LIPI

REINWARDTIA

A JOURNAL ON TAXONOMIC BOTANY, PLANT SOCIOLOGY AND ECOLOGY

ISSN 0034 – 365 X | E-ISSN 2337 – 8824 | Accredited 10/E/KPT/2019

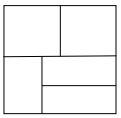
2019 18 (1)

REINWARDTIA

A JOURNAL ON TAXONOMIC BOTANY, PLANT SOCIOLOGY AND ECOLOGY

Vol. 18 (1): 1 – 50, June 28, 2019

Correspondence on editorial matters and subscriptions for Reinwardtia should be addressed to:
HERBARIUM BOGORIENSE, BOTANY DIVISION,
RESEARCH CENTER FOR BIOLOGY– INDONESIAN INSTITUTE OF SCIENCES
CIBINONG SCIENCE CENTER, JLN. RAYA JAKARTA – BOGOR KM 46,
CIBINONG 16911, P.O. Box 25 CIBINONG
INDONESIA
PHONE (+62) 21 8765066; Fax (+62) 21 8765062
E-MAIL: reinwardtia@mail.lipi.go.id
http://e-journal.biologi.lipi.go.id/index.php/reinwardtia



Cover images: *Begonia mattampensis* Ardi & D.C.Thomas *spec. nov*. (§ *Petermannia*). Top left: Habit. Top right: Stipules. Below left: Male inflorescence. Middle: Male flower & female flower. Below right: Fruit & ovary cross section (middle part). Photos: W.H. Ardi.

The Editors would like to thank all reviewers of volume 18(1):

Eizi Suzuki, Kagoshima University, Japan
Mark Hughes, Royal Botanic Garden Edinburgh, United Kingdom
Frédéric Danet, Jardin botanique de la Ville de Lyon, France
Barry J. Conn, School of Life and Environmental Sciences, The University of Sydney, Australia
Michele Rodda, Singapore Botanic Gardens, Singapore
Mark Newman, Royal Botanic Garden Edinburgh, United Kingdom

REINWARDTIA
Vol. 18. No. 1. pp: 31–42
DOI: 10.14203/reinwardtia.v18i1.3729

AN UPDATE OF THE GENUS *ETLINGERA* (ZINGIBERACEAE) IN SULAWESI INCLUDING THE DESCRIPTION OF A NEW SPECIES

Received April 25, 2019; accepted May 15, 2019

MARLINA ARDIYANI
Herbarium Bogoriense, Botany Division, Research Center for Biology-LIPI, Cibinong Science Center, Jln. Raya Jakarta-Bogor Km. 46, Cibinong 16911, Bogor, Indonesia. Email: marlina.ardiyani@gmail.com

AXEL D. POULSEN
Royal Botanic Garden Edinburgh, 20A Inverleith Row, Edinburgh EH3 5LR, Scotland, United Kingdom.
Email: axel@dalbergpoulsen.com

ABSTRACT
ARDIYANI, M. & POULSEN, A. D. 2019. An update of the genus *Etlingera* (Zingiberaceae) in Sulawesi including the description of a new species. *Reinwardtia* 18(1): 31–42. — A new species, *Etlingera mamasarum* A.D.Poulsen & Ardiyani was discovered in Gunung Gandangdewata National Park, West Sulawesi. It is similar to *Etlingera flexuosa* A.D.Poulsen but differs in having flowers which are shorter than the bracts. It is described, illustrated and DNA barcoded. Three additional species (*Etlingera cylindrica* A.D.Poulsen, *E. grallata* A.D.Poulsen, *E. spinulosa* A. D.Poulsen) were documented in this national park and represent new records for West Sulawesi Province. We also update information on the morphology of *E. calobates* A.D.Poulsen, correct an error in the typification of *Alpinia chrysogynia* (K.Schum.) K.Schum. and discuss the distribution of the Achasma Group of *Etlingera* east of Wallace's Line.

Key words: DNA barcoding, *Etlingera calobates, E. mamasarum*, *E. megalocheilos,* Indonesia, Zingiberales.

ABSTRAK
ARDIYANI, M. & POULSEN, A. D. 2019. Perbaruan data marga *Etlingera* (Zingiberaceae) di Sulawesi termasuk pertelaan jenis baru. *Reinwardtia* 18(1): 31–42. — Jenis baru *Etlingera mamasarum* A.D.Poulsen & Ardiyani telah ditemukan di Taman Nasional Gunung Gandangdewata, Sulawesi Barat. Jenis baru ini mirip dengan *Etlingera flexuosa* A.D.Poulsen tetapi berbeda dalam karakter bunga yang lebih pendek dari braktea. Jenis baru tersebut dipertelakan, diilustrasikan dan dilakukan barkoding DNA. Tiga jenis lainnya (*Etlingera cylindrica* A.D.Poulsen, *E. grallata* A.D.Poulsen, *E. spinulosa* A.D.Poulsen) telah didokumentasikan dan merupakan rekaman baru untuk provinsi Sulawesi Barat. Informasi morfologi *E. calobates* A.D.Poulsen telah diperbaharui, kesalahan tipifikasi *Alpinia chrysogynia* (K.Schum.) K.Schum. telah dikoreksi dan informasi persebaran *E. megalocheilos* (Griff.) A.D.Poulsen di timur garis Wallace didiskusikan dalam tulisan ini.

Kata Kunci: Barkoding DNA, *Etlingera calobates, E. mamasarum*, *E. megalocheilos,* Indonesia, Zingiberales.

INTRODUCTION

A recent revision of the genus *Etlingera* (Zingiberaceae) in Sulawesi by Poulsen (2012) included 48 taxa. The focus of that study was to revisit type localities in Sulawesi in 2008–2009 to obtain a better understanding of the morphology of the species. As several types, mostly made by Sarasin & Sarasin, and deposited in Berlin, had been lost during the Second World War, several neotypes were designated by making use of the 80 collections made during that fieldwork (Poulsen, 2012).

In 2016, an expedition to Gunung Gandangdewata, West Sulawesi was carried out by the Research Center for Biology, the Indonesian Institute of Sciences (LIPI) to conduct a biodiversity inventory (Achmadi *et al.,* 2018). West Sulawesi Province does not contain any type localities of gingers and has been poorly explored. As a result of the expedition, useful ginger collections were made including a species of *Etlingera* that did not key out in Poulsen (2012). The present paper includes a full description of this new species as well as sequencing its DNA barcoding markers *rbc*L, *mat*K, ITS and *trn*H-*psb*A. In addition, some new records from West Sulawesi are added, and the fruit of *E. calobates* recently collected by Wisnu Ardi at Nokilalaki is described. Moreover, the distribution of *E. megalocheilos* is discussed in relation to the new publication of Trimanto and Hapsari (2018).

MATERIALS AND METHODS

Four DNA barcode regions, *rbc*L, *mat*K, the nuclear Internal Transcribed Spacer (ITS), and *trn*H-*psb*A were successfully sequenced from the Type material and deposited in the NCBI GenBank (Table 2). DNA extraction, amplification and

sequencing followed Kress *et al.* (2002) and Kress & Erickson (2007). Morphological observations were made using living collections in the wild and herbarium specimens in BO and E. Measurements were made using a ruler and a calibrated eye piece under a dissecting microscope.

RESULTS AND DISCUSSION

1. **Etlingera mamasarum** A.D.Poulsen & Ardiyani, *spec. nov.*—Type: Indonesia, West Sulawesi Province, Mamasa, Rantepongko Village, Gunung Gandangdewata, 02°52'53.1"S, 119°22'57.0"E, 1,642 m, flowering and fruiting, 21 April 2016, *M. Ardiyani with W. Santoso, Obet, Ama, A. Kartonegoro, D. Wulansari Sulbar 004* (Holotype: BO!; iso E!), Fig. 1, 2 & 3. DNA barcoding in Table 2.

Diagnosis. Similar to *Etlingera flexuosa* A.D. Poulsen but differs in the length of the flowers which are shorter than the bracts, the longer petiole (45–55 mm in *E. mamasarum vs* 10–40 mm in *E. flexuosa*), the length to width ratio of the lamina (3.5–4 *vs* 4.2–5.6), the shape of the base of the lamina (rounded to cordate *vs* cuneate to auriculate), the size of the fertile bract (5.5−7 × 2.5−3.3 cm *vs* 2–5 × 0.6–2.5 cm), the position of the pedicel (4 mm stalk above the bracteole *vs* 1–4 mm below bracteole), the longer bracteole (3.6 cm *vs* 1.7–3 cm), the apices of the calyx spreading laterally to opposite sides of the flower (*vs* pointed straight forward), and the shape and size of the labellum (unevenly panduriform, 20–21 × 16 mm *vs* ovate, 17–22 × 14–20 mm).

Rhizome short-creeping, 2.5 cm across (when dry), golden-brown sericeous, rhizome scales to 3.5 cm long, yellowish brown, apex mucronate; stilt roots absent. *Leafy shoots* to 3.75 m long, in loose clump: *ca.* 16 cm between neighbouring leafy shoots, with ± 13 leaves per shoot; base to 6 cm across, yellowish brown, pubescent at very base; sheath yellowish brown or brown, striate, glabrous, margin glabrous; ligule to 2.7−3.1 cm long, entire, apex truncate to slightly emarginate, blackish brown, hirsute especially towards margin; petiole to 4.5−5.5 cm long, glabrous, dark green tinged dark brown; lamina narrowly ovate, to 35.5 –80 × 10–19.5 cm, length to width ratio 3.5–4, dark green with yellowish green midrib, light green beneath, glabrous throughout; base rounded to cordate, oblique; margin densely hirsute; apex acuminate. *Flowering shoot* 15−17 cm long, erect, with *ca.* 80 flowers, up to 4 open at a time; peduncle 10.5 cm long, peduncular bracts to 3.5 × 1.5 cm, acute, mucronate, yellowish brown; spike (including flowers) 8 × 5.5 cm, flowers reaching to 0.5 cm below the supporting bracts; sterile bracts: lower to 2.5 cm wide, yellowish brown with shiny mucronate apex, apex acute, glabrous; fertile bracts 5.5−7 × 2.5−3.3 cm, broadly spathulate to obovate, apex blunt or mucronate to 3 mm, light yellow tinged brown, pubescent to velutinous towards apex; pedicel absent (*ca.* 4 mm stalk between bracteole and ovary); bracteole 3.6 cm long, rigid, light brown, with two fissures: 1.2 cm adaxially, 1.8 cm abaxially, densely pubescent especially in lower half, apex bilobed, each mucronate to 1 mm, reaching 5 mm below apex of calyx. Flower *ca.* 5.6 cm long; calyx *ca.* 3.3 cm long, reaching 3–4 mm above base of stamen and 9–11 mm short of apex of corolla lobes, pinkish white, with 3 fissures of 0.3–0.6 cm, pubescent in lower half, apex 3-toothed; two pointed, spreading laterally to opposite sides of the flower; corolla tube 2.9 cm long, pink, glabrous, tube inside glabrous; lobes pinkish white, yellow green towards apex, glabrous, reaching 4 mm short of apex of anther; dorsal lobe 22 × 6 mm, spathulate, cucullate; lateral lobes 22 × 3.5 mm, spathulate, cucullate, attached straight to the tube, inserted 0–1 mm below dorsal lobe; staminal tube 9 mm long, pink; labellum unevenly panduriform, 20–21 × 16 mm, pinkish white with yellowish green tinge, margin lined with dark pink towards apex, glabrous, lateral lobes involute, forming a semi-tube widest in middle, narrowing towards apex, margin enclosing most of stamen, central lobe slightly bilobed, margin unevenly serrate, recurved, extending 3.5 mm (when flattened) beyond anther; stamen 16 mm long; filament 9 × 4 mm, pink; anther 7 × 4 mm, slightly broader at base, angled erect, pink, anther crest slightly bilobed; thecae dehiscent for *ca.* 4 mm from 2 mm above base, sericeous; ovary 8 × 5 mm, sericeous, stalked 4 mm, cream yellow; epigynous gland 6 mm long, cylindrical, bilobed, split to base adaxially, half from apex on opposite side, glabrous; style 4.5 cm long, with scattered hairs in upper 6 mm; stigma 1.8 mm wide, white, club-shaped, ostiole transverse elliptic *ca.* 1.5 mm, facing forwards. Infructescence above ground, head 14 × 12 cm, bracts and bracteoles rigid and persistent, calyx partly persistent, with about 50 fruits per head; pedicel to 0.9 cm long, fruit 3 × 2.5 cm, round, with soft spines in upper third, spines to 4 mm long, curved, pubescent, especially in upper part; seeds immature, 4–4.5 × 3.5–4 mm including aril.

Distribution. So far known only from the type locality at Gunung Gandangdewata.

Habitat & Ecology. Grows in primary forest on a moderate slope not far from river at about 1,700 m.

Etymology. The epithet honours the people of Mamasa, West Sulawesi, where the new species was found.

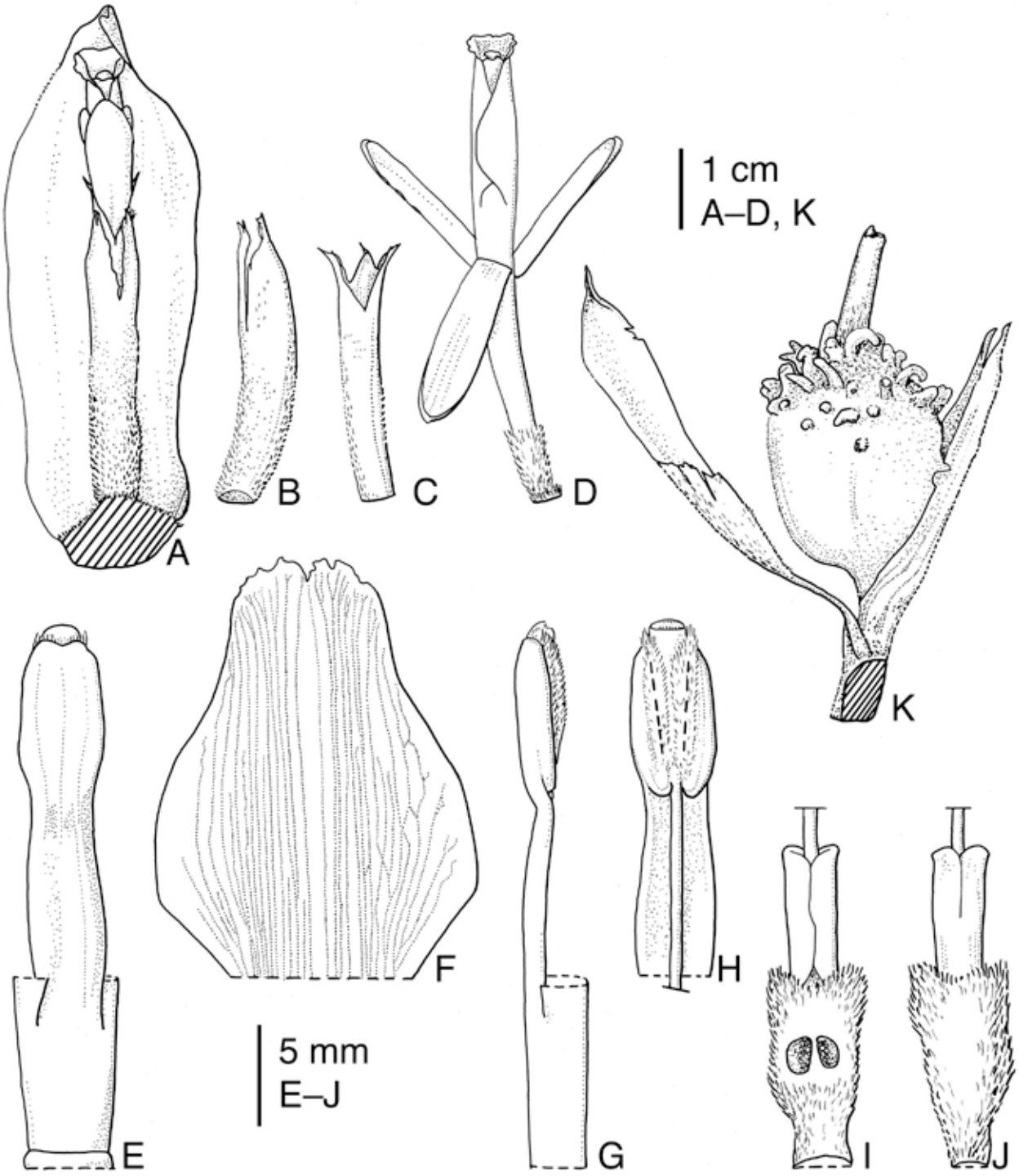


Fig. 1. *Etlingera mamasarum* A.D.Poulsen & Ardiyani, *spec. nov*. A. Fertile bract and flower. B. Bracteole. C. Calyx. D. Flower, calyx removed. E. Stamen, dorsal view. F. Labellum, flattened, dorsal view G. Stamen, lateral view H. Stamen, style and stigma, ventral view. J. Ovary and epigynous gland, dorsal view. K. Ovary and epigynous gland, ventral view. L. Fruit with ± persistent bract, bracteole and calyx. Drawn from the type by Axel Dalberg Poulsen.

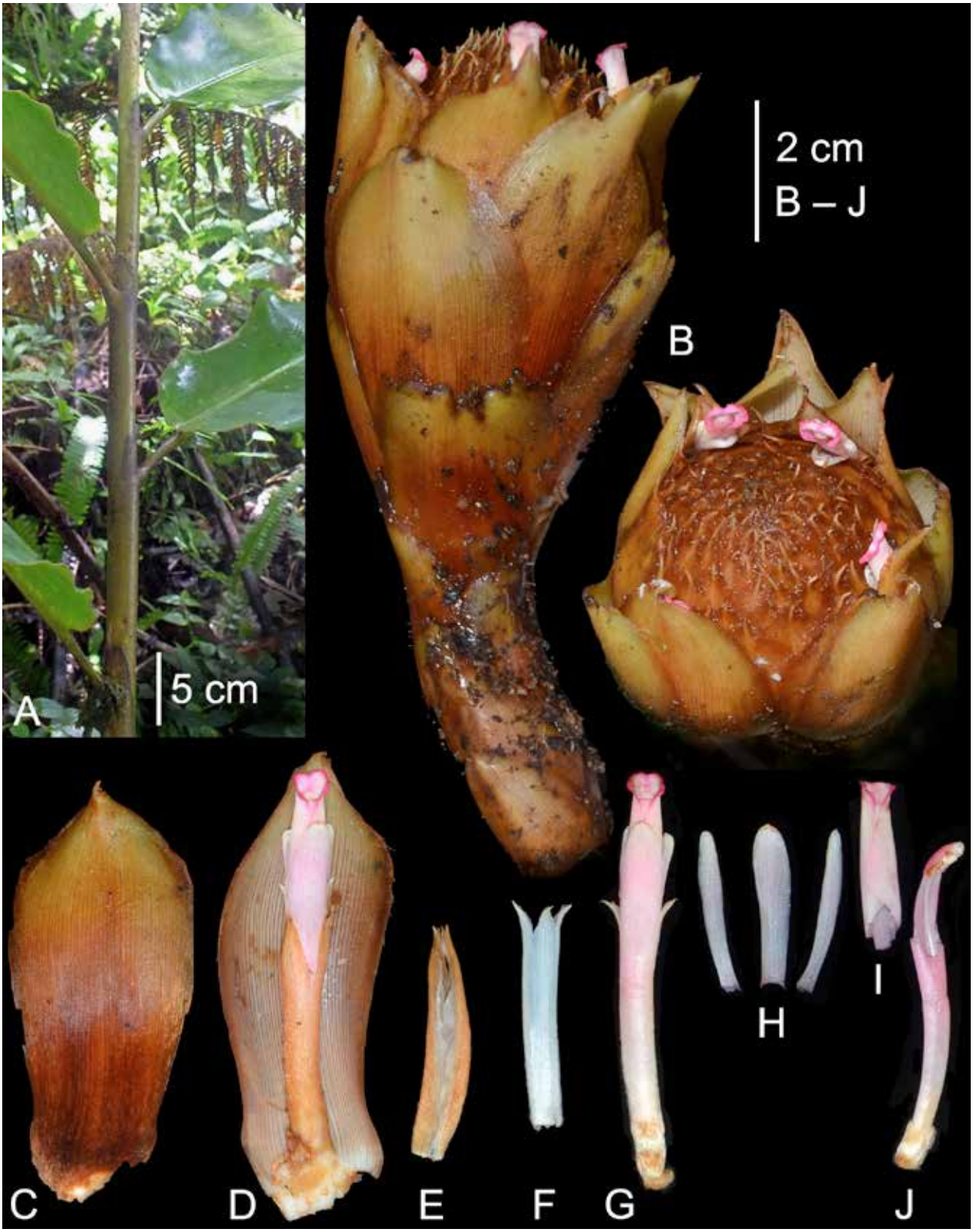


Fig. 2. *Etlingera mamasarum* A.D.Poulsen & Ardiyani, *spec. nov*. A. Leafy shoot. B. Inflorescence, lateral and front view. C. Fertile bract. D. Fertile bract and flower. E. Bracteole. F. Calyx. G. Flower, calyx removed. H. Corolla lobes. I. Labellum. J. Flower with calyx, corolla lobes and labellum removed. Photos: Marlina Ardiyani.

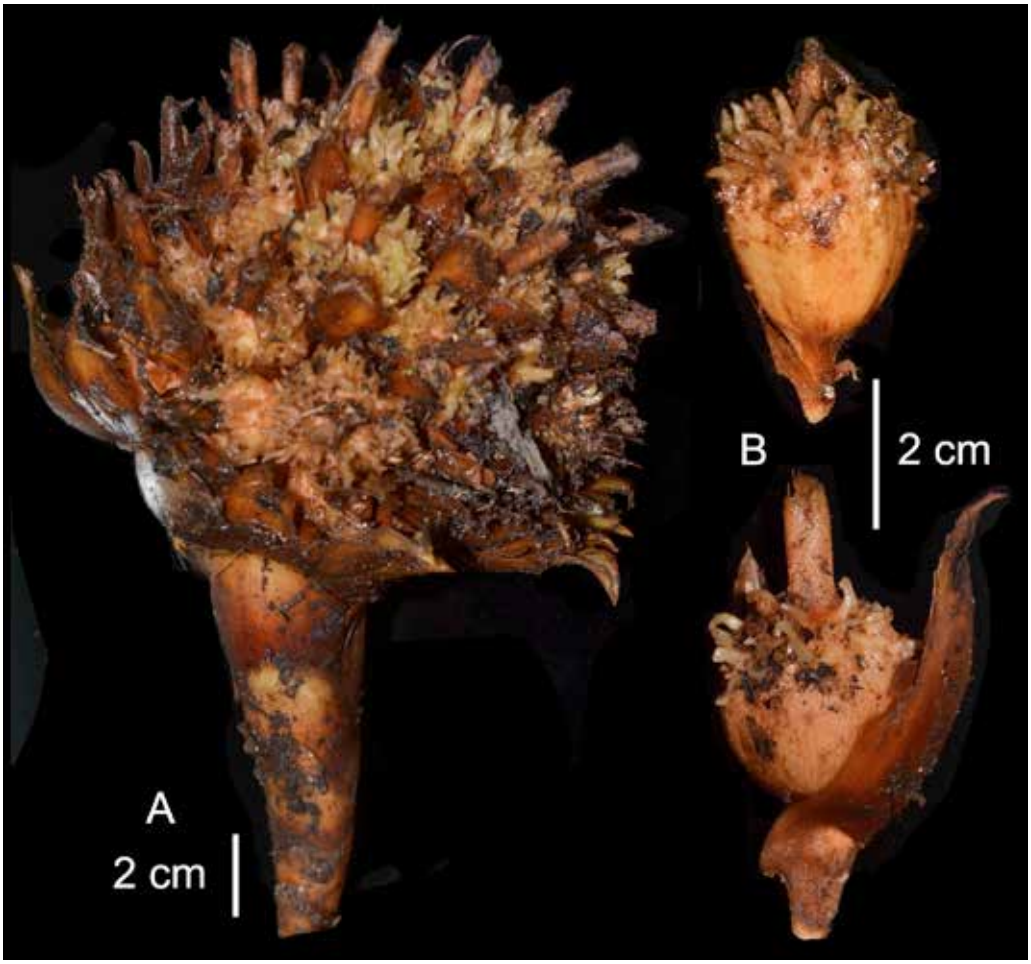


Fig. 3. *Etlingera mamasarum* A.D.Poulsen & Ardiyani, *spec nov*. A. Infructescence. B. Fruits, upper one with bract removed. Photos: Marlina Ardiyani.

Phenology. Flowering and fruiting recorded in April.

Local name & uses. Katimbang (Mamasa language), fruits are eaten.

Conservation status. This species endemic in Sulawesi is only known from the type locality, the area is within the well-managed protected area of Gunung Gandangdewata National Park which has no current threats. So although this species is very restricted with an area of occupancy (AOO) of only 4 km^2, this species is assessed as Least Concern. The species is dependent on the protected area being well managed and so the habitat should be periodically monitored for any changes.

Notes. In Sulawesi, this species is most similar to *Etlingera flexuosa.* Diagnostic morphological characters are presented in Table 1.

UPDATED KEY TO THE SULAWESI SPECIES OF *ETLINGERA*

In Poulsen (2012), *E. mamasarum* keys out as *E. flexuosa* at couplet 38 (trail: 2–3–4–5–22–26–38). Thus the new species must be inserted at this point, as follows:

38. Ligule 17–30 mm long 39
    Ligule 1–15 mm long 40
39. Length of petiole 10–40 mm; fertile bract 2–5 × 0.6–2.5 cm, shorter than flower; apex of calyx pointed forwards ..... 23. *E. flexuosa*
    Length of petiole 45–55 mm; fertile bract 5.5−7 × 2.5−3.3cm, longer than flower; apex of calyx spreading laterally to opposite sides of flower ..... 24. *E. mamasarum*

A full key including *E. mamasarum* can be seen in the Appendix.

Table 1. Morphological characters of *Etlingera flexuosa* and *E. mamasarum*

Characters	***Etlingera flexuosa*** (from Poulsen, 2012)	***E. mamasarum***
Base of leafy shoot (colour)	Reddish brown or purple	Yellowish brown
Shape of ligule	Slightly bilobed or entire	Entire with truncate to slightly emarginate apex
Length of petiole	10–40 mm	45–55 mm
Length to width ratio of lamina	4.2–5.6	3.5–4
Base of lamina	Cuneate to auriculate	Rounded to cordate
Colour of sterile bracts	Reddish brown (rarely pale yellow-green)	Yellowish brown
Colour of fertile bracts	Pale brownish orange at base and dark reddish brown at margin and apex	Light yellow tinged brown
Shape of calyx	Pointed	Pointed, spreading laterally to opposite sides of the flower
Colour of corolla lobes	Pink or pale pink often darker towards centre and apex	Pinkish white, yellow green towards apex
Shape of labellum	Ovate	Unevenly panduriform
Colour of labellum	Cream or pale pink, pink in centre and at margin	Pinkish white with yellowish green tinge, margin lined with dark pink towards apex
Shape of anther	Broadest in centre	Slightly broader at base, angled erect
Anther crest	Apex constricted, slightly emarginate	Slightly bilobed

Table 2. DNA barcoding of *E. mamasarum*

Species	NCBI GenBank Accession No.			
	*rbc*L	*mat*K	*trn*H-*psb*A	ITS
Etlingera mamasarum	MK830667	MK830668	MK830669	MK830666

NEW RECORDS OF SPECIES OF *ETLINGERA* IN WEST SULAWESI

The following species have now been documented for the first time:

2. ETLINGERA CYLINDRICA A.D.Poulsen
Etlingera cylindrica A.D.Poulsen, *Etlingera* of Sulawesi (2012) 117. — Type: Indonesia, South Sulawesi Province, trail from Karangan to Rantemario, 1,850 m, 03°24'49.5"S, 120°0'0"E, flowering and fruiting, 31 Januari 2009, *A.D. Poulsen, Firdaus, Sahir Tiburrung, Ucci, Hikmah, Laopa & Rahman 2781* (Holo BO; iso AAU, E, SING).

Specimen examined. Indonesia, West Sulawesi Province, Mamasa, Gunung Gandangdewata, 1,686 m, 02°52'52.2"S, 119°23'09.0"E, fruiting, 26 April 2016, *Marlina Ardiyani with Anis, W. Wardani, P.K. Wardani, D. Wulansari Sulbar 067* (BO).

Local name. Laiyah-laiyah (Mamasa language).

Ecology. Grow in primary forest on steep slopes.

3. ETLINGERA GRALLATA A.D.Poulsen
Etlingera grallata A.D.Poulsen, *Etlingera* of Sulawesi: 153 (2012). — Type: Indonesia, Central Sulawesi Province, Lore Lindu NP, Gunung Nokilalaki, 1,875 m, 01°14'35"S, 120°09'08"E, flowering, 3 March 2008, *A.D. Poulsen & Firdaus 2658* (holo BO; iso AAU, CEB, E, SING).

Specimen examined. Indonesia, West Sulawesi Province, Mamasa, Gunung Gandangdewata, 1,705 m, 02°52'40.8"S, 119°22'56.5"E, flowering, 21 April 2016, *Marlina Ardiyani with A. Karto-negoro, W. Santoso, D. Wulansari, Obet, Ama Sulbar 022* (BO).

Local name. Katimbang (Mamasa language).

Ecology. Grow in primary forest on a steep slope close to a waterfall of the Tetean River.

Note. The more recent collection, Ardiyani *et al.* Sulbar 022, is only the third of this species and

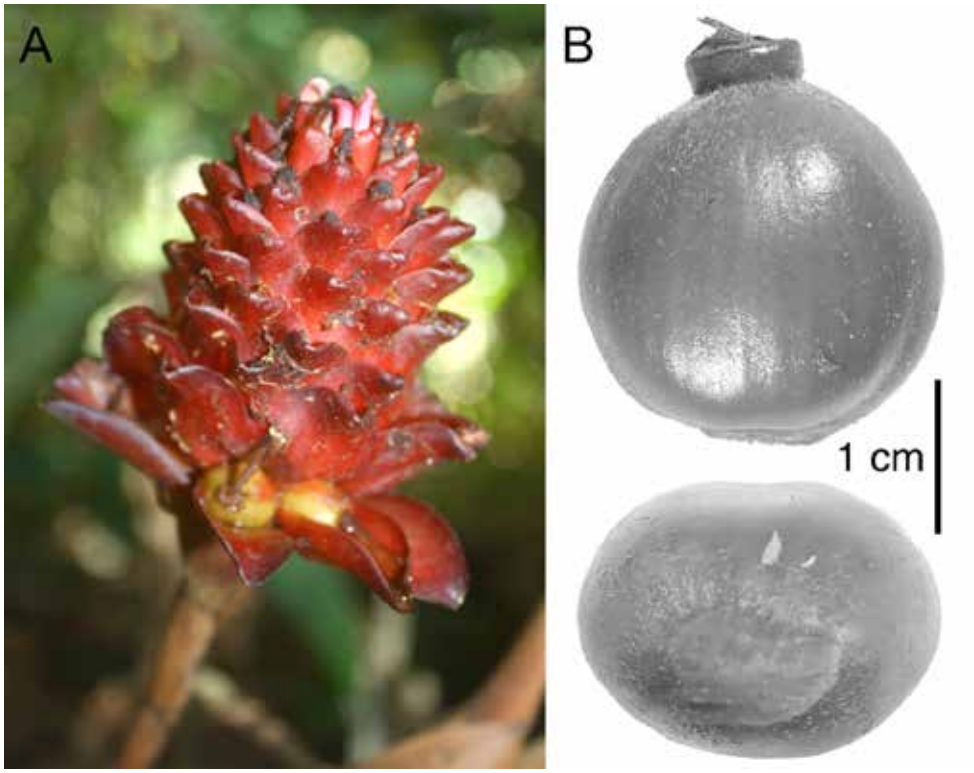


Fig. 4. *Etlingera calobates* A.D.Poulsen. A. Inflorescence with two fruits visible at the lowermost bracts. B. Fruit, lateral view and seen from base (*Wisnu Ardi et al. 223*). Photos: Wisnu H. Ardi.

differs vegetatively from the type by having shorter ligule (5 mm *vs* up to 15–23 mm), petiole (1 mm *vs* up to 10–16 mm) and lamina (to 28 × 4 cm *vs* to 37 × 2 cm) but the fertile characters match very well the original description. It is likely that the range of characters of *E. grallata* may have to be widened as more collections become available. This will also result in a need to adjust the key to species in Sulawesi.

4. ETLINGERA SPINULOSA A.D.Poulsen
Etlingera spinulosa A.D.Poulsen, *Etlingera* of Sulawesi: 227 (2012). — Type: Indonesia, South Sulawesi Province, trail from Karangan to Rantemario, 3°24'49.5"S, 120°0'0"E, 1,850 m, flowering, 31 Jan 2009, *A.D. Poulsen, Firdaus, Sahir Tiburrung, Ucci, Hikmah, Laopa & Rahman 2782* (holo BO; iso AAU, CEB, E, SING).

Specimen examined. Indonesia, West Sulawesi Province, Mamasa, Gunung Gandangdewata, 1,681 m, 02°52'48.7"S, 119°22'55.1"E, flowering, fruiting, 22 April 2016, *Marlina Ardiyani with A. Kartonegoro, W. Santoso, Obet, Ama Sulbar 030* (BO).

Local name. Katimbang Balao (Mamasa language).

Ecology. Grow in primary forest on a steep slope flanked by two rivers.

NEW INFORMATION ON SULAWESI SPECIES OF *ETLINGERA*

5. ETLINGERA CALOBATES A.D.Poulsen
Etlingera calobates A.D.Poulsen, *Etlingera* of Sulawesi: 90 (2012). — Type: *A.D. Poulsen & Firdaus 2642* (holo BO; iso AAU, E, SING), Indonesia, Central Sulawesi Province, Lore Utara, Dongi Dongi, 01º18'16"S, 120º16'36"E, 1,300 m, flowering, 28 Feb. 2008.

Specimen examined. Indonesia, Central Sulawesi, Gunung Nokilalaki, beside the trail between shelter 1 and 2, 01°13'57.01"S, 120°09'12.66"E, 1,400–1,500 m, flowering and fruiting, 24 July 2018, *Wisnu H. Ardi, Roland & Adhy WI 223* (KBR, BO). Field notes: In semi-shaded place with *Piper* sp. and many ferns. Stilt-rooted.

Updated description. Fruit 12–14 × 8–10 mm, sessile, ellipsoid, laterally compressed, glabrous at base and in middle, puberulous at apex near ± persistent calyx (Fig. 4).

Note. Poulsen (2012) did not include a description of the fruits but assigned *E. calobates* to the informal Acanthodes Group. The shape of the fruit is similar to other known of species in this group and therefore supports this placement.

CORRECTION TO TYPIFICATION OF SULAWESI SPECIES OF *ETLINGERA*

6. ETLINGERA ALBA (Blume) A.D.Poulsen
Etlingera alba (Blume) A.D.Poulsen, *Etlingera* of Sulawesi: 58 (2012). — Types: *C.G.C. Reinwardt s.n.* (lecto designated by Poulsen 2012, L 0193641; isolecto L 0193642), [20–23 Oct. 1821], near Tondano, Sulawesi: *A.D. Poulsen, Marlina Ardiyani & Erik Kaunang 2621* (epi BO; isoepi E), North Sulawesi Province, Gunung Masarang, Rampun plantation, 01º19'19"N, 124º51'41"E, 960 m, flowering, 20 Feb. 2008.

Basionym. *Elettaria alba* Blume, Enum. pl. Javae (1827) 53; Teijsm. & Binn., Catalogus van 's Lands Plantentuin te Buitenzorg (1866) 58.

Homotypic synonyms. *Alpinia alba* (Blume) D. Dietr., Syn. pl. 1 (1839) 12. *Cardamomum album* (Blume) Kuntze, Revis. gen. pl. 2 (1891) 686. *Amomum album* (Blume) Koord., Meded. Lands Plantentuin 19 (1898) 318.

Heterotypic synonym. *Alpinia chrysogynia* (K. Schum.) K. Schum., Pflanzenr. IV, 46 (Heft 20) (1904) 364, 365; M.F.Newman, A. Lhuillier & A.D. Poulsen, Checkl. Zingib. Malesia (2004) 10. Types: *P. & F. Sarasin 414* (syn B, assumed lost in the Second World War), North Sulawesi, Tomohon, flowering, 31 May 1894, *P. & F. Sarasin 674* (syn B, assumed lost in the Second World War), Central Sulawesi, Buol, flowering, 15 Aug. 1894; *O. Warburg 15732* (syn B, assumed lost in the Second World War), North Sulawesi, Boyong, Aug.–Sep. 1888. *A.D. Poulsen, Julianus Kinho, Tinus Sandaling & Nikolas Mandei 2817* (neo BO, designated here; isoneo E), North Sulawesi Province, Gunung Lolombulan, trail from Boyong Atas village, 01º5'16.3"N, 124º25'31.1"E, 700 m, flowering and fruiting, 25 Feb. 2009.

See full synonymy in Poulsen (2012).

Note. In Poulsen (2012), the neotype of *Alpinia chrysogynia* was wrongly numbered 2625 but the rest of the specimen information presented above is correct. *Poulsen et al. 2625* is the neotype of *E. heliconiifolia* designated in Poulsen (2012: 156).

DISTRIBUTION OF *THE ACHASMA GROUP EAST OF WALLACE'S LINE*

Trimanto and Hapsari (2018), reported *Etlingera megalocheilos* (Griff.) A.D.Poulsen in Sulawesi, crossing Wallace's Line. Previously this species was known to occur only in Sundaland (from Peninsular Malaysia, Sumatra, Java to Borneo). Trimanto and Hapsari based their conclusion on a single cultivated collection (P19930724/Sim.007) cultivated at Purwodadi Botanic Garden originating from Pangi Binanga Nature Reserve, Central Sulawesi which they found matched well to the descriptions in Poulsen (2006 & 2007). They noted that *E. megalocheilos* is most easily confused with *E. coccinea* (Blume) S.Sakai & Nagam. which also belongs to the Achasma Group of the genus but failed to mention that this group is represented in Sulawesi by a single species, namely the endemic *E. penicillata* (K.Schum.) A.D.Poulsen, which is known from Central and Southeast Sulawesi Provinces (Poulsen, 2012) and is much more similar in floral morphology to their collection than *E. coccinea.* We were unable to examine the cultivated plant or the collections made by Trimanto and Hapsari (2018) but compared the detailed description (Trimanto & Hapsari, 2018). Their description is intermediate between our present understanding of *Etlingera megalocheilos* and *E. penicillata* in the lengths of the lamina, flower and labellum. It furthermore differs from *E. penicillata* in having more flowers per inflorescence (10–12 *vs* 5–7), longer corolla lobes, a longer staminal tube and the margin to the labellum sometimes having a yellow margin.

Based on the three collections only observed so far in the wild, *Etlingera penicillata* has a plain red labellum (Poulsen, 2012). As discussed in the revision of Bornean *Etlingera* Poulsen (2006), the colour of the labellum of *E. megalocheilos* is highly variable from monochrome red to red with a clearly yellow margin and it is not unlikely that *E. penicillata* may also exhibit this variation as speculated by Poulsen (2012: 202). We would therefore like to see evidence from the natural habitat in Sulawesi before accepting that *E. megalocheilos* should be added to the list of *Etlingera* species native to Sulawesi. Alternatively, one may accept the material examined by Trimanto and Hapsari as *E. penicillata* in which case the description of *E. penicillata* should include populations with a yellow margin to the lateral lobes of the labellum and the updated descriptions also regarding other characters (numbers of flowers per spike, lengths of the corolla lobes, staminal tube and labellum) but additional wild collections are desirable before making that decision.

In the Philippines, just north of Sulawesi, the Achasma Group is clearly represented by *E. philippinensis* (Ridl.) R.M.Sm. (Poulsen & Docot, 2018) the morphological variation of which is still not fully understood but may well have bearings on distribution patterns in the region. Furthermore, after recent exploration in New Guinea, only *E. labellosa* (K.Schum.) A.D.Poulsen of the Achasma Group occurs there. Curiously, this species also displays variation of

the colour of the lateral lobes from plain red, to yellow or white.

ACKNOWLEDGEMENTS

The first author is indebted to the Research Center for Biology, the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia-LIPI) for involving her in the Expedition to Gunung Gandangdewata National Park in 2016. She also thanks the BKSDA of Sulawesi Selatan for the permit given to collect specimens. She is grateful to the local people of Mamasa, who helped a lot in the Expedition, and to the great team of the Expedition. We thank Wisnu Handoyo Ardi for sharing his information of the specimens of fruits of *E. calobates.* We thank Susila who helped us in the molecular laboratory when doing the DNA barcoding of the new species. Last but not least, we thank Drs. Mark Newman and Robert Mill who helped to confirm the Latin name of the epithet of the new species.

REFERENCES

ACHMADI, A. S., HAMIDY, A., MARYANTO, I., LUPIYANINGDYAH, P., SIHOTANG, V. B. L., KAHONO, S., KARTONEGORO, A., ARDIYANI, M., MULYANINGSIH, E. S. & KANTI, A. (Eds.). 2018. *Ekspedisi Sulawesi Barat: Flora, Fauna, dan Mikroorganisme Gandangdewata.* LIPI Press, Jakarta.

KRESS, W. J. & ERICKSON, D. L. 2007. A two-locus global DNA barcode for land plants: The coding *rbc*L gene complements the non-coding *trn*H-*psb*A spacer region. *PLoS ONE* 2: e508.

KRESS, W. J., PRINCE, L. M. & WILLIAMS, K. J. 2002. The phylogeny and a new classification of the gingers (Zingiberaceae): evidence from molecular data. *American Journal of Botany* 89: 1682–1696.

POULSEN, A. D. 2006. *Etlingera of Borneo*. Natural History Publications (Borneo), Kota Kinabalu.

POULSEN, A. D. 2007. *Etlingera* Giseke of Java. *Garden's Bulletin Singapore* 59 (1&2): 145–172.

POULSEN, A. D. 2012. *Etlingera of Sulawesi*. Natural History Publications (Borneo), Kota Kinabalu.

POULSEN, A. D. & DOCOT, R. V. A. 2019. How many species of *Etlingera* (Zingiberaceae) are there in the Philippines? *Edinburgh Journal of Botany* 76 (1): 33–44.

TRIMANTO & HAPSARI, L. 2018. A new record of *Etlingera megalocheilos* (Griff.) A.D. Poulsen (Zingiberaceae) in Sulawesi, Indonesia (Short Communication). *Biodiversitas* 19(4): 1227–1235.

APPENDIX

The modified key to *Etlingera* of Sulawesi [from Poulsen 2012], after *Etlingera mamasarum* A.D.Poulsen & Ardiyani, *spec. nov.* is added and to include species from West Sulawesi.

1. Leaves to 1.5 cm wide ..... 42. *E. stenophylla*
   Leaves at least 2 cm wide 2
2. Flowering shoot erect, more than 50 cm; bracts to 13 cm long, outer ones recurved when flowering ……..….. 19. *E. elatior*
   Flowering shoot less than 50 cm; bracts shorter than 9 cm long, not recurved 3
3. Calyx >5 cm long; labellum extending more than 2 cm beyond anther, 22 mm wide ... 35. *E. penicillata*
   Calyx <4 cm long; labellum extending less than 1.2 cm beyond anther even when flattened, to 20 mm wide 4
4. Ligule 5–8 cm long, caducous; lateral lobes of the labellum reflexed fully exposing the stamen ..... …… 32. *E. orbiculata*
   Ligule to 4 cm long; lateral lobes of the labellum folded over the stamen, rarely erect ……..……..... 5
5. Ovary constricted at the base and apex (barrel-shaped); anther dehiscent along its entire length; fruits smooth or rarely with 2–3 spines at apex, hidden by persistent bracts; labellum glabrous..... 6
   Ovary not constricted at the base and apex; anther dehiscent for up to half of its length; fruits with many spines, at least the apex visible even if the bracts are persistent; labellum pubescent or rarely glabrous …… 22
6. Filament *ca.* 5 mm long, slightly S-shaped; anther dehiscent for 1.5 mm apex only; f ruits with 2–3 spines at apex ..... 29. *E. mendumiae*
   Filament 0–3 mm long (rarely to 4.5 cm), straight; anther dehiscent for all or most of its length; fruits smooth 7
7. Bracts most often mucilaginous; flower pale yellow to yellow ..... 34. *E. pausodipsus*
   Bracts not mucilaginous; flower pale to dark pink or red 8
8. Ligule emarginated or deeply bilobed 9
   Ligule entire 14
9. Ligule deeply bilobed, clasping the pseudostem laterally 10
   Ligule emarginated, not clasping the pseudostem 11
10. Fertile bract 2.5–4 cm long; flower <3.8 cm long; filament 0.5–1 mm long ……... 1. *E. acanthodes*
    Fertile bract 4.1–6 cm long; flower >4 cm long; filament *ca.* 2.5 mm long ……... 41. *E. spinulosa*
11. Ligule to 19–21 mm long; bracts mucronate; stamen ± sessile (filament 0–0.5 mm long) ……... 12
    Ligule *ca.* 30 mm long; bracts rounded, not mucronate; filament *ca.* 3 mm long…..…….. 27. *E. hyalina*
12. Ligule glabrous or puberulous; fertile bracts green with 7–12 mm long mucro ……. 13. *E. chlorodonta*
    Ligule densely hairy; fertile bracts reddish brown, mucro<2 mm..... 13
13. Leaf *ca.* 54 × 14 cm; margin of fertile bract not emarginate; labellum *ca.* 11 mm long; anther *ca.* 7 mm long ..... 2. *E. aculeatissima*
    Leaf *ca.* 35–36× 4.5–6cm; margin of fertile emarginate; labellum *ca.* 8.5 mm long; anther *ca.* 5.5 mm long ……..... 43. *E. steringophora*
14. Spike 0.7–1 cm wide, 2–3 flowers per spike; bracteole 3.2–3.3 cm long..... 15. *E. cylindrica*
    Spike 1.2–6 cm wide, >8 flowers per spike; bracteole 0.9–2.7 cm long 15
15. Apex of bracts rounded not mucronate 16
    Apex of bracts acute and ± mucronate 17
16. Leaves sessile; upper peduncular bracts 2.7–3.7 cm long, loosely adhering to the peduncular axis; spike turbinate, flat-topped ..... 9. *E. calobates*
    Leaves petiolate 3–4 mm long; upper peduncular bracts to *ca.* 2 cm long, firmly enclosing the axis; spike ellipsoid, apex rounded ..... 21. *E. elliptica*
17. Ovary and fruit densely pubescent 18
    Ovary glabrous in centre (but maybe hairy at the constrictions at base and apex) 19
18. Petiole to 8 mm; bracts dark red, reddish brown or pale brown and with greenish apices not translucent; spike turbinate to ovoid; corolla lobes pubescent in centre..... 33. *E. orophila*
    Lamina sessile; bracts plain pink, translucent; spike globose; corolla lobes glabrous ... 45. *E. translucens*
19. Lamina >5 cm wide; flowering shoot 13–14 cm long; peduncle 6–8 cm; receptacle 1.8–7 cm long; 90–225 flowers per spike 20
    Lamina <4.5 cm wide; flowering shoot 3–7.5 cm long; peduncle 1–4 cm; receptacle <1 cm long; 8–50 flowers per spike 21
20. Ligule 16–18 mm long; petiole 5–6 mm long; spike 5–11 cm long; labellum 14–17 mm long; stamen 9.5–11 mm long..... 16. *E. doliiformis*

Ligule 8–10 mm long; lamina sessile; spike 4–4.5 cm long; labellum 11–11.5 mm long; stamen 5–7 mm long ..... 31. *E. mucronata*
21. Ligule 15–23 mm long; petiole 10–16 mm long; mucro on bracts <1mm..... 24. *E. grallata*
Ligule 4–6 mm long; lamina sessile; mucro on bracts 4–7 mm long ..... 44. *E. sublimata*
22. Leaf base auriculate, clasping the pseudostem, covering the ligule; leaves large, 80–120 × 13–27 cm 23
Leaf base, even if rounded or auriculate, not clasping the pseudostem, leaving the ligule exposed; leaves small to large, 18–87 × 2.5–19 cm 26
23. Flowers plain yellow; labellum widest near apex; anther dehiscent in the middle ..... 46. *E. tubilabrum*
Flowers red, pink, or white; labellum widest below the middle; anther dehiscent in the upper half …. 24
24. Flowering head mucilaginous; labellum pink; corolla and labellum glabrous; filament *ca.* 6 × 3 mm ……..…….... 30. *E. mucida*
Flowering head not mucilaginous; labellum red or white; corolla and labellum sericeous (silky-hairy); filament 1–2 × 4–5 mm ..... 25. *E. heliconiifolia*
25. Corolla and labellum brilliant red ..... 25. *E. heliconiifolia* subsp. *heliconiifolia*
Labellum white, corolla lobes may be tinged pink..... 26. *E. heliconiifolia* subsp. *leucocheilos*
26. Anther wider at apex or parallel-sided; filament ± straight, rarely hairy ventrally 27
Anther elliptic, narrowing towards apex; filament slightly incurved at apex; most often densely hairy ventrally 38
27. Anther dehiscent in the middle or below 28
Anther dehiscent in upper half 31
28. Most of the dehiscence below the middle; labellum yellow with green veins; ligule *ca.* 1 mm long; lamina *ca.* 24 × 2.5 cm ..... 22. *E. flavovirens*
Anther dehiscence in the middle, flowers yellow to pale yellow without green veins; ligule 3–15 mm long; lamina 60–90× 8–17 cm 29
29. Ligule 3–5 mm long; lamina glabrous; ligule bilobed ..... 14. *E. chrysantha*
Ligule 8–15 mm long; lamina ± hairy beneath; ligule entire 30
30. Ligule *ca.* 15 mm long; leaves petiolate 27–35 mm long; receptacle to 6.5 cm long ..... 11. *E. canarina*
Ligule *ca.* 8 mm long; leaves sessile; receptacle to 11 cm long ..... 4. *E. aulocheilos*
31. Labellum widest at apex, ± trumpet-shaped semi-tubular with flattened, petaloid apex ……..…. 32
Labellum widest in the middle or in lower half, not trumpet-shaped..... 36
32. Labellum plain yellow; stamen 7–8 mm long; filament 2–3 mm long; stigma club-shaped; fruit 2.2– 3.5 × 2.2–2.7 cm, elliptic when dry ..... 10. *E. calophrys*
Labellum white ± pink towards margin or plain pink; stamen 8.5–13 mm long; filament 3.5–7 mm long; stigma with two distinct lateral knobs; fruit 1.1–2.5 × 1.4–2.7 cm, globose when dry ……..… 33
33. Flowers congested in the spike; fertile bracts 3.2–6 cm long; corolla lobes white, distinctly red in upper half; labellum plain pink, cream in centre; spines <1 mm, only in upper half of fruit ... 38. *E. rubroloba*
Flowers well-spaced in the spike; fertile bracts to 1.5–4.5 cm long; corolla lobes white tinged ± yellow-green or pale pink towards margin; labellum white, yellow-green in centre, tinged ± pink towards margin; spines to 4 mm, all over the fruit 34
34. Leafy shoot >3.5 m long; ligule 10–15 mm long; petiole >10 mm long; lamina to 52–66 × 11–14 cm; 23 –52 flowers per spike ..... 3. *E. alba*
Leafy shoot <2.5 m long; ligule 3–7 mm long; petiole 1–7 mm long; lamina to 28–34 × 5–6.5 cm; 15–20 flowers per spike 35
35. Labellum 23 × 16 mm, clearly bilobed, incision *ca.* 5 mm; stamen 12.5–13 mm long; filament 7 mm long ……..…… 6. *E. biloba*
Labellum 20 × 12.5 mm, bilobed, incision to 3 mm; stamen 8.5–9 mm long; filament 3.5 mm long …….. ..... 18. *E. echinulata*
36. Labellum pale pink, lateral lobes pink; stamen 11.5–13 mm long; filament 6–7 mm long.…… …… 7. *E. borealis*
Labellum plain yellow or cream; stamen 8–11 mm long; filament 2–4 mm long 37
37. Leafy shoot <2 m long; fertile bracts obovate, greenish brown, apex forming a curved point to 5 mm long; corolla lobes pale yellow; labellum yellow ..... 48. *E. xanthantha*
Leafy shoot 3–6 m long; fertile bracts spathulate, reddish, mucronate but apex not forming a distinct point; corolla lobes white, reddish towards apex; labellum pale yellowish cream or white ……..... …… 39. *E. sarasinorum*
38. Ligule 17–30 mm long 39
Ligule 1–15 mm long 40
39. Length of petiole 10–40 mm; fertile bract 2–5 × 0.6–2.5 cm, shorter than the flower; apex of calyx pointed forwards..... 23. *E. flexuosa*
Length of petiole 45–55 mm; fertile bract 5.5−7 × 2.5−3.3 cm, longer than the flower; apex of calyx

spreading laterally to opposite sides of the flower ..... 28. *E. mamasarum*
40. Ovary obovoid, glabrous except for a dense ring of long hairs at the base; fruit smooth; margin of terminal lobe of labellum serrated ..... 40. *E. serrata*
Ovary obconical or elliptic, pubescent throughout; fruit spiny; margin of terminal lobe of labellum entire 41
41. Leaf apex caudate 3–4 cm 42
Leaf apex shortly acuminate (to 2.5 cm), caudate to 2.5 cm, or tapering 44
42. Ligule *ca.* 15 mm long, tapering and only minutely bifid at apex; leaves petiolate to 15 mm; spike with >100 flowers ..... 12. *E. caudata*
Ligule to 5 mm long, entire or emarginated to bilobed; leaves sessile; spike with 20–25 flowers 43
43. Leafy shoot *ca.* 2 m long; ligule emarginated to bilobed; flower > 4.5 cm long; fruit with scattered spines..... 47. *E. urophylla*
Leafy shoot *ca.* 1 m long; ligule entire; flower *ca.* 4 cm long; fruit completely smooth ..... 49. *E. yessiae*
44. Rhizome stout, 1.5–3.5 cm diameter; leafy shoot 2.5–5 m long; lamina 46–87 × 11–18 cm; spike mucilaginous, 3–7.5 cm wide with 50–260 flowers 45
Rhizome slender, to 0.5 cm diameter; leafy shoot 0.6–1.5(–2) m long; lamina 17–23 × 2–6 cm; spike not mucilaginous, 1–3 cm wide with 10–20 flowers 47
45. Leafy shoot 4–5 m long; lamina 70–87 × 13–18 cm; spike 4–7 cm long (including flowers); fertile bract ovate; corolla lobes plain pale pink or red; fruit 3–4.5 × 2–4 cm ..... 46. *E. polycarpa*
Leafy shoot to 2.5 m long; lamina *ca.* 46 × 11 cm; spike 3 cm long (including flowers); fertile bract obovate; corolla lobe white with red tip; fruit 2 × 2 cm ..... 5. *E. bicolor*
46. Ligule 2–4 mm, distantly bilobed; flowers pale pink; labellum 9–12 mm wide, ovate to panduriform ..... 36. *E. polycarpa* subsp. *polycarpa*
Ligule 7–12 mm, entire; flowers dark reddish pink; labellum 11–14.5 mm wide, ovate to ± 3-lobed ..... 37. *E. polycarpa* subsp. *ligulata*
47. Ligule 3–4 mm long; spike 4.7–5.5 cm long (including flowers); labellum plain cream, widest below the middle; filament glabrous ..... 17. *E. eburnea*
Ligule 1–1.5 mm long; spike 3.5–4.5 cm long (including flowers); labellum cream and pink, widest above the middle; filament densely pubescent 48
48. Leaf petiolate to 25 mm, to 6 cm wide, base cordate, apex caudate to 2 cm; flowers sessile; ovary ellipsoid, densely villose ..... 8. *E. bullata*
Leaf sessile, 2.2–3.5 cm wide, base cuneate, apex tapering ..... 20. *E. elegans*

INSTRUCTION TO AUTHORS

Scope. *Reinwardtia* is a scientific regular journal on plant taxonomy, plant ecology and ethnobotany published in June and December. Manuscript intended for a publication should be written in English.

Titles. Titles should be brief, informative and followed by author's name and mailing address in one-paragraphed.

Abstract. English abstract followed by Indonesian abstract of not more than 250 words. Keywords should be given below each abstract.

Manuscript. Manuscript is original paper and represent an article which has not been published in any other journal or proceedings. The manuscript of no more than 36 pages by using Times New Roman 11, MS Word for Windows of A4 with double spacing, submitted to the editor through <reinwardtia@mail.lipi.go.id>. New paragraph should be indented in by 5 characters. For the style of presentation, authors should follow the latest issue of Reinwardtia very closely. Author(s) should send the preferred running title of the article submitted. Every manuscript will be sent to two blind reviewers.

Identification key. Taxonomic identification key should be prepared using the aligned couplet type.

Nomenclature. Strict adherence to the International Code of Nomenclature is observed, so that taxonomic and nomenclatural novelties should be clearly shown. English description for new taxon proposed should be provided and the herbaria where the type specimens area deposited should be presented. Name of taxon in taxonomic treatment should be presented in the long form that is name of taxon, author's name, year of publication, abbreviated journal or book title, volume, number and page.

Map/line drawing illustration/photograph. Map, line drawing illustration, or photograph preferably should be prepared in landscape presentation to occupy two columns. Illustration must be submitted as original art accompanying, but separated from the manuscript. The illustration should be saved in JPG or GIF format at least 350 pixels. Legends or illustration must be submitted separately at the end of the manuscript.

References. Bibliography, list of literature cited or references follow the Harvard system as the following examples.

Journal : KRAENZLIN, F. 1913. *Cyrtandraceae* novae Philippinenses I. *Philipp. J. Sci.* 8: 163–179.
MAYER, V., MOLLER, M., PERRET, M. & WEBER, A. 2003. Phylogenetic position and generic differentiation of *Epithemateae* (Gesneriaceae) inferred from plastid DNA sequence data. *American J. Bot.* 90: 321–329.

Proceedings : TEMU, S. T. 1995. Peranan tumbuhan dan ternak dalam upacara adat "Djoka Dju" pada suku Lio, Ende, Flores, Nusa Tenggara Timur. In: NASUTION, E. (Ed.). Prosiding Seminar dan Lokakarya Nasional Etnobotani II. LIPI & Perpustakaan Nasional. Pp. 263–268. (In Indonesian).
SIMBOLON, H. & MIRMANTO, E. 2000. Checklist of plant species in the peat swamp forests of Central Kalimantan, Indonesia. In: IWAKUMA, T., INOUE, T., KOHYAMA, T., OSAKI, M., SIMBOLON, H., TACHIBANA, H., TAKAHASHI, H., TANAKA, N., YABE, K. (Eds.). Proceedings of the International Symposium on: Tropical Peatlands. Pp. 179 – 190.

Book : RIDLEY, H. N. 1923. *Flora of the Malay Peninsula 2*. L. Reeve & Co. Ltd, London.

Part of Book : BENTHAM, G. 1876. *Gesneriaceae*. In: BENTHAM, G. & HOOKER, J. D. (Eds.). *Genera Plantarum 2*. Lovell Reeve & Co., London. Pp. 990–1025.

Thesis : BAIRD, L. 2002. *A Grammar of Kéo: An Austronesian Language of East Nusantara*. Australian National University, Canberra. [PhD. Thesis].

Website : http://www.nationaalherbarium.nl/fmcollectors/k/KostermansAJGH.html. (Accessed 15 February 2012).

Reinwardtia
Published by Herbarium Bogoriense, Botany Division, Research Center for Biology,
Indonesian Institute of Sciences
Address: Jln. Raya Jakarta-Bogor Km. 46 Cibinong 16911, P.O. Box 25 Cibinong
Telp. (+ 62) 21 8765066; Fax (+62) 21 8765062
Email: reinwardtia@mail.lipi.go.id

REINWARDTIA Author Agreement Form

Title of article :

Name of Author(s) :

I/We hereby declare that:

- My/Our manuscript was based on my/our original work.
- It was not published or submitted to other journal for publication.
- I/we agree to publish my/our manuscript and the copyright of this article is owned by Reinwardtia.
- We have obtained written permission from copyright owners for any excerpts from copyrighted works that are included and have credited the sources in our article.

Author signature (s) Date

_____

Name

REINWARDTIA
Vol. 18. No. 1. 2019
CONTENTS

Reinwardtia is a accredited Journal (10/E/KPT/2019)
http://e-journal.biologi.lipi.go.id/index.php/reinwardtia

Herbarium Bogoriense
Botany Division
Research Center for Biology – Indonesian Institute of Sciences
Cibinong Science Center
Jln. Raya Jakarta − Bogor, Km 46
Cibinong 16911, P.O. Box 25 Cibinong
Indonesia