Studies on Schismatoglottideae (Araceae) of Borneo XXIV — Two new species of Aridarum from Kalimantan, and notes on the Aridarum Burttii Complex

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Studies on Schismatoglottideae (Araceae) of Borneo XXIV – Two new species of Aridarum from Kalimantan, and notes on the Aridarum Burttii Complex


Two taxonomically novel Aridarum species, A. kazuyae and A. orientale, are described from Kalimantan Timur, Indonesian Borneo. They are most similar to A. burttii from Sarawak, and together with A. minimum from Kalimantan Barat represent a morphotaxon, here called the Burttii Complex, defined by staminate flowers comprised of one stamen with an obliquely excavated expanded connective, hemispherical interstice staminodes, a spathe limb deliquescing acroscopically from its junction with the lower persistent portion and leaf blades with adaxially prominently raised primary lateral veins. Recognition of the new species proposed here takes the genus Aridarum to 12 accepted species. A key to all Aridarum species is provided, the two new species are illustrated and a comparison plate of the spadices of the four species assigned to the Burttii Complex as well as notes on the defining morphological features of this species group and some brief observations on pollination are given.

Additional key words: aroids, Aridarum kazuyae, Aridarum orientale, taxonomy, rheophyte, Indonesia

Introduction

Aridarum Ridl., a genus of 10 accepted species of obligate rheophytes endemic on Borneo, was last revised by Bogner & Hay (2000), who recognised eight species, including one novelty, and one distinct but undeterminable species represented by sterile material only. Since then, A. minimum H. Okada (2006) was described and, based on new collections, A. crassum S. Y. Wong & P. C. Boyce was established (Wong & Boyce 2007) for the indeterminable taxon highlighted by Bogner & Hay (2000). Since 2007, examination of more herbarium material coupled with extensive and continuing fieldwork has revealed further undescribed Aridarum species. Two novelties resulting from this fieldwork are here described.

Results and Discussion

Aridarum kazuyae S. Y. Wong, P. C. Boyce & S. L. Low, sp. nov.
Holotype: Indonesian Borneo, Kalimantan Timur, Kabupaten Malinau, Kecamatan Malinau Selatan,SEMBAKUNG, 80 km SW of Malinau, Tempat Wisata Loreh, 3 km N of Long Loreh village, 3°9’24”N, 116°29’36”E, 3.5.2012, K. Nakamoto AR-3927 (BO!; isotype: SAR!).
Aridarum kazuyae very closely resembles A. orientale S. Y. Wong & al. in vegetative appearance but is immediately distinguished by the combination of a long naked sterile interstice separating the pistillate and staminate flower zones, and the concave, verrucate (not convex,
smooth) stamen connective with serrate-dentate (not rounded) margins.

Medium-sized obligate rheophyte 10–25 cm tall. Stem somewhat condensed, suberect, later to c. 20 cm long, c. 1.5 cm in diameter. Leaves up to 12 together, petioles erect with blades arching; petiole 6–19 cm long, 2–3 mm in diameter, very weakly D-shaped in cross section, and weakly channelled dorsally, with the edges rounded, sheathing at the extreme base, medium green; petiolar sheath with wings extended into a narrowly triangular ligular portion 3–6 cm long, ligule soon deliquescing; blade thinly coriaceous, elliptic, 6–18 cm long × 2–6 cm wide, base cuneate, apex acute, shortly acuminate and apiculate for c. 12 mm, adaxially semiglossy dark green, paler abaxially; midrib abaxially and adaxially prominent; primary lateral veins 4–5 on each side, diverging from the midrib at c. 30°, adaxially prominent; interprimary veins very few, much less prominent than primaries and not visibly reaching the midrib or blade margins; secondary venation obscure; tertiary venation adaxially obscure, abaxially forming a slightly darker irregular reticulum. Inflorescence solitary, subtended by a 6–11 cm long, very narrowly triangular somewhat membranous cataphyll. Peduncle shorter than the petioles, 9–15 cm long, terete, medium green, inserted dorsal-obliquely on the spathe. Spathe broadly ovate, not constricted, c. 6.5 cm long; lower part salverform at anthesis, gibbous ventrally, green, ultimately persistent through fruiting, limb glistening white, apiculate for up to 8 mm, apiculate distally green; limb gaping at pistillate anthesis, during staminate anthesis deliquescent acroscopically from the junction of the spathe limb and the persistent lower part, the limb eventually falling to leave the persistent part with a wide ragged margin of degrading tissue, this tissue then liquefying and leaving the salverform persistent lower spathe with a scarred irregular rim. Spadix subcylindrical 3–3.5 cm long, c. 0.6 cm in diameter; pistillate flower zone comprising c. ⅓ of the spadix, obliquely inserted on peduncle, ventral side c. 6 mm long, dorsal side c. 4 mm long, with an incomplete row of clavate white staminodes at the base; pistils subglobose, truncate, c. 2 mm in diameter, green; stigma subsessile, discoid, papillose, slightly less wide than ovary, greyish; interpistillar staminodes absent; sterile interstice slender cylindric, naked, white, subequalling the pistillate zone in length, c. 6 mm long, with several incomplete longitudinal ridges and one or two cylindric-clavate staminodes at the top (below the staminate flower zone), white; staminate flower zone c. ⅓ of total spadix length, c. 6 mm long × c. 5 mm in diameter, cylindrical, basically abruptly truncate at junction with sterile interstice; staminate flowers each comprising of a single stamen, ± circular in plan view, with a suture between the thecae, comparatively large, c. 2.5 × 2.5 mm, connective verrucate, centrally impressed with the distal (with respect to spadix axis) margins forming a spreading serrate-dentate rim; thecae globose, each c. 1 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, slightly stiff, directed upwards; appendix c. 1.9 cm long, comprising slightly more than ⅓ of the entire spadix, bluntly tapering; appendix staminodes mostly comprised of very densely-packed circular and partially coherent verrucate staminodes, the terminal-most few somewhat more laxly arranged and ending to be tuberculate, rarely the appendix clothed mainly with smooth-surfaced tuberculate staminodes with the lowermost reminiscent of staminate flowers but lacking thecae, and transitioning to staminate flowers, cream. Fruiting spathe very broadly obconic, c. 1.5 cm diameter, and 1 cm tall, pale to medium green with a ragged scar along the rim; fruits and seeds not seen. – Fig. 1.

Ecology — Aridarum kazuyae grows on shale river boulders and in waterfalls under wet lower hill forest at an altitude of about 200 m.

Distribution — The species is known only from the type locality in Indonesian Borneo, Kalimantan Timur.

Eponymy — This new Aridarum species is named for Kazuya Nakamoto, an indefatigable explorer and excellent grower of aquatic and rheophytic aroids.


Discussion — When not in flower, plants of Aridarum kazuyae and A. orientale are almost indistinguishable. Both are also reminiscent of A. burttii Bogner & Nicolson, although this is a smaller-growing species with much darker green leaf blades. Flowering plants of all three (Fig. 3A, B, D) are readily separated by the different morphology of the stamen connective and thecae horns. Vegetatively very different, A. minimum is the only other Aridarum so far known to possess a naked interstice between the pistillate and staminate flower zones. However, the spadix of A. minimum differs in many other ways (Fig. 3C).

The lower persistent spathe of Aridarum kazuyae is unusually wide and shallow for the genus, and also somewhat oblique owing to the peduncle insertion. It differs markedly to that of A. orientale (compare Fig. 1E and 2G).

Aridarum orientale S. Y. Wong, P. C. Boyce & S. L. Low, sp. nov.

Holotype: Indonesian Borneo, Kalimantan Timur, Kabupaten Tana Tidung, Kecamatan Sesayap, Kampung
Fig. 1. *Aridarum kazuyae* – A: plant in habitat; B: shale waterfall and overhang, the green expanse at the middle and bottom of the photograph is an extensive pure stand of *A. kazuyae*; C: inflorescence at early pistillate anthesis; D: inflorescence at onset of staminate anthesis, note that the spathe limb has deliquesce from the junction of the lower, persistent spathe; E: inflorescence during staminate anthesis, with the ragged liquefying portions of the spathe limb still adhering to the lower spathe; F: spadix (spathe artificially removed) at early staminate anthesis. – Photographs A–B from K. Nakamoto AR-3910 by K. Nakamoto; C–F from K. Nakamoto AR-3927 by P. C. Boyce.
Rian, Air Terjun Gunung Rian, 45 km SE of main road to Tanjung Selor, 3°29′60″N, 116°50′60″E, 19.4.2011, Kazuya Nakamoto AR-3539 (BO!)

Aridarum orientale is readily distinguished from all other species of the Burttii Complex by the combination of a conspicuous zone of large staminodes below the pistillate flowers, a convex, raised stamen connective with a smooth or slightly sulcate rim, conspicuously globose (not flattened) stamen thecae and the longer, high-arched stiff thecae horns.

Medium-sized obligate rheophyte 10–35 cm tall. Stem somewhat condensed, suberect, later to c. 10 cm long, 1.5 cm in diameter. Leaves up to 15 together, petioles erect with blades arching; petiole 4–17 cm long, 1.5–3 mm in diameter, very weakly D-shaped in cross section, weakly channelled dorsally, with the edges rounded, sheathing at the extreme base, medium green; petiolar sheath with wings extended into a narrowly triangular ligular portion 3–6 cm long, this ligule soon deliquescent; blade coriaceous, elliptic, 6–16 cm long × 2–5 cm wide, base cuneate, apex acute, shortly acuminate and apiculate for 8–10 mm, adaxially semiglossy dark green, paler abaxially; midrib abaxially and adaxially prominent; primary lateral veins 4–5 on each side, diverging at c. 30° from the midrib, adaxially prominent; interprimary veins very few, much less prominent than primaries and not visibly reaching the midrib or blade margins; secondary venation obscure; tertiary venation adaxially obscure, abaxially forming a slightly darker irregular reticulum. Inflorescence solitary, subtended by a 6–9 cm long very narrowly triangular membranous cataphyll. Peduncle mostly shorter than the petioles (exceptionally, longer in environmentally dwarfed individuals), 9–15 cm long, terete, medium green. Spathe broadly ovate, not constricted, 4.5–6 cm long, lower part green and ultimately persistent at fruiting, the remainder white, gaping and caducous by acroscopic deliquesence from the junction of the spathe limb with the lower, persistent portion during anthesis, spathe apiculate for up to 1 cm, apicule distally green. Spadix subcylindric (1.5–)2–3 cm long, c. 0.6 cm in diameter; pistillate flower zone comprising c. 1/3 of the spadix, obliquely inserted on peduncle and subtended by a zone of large, weakly rhomboidal, white staminodes, ventral side of pistillate zone 8–10.9 mm long, dorsal side 3.8–5.6 mm long; pistils subglobose, truncate, c. 2 mm diameter, green; stigma subsessile, discoïd, papillose, slightly wider than the ovary, white; inter pistillar staminodes absent; sterile interstice composed of 2 or 3 clavate-rounded sterile anthers, white; staminate flower zone accounting for slightly less than 1/2 of the entire spadix length, 6–9.6 mm long × 4.5–6.8 mm wide; staminate flowers comprised of a single stamen, stamens more or less circular in plan view, with a deep suture between the thecae, comparatively large, c. 2.5 × 2 mm, connective centrally impressed with the margins forming a convex, raised, rounded rim, this smooth, occasionally slightly ridged, the whole somewhat kidney bowl-shaped; thecae globose, c. 1 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, stout; appendix c. 1/3 of the entire spadix, 4–6.6 mm long, bluntly tapering; appendix staminodes comprised of 1–3 branched knobby sterile stamens, those at the base tending to be larger (up to 2 mm long), white. Fruting spathe broadly obconic, c. 1 cm in diameter, and tall, subtending a ± globose cluster of berries, medium green with a conspicuous pale brown scar from the spathe limb abscission; berries globose, c. 3 mm in diameter, crowned with old stigma remnants, many-seeded; seeds c. 2 mm long, 0.6–0.7 mm in diameter, narrowly ellipsoid, dark brown, slightly longitudinally ribbed, with a long curved translucent micropylar appendage 1.2–1.5 mm long, the appendages intertwined in the upper part of the berry. – Fig. 2.

Ecology — The species grows on shale river boulders and in waterfalls under lowland perhumid forest, at about 50 m altitude.

Distribution — Aridarum orientale is known only from the type locality on Gunung Rian, Kalimantan Timur.

Etymology — The epithet of this Aridarum species refers to its distribution in eastern Borneo (orientalis, Latin for “eastern”).

Additional specimen seen — INDONESIA: BORNEO: Kalimantan Timur, Kabupaten Tanjung, Kecamatan Sesayap, Kampung Rian, Air Terjun Gunung Rian, 45 km SE of main road to Tanjung Selor, 3°29′60″N, 116°50′60″E, 28.4.2012, K. Nakamoto AR-3912 (SAR).

Discussion — When not flowering, Aridarum orientale and A. kazuyae are indistinguishable; in flower, however, A. orientale is readily differentiated by lacking a naked interstice and by the convex, smooth or smooth-rimmed (not concave, serrate-dentate) stamen connective. Vegetatively, A. orientale is also closely similar to A. burttii, but this latter species differs also by the concave stamen connective with serrate-dentate distal rim, furthermore by the presence of globose staminodes at the base of the staminate flower zone (not absent or closely resembling staminate flowers) and by rather soft, short and straight (not long, stiff, arching) thecae horns. The ratio of the spadix zones to spadix length differs in all three species.

Key to the species of Aridarum

1. Staminiate flowers comprised of one stamen; thecae on the proximal side of the flower (with respect to spadix axis) ............................................. 2
Fig. 2. *Aridarium orientale* – A: plant in habitat; B: inflorescence at pistillate anthesis; C: spadix at early pistillate anthesis, spathe artificially removed; D–E: alcohol preserved spadices to show typical variation of plants from one population; F: inflorescence at late staminate anthesis, with the lower spathe persisting after the spathe limb has been shed; note the damage to the appendix resulting from chrysomelid beetle predation during pollination; G: infructescence at mid-maturity; the scar along the rim of the persistent lower spathe results from the spathe limb being shed during anthesis. – Photographs A, D–G from K. Nakamoto AR-3539; B–C from K. Nakamoto AR-3912; A, F–G by K. Nakamoto; B–E by P. C. by Boyce.
Staminate flowers comprised of two stamens; thecae on the ends or the inner face of each anther of the stamen pair ........................................... 6

2. Connective not expanded, horseshoe-shaped; staminodes of interstice horseshoe-shaped, expanding laterally post pistillate anthesis; stamens and staminodes coarsely verruculate; spathe limb caducous, falling by lesion from the lower, persistent spathe; primary lateral veins not conspicuously raised ................................. A. rostratum Bogner & A. Hay

– 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; stamens and staminodes smooth or verrucate; spathe limb deliquescing acroscopically from the junction with the lower persistent part; leaf blades with the primary lateral veins conspicuously raised adaxially ........................................ 3

3. Pistillate and staminate flower zones separated by a naked interstice equalling the staminate flower zone in length; staminodes few, cylindric-clavate, at base of staminate flower zone; stamens and appendix staminodes verrucate ...... A. kazuyae S. Y. Wong & al.

– 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 .................................................. 4

4. Leaf blades linear-lanceolate, adaxially with strong marginal veins; pistillate flower zone with a few vermiciform staminodes at the base. Kalimantan Barat ............................................. A. minimum H. Okada

– Leaf blades not linear-lanceolate; pistillate flower zone with none or prismatic staminodes at the base .................................................. 5

5. 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. Kalimantan Timur ......................... A. orientale S. Y. Wong & al.

– Stamen connective concave, distal rim serrate-dentate; staminodes at base of staminate flower zone globose; thecae horns rather soft, short, straight. C. Sarawak (Kapit) ............... A. burttii Bogner & Nicolson

6. Thecae on each end of each anther ....................... 7

– Thecae on the inner face of each member of the stamen pair ........................................ 11

7. Leaf blades linear; horns of thecae very long and thin,
with the tips overlapping; stamen connective um-bonate. Sarawak (Sri Aman) ... A. montanum Ridl.
– Leaf blades narrowly elliptic to elliptic; horns of an-
ther thecae short and stubby; stamen connective excava-
ted or rarely flat ................................. 8
8. Leaf arrangement strictly distichous. Sarawak (vicin-
ity of Matang) .................................... 10
9. Stamen connective not excavated; horns of the-
cae short but robust, their bases occupying the
whole upper surface of the anther. West Kalimantan
..... A. incavatum H. Okada & Y. Mori
– Stamen connective excavated; horns of the thecae
small, on the narrow ends of the anther. Sarawak and
West Kalimantan .................................. 10
10. 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. Sarawak
(Gunung Gaharu & Batu Balau (‘Bukit Lingga’) ......... A. crassum S. Y. Wong & P. C. Boyce
– Leaf blade rubbery-coriaceous, matte medium green
adaxially when fresh; stigma as wide as ovary; thecae
horns long, pointed at the end. Sarawak (Bako & San-
tubong) ............................................. A. nicolsonii Bogner
11. Horns of thecae shorter than width of stamen.
Sarawak and Brunei ...... A. caulescens M. Hotta
– Horns of thecae longer than width of stamen. Sarawak
..... A. purseglovei (Furtado) M. Hotta

The Aridarum Burttii Complex

Recognition of the two novel species above brings into
focus the existence of a distinct species group within
Aridarum defined by unistaminate flowers with distally
positioned thecae and a proximally expanded connective,
spathes senescing by acroscopic deliquescence from the
junction of the lower persistent portion and the limb, a
well-developed spadix appendix, and leaf blades adaxi-
ally with the tips overlapping; stamen connective um-
bonate. Sarawak (Sri Aman) ... A. montanum Ridl.

Pollination

The pollinators of Aridarum species have yet to be con-
formed, although observations have shown A. nicolsonii to
be visited by Colocasiomyia flies (Gibernau & al. 2010).
In addition to observing flies, the authors have seen nu-
erious instances of beetles of families Chrysomelidae
and Nitidulidae as visitors to Aridarum inflorescences.
Josef Bogner reports seeing Nitidulidae beetles visiting
A. nicolsonii and notes that these beetles are known to
feed on pollen (Bogner, pers. comm.). The authors have
often observed chrysomelid beetles chewing the stami-
nate flowers of several Aridarum species, producing in
the type of damage shown in Fig. 2F.

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References

Bogner J. & Hay A. 2000: Schismatoglottideae in
Malesia II – Aridarum, Bucephalandra, Phymatarum
Gibernau M., Chartier M. & Barabé D. 2010: Recent
advances towards an evolutionary comprehension of
Araceae pollination. – Pp. 101–114 in: Seberg O.,
Petersen G., Barfod A. S. & Davis J. I. (ed.). Diver-
sity, phylogeny & evolution in the monocotyledons. –
Denmark: Aarhus University.

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