4 mm long, glabrous	2–4 mm long, hairy
Petiole length (cm)	3.3–17.4	4.3–18.4
Leaf shape	elliptic-oblong	oblanceolate to elliptic-oblong
Leaf surface (lower)	glabrous	hairy
Peduncle length (cm)	3.1–6.2	1.5–5.2
Calyx	shortly 3-toothed, apex hairy	2-toothed, apex glabrous
Ovary	glabrous	hairy
Stylodial gland	4–6 mm long, surrounding the style	3–4 mm long, not surrounding the style
Fruit	globose, white, turned to reddish	ovoid, pinkish, turned to brownish

and, for the first time, showed us this new species in its type location.

Note: This new species, together with *E. exerta* (Scort.) Baker belongs to the group of *Elettariopsis*, with an elongated prostate scape. However, it can be easily distinguished from *E. exerta* by its hairy ligule; oblanceolate to elliptic-oblong leaves, pubescent lower leaf surface, hairy ovary with 2 stylodial glands not surrounded the style, and an ovate fruit with 6–7 longitudinal ridges.

3. ***Elettariopsis ranongensis*** Picheans. & Yupparach, sp. nov. [Figs. 5–6]

Elettariopsidi smithiae similis, foliis linearibus, ovario pubescenti, fructibus albis ovoideis cristis longitudinalibus 6–8 differt.

Type: THAILAND. Changwat Ranong, Khao Phoe Ta, Luang Kaew, alt. 931 m, 5 May 2008, C. Picheansoonthon & P. Yupparach 055 (BKF– holotype).

Perennial slender herbs. Rhizome creeping, slender, bearing, pseudostem at intervals. Pseudostem 27.4–56.2 cm; leaf sheath glabrous, bladeless leaves 1–2. Leaves 2–9; ligule , glabrous, 2–3 mm long, apex 2-lobed; petiole 2.9–7.5 cm, glabrous, channeled; leaf blades linear 14.5–25.3 × 2.4–4.3 cm, base attenuate, apex acuminate to caudate, margin entire to slightly undulate and serrate at the apex, both sides glabrous. Inflorescence arising from base of pseudostems, with flowers in an elongate prostate scape; peduncle 3.2–7.3 cm long, glabrous; bracts ovate, brownish, glabrous, apex acute, 1.1–2.1 cm × 3–4 mm; bracteole lanceolate, white, glabrous, apex acute, 5–6 × 2–3 mm. Flowers white with yellow median band; calyx tubular, white but turns greenish toward the top, 1.4–3.5 cm, apex acute, glabrous; corolla tube slender, 2.9–4.7 cm long; white, glabrous, lobes 3; dorsal lobe oblong, 1.5–2.1 cm × 4–5 mm, yellow, glabrous, apex hooded; lateral lobes oblong, 1.4–2 cm × 4–5 mm, yellow, glabrous; labellum obovate, 2.1–2.6 × 1.7–2 cm, white with reddish base and yellow median band, base clawed, distal part 3-lobe, median lobe slightly emarginated; filament 4–6 × 2–3 mm; anther 3–4 × 2–3 mm; connective appendage 5–6 × 2–4 mm, apex obtuse to truncate; ovary 3–4 × ca. 2 mm, hairy; stylodes 2, slender, 5–6 × ca. 2 mm, not surrounding the style. Fruit capsule, ovoid, white, 1.6–1.9 × 1.4–

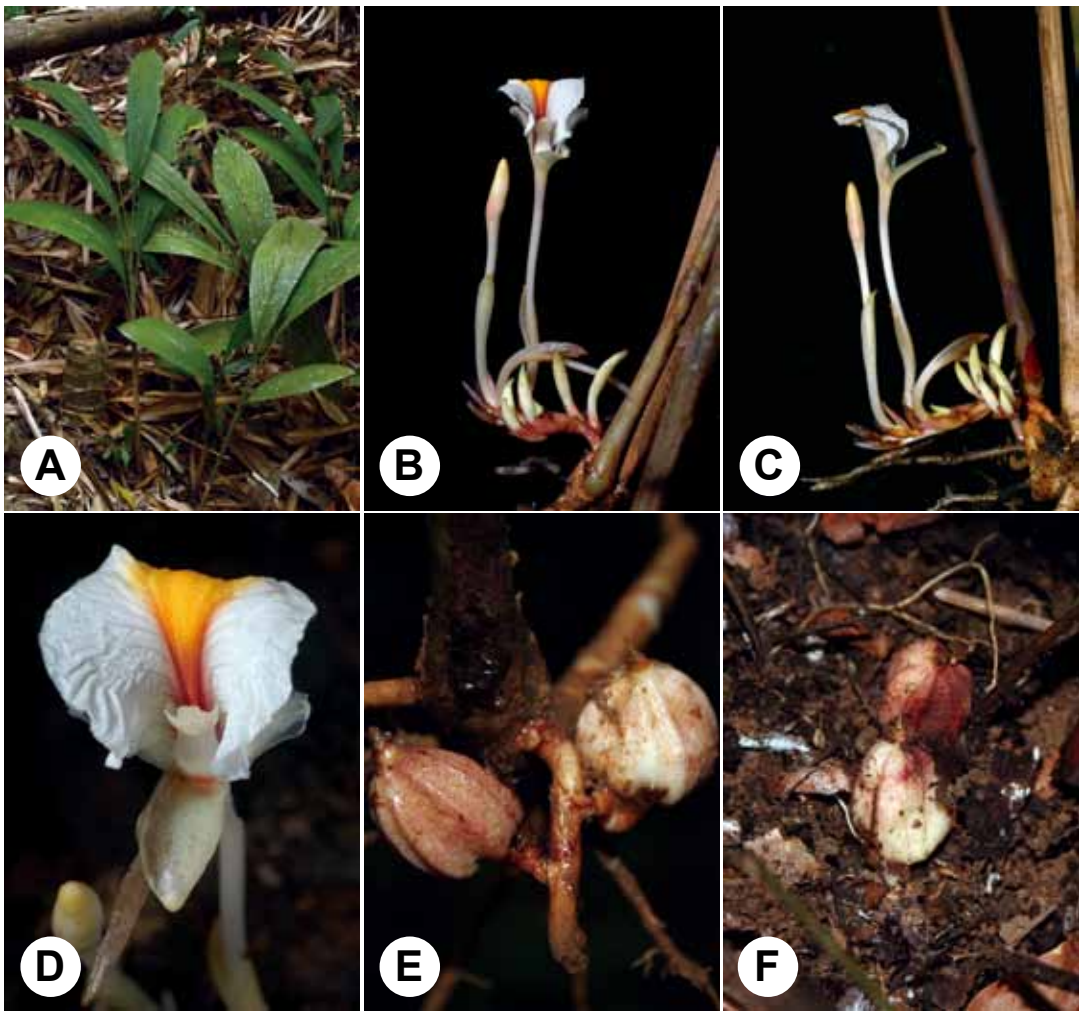

Fig. 4. *Elettariopsis poonsakiana* Picheans. & Yupparach. A. Habit (at the type locality). B, C. Inflorescence showing different view of the full-bloomed flower. D. Flower showing dorsal corolla lobe, labellum, anther crest and stigma. E, F. Infructescence with two fruits. Photographed by Chayan Picheansoonthon.

1.8 cm, with 6–8 longitudinal ridges. Flowering March–April, fruiting April–May.

Other specimen studied: THAILAND. Type location, 5 May 2008, C. Picheansoonthon & P. Yupparach 056 (BKF).

Distribution: Thailand. This new species can be found in several locations in Changwat Ranong (Amphurs Muaeng Ranong and Kapur).

Ecology: The new species grows under the shade of evergreen forest, at an altitude of 931 m.

Etymology: This new species is named after Changwat Ranong, the type location of this new taxa.

Note: This new species, together with *E. smithiae* Y. K. Kam, belongs to the group of *Elettariopsis*, with an elongated prostate scape. However, it can be easily distinguished from *E. smithiae* by its linear leaves and white ovoid fruits with 6–8 longitudinal ridges.

Discussion

Members of the genus *Elettariopsis* Baker

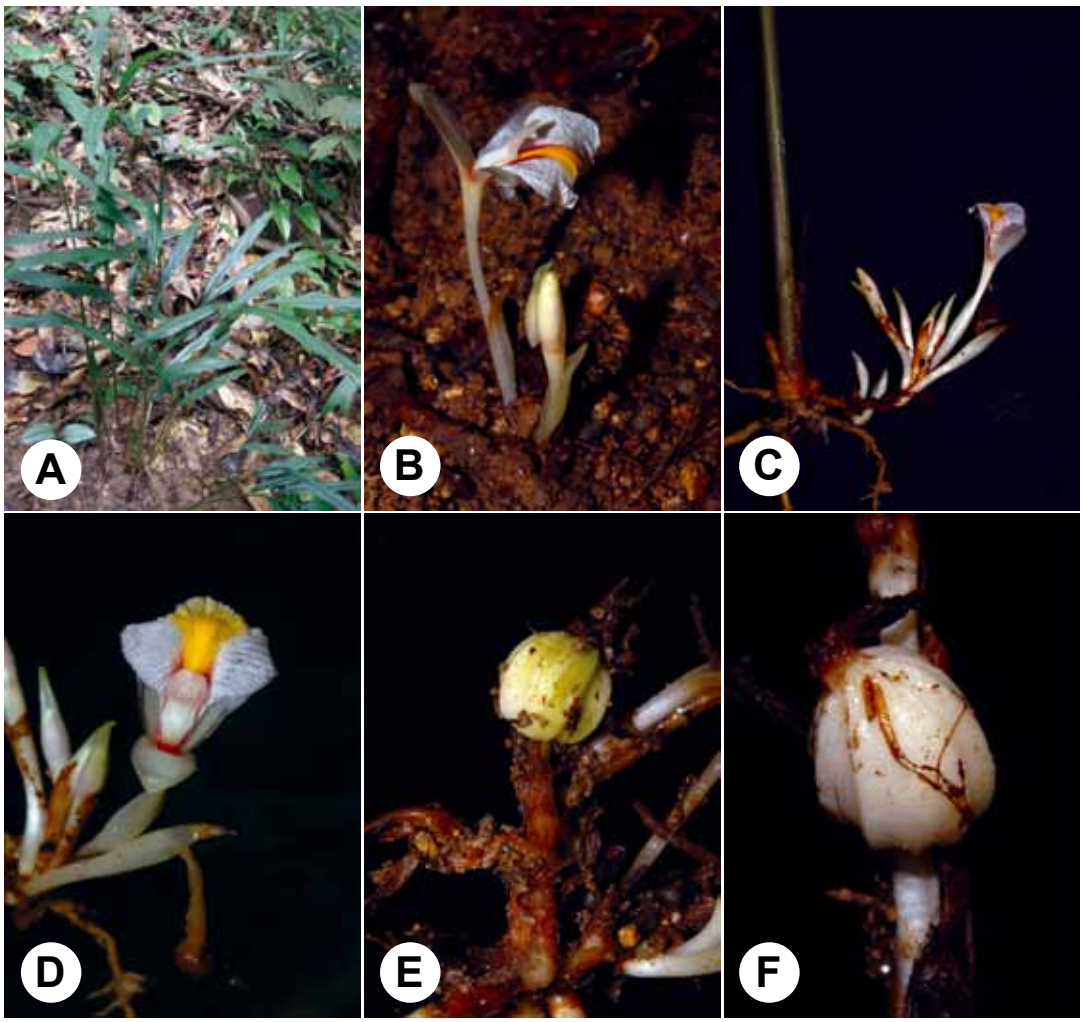

Fig. 5. *Elettariopsis ranongensis* Picheans. & Yupparach. A. Habit (at the type locality). B, C. Inflorescence, showing different view of the full-bloomed flower. D. Flower, showing dorsal corolla lobe, labellum, anther crest and stigma. E. Young fruit. F. Matured fruit. Photographed by Chayan Picheansoonthon.

are low plants with few long-petiolate leaves, usually not taller than 1 m and with 1–8 leaves. Floral structure of all taxa is similar in form, shape, coloration of the labella, and anther crest. The labella are always white with median yellow patch or band bordering with red stripes or red patch at base. Vegetative morphology and inflorescence structure are important characters for species differentiation.

This plant group can be divided into two groups based on the inflorescence structure, i.e., a group with flowers in a dense head and a group with flowers spaced along a decurrent rachis. The following taxonomic key is proposed for species differentiation of these 10 taxa currently recognized for Thailand.

Key to the species of *Elettariopsis* Baker in Thailand

1. Scape with flowers in a dense head 2
1. Scape with flowers spaced along a decurrent rachis 7

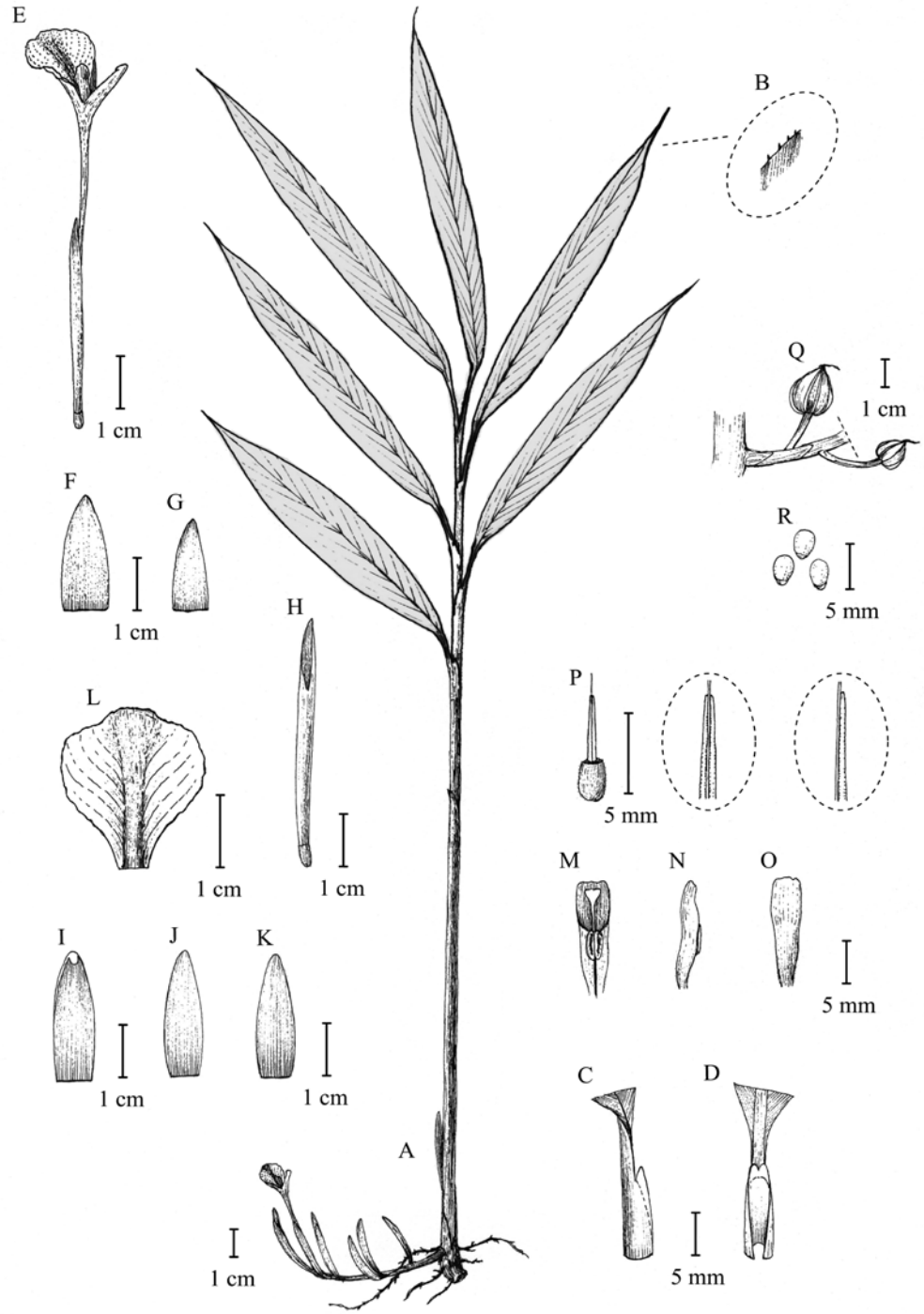

Fig. 6. *Elettariopsis ranongensis* Picheans. & Yupparach. A. Habit showing rhizomes, leafy stems, and inflorescences. B. Leaf margin near the leaf apex. C, D. Ligule (C, side view and D, front view). E. Flower. F. Bract. G. Bracteole. H. Calyx tube. I. Dorsal corolla lobe. J, K. Lateral corolla lobes. L. Labellum. M, N, O. Anthers, anther crest and stigma (M, front view, N, side view, and O, rear view). P. Ovary with stylodial glands and lower part of the style. Q. Stylodial glands. R. Seeds. Drawn by Chalermchoke Boonchit.

2. Leaves prominently veined ..... *E. slahmong*
2. Leaves not prominently veined 3
3. Anther crest with a small tooth-like lobe at the base on each side 4
3. Anther crest without a small tooth-like lobe at the base 6
4. Ligule glabrous ..... *E. triloba*
4. Ligule puberulous or villous 5
5. Bract and bracteole glabrous *E. wandokthong*
5. Bract and bracteole hairy ..... *E. limiana*
6. Leaf apex acuminate to shortly caudate .... *E. chayaniana*
6. Leaf apex mucronate ..... *E. monophylla*
7. Leaves lanceolate, glabrous and shiny 8
7. Leaves elliptic, coriaceous and dull, strongly plicate 9
8. Fruit ovoid, whitish, with 6–8 longitudinal ridges ..... *E. ranongensis*
8. Fruit globose, reddish, without longitudinal ridge ..... *E. smithiae*
9. Lower leaf surface glabrous ..... *E. exerta*
9. Lower leaf surface pubescent .... *E. poonsakiana*

Molecular study of ITS1–ITS2 and *mat*K DNA regions of all known Thai and Malay Peninsula taxa confirmed that these proposed three new species are distinct from their closest counterparts (Yupparach 2010).

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C. Picheansoonthon[a, b], P. Yupparach[b]:**タイ産 *Elettariopsis*（ショウガ科）に関する最近の研究—3 新種の記載**

タイ産 *Elettariopsis* 属（ショウガ科）において，E. *limiana* Picheans. & Yupparach, *E. poonsakiana* Picheans. & Yupparach, *E. ranongensis* Picheans. & Yupparach の 3 新種を記載した．この 3 新種を加えて，タイ産 *Elettariopsis* 属全 10 種の検索表を示した．

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