

## **Studies on Schismatoglottideae (Araceae) of Borneo II: *Aridarum crassum*, a New Species from Sarawak, Malaysian Borneo**

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### **Abstract**

*Aridarum crassum* S.Y.Wong & P.C.Boyce is described as a new species from Sarawak, Malaysian Borneo. The existing key to the genus *Aridarum* Ridl. is amended to include the new species.

### **Introduction**

*Aridarum* Ridl. is a genus consisting of nine species of rheophytic, sometimes facultatively lithophytic, forest herbs, are all endemic to Borneo. Previous work by Bogner & Hay (2000) recognised nine species of which one species was at that time inadequately known and thus not fully described. The species, treated as sp. A in Bogner & Hay (2000), was known from a single collection from the summit (850 m asl) of Gunung Gaharu (Sri Aman Division, Sarawak). Fieldwork by the second author at the same location, although at lower altitude (the summit is no longer accessible) resulted in three collections of what we believe to be the same species. This species is clearly distinguished from the rest of the genus *Aridarum* by the leaf laminae very stiffly coriaceous, glossy deep green adaxially and conspicuously raised punctate abaxially when fresh. We are hereby describing this novelty as *Aridarum crassum* S.Y.Wong & P.C.Boyce.

### **Key to species of *Aridarum***

- 1a. Thecae on each end of the anther (Sect. *Aridarum*) ..... 2
- 1b. Thecae together on one side of the anther (Sect. *Caulescentia*) ..... 6

- 2a. Leaf laminae almost linear; horns of anther thecae long and thin; Sarawak (Santubong).....**A. montanum**
- 2b. Leaf laminae very narrowly elliptic to elliptic; horns of anther thecae short and stubby ..... **3**
- 3a. Leaf arrangement distichous; Sarawak (vicinity of Matang) ..... **A. borneense**
- 3b. Leaf arrangement spiral..... **4**
- 4a. Spadix fertile to apex (possibly except a few apical sterile stamens); anthers not excavated; horns of thecae short but robust, their bases occupying the whole upper surface of the anther; West Kalimantan ..... **A. incavatum**
- 4b. Spadix with an appendix of staminodes; anthers excavated; horns of the thecae small, on each end of the anther; Sarawak and West Kalimantan ... **5**
- 5a. Leaf laminae very stiffly coriaceous, glossy deep green adaxially when fresh, conspicuously raised-punctate abaxially when fresh, weakly and minutely punctate in dry material, margins revolute in dry material, primary lateral venation weakly raised adaxially when fresh, 5-8 primary lateral veins at each side but obscure in dry material, obscure abaxially when fresh and in dry material; sweet smelling (esterases) at female anthesis, ovary ovoid to elongate-ovoid, stigma <sup>2</sup>/<sub>3</sub> of ovary diam. strongly papillate, umbonate, staining brownish red in alcohol; thecae horns very short, rounded at the end; Sarawak (Gunung Gaharu) ..... **A. crassum**
- 5b. Leaf laminae rubbery-coriaceous, matte medium green adaxially when fresh, inconspicuously raised punctate abaxially when fresh, conspicuously raised punctate in dry material, margins planate in dry material, primary lateral venation obscure adaxially when fresh and in dry material, weakly raised abaxially when fresh and in dry material, to ca 3 primary lateral veins on each side; inflorescence with no smell at female anthesis, ovary ovoid, stigma as wide as ovary, weakly papillate, scutiform, staining light brown in alcohol; thecae horns long, pointed at the end; Sarawak (Bako National Park) and West Kalimantan ..... **A. nicolsonii**
- 6a. Stamens arranged in pairs; thecae on the inner face of each member of the stamen pair ..... **7**
- 6b. Stamens single (but crowded); thecae on the proximal (with respect to the spadix axis) side of the anther..... **8**
- 7a. Horns of thecae shorter than width of stamen; Sarawak and Brunei ..... **A. caulescens**
- 7b. Horns of thecae longer than width of stamen; Sarawak .... **A. purseglovei**

- 8a. Stamens and staminodes coarsely verruculate; appendix well-differentiated; spathe beaked for more than half its length; West Kalimantan (Bidang Menabei) ..... **A. rostratum**
- 8b. Stamens and staminodes not verruculate; appendix reduced to a few terminal sterile stamens; spathe not long-beaked; Sarawak and West & Central Kalimantan ..... **A. burttii**

***Aridarum crassum* S.Y.Wong & P.C.Boyce sp. nov.**

*Aridarum crassum* differt ab speciebus ceteris laminis foliorum valde rigide coriaceis, adaxiali atro-viride, nitentibus, abaxiali punctis elevatis instructa (in stato vivo). *Aridarum crassum* *A. nicolsonii* similis videtur sed laminis foliorum abaxiali punctis elevatis instructa (in stato vivo) sed folia siccitatae abaxiali perpunctulatus, nervis lateralibus primariis parum prominentibus, 5–8 in quoque latere in stato vivo, valde obscuris in stato sicco, inflorescentia odorus per anthesin feminae, quam stigmatibus quam ovaria ca<sup>2</sup>/ diametro, cum alcoholis rubiginosus, cornu thecis antherae brevissimus, obtusus differt.

**Typus:** Malaysia, Sarawak, Sri Aman Division, Pantu, Gn. Gaharu, 01° 02' 39.5"; 110° 53' 18.3", 100 m asl, 23 Sept. 2004, P.C.Boyce & Jeland ak Kisai AR-692 (holo, SAR). Plates 1 & 2

Small, moderate to robust rheophytic **herbs** to ca. 20 cm tall. **Stem** epigeal, pleionanthic, erect to semi-decumbent, condensed, to 1.6 cm long x 1.3 cm diam., roots green, photosynthetic, robust to ca 2 mm diam. **Leaves** few together, spirally arranged, to ca 4 per module; *petioles* stout, glabrous, 4–8 cm long x 3.5–5 mm diam., dark green, similar colour to adaxial side of leaf lamina, D-shaped adaxially in cross section; sheathing only at the extreme base, the sheaths fused and extending into a very narrowly triangular marcescent ligular portion to ca 2.8 cm long, <sup>1</sup>/<sub>3</sub> to <sup>1</sup>/<sub>2</sub> of petiole length; lamina broadly oblanceolate to broadly oblong-lanceolate to elliptic or narrowly obovate, very stiffly coriaceous, glabrous, 11–14 cm long x 3–5 cm wide, base cuneate to decurrent, oblique, apex acuminate, sometimes acute, acuminate for ca 1.3 cm, tubular apiculate to ca 1.5 mm; margins entire, markedly thickened when fresh, revolute (in dry material), adaxially shining dark green, abaxially matte paler green, minutely rugulose, marked conspicuously with dense, raised punctate when fresh but weakly and minutely punctate in dry material; midrib adaxially flush with lamina, abaxially prominent, raised canaliculate in cross section; primary lateral venation weakly raised adaxially when fresh, 5–8 primary lateral veins at each side but obscure in dry material, very obscure abaxially when fresh and in dry material, secondary venation obscure, primary and secondary venation diverging at 30°–45° from mid-vein, running into obscure marginal vein; tertiary venation invisible.

**Inflorescence** solitary, sub-erect, sweet smelling (esterases) at female anthesis, peduncle to ca 8 cm long, always exceeding petioles, subtended by a pair of fused ligules, to ca 4.5 cm long these splitting into two at the end, to ca 2.3 cm long, sometimes two rudimentary leaves present, these to ca 2 mm followed by a prophyll and a cataphyll; **spathe** more or less broadly ovate, not constricted, softly coriaceous, interior glossy, exterior semi-glossy, to 6-8 cm long; lower spathe cup-shaped, obconic, 2.2 cm long x 1.9 cm diam. (across), spathe abscission layer coinciding with base of male zone, green when fresh, persistent into fruiting, margins convolute; limb broadly ovate, convolute, white, to ca 3.8 cm long, tip mucronate to ca 3 mm, caducous after male anthesis; **spadix** sessile, adnate isodiametrically to the spathe in the lower  $\frac{1}{4}$  of female zone on the dorsal side, cylindric, to ca 4.5–5.5 cm long, subequalling spathe; female zone cylindric, often constricted at the adnation, green when fresh, ca 1 cm long x 8.6 mm–1 cm diam.,  $\frac{1}{5}$  of spadix length; pistils many, somewhat crowded, ovoid to elongate-ovoid, ca 1.2 mm long x 0.85 mm diam., turning white in alcohol, stigma sessile, raised, notably papillate, ca 0.60–1.1 mm diam.,  $\frac{2}{3}$  of ovary diam., staining brownish red in alcohol; interstillar staminodes, staminodes confined to a single row at the base of spadix, laxly arranged, more-or-less square to round, impressed in the middle, shorter than pistils, about same size as ovary, shortly stipitate; sterile interstice cylindric, always wider in diameter than female zone, 4–6 mm long x 8 mm–1.1 cm diam.,  $\frac{1}{10}$  of spadix length, without constriction, clothed with staminodes, more-or-less circular, sometimes rectangular, truncate, ca to 1 mm across, excavation circular deep, sometimes wide impressed; male zone tapering-cylindric, basally slightly thickened above interstice, 2.2 cm long x 8 mm long,  $\frac{1}{2}$  of spadix length; stamens arranged in longitudinally aligned pairs, crowded, rectangular, ca 1 mm across; connective deeply excavated, with the cavity not septate; **thecae** opposite on the distal and proximal (with respect to the spadix axis) sides of the anther; horns very short, round to slightly point at end, erect to suberect; appendix tapering-cylindric to a blunt tip, ca 8.5 mm long,  $\frac{1}{5}$  of spadix length, staminodes more or less circular, sometimes irregularly polygonal, 0.6 mm to 1 mm wide, excavations circular deep, sometimes wide impressed. **Infructescence** solitary; peduncle to ca 8 cm long, not exerted, erect; fruiting spathe obconic, ca 2 cm.

*Distribution:* Endemic to Sarawak: Sri Aman Division (Gn. Gaharu).

*Habitat:* Rheophytic on large sandstone boulders at low altitudes, mainly on wet sandstone cliff surfaces at higher altitudes, 100 to 850 m asl.

*Notes:* *Aridarum crassum* is clearly distinctive from the rest of the genus by the leaf laminae very stiffly coriaceous, glossy deep green adaxially and conspicuously raised punctate abaxially when fresh. *Aridarum crassum* is



**Plate 1:** *Aridarum crassum* S.Y.Wong & P.C.Boyce (Figs. A, B & D) and *Aridarum nicolsonii* Bogner (Fig. C): **A.** Note very stiffly coriaceous and glossy deep green leaf laminae and stout petioles of *Aridarum crassum*. **B.** Adaxially weakly raised primary lateral venation seen in *Aridarum crassum*. **C.** Note in *Aridarum nicolsonii* the matte medium green leaf laminae and primary lateral venation obscure adaxially, note slender petioles. **D.** Inflorescence of *A. crassum* in bud.



**Plate 2:** *Aridarum crassum* S.Y.Wong & P.C.Boyce (Figs. A, C & E) and *Aridarum nicolsonii* Bogner (Figs. B, D & F): **A.** Abaxial surface of leaf lamina of *Aridarum crassum* showing obscure primary lateral venation and conspicuous raised punctae. **B.** Abaxial surface of leaf lamina of *Aridarum nicolsonii* showing weakly raised primary lateral venation. **C.** Spadix of *A. crassum* (spathe artificially removed) to display stigma smaller than ovary and tapering male zone. **D.** Spathe of *Aridarum nicolsonii* at gaping stage. **E.** Inflorescence of *A. crassum* at male anthesis. **F.** Spadix (spathe artificially removed) of *Aridarum nicolsonii* to display stigma smaller than ovary and cylindrical male zone.

most similar to *A. nicolsonii* Bogner but is readily separable by the above noted characters plus in having stigmas smaller than ovary diameter, by inflorescences fragrant of esterases at female anthesis, and a tapering-cylindric (*vs* cylindric) male zone. Additionally, *A. crassum* is more robust with stouter petioles than *A. nicolsonii*, which tends to be gracile with slender petioles.

Leaf laminae of *A. crassum* are abaxially conspicuously marked with raised punctae when fresh, but weakly and minutely punctate in dry material at which time the margins are conspicuously revolute as compared to *A. nicolsonii* with inconspicuous raised punctae abaxially when fresh but conspicuous raised punctate and a planate leaf margins in dry material. Leaf laminae of *A. crassum* are broadly oblanceolate to broadly oblong-lanceolate to elliptic or narrowly obovate with the apex shortly acuminate (to *ca* 1.3 cm), as compared to elliptic to broadly oblanceolate with the leaf acuminate to *ca* 2 cm in *A. nicolsonii*. Primary lateral venation of *A. crassum* consists of 5-8 primary lateral veins per side are weakly raised adaxially when fresh but obscure in dry material, abaxially these veins are obscure both in fresh and dry material. In *A. nicolsonii* primary lateral venation (to *ca* 3 primary lateral veins per each side) is obscure adaxially when fresh and in dry material, but weakly raised abaxially both in fresh and dry material.

*Aridarum crassum* emits a sweet smell (esterases) at female anthesis whereas *A. nicolsonii* does not emit any smell at any time during anthesis. Ovaries in *A. crassum* are ovoid to elongate-ovoid (compared to ovoid in *A. nicolsonii*) with a strongly papillate, umbonate, smaller stigma (to  $\frac{2}{3}$  of ovary diam.) staining brownish red in alcohol (*vs* a less papillate, scutiform stigma as wide as ovary and staining light brown in alcohol in *A. nicolsonii*). The thecae horns are very short and rounded at the tips in *A. crassum*, compared to longer thecae horns that are pointed at the end in *A. nicolsonii*.

*Aridarum crassum* is endemic to Gunung Gaharu, Sri Aman Division, Sarawak whereas, *A. nicolsonii* is widespread in Bako National Park, Kuching Division, Sarawak and in West Kalimantan.

*Etymology*: The species epithet is derived from the Latin, *crassus*, 'thick' reflecting the markedly stiffly coriaceous leaf laminae that immediately distinguishes this species.

*Other specimens examined*: SARAWAK. Sri Aman Division: Pantu, Gn. Gaharu, 01° 02' 39.5"; 110° 53' 18.3", 22 March 2004, *P.C.Boyce & Jelandak Kisai AR-251* (SAR); *Ibid*, 01° 01' 19.5"; 110° 52' 52.8", 22 March 2004,

*P.C.Boyce & Jeland ak Kisai AR-263 (SAR + spirit).*

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### Reference

Bogner, J. and Hay, A. 2000. Schismatoglottideae in Malesia II – *Aridarum*, *Bucephalandra*, *Phymatarum* and *Piptospatha*. *Telopea* **9(1)**: 183–194.

### Additional notes on *Aridarum crassum*

*Aridarum crassum* also occurs on Gn. Lingga (Sri Aman Division) which is 150 km further eastwards from Gn. Gaharu. *Aridarum nicolsonii* also occurs on Gn. Lesung, Lingga (based on a collection of Carlo Hansen No. 1044); the occurrence of two *Aridarum* species together is unusual. Especially interesting is the occurrence of a species at high elevation (*A. crassum*) and another allopatrically at low elevation (*A. nicolsonii*); this is also the instance at Gn. Bako (Kuching Division) where the enigmatic *Aridarum montanum* Ridl. occurs towards the summit, while the lower slopes harbours *A. nicolsonii*.

*Additional specimens examined:* SARAWAK. Sri Aman Division: Pantu, Gn. Gaharu, 8 Oct. 1974, *Illias & Azahari S. 35676 (SAR)*; Gn. Gaharu, 7 Dec. 2004, *Bogner 2835 (M)*; Gn. Lingga, June 1906, *Hewitt series 826 (SAR)*; *ibid*, June 1906, *Hewitt series 446 (SAR)*; *ibid*, June 1906, *Hewitt series 1095 (SAR)*.