

A key to the genus *Zingiber* (Zingiberaceae) in Thailand with descriptions of 10 new taxa

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ABSTRACT. A key to the genus *Zingiber* in Thailand is presented and 10 new taxa are described and illustrated: *Z. brachystachys* Triboun & K. Larsen, *Z. callianthus* Triboun & K. Larsen, *Z. chantaranothaii* Triboun & K. Larsen, *Z. cornubracteatum* Triboun & K. Larsen, *Z. isanense* Triboun & K. Larsen, *Z. parashii* Hook.f. subsp. *phuphanense* Triboun & K. Larsen, *Z. pyroglossum* Triboun & K. Larsen, *Z. sadakornii* Triboun & K. Larsen, *Z. tenuiscapus* Triboun & K. Larsen and *Z. vittacheilum* Triboun & K. Larsen.

KEYWORDS: new taxa, *Zingiber*, Zingiberaceae, Thailand

INTRODUCTION

Zingiber is one of the most widespread genera of the Zingiberaceae, occurring almost throughout S and SE Asia to China and Japan and to northern Australia with its centre of diversity in monsoon continental Asia (Larsen, 2005). In Thailand, few species were known up to 1912 when three new species were described on Thai materials by Craib, viz.: *Z. bradleyanum*, *Z. kerrii* and *Z. smilesianum*. In 1999, Theilade presented the first revision of the genus in the country. She recognized 26 species of which six were

described as new. In her work, she wrote that “at present, too little is known about the genus in Thailand to warrant an in-depth discussion of relationships within the sections”. She also mentioned that her work was mainly based on herbarium materials and that further collecting was necessary to reach a full understanding of this complex genus. It was her plan to follow up on her work but a new assignment prevented her so she suggested that the first author should take over from her.

Since 2000, the first author, as a member of the team working on a revision of Zingiberaceae for the Flora of Thailand, has collected and studied the genus throughout Thailand and found that the diversity is far

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more complex than hitherto realized. The present paper is in preparation for the revision in the Flora of Thailand. With 56 species (60 taxa) now recognized, Thailand

is the country with the richest representation of this genus but future collection in the neighbouring Indo-Chinese countries will undoubtedly reveal much new information.

KEY TO TAXA

1. Inflorescence terminal on the leafy shoot 2
1. Inflorescence on a separate basal shoot 5
2. Plant glabrous **Z. junceum**
2. Plant villous 3
3. Leaf blade linear **Z. gramineum**
3. Leaf blade elliptic to oblong 4
4. Labellum yellow with reddish patches at margin **Z. pellitum**
4. Labellum yellow with brown tint inside **Z. barbatum**
5. Spike cone shaped. Distal bracts not the same level as proximal bracts 6
5. Spike more or less flat-topped. Distal bracts always in the same level as proximal bracts 44
6. Peduncle procumbent 7
6. Peduncle erect 9
7. Spike obclavate or pandurate **Z. thorelii**
7. Spike ovate or fusiform 8
8. Leaf blade 18-25 by 4.5-6.2 cm. Apex of spike acute **Z. peninsulare**
8. Leaf blade 35-45 by 8-11 cm. Apex of spike rounded **Z. newmanii**
9. Leafy shoot densely hairy 10
9. Leafy shoot glabrous or glabrescent but not densely hairy 11
10. Inflorescence with short peduncle, 6-9 cm long **Z. barbatum**
10. Inflorescence with long peduncle, 15-30 cm long **Z. idae**
11. Peduncle shorter than or equal to spike 12
11. Peduncle longer than spike 14
12. Ligule lobes joined almost to apex, truncate **Z. neutruncatum**
12. Ligule lobes free 13
13. Peduncle less than 10 cm long, lobes of ligule decurved
..... **Z. parishii** subsp. **phuphanense**
13. Peduncle more than 10 cm long, lobes of ligule protruding **Z. kerrii**
14. Ligule entire 15
14. Ligule bilobed 21
15. Corolla lobes yellow or pale pink 16
15. Corolla lobes white or creamy white 18

16. Spike ellipsoid or cylindric, labellum pale mottled **Z. ottensii**
16. Spike fusiform, labellum dark mottled 17
17. Bracts obovate, cream with some pinkish patches **Z. pyroglossum**
17. Bracts ovate, green with red tip **Z. laoticum**
18. Leafy shoot compressed, apex of bracts pointed **Z. citriodorum**
18. Leafy shoot terete, apex of bracts rounded 19
19. Ligule less than 1.5 cm long. Labellum mottled **Z. olivaceum**
19. Ligule more than 1.5 cm long. Labellum with or without brown patches but not mottled 20
20. Plant up to 1.3 m tall. Labellum cream with brown patches at base
..... **Z. zerumbet** subsp. **cochinchinense**
20. Plant more than 1.3 m tall. Labellum cream without patches
..... **Z. zerumbet** subsp. **zerumbet**
21. Leaf sheath and inflorescence (at least along margin of bracts) pubescent 22
21. Leaf sheath and inflorescence glabrous 25
22. Midlobe of labellum triangular, margin entire 23
22. Midlobe of labellum rotund or obovate, margin undulate 24
23. Spike vasiform. Lobe of ligules acute **Z. puberulum** var. **puberulum**
23. Spike ovoid. Lobe of ligules rounded **Z. puberulum** var. **ovoideum**
24. Spike ovoid or globose, bracts green **Z. gramineum**
24. Spike fusiform, bracts orange red or red **Z. corallinum**
25. Apex of bracts reflexed, induplicate 26
25. Apex of bracts slightly curved but not reflexed 34
26. Leafy shoot up to 80 cm tall. Spike 3-6 cm long 27
26. Leafy shoot more than 80 cm tall. Spike more than 6 cm long 28
27. Inflorescence borne from base of pseudostem. Flowers yellow **Z. chrysostachys**
27. Inflorescence borne from rhizome. Flowers white or cream **Z. brachystachys**
28. Ligule more than 1 cm long, lobes joined at base **Z. spectabile**
28. Ligule up to 1 cm long, lobes free 29
29. Apex of bracts obtuse. Leafy shoot strongly glaucous 30
29. Apex of bracts acute to subacute. Leafy shoot not glaucous 33
30. Apex of bracts appressed to each other. Staminodes and labellum without reddish patches 31
30. Apex of bracts free from each other. Staminodes or labellum with reddish patches 32
31. Flowers yellow. Bracts white with pinkish patches, bracteole longer than bract
..... **Z. niveum**
31. Flowers pale yellow. Bracts green, bracteole shorter than bract **Z. sadakornii**
32. Labellum with patches at base of labellum **Z. parishii** subsp. **phuphanense**
32. Labellum mottled all over **Z. parishii** subsp. **parishii**

33. Bracts elliptic. Apex of labellum acute **Z. chantaranothaii**
33. Bracts ovate. Apex of labellum truncate **Z. flavovirens**
34. Ligule glabrous 35
34. Ligule glabrescent or pubescent 37
35. Spike ovoid or fusiform. Cultivated **Z. officinale**
35. Spike ellipsoid or cylindric. Wild 36
36. Ligule up to 3 mm. Bracteole longer than bract **Z. junceum**
36. Ligule more than 3 mm. Bracteole shorter than bract **Z. tenuiscapus**
37. Spike ellipsoid or fusiform 38
37. Spike cylindric 42
38. Leaf blade linear or narrowly lanceolate 39
38. Leaf blade broad 40
39. Bracts ovate, apex pointed, dark mauve **Z. montanum**
39. Bracts widely elliptic, apex blunt, green with red tip **Z. kerrii**
40. Apex of bracts appressed each other **Z. corallinum**
40. Apex of bracts free from each other 41
41. Apex of bracts inflexed, pubescent **Z. wrayii** var. **wrayii**
41. Apex of bracts spreading and reflexed, glabrous to glabrescent
..... **Z. wrayii** var. **halabala**
42. Peduncle ascending. Leaf blade prominently veined **Z. kelantanense**
42. Peduncle erect. Leaf blade smooth 43
43. Ligule glabrescent. Leaf blade less than 9 cm wide. Labellum cream ... **Z. petiolatum**
43. Ligule pubescent. Leaf blade more than 9 cm wide. Labellum dark purple with streaks **Z. raja**
44. Peduncle erect. Rhizome vertical **Z. isanense**
44. Peduncle procumbent. Rhizome horizontal 45
45. Ligule entire 46
45. Ligule entire with 2-cleft apex or distinctly bilobed 50
46. Ligule short, 1-3.5 cm long, apex of ligule truncate or subtruncate 47
46. Ligule more than 3.5 cm long, apex of ligule obtuse or acute 49
47. Lateral staminodes reduced 48
47. Lateral staminodes well developed **Z. orbiculatum**
48. Ligule papery. Labellum yellow **Z. ligulatum**
48. Ligule leathery. Labellum with violet streaks **Z. vittacheilum**
49. Spike ovoid. Lateral staminodes conspicuously lobed. Labellum yellow with dark purplish mottles **Z. integrum**
49. Spike oblong. Lateral staminodes reduced. Labellum yellow **Z. longiligulatum**
50. Ligule up to 1 cm long 51

50. Ligule more than 1 cm long 58
51. Spike turbinate or cuneiform 52
51. Spike elliptic, ovate or obovate 54
52. Leaf base narrowly attenuate. Spike covered with a gelatinous substance. Flower white **Z. densissimum**
52. Leaf base cuneate. Spike not covered with a gelatinous substance. Flower red or yellow 53
53. Whole spike reddish. Apex of bracts curved with hook-like appendage **Z. cornubracteatum**
53. Whole spike light green. Apex of bract curved without appendage **Z. pardocheilum**
54. Inflorescence covered by many, densely imbricate bracts 55
54. Inflorescence covered by loose bracts 56
55. Leafy shoot 0.7-1.2 m tall. Flowers white. Labellum with undulate margin **Z. simaoense**
55. Leafy shoot 1.6-2 m tall. Flowers yellow with dark red mottling. Labellum entire **Z. rubens**
56. Leaf blade obovate-oblong **Z. larsenii**
56. Leaf blade lanceolate or narrowly lanceolate 57
57. Leafy shoot less than than 1 m tall. Ligule pubescent. Labellum yellow with red streaks **Z. smilesianum**
57. Leafy shoot more than 1 m tall. Ligule villous. Labellum white with purplish streaks **Z. yunnanense**
58. Spike ovoid. Sidelobes of labellum rotund or subrotund 59
58. Spike ellipsoid. Sidelobes of labellum oblong or lanceolate 62
59. Plant up to 1.2 m tall 60
59. Plant more than 1.2 m tall 61
60. Spike with open bracts. Ligule lobes parallel ensiform **Z. callianthus**
60. Spike with closed bracts. Ligule lobes not parallel ensiform **Z. bradleyanum**
61. Spike with open bracts **Z. longibracteatum**
61. Spike with closed bracts **Z. mekongense**
62. Bracts ovate-lanceolate 63
62. Bracts pandurate 64
63. Labellum yellowish mottled **Z. fragile**
63. Labellum white without mottling **Z. roseum**
64. Bracts yellow or pink. Corolla lobes yellow 65
64. Bracts red. Corolla lobes red **Z. monglaense**
65. Labellum with truncate apex **Z. bisectum**
65. Labellum with acute apex **Z. flavomaculosum**

NEW SPECIES OF *ZINGIBER*

1. *Zingiber brachystachys* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Saraburi, Phra Phutthabat, mixed bamboo forest, alt. 150-300 m, 10 Sep. 2002; *P. Triboun* 3400 (holotype BK; isotypes AAU, KKU). Figs. 1 & 11A.

Diagnosis: *Species Zingiber chrysostachye affinis a qua differt surculis foliaceis minoribus, inflorescentiis a pseudocaulis 2-4 cm distantis, bracteis obscure viridibus, floribus labello incluso albis.*

Rhizome slender, trailing, with long roots, pale pink outside, yellowish inside, aromatic. *Leafy shoots* 40-80 cm tall, with 10-20 leaves. *Leaf blade* oblong to lanceolate, 11-18 by 2.5-5.8 cm, upper leaves smaller than the lower ones, apex acuminate, base obtuse, glabrous on both surfaces except for sparse hairs on the midrib of lower surface, green; 2-3 sheaths at base of leafy shoot without blade, glabrescent, green or pale pink. *Petiole* 3-7 (-10) mm long, glabrous or sparsely hairy, green. *Ligule* bilobed; lobes free, 2-3 by ca. 3 mm, apex obtuse, glabrous. *Inflorescences* 1-2, radical (rarely apical on the leafy shoot), erect, 2-4 cm long from the leafy shoot. *Peduncle* 6-14 cm long, with 3-6 sheaths, glabrescent, cream to pale pink. *Spike* cylindrical, 3.5-5.5 by 0.8-2 cm; with ca. 13, imbricate floral bracts. *Bracts* suborbicular, 2.4-2.5 by 2.2-2.3 cm, apex mucronate, induplicate, glabrous, green turning yellowish orange or red in fruit. *Bracteoles* obovate-oblong, 1.9-2 by 1-1.2 cm, sparsely hairy

on both surfaces, apex obtuse, comose at tip. *Calyx* tubular, 1-1.4 cm long; tube 0.7-0.8 cm, pubescent; lobes three, 0.4-0.6 cm long. *Corolla* creamy white; dorsal lobe ca. 1.8 by 0.8 cm; lateral lobes ca. 1.8 by 0.4 cm. *Labellum* conspicuously 3-lobed, 1.6-1.8 cm long, creamy white; midlobe 1.3-1.5 by 1.5-1.6 cm, apex emarginate, margin undulate; side lobes ca. 7 by 4-5 mm, oblong, apex obtuse. *Anther* ca. 9 by 3 mm; filament ca. 2.5 mm long; appendage 7-8 mm long, tapering, tip retuse, cream, shorter than stigma. *Stylodes* slender, up to 3 mm long. *Ovary* globose, ca. 2 by 2 mm, villous. *Ovules* ca. 10 per locule. *Fruit* unknown.

Distribution.— Endemic to Thailand.

Ecology.— Mixed bamboo forest on limestone hill, alt. 150-400 m.

Phenology.— Flowering in July to September.

Specimens examined.— **THAILAND.** EASTERN: Nakhon Ratchasima [Chan Tuk, Kao Sisiat, ca. 400 m, 1 Sep. 1924, *A.F.G. Kerr* 9110 (BK, BM, C, K-2 sheets, L); Pak Chong, Khao Lukchang, 4 Jul. 1963, *T. Smitinand & C. Phengklai* 5846 (BKF), Pak Thong Chai, Sakaerat For. Res., along Huai Krae stream, alt. 400 m, 30 Oct. 1969, *C.F. van Beusekom & C. Charoenpol* 1924 (AAU, BKF, L)]; SOUTH-WESTERN: Prachuap Khiri Khan [Pran, 26 Nov. 1929, *Put* 2461 (BK, BM, K, L)]; CENTRAL: Saraburi [Ban Nawng Bua, 26 Sep. 1927, *Put* 1087 (BK, K); Khao Sawng Phi Nawng, alt. 350 m, 4 Oct. 1963, *T. Smitinand et al.* 1355 (BKF, K, L); Muak Lek, ca. 200 m, 30 Aug. 1924, *A.F.G. Kerr* 9071 (BK, BM, C, K, L); Phra Phutthabat, 10 Sept. 2002, *P. Triboun* 1426-

in spirit collection (BK); *ibid.* 10 Sept. 2002, *P. Triboun* 1428—in spirit collection (AAU, BK, KKU)].

2. *Zingiber callianthus* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Tak, Mae Ramad, montane forest, alt. 800-1,200 m, 15 Jul. 2002; *P. Triboun* 3344 (holotype BK; isotypes AAU, KKU). Figs. 2 & 11B.

Diagnosis: *Species Zingiber larsenii affinis a qua differt foliorum laminis tenuioribus plus papyraceisque, bracteis inflorescentiae distincte laxis, liguliformibus, labello longiori bifido lobis linearibus.*

Rhizome light purple. *Leafy shoots* erect, 1-2 m with 10-13 leaves. *Leaf sheaths* maroon. *Leaf blade* ovate-oblong or ovate-lanceolate, 45-50 by 10-18 cm, slightly plicate, apex acuminate, base attenuate or cuneate, green on both surfaces except 2-3 lower ones slightly maroon on the lower, glabrous or sparsely hairy on the upper, glabrescent and pubescent near midrib on the lower surface. *Petiole* 1-2 cm long, green, pilose (on young leaves) to glabrescent. *Ligule* bilobed; lobes 1.7-4 by 0.5-0.8 cm, obtuse or acuminate, green, sometimes pale red on the lower leaves, glabrescent to pubescent. *Inflorescences* 1-5, radical. *Peduncle* procumbent, 8-15 cm long, with 4-7 sheaths, pink to red. *Spike* 7-10 by 3-5 cm, with 12-15 loosely imbricate floral bracts. *Bracts* linear, 5.5-6.5 by 1.3-1.5 cm, sparsely hairy outside, red. *Bracteoles* linear, 4-4.7 by 1.2-1.4 cm, slightly convolute, pubescent, pale red. *Calyx* tubular, ca. 2.5 cm long; tube ca. 1.1 cm long, pubescent,

translucent, pale pink; lobe 1.2-1.4 cm long, apex tridentate. *Corolla* tube 5.3-5.5 cm, white, sparsely hairy; lobes pale pink, hooded; dorsal lobe 3.4-3.6 by 1.3-1.5 cm; lateral lobes 2.8-3.2 by 0.8-1 cm. *Labellum* ca. 3.3 by 3.2 cm, apex truncate, emarginate, red mottled; midlobe 1.8-2.0 by 2.3-2.5 cm; side lobes 7-11 by 4-6 mm. *Anther* creamy white, 1.8-2 by 0.3-0.4 cm; filament ca. 4 by 2 mm; appendage elongate, 1.4-1.5 cm, red, tip bifid, acute. *Ovary* ca. 1 by 0.2-0.3 cm, villous. *Ovules* 23-24 per locule. *Fruit* unknown.

Distribution.— Endemic to Thailand.

Ecology.— In shady places in hill evergreen forest, alt. 400-1,200 m.

Phenology.— Flowering in July to August, flowering time 11 am-3 pm.

Notes.— The species is known only from the type locality at Mae Ramad, Mae Sot district and the surrounding areas.

Specimens examined.— **THAILAND.** NORTHERN: Mae Hong Son [Mae Surin Fall, alt. 1,000 m, 25 Dec. 2003, *T. Wongprasert* 0312-06 (BKF)]; Tak [Mae Ramad, alt. 800-1,000 m, 15 Jul. 2002, *P. Triboun* 1411—in spirit collection (AAU, BK, KKU)]; Mae Sot, 10 km from Ban Mussoe, alt. 400 m, 22 Jul. 1959, *F. Floto* 7658 (AAU, BKF, C); *ibid.*, 14 Jul. 1999, *M. Newman* 908 (BKF, E), Mae Sot-Um Phang, 14 Jul. 1999, 910 (E)].

3. *Zingiber chantaranothaii* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Mae Hong Son, mixed bamboo forest, 10 Aug. 2004; *P. Triboun* 3492 (holotype BK; isotype KKU). Figs. 3 & 11C.

Diagnosis: *Species Zingiber parishii affinis a qua differt bracteis non valde recurvatis pallide viridis apice apiculato, antheris multo longioribus.*

Leafy shoots erect, 1-1.2 m. *Leafblade* linear, ca. 25 by 2.4-2.6 cm, apex acuminate, base attenuate, glabrous on both surfaces. *Ligule* bilobed; lobes ovate, ca. 3 mm long, sparsely hairy along margin. *Inflorescences* 1-2, radical. *Peduncle* erect, with 6-8 sheaths, green. *Spike* oblong, 11-13 by 3-3.5 cm with ca. 35 floral bracts, apex acute, green. *Bracts* oblong, ca. 4 by 2.7 cm, apiculate, glabrous on the upper surface, pubescent on the lower surface. *Bracteoles* ca. 3.1 by 1.3 cm, glabrous on the upper surface, pubescent on the lower surface. *Calyx* ca. 1.3 cm long; lobes very wide, ca. 6.5 by 10 mm, pubescent especially at base. *Corolla* cream; tube 4-4.3 cm long; dorsal lobe 2.7-2.8 by 1.1-1.2 cm; lateral lobes 2.5-2.6 by 0.65 cm. *Labellum* yellow with dark rusty brown mottling; midlobe 1.5-1.6 by 1.5 cm; side lobes 5-7 by 8-9 mm. *Anther* ca. 1.5 by 0.4 cm; filament ca. 4 mm long; appendage 1.5-1.7 cm long, cream, protruding. *Stylodes* ca. 4 mm long. *Ovary* villous. *Ovules* 11-14 per locule. *Fruit* unknown.

Distribution.— Endemic to Thailand.

Ecology.— Mixed deciduous and bamboo forests.

Phenology.— Flowering in June to August.

Vernacular.— Khing yok (ขิงหยก) (Mae Hong Son).

Specimens examined.— **THAILAND.** NORTHERN: Mae Hong Son [Pang Mapha,

10 Aug. 2004, P. Triboun 1551—in spirit collection (BK, KKU)].

4. *Zingiber cornubraceatum* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Mae Hong Son, Ban Huay Hei, hill evergreen forest, alt. 1,000 m, 7 Sep. 2001; P. Triboun 3072 (holotype BK; isotypes AAU-2 sheets, KKU). Figs. 4 & 11D-E.

Diagnosis: *Species Zingiber recurvato affinis a qua differt ligula breviori, petiolo distincto, calyce tubulari, bracteis clavatis apice uncinato.*

Robust tufted herb. *Rhizome* thick, creamy to light brown. *Leafy shoots* erect, 1.8-2.6 m tall, with 20-23 leaves. *Leaf sheaths* brown, maroon and green in the lower part. *Leafblade* chartaceous, ovate to lanceolate, 44-47 by 11-18 cm, apex caudate (young leaves) to acuminate (mature leaves), base cuneate (young leaves) to obtuse (mature leaves), glabrous above, brown punctulate below, sparsely hairy. *Petiole* 2-2.5 cm long (less than 1.5 cm long in the upper leaves). *Ligule* bilobed; lobes ca. 4 mm long, slightly truncate, villous. *Inflorescence* from the base with a procumbent peduncle, 18-22 cm long, lower part embedded in ground with 8-10 sheaths, oblong, 5-7.5 by 1.7-2.4 cm. *Spike* fusiform or obconical, ca. 7.5 by 5-8 cm, with 20-60 floral bracts. *Bracts* oblong, base tapering, 5-10 by 2.8 cm, upper ones clavate and attenuate, ca. 4.2 by 1.4 cm, apex reflexed with exserted and incurved, hook-like tip, orange red, pubescent. *Bracteoles* oblong, 3.3-3.7 by ca. 0.9 cm, pubescent, apex truncate, piliferous and finely irregularly

serrate, base cream, red in upper part. *Calyx* tubular, 2.2-2.5 cm long, pubescent; lobes 1.1-1.2 cm long, piliferous at apex. *Corolla* tube *ca.* 5.2 cm long, pale yellow, pubescent; lobes red; dorsal lobe 3.3-3.5 by 1.1-1.2 cm; lateral lobes 3.4-3.7 by 0.6 cm. *Labellum ca.* 2.5 cm long, red with or without creamy mottling; midlobe *ca.* 1.4 by 1.3 cm, emarginate, tip bilobed; side lobes *ca.* 2 by 2-3 mm. *Anther ca.* 1.5 by 0.45 cm; filament 3-4 mm long; appendage 1.6-1.7 cm long, bright red or creamy at base, tip bifid. *Ovary* villous. *Ovules* 9-14 per locule. *Capsule* obovate to oblong, *ca.* 2.8 by 2.3-2.4 cm, with accrescent bracteole, *ca.* 3.7 cm long, with persistent tubular calyx *ca.* 2.6 cm long. *Seeds* pale pink with red apex when young turning to brownish red, 9-14 per locule.

Distribution.— Endemic to Thailand.

Ecology.— Shady places in rich soil along streams in hill evergreen forest, alt. 800-1,100 m.

Phenology.— Flowering in July to September, flowering time 11 am-3 pm, fruiting in September to November.

Notes.— Two sheets of *Larsen et al.* 46837 (AAU) belong to this species (except the spirit material).

Specimens examined.— **THAILAND.** NORTHERN: Mae Hong Son [Huay Hei, alt. 1,000 m, *K. Larsen et al.* 46837 (AAU); *ibid.*, 7 Sep. 2001, *P. Triboun* 1287—in spirit collection (AAU, BK, KKU)].

5. *Zingiber isanense* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Mukdahan, Phu Sa Dok Bua, in dry evergreen and deciduous forests, 12 Jun. 2003; *P. Triboun*, *W. Somprasong*, *P. Panchitra* & *P.*

Rattananupongse 3425 (holotype BK; isotypes AAU, KKU). Figs. 5 & 11F.

Diagnosis: *Species Zingiber junceo affinis a qua differt habitu humiliori, pseudocaule tenui gramineo, foliis et ligula multo minoribus.*

Rhizome vertical, 3-4 cm long, leafy shoots close together, with a bug-like smell when crushed. *Leafy shoots* 30-60 cm tall, the lower 2-4 sheaths without leaf blades, 9-11 sheaths with leaf blades. *Leaf sheaths* green or purple in lower part. *Leaf blade* narrowly lanceolate, 9-16 by 1-1.7 cm, apex acuminate to caudate, base cuneate, green and glabrous above, sparsely hairy below. *Petiole* 2-3 mm long, light green with some red dots, pilose. *Ligule* bilobed; lobes rounded, 2-3 mm long, obtuse, pilose. *Inflorescences* 1-5, radical, direct from the rhizome. *Peduncle* erect, 5-10 cm long, with 2-5 sheathing bracts, white, pale pink or purple. *Spike* capitulate, narrowly acuminate, 3-4 by 1-1.5 cm, with 6-10 imbricate floral bracts. *Flowers* opening 1-2 at a time. *Bracts* ovate-lanceolate, *ca.* 2.7 by 0.7 cm, apex long acuminate or caudate with hairy tips, sparsely hairy along margin, whitish green or greenish purple with purplish dots near apex. *Bracteoles* lanceolate, 2.2-2.7 by 0.7-1.2 cm, apex acute, glabrescent to pubescent, white. *Calyx ca.* 1.3 cm long; tube *ca.* 5 mm long; lobes 8-9 mm long, hairy at apex. *Corolla* white; tube 3.2-3.3 cm, white, glabrous; dorsal lobe 1.4-1.6 by 0.4-0.5 cm; lateral lobes 1.2-1.4 by 0.3-0.4 cm. *Labellum* white, yellow near base; midlobe rounded, 1-1.3 by 1-1.3 cm; side lobes 6-8 by 2-3.5 mm. *Anther* 6-7 by 2-3

mm, creamy yellow; filament *ca.* 2 mm long; appendage 0.9-1 cm long, white, longer than stigma. *Ovary* 2.5-3 by 1-2 mm, glabrescent or pubescent on the upper half. *Stylodes ca.* 4 mm long. *Ovules* (6-) 8-10 per locule. *Seeds* 3-4 per locule.

Distribution.— Laos and Thailand.

Ecology.— Shaded areas among sandstone rocks in dry evergreen and mixed deciduous forests.

Phenology.— Flowering from late May to June, flowering time in the afternoon.

Specimens examined.— **LAOS.** Salavanh [Kong Xedone district, Khok Sawat village, alt 230 m, *VL* 1999 (E, SING)]; Lakhon Pheng district, Okad village, Xe Bang Nouan NPA, alt. 114 m, *VL* 2015 (E, SING)]; **THAILAND.** NORTH-EASTERN: Mukdahan [12 Jun. 2003, *P. Triboun et al.* 1456—in spirit collection (AAU, BK, KKU)].

6. *Zingiber parishii* Hook.f. subsp. ***phuphanense*** Triboun & K. Larsen **subsp. nov.** —Type: Thailand: Sakon Nakhon, Phu Phan national park, 11 Jun. 2002; *P. Triboun & C. Kantachote* 3323 (holotype BK; isotypes AAU, KKU). Figs. 6 & 11G.

Diagnosis: *Subspecies parishii affinis a qua differt pseudocaulibus humilioribus, inflorescentibus minoribus, bracteis et omnibus partibus floralibus minoribus, labello incluso.*

Leafy shoots 0.9-1.1 m tall with 17-21 leaves, 3-5 leaf sheaths, the lower ones dark greenish red, leaf blades reduced, upper ones green and pilose near ligule. *Leaf blade* linear, 20-32 by 1.8-2.6 (-3) cm, apex long acuminate, glabrous above, pubescent

below. *Petiole ca.* 5 mm long, light green. *Ligule* bilobed; lobes rounded, *ca.* 4 by 5 mm, light green, translucent, edge of apex ciliate. *Inflorescences* 1-2, erect, from base of leafy shoot. *Peduncle* 6-9 (-15) cm long with 4-6 (-9) sheaths, apex rounded. *Spike* obovate, 4-9 by 2.5-4 cm, apex obtuse. *Bracts* obovate to subrotund, 3.5-4 by 2.9-3.7 cm, apex obtuse, recurved, tip ciliate, yellowish green, pubescent on upper surface, glabrous near base, membranous along margin. *Bracteoles* 2.8-3.0 by 1.7-1.8 cm, pubescent on both surfaces. *Calyx* 1.3-1.5 cm long; tube short; lobe 8-9 by 7 mm, apex tridentate, tip ciliate, pubescent at base. *Corolla* cream, *ca.* 6 cm long; tube 3.0-3.2 cm long; dorsal lobe 2.7-3.2 by 1.0-1.3 cm; lateral lobes 2.5-2.7 (-3) by 0.6 cm. *Labellum* cream; midlobe ovate to oblong, 1.5-1.7 by 1.2-1.5 cm, apex obtuse; side lobes equal or slightly unequal, 7-10 by 6-8 mm. *Anther* 1.2-1.3 by 0.4 cm; filament *ca.* 5 mm long; appendage *ca.* 1.9 cm long, cream. *Ovary ca.* 5 by 5 mm, villous. *Ovules* 18-25 per locule. *Fruit* unknown.

Distribution.— Endemic to Thailand.

Ecology.— In shaded, mixed deciduous forest, alt. 150-350 m.

Phenology.— Flowering in June to July.

Vernacular.— Khing phu phan (ขิงภูพาน) (Sakon Nakhon).

Specimen examined.— **THAILAND.** NORTH-EASTERN: Sakon Nakhon [Phu Phan, 11 Jun. 2002, *P. Triboun & C. Kantachote* 1337—in spirit collection (AAU, BK, KKU)].

7. *Zingiber pyroglossum* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Phetchabun,

Thung Salaeng Luang, in pine forest, 12 Aug. 2003; *P. Triboun* 3437 (holotype BK; isotypes AAU, BKF, KKU). Figs. 7 & 11H-I.

Diagnosis: *Species Zingiber junceoa affinis a qua differt ligula integra rubentnotata, bracteis valde curvatis, floribus cremeis distincte rubentistriatis.*

Leafy shoots 1-2 m tall, tapering to the distal part, with 5-7 sheaths; the lower ones without leaf blades, leaves 18-25, leaf sheaths green, the lower ones red, glabrous and glaucous. *Leaf blade* oblong to lanceolate, *ca.* 15.5 by 4.5-4.6 cm, apex acuminate to caudate, base cuneate, delicately nerved, green, glabrous and glaucous on both surfaces. *Petiole* 3-5 mm long, light green, glabrous. *Ligule* entire, 2-5 by 5-10 mm, obtuse, glabrous, brownish red or yellowish green with red at tip. *Inflorescences* 1-2, radical. *Peduncle* slender, erect, 22-35 (-47) cm long with 10-17 sheathing bracts, green, glabrous and glaucous. *Spike* oblong, 4-12 by 2-3.5 cm; lower bracts overlapping the upper ones by half their length, apex obtuse, creamy yellow. *Flowers* 1-2 blooming at a time. *Sterile bracts ca.* 3.8 by 1.4 cm. *Bracts* obovate, *ca.* 3.3 by 2.5 cm, apex obtuse, margin of upper half concave, glabrescent, more pubescent near apex, creamy yellow with pinkish patches. *Bracteoles* elliptic to oblong, *ca.* 3.2 by 2.2 cm, apex acute, outside glabrescent or pubescent, creamy yellow, tip red. *Calyx ca.* 1.4 cm long; tube 0.5-0.6 cm; lobe 0.7-0.9 cm, whitish cream, translucent. *Corolla tube ca.* 3.3 cm long, cream, glabrous to glabrescent; lobes yellow; dorsal lobe 2.3-2.7 by 1-1.1 cm; lateral lobes 2.2-2.6

by 0.6 cm. *Labellum* yellow with red streaks, midlobe obconical, 1.2-1.6 by 1.4-2 cm, apex nearly truncate, margin slightly emarginated; side lobes 5-6 by 5-7 mm. *Anther ca.* 1.2 by 0.4 cm, creamy yellow; filament 3-5 mm long; appendage 1.2-1.5 cm long, creamy yellow, equal to or shorter than stigma. *Ovary* 4-6 by 3 mm, densely hairy. *Stylodes ca.* 6 mm long. *Ovules* 15-19 per locule. *Fruit* unknown.

Distribution.— Thailand and Vietnam.

Ecology.— Open areas dominated by bamboo (*Vietnamosasa* sp.) in deciduous dipterocarp and pine forests.

Phenology.— Flowering from late July to September.

Vernacular.— Khing ka taai yai (ชิงกระต่ายใหญ่) (Sakon Nakhon); khing maeng daa (ชิงแมงดา) (Nong Khai).

Notes.— Number *KL* 47376 is a plant from the green house at Aarhus University. The plant is labelled as coming from Mae Hong Son, this seems, however, unlikely according to the known distribution.

Specimens examined.— **THAILAND.** NORTH-EASTERN: Bung Kan [Bueng Khla, Phu Wua Wildlife Sanctuary, trail from Pha Nang Khoi to Tham Noi, alt. 320 m, 30 Jul. 2008, *R. Pooma et al.* 7341 (BKF—2 sheets); Se Ka district, Phu Wua Wildlife Sanctuary, Chet Si Falls, alt. 200 m, 26 Aug. 2001, *R. Pooma et al.* 2723 (BKF); *ibid.*, alt. 500 m, 9 Aug. 2004, *I.C. Nielsen et al.* 1585 (BKF); Phu Tok Noi, 21 Jun. 1997, *C. Niyomdham* 5094 (AAU, BKF)]; Kalasin [Somdet, 24 Oct. 1975, *S. Sutheesorn & P. Sangkhachand* 3453 (BK)]; Khon Kaen [Chum Phae, alt. 850 m, 11 Oct. 1979, *T. Shimizu et al.* T-18310 (BKF, L)];

Mukdahan [Dong Luang, Ban Na Lak, km 22 on road no. 2287, near the dam (Fai Huai Din), alt. 160 m, 24 Aug. 2001, *R. Pooma et al.* 2493 (BKF–2 sheets); Tao Ngoi, Huai Huat National Park –Phu Pha Yon National Park, Huai Huat reservoir, alt. 220 m, 24 Aug. 2001, *R. Pooma et al.* 2561 (BKF–2 sheets)]; Phetchabun [Thung Salaeng Luang, 12 Aug. 2003, *P. Triboun* 1492—in spirit collection (AAU, BK, KKU)]; EASTERN: Chaiyaphum [Phu Khieo, Oct. 1999, *C. Phengklai et al.* 12317 (BKF)]; Thung Kra Mung, alt. 850 m, 9 Sept. 1972, *K. Larsen et al.* 31660 (AAU, BKF, E, K)]; Si Sa Ket [Kantharalak, alt. 130 m, 8 Oct. 1984, *G. Murata et al.* T–49655 (BKF)]; Ubol Rachathani [Huay Yang, alt. 150 m, 14 Sept. 2001, *J.F. Maxwell* 01–406 (BKF, CMU–2 sheets)]; Khong Chiam, near fire control station, Ban Bahai, 16 Sept. 2004, *R. Pooma et al.* 4748 (BKF–2 sheets); *ibid.*, alt. 150 m, 3 Aug. 2001, *M. Greijmans* 135 (BKF–2 sheets, CMU)]; CENTRAL: Nakhon Nayok [Khao Yai National Park, alt. 650 m, 8 Oct. 1979, *T. Shimizu et al.* T–19604 (BKF)]; VIETNAM. Gia Lai [Kon Ka Kinh National Park, 611 m, 31 Jul. 2009, *H.D. Trần et al.* 185 (E, SING)].

8. *Zingiber sadakornii* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Loei, Nong Hin, in mixed deciduous forest, 25 Jul. 2003; *P. Triboun* 3341 (holotype BK; isotypes AAU, KKU). Figs. 8 & 11J.

Diagnosis: *Species Zingiber zerumbeti affinis a qua differt ligula bilobata, spica longe ellipsoideo, bracteis smaragdinis.*

Leafy shoots 1–1.4 m tall; leaf sheaths pubescent, green, 3–4 cm long. *Leaf blade* oblong or obovate–oblong, 21–25 by 4–6 cm,

apex acuminate, base cuneate, both surfaces green, sparsely hairy above, glabrescent or long hairy below. *Petiole* 3–4 mm long, pubescent. *Ligule* bilobed; lobes rounded, 4–5 mm long, apex rounded, glabrescent to pubescent. *Inflorescences* 1–2, radical, erect from underground rhizome. *Peduncle* 9–20 cm long, with *ca.* 9 sheaths; sheaths elliptic, 4.5–5 cm long, outside pubescent. *Spike* ellipsoid, 9–10 by 3–3.5 cm. *Bracts* obovate, *ca.* 3.5 by 3 cm; apex rounded or submucronate, convex; the upper ones smaller, glabrous, pubescent near base. *Bracteoles* oblong, 2.9–3 by 1.5 cm, apex mucronate, glabrescent. *Calyx* *ca.* 1.2 cm long; lobe *ca.* 5 mm long, apex tridentate, villous near base. *Corolla* yellow; tube *ca.* 2.7 cm long; dorsal lobe *ca.* 2.2 by 0.9–1 cm; lateral lobes *ca.* 2.1 by 0.5 cm. *Labellum* yellow sometimes with a purplish mark near base; midlobe *ca.* 1.1 by 1.2 cm; side lobes *ca.* 6 by 4–5 mm. *Anther* 1.3–1.4 by 0.4 cm; filament short, up to 2 mm long; appendage *ca.* 1.2 cm long, yellow. *Stylodes* *ca.* 5 mm long. *Ovary* *ca.* 4 by 3 mm, villous. *Ovules* 32–35 per locule. *Fruit* unknown.

Distribution.— Endemic to Thailand.

Ecology.— Open areas at edges of primary and bamboo forests near limestone hills.

Phenology.— Flowering from late July to September.

Vernacular.— Pu loei dam (ปู่เลยดำ) (Chaiyaphum).

Notes.— The species is named after the late curator of the Bangkok herbarium (BK), Mr. Jaray Sadakorn, who worked for the conservation of the Thai flora.

Specimens examined.— **THAILAND.** NORTH–EASTERN: Loei [Ban Na Noi, alt. 240-250 m, 26 Aug. 1988, *M. N. Tamura* T-60427 (BKF)], EASTERN: Chaiyaphum [Phu Khieo, Oct. 1999, *C. Phengklai et al.* 12281 (BKF-2 sheets)].

9. *Zingiber tenuiscapus* Triboun & K. Larsen **sp. nov.** —Type: Thailand: Tak, Mae Sot, in mixed deciduous forest, alt. 800-1,000 m, 15 Jul. 2002; *P. Triboun* 3343 (holotype BK; isotypes AAU, KKU). Figs. 9 & 11K.

Diagnosis: *Species Zingiber montano affinis a qua differt scapo gracile, bracteis minoribus, labello flavido ad basin subroseobivittato bimaculato.*

Leafy shoots erect or decurved, 1-1.5 m tall with 20-25 leaves. *Leaf sheaths* green, glabrous with fine nerves; bladeless sheaths 4-5, pale pink. *Leaf blade* linear with fine, parallel nerves, 27-33 by 3-3.3 cm, apex acuminate, base cuneate. *Petiole* hairy, 2-5 mm long. *Ligule* papery, bilobed with truncate sheaths, ca. 8 by 6 mm, tip acute or obtuse, glabrous. *Inflorescences* 1-2 from rhizome near leafy shoot. *Peduncle* erect, slender, 30-35 cm long, with 6-10 sheaths, 2-3 lower sheaths pale pink, upper ones light green, glabrous. *Spike* ellipsoid or cylindrical, ca. 8 by 2.5 cm, apex acute, with 14-25 floral bracts. *Bracts* ca. 3 by 2.6 cm, brownish green or brownish red, glabrous on both surfaces. *Bracteoles* ca. 1.7 by ca. 1.5 cm, pilose on outside surface near base. *Calyx* tubular; tube ca. 1.0 cm long, pubescent; lobes ca. 7 mm long, apex bidentate. *Corolla* cream; dorsal lobe ca. 2.3 by 1.3 cm; lateral lobes ca. 2.3 by 0.8 cm. *Labellum* ca. 2.4

cm long, orbicular, truncate, emarginate or slightly bifid at apex; midlobe ca. 1.7 by 2 cm, pale yellow with 2 pinkish bands near base; side lobes ca. 9 by 6 mm, light yellow with one pinkish band near base. *Anther* ca. 1.2 by 0.3 cm, light brown, with a pale pink band on lower half of back side, sessile or with short filament; appendage 7-8 mm long, cream, apex bifid, shorter than stigma. *Ovary* globose, ca. 3 mm in diam., villous. *Fruit* unknown.

Distribution.— Endemic to Thailand.

Ecology.— Mixed deciduous forest, alt. 700-900 m.

Phenology.— Flowering in late July to September, blooming time after 4 pm.

Vernacular.— Phlai pa (พลีปา) (General).

Notes.— *Z. tenuiscapus* is used as a medicinal plant in the same way as *Z. montanum*.

Specimen examined.— **THAILAND.** NORTHERN: Tak [Mae Sot, alt. 800-1,000 m, 15 Jul. 2002, *P. Triboun* 1409—in spirit collection (AAU, BK, KKU)].

10. *Zingiber vittacheilum* Triboun & K. Larsen **sp. nov.** —Type: Thailand, Tak, Umphang, 17 Sep. 2003; *P. Triboun* 3405 (holotype BK, isotype KKU). Figs. 10 & 11L.

Diagnosis: *Species Zingiber orbiculato affinis a qua differt staminodiis lateralibus valde redactis, lobo mediali labelli albo venatione secus marginem clare violacea.*

Leafy shoots 2-2.2 m tall. *Leaf sheaths* red, pubescent. *Leaf blade* lanceolate, ca. 50 by 9 cm, apex acuminate, base obtuse, green on both surfaces, glabrous above, glabrescent

below, midrib with dense hairs. *Petiole* 0.6-1 cm long, red. *Ligule* entire, ligulate, ca. 3 cm long, apex truncate or bifid, brownish red, pubescent. *Inflorescences* 1-2 borne from the rhizome. *Peduncle* sheaths red. *Spike* capitate. *Bracts* ca. 4.8 by 1.4 cm, red, pubescent on outside surface. *Bracteoles* ca. 4.2 by 1.3 cm, red. *Calyx* ca. 2.6 cm long; lobe ca. 1.5 cm long, glabrescent on both surfaces. *Corolla* faintly pink; tube ca. 3.8 cm long, white, pubescent; dorsal lobe ca. 3.7 by 0.7 cm; lateral lobes ca. 3.6 by 0.6 cm. *Labellum* white with bright violet venation along edge, 3.0-3.2 by 1.8 cm; side lobes reduced. *Anther* 1.5-1.7 cm long, yellow; filament ca. 4 mm long; appendage 1-1.2 cm long, yellow. *Ovary* ca. 7 by 4 mm, densely hairy. *Ovules* 31-34 per locule. *Fruit* unknown.

Distribution.— Known only from the type locality.

Ecology.— Edge of dry evergreen to dipterocarp forests.

Phenology.— Flowering from July to August.

Specimen examined.— **THAILAND**. NORTHERN: Tak [Umphang, 17 Sept. 2003, *P. Triboun* 1508—in spirit collection (BK, KKU)].

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FIGURE 1. *Zingiber brachystachys* Triboun & K. Larsen. A. leafy shoot; B. inflorescence; C. bract; D. bracteole; E. dorsal lobe of corolla; F. lateral lobe of corolla; G. calyx with ovary; H. labellum (Scale bars: A.-B. = 5 cm, C.-H. = 1 cm).

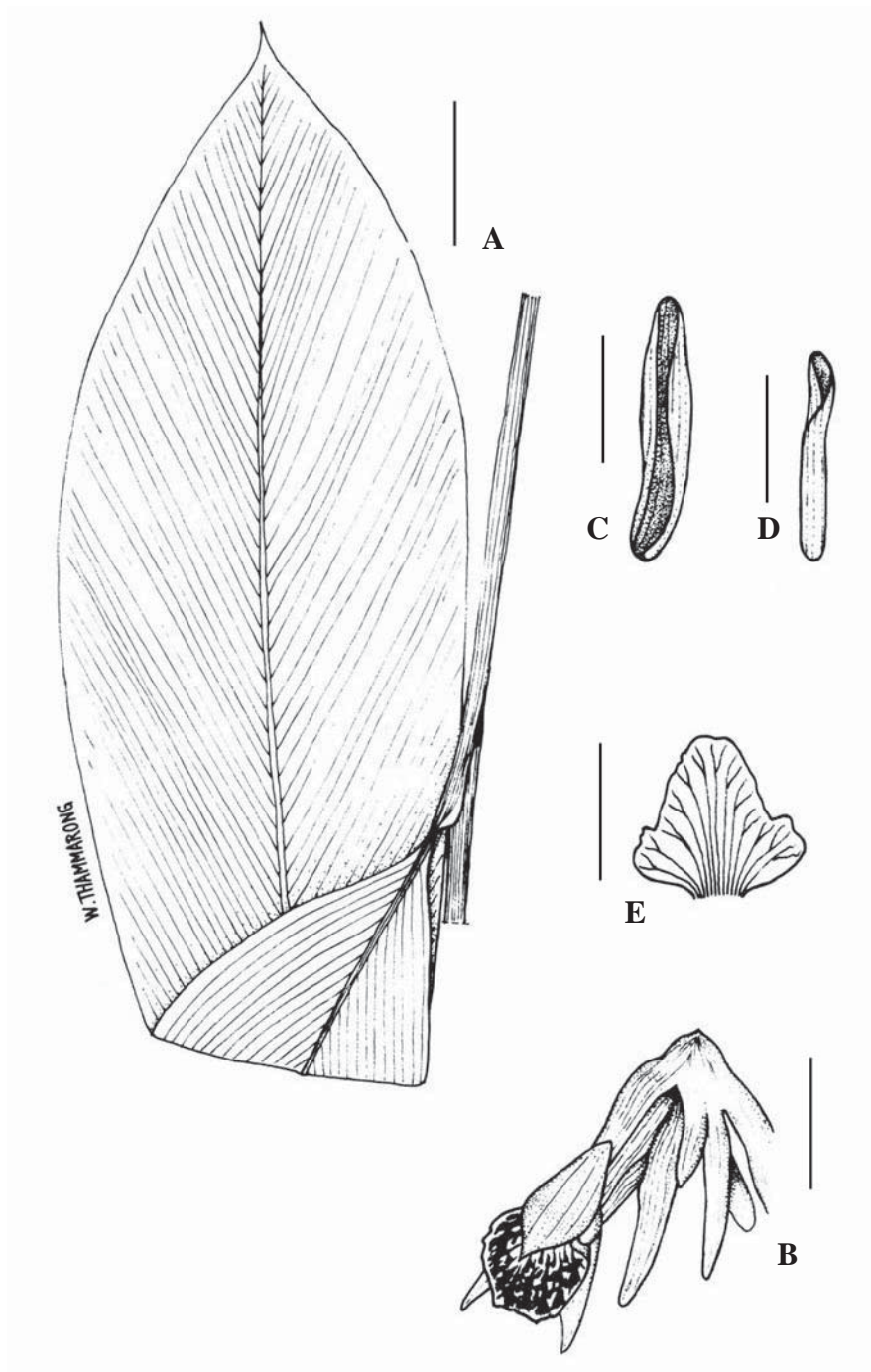


FIGURE 2. *Zingiber callianthus* Triboun & K. Larsen. A. leaf and sheath; B. inflorescence; C. bract; D. bracteole; E. labellum (Scale bars: A. = 5 cm, B.-E. = 3 cm).

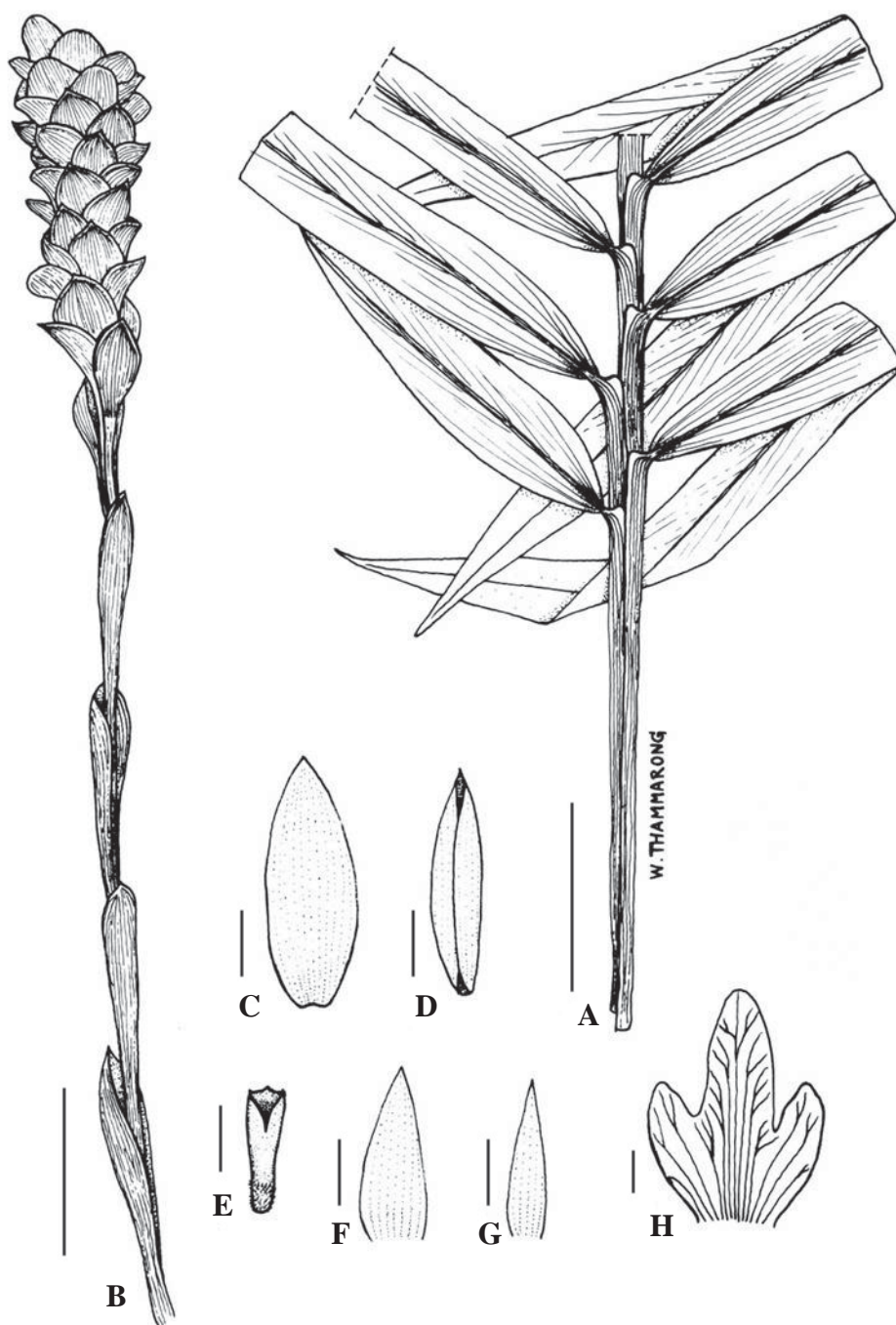


FIGURE 3. *Zingiber chantaranothaii* Triboun & K. Larsen. A. leafy shoot; B. inflorescence; C. bract; D. bracteole; E. calyx with ovary; F. dorsal lobe of corolla; G. lateral lobe of corolla; H. labellum (Scale bars: A.-B. = 5 cm, C.-H. = 1 cm).

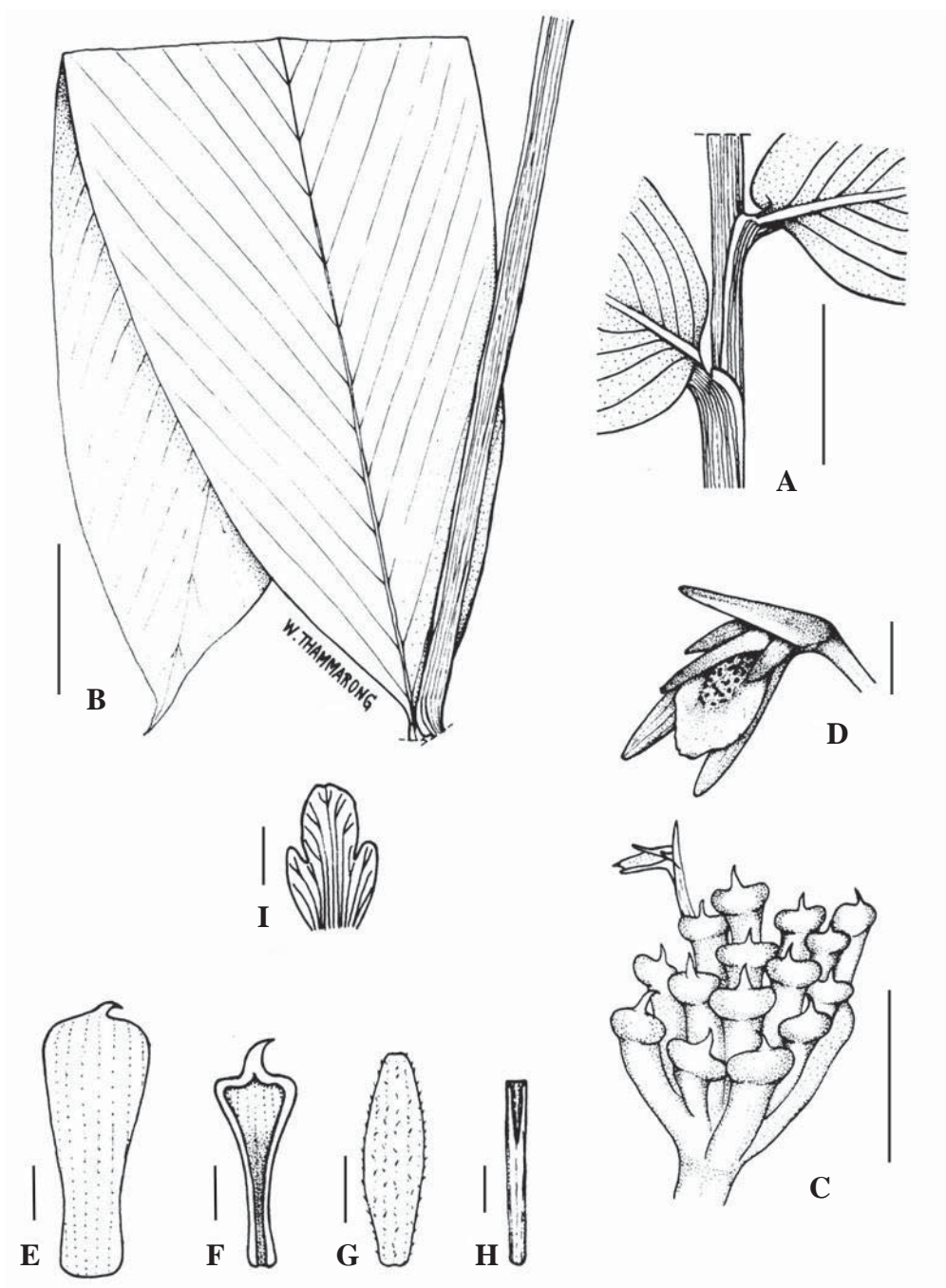


FIGURE 4. *Zingiber cornubracteatum* Triboun & K. Larsen. A. part of leafy shoot; B. leaf and sheath; C. inflorescence; D. flower; E. outer bract; F. inner bract; G. bracteole; H. calyx; I. labellum (Scale bars: A.-C. = 5 cm, D.-I. = 1 cm).

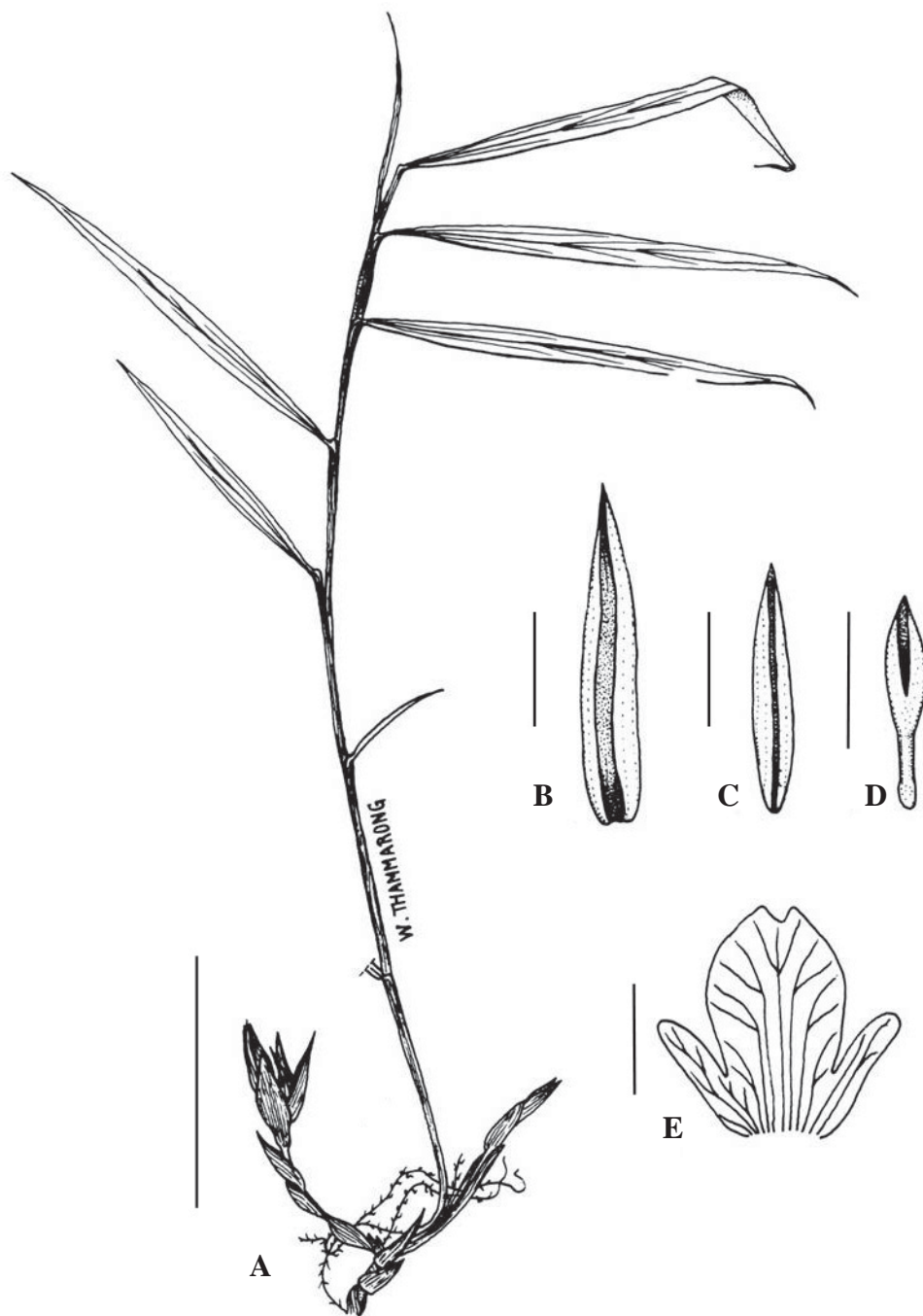


FIGURE 5. *Zingiber isanense* Triboun & K. Larsen. A. habit; B. bract; C. bracteole; D. calyx with ovary; E. labellum (Scale bars: A. = 5 cm, B.-E. = 1 cm).

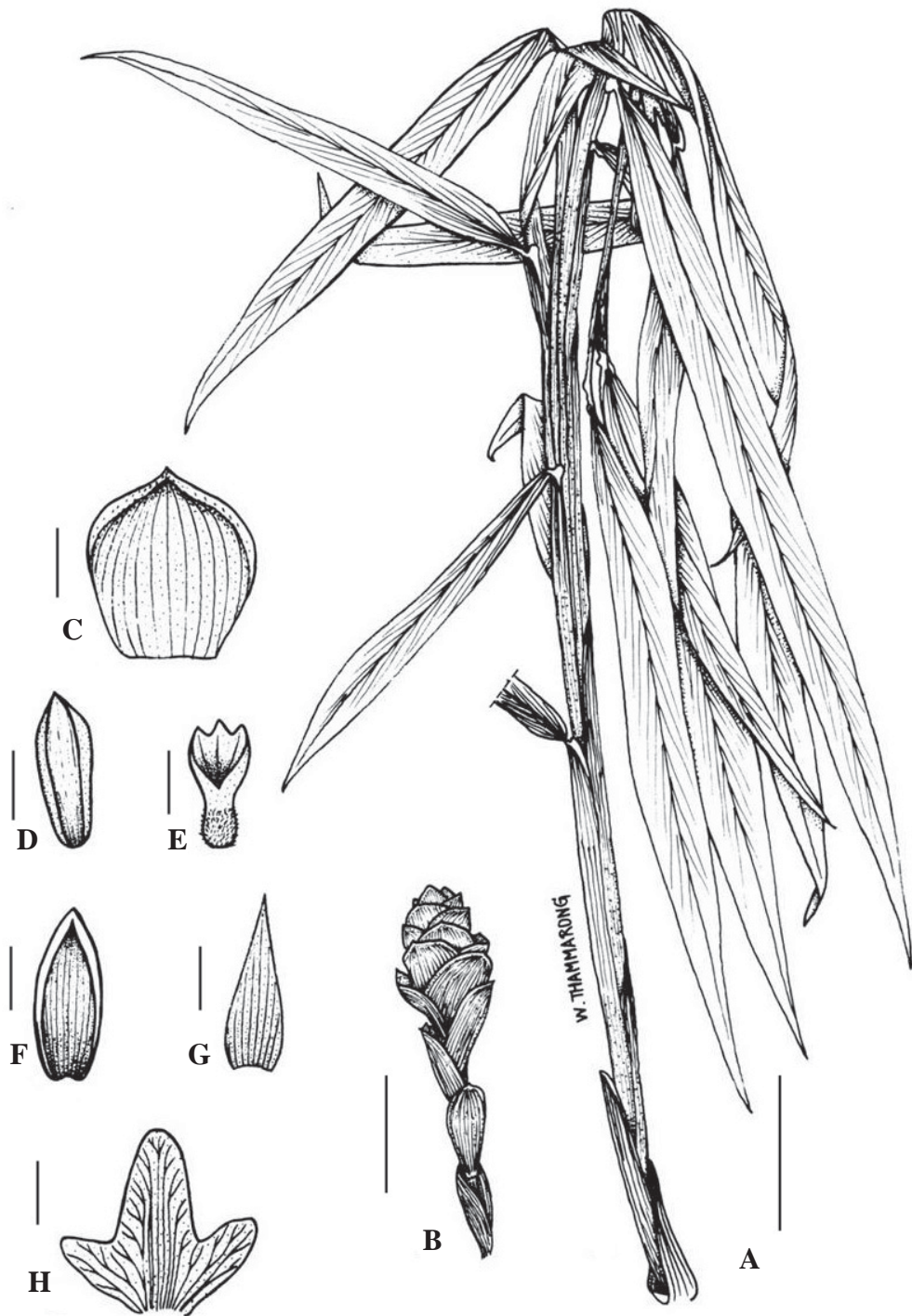


FIGURE 6. *Zingiber parishii* Hook.f. subsp. *phuphanense* Triboun & K. Larsen. A. leafy shoot; B. inflorescence; C. bract; D. bracteole; E. calyx with ovary; F. dorsal lobe of corolla; G. lateral lobe of corolla; H. labellum (Scale bars: A.-B. = 5 cm, C.-H. = 1 cm).



FIGURE 7. *Zingiber pyroglossum* Triboun & K. Larsen. A. part of leafy shoot; B. leaf; C. inflorescence; D. bract; E. bracteole; F. calyx with ovary; G. dorsal lobe of corolla; H. lateral lobe of corolla; I. labellum (Scale bars: A.-C. = 5 cm, D.-I. = 1 cm).

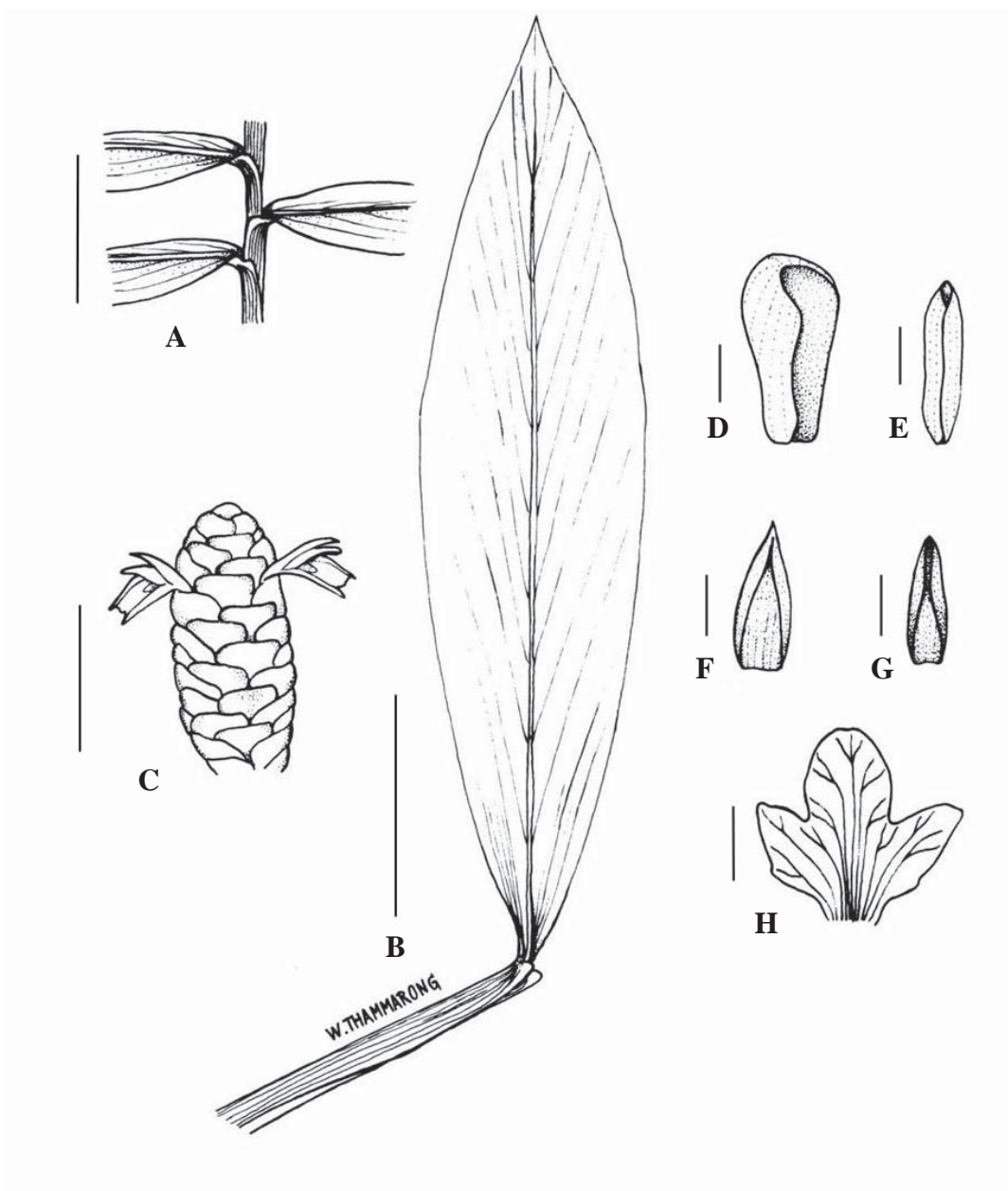


FIGURE 8. *Zingiber sadakornii* Triboun & K. Larsen. A. part of leafy shoot; B. leaf and sheath; C. inflorescence; D. bract; E. bracteole; F. dorsal lobe of corolla; G. lateral lobe of corolla; H. labellum (Scale bars: A.-C. = 5 cm, D.-H. = 1 cm).

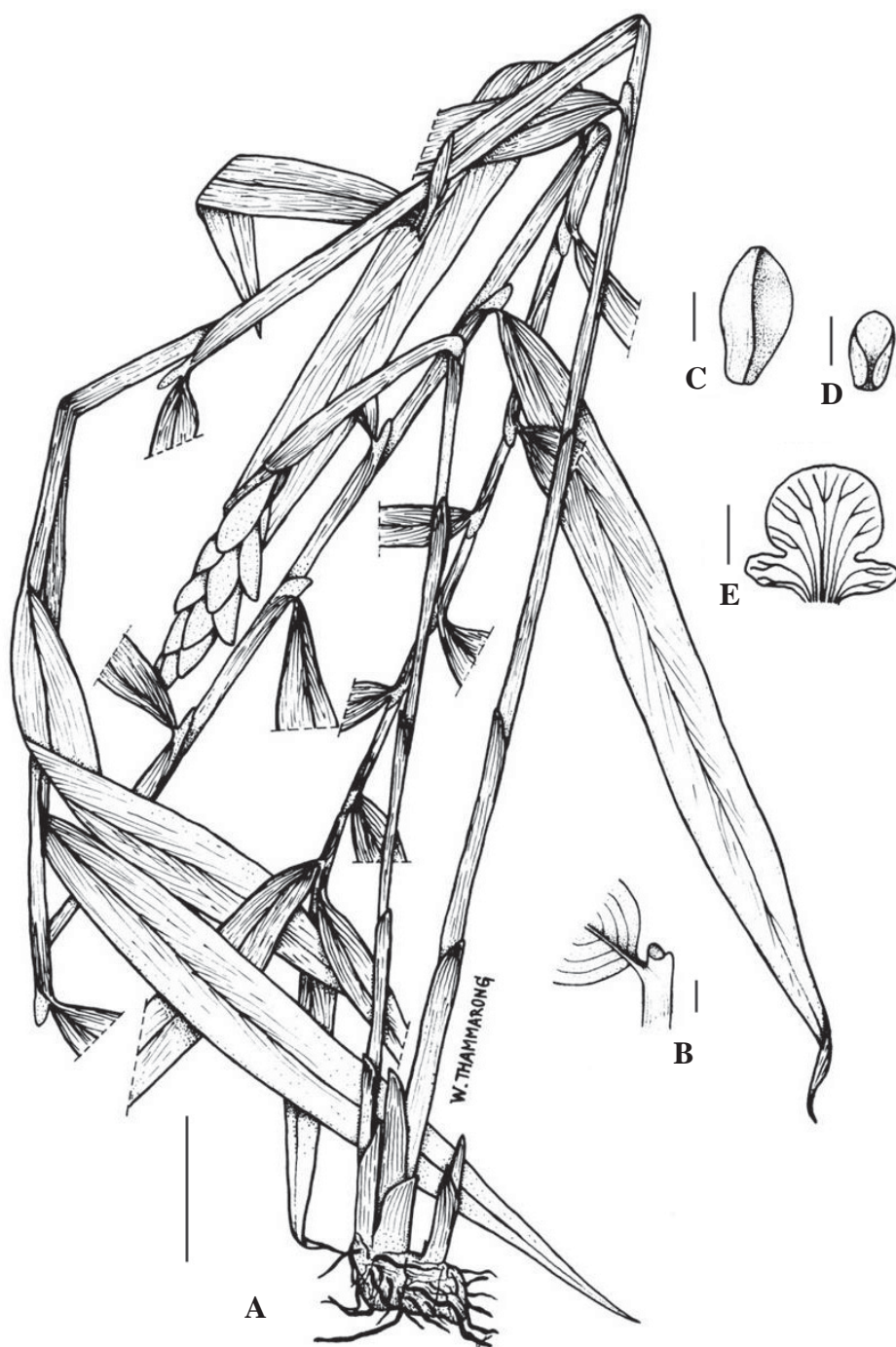


FIGURE 9. *Zingiber tenuiscapus* Triboun & K. Larsen. A. habit; B. part of leaf and ligule; C. bract; D. bracteole; E. labellum (Scale bars: A. = 5 cm, B.-E. = 1 cm).

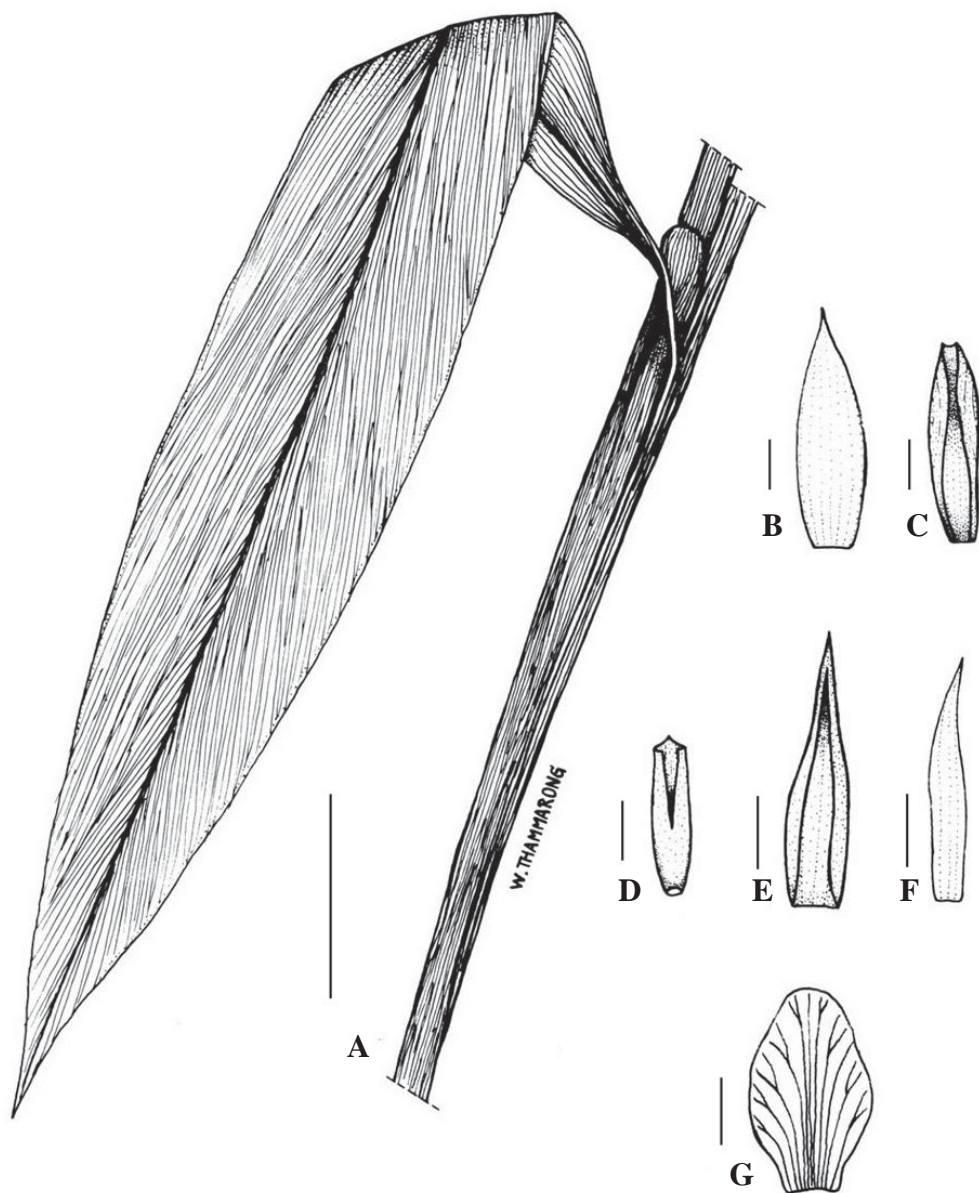


FIGURE 10. *Zingiber vittacheilum* Triboun & K. Larsen. A. leaf and sheath; B. bract; C. bracteole; D. calyx; E. dorsal lobe of corolla; F. lateral lobe of corolla; G. labellum (Scale bars: A. = 5 cm, B.-G. = 1 cm).



FIGURE 11. A. *Z. brachystachys* Triboun & K. Larsen; B. *Z. callianthus* Triboun & K. Larsen; C. *Z. chantaranonthaii* Triboun & K. Larsen; D.-E. *Z. cornubracteatum* Triboun & K. Larsen; F. *Z. isanense* Triboun & K. Larsen; G. *Z. parishii* Hook.f. subsp. *phuphanense* Triboun & K. Larsen, H.-I. *Z. pyroglossum* Triboun & K. Larsen; J. *Z. sadakornii* Triboun & K. Larsen; K. *Z. tenuiscapus* Triboun & K. Larsen; L. *Z. vittacheilum* Triboun & K. Larsen.