Studies on Schismatoglottideae (Araceae) of Borneo XXXXVII –*Aridarum ashtonii*, a new species from the Hose Mountains, and notes on *Aridarum burttii*

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ABSTRACT

Aridarum ashtonii is described as a new species from highland sandstones of the Hose Mountains, Kapit, Sarawak, Malaysian Borneo. *Aridarum ashtonii* has previously been confounded by the authors with *Aridarum burttii*, a species occurring on lowland riverine shales. Notes on *Aridarum burttii* are given and the purported origins of the Type specimen questioned. *Aridarum ashtonii* and *A. burttii* are illustrated from living plants, and a key to the five species of the *Aridarum* Burttii Complex is provided. Recognition of *A. ashtonii* takes *Aridarum* to 26 accepted, described species.

KEY WORDS

Shale, sandstone, *kerangas*

INTRODUCTION

During description of two new species of the *Aridarum* Burttii Complex (Wong et al.,

2012) a spadix was figured as *Aridarum burttii* Bogner & Nicolson (Wong et al., 2012: 266, **Figure 3)** determined on the basis that the plant originated from the Hose Mountains of Sarawak, from where the Type of *Aridarum burttii* was purported to have been collected (Bogner, 1979). At the time we harboured doubts privately as to the veracity of this determination, but with no better material to hand took a pragmatic approach.

Recently we had occasion to explore the Ulu (headwaters) of the Sungai (river) Engkari (Sarawak: Sri Aman, Lubok Antu), from where *Aridarum burttii* has also been collected (see Bogner & Hay, 2000: 189) and were fortunate to encounter significant populations of *Aridarum burttii* at every stage of flowering and thus were able to make extensive observations. It was soon apparent that the Sungai Engkari plants match very closely the Type of *Aridarum burtti* [*B. L. Burtt & A. M. Martin B 5116*], and likewise differ considerably from the plant [*AR-3726*] figured as *A. burttii* in Wong et al., 2012. On return to Kuching re-examination of living and liquid preserved collections of *AR-3726* established that not only were they not pertinent to *Aridarum burtii* neither did they match any described species of *Aridarum*. A search of SAR and of our photographic records of Herbarium material located specimens [*P. S. Ashton* S21256] matching our living plants from the Hose Mountains and we determined this to represent the same species.

We are describing this here as a new species of the *Aridarum* Burttii Complex – *Aridarum ashtonii* S. Y. Wong & P. C. Boyce.

KEY TO THE SPECIES OF THE *ARIDARUM* BURTTII COMPLEX

1. Pistillate flowers confined to two rows ± embedded in the spadix; inflorescence erect at anthesis 2

– Pistillate flowers in several rows not embedded in the spadix; inflorescence nodding at anthesis 3

2. Plants with rhizome creeping and rooting; leaf blades linear-lanceolate with prominently raised marginal veins; pistillate flower zone with a few vermiform staminodes at base. Lowlands, Kalimantan Barat . . . . ***A. minimum***

– Leaf blades broadly elliptic, primary lateral veins prominently raised on both surfaces of blade; erect; pistillate flower zone with a few squat rhomboidal staminodes at the base. Higlands, Kapit, Sarawak . . . . . ***A. ashtonii***

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***

– Pistillate and staminate flower zones not separated by a naked interstice; staminodes at base of staminate zone absent or globose; stamens and appendix staminodes smooth .. 4

4. 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***

– 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***

Aridarum ashtonii S. Y. Wong & P. C. Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Kapit Division, Hose Mts, Mujong, Ulu [Sungai] Amau, Bukit Lumut, 900m asl, 18 Apr. 1964, *P. S. Ashton S21256* (holotype SING!; isotypes K!, L!, SAR!). **Figures 1 & 2.**

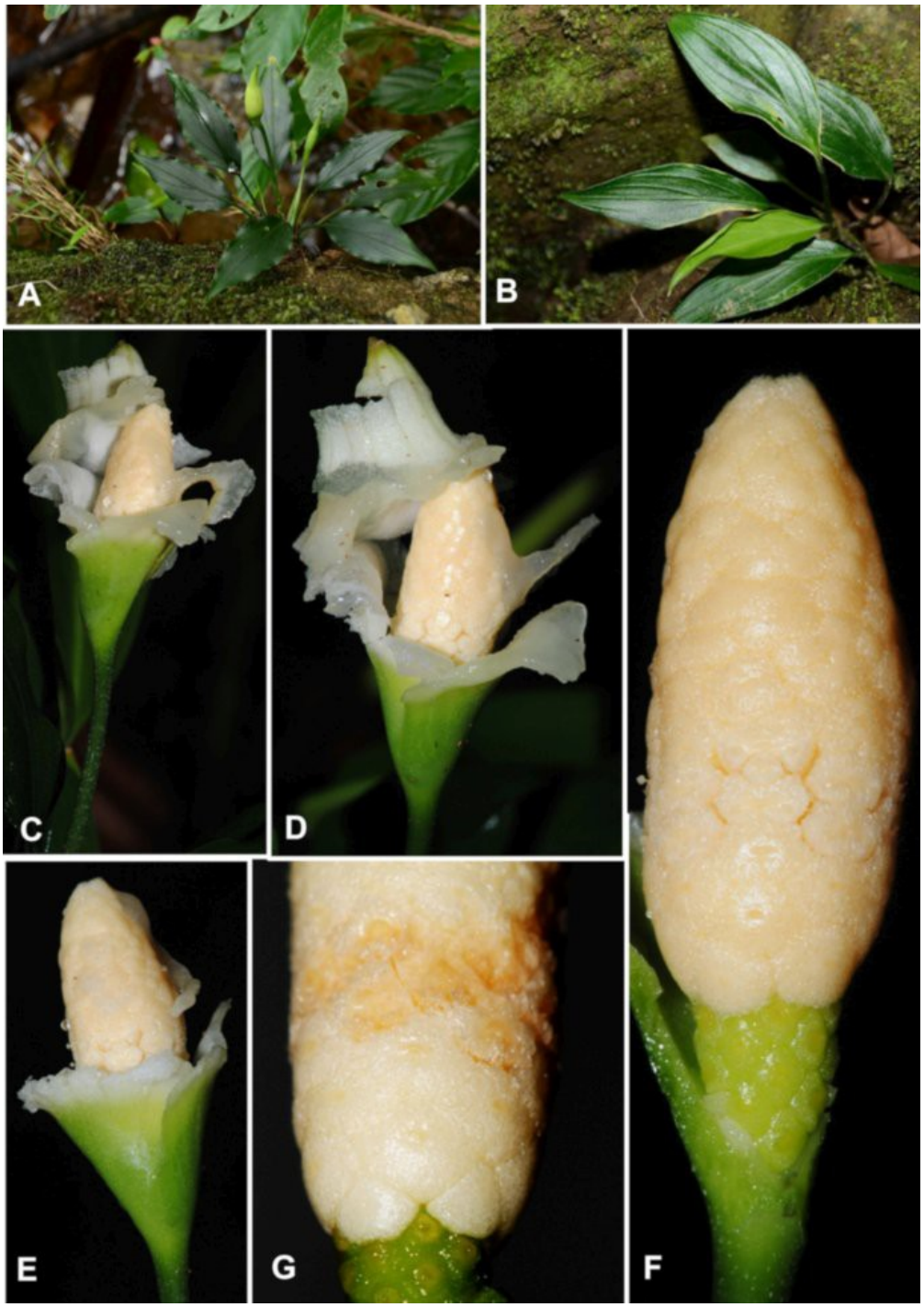

Figure 1. ***Aridarum ashtonii*** P. C. Boyce & S. Y. Wong. **A.** Flowering plant in habitat. **B.** Leaf blades showing the distinctive raised primary lateral veins. **C & D.** Inflorescence at staminate anthesis. **E.** Inflorescence at end of staminate anthesis. **F.** Spadix at staminate anthesis, spathe artificially removed. **G.** Detail of staminate flower zone (the darker median band) at staminate anthesis, spathe limb artificially removed. **A–E** from *AR-3726*. Images A & B © Mike Lo. Used with permission. Images C–G © P. C. Boyce.

Figure 2. ***Aridarum ashtonii*** P. C. Boyce & S. Y. Wong
Holotype specimen. *P. S. Ashton S21256* [SING].

Diagnosis

Aridarum ashtonii is readily distinguished from all other species of the *Aridarum* Burttii Complex by the combination of broad leaf blades, an erect inflorescence, staminate flowers reduced to two rows and embedded into the surface of the spadix, by the large, smooth appendix staminodes. By the much-reduced staminate flower zone and inflorescence erect at anthesis *Aridarum ashtonii* approaches *A. minimum*, although readily differentiated by the broadly elliptic (vs very narrow) leaf blades without primary lateral veins reduced to a single prominent marginal vein on each side, and the tufted (not creeping rhizomatous) habit. *Aridarum ashtonii* is a highland plant recorded from 900–1300m asl.

Small to medium-sized obligate rheophyte 10–20 cm tall. **Stem** somewhat condensed, sub-erect, later to ca 5 cm long, ca 1.5 cm in diam. **Leaves** up to 10 together, petioles erect with blades erect to slightly arching; **petiole** 6–17 cm long, 2–3 mm in diam., 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** rather stiffly coriaceous, elliptic, 4–11 cm long × 2–5.5 cm wide, base cuneate, apex acute, shortly acuminate and apiculate for ca 12 mm, adaxially semi-glossy medium green, paler abaxially; **midrib** abaxially and adaxially prominent; **primary lateral veins** 3–5 on each side, diverging from the midrib at ca 30°, adaxially prominent, abaxially less so; **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 4–6 cm long, very narrowly triangular somewhat membranous cataphyll. **Peduncle** shorter than the petioles, 5–9 cm long, terete, medium green, inserted dorsal-obliquely on the spathe. **Spathe** broadly ovate, not constricted, ca 3 cm long; **lower part** salverform at anthesis, green, ultimately persistent through fruiting, **limb** glistening white, ca 2.5 cm long, apiculate for up to 5 mm, apicule distally green; limb gaping at pistillate anthesis, during staminate anthesis splitting into semi-concentric rings from the junction of the spathe limb and the persistent lower part, limb eventually falling to leave lower persistent part with a wide ragged margin of degrading tissue, this tissue then liquefying and leaving salverform persistent lower spathe with a scarred irregular rim. **Spadix** stoutly cylindric-fusiform ca 2 cm long, ca 5 mm in diam.; **pistillate flower zone** comprising ca 1/6 of the spadix, obliquely inserted on peduncle, ventral side ca 2 mm long, dorsal side ca 3 mm long, with a few squat clavate white staminodes at the base; **pistils** subglobose, somewhat rhomboidal by compression, truncate, ca 1 mm in diameter, green; **stigma** sub-sessile, discoid, papillose, ca 2/3 the width of the ovary, greyish; **interpistillar staminodes** absent; **sterile**

interstice markedly wider than pistillate zone, ca 3 mm long; **interstice staminodes** large, rhomboidal, surface somewhat curved, ca 2 mm × 2 mm, waxy creamy white; **staminate flower zone** comprised of two whorls of flowers embedded into spadix, ca 1/6 of total spadix length, ca 2 mm long, medium dull yellow; **staminate flowers** each comprised of a single stamen, ± circular in plan view, with a suture between the thecae, comparatively large, ca 2.5 × 2.5 mm, connective smooth, centrally slightly impressed with the distal (with respect to spadix axis) margins forming narrow rim; **thecae** globose, each ca 1 mm long, displaced to the proximal (with respect to the spadix axis) side of the stamen with distal-pointing horns; **thecae horns** ca 0.3 mm long, stiff, directed upwards; **appendix** ca 1 cm long, comprising ca 2/3 of the entire spadix, bluntly tapering; **appendix staminodes** comprised of very densely-packed rhomboidal and partially coherent smooth staminodes, cream. **Fruiting spathe** very broadly salverform, ca 1 cm diameter, and 1 cm tall, pale to medium green with a ragged scar along the rim; **fruits and seeds** not seen.

Ecology — *Aridarum ashtonii* occurs on exposed sandstone river boulders and the margins of waterfalls, or on mossy boulders, under moist to perhumid lower montane heath forest (*kerangas*) on Oligocene sandstones between 900 and 1300 m asl.

Distribution —*Aridarum ashtonii* is known with certainty only from the Type locality on the NW flanks of the Hose Mountains of Central Sarwak, and from Gunung Gelanggang at the SE extremity of the same range.

Eponymy — Named for Peter Shaw Ashton, a pioneer of understanding the dynamics of the tropical wet forests of SE Asia. Ashton's work in tropical botany began after taking his B.A. at Cambridge University in 1956 by being appointed Forest Botanist to the Brunei Government (1957–1962) during which time he completed his MA (Cantab) and PhD (Cantab). Between 1962–1966 Ashton was Forest Botanist to the Sarawak Government, before moving to Aberdeen University (1966–1978), and then to The Arnold Arboretum of Harvard University, where he was director 1978–1987, and remains to this day, now as Charles Bullard Professor of Forestry, emeritus Harvard University. Author of numerous publications on the dynamics of tropical forests, Peter Ashton is universally acclaimed for his work, notably on the dipterocarps.

Additional specimens seen — MALAYSIA: BORNEO: Sarawak, Kapit, Nanga Merit, Hose Mountains, Gunung Gelanggang, 02°06'0.00"N 113°49'0.00"E, 1300m, *Mike Lo AR-3726* (SAR); Kapit, Bukit Sampadai, Sungai Sampurau, Melinau, 14 Aug 1967, *I. Paie S. 25803* (K!, SAR!, US).

Notes — Within Sarawak, *Aridarum ashtonii* is in overall appearance most reminiscent of lowland *Aridarum burttii*, notably by the

leathery elliptic leaf blades with their prominently raised primary lateral veins. *Aridarum ashtonii* is readily distinguished from *A. burttii* by the much reduced staminate flower zone in which the flowers are embedded in the spadix, and by the large appendix clothed with smooth rhomboidal staminodes (vs appendix reduced and clothed with verruculate staminodes, often with the distal-most part naked).

The spadix of *A. ashtonii* is most similar to that of *A. minimum* (**Figure 3)**, but these species may be differentiated as noted in the above Key and Diagnosis.

NOTES ON *ARIDARUM BURTTII*

As here defined *Aridarum burttii* (**Figures 4 & 5**) is a lowland species (extending to ca 400 m asl) restricted to riverine shales under lowland to hill mixed dipterocarp forest dominated by *Shorea oblongifolia*. *Aridarum burttii* is abundant along the Ulu Engkari, but absent from its junction with the Batang Ai reservoir, and for the first few kilometres of this river.

For *Aridarum* species with reliable (which is to say field-based) observational data it is evident that all are localized in their distribution. This being the situation, the circumscription of *A. burttii* adopted here raises the distinct probability that the locality stated on the Type of *A. burttii* is in error. If *A. burttii* were indeed collected from the Hose Mountains it must have originated from well above our current confirmed upper altitudinal range recorded for the species, because all immediately surrounding areas of the Hose Mountains are between 600 and 1300 m asl, with many peaks of the actual range over 1800 m asl, and with the highest point (Bukit Batu) reaching 2028 m asl.

The protologue of *Aridarum burttii* cites *Burtt & Martin 5116* (US) as the Holotype, although a search of the on-line database for US (www.http://collections.nmnh.si.edu/search/botany/) failed to bring up the specimen, although Alice Tangerini's line work (Bogner & Nicolson 1991: 42, **Figure 1)** is present. Type material of *A. burttii* was prepared entirely from living material of *B. L. Burtt & A. M. Martin B5116* cultivated at Royal Botanic Garden Edinburgh. Mark Newman (E) has been unable to locate a field-collected specimen of *Burtt & Martin B5116* in E and (pers. comm.) stated that he "strongly suspect[ed] that *Burtt* [*& Martin*] *B5116* was a seed or rhizome sample which was accessed into the living collection of RBGE as number 19672479 (*fide* label on the E isotype – but see below) which flowered in 1968, at which time a herbarium specimen was made in the cultivated plant number series. The handwriting on the main label of the Edinburgh Isotype 'C5936' is Rosemary Smith's and it is very likely that she was also the collector." Assuming that the information on the E Isotype is correct, this implies that the material at US (if such exists) is also a cultivated collection, grown at E, raised from a seed or rhizome

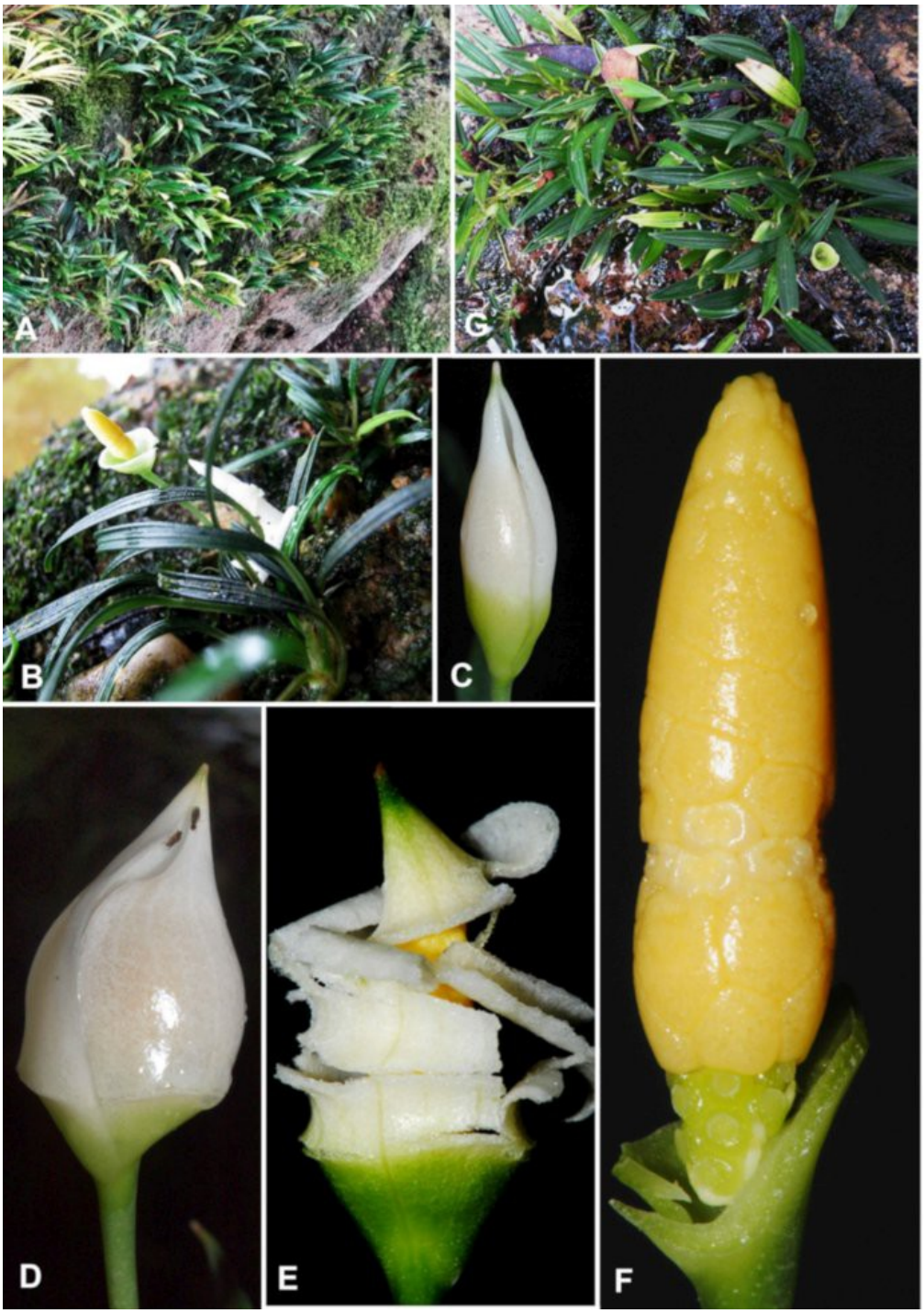

Figure 3. ***Aridarum minimum*** H. Okada
A. Plants in habitat. **B.** Flowering plant in habitat. **C.** Inflorescence at onset of pistillate anthesis. **D.** Inflorescence at late pistillate anthesis. **E.** Inflorescence at end of staminate anthesis. **F.** Spadix, not reduced staminate flower zone (the narrower band ca 1/3 up the spadix) median band) at pistillate anthesis, spathe limb artificially removed. **A–F** from *AR-3847*. Images A & B, G © K. Nakamoto. Used with permission. Images C–F © P. C. Boyce.

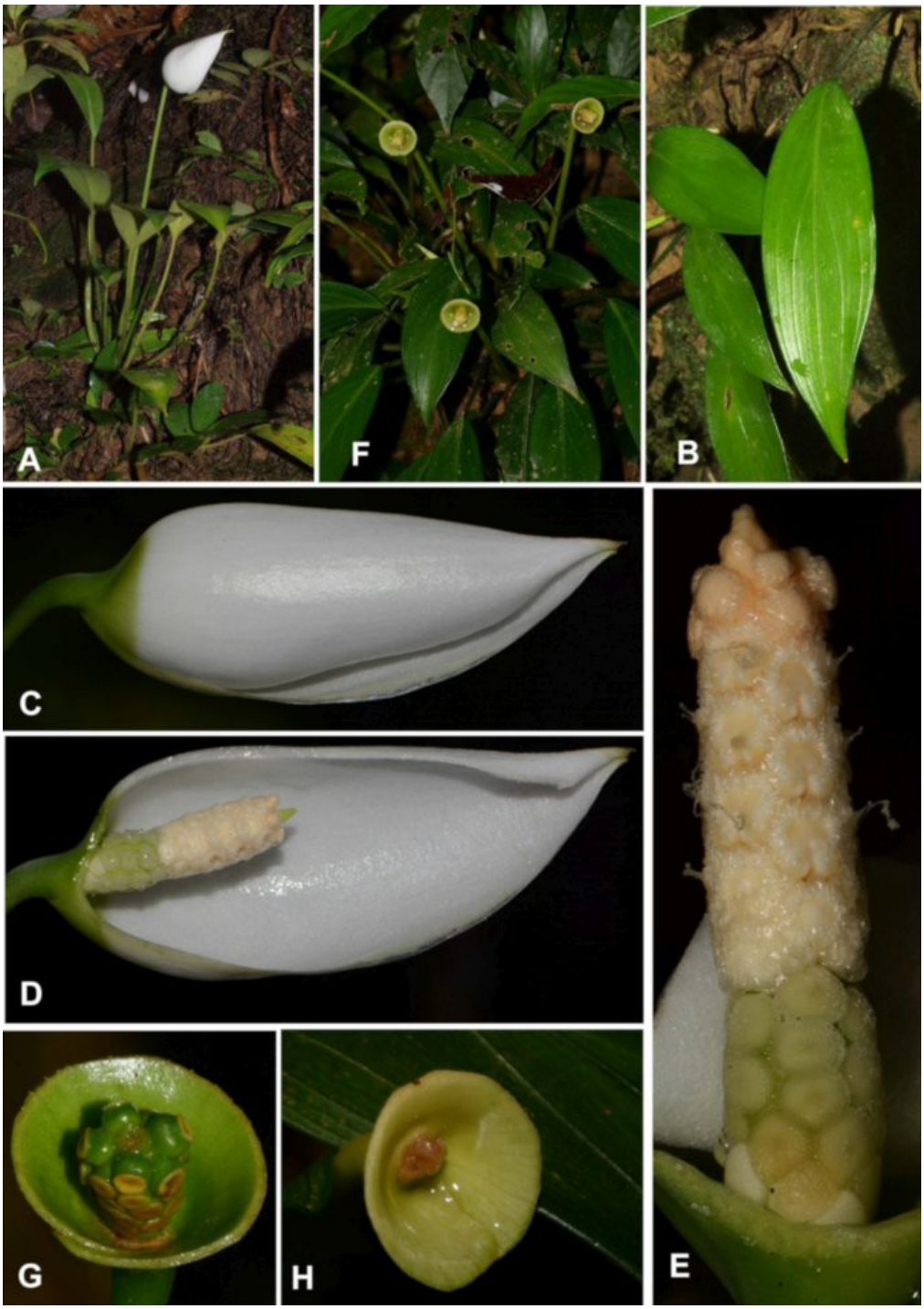

Figure 4. ***Aridarum burttii*** Bogner & Nicolson
A. Flowering plant in habitat. **B.** Leaf blade showing the distinctive raised primary lateral veins. **C.** Inflorescence at pistillate anthesis. The spathe gaping is typical. **D.** Spadix at pistillate anthesis, nearside spathe artificially removed. **E.** Spadix at staminate anthesis, spathe limb artificially removed. Note the pollen strings. **F.** Fruiting plant in habitat. **G.** Sub-mature infructescence with associated splash-cup. **H.** Post-dispersal infructescence with splash-cup beginning to decay. **A–H** from *AR-5116*. Images © P. C. Boyce.

Figure 5. ***Aridarum burttii*** Bogner & Nicolson. Isotype specimen. *B. L. Burtt & A. M. Martin B 5116* [E]. The living collection accession number 67 2479 is wrong. It should be 67 2068.

collection with field number *Burtt & Martin 5116*.

Rob Cubey, Plant Records Officer at Edinburgh Botanic Garden, kindly checked the garden's accession book for 1967. It turns out that the *Burtt & Martin* B5116 field number correlated to 19672068, not against accession 19672479, is not as stated on the E Isotype. Mark Newman concludes "B5116 came in as a plant (probably rhizome) and was accessed as 19672068 (not 19672479). The accession number on the isotype at E is wrong. As I thought, there is no indication that Burtt B5116 was ever a herbarium specimen. Despite this mislabelling (of the E Isotype) "I don't think this alters the fact that *B5116* was never a herbarium specimen, unless it is at US which is unlikely; Bill Burtt would usually have deposited his top set at E.

In conclusion we speculate that the living plants from which the Type of *Aridarum burttii* were prepared were wrongly numbered, and did not originate from the Hose Mountains.

Bogner & Hay (2000) list four specimens determined to *A. burttii* but not belonging to that taxon. These are:

P. S. Ashton S. 21256 (= *A. ashtonii* S. Y. Wong & P. C. Boyce, **sp. nov.**);

I. Paie S. 25803 (= *A. ashtonii* S. Y. Wong & P. C. Boyce, **sp. nov.**);

J. S. Burley et al. 441B (= *Aridarum minimum* H. Okada);

C. Ridsdale PBU267 (= an undescribed species);

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