

NORDIC JOURNAL OF BOTANY

Research article

Discovery through citizen science III: *Cryptocoryne zamboangensis* (Araceae), a new water trumpet discovered in Zamboanga del Norte, Philippines

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Nordic Journal of Botany

2023: e04181

doi: [10.1111/njb.04181](https://doi.org/10.1111/njb.04181)

Subject Editor: John Parnell

Editor-in-Chief: Torbjörn Tyler

Accepted 20 September 2023

Published 16 October 2023

Cryptocoryne zamboangaensis, is described as a new water trumpet species discovered by citizen scientists in the streams of Zamboanga del Norte, southwestern Philippines. It resembles *C. apogonitifolia* in having a spathe tube longer than spathe limb, but differs significantly by its ovate, densely verrucose bright purple limb with a narrow collar. A preliminary analysis of the conservation status and a dichotomous key to the species of the genus in the Philippines are provided.

Keywords: aquatic plants, biodiversity, endangered, western Mindanao, Zamboanga Peninsula

Introduction

The Zamboanga Peninsula, located in western Mindanao, is a distinct landmass known for its unique biodiversity (Naive et al. 2022a). It is believed to have originated during the Miocene era as a separate piece of land, possibly connected to Palawan in the past. The regions to the east of Zamboanga Peninsula consist of more recent ophiolitic deposits, and its plant life share significant similarities with that found in Borneo (Hall 1996, 1998, Yumul et al. 2004). The peninsula is politically divided into three provinces: Zamboanga Sibugay, Zamboanga del Norte and Zamboanga del Sur. Among the three provinces, Zamboanga del Norte has the greatest number of recorded *Cryptocoryne* species. These are: *Cryptocoryne esquerionii* Naive and Wongso (Naive et al. 2023a), *C. paglaterasiana* Naive and N.Jacobsen (Naive et al. 2022b) and *C. pygmaea* Merr. (Naive et al. 2022c). Despite the importance of the Zamboanga Peninsula in terms of presence of restricted-range and endemic species, very few studies have been conducted in the area. However, thanks to ongoing field exploration efforts in the area over the past few years, new plant taxa have been discovered within the



Zamboanga Peninsula such as *Plagiostachys lourdesiae* Docot (Docot 2020), *Macrosolen zamboangensis* Mazo, Nickrent and Pelser (Mazo et al. 2022), *Begonia bangsamoro* subsp. *bagasa* Naive (Naive et al. 2022a) and many more.

With the help of three citizen scientists (two of which are the third and fourth authors), an unknown *Cryptocoryne* population was found in one of the streams of Zamboanga del Norte province, western Mindanao in March 2023. Specimens were then collected and upon meticulous examination of its morphology and relevant literature, it became evident that the unknown plant did not match any other known *Cryptocoryne* species and is distinctive. Hence, we hereby describe it as *Cryptocoryne zamboangaensis*, a species new to science and the 11th representative of the genus in the Philippine archipelago. A detailed description, photographs to aid identification, distribution, phenology, ecology, proposed conservation status and comparison to allied species are provided below. This paper represents the third installment in a series that seeks to assess and document the genus *Cryptocoryne* in the Philippines through the help of citizen science (Naive et al. 2022a, 2023b).

Material and methods

The measurements and descriptions were based on fresh collected material and herbarium specimens. The general plant descriptive terminology follows Beentje (2016). Herbarium citations follow Index Herbariorum. Relevant literatures and type specimens of *Cryptocoryne* species from the Philippines and neighboring countries were examined in different herbaria through high-resolution images accessed from <https://plants.jstor.org> and/or global biodiversity information facility (GBIF) accessed from <https://www.gbif.org>. An assessment of conservation status was carried out following IUCN (2022).

Taxonomy

Cryptocoryne zamboangaensis Naive, sp. nov. Fig. 1–2

A species similar to *Cryptocoryne aponogetifolia* Merr. (Fig. 3) in having very long leaves and a long spathe tube, but recognized by having a narrowly ovate, ca 2 cm broad, densely verrucose bright purple spathe limb with a distinct narrow collar (vs lanceolate, ca 1 cm broad \pm smooth, not bright purple spathe limb without a narrow collar).

Type: Philippines, western Mindanao, Zamboanga Peninsula, Zamboanga del Norte, ca 130 m a.s.l., 30 Mar. 2023, MAK Naive 141 (holotype HNUL, isotype BUKH). Full locality withheld owing to the risk of potential exploitation of wild populations for commercial purposes.

Etymology

Named after the Zamboanga Peninsula, where this species was discovered. This also serves to highlight the importance

of the Zamboanga Peninsula as the center of speciation in the genus *Cryptocoryne* in the Philippine archipelago.

Description

Perennial, amphibious, large herb. Rhizome terete, ca 1 cm in diameter, rugose; roots numerous, ca 3 mm in diameter. Cataphylls narrowly triangular, 10–12 cm long by 1.5–1.8 cm wide, striate, glabrous, brownish, with entire margin, cucullate, long-acuminate at apex. Leaves up to 75 cm long, petiolate; petiole flattened, up to ca 30 cm long, 5–7 mm in diameter, glabrous, basal 1/3 brownish, remaining length green to pale green; lamina narrowly oblong-lanceolate, 40–45 cm long by 2.2–2.7 cm wide, chartaceous, bullate to rugose, glabrous on both sides, olive green to green adaxially, pale green abaxially, with entire margin, undulate, acute to attenuate at apex. Peduncle terete, up to 8 cm long, fleshy, basal half cream, the rest of the length brownish purple. Spathe erect, up to 14 cm long, solitary; kettle short, torulose, 1.5–1.7 cm long, 1.2–1.4 cm in diameter, fleshy, glabrous, pale purplish red; tube long, a little twisted, 10–11 cm long, 7–9 mm in diameter, fleshy, glabrous, pale purplish red to purplish red; limb narrowly ovate, 7.0–7.5 cm long by 2.0–2.2 cm wide, fleshy, densely verrucose, surface sometimes with more or less distinct furrows, purplish red, pale greyish brown outside, with slightly revolute margin, entire, at apex cucullate, acuminate, reclinate; collar narrow, purplish red. Spadix 1.6–1.8 cm long. Female flowers 9–10; ovary 5.0–6.5 mm long, greenish yellow, sulcate, glabrous; stigmas ovoid, concave, obtuse; olfactory bodies golden yellow; naked axis 5–6 mm long. Male flowers 50–60, golden yellow with cream to pale yellow margin, congested; sterile appendix broadly ovoid, 1.0–1.5 mm long. Syncarp not observed.

Phenology

The new species was observed flowering in March–June.

Distribution and habitat

Endemic to the Zamboanga Peninsula. The species has so far only been found in the streams of Zamboanga del Norte province. It was found in sandy soil submerged in a stream with clear, slow running water ranging from a deeply shaded to brightly lit environment with abundant decaying leaves at an elevation of 130 m a.s.l.

Proposed conservation status

So far, the species has only been found in its type locality where fewer than 250 mature individuals have been observed. However, this population is currently under threat by anthropogenic activities as the area is near human settlement and agricultural land, endangering the existence of this narrowly endemic species. Following the Red List criteria of the IUCN Standards and Petitions Subcommittee (IUCN 2022), we herein proposed this species be treated as ‘Endangered’ (EN D).

Cultivation

Cultivation experiments have demonstrated that this species thrives best in shaded environments with a substrate

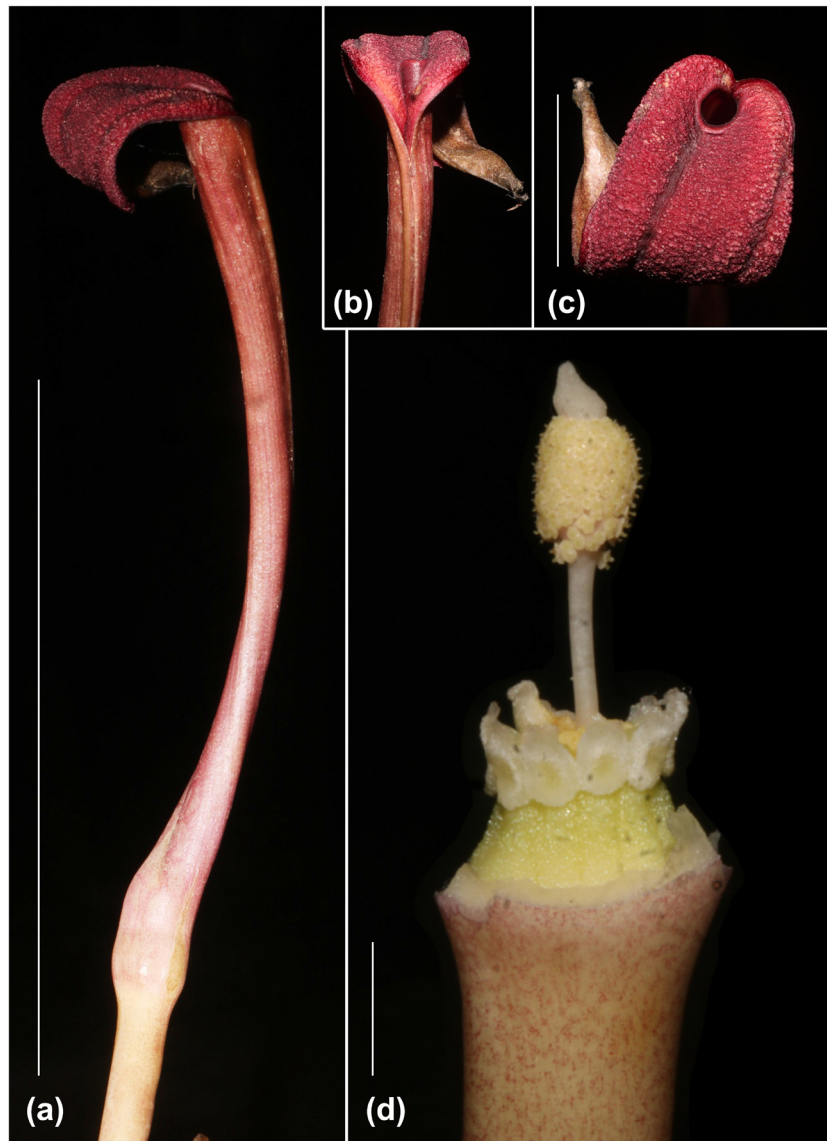


Figure 1. *Cryptocoryne zamboangaensis* Naive. sp. nov. (a) Spathe, (b) tube, (c) detail of Limb, (d) spadix. Scale bar: a = 10 cm, c = 2 cm, d = 5 mm. Photos by M. A. K. Naive.



Figure 2. In situ photograph of *C. zamboangaensis* Naive sp. nov. (a) Habitat, (b) excavated plant. Photos by M. A. K. Naive.

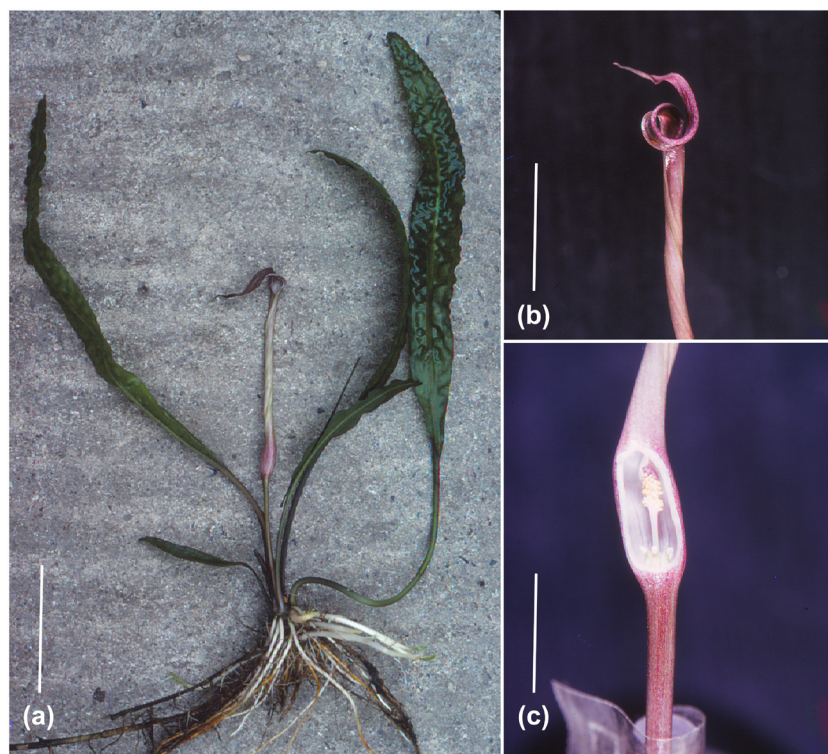


Figure 3. *Cryptocoryne aponoetifolia* Merr. (a) Excavated plant, (b) details of tube and limb, (c) dissected kettle showing the detail of spadix. Scale bar: a = 5 cm, b = 2 cm, c = 1 cm. Photos by N. Jacobsen.

composed of clayish soil or a mixture of sand and gravel. Growth appears to be more lush in the presence of organic debris within the substrate. Notably, the leaves display high sensitivity to drying and thus prefer a highly humid atmosphere or constant submersion in water.

Taxonomic notes

With the discovery of this new endemic species from Zamboanga del Norte, the Philippines now holds 11 taxa of *Cryptocoryne*. Aside from *C. aponoetifolia*, the new species is also somewhat similar to *C. coronata* Bastm. and Wijng. (Bastmeijer and Winjgaarden 1999). However, the new species differs from *C. coronata* in having an up to 45 cm long leaf lamina (versus up to 30 cm lamina in *C. coronata*), slightly twisted, 2 cm broad spathe limb (versus strongly twisted 1 cm broad spathe limb in *C. coronata*), purple red throat (versus purplish white in *C. coronata*), reclinate, densely verrucose, narrowly ovate limb (versus upright twisted, slightly rough, lanceolate limb in *C. coronata*).

Since the discovery of a single population of *C. zamboangaensis* and its precarious state, the species is suitable for the Endangered conservation status. It is plausible that further populations of *C. zamboangaensis* could persist in the streams of the under-collected and explored forests in Zamboanga Peninsula. This habitat should be extensively explored and preserved. Furthermore, propagation and *ex situ* conservation should be done to create enough stock for conservation work and for the possibility of re-introducing this species in its natural habitat.

Key to the Philippine *Cryptocoryne* species (modified from Naive et al. 2023a)

From the type specimen of *C. aponoetifolia* (from Panay, Ramos and Edaño, Bur. Sci. 31119) it is difficult to interpret the exact form and colour of the spathe limb, but it is here interpreted as the well-known aquarium plant found at Mt. Bulosan, Luzon (Bastmeijer 2000).

1. Spathe tube shorter than the spathe limb..... 2
 - Spathe tube 2 or more times as long as the spathe limb 6
2. Spathe distinctly colliculate on outer surface, all yellow to purplish shaded *C. esquerionii* Naive & Wongso
 - Spathe not distinctly colliculate on outer surface, deep greenish-brownish-purplish 3
3. Spathe with a distinct yellow collar zone..... *C. paglaterasiana* Naive & N.Jacobsen
 - Spathe without a distinct yellow collar zone..... 4
4. Spathe limb directed forward and horizontally twisted, tail not prominent, collar prominent; leaf blade 4.0–5.0 × 1.5–2.0 cm, shiny green..... *C. pygmaea* Merr.
 - Spathe upright, mostly with a long tail, inner surface dark purple, collar zone broad; leaf blade 4–13 × 1–3 cm, glossy brownish or olive green or with ± shiny purplish stripes or markings 5
5. Leaf blade 4–13 × 1–2 cm, olive green or brownish, with ± shiny purplish stripes or markings; spathe limb upright forward twisted, with a narrow opening..... *C. palawanensis* Bastm., N.Jacobsen and Naive

- Leaf blade 4–6 × 2–3 cm, glossy brownish green; spathe limb upright triangular with a broad opening and a visible collar zone..... *C. vinzelii* Naive
- 6. Spathe limb with 0.5–1.0 cm long purple cilia along the margin, mangrove plant..... *C. ciliata* (Roxb.) Schott var. *latifolia* Rataj
- Spathe limb without long purple cilia along the margin, not mangrove plant 7
- 7. Spathe opening yellow, limb yellow to brownish..... 8
- Spathe opening and limb white or purplish 10
- 8. Leaf blades 10.0–15.0 × 3.0–4.5 cm, lanceolate, silvery green with darker green elongate irregular markings on the upper surface..... *C. joshanii* Naive and R.J.Villanueva
- Leaf blades mostly much more than 15 cm long, not silvery green with irregular markings, or shorter and then brown-purple and brick red on the lower surface..... 9
- 9. Leaf blades 10–30 × 3–5(–10) cm, often purple on the lower surface; spathe limb brownish to yellow, pointing backward, twisted..... *C. usteriana* Engl.
- Leaf blades ovate to oblong, 5–8 × 2–4 cm, with lower surface brick red; spathe limb dark brown, pointing upward or forward, not backward twisted..... *C. paglaterasiana* Naive and N.Jacobsen
- 10. Leaves green on upper surface, red on lower surface; spathe limb with a whitish opening and prominent protuberances *C. coronata* Bastm. and Wijng.
- Leaves green on both surfaces; spathe limb without a whitish opening and prominent protuberances 11
- 11. Spathe limb ca 1 cm wide, with a broad collar or collar zone, surface irregular rough, dull brownish to light to dark purple..... *C. aponoetifolia* Merr.
- Spathe limb ca 2 cm wide, with a narrow collar, surface densely verrucose, purplish red..... *C. zamboangaensis* Naive

Acknowledgements – The authors would like to thank Jobeth Mark Anthony for the assistance during fieldwork; and DENR Region IX for the issuance of gratuitous permit.

Funding – The first author would like to thank Yayasan Konservasi Biota Lahan Basah and Department of Science and Technology through the National Research Council of the Philippines Expert Tool Program (NSTEP-SRD-052) for the funding support.

Author contributions

Mark Arcebal K. Naive: Conceptualization (equal); Data curation (equal); Formal analysis (equal); Investigation (equal); Supervision (equal); Validation (equal); Visualization (equal); Writing – original draft (equal). **Suwidji Wongso:** Investigation (equal); Supervision (supporting); Writing – review and editing (supporting). **Ariel Paglalunan:** Data curation (equal); Investigation (equal); Visualization (equal); Writing – original draft (supporting). **Edilberto Ponteras:** Data curation (equal); Investigation (equal); Visualization (equal); Writing – original draft (supporting). **Niels Jacobsen:** Formal analysis (equal); Investigation (equal);

Project administration (equal); Validation (equal); Writing – review and editing (equal).

Data availability statement

This article contains no additional data.

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