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Research article

Cryptocoryne esquerionii (Araceae), a remarkable new species discovered by a citizen scientist in Zamboanga Peninsula, southwestern Philippines

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A species new to science, *Cryptocoryne esquerionii* Naive & Wongso from the island of Mindanao is herein described and illustrated. It differs significantly from all other *Cryptocoryne* species by its yellow, colliculate spathe with a long acuminate apex. A detailed description, colour plates, phenology, geographical distribution information and a provisional conservation status are provided. The discovery of this new endemic species further highlights the importance of the citizen science in exploring and conserving the Philippine biodiversity.

Keywords: aroids, *Cryptocoryne*, Mindanao, Philippines, Zamboanga del Norte

Introduction

It was more than 100 years ago since the first species of *Cryptocoryne* from the Philippines was described: *Cryptocoryne usteriana* Engl. from the Island of Guimaras (Engler 1905). Recently, *C. joshanii* Naive & R.J.T.Villanueva was described from Basilan Island of Sulu Archipelago, *C. paglaterasiana* Naive & N.Jacobsen from Zamboanga del Norte and *C. palawanensis* Bastmeijer, N.Jacobsen & Naive from the islands of Palawan and Busuanga, bringing the total reported number of *Cryptocoryne* species up to eight for the Philippines, seven of which are known to be endemic (Naive and Villanueva 2018, Naive et al. 2022a, b). The genus is underexplored in the Philippines, however, future fieldwork will probably result in the discovery of more species either endemic or as new records from neighbouring countries.

During a fieldtrip to Zamboanga Sibugay province in the western part of Mindanao, an unknown species of *Cryptocoryne* was documented by a citizen scientist in July 2019. In May 2022, it was again documented by the citizen scientist on his fieldtrip in Tampilisan, Zamboanga del Norte. The citizen scientist then consulted the authors to help him in the identification of the documented enigmatic species. Meticulous



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examination of its morphology and consultation of all relevant literature as well as digitized herbarium specimens revealed that the collected specimen did not match any other known *Cryptocoryne* species. It is here described as *Cryptocoryne esquerionii*, a species new to science. With this discovery, the Philippines now holds a total number of nine *Cryptocoryne* species.

Material and methods

The measurements and descriptions were based on freshly collected materials. Multiple photographs were taken, and the coloured plates were prepared and edited in Affinity Photo software. Inflorescences were preserved in 70% ethanol and were subjected to stereomicroscopy. Relevant specimens and

literature of *Cryptocoryne* species from the Philippines and neighbouring countries were examined in different herbaria and through high-resolution images from Global Plants on JSTOR accessed at <https://plants.jstor.org/> and Global Biodiversity Information Facility (GBIF) accessed from www.gbif.org. An assessment of conservation status was carried out following IUCN (2022), based on our current knowledge and using their terminology on categories, criteria and subcriteria.

Taxonomic treatment

***Cryptocoryne esquerionii* Naive & Wongso, sp. nov. (Fig. 1, 2)** Unique among all other *Cryptocoryne* species by having somewhat rugose to bullate leaves and a yellow, colliculate spathe with a long-acuminate apex.

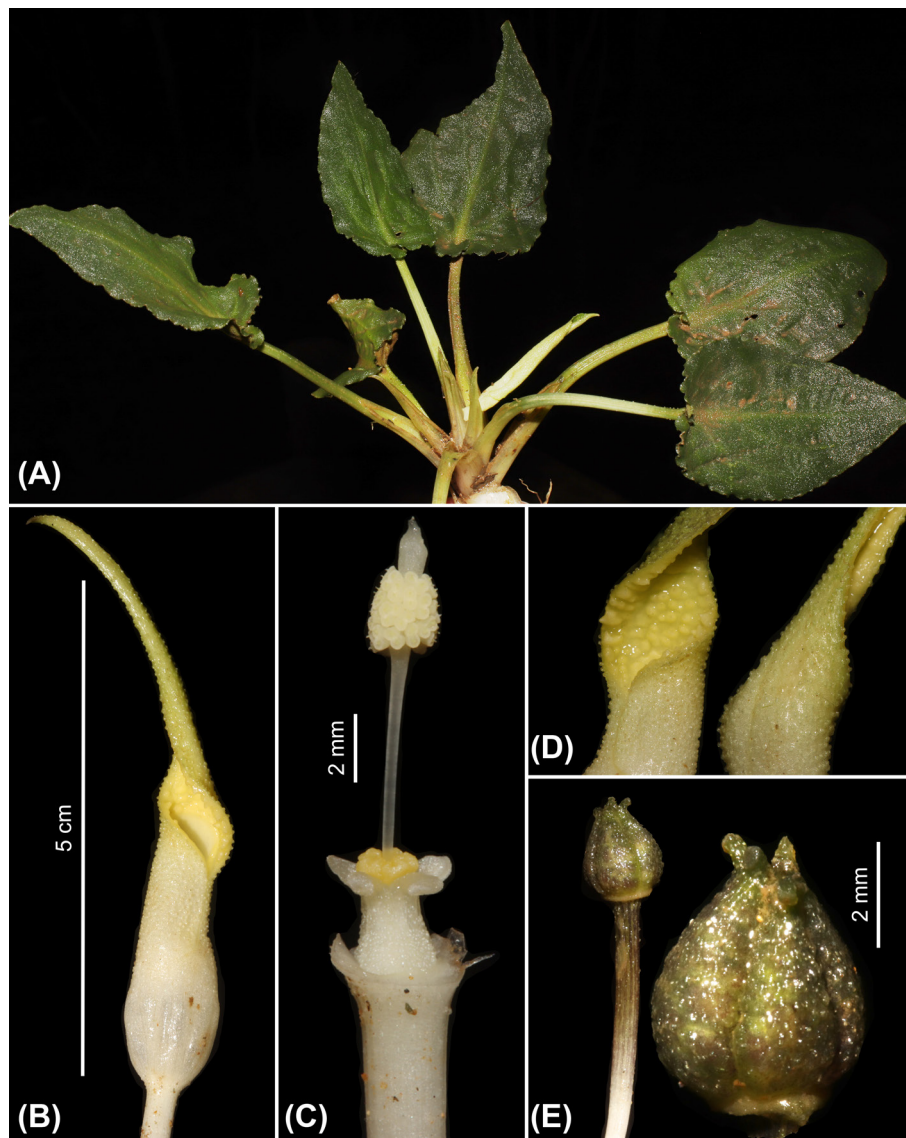


Figure 1. *Cryptocoryne esquerionii* Naive & Wongso sp. nov. (A) habit, (B) spathe, (C) spadix, (D) detail of Limb, (E) young syncarp. Photos by: MAK Naive.



Figure 2. *Cryptocoryne esquerionii* Naive & Wongso sp. nov. (A) and (B) habitat among tree roots in sand and pebbles among stones. Photos by: E. Prieto.

Type: PHILIPPINES. Western Mindanao, Zamboanga Peninsula, Zamboanga del Norte, Tampilisan, 145 m a.s.l., 26 May 2022, MAK Naive 133 (holotype PNH, isotype HNUL).

Etymology

Named after Mr Esquerion Prieto, a long-time investigator of aquatic flora in the Philippines and the discoverer of this beautiful endemic new species.

Description

Amphibious perennial herb, up to 8 cm tall. *Rhizome* terete, 8–10 mm in diameter, fleshy, glabrous, brownish white outside, creamy white inside, bearing short, stout, subterranean stolons. *Cataphylls* narrowly triangular, 2.5–3.0 cm long, glabrous, pale green to whitish green, margin entire, cucullate, apex acuminate. *Leaves* 8–12 cm long, fully spreading, up to 10 per individual plant; *petiole* terete to flattened, 4.5–7.0 cm long, green to pale green; *lamina* ovate, 4.0–7.5 cm long by 2.0–4.5 cm wide, green to blackish brown, somewhat bulate to rugose, with conspicuous veins, margin entire to sinuate, base cordate, apex attenuate. *Peduncle* 1.0–1.5 cm long, glabrous, creamy white. *Spathe* 5–7 cm long, outside all yellow, basally more whitish; *kettle* urceolate, about 1 cm long, fleshy, colliculate except in the basal half, creamy white to yellowish white, flap light yellowish; *tube* 4–5 mm long, colliculate, whitish yellow to pale yellow; *limb* twisted, narrowly triangular, ascending to upright, 3.0–3.5 cm long, colliculate, greenish yellow outside, yellow inside, margin entire, apex long-acuminate; *collar* distinct, throat whitish yellow to pale yellow. *Spadix* about 1 cm long. *Female flowers* 5–6; *ovary* 2.0–2.5 mm long, creamy white, minutely, sparsely papillose; *stigmas* ca 1 mm long, ellipsoid, horizontally spreading; *olfactory bodies* yellow; naked *axis* 4–5 mm long, glabrous, translucent yellow. *Male flowers* 20–30, pale yellow, congested; sterile *appendix* whitish yellow to pale yellow. Young *syncarp*

ovoid, 5–6 mm long, 4 mm in diameter, greenish brown, verrucose, apex apiculate.

Phenology

Observed flowering and fruiting in the wild in June, July, August and September.

Distribution, habitat and conservation status

Endemic to the Zamboanga Peninsula. The species is presently only known from the type locality (Zamboanga del Norte) and in the province of Zamboanga Sibugay. It was found growing in hill streams with sometimes swiftly running water, along banks in gravel and among tree roots or in crevices of ledges in deeply shaded places at 165 m a.s.l. As *Cryptocoryne esquerionii* is presently known only from the type locality, it is difficult to ascertain its conservation status according to IUCN (2022) categories and criteria, except that it is data deficient (DD). More observations are needed in order to outline a conservation assessment, but collecting for commercial purpose, quarrying, slash and burn and tourism is a risk.

Cultivation

Cultivation experiments have found that it thrives best shaded. The planting substrate was a mixture of sand and gravel. Growth was more lush in the presence of organic debris in the substrate. The leaves are very sensitive to drying and prefer a highly humid atmosphere or to be constantly submerged in water.

Taxonomic notes

Morphologically, *Cryptocoryne esquerionii* is unique among all Philippine *Cryptocoryne* species by having a yellow, colliculate spathe. Compared to the recently described *C. paglat-erasiana*, the new species differs significantly in having a pale yellow to greenish yellow, colliculate spathe (versus a maroon

spathe limb in *C. paglaterasiana*), a distinct collar with whitish yellow to greenish yellow throat (versus vaguely indicated collar with yellow throat in *C. paglaterasiana*) and ellipsoid and horizontally spreading stigmas (versus narrowly obtuse, ascending to erect stigmas in *C. paglaterasiana*).

The discovery of this new species further highlights the importance of the citizen science in exploring and conserving the Philippine biodiversity. In addition, the need to conduct further survey to ascertain the conservation status of this beautiful new endemic species is a must, given the increasing pace of forest destruction and habitat loss in Mindanao.

Key to the Philippine *Cryptocoryne* species

1. Spathe tube shorter than the spathe limb.....2
 - Spathe tube 2 or more times as long as the spathe limb4
2. Spathe all yellow, colliculate outside, limb upright.....
 -*C. esquerionii* Naive & Wongso
 - Spathe not all yellow, not distinctly colliculate on outer surface3
3. Leaf blade 4–5 × 1.5–2 cm, shiny green adaxially, pale green abaxially; spathe limb directed forward and horizontally twisted, collar prominent..... *C. pygmaea* Merr.
 - Leaf blade 4–13 × 1–2 cm, olive green or brownish, ± shiny purplish striped to marmorated; spathe limb upright twisted, collar zone distinct
 - C. palawanensis* Bastm., N.Jacobsen & Naive
4. Spathe limb with 0.5–1 cm long purple cilia along the margin..... *C. ciliata* (Roxb.) Schott var. *latifolia* Rataj
 - Spathe limb without long purple cilia along the margin5
5. Spathe opening yellow, limb yellow to brownish.....6
 - Spathe opening and limb in white or purplish colours..8
6. Leaf blades lanceolate, subcoriaceous, 10–12 × 3–4 cm, silvery green with darker irregular markings.....
 -*C. joshanii* Naive & R.J.T.Villanueva
 - Leaf blades 10–30 × 3–5(–10) cm, green, smooth to strongly bullate, often purple on the lower surface – or ovate to oblong, 5–8 × 2–4 cm, brown to reddish brown, lower surface brick red, cordate at base7
7. Leaf blades 10–30 × 3–5(–10) cm, green, smooth to strongly bullate, often purple on the lower surface; spathe limb brownish to yellow*C. usteriana* Engl.
 - Leaf blades ovate to oblong, 5–8 × 2–4 cm, brown to reddish brown, with lower surface brick red, cordate at base
 - C. paglaterasiana* Naive & N.Jacobsen
8. Leaf blade green on upper surface, purple on lower surface..... *C. coronata* Bastm. & Wijng.
 - Leaf blade green at both sides *C. aponogetifolia* Merr.

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Author contributions

Mark Arcebal Naive: Conceptualization (equal), Data curation (equal); Formal analysis (equal); Funding acquisition (equal); Investigation (equal); Methodology (equal); Project administration (equal); Resources (equal); Software (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing – original draft (equal); Writing – review and editing (equal). **Reagan Joseph Villanueva:** Investigation (equal); Resources (equal); Validation (equal); Writing – review and editing (equal). **Suwidji Wongso:** Investigation (equal); Project administration (equal); Validation (equal); Writing – original draft (equal); Writing – review and editing (equal). **Niels Jacobsen:** Investigation (equal); Project administration (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing – review and editing (equal).

Data availability statement

There are no additional data for this article.

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