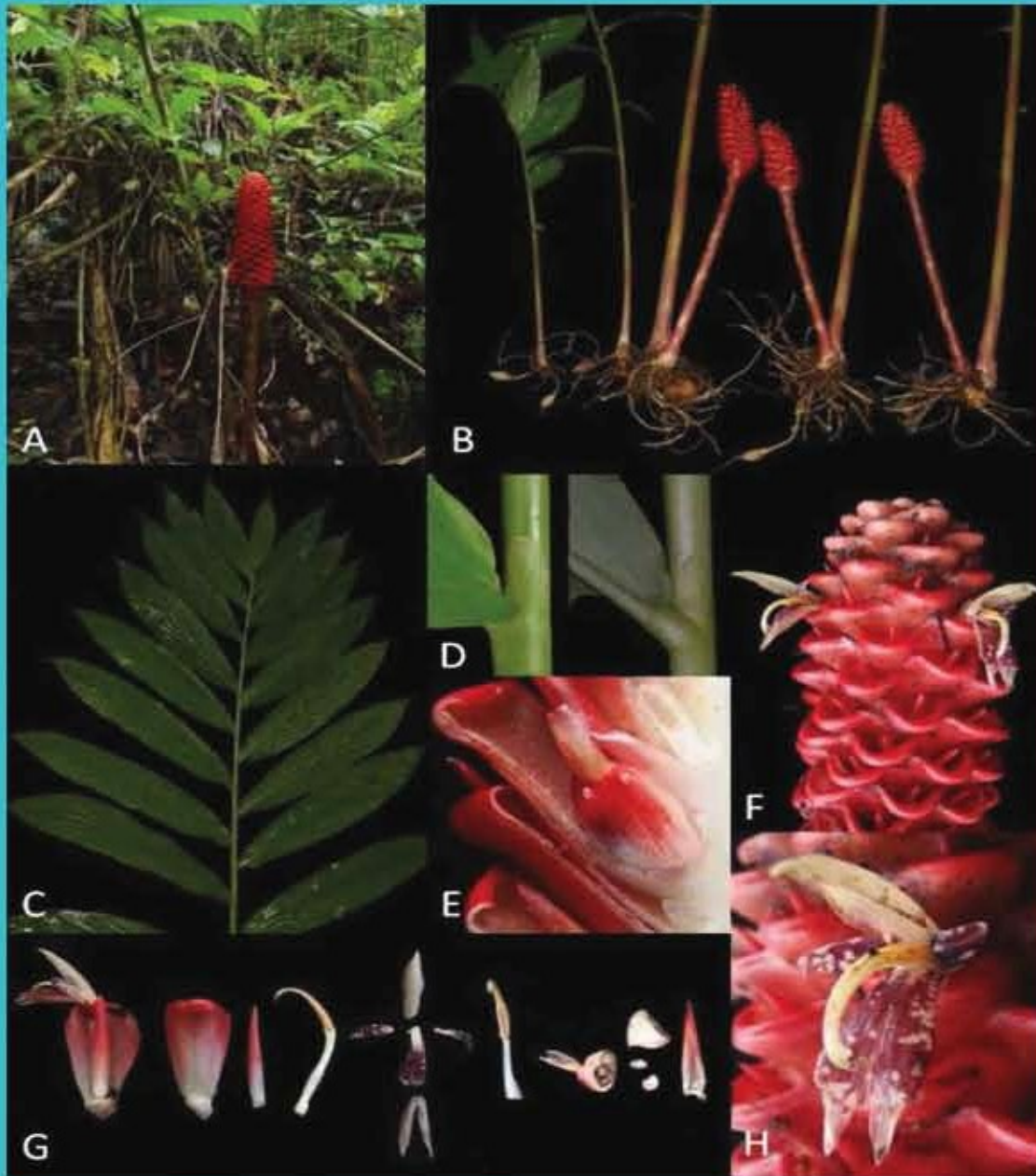




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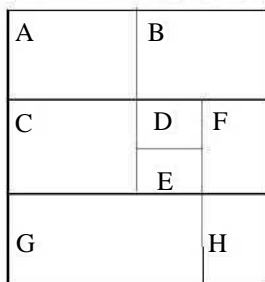
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Cover images: *Zingiber engganoensis* Ardiyani. A. Habit B. Leafy shoot and the inflorescence showing rhizomes, roots and root-tuber C. Leaves D. Ligule and swollen petiole E. Dissection of inflorescence showing fruit F. Spike and flowers G. Dissection of flowers and fruits showing bract, bracteole, two lateral staminodes, two petal lobes, labellum, and the four appendages of the anther H. Flower. Source of materials: E190 (BO). Photo credits: B, C, D by Arief Supriatna. A, E, F, G, H by Marlina Ardiyani.

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TWO NEW SPECIES OF *ALPINIA* (ZINGIBERACEAE) FROM SULAWESI, INDONESIA

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ABSTRACT

ARDI, W. H. & ARDIYANI, M. 2015. Two new species of *Alpinia* (Zingiberaceae) from Sulawesi, Indonesia. Reinwardtia 14(2): 311 – 316. — Two new species of *Alpinia* section *Alpinia* subsection *Cenolophon*, *Alpinia macrocrista* Ardiyani & Ardi, and *Alpinia pusilla* Ardi & Ardiyani, from Sulawesi, Indonesia, are described. Colour plates are provided, and four-loci DNA barcodes have been generated for the purpose of identification. Tabulated key to species of *Alpinia* subsection *Cenolophon* in Sulawesi is also presented.

Key Words: *Alpinia*, endemic, ginger, new species, subsection *Cenolophon*, Sulawesi, taxonomy, Zingiberaceae.

ABSTRAK

ARDI, W. H. & ARDIYANI, M. 2015. Dua jenis baru *Alpinia* (Zingiberaceae) dari Sulawesi, Indonesia. Reinwardtia 14(2): 311 – 316. — Dua jenis baru *Alpinia* (Zingiberaceae) dari *Alpinia* seksi *Alpinia* subseksi *Cenolophon*, *Alpinia macrocrista* Ardiyani & Ardi sp. nov., dan *Alpinia pusilla* Ardi & Ardiyani sp. nov., dari Sulawesi, Indonesia telah dipertelakan. Gambar berwarna dari kedua jenis baru tersebut, dan empat lokus DNA barcode telah dihasilkan untuk keperluan identifikasi.

Kata kunci: *Alpinia*, endemik, jahe, jenis baru, subseksi *Cenolophon*, Sulawesi, taksonomi, Zingiberaceae.

INTRODUCTION

Alpinia is a large genus consisting of about 230 species distributed across South Asia to Australia (Kress *et al.*, 2005). *Alpinia* subsection *Cenolophon* (Blume) R. M. Sm. was proposed by Smith (1990), adopting the original generic name of the type species, *Cenolophon rubrum* Blume (1823; = *Alpinia rubricaulis* K. Schum.). The subsection is characterized by erect and branchless inflorescences which produce flowers singly, never in cincinni, and the absence of bracteoles (occasionally) minute and caducous very early. Phylogenetic analysis shows that the group is embedded in Clade Zerumbet-IV showing an affinity with *Alpinia zerumbet* (Pers.) B. L. Burt & R. M. Sm. (Kress *et al.*, 2005). As *Alpinia* is not monophyletic and the type of the genus, *A. galanga* (L.) Willd., is not included in the Zerumbet clade, a new generic name is expected to be given to this in the future.

Alpinia subsection *Cenolophon* is a relatively small group which belongs to subgenus *Alpinia* section *Alpinia* and comprises about 24 species distributed in southern China, Indo-China, Peninsular Malaysia, and Indonesia. In Indonesia, they are restricted to Sulawesi, Borneo and the Sula Islands (Sanana). Five endemic species belonging to this subsection are found in Sulawesi, namely *Alpinia orthostachys* K. Schum., *A. hulstijnii* Valetton, *A. padacanca* Valetton ex K. Heyne, *A. rubricaulis* K.

Schum., *A. versicolor* K. Schum. and *A. warburgii* K. Schum.

During an inventory of the gingers in Bogor Botanic Garden, five species of *Alpinia* subsection *Cenolophon* were recorded, namely *A. padacanca*, *A. rubricaulis*, *A. warburgii* and two species which proved to be new to science. The new species which we describe as *Alpinia macrocrista* below had originally been collected sterile in West Sulawesi Province while *Alpinia pusilla*, also collected sterile, came from Natali Baru Village, North Sulawesi Province. Both were cultivated at Bogor Botanic Gardens until they flowered and are described formally here.

The two new species increase the number of *Alpinia* subsection *Cenolophon* in Sulawesi to seven species which are all endemic. Descriptions of the new species are presented and key morphological characters separating the seven species of the subsection are tabulated in the present paper.

MATERIALS AND METHODS

The morphology of the new species was characterized from living plants collected at Bogor Botanic Gardens. Detailed morphological measurements were made using a ruler and a calibrated eyepiece under a dissecting microscope. Herbarium specimens to serve as types were taken from plants

cultivated in the Garden (see Taxonomic Treatment).

DNA extraction, amplification and sequencing of four barcoding regions, namely *rbcL*, *matK*, the intergenic spacer between *trnH* and *psbA*, and ITS2 were carried out using published primers under standard conditions (see Kress and Erickson, 2007). GenBank accession numbers for the four-locus barcode regions are summarized in Table 1.

TAXONOMIC TREATMENT

1. *Alpinia macrocrista* Ardiyani & Ardi, *spec. nov.*

— Type: Indonesia, Cultivated in Bogor Botanic Garden from vegetative material collected in the wild (Mamuju District, Inhutani Palade, West Sulawesi Province, Indonesia) 14 iv 2013, *Wisnu Ardi & Marlina Ardiyani WI 80* (BO; isotype BOHB). Plate 1.

The new species resembles *Alpinia macrostephana* (Baker) Ridl. in the flowers and anther crest shape and size, but differs consistently by the shorter leafy shoots (up to 80 cm tall), subsessile leaflets, smaller leaf size (21.5–34 × 4–8 cm), and symmetrically cuneate leaf base. In contrast, in *Alpinia macrostephana* the length of leafy shoots are up to 2.5 m tall, petioles up to 11 cm long, leaf size 60 × 9 cm and strongly asymmetric, cordate leaf base. *A. macrocrista* differs from all other species of *Alpinia* subsection *Cenolophon* in Sulawesi by its subsessile coriaceous lamina, large flowers (> 4.5 cm long) and large, broadly ovate anther crest which is more than twice the length of the anther (10 × 12–14 mm).

Description. Perennial herb. *Rhizome* ca. 10 mm diameter, scales cream greenish externally, 2–3 cm long. Leafy shoots 4 cm apart forming a loose clump of few shoots, shoot 60–80 cm long with 6–11 leaves, green, base slightly swollen; leaf sheath green with red-brown margin. *Ligule* 5–10

mm long, red-brown, margin sparsely ciliate, apex deeply bilobed; leaf epetiolate or sessile. *Leaves* elliptic-oblong, 21.5–34 × 4–8 cm, glabrous on both surfaces, adaxially green, shiny, abaxially pale green, margin entire from the middle part to the base, hairy towards the apex, slightly undulating, base cuneate, apex acuminate. *Inflorescence* terminal, racemose, flower bearing part 13 cm long, densely set with 10–20 flowers, 1–2 flowers open at a time. *Peduncle* 2–2.5 cm long, pubescent, bracts absent. *Flowers* 5–5.5 cm long. *Pedicel* ca. 1–2 mm long, red. *Calyx* reaching shorter than corolla, tubular, up to 19–23 mm long, apex three-lobed, split unilaterally, pubescent, white. *Corolla* tube 15–17 mm long, white; corolla lobes oblong, reaching shorter than filament, pubescent, white tinged pink, dorsal lobe oblong mucronate, 2.2–2.5 × 0.5–1.0 cm, lateral lobes 2.4–2.7 × 0.7–1.0 cm. *Labellum* broadly obovate, 3.1–3.3 × 2.5–2.8 cm, adaxially pink with two broad, yellowish green lines between the middle band and red stripes on the middle band, apex tinged yellow, margin entire from base to the middle part and crenate from the middle part to the apex, apex obtuse. *Stamen* 2.1–2.7 cm long, pinkish, outer surface sparsely covered with glandular hairs. *Filament* 16–20 mm long. *Anther* 5–7 × 4–4.5 mm, pink; anther crest broadly obovate, apex crenate, 10 × 12–14 mm. *Lateral staminodes* subulate, 10–15 mm long, green with red blotches. *Ovary* spherical, pale green, tomentose, ca. 2–4 × 4 mm. *Style* 4–4.5 cm long, glabrous. *Stigma* funnel-shaped. *Nectary gland* entire, split to the base in one side close to the base of the style, 2–3 mm long, clasping the base of the style. *Fruit* and seeds unknown.

Distribution. At present this species is only known from the type locality in West Sulawesi and is probably endemic to Sulawesi.

Etymology. The specific epithet is derived from

Table 1. Voucher information and Genbank accession numbers for *Alpinia macrocrista* and *A. pusilla*

Species	Gene region	Genbank accession number	Voucher (Herbarium location)
<i>Alpinia macrocrista</i>	<i>rbcL</i>	KT280458	WI 80 (BO, HBBO)
	<i>matK</i>	KT280460	WI 80 (BO, HBBO)
	<i>trnH-psbA</i>	KT280462	WI 80 (BO, HBBO)
	ITS2	KT280464	WI 80 (BO, HBBO)
<i>A. pusilla</i>	<i>rbcL</i>	KT280459	WI 81 (BO, HBBO)
	<i>matK</i>	KT280461	WI 81 (BO, HBBO)
	<i>trnH-psbA</i>	KT280463	WI 81 (BO, HBBO)
	ITS2	KT280465	WI 81 (BO, HBBO)

macro (Latin – large) and *crista* (Latin - crested) referring to the large anther crest.

Phenology. *Alpinia macrocrista* has been observed in flower at Bogor Botanic Garden from May to June.

Conservation status. Data deficient (DD). *Alpinia macrocrista* is known from one collection from a single location which could not be georeferenced with certainty. Further exploration is required to assess the current range of the species on the island.

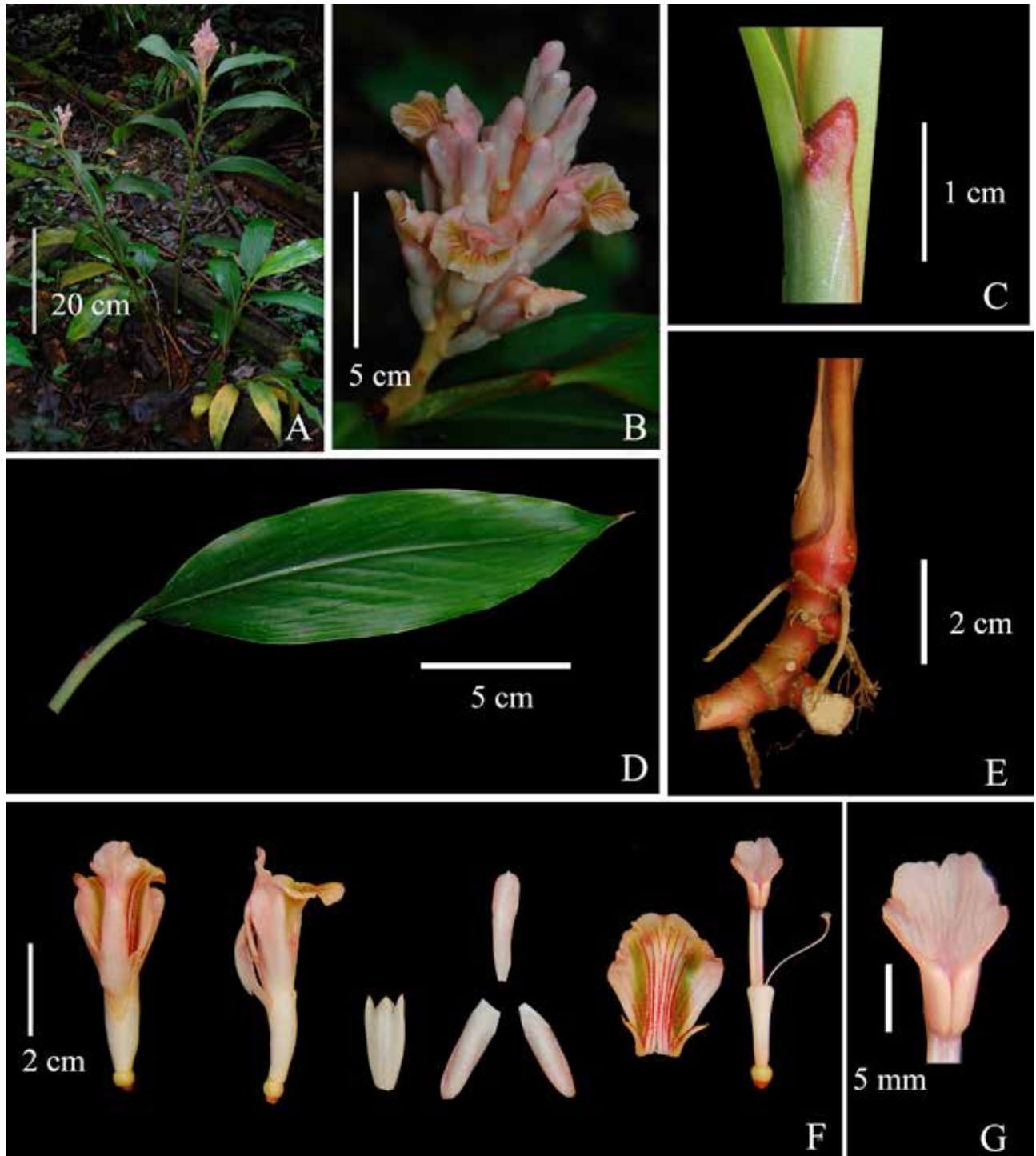


Plate 1. *Alpinia macrocrista* Ardiyani & Ardi. A. Habit in cultivation at the BBG B. Inflorescence C. Ligule D. Leaf E. Rhizome and base of leafy shoot F. Two whole flowers and one dissected showing calyx, corolla lobes, labelum with lateral staminodes, ovary with corolla tube, stamen and pistillum G. Anther. Photographs of WI 80 (BO) by Wisnu Ardi.

Notes. At first, this species was misidentified in the Garden as *Amomum abendanoni*, which was a *nomen nudum* of Valeton. A specimen of *Amomum abendanoni* was found in Herbarium Bogoriense but the species had never been published. When the living material in Bogor Botanic Garden flowered, we could identify it as a species of *Alpinia*.

2. *Alpinia pusilla* Ardi & Ardiyani, *spec. nov.* — Type: Indonesia, Cultivated in Bogor Botanic Garden from vegetative material collected in the wild (Natali Baru Village, North Sulawesi

Province, Indonesia) 14 iv 2013, *Wisnu Ardi & Marlina Ardiyani WI 81* (BO, isotype BOHB). Plate 2.

This species differs from all other species of *Alpinia* subsect. *Cenolophon* in its considerably small stature, few-flowered inflorescence and relatively large size flower.

Description. Perennial herb. *Rhizome* 5–8 mm diameter, scales cream greenish externally, 2–3 cm long. *Leafy shoots* 3–4 cm apart forming a dense clump of up to 10 shoots, shoot 25–30 cm

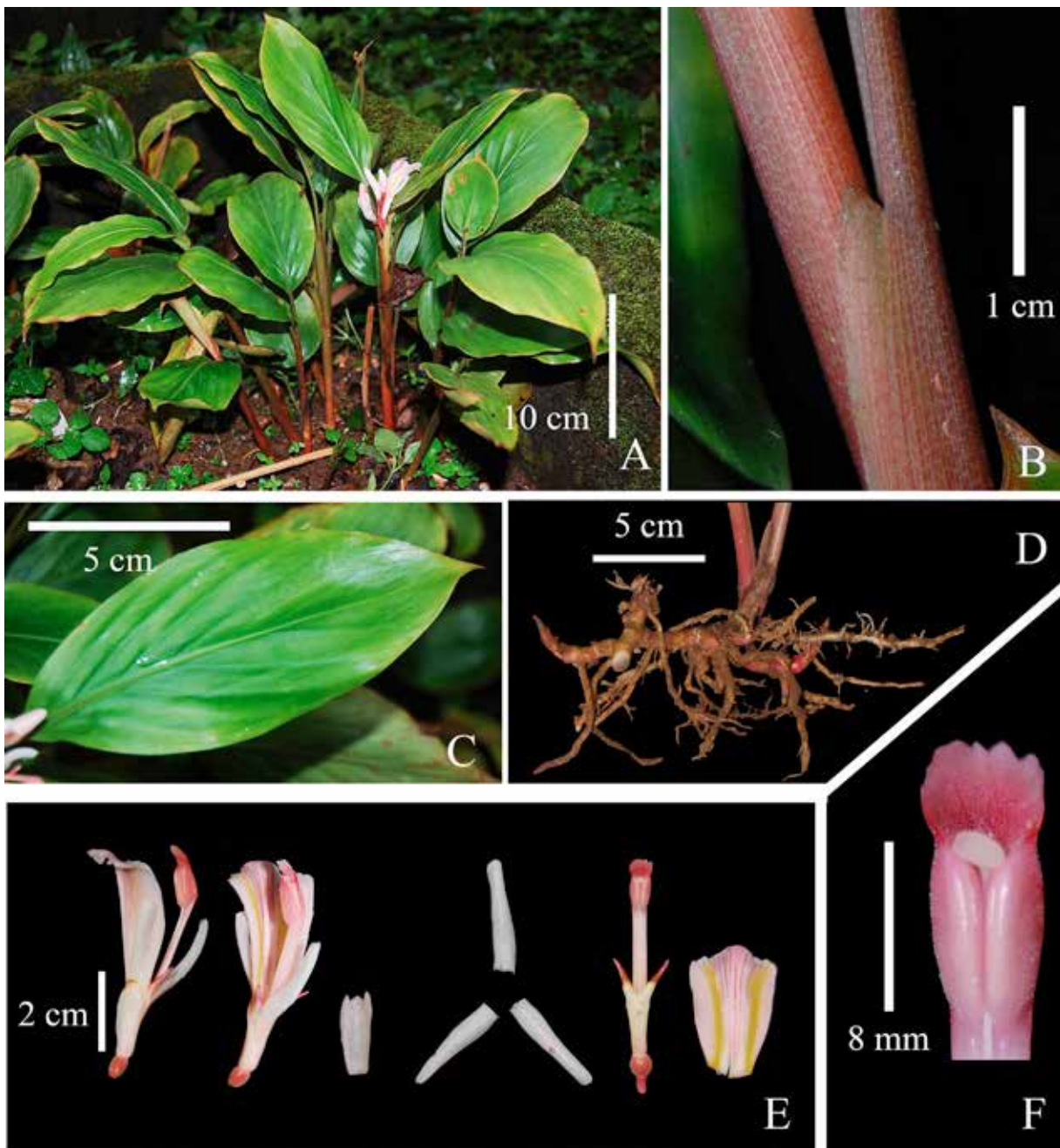


Plate 2. *Alpinia pusilla* Ardi & Ardiyani. A. Habit in the cultivation in the BBG B. Ligule C. Lamina D. Rhizome, roots and two leafy shoot bases E. Two whole flowers and one dissected showing calyx, corolla lobes, ovary with corolla tube, lateral staminodes, stamen and pistillum, labellum F. Anther. Photographs of WI 81 (BO) by Wisnu Ardi.

long with 3–5 leaves, brownish to red, pubescent. *Ligule* 3–5 mm long, reddish to brownish, margin ciliate, apex bilobed. *Petiole* 1.5–4.5 cm long, green or red, glabrous. *Leaves* elliptic, 8.5–15 × 3–8 cm, pubescent on both surfaces, adaxially green, abaxially pale green, slightly plicate, margin entire, base slightly oblique, sub-rounded, apex acuminate. *Inflorescence* terminal, a simple raceme, branchless, flower-bearing part 6–7.5 cm long with 4–5 well-spaced flowers, 1–2 open at a time. *Peduncle* 1–2 cm long, pubescent. *Flowers* 4.0–4.5 cm long. *Pedicel* ca. 1–2 mm long, red. *Calyx* reaching shorter than corolla, tubular, up to 19 mm long, apex three-lobed, split unilaterally, white pinkish, pubescent. *Corolla* tube 11–14 mm long, cream; corolla lobes oblong, reaching shorter than filament, white, pubescent, dorsal lobe oblong 1.6–2.5 × 0.4–0.6 cm, lateral lobes 1.7–2.4 × 0.5–0.6 cm. *Labellum* obovate, curved outward 2.8–3.3 × 1.8–2.3 cm, adaxially white pinkish with red stripes in between of two yellow bands, margin entire, apex three-lobed. *Stamen* 3.2–3.7 cm long, pink, outer surface covered with glandular hairs. *Filament* 27–30 mm long. *Anther* 6–7 × 3.5–4 mm, pink with red strips on the upper surface, pink creamy underneath; anther crest ovate, apex crenulate, 5 × 5.5–6 mm. *Lateral staminodes* subulate, 7–10 mm long, red. *Ovary* spherical, dark red, tomentose, ca. 4–4.5 mm long, 3–3.5 mm diameter; style glabrescent; stigma 4 mm long, funnel-shaped; nectary gland entire, split to the base in one side close to the base of the style, 2–3 mm long.

Distribution. At present *Alpinia pusilla* is only known from the type locality, endemic to North Sulawesi.

Etymology. The specific epithet is derived from *pusillus* (Latin – very small), referring to the small stature of the plant which, at only 30 cm tall, is the smallest of all the species of subsection *Cenolophon*.

Phenology. *Alpinia pusilla* has been observed in flower at Bogor and Cibodas Botanic Gardens from May to June.

Conservation status. Data deficient (DD). *Alpinia pusilla* is known from one collections from single location which could not be georeferenced with certainty. Further exploration is required to assess the current range of the species on the island.

Notes. *A. pusilla* is distinct from all other species not only in its short leafy shoots but also in the number of flowers per inflorescence and the size of the flower. Even if cultivation outside its natu-

rally habitat may have prevented it from growing to its maximum size, it will still be easy to distinguish it even if taller plants would be collected in nature in the future.

Notes on *Alpinia* subsection *Cenolophon* in Sulawesi

The number of the member of *Alpinia* subsection *Cenolophon* in Sulawesi reaches seven species which are all endemic. This number may increase as new species are likely to be found. Table 1 shows the comparison of morphological characters of *Alpinia* subsect. *Cenolophon*. The leafy shoot of *A. pusilla* is up to 30 cm long, while all other species reach more than 50 cm. The number of flowers per inflorescence vary from 4 flowers in *A. pusilla* to 40 flowers in *A. warburgii*. The flower size also vary from less than 4 cm to 5 cm or more. The largest flowers are found in *A. macrocrista*. The size and the shape of the labellum vary, *A. pusilla* has an obovate labellum with entire margin which is relatively big (3.3 × 2.3 cm) compared to the other species from Sulawesi. *Alpinia macrocrista* is unique and distinct from others because of its sessile and coriaceous leaf blades, large flower (5–5.5 cm long) and conspicuously large, broadly obovate anther crest (10 × 12–14 mm) compared to other species.

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Table 2. Comparison of morphological characters of *Alpinia* spp. in *Alpinia* subsect. *Cenolophon* in Sulawesi

	<i>A. huljstini</i>	<i>A. orthostachys</i>	<i>A. padacanca</i>	<i>A. rubricaulis</i>	<i>A. versicolor</i>	<i>A. warburgii</i>	<i>A. pusilla</i>	<i>A. macrocrista</i>
Leafy shoot	0.4-0.6 m	2 m	0.9 m	1.6 m	3 m	0.7 m	0.3 m	0.6-0.8 m
Petiole; petiole length	Petiolate; 2-7 cm	Petiolate; 8 mm	Petiolate; 1.5-4 cm	Petiolate; 1-5 cm	Petiolate; 2 cm	Petiolate; 1.2 cm	Petiolate; 1.5-4 cm	Subsessile
Shape of leaf	Ovate-oblong	Oblong	Elliptic-oblong	Elliptic	Elliptic-oblong	Narrowly oblong	Elliptic	Elliptic-oblong
Size of leaf	20-40 × 7-8 cm	30-35 × 7.5 cm	12-24 × 4-8 cm	18-40 × 8.5-12 cm	50 × 14 cm	40 × 5 cm	8.5-15 × 3-8 cm	21-34 × 4-8 cm
Number of flower per inflorescence	-	-	4-10	17-25	-	14-40	3-5	10-20
Flower size (length)	3-4 cm	-	3-3.5 cm	3.2-3.5 cm	-	3-3.5 cm	4-4.5 cm	5-5.5 cm
Shape of labellum	Obovate	Obovate	Broadly obovate	Obovate	Obovate	Obovate	Obovate	Broadly obovate
Size of labellum	32 × 20 mm	-	22-24 × 19-21 mm	22-24 × 14-16 mm	25 mm long	14 mm long	33 × 23 mm	31-33 × 25-28 mm
Anther crest	Ovate	Ecristate	Ovate	Ovate	-	Ovate	Ovate	Broadly obovate
Anther crest size	4 mm long	-	3 × 2.5 mm	3-4 × 2.5-3 mm	-	1.5 mm long	6-7 × 3.5 mm	10 × 12-14 mm



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