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Amorphophallus samarensis (Araceae), a new species endemic to Samar Island, Eastern Visayas, Philippines

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Abstract. *Amorphophallus samarensis* is described as a new species from Paranas, Samar Island Natural Park, Samar Eastern Visayas, Philippines. *A. samarensis* resembles *A. calcicola* by having a solitary leaf, long peduncled solitary flower, cylindrical female zone, ovary depressed, disk shape, slightly distant ovaries, and absence of staminode. It differs from *A. calcicola* by having the rachis winged at the distal part of the leaf, pale to dark maroon slightly depressed globose capitate stigma, style color, length of spadix, and truncate anther. The new species is considered Critically Endangered (CR) based on IUCN guidelines due to persistent anthropogenic activities. There are 30 individual plants encountered in the locality with less than 100 sq. km area of occupancy with an observed threat.

Keywords: *Amorphophallus calcicola*, biodiversity, conservation, critically endangered, taxonomy.

INTRODUCTION

One of the biggest families of flora is Araceae. This family is also called “Arum” (Moodley et al. 2016). *Amorphophallus* is one of the biggest genera of the family Araceae (Claudel and Lev-Yadun 2021; Islam et al. 2023). This genus is considered to have an extremely small population (Tang et al. 2020) and is the third-largest genus of the family Araceae with paleotropical dispersion (Claudel and Lev-Yadun 2021). Based on the record of the World Checklist of Vascular Plants (WCVP 2022), there are 241 accepted *Amorphophallus* species worldwide (Bulawin et al. 2022; Bulawin et al. 2023). In the Philippines, a total of 20 accepted *Amorphophallus* species (Pelser et al. 2011 onwards; Bulawin et al. 2023) are currently recorded, and one of these could

also be found in Samar. The discovery of *A. samarensis* is another addition to Philippine *Amorphophallus*.

Due to its unique topography, climate condition, and physical structure, the Philippines has a rich biodiversity consisting of endemic and diverse species, nevertheless, it is on the list of conservation preferences (Batuyong et al. 2020). In the Philippines, Samar is considered the third largest island, with a total land area of 13,458 sq km (PCARRD 2006). Samar Island consists of a huge area of karst, and some of these areas are part of Samar Island Natural Park (SINP) (Villanueva et al. 2021) and located in Northern and Eastern Samar. The park has highlands with distinct peaks surrounded by limestone rock (Patindol 2016). Under Presidential Proclamation 442, SINP was established as Protected Area on April 13, 2003 (Meniano 2022) by the National Integrated Protected Areas System (NIPAS) Act of 1992. The forest of Samar Island Natural Park covers 330,300 hectares and 124,500 hectares buffer zone and was nominated as UNESCO World Natural Heritage Site (Villanueva et al. 2021).

The SINP is one of the significant spots in Samar because of its rich biodiversity (Patindol 2016). It is also a dwelling area for the Philippine Eagle, Philippine Hawk Eagle, and the Philippine Cockatoo and some endangered species like Giant Golden-Crowned Flying Fox, Philippine Nectar Bat, Philippine Pygmy Roundleaf Bat, Philippine Warty Pig, Philippine Brown Deer, large forest rat, hairy tailed rat, and squirrel (Senate Bill No. 2392). Additionally, new species of palms and orchids are included in the present record of SINP's biodiversity.

The first author conducted fieldwork last 2019 and found this interesting *Amorphophallus* species. Another fieldwork was done at SINP in 2022 to validate the new species and additional specimens were collected for further examination.

MATERIALS & METHODS

Gratuitous Permit no. 312 with GP holder (Norilyn Fontarum-Bulawin) was obtained from the Department of Environment and Natural Resources Biodiversity Management Bureau (DENR-BMB). Fieldworks at Paranas, Samar Island Natural Park, Samar Eastern Visayas, Philippines was conducted from June 23-25, 2022.

Specimens were collected over the steep shaded karst in SINP, Paranas, Samar, Eastern Visayas (Fig 1). Field data were recorded, and photo documentation was done to get accurate information of the plant in situ. Specimens were collected for herbarium studies and the vouchers were deposited in PNH and USTH. *A.*

samarensis was comprehensively compared to the protologues and digital type specimens of closely related species, namely *A. calcicola* Tamayo et al., *A. longispathaceus* Engl. & Gehrm, and *A. rostratus* Hett. An updated taxonomic key of five (5) Philippine *Amorphophallus* is here presented with reference using Hetterscheid (1994), Pelser et al. (2011) onwards, Magtoto et al. (2013), Bustamante et al. (2020), and Tamayo et al. (2021).

TAXONOMIC TREATMENT

Amorphophallus samarensis Fontarum-Bulawin, Medecilo-Guiang & Alejandro, **sp. nov.** (Figures 2, 3, & 4).

Type: Philippines, Eastern Visayas, Samar Island, Municipality of Paranas, Samar Island Natural Park (SINP), 137–329 masl elevation, on the shady areas, karst forest, 23 June 2022, *Norilyn Fontarum-Bulawin 031* (holotype PNH! [258714]; isotypes PNH! [258715] & USTH! [016887]).

Diagnosis

Amorphophallus samarensis has widely triangular, undulating, pale green, cream to maroon spathe, with maroon spots, an undulate to entire spathe margin; cylindrical female zone; spadix longer than spathe; slightly distant depressed globose ovaries; pale to dark maroon slightly depressed globose capitate stigma; elongate cylindrical male zone; truncate anther; absent of staminode; and smooth narrowly elongate cylindrical appendix. *A. samarensis* is like *A. calcicola*, *A. longispathaceus*, and *A. rostratus* for having solitary leaf, spadix longer than spathe, long peduncled solitary flower, congested male flowers, and slightly distant female flowers. However, it differed from *A. calcicola* by its subglobose tuber, smooth petiole, distal part of winged rachis not branched, narrowly elliptic leaflets, undulate to entire leaf margin, undulated in the upper part and entire in the lower part spathe margin, pale to dark maroon slightly depressed globose capitate stigma, and elongate to widely triangular-ovate spathe. Also different from *A. longispathaceus* by its tuber, rachis, leaflets shape, spathe margin, shape of stigma, and spathe shape. Different from *A. rostratus* in leaflets, rachis, absence of staminode, ovary shape, and shape of stigma.

Description

Tuber subglobose, 6–7 cm in diameter, 3.5–4.5 cm high, pale to dark brown. Leaf solitary; petiole 55–58 cm long, 3.3–3.5 cm in diameter, surface smooth narrow-

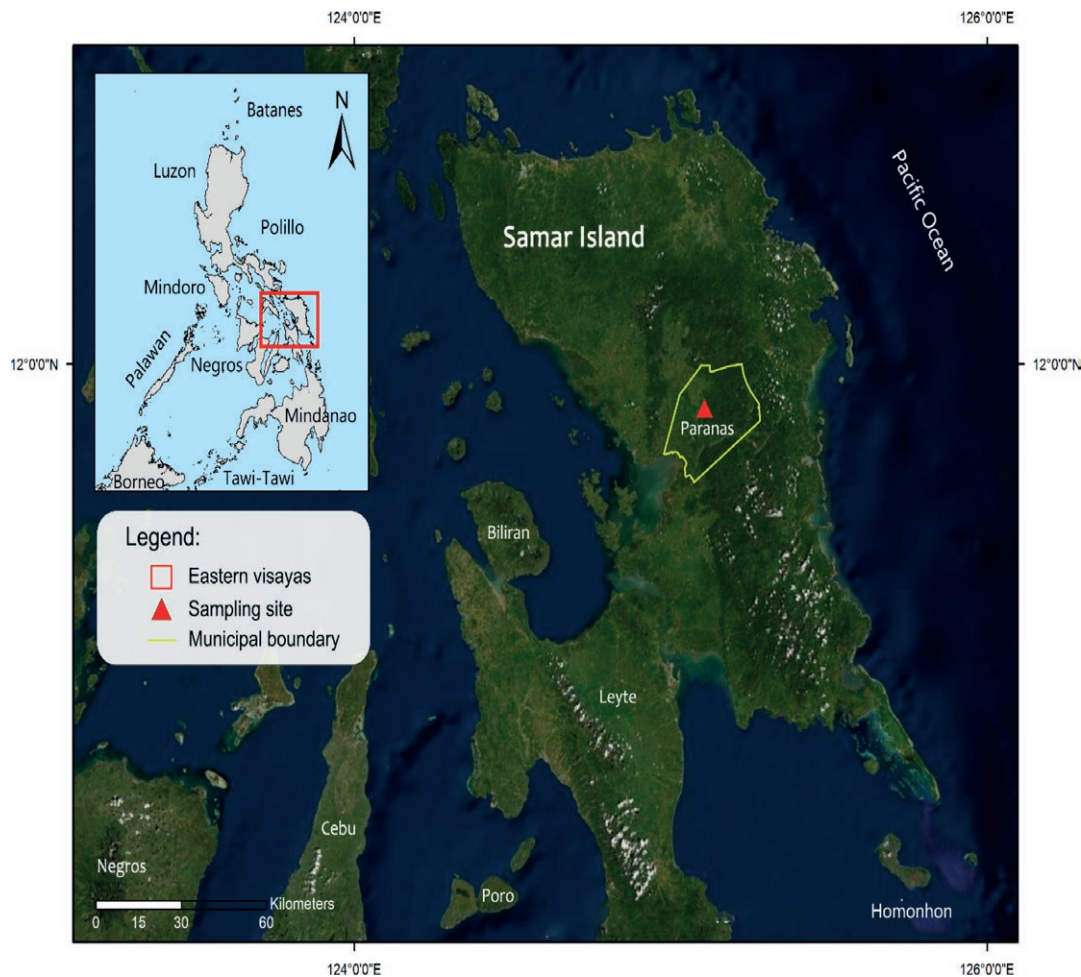


Figure 1. Map of the type locality. Eastern Visayas, Samar Island (province), Municipality of Paranas (in red triangle), Samar Island Natural Park.

ing to the upper part, pale to dark brown or pale to dark green with irregular to narrowly elliptic, green whitish, purple or dark brown spots from the base to the upper part; lamina 36–40 cm in diameter; rachis winged at the distal part not branched, divided into three leaflets, green or light brown, smooth with white and green spots, 12.7–15 cm long, 1.5–2 cm in diameter; leaflets narrowly elliptic, 13.5–16 cm long, 2–3.5 cm wide with acumens 1–1.5 cm long, acuminate tip and cuneate to narrowly cuneate base, their adaxial surface green to dark green, abaxial surface pale green to green, with depressed midrib and impressed lateral veins in 7–11 nerve pairs, brochidodromous secondary veins forming prominent upward loops near the margin; lamina margin undulate to entire with decurrent leaf attachment. Inflorescence solitary erect; peduncle 34–36 cm long, 3.2–3.5 cm in diameter, pale green to cream or white, smooth with green and maroon spots upward, white and maroon spots downward. Spathe elongate, widely triangular-ovate when spread,

15–16 cm long, 13–14 cm wide erect, without constriction, at the base outside distinctly convolute, pale green to cream or white with vertical veins and irregular purple or maroon spots, inside pale green to cream or white, reddish to maroon downward with slightly grooved and verrucae; limb outside widely triangular undulating, pale green, reddish to maroon with purple or maroon spots, inside pale green to reddish to maroon with purple or maroon spots, undulate margin upward, entire margin downward. Spadix sessile, much longer than spathe, 17–19 cm × 0.53–3 cm; female zone cylindrical, 4–5 cm long, 3–4 cm in diameter; female flowers slightly distant, pale to dark maroon; ovaries depressed globose, 1.7–3.4 mm diam, 1.33–2.85 mm high, pale to dark maroon, unilocular; style straight upward, 5–6.4 mm long, 0.58–0.62 mm in diameter, pale to dark maroon; stigma slightly depressed globose capitate, pale to dark maroon, 0.63–2.1 mm in diameter, 0.89–1.29 mm high; male zone elongate, 4–5 cm long, 3–4 cm in diameter; male flowers with one



Figure 2. *Amorphophallus samarensis* Fontarum-Bulawin, Medecilo-Guiang & Alejandro. A. Rear view of inflorescence, B. Habit in situ, C. Front view of inflorescence, D. Posterior view of peduncle, E. Petiole in situ, F. Anterior view of the peduncle. Photos taken by Norilyn Fontarum-Bulawin.



Figure 3. *Amorphophallus samarensis* Fontarum-Bulawin, Medecilo-Guiang & Alejandro sp. nov. A. Leaves, B. Top and side view of the tuber, C. Anterior view of young inflorescence, D. Female flowers, E. Pollens released from male flowers, F. Male flowers. Photos taken by Norilyn Fontarum-Bulawin.

stamen, irregular nearly ovate shaped, congested, slightly distant at the base, cream to pale yellow; stamens 1.79–2.3 mm long, cream to pale yellow; anthers .5–1

mm long, truncate, with .3–.5 mm subfusiform apical pores; filaments 1.5–2 mm long, slightly clavate; appendix smooth narrowly elongate cylindrical, 7–11.5 cm long,

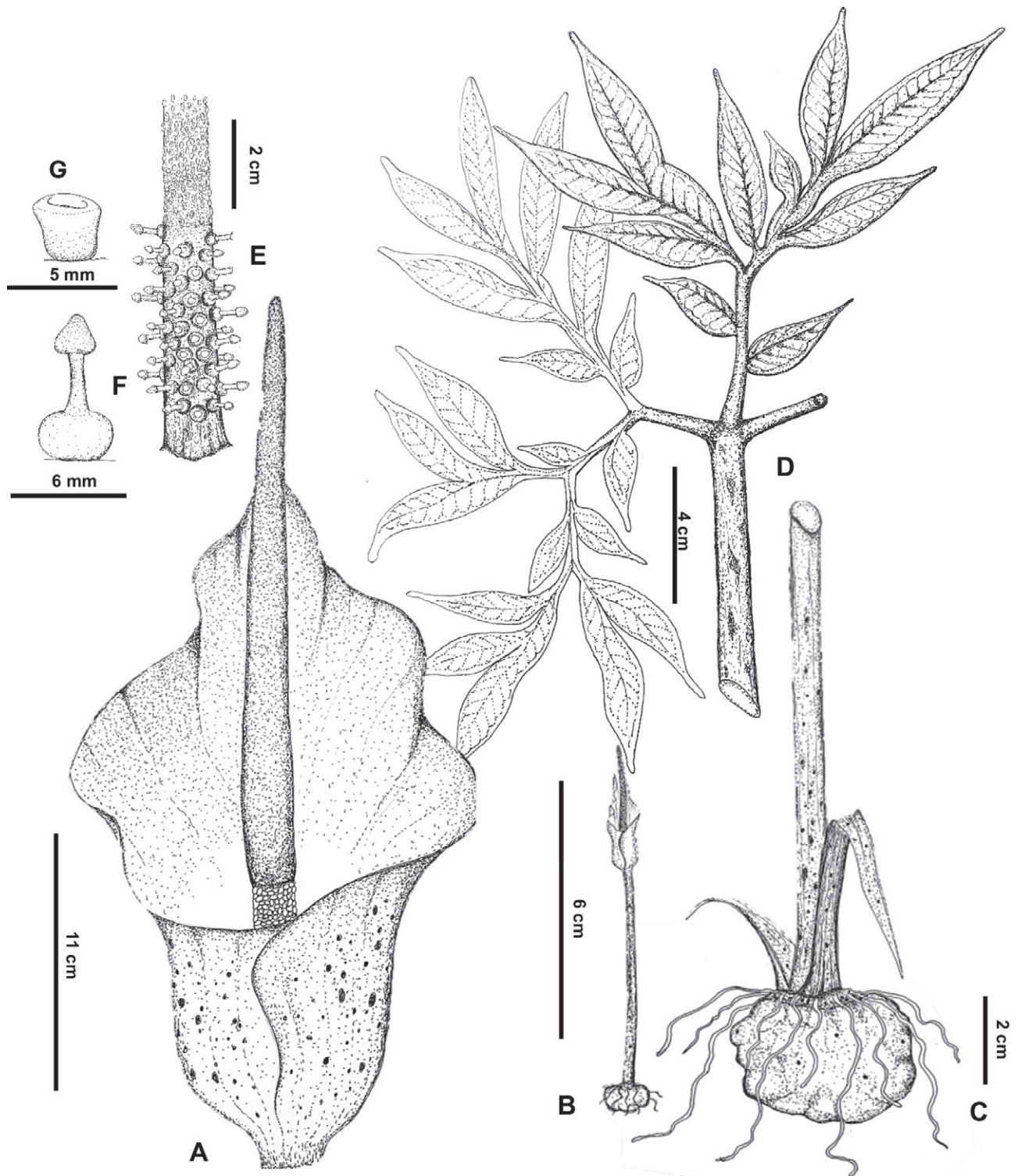


Figure 4. *Amorphophallus samarensis* Fontarum-Bulawin, Medecilo-Guiang & Alejandro sp.nov. A. Inflorescence during maturity, B. Habit, C. Tuber, D. Leaves, E. Spadix, F. Female flower, G. Male flower. Illustration by: Michael A. Calaramo.

5.88–9.29 mm in diameter above the base; base dilated cylindrically, slightly smooth, maroon to dark maroon, at apex narrowly long cylindric tapered maroon to dark maroon. Fruits not observed.

Etymology

The species epithet was attributed to its type locality, Samar Island.

Phenology

Flowering from June to July; fruiting not observed.

Distribution and ecology

Amorphophallus samarensis is endemic in Eastern Visayas Samar, Samar Island Natural Park (SINP) Philippines. This species is found in Paranas, within 556.12 sq km land area in the shady areas, karst forest at 137–329 m elevation.

Conservation status

Since the extent of occurrence of *A. samarensis* is less than 100 km² and there are less than 250 mature plants in the forest, it is considered critically endangered [CR] (IUCN, 2022). There are 30 individual plants, and three inflorescences were encountered in the locality. Being a small population and having limited distribution, endemic species are more vulnerable to the impact of anthropogenic and natural calamities (Yudaputra et al. 2022; Calaramo et al. 2022).

Notes

Amorphophallus samarensis is comparable to *A. calcicola* by solitary leaf, long peduncled solitary flower, cylindric female zone, ovary depressed, disk shape, slightly distant ovaries, and absence of staminode. However, it differed to *A. calcicola* by its subglobose tuber, smooth petiole, distal part of winged rachis not branched, narrowly elliptic leaflets, undulate to entire leaf margin, undulated in the upper part and entire in the lower part spathe margin, slightly depressed globose capitate stigma, and elongate to widely triangular-ovate spathe. It resembles *A. longispathaceus* by its smooth petiole, solitary leaf, long peduncled solitary flower, cylindric female zone, ovary shape, and truncate anther. But different by its tuber, rachis, leaflets shape, spathe margin, shape of stigma, and spathe shape. Besides, it is similar to *A. rostratus* by having spadix longer than spathe, slightly distant female flowers, congested male flowers, solitary leaf, and long peduncled solitary flower, except in leaflets, rachis, absence of staminode, ovary shape, and stigma. A comparison of *A. samarensis*, *A. calcicola*, *A. longispathaceus*, and *A. rostratus* is presented in Table 1.

Table 1. Comparative morphology of *A. samarensis*, *A. calcicola*, *A. longispathaceus*, and *A. rostratus*.

Characters	<i>A. samarensis</i>	<i>A. calcicola</i>	<i>A. longispathaceus</i>	<i>A. rostratus</i>
Petiole diam	3.3–3.5 cm	1.0–2.5 cm	2–6 cm	1–2 cm
Leaflets apex	acuminate	long acuminate	long acuminate	long acuminate
Acumen	1–1.5 cm long	3.0–3.5 cm long	3 cm long	3–4 cm long
Spathe base inside	pale green to cream or white upward, reddish to maroon downward with slightly grooved and verrucae	dirty white and densely clothed with ovoid or irregularly shaped warts	dark purple densely clothed with short and long simple or branched, fleshy or flacky purple to reddish or brown finger-like warts	uniformly green with numerous large irregular warts aligned into vertical ridges
Spathe length	15–16 cm	9–17 cm	30–38 cm	20–45 cm
Spadix length	17–19 cm	16–30 cm	42–60 cm	35–90 cm
Female zone length	4–5 cm	2.0–3.0 cm	4–8.5 cm	4–5 cm
Stigma	slightly depressed globose capitate	lobed	lobed	lobed/rostrate
Stigma lobes	capitate	2–3 lobed	2–3 lobed	1 to many
Male zone length	4–5 cm	1.7–2.5 cm	4.5–6.5 cm	4–5 cm
Stamen	1.79–2.3 mm	1.5–1.8 mm	1–1.5 mm	1.5 mm
Filament	thick, fused at the base, 1.5–2 mm long	connate, 1.0–1.2 mm long	0.1–0.5 mm long, connate	0.5 mm long

Identification key of morphologically similar species of Philippine *Amorphophallus*

1. Limb outside brown with white spots; stamen reddish, 1–1.5 mm long..... 2
 - Limb outside pale green reddish to maroon with purple or maroon spots; stamen cream to pale yellow, 1.79–2.3 mm long 3
2. Peduncle greyish green with whitish or green spots; 60–130 cm × 1–3.5 cm *A. longispathaceus*
 - Peduncle green to purplish brown with whitish green to whitish purple spots; 158 cm × 3.5 cm 4
3. Ovary depressed disk-shaped; stigma yellowish, 2–3 lobed; spadix 16–30 cm × 0.8–1.5 cm *A. calcicola*
 - Ovary depressed globose; stigma pale to dark maroon with 1 lobed; spadix 17–19 × 0.53–3 cm *A. samarensis*
4. Leaflets lanceolate, 3–7 cm long; male flowers congested *A. rostratus*
 - Leaflets oval to elongate elliptic, 9.5–24 cm long; male flowers distant *A. adamsensis*

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