



## On the identity of *Cryptocoryne pygmaea* (Araceae) from Western Mindanao and the description of a new species from the islands of Palawan and Busuanga

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### Abstract

Recent fieldwork in Zamboanga del Norte resulted in the recollection of the poorly known aquatic aroid, *Cryptocoryne pygmaea*. In this study, we have clarified the identity of *C. pygmaea* as well as provided a detailed morphological description based on our recently collected material, updated its geographical distribution information, ecology, phenology, and a proposed conservation status. Through this recollection, it was revealed that plants previously identified as *C. pygmaea* in Palawan and Busuanga are different, thus we describe them here as *C. palawanensis*, a species new to science and the eighth representative of the genus for the Philippine archipelago.

**Keywords** Aroid, aquatic plants, Philippine Biodiversity, Zamboanga Peninsula

### Introduction

The genus *Cryptocoryne* Fisch. ex Weyler (1830: 428), belonging to family Araceae, is represented by more than 60 species which are distributed from India, Sri Lanka, Mainland Asia, Malay Peninsula, Sumatra, Borneo, the Philippines and New Guinea (Bastmeijer 2018, Wongso *et al.* 2019). In the Philippines, the discovery of *Cryptocoryne joshanii* Naive & Villanueva (2018: 248) and *C. paglaterasiana* Naive & N.Jacobsen in Naive *et al.* (2022: 540) increased the total number of the genus to seven, of which six are known to be endemic. The genus is under-explored in the Philippines, however, future fieldwork will probably result in the discovery of more species either endemic or as new records from neighbouring countries. Unfortunately, many *Cryptocoryne* species are becoming endangered mainly because of habitat destruction and poaching (illegal trade of the plants for ornamental purposes).

Recent intensified fieldwork and investigation of the streams of Zamboanga del Norte has been undertaken resulting in the discovery of an unknown *Cryptocoryne* population. After examining its vegetative and reproductive morphology and comparison with protologues and relevant literature as well as digitized type specimens of the genus *Cryptocoryne*, a match was made with *Cryptocoryne pygmaea* Merrill (1919: 371). *C. pygmaea* was described by E.D. Merrill based on his collected material from Sax River, District of Zamboanga. A number of other *Cryptocoryne* collections from other localities in the Philippines have over the years been referred to *C. "pygmaea"* (e.g., Palawan and Busuanga). We could see that there was a range of morphological differences, but Merrill's original description was not very clear about the details of the spathe limb. An investigation of the spathes from the not well-preserved herbarium specimens of the neotype of *C. pygmaea* did not provide any information as to how exactly a spathe of a live specimen would look like given that fresh live material was not readily available. The discovery of new populations in Zamboanga del Norte proved to be very similar to the original description and the neotype of *C. pygmaea* and clearly

different from the Palawan specimens. This study prompted us to clarify its identity, update the description for this species, provide photographs to aid identification and to provide updated information on its geographical distribution. Further, our investigation caused us to realize the differences of the populations collected from Palawan and Busuanga to the true *C. pygmaea* from Zamboanga Peninsula and describe it here as a species new to science.

## Materials and methods

The measurements and descriptions were based on fresh collected materials. The coloured plates were prepared and edited in Affinity Photo software. Flowers 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 through high-resolution images from Global Plants on JSTOR accessed at <https://plants.jstor.org/> and Global Biodiversity Information Facility (GBIF) accessed from <https://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.

## Taxonomy

### *Cryptocoryne pygmaea* Merrill (1919: 371) Fig. 1.

**Type:**—PHILIPPINES, Zamboanga District, Sax River, Merrill 8174, 6 December, 1911; type lost during WW2. **Neotype** (designated by Rataj, 1975): PHILIPPINES, Western Mindanao, Zamboanga Peninsula, near Kabasalan, Muralong Mountain, 27 November 1940, L.E. Ebaló 717 (neotype GH!, isoneotypes, PNH!, MICH!).

Amphibious, perennial herb, up to 10 cm tall. *Rhizome* terete, 6–8 mm in diameter, fleshy, glabrous, creamy to brownish white outside, creamy white inside. *Cataphylls* narrowly subulate, 2.5–3.0 cm long by 0.4–0.6 cm wide, papery, striate, glabrous, brown except the whitish basal 1/3, margin membranous, entire, apex long acuminate, slightly cucullate. *Leaves* 15–20 cm long, fully spreading, up to 10 leaves per individual; *petiole* 6–8 cm long, flattened, glabrous, canaliculate; *lamina* narrowly ovate to oblong, 4–5 cm long by 1.5–2.0 cm wide, glabrous on both sides, shiny green adaxially, pale green abaxially, margin entire, base cordate, apex acute. *Peduncle* terete, up to 2 cm long, glabrous, creamy white. *Spathe* 3.0–3.5 cm long; *kettle* urceolate, ca. 1 cm long, 0.7–0.9 cm in diameter, fleshy, glabrous, greenish white; *tube* tubular, ca. 1 cm long, 0.7–0.8 cm in diameter, glabrous, greenish white suffuse with purple; *limb* narrowly ovate to subulate, forward obliquely, horizontally twisted hiding the collar, ca. 2 cm long by ca. 0.5 cm wide, glabrous on both sides, surface rough, green suffuse with purple outside, purple inside, apex long acuminate; *collar* distinctly raised, purple. *Spadix* ca. 1 cm long. *Female flowers* 6; *ovary* 1.0–1.5 mm long, 1 mm in diameter, creamy white, minutely papillose; *stigmas* creamy white, erect, concave, obtuse. *Male flowers* ca. 40, pale yellow, irregularly rounded, smooth, slightly spreading; naked *axis* 3.0–3.5 mm long; sterile *appendix* creamy white; *olfactory bodies* pale yellow. *Fruit* not seen.

**Distribution:**—Endemic to Zamboanga Peninsula, Western Mindanao, Philippines. The species had previously been found in the provinces of Zamboanga del Sur, Zamboanga Sibugay from which there are no newer confirmations and presently Zamboanga del Norte.

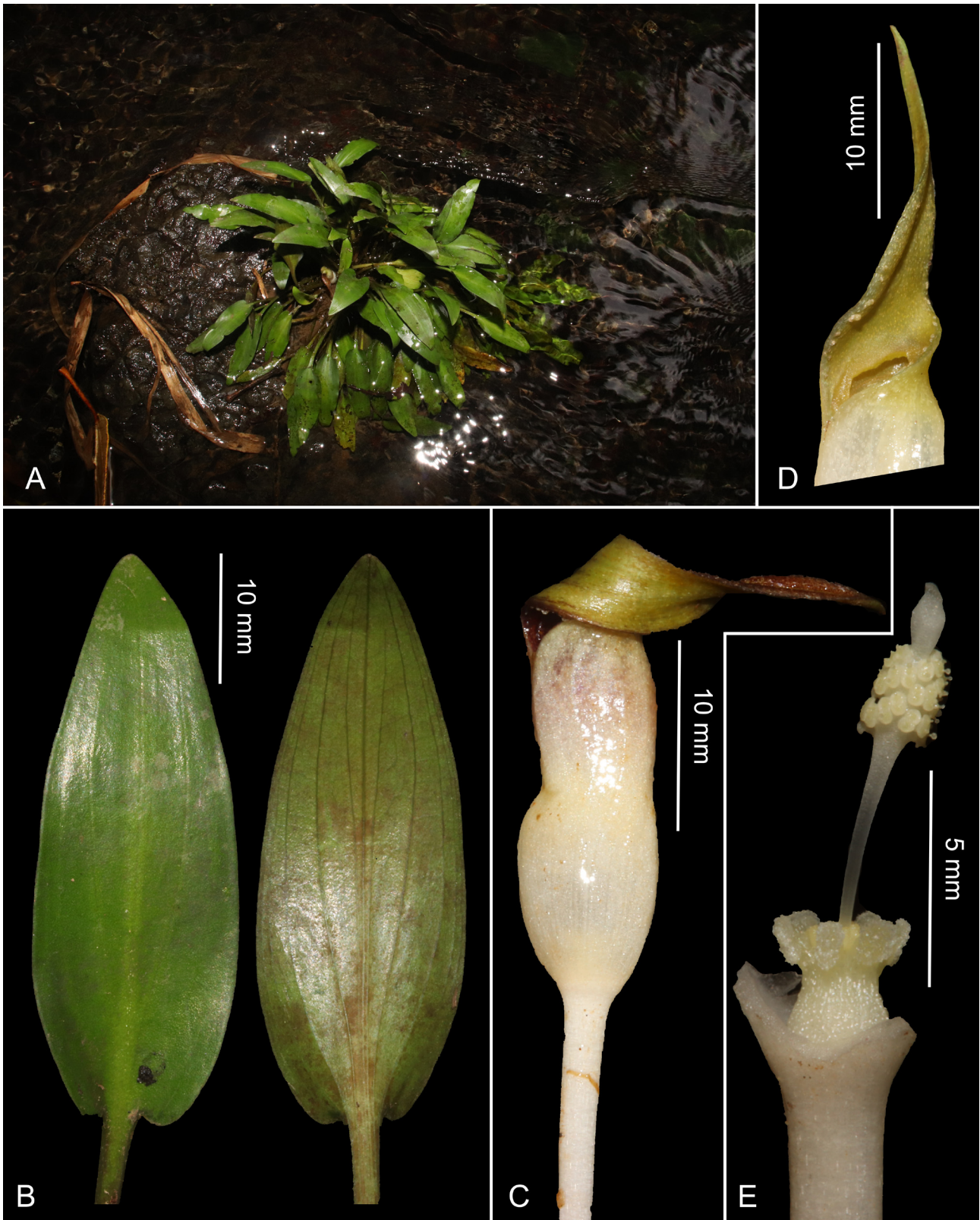
**Ecology:**—The collected specimen was found growing in a crack of a rock in a stream with clear, slow running water and deeply shaded locality at 150 m a.s.l. Merrill (1919) says that *C. pygmaea* grows “in the crevices of ledges, in stream beds, in very damp shaded ravines, in situations subject to overflow, at an altitude of about 300 meters”. An original habitat situation for *C. pygmaea* would probably be along the banks of small forest streams, and presently with intensified agricultural development it has survived in places where it has been able to maintain a root grip, i.e., “in the crevices of ledges”, a niche which has also been noted for other *Cryptocoryne* species.

**Phenology:**—Observed flowering in July, November, and December.

**Vernacular name:**—The species was locally known as “*Sigbut*” by the Subanen, as indicated in the specimen of L.E. Ebaló.

**Proposed conservation status:**—The distribution of the species now is restricted within Zamboanga Peninsula and is really rare with less than 10 mature individuals found within the stream in Zamboanga del Norte. The species

was found growing near a human settlement where several anthropogenic activities are observed such as quarrying, rubber plantation and poaching. Following the Red List Criteria of the IUCN Standards and Petitions Subcommittee (IUCN 2022), we proposed this species to be treated as Critically Endangered under subcriteria D (very small or restricted population) ‘CR D’.



**FIGURE 1.** *Cryptocoryne pygmaea* (MAK Naive 130). A. Habit and habitat. B. Details of the leaf (left adaxial, right abaxial). C. Spathe showing the forward bent limb. D. Detail of a yellow, more upright limb showing the raised collar. E. Details of female flowers at the base of the spadix and the male flowers in the distal part. Photos and prepared by: MAK Naive.

**Specimen examined:**—PHILIPPINES. Western Mindanao, Zamboanga del Norte, elev. 150 m, 31 July 2022, *MAK Naive 130* (PNH!). Full locality data withheld owing to the risk of potential exploitation of wild populations for commercial purposes.

**Notes:**—With the identity of *C. pygmaea* established, there are other Philippine *Cryptocoryne* collections referred to *C. pygmaea* over the years which need further investigation.

*Edano 46022*, Capiz Prov., Panay, Oct. & Nov. 1926 (NY!). Identity unresolved, but the size of the leaves is much larger than those of both *C. pygmaea* and *C. palawanensis* and they could indicate small specimens of *C. aponogetifolia* Merrill (1919: 370).

*Ramos & Edano 37040*, Mindanao, Zamboanga District, Malangas, Oct. & Nov. 1919 (BM!, BO!, K!, L!, P!, US!). Although there are several duplicate specimens available from several herbaria, it is difficult to interpret exactly what the spathe looks like, except that it seems to be an upright spathe perhaps 2.5 cm long and dark purple in the upper, upright part. The leaves are about 15 cm long, blades narrowly ovate 6 × 2.5 cm with a cordate base. The plant seems different from the species known.

### ***Cryptocoryne palawanensis* Bastmeijer, N.Jacobsen & Naive, sp. nov. Fig. 2.**

*Cryptocoryne palawanensis* is somewhat similar to *C. pygmaea* however, the new species can be recognized by having these following characters: olive green or brownish, more or less shiny purplish striped to marmorated leaves that are ovate to narrowly ovate; the spathe has an obliquely twisted limb with a rough inner surface, without a distinct collar, 1–3 cm long caudate appendage, and the colour of the whole inside is red to dark red.

**Type:**—PHILIPPINES. Luzon, Palawan, W of Taytay, stream near the Nagbenter River, close to the tidal area, 13 May 1999, *Bastmeijer 794* (holotype L!, isotypes PNH!, HNUL!).

Amphibious herb, submerged specimens up to 25 cm. *Rhizome* rather stout, stolons long, slender. *Cataphylls* 2–3 cm long, subulate, whitish to greenish, striate, glabrous, somewhat recurved. *Leaves* 5–25 cm long, up to more than 10, submerged longest, green to olive green or brownish, more or less purplish striped to marmorated on the upper surface, lower surface green to more or less dark red; *petiole* 4–15 cm long, longest in continuously submerged specimens; *lamina* smooth to somewhat undulate at the margin, somewhat shiny, ovate to narrowly ovate, 4–13 cm long and 1–2 cm broad with a rounded to truncate to more or less cordate base, apex acute to obtuse. *Peduncle* 1–5 cm long. *Spathe* 3.5–5.0 cm long, the upper part greenish to brownish, smooth to rough with elongate protuberance like structures on the outer surface, the lower part whitish; *kettle* ca. 1 cm long, inside white; *tube* short, usually less than 0.5 cm long, flap whitish; *limb* 2–4 cm long, inner surface rough, without a distinct collar, more or less upright forward twisted, into a 1–3 cm long caudate appendage; the colour of the whole inside is red to dark red. *Spadix* ca. 1 cm long. *Female flowers* 5–7, greenish to whitish, more or less finely purple spotted, with small, rounded stigmas. *Olfactory bodies* rounded, whitish to yellow. *Male flowers* 20–30; appendix white. *Syncarp* more or less broadly ovoid, smooth, seeds brownish, endosperm present, embryo simple, cone shaped, with an undifferentiated plumule. Chromosome number  $2n = 34$  (Reported for *NJ 2962!*, from Busuanga; Arends *et al.* 1982).

**Distribution:**—Endemic to the Philippines. The species has been observed in northern Palawan and Busuanga.

**Habitat:**—Small streams or rivers with slow to rather quickly running water, with a sandy or stony bottom, not high above sea level.

**Proposed conservation status:**—The distribution of the species is restricted to the islands of Busuanga and Palawan with less than half a dozen known localities (1999). The habitats in which it occurs were already then generally severely degraded and found near human settlements. Following the Red List Criteria of the IUCN Standards and Petitions Subcommittee (IUCN 2022), we proposed this species to be treated as Near Threatened ‘NT’.

**Etymology:**—The specific epithet ‘*palawanensis*’ was coined after the island of Palawan, Philippines, situated in the western part of the archipelago.

**Cultivation:**—The first results in cultivation shows that it is an easy grower in mineral soil, and with some leaf peat added. It also proves that it is a good aquarium plant.

**Specimen examined:**—PHILIPPINES. *Bastmeijer 787*, 07 May 1999, Busuanga. Near Labangan bridge nr 1; *B 788*, 11 May 1999, Palawan. S of Taytay. NW of lake Manguao; *B 789*, 12 May 1999, Palawan. S of Taytay. Near Bato bridge; *B 790*, 12 May 1999, Palawan. S of Taytay. Near Bato bridge; *B 791*, 13 May 1999, Palawan. W of Taytay, near Embarcadero bridge; *B 792*, 13 May 1999, Palawan. NW of Taytay. Near Isang bridge nr. 1; *B 793*, 13 May 1999, Palawan. NW of Taytay. Near a bridge (under construction); *B 794*, 13 May 1999, Palawan. W of Taytay. Near the

Nagbenter river; *B* 795, 14 May 1999, Palawan. N of Taytay. Near Sandoval (*B* numbers at C!, L!, PNH!, SING!); *NJ* 2962, Busuanga, commercial import, 8 October 1975 (C!); *Merrill* 9272 (K!, US!), *Cryptocoryne* “*pygmaea*” from Palawan, Tatay, May 1913.



**FIGURE 2.** *Cryptocoryne palawanensis*. A. Habitat and habit (*B* 787). B. Fruiting plant showing the opened, starshaped syncarp (*B* 794). C. Cultivated, flowering plant (*B* 790). D–F (*B* 793). D. Spathe showing the oblique opening of the limb. E. Detail of limb surface. F. Close up of the cut open kettle showing the female flowers, olfactory bodies, and male flowers and the flap. Photos by J.D. Bastmeijer. Scale 1 cm.

**Notes:**—For a number of years, *Cryptocoryne palawanensis* was referred to *C. pygmaea* and was only known from a few herbarium specimens. It was not until 1999 when new material was obtained (Bastmeijer & Morco 2000), allowing us to get a good knowledge of the species still assuming that the Palawan samples belonged to *C. pygmaea*.

Live specimens in cultivation were first known in 1975 when an unknown plant (*NJ 2962*, C!), in a commercial shipment of *C. aponogetifolia* from the Philippines, turned up in Copenhagen (Planteimporten). After flowering, the plant was referred to *C. “pygmaea”* (de Wit 1990, Bastmeijer 2018). The unknown origin of this plant was cleared up during Bastmeijer’s trip to visit Herson Morco in 1999 (Morco International Aquatics, Manila, Philippines). It was possible to disclose the former 1975 locality to the island of Busuanga (Calamian group, halfway from Mindoro to Palawan), from where local suppliers had sent plants to Manila where they were shipped to Copenhagen (Bastmeijer 2018).

In 1984 a botanical expedition to Palawan, sponsored by the Hilleshög Forestry (timber) Company (Hilleshög, 1985), found *C. “pygmaea”* near Lake Manguao (= Lake Danao) - but no live material was brought back. During Bastmeijer’s and Morco’s trip in 1999, a number of new localities were found in the northern part of Palawan. The specimens growing on the banks were 5–8 cm in height while the ones from deeper water grew up to 25 cm (Bastmeijer 2018).

The Busuanga plants generally have narrower and more colourful leaves than those from Palawan, and the spathe limb ends in a short tail, while the tail in the Palawan specimens is longer.

*C. palawanensis* has up to now not been found in mid and southern Palawan.

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