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## *Cryptocoryne aura* (Araceae), a new species from West Kalimantan, Indonesia

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**Abstract:** A new species, *Cryptocoryne aura* Wongso & Ipor, from West Kalimantan, Indonesia, is described and illustrated. It differs from other *Cryptocoryne* species primarily by having a transparent, ciliate membrane along the leaf margin and a short spathe with a yellow, forward-twisted limb. It has a chromosome number of  $2n = 26$ , which has not hitherto been recorded within the genus. The morphology of the germinating seed is unique within the genus, the embryo emerging c.  $\frac{1}{3}$  from the distal end of the seed with 3(or 4) plumular processes (prophylls).

**Key words:** Araceae, *Cryptocoryne*, aroids, taxonomy, new species, chromosome number, seedlings, Indonesia, Borneo, Kalimantan

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## Introduction

During the last fifteen years knowledge of Bornean species of *Cryptocoryne* Fisch. ex Wydler has increased considerably (see Ipor & al. 2009 for the most recent comprehensive summary) including the description of a number of new taxa: *C. xbatangkayanensis* Ipor & al., *C. ferruginea* var. *sekadauensis* Bast. & al., *C. ideii* Budianto, *C. noritoi* Wongso, *C. xpurpurea* nothovar. *borneoensis* N. Jacobsen & al., *C. uenoi* Yuji Sasaki, *C. yujii* Bastm. and *C. zaidiana* Ipor & Tawan (Bastmeijer 2016).

Borneo (736 000 km<sup>2</sup>) is accepted as one of the world's "hot spots" for floral biodiversity (MacKinnon & al. 1996). Currently the genus *Cryptocoryne* is best known from Sarawak, although in recent years e.g. H.B., I.B.I. and S.W. have been conducting a number of field trips into Kalimantan in order to establish the occurrence and distribution of *Cryptocoryne* there. Presently, Kalimantan has 13 described species, two varieties, and a natural hybrid of *Cryptocoryne* (Bastmeijer 2016).

Recently an image of a *Cryptocoryne* labelled as *C. cordata* Griff. "*rotundifolia*" was circulated on the inter-

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net, and plants became available commercially at the end of 2014. The commercial plant-collector found this *Cryptocoryne* by chance when he was searching for species of *Bucephalandra* Schott (*Araceae*), a plant also sought after for the commercial aquarium plant trade. Early in 2015 we had the opportunity to be guided to the habitat where we were able to sample the plant and make observations. The plants we found there were clearly different from any other known species of *Cryptocoryne*, and we therefore describe it here as a new species.

## Results and Discussion

### *Cryptocoryne aura* Wongso & Ipor, sp. nov.

Holotype: Indonesia, Kalimantan Barat, West Kalimantan, Kabupaten Sekadau, Kecamatan Nanga Taman, 26 Feb 2015, S. Wongso & I. B. Ipor SW1508 (BO; isotypes: C, L, M, SAR, Herbarium Universiti Malaysia Sarawak).

*Diagnosis* — *Cryptocoryne aura* differs from all other *Cryptocoryne* species by having the leaf blade margin with a distinct, whitish, slightly transparent, undulate membrane with whitish, short, ciliate trichomes. The germinating seed is unique within the genus in that the embryo emerges c.  $\frac{1}{3}$  from the distal end of the seed and bears 3(or 4) plumular processes (prophylls). Its chromosome number of  $2n = 26$  has hitherto not been recorded for *Cryptocoryne*.

*Description* — *Herbs* perennial, aquatic to amphibious, 5–10(–15) cm tall. *Rhizome* whitish to rusty brown outside, whitish creamy inside, notched, 3–5 cm long, 2–4 mm in diam., fleshy; *roots* many, arising from rhizome and from between lower leaves. *Cataphylls* whitish or dark purplish brownish with a thin transparent margin, linear, 10–25 mm long, 2-ribbed, apex acuminate or sometimes cleft. *Leaves* many, 15–20(–35) per individual, fully spreading at water surface or on ground surface; *petiole* whitish or rusty brown at base (especially parts buried in soil), dark green-purplish in distal part (exposed to light), abaxially rounded, adaxially flattened (D-shaped in cross-section), 7–15 cm long, wider (3–5 mm) at base, gradually narrowing (1.5–2 mm) distally; *lamina* abaxially dark purplish, also with whitish dots, adaxially greenish, densely punctate with whitish dots (easily seen with a lens), ovate-cordate, 2.5–4 × 4–6 cm, base ± cordate, apex acute; *margin* with distinctive undulating transparent whitish membrane c. 1 mm wide with margin furnished with whitish short ciliate trichomes, appearing whitish creamy with ciliate trichomes easily detached when dried; midrib adaxially distinctly greenish, with 3 pairs of prominent secondary veins and 1 pair of less prominent veins running close to margin. *Peduncle* 1–4 cm long. *Spathe* elongate,

c. 10 cm long; *kettle* whitish outside, whitish inside with slight purplish tinge, weakly globose-cylindric, slightly or not constricted at middle, c. 1 cm long; *tube* whitish outside with scattered purplish spots, slightly twisted, c. 6 cm long; *limb* yellowish greenish outside, yellow inside, ovate, strongly forward-twisted, 2–2.5 cm long; *collar* distinctly raised, deep yellow. *Female flowers* (4 or 5); ovary whitish, c. 3 mm long, c. 1.5 mm wide; stigmas whitish, ovate-obovate with rounded apex. *Male flowers* c. 25, creamy whitish, elongate, smooth. Naked *axis* 3–4 mm long; sterile *appendix* whitish; olfactory bodies yellowish. *Flap* whitish, ovate, apex apiculate. *Syncarp* dark purplish brown, ovoid, c. 7 × 4 mm, with slightly verrucose surface, apex apiculate. *Seeds* brownish blackish with finely striate surface, ellipsoid, slightly curved, 5–8 mm long, c. 1 mm wide, distal end thinly pointed with primary root emerging; embryo breaking through testa c.  $\frac{1}{3}$  from distal end of seed with 3(or 4) plumular processes (prophylls) where secondary roots also emerge.

*Chromosome number* —  $2n = 26$ , reported here for SW1508.

*Distribution* — Endemic to Borneo, known only from the type locality at Nanga Taman.

*Ecology* — The population of this species thrives well in low-lying streams in gentle valleys between small hills in undulating terrain. The vegetation is mainly rubber farms and degraded secondary forest dominated by *Dillenia suffruticosa* Griff., *Miscanthus floridulus* (Labill.) Warb. and *Scleria sumatrensis* Retz. The population comprises several patches of various sizes growing on black, peaty loam soil over which clear water gently flows. The water has a pH of 6.5, a conductivity of 14 $\mu$ s/cm and a temperature of 26 °C at midday. The plants are frequently submerged after the monsoon rains and semi-submerged or emergent during the dry season. The rhizome and roots tend to penetrate downward into peaty soil, with the leaves semi- to fully submerged depending on the water level. In natural habitat there are often several rosettes per plant clump.

*Conservation status* — Data Deficient (DD) (IUCN/SPS 2014). As the new species is presently known only from one locality, more observations are needed in order to outline a conservation assessment.

The continuous degradation of essential habitats, as a result of over-exploitation of forest resources mainly through intensive logging, transformation to large-scale agriculture, indiscriminate discharge of industrial waste and domestic sewage as well as illegal gold extraction in most rivers, directly contributes to river pollution that is particularly harmful to the aquatic flora in Kalimantan. *Cryptocoryne* species are no exception, and many of them are presently vulnerable or endangered.

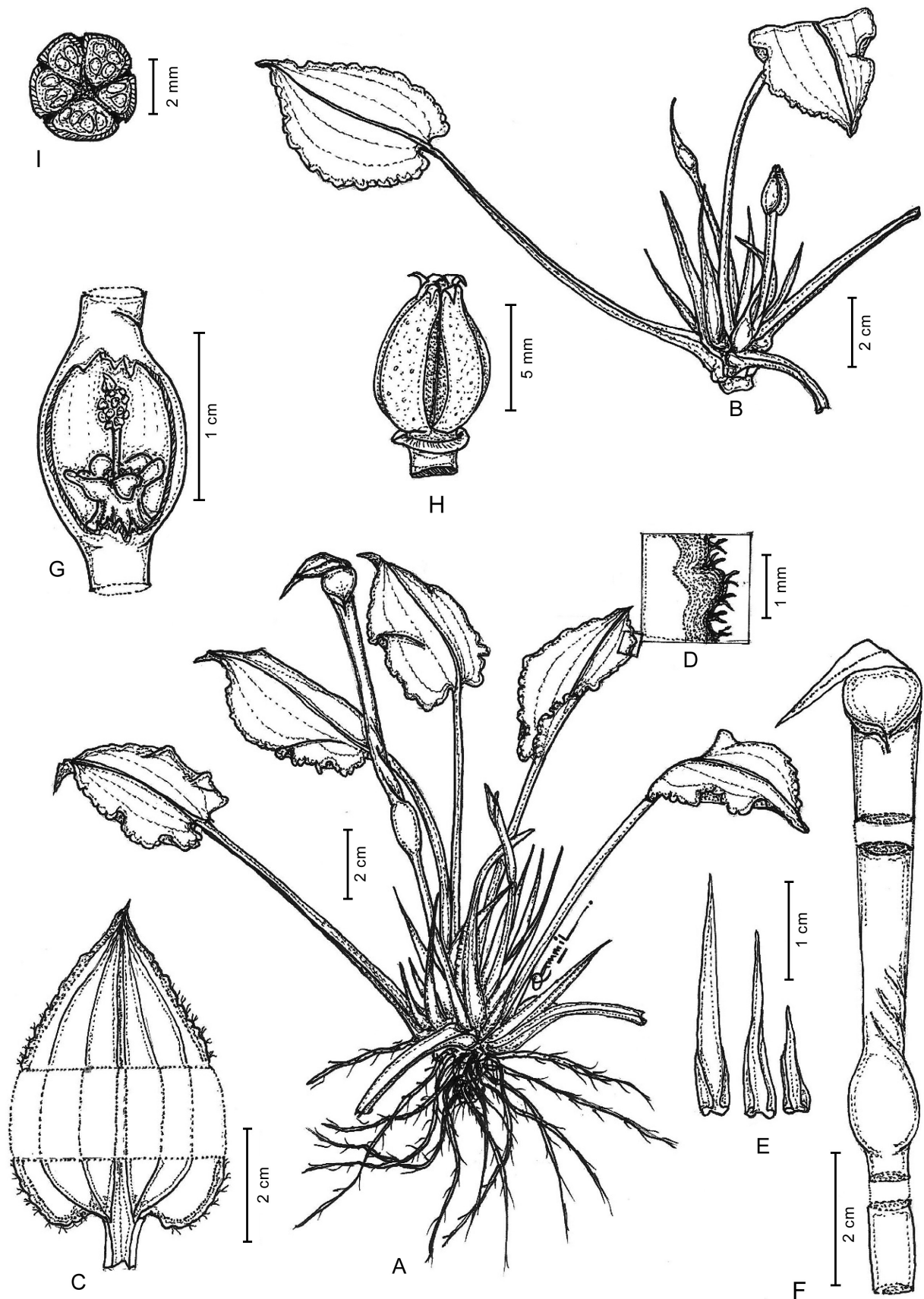


Fig. 1. *Cryptocoryne aura* – A: whole plant with inflorescence; B: whole plant with infructescence; C: leaf base and apex; D: membranous leaf margin with trichomes; E: cataphylls; F: spathe; G: dissected kettle; H: syncarp; I: cross-section of syncarp. – Drawing by Meekiong Kalu.





Fig. 2. *Cryptocoryne aura* – A: habitat at type locality with slower-flowing water; B: close-up of plants in A. – Photographed on 26 February 2015 by S. Wongso.

**Etymology** — The epithet alludes to the well-developed, slightly transparent, whitish membrane surrounding the leaf margin, which is likened to an aura.

**Remarks** — *Cryptocoryne aura* has a growth stature resembling that of *C. elliptica* Hook. f. (Peninsular Malaysia) and *C. bogneri* Rataj (Sri Lanka) in having all parts of the plant of small size and a rosette of many leaves, indicating that the plants are situated in shallow water with the leaf blades just below the water surface. This

common rosette phenomenon in these species is no doubt an adaptation to similar habitat niches and does not necessarily reflect a close phylogenetic relationship.

The morphology of the germinating embryo is unique for the genus, with the seeds having a rather thin and pointed distal end, with the embryo breaking through the testa c.  $\frac{1}{3}$  from this end with 3(or 4) plumular processes (prophylls); the primary root emerges from the distal end of the seed, while secondary roots emerge along with the plumular processes.





Fig. 3. *Cryptocoryne aura*, close-up of plants in Fig. 2. – A: newly opened spathes showing subobliquely twisted limb; B: older spathes showing forward-twisted limb. – Photographed on 26 February 2015 by S. Wongso.

Most species of *Cryptocoryne* have a rather undifferentiated embryo, which pushes through the distal end of the seed (micropylar end), and the root hairs can be seen at the “tip” of the embryo; just behind that, the plumular processes (prophylls) are seen pointing “backwards”. After further growth, more roots and leaves appear. Most of the embryo remains inside the seed, where it serves to absorb the endosperm in order to feed the growing embryo during the initial stages. There are a few exceptions to this simple embryo in

*Cryptocoryne*: *C. ciliata* (Roxb.) Schott, *C. dewittii* N. Jacobsen and *C. versteegii* Engl. have many plumular processes; in *C. ciliata* and *C. versteegii* this is obviously related to the viviparous mode of germinating in tidal habitats. *Cryptocoryne longicauda* Becc. ex Engl. has 6 or 7 plumular processes, and *C. lingua* Becc. ex Engl. and *C. pallidinervia* Engl. have 2 or 3 plumular processes (Wit 1990), and their function has not been studied further.

The chromosome number of  $2n = 26$  has not pre-





Fig. 4. *Cryptocoryne aura* – A: leaf showing surface patterns and transparent margin; B: close-up of transparent margin (the “aura”) with ciliate trichomes. – Photographs by S. Wongso.

viously been reported for *Cryptocoryne*, and from this number alone it is not possible to say anything about relationships (Arends & al. 1982). The basal chromosome numbers of  $x = 10, 11, 15, 17$  and  $18$  have been recorded for Bornean species;  $x = 10$  has been found in the Bornean *C. hudoroi* Bogner & N. Jacobsen, *C. ideii*, *C. keei* N. Jacobsen and *C. striolata* Engl.;  $x = 11$  has been found in the widespread SE Asian *C. ciliata*; and  $x = 14$  has been found in the Sri Lankan group around *C. beckettii* Thwaites ex Trimen. However, the morphology and the chromosome number together do not provide any clue as to relationships between *C. aura* and other *Cryptocoryne* species.

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Fig. 5. *Cryptocoryne aura* – A: plant showing limb of spathe slightly subobliquely twisted (older spathe); B: limb of spathe bent forward at a younger stage than in A; C: spathe longitudinally cut open showing kettle in lower part; D: limb of spathe showing slightly raised collar; E: opened kettle showing female flowers below, olfactory bodies (yellow) above, sterile interstice, and male flowers above. – Photographs by S. Wongso.



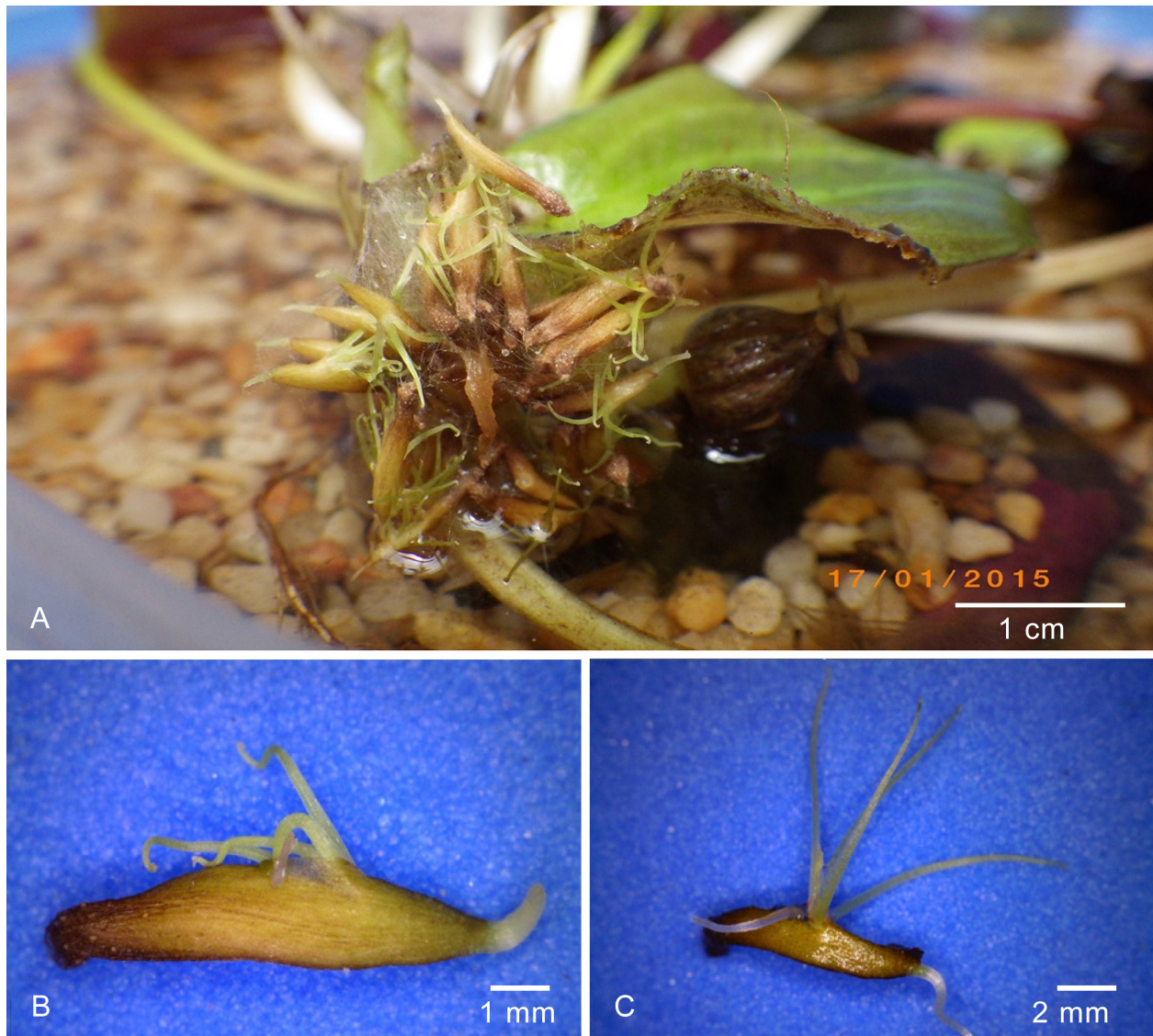


Fig. 6. *Cryptocoryne aura* – A: plant with opened syncarp with germinating seeds showing green plumular processes; B: germinating seed showing first stage of primary root emerging from distal end of seed (right) and still curled-up plumular processes emerging from testa; C: germinating seed at later stage than in A, showing long, bent primary root and 4 plumular processes. – Photographs by S. Wongso.

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