

Studies on Schismatoglottideae (Araceae) of Borneo XXXV – Seven New species of *Aridarum*

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ABSTRACT

Seven new species of *Aridarum* are described and illustrated: *Aridarum pendek* S.Y.Wong, S.L.Low & P.C.Boyce and *A. velutandrums* S.Y.Wong, S.L.Low & P.C. Boyce [Sarawak, Malaysian Borneo]; *A. alatense* S.Y.Wong, S.L.Low & P.C.Boyce, *A. surukense* S.Y.Wong, S.L.Low & P.C. Boyce, and *A. zygozetum* S.Y.Wong, S.L.Low & P.C.Boyce [Kalimantan Barat and Kalimantan Tengah, Indonesian Borneo]; and *A. hebe* S.Y.Wong, S.L.Low & P.C.Boyce [Kalimantan Utara, Indonesian Borneo]. *Aridarum caulescens* var. *angustifolium* Bogner & Nicolson is shown to represent a further undescribed species from Sarawak, and is here published as *Aridarum orestum* S.Y.Wong, S.L.Low & P.C.Boyce. Together these seven novelties take the genus *Aridarum* to 21 accepted, described species. An identification key to all species is provided.

KEY WORDS

Araceae, *Aridarum*, Borneo, Malaysia, Sarawak, Indonesia, Kalimantan, rheophytic.

INTRODUCTION

The most recent treatment for *Aridarum* (Bogner & Hay, 2000) recognized nine species, of which one (*A. rostratum* Bogner & A. Hay) was taxonomically novel, one (*A. borneense* (M. Hotta) Bogner & A. Hay) represented a new combination resulting from sinking *Heteroaridarum* M.Hotta into *Aridarum*, and one was treated as incompletely known.

Fieldwork on Borneo subsequently has clarified the identity of the incompletely known species (described as *Aridarum crassum* S.Y.Wong & P.C.Boyce – Wong & Boyce, 2007), succeeded (after more than a century of representation by a single herbarium specimen) in re-collecting *Aridarum montanum* Ridl., the type species for the genus (Wong & Boyce, 2013b), and to date has resulted in the description of six remarkable new species (Okada, 2006; Wong et al., 2012; Wong & Boyce, 2013a).

Here we are describing an additional seven taxonomic novelties which together take the genus *Aridarum* to 21 described species.

KEY TO THE SPECIES OF *ARIDARUM*

1. Staminate flowers each comprised of one stamen; thecae on the proximal

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- side of the flower (with respect to spadix axis) 2
- Staminate flowers each comprised of two stamens; thecae on the longitudinal ends, or the inner face of each anther of the stamen pair 10
2. Connective not expanded, individual staminate flowers horseshoe-shaped; staminodes of interstice horseshoe-shaped, expanding laterally post pistillate anthesis; spathe limb caducous, falling by lesion from the lower, persistent spathe; primary lateral veins not conspicuously raised 3
- Connective expanded on the distal side (with respect to the spadix axis) into a rim; staminodes of interstice (if present) never horseshoe-shaped and never expanding; spathe limb deliquescing acropically from the junction with the lower persistent part; leaf blades with the primary lateral veins raised conspicuously adaxially 7
3. Leaf blades quilted, abaxially with conspicuous pellucid interprimary veins; adaxially with primary lateral veins impressed; petioles scabrous; staminate flowers completely verruculose; appendix staminodes deeply and irregularly fissured. Central northern Schwaner Mountains (Melawi and Sanggau, Kalimantan Barat), sandstones ***A. rostratum***
- Leaf blades smooth, abaxially without pellucid interprimary veins; primary lateral veins barely visible; petioles smooth; staminate flowers glabrous, or with only connective having a verruculose margin 4
4. Thecae horns stout. Gunung Sepangin (Putussibau, Kalimantan Barat), granites ***A. unicum***
- Thecae horns very slender 5
5. Leaf blades adaxially slightly velvety very dark green; spathe ca. 5.5 cm long; spadix ca. 2.5 cm long; interstillar staminodes absent; interstice staminodes rather weakly differentiated from the staminate flowers; appendix staminodes lacking glands. Western Muller Mountains, Nanga Suruk (Kapuas Hulu, Kalimantan Barat), volcanics ***A. surukense***
- Leaf blades semi-glossy medium to dark green; spathe ca. 7 cm long; spadix 3.5–4 cm long; interstillar staminodes present at the base of the spadix; interstice staminodes well differentiated from the staminate flowers; appendix staminodes with conspicuous pellucid glands 6
6. Staminate flowers in ca. 3 rows, white. Nanga Taman (Kalimantan Barat), sandstones . . ***A. biprocrepis***
- Staminate flowers in ca. 6 rows, pale orange. Schwaner Mountains, Gunung Alat (Sintang, Kalimantan Barat), metamorphics . . ***A. alatense***
7. Pistillate and staminate flower zones separated by a naked interstice equalling the staminate flower zone in length; staminodes few, cylindrical-clavate, at base of staminate flower zone; stamens and appendix staminodes verrucate. Loreh (Malinau Selatan, Kalimantan Utara), shales ***A. kazuyae***
- Pistillate and staminate flower zones not separated by a naked interstice, or if interstice present then very short; staminodes at base of staminate zone absent or globose; stamens and appendix staminodes smooth 8
8. Leaf blades linear-lanceolate, adaxially with strong marginal veins; pistillate flower zone with a few vermiform staminodes at the base. Muller Range (Kalimantan Tengah), volcanics ***A. minimum***
- Leaf blades not linear-lanceolate; pistillate flower zone with none or prismatic staminodes at the base . . . 9
9. Stamen connective convex, distal rim rounded, smooth or slightly sulcate; staminodes at base of staminate flower zone absent or closely resembling staminate flowers; thecae horns long, stiff, arching. Gunung Rian, (Tana Tidung, Kalimantan Utara), shales ***A. orientale***
- Stamen connective concave, distal rim serrate-dentate; staminodes at

- base of staminate flower zone globose; thecae horns rather soft, short, straight. Hose Mountains (Kapit, C. Sarawak), limestones ***A. burttii***
10. Thecae on each end of each anther 11
 – Thecae on the inner face of each member of the stamen pair18
11. Horns of thecae very long and thin, with the tips overlapping; stamen connective not excavated12
 – Horns of anther thecae short and stubby; stamen connective excavated or not13
12. Leaf blades linear-lanceolate, stiffly coriaceous, up to 10 cm long × 4.5 mm wide; stems very slender (ca. 3–4 mm diam.), trailing, clothed in netted persistent fibers; spathe ca. 2 cm long; spadix ca. 1.5 cm long; staminate flower connective umbonate. Scattered localities in Sri Aman & Sarikei (W. Sarawak), shales***A. montanum***
 – Leaf blades elliptic, softly coriaceous, up to 22 cm long × 5 cm wide; stems stout. (ca. 2.5 cm diam.), erect, naked; spathe ca. 9 cm long; spadix ca. 4.5 cm long; staminate flower connective flat with a shallow central longitudinal groove. Nanga Taman (Kalimantan Barat) & Kudangan (Kalimantan Tengah), granites.***A. zygosetum***
13. Stamen connective deeply excavated; thecae horns slender with a narrow base.14
 – Stamen connective not excavated; thecae horns stout, their bases occupying the whole upper surface of the anther17
14. Thecae horns blunt, peg-like, erect; interstice staminodes oblong in plan outline, with a deep, oblong excavation filled at pistillate anthesis with a yellowish sticky substance. Riam Marthin Billa (Malinau Selatan, Kalimantan Utara), very hard shales***A. hebe***
 – Thecae horns pointed, triangular, directed into the cavity of the connective; interstice staminodes ± circular in plan outline, with an empty circular excavation. W Sarawak15
15. Leaf arrangement strictly distichous. Matang (NW Sarawak), sandstones and granodiorite.***A. borneense***
 – Leaf arrangement not so16
16. Leaf blade very stiffly coriaceous, glossy deep green adaxially when fresh; stigma 2/3 of ovary diameter; thecae horns very short, rounded at the end. Gunung Gaharu & Batu Balau ('Bukit Lingga') (Sri Aman–SW Sarawak), alkaline volcanics***A. crassum***
 – Leaf blade rubbery-coriaceous, matte medium green adaxially when fresh; stigma as wide as ovary; thecae horns long, pointed at the end. Bako & Santubong (NW Sarawak), sandstones***A. nicolsonii***
17. Plants 10–20 cm tall; leaves erect, 9–17 cm long, leaf blades lanceolate-elliptic; peduncle 6–9 cm long; spathe 2.5–4 cm long; spadix 1–1.5 cm long. Gunung Niut (NW Kalimantan Barat), basalts***A. incavatum***
 – Plants 2 cm tall; leaves appressed, ca. 3 cm long, leaf blades oblanceolate; peduncle ca. 5 mm long; spathe ca. 1.5 cm long; spadix ca. 4.5 mm long. Batang Balleh (Kapit – C. Sarawak), shales***A. pendek***
18. Staminate flowers pubescent19
 – Staminate flowers glabrous20
19. Leaf blades very stiff, sharply V-shaped in cross-section with the tip acicular (sharply pointed); mid-rib and marginal veins equally prominent; stems very short, naked. Similaju (Sarawak: Bintulu), lowland sandstones.***A. velutandrums***
 – Leaf blades softly leathery, almost flat with undulate-crispulate margins, tip provided with a tubular mucro; mid-rib and marginal veins not equally prominent, marginal veins almost invisible; fibrous-netted cataphyll, ligule, and leaf base remnants. Loagan Bunut (Sarawak: Miri–Marudi), upper hill forest sandstones***A. orestum***

20. Horns of thecae shorter than width of stamen. E Sarawak and Brunei, mainly sandstones . . . *A. caulescens*
 – Horns of thecae longer than width of stamen. NE Sarawak, shales.
 *A. purseglouei*

Aridarum alatense S.Y.Wong, S.L.Low & P.C.Boyce, **sp. nov.** Type: Indonesian Borneo, Kalimantan Barat, Sintang, Serawai, northern flanks of the Schwanner Mountains, Gunung Alat, north of Nanga Serawai and 120 km east of Nanga Pinoh, 00°4'9.00"S 112°25'38.58"E, 17 May 2013, *K.Nakamoto AR-4156* (holo BO – alcohol!; iso SAR – alcohol!).
Figs. 1, 2 and 11C.

Diagnosis

Aridarum alatense differs from all other species allied to *A. rostratum* by the combination of narrowly elliptic leaf blades with weakly undulate and minutely crispulate margins, and the matte medium green petioles and peduncles. In overall appearance *A. alatense* most closely approaches *A. hippocrepis* but differs ca. twice the number of rows (6 vs. ca. 3) of pale orange (vs. white) staminate flowers.

Description

Medium-sized obligate clumping rheophytes to ca. 20 cm tall. **Stem** condensed, suberect, ca. 2 cm diam., with copious strong roots. **Leaves** many together, arching; **petiole** 5–12 cm long, weakly D-shaped, c. 2 mm wide × c. 3 mm high, sheathing at the extreme base, minutely scabridulous matte medium green; **petiole-sheath** with wings extended into a narrowly triangular ligular portion up to 8 cm long, soon deliquescent; **blade** softly coriaceous, elongate-elliptic, 17–20 cm long × 5–6 cm wide, base cuneate, apex acute to slightly acuminate, apiculate for c. 5 mm, adaxially semi glossy medium, pale grey green and minutely punctate abaxially; **midrib** abaxially prominent, adaxially bluntly raised; **primary lateral veins** ca. 6

per on each side, weakly raised abaxially, slightly impressed adaxially, diverging at ca. 30°; **interprimary veins** weaker than primaries; **secondary venation** adaxially invisible, abaxially nearly invisible. **Inflorescence** solitary, subtended by a ca. 8 cm long, narrowly triangular somewhat leathery prophyll; **peduncle** very slender, arching with the inflorescence pendent, shorter to equalling the leaves, ca. 10 cm long, ca. 2 mm in diam., terete, matte medium green, inserted ventral-obliquely on the spathe; **spathe** broadly ovate, not constricted, barely opening at pistillate anthesis, 6–7 cm long, lower part narrowly campanuliform at anthesis, weakly gibbous ventrally, matte medium green, ultimately persistent through fruiting; **limb** glistening white, apiculate for up to 7 mm, apiculate distally green, limb loosening at pistillate anthesis, prior to and during staminate anthesis deliquescent and crumbling from the junction of the spathe limb and the persistent lower part, limb tearing into jagged adherent strips that eventually fall to leave a brown slimy collar of decomposing tissue that this later rots and falls to leave the narrowly campanuliform persistent lower spathe, with a scarred irregular rim. **Spadix** subcylindric ca. 3.5 cm long × c. 8 mm in diam. (widest part); **pistillate flower zone** slender cylindrical, markedly thinner than the rest of the spadix, comprising slightly more than ¼ of the spadix, slightly obliquely inserted on peduncle, zone ca. 4 mm in diam., ventral side 1.1 cm mm long, dorsal side ca. 8 mm long; **interpistillar staminodes** confined to a single row at the base of the pistillate zone, ligular, ca. 1 mm long, glossy white; **pistils** trapezoid-subglobose, truncate, c. 1.1 mm in diam., greenish white; **stigma** sessile, slightly impressed, discoid, papillose, somewhat less wide than ovary, cream; **sterile interstice** cylindrical, abruptly truncate with the top of the pistillate zone, ca. 4 mm long, with several dense whorls of staminodes; **interstice staminodes** well-developed, ligular-clavate, glossy white ca. 1.5 mm wide, initially interpistillar zone equalling the staminate zone in width, later (at staminate anthesis) staminodes



Fig. 1. *Aridarum alatense* S.Y.Wong, S.L.Low & P.C.Boyce. **A. & B.** Flowering plant in habitat, Type locality. Note the developing infructescence to the left of the inflorescence. **C.** Juvenile plants on the lower part of the same boulder. The undulate, crispulate leaf blade margins are clearly seen. **D.** Detail of a fully developed but unripe infructescence. Note the laterally thickened stylar region. **A–D** from *AR-4156*. Images © K.Nakamoto.

expanding laterally by extension of the filament until zone ca. 6.5 mm wide and blocking access to the pistils; **staminate flower zone** ca. $\frac{1}{2}$ of total spadix length,

ca. 1.5 cm long \times ca. 8 mm wide, cylindrical, basally merging with the interstice and apically merging with the appendix; **staminate flowers** each comprised of

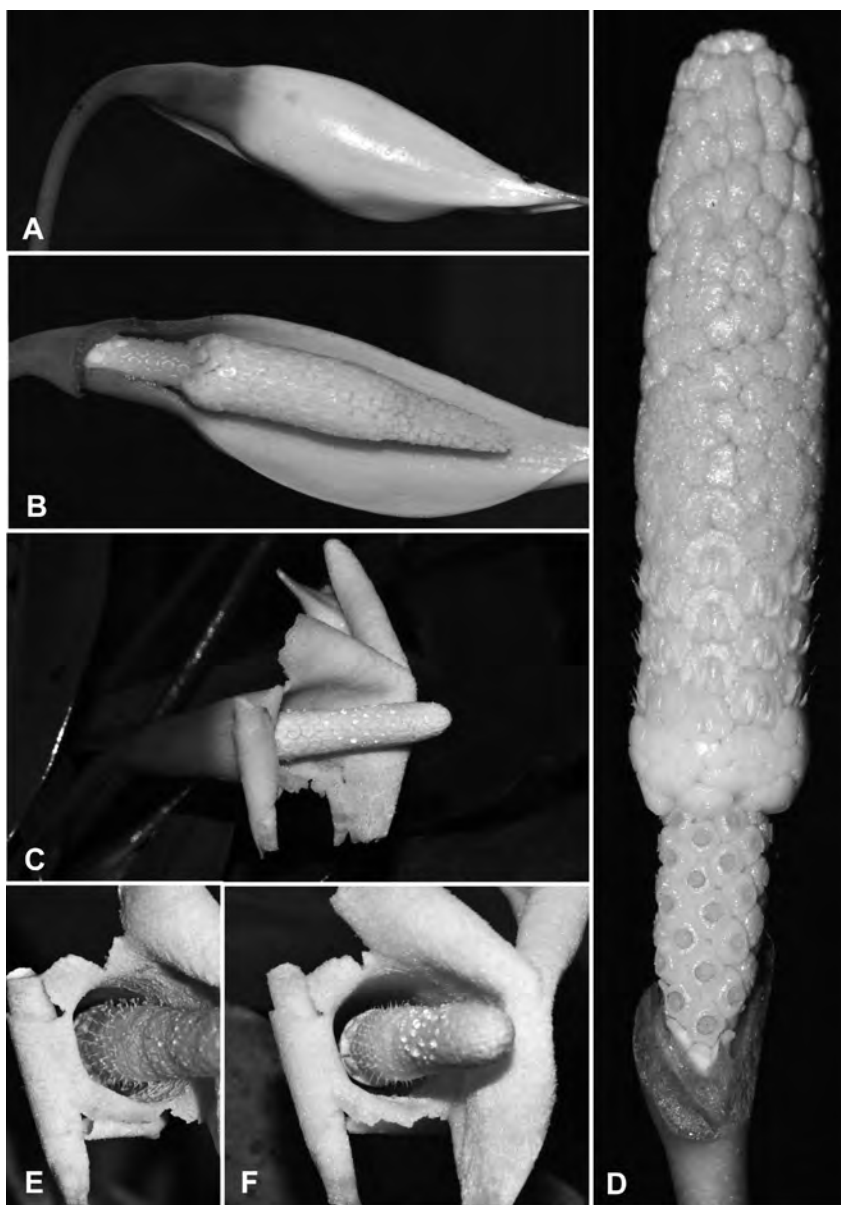


Fig. 2. *Aridarium alatense* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** Inflorescence at onset pistillate anthesis; note the inflation and the opening at the lower persistent part of the spathe. **B.** The same inflorescence with the nearside spathe artificially removed. The appendix in this specimen is deformed, but the remainder of the spadix is correctly developed. **C., E. & F.** Inflorescence at staminate anthesis. Note manner in which the spathe limb has opened, with the tearing of the limb occurring about mid-way along, and not at the junction of the spathe limb with the lower persistent part. **D.** Spadix at onset of staminate anthesis, spathe artificially removed. In this example the appendix has developed normally. **A–B** from *AR-AR-4155*; **C–F** from *AR-4156*. Images © P.C.Boyce.

a single stamen, pale orange, \pm horseshoe-shaped in plan view, with a deep narrow suture between the thecae, this more conspicuous in alcohol-preserved specimens, ca. 1.5×1.5 mm, connective with the inner part slightly channelled, smooth, and the distal margins (with respect to spadix axis) verruculose; **thecae** ellipsoid, imperceptibly embedded in the ends of the 'arms' of the horseshoe-shaped connective, each c. 0.3 mm long, displaced to the proximal (with respect to the spadix axis) side of the stamen with distal-pointing horns; **thecae horns** c. 0.5 mm long, stiff, translucent except for the base, directed upwards; **appendix** 10–15 mm long, usually comprising slightly more than $\frac{1}{2}$ of the entire spadix, cylindrical, obtuse; **appendix staminodes** mostly comprised of very densely-packed cylindrical-globose occasionally partially coherent, lowermost staminodes closely reminiscent of staminate flowers but lacking thecae horns, terminal-most few more laxly arranged, pale orange. **Infructescences** with the lower persistent spathe somewhat narrowly funnelform, ca. 2 cm long \times 1 cm wide across the mouth; **fruits** (fully developed but not ripe) obpyriform, semi glossy pale green with the stylar region somewhat laterally thickened; **seeds** not observed.

Distribution—*Aridarum alatense* is so far known only from the middle altitudinal range of Gunung Alat, Schwaner Mountains.

Ecology—*Aridarum alatense* occurs as a rheophyte on riverside metamorphic rocks and boulders under somewhat open moist upper hill forest at ca. 900 m asl.

Etymology—Combined from Latin, *ensis* [ense – neut.], meaning 'from', and [Gunung] Alat – thus the *Aridarum* from [Gunung] Alat.

Notes—*Aridarum alatense* is vegetatively superficially similar to *A. hippocrepis* P.C.Boyce & S.Y.Wong. The spadix of *A. alatense* also most closely resembles that of *A. hippocrepis* P.C.Boyce & S.Y.Wong (compare **Fig. 11C and 11D**).

Other material examined: **INDONESIAN BORNEO. Kalimantan Barat**, Sintang, Serawai, Gunung Alat, north of Nanga Serawai and 120 km east of Nanga Pinoh, $00^{\circ}4'9.00''S$ $112^{\circ}25'38.58''E$, 17 May 2013, *K.Nakamoto AR-4155* (BO! – alcohol; SAR! – alcohol).

Aridarum bebe S.Y.Wong, S.L.Low & P.C.Boyce, **sp. nov.** Type: Indonesian Borneo, Kalimantan Utara, Malinau, Sembakung 70 km S.W. of Malinau, 80 km S.W. of Long Loreh Coalmine Village, Riam Marthin Billa, $2^{\circ}47'N$ $115^{\circ}50'E$, 4 May 2012, *K.Nakamoto AR-3922* (holo BO – alcohol!; iso SAR – alcohol!). **Fig. 3.**

Diagnosis

Aridarum bebe differs from all other *Aridarum* species by the combination short, erect peg-like thecae horns, and the oblong, deeply excavated interstice staminodes filled with amber-yellow sticky fluid.

Description

Medium-sized clumping obligate rheophytes to 35 cm tall. **Stem** initially erect and somewhat condensed, later decumbent and rhizome-like, ca. 20 cm long \times ca. 2.5 cm in diam., active portions obscured by the dense leaf bases, older parts naked with conspicuous scars and often producing reiterative shoots, stem copious strong roots. **Leaves** several together, petioles erect with blades very slightly arching; individual modules with 3–5 leaves, modules subtended by a linear-triangular 2-keeled prophyll to 5 cm long and ca. 5 mm wide, initially prophyll green, but soon decaying; **petiole** 11–17 cm long, very weakly D-shaped in cross section, ca. 3 mm wide \times ca. 2.5 mm high, sheathing at the extreme base, dorsal edges slightly raised, semi glossy medium green; **petiolar sheath** with wings extended into a narrowly triangular ligular portion 5–9 cm long, ligule soon marcescent and shedding to leave a short collar of brown papery tissue; **blade** softly coriaceous, elliptic,

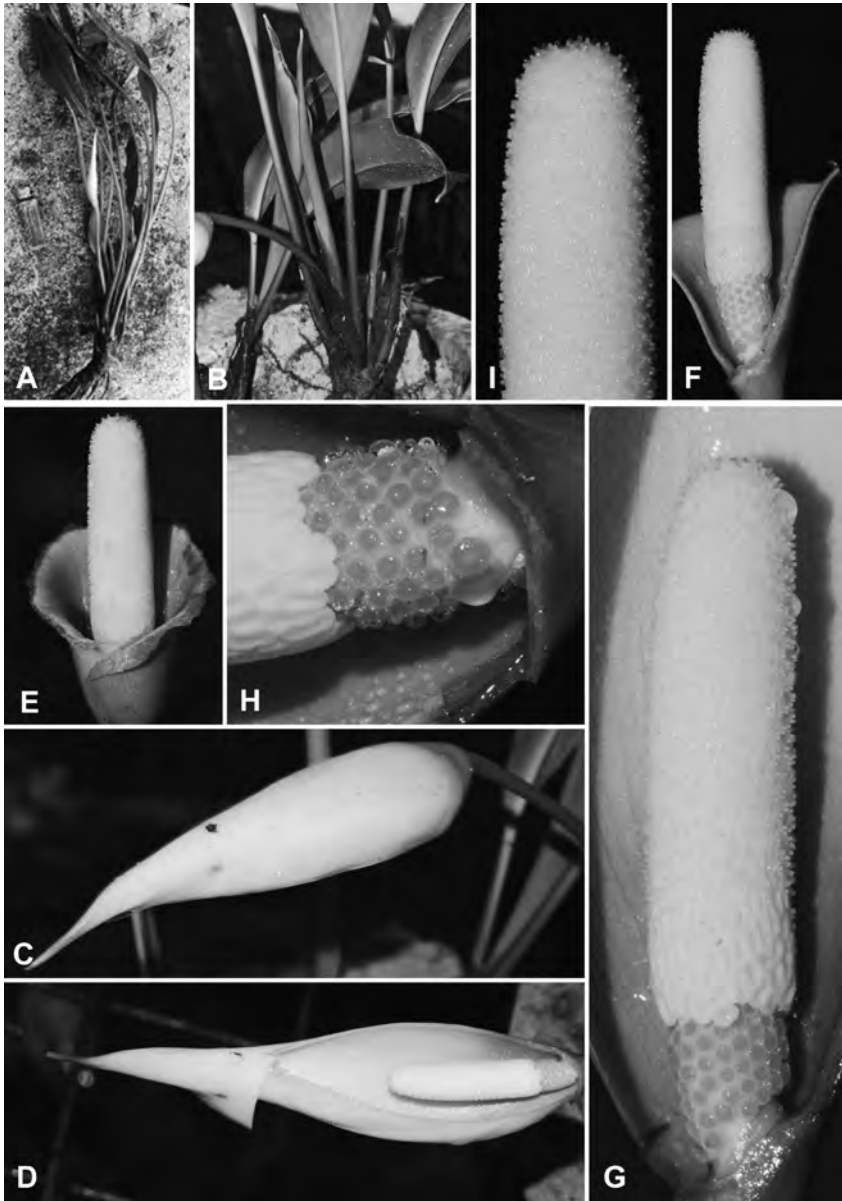


Fig. 3. *Aridarum bebe* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** Flowering plant from habitat, Type locality. **B.** Cultivated specimen from the same plant showing the long ligular portion of the petiolar sheath and developing new shoot (to the right of the peduncle). **C.** & **D.** Inflorescence at onset pistillate anthesis. The nearside spathe in **D** artificially removed. Note that the spadix is less than half the length of the spathe. **E.** & **F.** Inflorescence at late staminate anthesis, the spathe limb naturally shed at its junction with the persistent lower spathe and in **F** the nearside of the lower persistent spathe artificially removed. Note the sticky fluid filling the interstice staminodes. **G.** Detail of the pistillate flower zone and lower part of the interstice at pistillate anthesis. Note the conspicuous stigmatic droplet, and the beginning of fluid secretion into the excavated interstice

17–22 cm long \times 4–5 cm wide, base cuneate, apex acute, apiculate for ca. 6 mm, adaxially semi glossy very dark green, glossy pale green abaxially; **midrib** abaxially prominent, somewhat paler than the rest of the blade, adaxially bluntly raised, with ca. 4 adaxially very weakly defined **primary lateral** veins on each side, these diverging at ca. 30°, adaxially primary lateral veins merging into the slightly raised marginal vein running ca. 2 mm in from the leaf margin; **interprimary veins** invisible adaxially, abaxially slightly darker than the primaries; secondary venation adaxially invisible. **Inflorescence** solitary, subtended by a ca. 5 cm long, very narrowly triangular somewhat leathery cataphyll; **peduncle** slender, spreading to slightly pendent, shorter than the petioles, up to 10 cm long, ca. 3 mm diam., terete, medium green, inserted slightly obliquely on the spathe; **spathe** narrowly ovate with a very long acuminate tip, not constricted, ca. 9.5 cm long, lower part campanuliform at anthesis, medium green, ultimately persistent through fruiting, long-apiculate for up to 1.5 cm, limb exterior glistening white, interior greenish in the lower 1/3, the remainder white, apicule distally green; **limb** inflating and then gaping at pistillate anthesis, prior to staminate anthesis limb caducous from the junction with the persistent lower part, limb falling more-or-less intact to leave the narrowly campanuliform persistent lower spathe, with a scarred regular rim. **Spadix** cylindrical, ca. 4.5 cm long \times ca. 6 mm in diam., less than half the length of the spathe, fertile almost to the tip, basally very shortly stipitate; **stipe** oblique, ca. 5 mm wide \times ca. 2 mm long on longest side, white; **pistillate flower zone** weakly fusiform-cylindric, about the same width as the other fertile parts of the spadix, comprising about 1/5 of the spadix, ca.

7 mm long; **pistils** subglobose, truncate, c. 1.1 mm in diam., pale green; **stigma** sessile, capitate, papillose, almost as wide as the ovary medium green, producing a very conspicuous stigmatic droplet at anthesis, turning brownish as post anthesis; **sterile interstice** cylindric, equalling the pistillate zone in width, occasionally with the lowermost part irregularly naked, ca. 7 mm long, with 3–6 dense whorls of mainly oblong, excavated staminodes, these ca. 1.5 mm long \times .75 mm wide, medium yellow, the cavity filling with an amber-yellow sticky fluid during staminate anthesis; **staminate flower zone** ca. 2/3 of total spadix length, ca. 2 cm long, lower part equalling the width of the sterile interstice, fertile to the tip, or the tip furnished with a few staminodes, glossy white; **staminate flowers** densely packed, each comprised of two stamens, ivory, \pm oblong, with the long sides parallel to the spadix axis, ca. 2 \times 1 mm, connective excavated; **thecae** ellipsoid, embedded in the ends connective, each ca. 0.5 mm long; **thecae horns** two per stamen, ca. 0.5 mm long, peg-like, erect. **Infructescence** not observed.

Distribution—*Aridarum hebe* is known only from the Type locality, where it is decidedly rare. Riam Marthin Billa is a beguilingly aroid species-rich site, host to numerous new or just-described aroid species, notably *Piptospatha pileata* S. Y. Wong & P. C. Boyce.

Ecology—*Aridarum hebe* is an obligate rheophyte on very hard shale waterfalls and river boulders under extremely wet hill forest at altitude of ca. 400 m asl.

Etymology—In Greek mythology, *Hebe*, the daughter of Zeus and Hera, was the goddess of youth and also the cupbearer for the gods and goddesses of Mount

←

staminodes. **H.** Inflorescence at onset of staminate anthesis, nearside spathe artificially removed. Note that the interstice staminodes are beginning to fill with sticky fluid. **A–H** from AR-3922. Image A © K.Nakamoto, used with permission; images B–H © P.C.Boyce.

Olympus, serving their nectar and ambrosia. The epithet is chosen to highlight sticky amber-yellow liquid that is secreted into the excavated interstice staminodes during staminate anthesis.

Notes—The morphology and configuration of the staminate flowers of *A. bebe* are reminiscent of those of species of the NW Bornean *Aridarum* Borneense Group (*A. borneense*, *A. nicolsonii* Bogner, and *A. crassum*), although preliminary molecular analyses (Low, in prep.) does not support a close relationship between *A. bebe* and the Borneense Group.

The role of the liquid-filled interstice staminodes is unknown, but very probably is associated with pollination mechanics and pollinator management.

Aridarum orestum S.Y.Wong, S.L.Low & P.C.Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Miri, Marudi, Ulu Sungai Chipidi, Ulu Tinjar, 12 Aug. 1974, *P.Chai S.34798* (holo K!; iso L, KEP!, MO!). **Figs. 4 and 5.**

Aridarum caulescens var. *angustifolium* Bogner & Nicolson, *Aroideana* 2: 119, fig. 11 (1979) & *Willdenowia* 21: 43, fig. 2 (1991).

Diagnosis

Aridarum orestum shares the occurrence of pubescent staminate flowers with *A. velutandrum*, but is readily differentiated in having elongated stems clothed in conspicuous fibrous-netted cataphyll, ligule, and leaf base remnants (vs. stems very short and naked), and by the softly leathery (not very stiff), almost flat (vs. sharply V-shaped), leaf blades with a tubular (not sharply pointed) leaf tip.

Description

Diminutive tufted to mat-forming obligate rheophytes to 5 cm tall. **Stem** somewhat elongated, eventually sub erect to decumbent and rooting, 1–4 cm long, 1.5–2 mm in diam., more or less clothed in conspicuous fibrous-netted cataphyll, ligule, and leaf base remnants, the older parts

becoming bare. **Leaves** few to numerous together; **petiole** 0.7–1 cm long, ca. 0.4 mm diam., adaxially canaliculate, sheathing at the extreme base; **petiolar sheath** with wings extended into a very narrowly triangular ligular portion 1 cm long drying dark red-brown; **blade** thinly coriaceous, adaxially dark green, paler abaxially, very narrowly linear, 1–2.5 cm long × 2–2.5 mm wide, base narrow cuneate, apex mucronate to cuspidate, apiculate for 0.5–0.8 mm, margin somewhat thickened and slightly revolute; **midrib** abaxially very prominent, adaxially prominent, primary lateral veins indistinguishable from the interprimary venation, diverging at 20–35° and running to a more or less thick marginal vein; **secondary venation** adaxially and abaxially very faint to completely obscure; **tertiary venation** mostly completely obscure in living material, forming a faint tessellate reticulum in dry material. **Inflorescence** solitary; **peduncle** somewhat stout, exceeding the petioles, ca. 8 mm long × 0.4 mm diam., terete, pale green; **spathe** more or less ovoid, not constricted, ca. 1.5–1.8 cm long and apically beaked for 3–4 mm; lower part funnel-shaped, green, persistent, the upper part gaping, glistening white, caducous, apical beak medium green. **Spadix** subcylindric to bluntly spindle-shaped, 6–7 mm long, ca. 2 mm diam.; **pistillate flower zone** ca. 1 mm long, reduced to a single whorl of pistils, ca. 2 mm diam.; **pistils** crowded, subglobose, ca. 0.5–1.5 mm diam.; **stigma** sessile, discoid, centrally impressed, about the same width as the ovary; interpistillar staminodes confined to a row along the spathe/spadix adnation, shortly stipitate, broadly to narrowly spindle shaped to almost filamentous, about the height of the pistils; **sterile interstice** defined a partial to complete whorl of staminodes, these globular, 0.5–0.6 mm in diam.; **staminate flower zone** ca. 5–9 mm long, comprised of 1–2 rows of fertile flowers; **staminate flowers** pubescent, crowded, each comprised of two stamens arranged in longitudinally aligned pairs, truncate, deeply excavated with the thecae together on the inner (with respect to the stamen pairs) side of the anther, ellipsoid to ellipsoid-oblong from



Fig. 4. *Aridarum orestum* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** Habit 2 \times . **B.** Base of petiole and sheath with free ligule 10 \times . **C.** Tip of leaf blade showing the tubule 15 \times . **D.** Upper part of leaf blade 4 \times . **E.** Inflorescence 7 \times . **F.** Spadix 7 \times . **G.** Pistil in longitudinal section, showing the basal placentation with the ovules, 70 \times . **H.** Three pistillate flowers with staminodes at the base of the spadix 20 \times . **I-K.** Stamens in different views, note the pubescent rims 15 \times . Staminate flowers seen from above 15 \times . Note the deeply excavated connectives and the position of the horned thecae. A-L from *P.Chai* S.34798 (M!). Drawing A.Tangerini, © Smithsonian Institution, Washington, DC.



Fig. 5. *Aridarum orestum* S.Y.Wong, S.L.Low & P.C.Boyce. Holotype specimen. Sarawak, Miri, Marudi, Ulu Sungai Chipidi, Ulu Tinjar, 12 Aug. 1974, P.Chai S.34798. Image © Herbarium & Library, Royal Botanic Gardens, Kew. Used with permission.

above, 0.8–1 mm long \times 0.4–0.6 mm wide; **thecae** separated by a ridge forming a septum in the cavity, very shortly horned, with the horns inside the lip of the anther cavity; **appendix** ca. 1–4 mm long, rounded; **appendix staminodes** more or less irregularly globular to ellipsoid, mostly flat-topped, occasionally more or less excavated, ca. 0.5–0.8 mm diam. **Fruiting** material not seen.

Distribution—*Aridarum orestum* known only from the Type locality. The Type material is plentiful, with each sheet carrying several quite large clumps, indicating that the plant is (or at least was) plentiful.

Ecology—*Aridarum orestum* occurs as a rheophyte on sandstone riverside boulders pockets in mossy upper hill forest at ca. 800 m asl.

Etymology—From Greek, *orestes* (masc.) – a mountaineer – in allusion to this species occurring, for the genus, at high altitude.

Notes—*Aridarum orestum* is evidently closely related to *A. velutandrum* by sharing pubescent staminate flowers, a characteristic otherwise unknown in *Aridarum*, although occurring sporadically in *Ooia* and *Piptospatha*.

It is odd that the velvety staminate flowers, that are well depicted in the plate reproduced here (**Figure 4**) have never previously been mentioned in descriptions of this species under its synonym *A. caulescens* var. *angustifolium*.

Aridarum pendek S.Y.Wong, S.L.Low & P.C.Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Kapit, Batang Baleh, Nanga Suptai, 02°01'0.0"N 113°01'0.0"E, 29 May 2013, *P.C.Boyce & S.Y.Wong AR-4163* (holo SAR – alcohol!). **Fig. 6.**

Diagnosis

Aridarum pendek is unique in the genus by the combination of stout thecae horns with their bases occupying the whole upper

part of the anther, and diminutive habit with the leaves closely appressed to the substrate. Similar thecae horns are found in *Aridarum incavatum*, from which *A. pendek* differs by the very much smaller habit (plants ca. 2 cm tall vs. 10–20 cm tall), the appressed (not erect) leaves with the blades ca. 3 cm (vs. 9–17 cm long), the much smaller spathe (ca. 1.5 cm long vs. 2.5–4 cm long), and spadix (4.5 mm vs. 1–1.5 cm long.)

Description

Diminutive mat-forming obligate rheophytes to 2 cm tall. **Stem** creeping and rooting, 1–4 cm long, ca. 2 mm in diam., more or less obscured by overlapping leaf bases and ligule remains. **Leaves** few together; **petiole** ca. 3 mm, ca. 0.4 mm diam., adaxially canaliculate, sheathing at the extreme base, whitish green; **petiolar sheath** with wings extended into a very narrowly triangular ligular portion ca. 1 cm long drying dark red-brown, soon shed; **blade** thinly coriaceous, oblanceolate, adaxially dark green and minutely pitted, abaxially much paler with numerous minute darker glandular raised punctuations, 2.5–3 cm long \times ca. 1 cm wide, base narrow cuneate, apex obtuse with a very short mucro ca. 0.4 mm long, margin hyaline-crispulate; **midrib** abaxially and adaxially slightly prominent; **primary lateral** veins one on each side, arise from the base of the leaf blade and running half way between the midrib and the margin from the base to the tip; **interprimary venation** obscure, approximately following the line of the primary lateral veins; **secondary venation** adaxially and abaxially very faint to completely obscure; **tertiary venation** forming a faint tessellate reticulum. **Inflorescence** solitary; **peduncle** relatively stout, exceeding the petioles, ca. 5 mm long \times 0.4 mm diam., terete, pale green; **spathe** more or less ovoid, not constricted, ca. 1.5 cm long, apically beaked for ca. 0.7 mm; lower part funnel-shaped, green, persistent; spathe limb gaping at pistillate anthesis, caducous before the end of staminate anthesis, glistening white, apical beak medium green. **Spadix** subcylindric

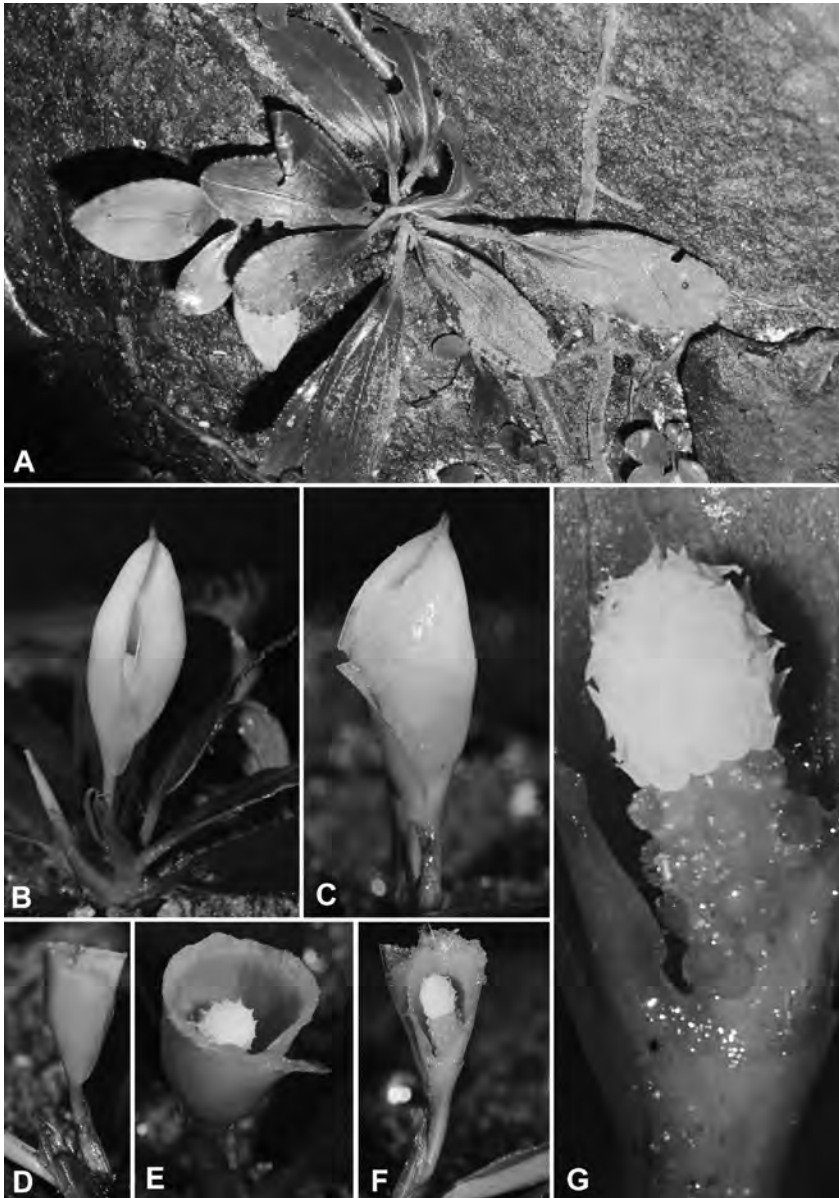


Fig. 6. *Aridarum pendek* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** Plant in habitat on shales, Type locality. Note leaves appressed to the rock surface. **B.** & **C.** Inflorescence towards the end of pistillate anthesis. The spathe limb in **C** can be seen detaching from the persistent lower spathe. **D.–F.** Inflorescence at onset staminate anthesis. The spathe limb has been shed naturally. In **F** the nearside lower spathe is artificially removed. **G.** Spadix (nearside lower spathe artificially removed). The structure and orientation of the staminate flowers. **A–G** from *AR-4163*. Image **A** © K.Nakamoto; images **B–G** © P.C.Boyce.

to bluntly spindle-shaped, ca. 4.5 mm long, ca. 2 mm diam.; **pistillate flower zone** ca. 2 mm long, comprised for ca. 3 whorls of pistils, ca. 2 mm diam.; **pistils** crowded, sub cylindrical, ca. 0.5 mm diam., medium green; **stigma** sessile, discoid, about the same width as the ovary, green; **inter-pistillar staminodes** and **sterile interstice** absent; **staminate flower zone** ca. 4 mm long, comprised of 2 rows of fertile flowers; **staminate flowers** narrowly ellipsoid-rectangular from above, ca. 0.5 mm across, the connective not excavated, pale yellow, minutely glandular; **thecae** situated on the proximal and distal (with respect to the spadix axis) sides of the anther, each with a short, robust, slightly to strongly in-curved horn 0.2 mm long; **appendix** absent. **Fruiting spathe** funnel-form with a very ragged margin where the spathe limb has fallen; **fruits** and **seeds** not seen.

Distribution—*Aridarum pendek* is known only from the Type locality where it seems to be very rare.

Ecology—*Aridarum pendek* occurs as a rheophyte strongly rooted to shale river-side boulders under lowland moist forest at ca. 20 m asl.

Etymology—From Malay, *pendek* – short – in reference to this plants diminutive habit.

Notes—An extraordinary *Aridarum* that, based on the morphology of the staminate flowers, appears to be allied to *A. incavatum* H. Okada & Mori, a vegetatively very different species from the basalts of Gunung Niut in NW Kalimantan Barat. Molecular analyses is wanting.

Aridarum surukense S.Y.Wong, S.L.Low & P.C.Boyce, **sp. nov.** Type: Indonesian Borneo, Kalimantan Barat, Kapuas Hulu, Bunut Hulu, Nanga Suruk, 00°32'14.81"N 112°41'28.95"E, 24 Sept. 2013, *K.Nakamoto AR-4218* (holo BO – alcohol!; iso SAR – alcohol!). **Figs. 7 and 11E**

Diagnosis

Aridarum surukense may be readily distinguished from all other *Aridarum* species by the very dark green velvety elliptic leaf blades. Among the Rostratum Complex it has the shortest spathe (ca. 5.5 cm long), and spadix (ca. 2.5 cm long).

Description

Small obligate clumping rheophytes ca. 18 cm tall. **Stem** condensed, suberect, ca. 1.5 cm diam, with copious strong roots. **Leaves** up to 15 together, petioles suberect with blades arching; **petiole** 5–7 cm long, laterally somewhat compressed, ca. 2 mm wide × ca. 3 mm high, distally weakly dorsally channelled, with the edges slightly raised and rounded, sheathing at the extreme base, very dark green, minutely roughened; **petiolar sheath** with wings extended into a narrowly triangular ligular portion ca. 4 cm long, ligule of short duration; **blade** coriaceous, elliptic, 8–10 cm long × 5–5.5 cm wide, base cuneate, apex acute to slightly acuminate, apiculate for ca. 5 mm, adaxially velvety very dark green, abaxially velvety pale olive green; **midrib** abaxially prominent, adaxially bluntly raised; **primary lateral veins** with ca. 4 on each side, diverging at c. 30°, adaxially prominent, abaxially very slightly sunken; **interprimary veins** almost equalling the primaries in appearance, abaxially defined by being darker than the surrounding tissue; **secondary venation** ± invisible. **Inflorescence** solitary, subtended by a 3–4 cm long, very narrowly triangular somewhat leathery prophyll; **peduncle** very slender, arching with the inflorescence pendent, equalling the petioles, 6–8 cm long, 2–2.3 mm in diam., terete, dark green, inserted ventral-obliquely on the spathe; **spathe** narrowly ovate, not constricted, barely opening at pistillate anthesis, ca. 5.5 cm long, lower part narrowly campanuliform at anthesis, weakly gibbous ventrally, dark green, ultimately persistent through fruiting; **limb** glistening white, apiculate for ca. 5 mm, apicule dark green; limb loosening at

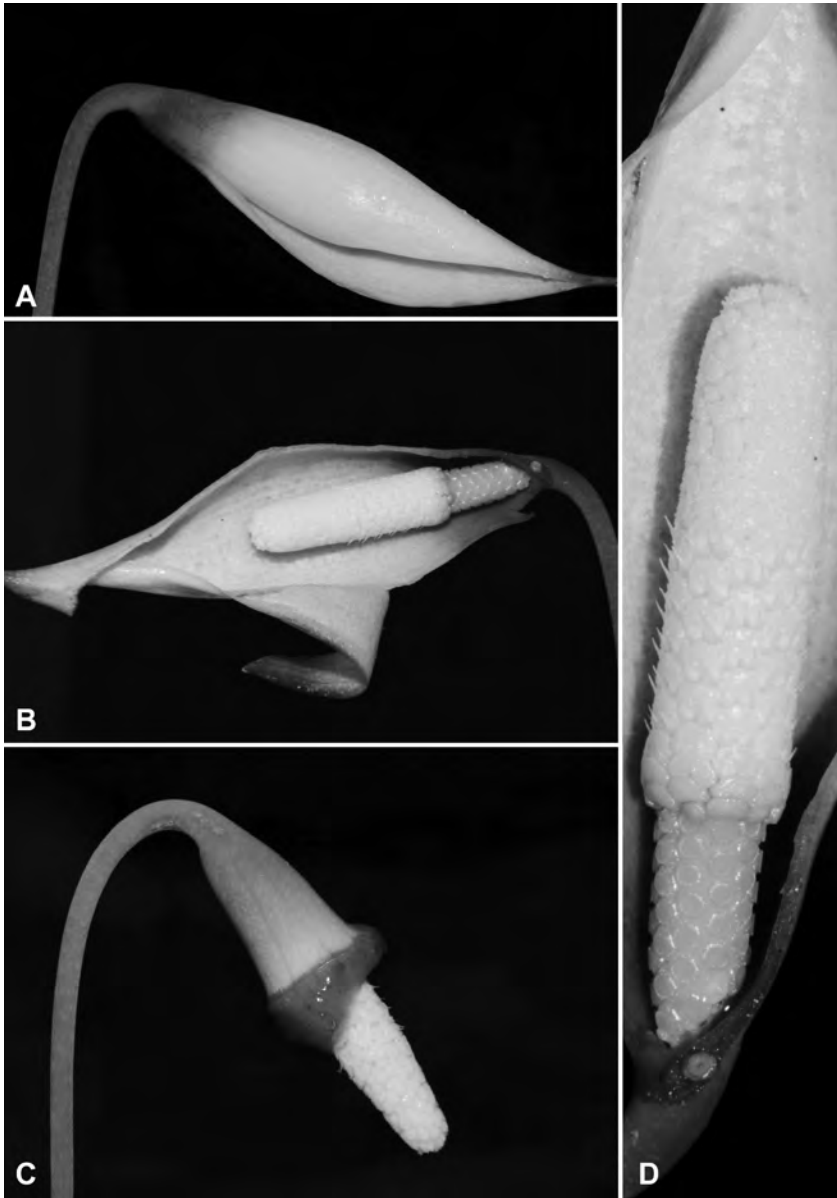


Fig. 7. *Aridarum surukense* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** Inflorescence at pistillate anthesis. **B.** Inflorescence at pistillate anthesis, nearside spathe removed artificially. **C.** Inflorescence at late staminate anthesis. Note that the majority of the spathe limb has been shed, with lowermost portion deliquescent. **D.** Inflorescence at late staminate anthesis, nearside spathe artificially removed. **A–D** from AR-4218. Images © P.C.Boyce.

pistillate anthesis, prior to and during staminate anthesis deliquescent and crumbling from the junction of the spathe limb and the persistent lower part, limb tearing

into jagged adherent strips that eventually fall to leave a brown slimy collar of decomposing tissue that this later rots and falls to leave the narrowly campanuliform

persistent lower spathe, with a scarred irregular rim. **Spadix** subcylindric ca. 2.5 cm long \times ca. 4.5 mm in diam. (widest part); **pistillate flower zone** slender cylindric, thinner than the rest of the spadix, comprising ca. 1/3 of the spadix, obliquely inserted on peduncle, zone ca. 3 mm in diam., ventral side ca. 1 cm long, dorsal side ca. 6 mm long; **pistils** trapezoid-subglobose, truncate, ca. 0.9 mm in diam., pale green; **stigma** sessile, slightly impressed, discoid, papillose, less wide than ovary, cream; **sterile interstice** cylindric, truncate with the top of the pistillate zone, ca. 2 mm long, with one partial whorl of staminodes; **interstice staminodes** rather weakly differentiated from the staminate flowers, ca. 1.5 mm wide, greenish white, interpistillar zone equalling the staminate zone in width, later (at staminate anthesis) staminodes expanding laterally by extension of the filament until zone ca. 4 mm wide and blocking access to the pistils; **staminate flower zone** ca. 1/2 of total spadix length, ca. 1.2 mm long \times ca. 4.5 mm wide, cylindrical, basally merging with the interstice and apically merging with the appendix; **staminate flowers** each comprised of a single stamen, ivory, \pm horseshoe-shaped in plan view and somewhat arching, with a conspicuous deep narrow suture between the thecae, ca. 1 \times 1 mm, connective with the inner part slightly channelled, smooth, and the distal margins (with respect to spadix axis) verruculose; **thecae** ellipsoid, imperceptibly embedded in the ends of the 'arms' of the horseshoe-shaped connective, each ca. 0.3 mm long, displaced to the proximal (with respect to the spadix axis) side of the stamen with distal-pointing horns; **thecae horns** ca. 0.4 mm long, stiff, translucent except for the base, directed upwards; **appendix** ca. 1 cm long, usually comprising slightly more than 1/3 of the entire spadix, cylindrical, obtuse; **appendix staminodes** mostly comprised of very densely-packed irregular circular and partially coherent verruculose and pellucid-glandular brain-like staminodes, lowermost staminodes closely reminiscent of staminate flowers but lacking thecae horns, terminal-most few more laxly arranged, pale cream. **Infructescences** not observed.

Distribution—*Aridarum surukense* is known only from the area of Nanga Suruk, on the western flank of the Muller Range.

Ecology—*Aridarum surukense* is an obligate rheophyte on exposed volcanic rocks along fast flowing streams under lowland perhumid forest at ca. 40 m asl.

Etymology—The trivial epithet is derived from the name of the Type locality, plus Latin *ense* [*ensis*, *masc.*]. Nanga in the Iban language is the point of a smaller river entering (or leaving) a larger river.

Notes—*Aridarum surukense* is a highly distinctive species, not only by virtue of the velvety very dark black-green leaves, but also in lacking staminodes at the base of the spadix (present in all other *Aridarum* species so far described), but also in the rather weak differentiation of the interstice staminodes from the staminate flowers.

Aridarum velutandrum S.Y.Wong, S.L.

Low & P.C.Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Bintulu, Similajau N.P., Batu Anchau trail, 03°21'21.8"N 113°09'41.0"E, 16 July 2006, P.C.Boyce et al. *AR-1915* (holo SAR – alcohol!). **Fig. 8.**

Diagnosis

Aridarum velutandrum and *A. orestum* both have pubescent staminate flowers. *Aridarum velutandrum* is, however, readily distinguished by having very short, naked stems (vs. stems elongated and clothed in conspicuous fibrous-netted cataphyll, ligule, and leaf base remnants), and very stiff leaf blades that are sharply V-shaped in cross-section, and furnished with a sharply pointed tip (vs. leaf blades by the softly leathery, almost flat with a tubular leaf tip).

Description

Very diminutive mat-forming obligate rheophytes to 3 cm tall. **Stem** very short, at most ca. 1.5 cm long, ca. 2 mm in diam., naked. **Leaves** many together, forming a



Fig. 8. *Aridarum velutandrum* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** Flowering plant in habitat on sandstone boulders, Type locality. **B.** & **C.** Inflorescence at onset pistillate anthesis. Note that the spathe has inflated to create a slit through which the spadix is visible. **D.** & **E.** Inflorescence at pistillate anthesis, spathe artificially removed. Note the pubescent staminate flowers. **A–E** from AR-1915. Images © P.C.Boyce.

dense sward; **petiole** 0.5–1 cm long, ca. 1 mm diam., adaxially canaliculate, sheathing at the extreme base; **petiolar sheath** with wings extended into a very narrowly

triangular ligular portion 1 cm long drying dark red-brown; **blade** very stiff, adaxially very dark green, paler abaxially, acicular, 0.5–2.5 cm long × 1–2 mm wide, base very

narrow cuneate, apex sharply pointed, for ca. 0.5 mm, margin thickened; midrib abaxially prominent, adaxially impressed, primary lateral almost indistinguishable, running to a thick marginal vein; secondary and tertiary venation mostly completely obscure in living material, forming a faint tessellate reticulum in dry material. **Inflorescence** solitary; **peduncle** somewhat stout, exceeding the petioles, ca. 5 mm long \times 1 mm diam., terete, pale green; **spathe** more or less ovoid, not constricted, ca. 1.5 cm long and apically beaked for ca. 2 mm; lower part funnel-shaped, green, persistent; **limb** inflating and gaping to create a slit at pistillate anthesis, then soon-caducous, glistening white, apical beak medium green. **Spadix** bluntly spindle-shaped, ca. 8 mm long, ca. 3 mm diam.; **pistillate flower zone** ca. 0.5 mm long, reduced to one or incompletely 2 whorl of pistils, ca. 2 mm diam.; **pistils** crowded, subglobose, ca. 0.5–1.5 mm diam., green; **stigma** sessile, discoid, centrally impressed, about the same width as the ovary, green; **interpistillar staminodes** confined to a row along the spathe/spadix adnation, shortly stipitate, globose, deep yellow, darker on the top, about the height of the pistils; **sterile interstice** defined a partial to complete whorl of staminodes, these pubescent, globular, 0.5–0.6 mm in diam., medium yellow; **staminate flower zone** ca. 5–9 mm long, comprised of 1–2 rows of fertile flowers; **staminate flowers** crowded, each comprised of two stamens arranged in longitudinally aligned pairs, truncate, deeply excavated with the thecae together on the inner (with respect to the stamen pairs) side of the anther, ellipsoid to ellipsoid-oblong from above, 0.8–1 mm long \times 0.4–0.6 mm wide, pubescent, medium yellow; **thecae** separated by a ridge forming an incomplete septum in the cavity or this weak or absent, very shortly horned, with the horns on edge of the anther; **appendix** ca. 1–4 mm long, rounded; **appendix staminodes** more or less irregularly globular to ellipsoid, mostly flat-topped, lowermost ones more or less excavated, ca. 0.5–0.8 mm diam., pubescent,

medium yellow. **Fruiting spathe** funnel-form, pale greenish; **fruits** not seen.

Distribution—*Aridarum velutandrum* is known only from Similajau N.P. (Bintulu, Sarawak), where it is restricted to the very hard sandstones of the Sungai Anchau.

Ecology—*Aridarum velutandrum* occurs as a rheophyte on in slightly shaded very hard river sandstones under humid lowland forest between 30 and 60 m asl.

Etymology—From Latin, *velutinae* – velvety – and *anther* –hence the pubescent staminate flowers and staminodes.

Notes—*Aridarum velutandrum* and *A. orestum* are unique in the genus in having pubescent staminate flowers. It is highly probable that they are closely related and possibly the result of a vicariance event separating a lowland (*A. velutandrum*) and a highland (*A. orestum*) population. Molecular analyses is required but will necessitate re-collection of *A. orestum* since attempts to retrieve DNA from the alcohol-treated prior to pressing Type material have comprehensively failed.

Aridarum zygosetum S.Y.Wong, S.L.Low & P.C.Boyce, **sp. nov.** Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Nanga Taman, 00°16'6.0"S 110°49'6.0"E, 4 April 2012 *K.Nakamoto AR-3843* (holo BO – alcohol!; iso SAR – alcohol!). **Figs. 9 and 10.**

Diagnosis

Uniquely *Aridarum zygosetum* shares with *A. montanum* having each stamen furnished with a pair of long setiform thecae horns with the tips of each horn pair overlapping, but is easily distinguished by the much larger, erect, elliptic, softly coriaceous leaf blades up to 22 cm long \times 5 cm wide (vs. leaf blades linear-lanceolate, stiffly coriaceous, up to 10 cm long \times 4.5 mm wide), the large spathe (ca. 9 cm vs. ca. 2 cm long), and longer spadix (ca. 4.5 cm vs. 1.5 cm long).

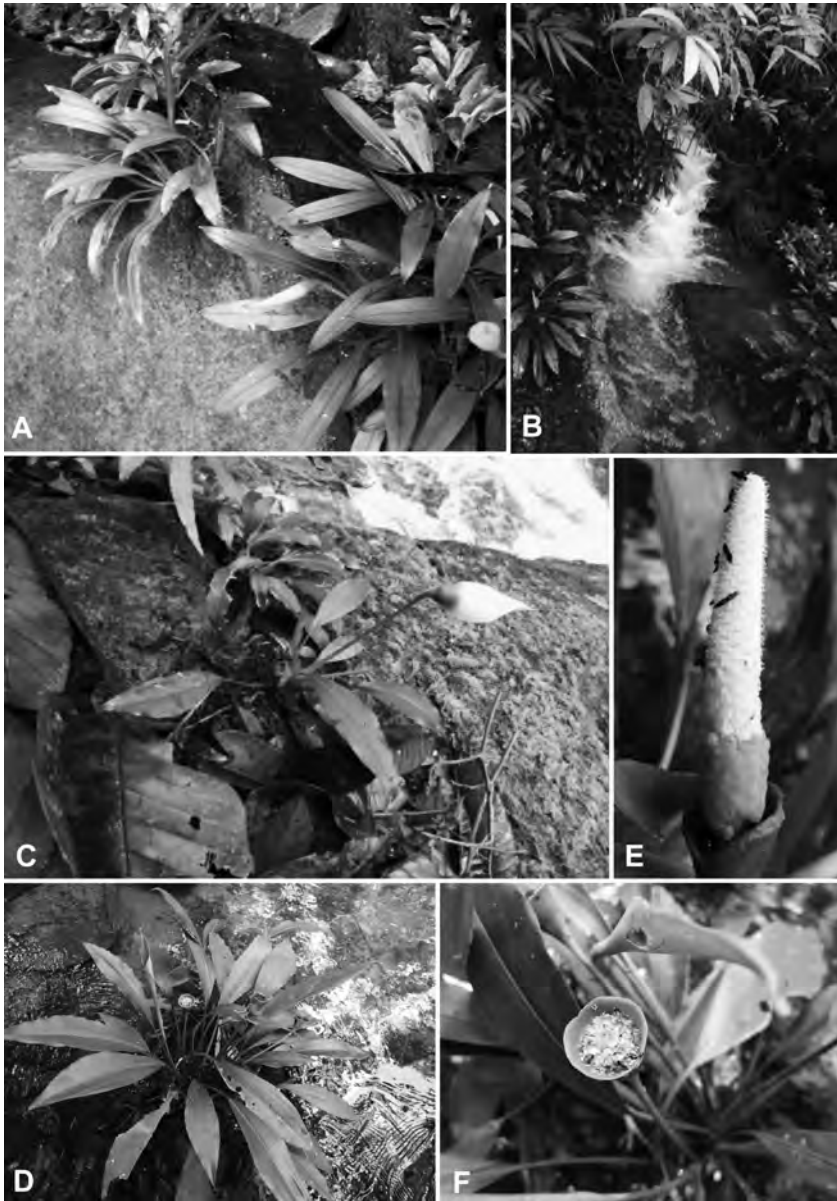


Fig. 9. *Aridarum zygosetum* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** & **C.** Flowering plants in habitat on granite. **B.** Large population in a granite-lined gully. **D.** & **F.** Fruiting plant in habitat. Note (**F**) that the fruits have decomposed. Later these will be washed from the splash-cup by rain or water spate. **E.** Spadix at late staminate anthesis, spathe artificially removed. Note the staphylinids, the likely pollinator. **A** from AR-3774; **B–C** from AR-3987; **D** & **F** from AR-3843; **E** from AR-3771. Images © K.Nakamoto.

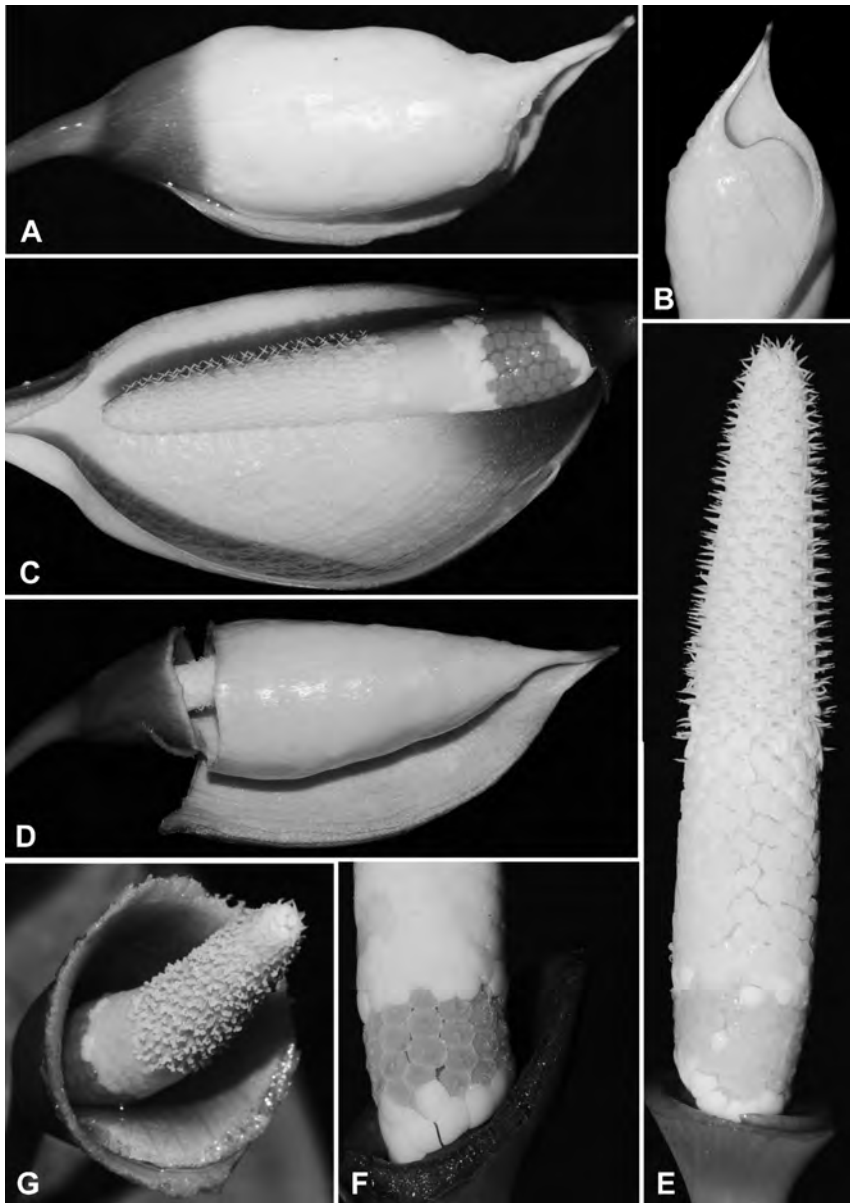


Fig. 10. *Aridarium zygoseum* S.Y.Wong, S.L.Low & P.C.Boyce. **A.** & **B.** Inflorescence at pistillate anthesis. Note (**B**) the manner that the spathe limb has inflated and unfurled. **C.** Inflorescence at late pistillate anthesis, nearside spathe artificially removed. Note that pistils are still wet and that the thecae horns are becoming erect. **D.** Inflorescence at staminate anthesis with the spathe limb separating from the persistent lower part. **E.** Spadix at staminate anthesis with the thecae horns fully erect. **F.** Detail of the lower part of the spadix, showing the inter pistillar staminodes at the base, the pistillate flower zone, and the lower part of the interstice. **G.** Inflorescence at staminate anthesis. The spathe limb is shed, leaving a ragged margin to the persistent lower spathe. Note the pollen masses at the tips of the thecae horns. **A** & **B** from AR-3771; **C** from AR-3777; **D** from AR-3993; **E.** from AR-3843; **F** from Ar-3800; **G** from AR-3845. Images © P.C.Boyce.

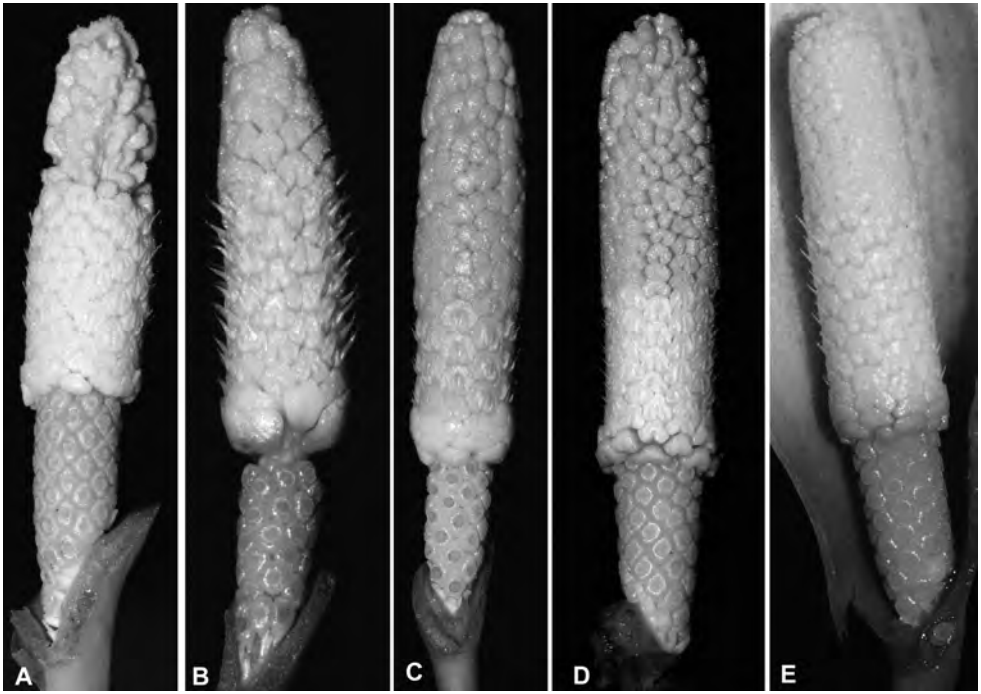


Fig. 11. *Aridarum* Rostratum Complex spadix comparisons, spathe artificially removed in A–C; nearside spathe artificially removed in E. *Aridarum rostratum* Bogner & A.Hay. A. *Aridarum uncum* P.C.Boyce & S.Y.Wong B. *Aridarum alatense* S.Y.Wong, S.L.Low & P.C.Boyce C. *Aridarum hippocrepis* P.C.Boyce & S.Y.Wong D. *Aridarum surukense* S.Y.Wong, S.L.Low & P.C.Boyce E. A from AR-3532; B from AR-3901; C from AR-4156; D from AR-3842; E from AR-4218. Images © P.C.Boyce.

Description

Medium-sized clumping obligate rheophytes to 30 cm tall. **Stem** condensed, erect, ca. 5 cm long \times ca. 2 cm in diam., mostly obscured by the dense leaf bases, with copious strong roots and often with stilt-roots emerging from between the leaf bases. **Leaves** many together, petioles sub erect with blades slightly arching; individual modules with several leaves, modules subtended by a linear-triangular 2-keeled prophyll to 7 cm long and ca. 5 mm wide, initially prophyll green, but soon decaying; **petiole** 9–14 cm long, weakly D-shaped in cross section, ca. 3 mm wide \times ca. 2.5 mm high, dorsal edges slightly raised, sheathing at the extreme base, medium green; **petiolar sheath** with wings extended into a narrowly triangular ligular portion 5–8 cm

long, ligule soon marcescent and shedding to leave a short collar of papery tissue; **blade** softly coriaceous, elliptic, 14–22 cm long \times 4–5.5 cm wide, base cuneate, apex acute, apiculate for ca. 5 mm, adaxially semi glossy dark green, glossy pale abaxially; **midrib** abaxially prominent, somewhat paler than the rest of the blade, adaxially bluntly raised; **primary lateral** 4 or 5 adaxially weakly defined veins on each side, these diverging at ca. 30°; **interprimary veins** slightly darker than the primaries in appearance; **secondary venation** adaxially invisible. **Inflorescence** solitary or up to three together alternating with foliage leaves, subtended by a ca. 7 cm long, very narrowly triangular somewhat leathery cataphyll; **peduncle** slender, erect, equalling to slightly exceeding the petioles up to 14 cm long, ca. 3 mm

diam., terete, medium green, inserted slightly obliquely on the spathe; **spathe** broadly ovate with a long acuminate tip, not constricted, 8–9 cm long, lower part campanuliform at anthesis, medium green, ultimately persistent through fruiting, limb glistening white, apiculate for up to 1 cm, apicule distally green; limb gaping at pistillate anthesis, caducous from the junction of the spathe limb and the persistent lower part, limb falling more-or-less intact to leave the narrowly campanuliform persistent lower spathe, with a scarred regular rim. **Spadix** tapering cylindrical, ca. 4.5 cm long \times ca. 7 mm in diam. (widest part), usually fertile to the tip; **pistillate flower zone** oblong cylindrical, about the same width as the other fertile parts of the spadix, comprising slightly less than $\frac{1}{4}$ of the spadix, ca. 1 cm long, 2–3 rows of trapezoidal to hexagonal glossy white staminodes at the base; **pistils** subglobose, truncate, c. 1.1 mm in diam., pale green; **stigma** sessile, slightly impressed, hexagonal, papillose, wider than ovary, pale green; **sterile interstice** cylindrical, equaling the pistillate zone in width, ca. 1.3 cm long, with several dense whorls of hexagonal staminodes, these ca. 1.3 mm in diam., glossy white; **staminate flower zone** ca. $\frac{1}{2}$ of total spadix length, ca. 2 cm long, lower part equalling the width of the sterile interstice, fertile to the tip, or the tip furnished with two or three staminodes, glossy white; **staminate flowers** densely packed, comprised of two stamens, ivory, \pm oblong, with the long sides parallel to the spadix axis, ca. 2×1 mm, connective with the surface with a narrow longitudinal groove; **thecae** ellipsoid, imperceptibly embedded in the ends connective, each ca. 0.5 mm long; **thecae horns** two per stamen, ca. 3 mm long, stiff, semi-translucent, appressed to the stamen during pistillate anthesis, becoming semi-erect and then erect at staminate anthesis, and then producing an irregular mass of pollen from the tip. **Infructescence** an erect splash-cup. **Fruiting spathe** campanuliform, ca. 1.5 cm long \times c. 1.5 cm wide, medium green with a scar along the rim; **immature fruits** prismatic globose, c. 2 mm tall and in diam., dark

green; stigmatic remains sunken, dark brown; **ripe fruits** deliquescent into a pale whitish slime; **seeds** ellipsoid, longitudinally very finely ridged, on one end with an elongate, curved micropylar appendage.

Distribution—*Aridarum zygasetum* is known from two discrete populations ca. 150 km distant at Nanga Taman (Kalimantan Barat), and Kudangan (Kalimantan Tengah).

Ecology—*Aridarum zygasetum* occurs as a rheophyte on exposed riverside granite boulders under lowland to hill perhumid forest; 90–350 m asl.

Etymology—From Green, *zygos* – a yoke –, and Latin, *setos* – a bristle –, in allusion to the paired thecae horns.

Notes—Despite sharing the characteristic long setiform thecae horns with *A. montanum* in all other respects *A. zygasetum* is highly differentiated from *A. montanum* and it is not at all clear to which species *A. zygasetum* may be most closely related. Preliminary molecular analyses by the second author place *A. zygasetum* alone in an isolated clade.

Plants from Kudangan (Kalimantan Tengah, ca. 150 km SW of the Type locality at Nanga Taman) are indistinguishable in vegetative morphology from plants at Nanga Taman, but differ by the shorter sterile interstice separating the pistillate and staminate flower zone, the less robust thecae horns, and the shorter spathe limb inflating less at pistillate anthesis. Further analytical work is needed to determine if these two populations represent taxonomically significant units.

On several occasions inflorescences of *A. zygasetum* have been found in habitat with staphylinid beetles present at pistillate and staminate anthesis (**Fig. 9E**). Staphylinids have never previously been recorded for *Aridarum*, and they are not common pollinators in tropical Araceae in general. More investigations are needed

Other material examined: INDONESIAN BORNEO. **Kalimantan Barat:** Sekadau.

Nanga Taman, south east of Nanga Taman, Kampung Seri Punti, Gunung Raya, south slope, 3 Feb. 2012, *K.Nakamoto AR-3771* (BO! – alcohol; SAR! – alcohol); Nanga Taman, south east of Nanga Taman, Gunung Taman, east slope, 00°27'35.41"S 111°02'3.21"E, 5 Feb. 2012, *K.Nakamoto AR-3774* (BO! – alcohol; SAR! – alcohol) & 5 Feb. 2012, *K.Nakamoto AR-3777* (BO! – alcohol; SAR! – alcohol) & 5 Feb. 2012, *K.Nakamoto AR-3800* (BO! – alcohol; SAR! – alcohol); Nanga Taman Nickel Mine, 22 May 2012, *K.Nakamoto AR-3930* (BO! – alcohol; SAR! – alcohol) & 22 May 2012, *K.Nakamoto AR-3934* (BO! – alcohol; SAR! – alcohol); Nanga Taman, SE of Manterahidup, 00°08'45.2"S 111°00'47.0"E, 22 May 2012, *K.Nakamoto AR-3933* (BO! – alcohol; SAR! – alcohol); Nanga Taman, 22 May 2012, *K.Nakamoto AR-3935* & *AR-3944* (BO! – alcohol; SAR! – alcohol). Kalimantan Tengah: **Lemandau**, Dalang Kudangan, Sungai Lemandu, 01°34'59.99"S 111°04'1.20"E, 4 April 2012, *K.Nakamoto AR-3845* (BO! – alcohol; SAR! – alcohol) & 24 June 2012, *K.Nakamoto AR-3986* (BO! – alcohol; SAR! – alcohol) & 24 June 2012, *K.Nakamoto AR-3987* (BO! – alcohol; SAR! – alcohol).

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