A new species of *Amorphophallus* (Araceae: Thomsonieae) from Sarawak, Borneo

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Abstract

Amorphophallus julaihii Ipor, Tawan & P.C. Boyce a new species from forested limestone in Mulu National Park, Sarawak, Borneo is described and illustrated.

Introduction

Recognition of *Amorphophallus julaihii* as a new species takes to fifteen the number of indigenous species of *Amorphophallus* recorded from Borneo (Bogner 1989; Hetterscheid 1994, 2001). Including *A. julaihii* there are eight species in Sarawak, *viz*: *A. angulatus* Hett. & A.Vogel, *A. brachyphyllus* Hett., *A. eburneus* Bogner, *A. hewittii* Alderw., *A. hottae* Bogner & Hett., *A. infundibuliformis* Hett., A. Dearden & A. Vogel, *A. pendulus* Bogner & Mayo. Five species have been recorded from Sabah: *A. hottae*, *A. lambii* Mayo & Widjaja, *A. rugosus* Hett. & A.L. Lamb., *A. tinekeae* Hett. & A. Vogel and *A. venustus* Hett., A. Hay & J. Mood. Eight species are recorded from Kalimantan: *A. borneensis* (Engl.) Engl. & Gehrm., *A. costatus* Hett., *A. hewittii*, *A. infundibuliformis*, *A. lambii*, *A. linguiformis* Hett., *A. pendulus* and *A. prainii* Hook.*f.* (the last perhaps based on a mis-labelled specimen; *A. prainii* is otherwise known only from Peninsular Malaysia and Sumatera). With the exception of *A. prainii* all Bornean *Amorphophallus* are endemic to Borneo. The most remarkable aspect of these data is that 13 of these 15 species have been described within the past 25 years. This extraordinary increase in recognized species is being repeated throughout the range of the genus such that *Amorphophallus* now numbers over 200 species, of which in excess of one third are novel taxa described since 1980. Recent and on-going fieldwork indicates that there are more novel Bornean *Amorphophallus* awaiting description.

Ecology of *Amorphophallus* in Sarawak

Two of the authors (I.I. & P.C.B.) have been observing *Amorphophallus* populations in North Borneo for many years and based on these observed data the following summary of *Amorphophallus* ecology in Sarawak may be drawn.

Five of the eight Sarawak *Amorphophallus* species occur in limestone forest with three, *A. brachyphyllus*, *A. eburneus* and *A. julaihii*, seemingly restricted to this habitat. *Amorphophallus brachyphyllus* and *A. eburneus* occur sporadically and allopatrically on both the Bau and Padawan limestones. There are also records of *A. brachyphyllus* from the Mulu and Niah limestones, although these records have yet to be verified and it is quite possible that the Mulu and Niah plants represent one or more additional undescribed vicariant taxa in the species-rich Manta Group (Hetterscheid, in prep.). The single record from Mulu for the otherwise Sabahan *A. hottae* also requires verification not least because in Sabah *A. hottae* is never associated with limestone.

Amorphophallus hewittii as currently circumscribed is frequently found in association with limestone, occurring commonly on both the Bau and Padawan limestones where the flowering of large specimens occasionally receives coverage in the local press. However, *A. hewittii* is not restricted to calcareous rocks, and is also found on the hard sandstones of the Penrissen Range and occurs in several widely scattered, mostly sandstone, locations throughout Sarawak. It should be noted that this apparent ecological diversity may be an artifact of imperfect taxonomy. The large size of this plant, both florally and vegetatively, makes it an unpopular subject for herbarium collection and our knowledge of its morphology is based on a decidedly meagre collection of mediocre specimens.

All other Sarawak species appear to be sandstone or shale associated. *Amorphophallus pendulus*, described from Gn. Matang (Bogner *et al.* 1985), is widespread and frequently locally common on moist sandstones at least as far east as Kapit (Belaga) (Boyce, *pers. obs.*). *Amorphophallus infundibuliformis* is widespread but scattered and seldom locally abundant in Kuching and Sri Aman Divisions, with collections known from wet but well-drained sandstone sites between 60–870 m asl in Lundu, Padawan, Bau & Ulu Batang Ai. *Amorphophallus angulatus* was described from the sandstones of Gunung. Selantik (Sri Aman), is also recorded from Gunung. Ampungan (Samarahan) and has recently been discovered at Nanga Gaat (Kapit) where it occurs on hard shales exposed by stream action (Boyce, *pers. obs.*).

Relationships of *Amorphophallus julaihii*

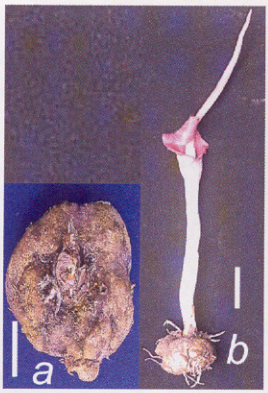
Amorphophallus julaihii fits uncontroversially into Hetterscheid's 'Manta Group' (Hetterscheid, in prep), into which also belong all the other Sarawak

Figure 1. ***Amorphophallus julaihii*** Ipor, Tawan & P.C. Boyce.**A.** seedling, **B.** leaflet of seedling, **C.** mature plant, **D.** tuber with adventitious roots, **E.** tuber from inflorescence, **F.** leaflets of mature plant, **G.** inflorescence with cataphylls, **H.** L S. of the inflorescence, **I.** male and female zones, **J.** stamens, **K.** pistils, **L** infrutescence with berries, **M.** berry and in L.S..
A,B, C & D, E, F, G, H, I, J, K from CST 2527, L & M from CST 2530 – drawings from fresh samples.

species to which *A. julaihii* is most similar. The Manta Group is defined as: Small to medium-sized herbs with tubers depressed-globose or subglobose that are not offsetting; petioles sometimes forming an intercalary bulbil at the junction with the lamina (*A. angulatus*). Seedling leaves often flushed with dark red or lilac-red (*A. angulatus*, *A. pendulus*, - Boyce, *pers. obs.*) Spathe linguiform, narrow or broad. Spadix shorter than or only slightly longer than spathe. Male flowers often longitudinally elongate and fused into rows.

Amorphophallus julaihii Ipor, Tawan et P.C. Boyce ***sp. nov***. Ab omnibus speciebus in habitu calcicola lithophytica Borneensibus borealis spatha parva in toto atropurpureis differt. ***Typus.*** Sarawak, Miri Division, Mulu National Park, forest on limestone, *C.S. Tawan & I.B. Ipor* CST 2527, 14 April 2004 (**Holotypus**: HUMS (Herbarium Universiti Malaysia Sarawak) inflorescence and tubers in spirit; vegetative parts (petiole with leaflets, seedlings) - herbarium specimens.)

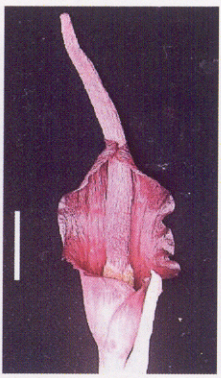
Small to medium-sized **herb**, 50–100 cm tall. ***Tuber*** depressed sub-cylindrical to globose, with irregular raised areas, up to 5.8 cm diam., 6.0 cm high, surface dull brown greyish, inner part fleshy, whitish. ***Adventitious root*** scars present on top portion of tuber at flowering stage, new roots developing during vegetative stage. ***Petiole*** up to 44 cm long, *c.* 19 mm diameter at base, turgid, cylindrical, smooth, bright green, enveloped basally by dried decaying brownish cataphylls; ***lamina*** highly dissected, rachises naked, narrowly channelled, yellowish green; ***leaflets*** elliptic-lanceolate, 11.0–13.0 x 4.0–4.4 cm, some petiolulate, petiolule 1.5–3.0 cm long, slightly channelled adaxially, ultimate leaflet sessile, leaflets asymmetrical, apex apiculate 1.5–2.0 cm long; base unequal; margin slightly wavy and sparsely fine-toothed; adaxial surface bright green, thin slightly leathery, abaxial surface pale green; 6–16 pairs of secondary veins with intermediate veins per leaflet, these adaxially channelled and adaxially raised; venation forming distinct submarginal veins; tertiary veins reticulate; lamina texture leathery when fresh, chartaceous when dry. ***Inflorescence*** solitary, flowering without foliage leaves; peduncle cylindrical, up to 17.5 cm long, 8–9 mm diam. at base, yellowish to creamy. ***Cataphylls*** 6; first 1–4 ovate to linear, 3–13 cm x 1.5–2.0 cm, brownish to dark brown, thin, soon withering and decaying; the next 5–6 linear-oblong, 15–21 x 2.4–3.5 cm, light purplish to whitish and slightly purplish stained. ***Spathe*** elongate-oblong, limb erect at anthesis, later recurved and twisted towards the base, up to 12 cm long, width at base 4.0 cm, at middle 4.0 cm, at apex 4.5 cm, lower spathe strongly convolute and forming a short tube 3.5–4.0 cm long; ***inner surface*** of upper spathe limb ribbed with distinct venation, purplish, lower part rough and verrucose, deep purple; ***outer surface*** of upper spathe limb with distinct longitudinal venation, margin thinly undulate, apex dentate; upper part of spathe



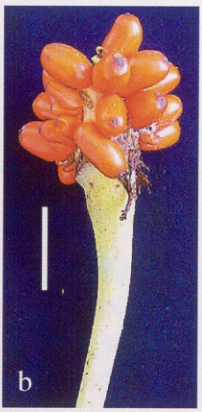
a. tuber, *b*. inflorescence with tuber,
c. leaflet (Scale bars – 3 cm)

Foliage (Scale bar – 6 cm)

Inflorescence (scale bars — 6 cm)



Spathe (Scale bars – 4 cm)



a. Spathe and spadix, b. Infrutescence.
(Scale bars-2 cm)

Male and female zones of the spadix
(Scale bar–2 cm)

Figure 2. ***Amorphophallus julaihii*** Ipor, Tawan & P.C. Boyce

limb rich purple-scarlet, middle part and margins darker. ***Spadix*** exceeding spathe, 18.5–19.0 cm, short stipe, 1.0–1.5 cm long. ***Appendix*** up to 14 cm long, cylindrical, spongy, purplish, 9–9.2 mm diam. at base; 7.5 mm diam. at middle, 2 mm diam. at apex, surface verrucose with longitudinal lines, appendix producing an unpleasant odour similar to that of rotten fish. ***Flowers*** unisexual; ***male zone*** cylindrical, up to 3 cm long, 9 mm diam. at middle, whitish to creamy; ***stamens*** connate and short, *c.* 1 mm long, *c.* 0.5 mm broad across, fused with adjacent stamens, filaments *c.* 5 mm, truncate, pores apical, rounded or variously elongate. yellowish or creamy, pollen brownish. ***Female zone*** cylindrical, separated by irregular zone of sterile stamens from the male zone, 1.5–2 cm long, 10 mm diameter; pistils in irregularly rows, rather lax, sometimes almost in V-shaped rows; ovaries ovoid-subglobose, 2.5–3.0 mm in long, 1.8–2.0 mm broad at base, dark purple, unilocular rarely bilocular; stigma sessile, two to three lobed or sometimes irregularly lobed, ***Infructescence*** with up to 35 berries, pedunculate up to 22 cm long, 6 mm diam. at base, 9 mm diam. at apex, with blackish-dark brown V-shaped scar from the marcescent spathe, basally with remains of the cataphylls. ***Berries*** when ripe deep orange, ellipsoid 15–16 mm x 8–10 mm, apex rounded, with blackish stigma remnants, one seeded. **Seeds** ellipsoid, 12–14 mm x 7–8.2 mm wide, testa smooth, thin, yellowish green, seed copiously starchy, embryo small.

Distribution: Endemic in Sarawak, so far recorded only from Mulu National Park, Miri Division.

Ecology: Limestone forest, growing in shady areas, in humus-filled fissures and holes in limestone. Flowering recorded in April.

Notes: Amorphophallus julaihii is most similar to *A. angulatus*, *A. brachyphyllus* and *A. eburneus*, (all Sarawak) and *A. costatus* (Kalimantan). From *A. angulatus* (with which *A. julaihii* shares a purple spathe), it differs by the spadix appendix exceeding the spathe and by the smaller, not diamond-shaped male flowers. From *A. eburneus* and *A. brachyphyllus* (also both restricted to limestone), *A. julaihii* is immediately separable by the purple ribbed spathe. The resemblance of *A. julaihii* to *A. costatus* is in having an erect elongate triangular spathe with the base strongly convolute forming a narrow tube. In both species, the spadix exceeds the spathe but in *A. julaihii* the spadix is shortly stipitate while it is sessile in *A. costatus*; the male zones in both species are similar - cylindrical, flowers slightly distinct, irregularly arranged or in longitudinal oblique, interrupted rows. The matt-purple spathe of *A. julaihii* readily separates it from *A. costatus* in which the spathe interior is glossy maroon. To date *A. costatus* is recorded only from southern Kalimantan.

Etymology: This species is named after Mr. Julaihi Abdullah, Deputy Research Manager of Sarawak Forestry Corporation, who first showed the first two authors this species in the Mulu National Park, Sarawak. He was formerly Botanist of the Sarawak Forest Department, Kuching.

Other specimens seen: Type locality, inflorescence, *C.S. Tawan & I.B. Ipor* CST 2528, 14 April 2004 (HUMS); Type locality, inflorescence, *C.S. Tawan & I.B. Ipor* CST 2529, 14 April 2004 (SAR); Type locality, infructescence in spirit *C.S. Tawan & I.B. Ipor* CST 2530, 14 April 2004 (HUMS); Sarawak, Miri Division, Mulu National Park, unspecified locality, *J.Brodie* AM-39, 12 May 1999 (SAR).

Acknowledgements

The first two authors thank Universiti Malaysia Sarawak for the grant to undertake this project. All authors would also like to thank the Director of Sarawak Forest Department for permission to collect the specimens, and also to Julaihi Abdullah, Sulaiman Jamhari, Malcom Demies, Meekiong Kalu, James Abai, Mohd. Rizan Abdullah, Hidir Marzuki and Sekudan Tedong for their help. Our appreciation also goes to Joseph Pao for the botanical illustrations.

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