

Studies on Schismatoglottideae (Araceae) of Borneo LIV - A summary of the species of the *Schismatoglottis* Multiflora Group

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ABSTRACT

A taxonomic synopsis, and identification key to species, of the *Schismatoglottis* Multiflora Group is provided. *Schismatoglottis bulbifera* H. Okada, H. Tsukaya & Y. Mori is resurrected from *S. multiflora* Ridl., to which it was relegated, taking the Multiflora Group to 18 species. All species are illustrated from living plants.

KEY WORDS

Rheophytes, shale, sandstone, Malaysia, Indonesia, Sarawak, Kalimantan.

INTRODUCTION

The *Schismatoglottis* Multiflora Group (Hay & Yuzammi 2000; Wong 2010; Wong &

Boyce 2014b) is a wholly Bornean morphotaxon currently comprising 18 species, 10 of which have been described since 2000. All Multiflora Group species have the petiolar sheath attached only at the base with the rest forming a free ligule. In most the ligular portion of the sheath is marcescent, and eventually lost, although *Schismatoglottis erecta* M.Hotta, *S. schottii* Bogner & Nicolson, *S. monoplacenta* M.Hotta, and *S. persistens* S.Y.Wong & P.C.Boyce have the ligular portion long-persistent. Ecology varies from obligate rheophytes (*Schismatoglottis bulbifera* H.Okada, H.Tsukaya & Y.Mori, *S. cyria* P.C.Boyce, *S. hayana* Bogner & P.C.Boyce, *S. iliata* S.Y.Wong & P.C.Boyce, *S. multiflora* Ridl., *S. persistens* and *S. roseospatha* Bogner), to lithophytes on sandstone (*S. maelii* P.C.Boyce & S.Y.Wong, *S. mayoana* Bogner

& M.Hotta and *S. nicolsonii* A.Hay), shales (*S. clausula* S.Y.Wong), or forested limestone (*S. bauensis* A.Hay & Chi.C.Lee, *S. confinis* S.Y.Wong & P.C.Boyce, *S. dulosa* S.Y.Wong and *S. monoplacenta*), to terrestrial mesophytes in gallery forest (*S. erecta*, *S. jitinia* S.Y.Wong and *S. schottii*).

Molecular analyses (Low et al., in prep.) failed to recover the complete Multiflora Group as a monophyletic unit, though various species assigned to it resolved as clades, notably the *Schismatoglottis mayoana* Complex (Wong & Boyce 2014b). Nevertheless, the Multiflora Group retains utility for field and herbarium studies owing to the distinctive free ligule of the petiolar sheath. Additionally, Multiflora Group species fall into two groups based on the presence or absence of a spadix appendix.

KEY TO THE SPECIES OF THE *SCHISMATOGLOTTIS* MULTIFLORA GROUP

- 1a. Spadix with a terminal sterile appendix 2
- 1b. Spadix fertile to the tip 11
- 2a. Leaf blades with upper surface conspicuously corrugated, bright glossy green *Schismatoglottis maelii* P.C.Boyce & S.Y.Wong
- 2b. Leaf blades with upper surface not corrugated, dull dark to matte olive green 3
- 3a. Ligular portion of petiolar sheath long-persistent 4
- 3b. Ligular portion of petiolar sheath marcescent 5
- 4a. Stem erect, leaf blades pendulous from the tip of the petiole, petiole 20–30 cm long, ligular portion of petiolar sheath to 13 cm long; leaf blade elliptic to oblong elliptic, ca. 30 cm long × 13 cm wide. Vertical karst limestone cliffs. Mulu *Schismatoglottis monoplacenta* M.Hotta
- 4b. Stem creeping, leaf blades erect from the tip of the petiole, petiole 8–12 cm, ligular portion of petiolar sheath ca. 5 cm long; leaf blade broadly oblanceolate to narrowly elliptic, 12–23 cm long × 3–7 cm wide. Rheophyte on clay-loam river banks. Batang Ai *Schismatoglottis persistens* S.Y.Wong & P.C.Boyce
- 5a. Spathe limb marcescent, clasping spadix. Sarawak [Bau]. Limestone *Schismatoglottis dulosa* S.Y.Wong
- 5b. Spathe limb caducous 6
- 6a. Spathe limb shedding in a single piece 7
- 6b. Spathe limb disarticulating into circumferential rings along its length, then collapsing. Sarawak [Sarikei]. Shales *Schismatoglottis clausula* S.Y.Wong

- 7a. Terrestrial herbs with ascending stems; leaf blades more-or-less erect; inflorescences erect on a short peduncle (peduncle obscured by subtending cataphylls); lower spathe walls thick (ca. 3 mm), fleshy-spongy ***Schismatoglottis jitiniae*** S.Y.Wong
- 7b. Rheophytes or lithophytes with creeping, rooting stems; leaf blades pendulous, inflorescences arching to pendulous on a long peduncle; lower spathe walls thin (ca. 1 mm), leathery 8
- 8a. Robust herb to 1.2 m tall; petiole ca. 1 m long; leaf blades to 44 cm long × 24 cm wide; thecae each with a single pore. Shales. Brunei (Temburong) ***Schismatoglottis cyria*** P.C.Boyce
- 8b. Slender herb to 30 cm tall; petiole ca. 13–26 cm long; leaf blades to 25 cm long × 15 cm wide; thecae each with two pores. Sandstones. Sarawak (Kuching) 9
- 9a. Spathe limb white; infructescence erect 10
- 9b. Spathe limb jade-green; infructescence pendulous. Sarawak (Sempadi) ***Schismatoglottis iliata*** S.Y.Wong & P.C.Boyce
- 10a. Spadix ca. 4.5 cm long. Sarawak (Bako & Santubong) ***Schismatoglottis nicolsonii*** A.Hay
- 10b. Spadix ca. 8 cm long. Sarawak (Matang)
. ***Schismatoglottis mayoana*** Bogner & M.Hotta
- 11a. Ligular portion of petiolar sheath long-persistent; stems erect 12
- 11b. Ligular portion of petiolar sheath marcescent; stems creeping and rooting 13
- 12a. Connective deeply 1-grooved from theca to theca; spathe limb exterior coppery-orange. C. Sarawak ***Schismatoglottis erecta*** M.Hotta
- 12b. Connective slightly raised between the thecae, not grooved; spathe limb exterior green. Kalimantan Tengah ***Schismatoglottis schottii*** Bogner & Nicolson

- 13a. Leaf blades abaxially producing bulbils & plantlets along the mid-rib.
 ***Schismatoglottis bulbifera*** H. Okada, H. Tsukaya & Y. Mori
- 13b. Leaf blades not producing bulbils 14
- 14a. Rheophytes 15
- 14b. Terrestrial or lithophytic; not associated with the flood zone of
 rivers 17
- 15a. Spathe distinctly inflated at anthesis 16
- 15b. Spathe unrolling slightly at anthesis but not distinctly inflated; Sarawak
 [Matang & Bau]. Sandstones ***Schismatoglottis multiflora*** Ridl.
- 16a. Spadix ca. 4.5 cm long; spathe pink; leaves abaxially very glossy. Sarawak
 [Rejang Valley]. Shales ***Schismatoglottis roseospatha*** Bogner
- 16b. Spadix ca. 6–7 cm long; spathe white; leaves abaxially slightly glossy.
 Sarawak, Sematan. Sandstones
 ***Schismatoglottis hayana*** Bogner & P.C.Boyce
- 17a. Leaf blades abaxially not glaucous, base obtuse to slightly
 decurrent, secondary and tertiary venation obscure; pore at edge of
 stamen, punctiform (ca. 0.15 mm) with protruding tissue from
 innermost surface, connective elevated, male zone remained white
 basally and stained brown distally in alcohol. Sarawak [Bau].
 Lithophytic on limestones
 ***Schismatoglottis bauensis*** A.Hay & Chi.C.Lee
- 17b. Leaf blades abaxially glaucous, leaf base always decurrent,
 secondary venation prominent, tertiary venation sometimes
 pronouncedly tessellate; pore at inner surface of stamen, oblong (ca.
 0.3 mm), connective flat, male zone completely stained brown in
 alcohol. Sarawak. [Padawan and Serian]. Terrestrial in deep soil on
 limestones and sandstones
 ***Schismatoglottis confinis*** S.Y.Wong & P.C.Boyce

MULTIFLORA GROUP – THE APPENDICULATE SPECIES

Schismatoglottis clausula S.Y.Wong, Gard. Bull. Singapore 61(2): 530[–532], **Figure 1** (2010). Type: Malaysia Borneo, Sarawak, Sarikei, Ulu Sarikei, 01°55'05.4"N; 111°29'35.8"E, 7 Dec 2005, *P.C.Boyce et al.* AR–1582 (holotype SAR!). **Figure 1.**

Notes — *Schismatoglottis clausula* is immediately distinguished by the spathe limb senescing by disarticulating into numerous circumferential rings, then collapsing downwards, and ultimately remaining marcescent post anthesis.

Schismatoglottis cyria P.C.Boyce, Kew Bull. 49: 796[–798], **Figure 2.** (1994); Hay & Yuzammi, *Telopea* 9: 85–87, **Figure 13** (2000). Type: Brunei, Temburong Dist., Kuala Belalong, Sg. Engkiang, above Kuala Belalong Field Station, 6 May 1991, *G.Argent & D.Mitchell 91203* (holotype E!; isotypes AAU!, BRUN!, K!, L!). **Figure 2.**

Notes — Placement of *S. cyria* in the Multiflora Group is somewhat provisional. The available herbarium material lacks a ligular extension to the adnate portion of the much-shortened petiolar sheath, which Boyce (1994) interpreted as the full extent of petiolar sheathing. Hay & Yuzammi (2000: 87), however, noted that “all along the distal rim of the sheath of the K isotype, there is a break in the tissue, suggesting that an extended [i.e., ligular] portion may be missing. . .”, and speculated

that the ligular portion of the sheath had been lost (i.e., ligule caducous or briefly marcescent). Meanwhile, species of *Schismatoglottis* have become known in which the petiolar sheath is undeniably much reduced and moreover lacks a ligular extension, with the sheath’s protective role taken homeotically by a subtending cataphyll (Boyce & Wong 2013; Wong & Boyce 2014a, 2016). Re-collection of *S. cyria* is needed to resolve placement.

Schismatoglottis dulosa S.Y.Wong, Gard. Bull. Singapore 61(2): 532[–535], **Figure 2** (2010). Type: Malaysian Borneo, Sarawak, Kuching, Bau, Kampung Jugan, 01°28'46.4"N; 110°05'08.5"E, 26 Mar 2004, *P.C. Boyce & Jeland ak Kisai AR–279* (holotype SAR!). **Figure 3.**

Notes — *Schismatoglottis dulosa* is overall generally reminiscent of *S. bulbifera* by the erect inflorescence and marcescent spathe limb, differing by the presence of a spadix appendix, and by leaf blades abaxially lacking adventitious bulbils along the mid-rib.

Schismatoglottis iliata S.Y.Wong & P.C.Boyce, *Willdenowia* 44: 6[–10], **Figure 1.** (2014). Type: Malaysian Borneo, Sarawak, Kuching, Lundu, Ulu Batang Kayang, 01°27'36"N, 109°53'35"E, 17 Jun 2012, *Jepom ak Tisai AR–3972* (holotype SAR!; isotypes SAR! [alcohol], BO! [alcohol]). **Figure 4.**

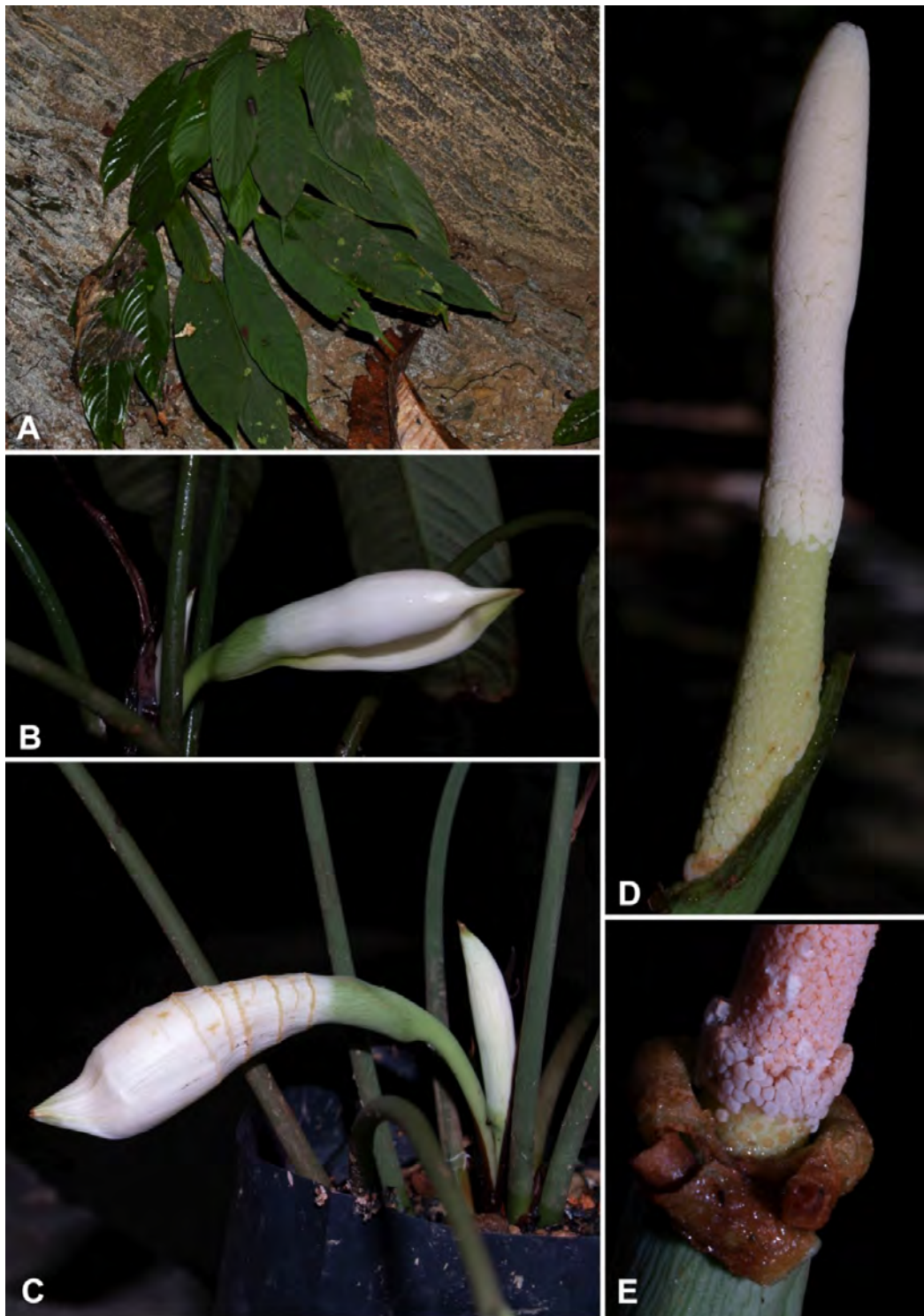


Figure 1. *Schismatoglottis clausula* S.Y.Wong. **A.** Plant in habitat on shale. **B.** Inflorescence at pistillate anthesis. **C** Inflorescence at staminate anthesis with spathe limb degrading into circumferential rings. **D.** Spadix at pistillate anthesis, spathe artificially removed. **E.** Detail of inflorescence at end of staminate anthesis – note the spathe limb remains at top of the persistent lower spathe, and expanded interstice staminodes. **A–G** from *P.C.Boyce et al. AR-1582*. Images © P.C. Boyce.



Figure 2. *Schismatoglottis cyria* P.C.Boyce. **A.** Collected Type plant in habitat, prior to pressing. Image © G. Argent, used with permission.

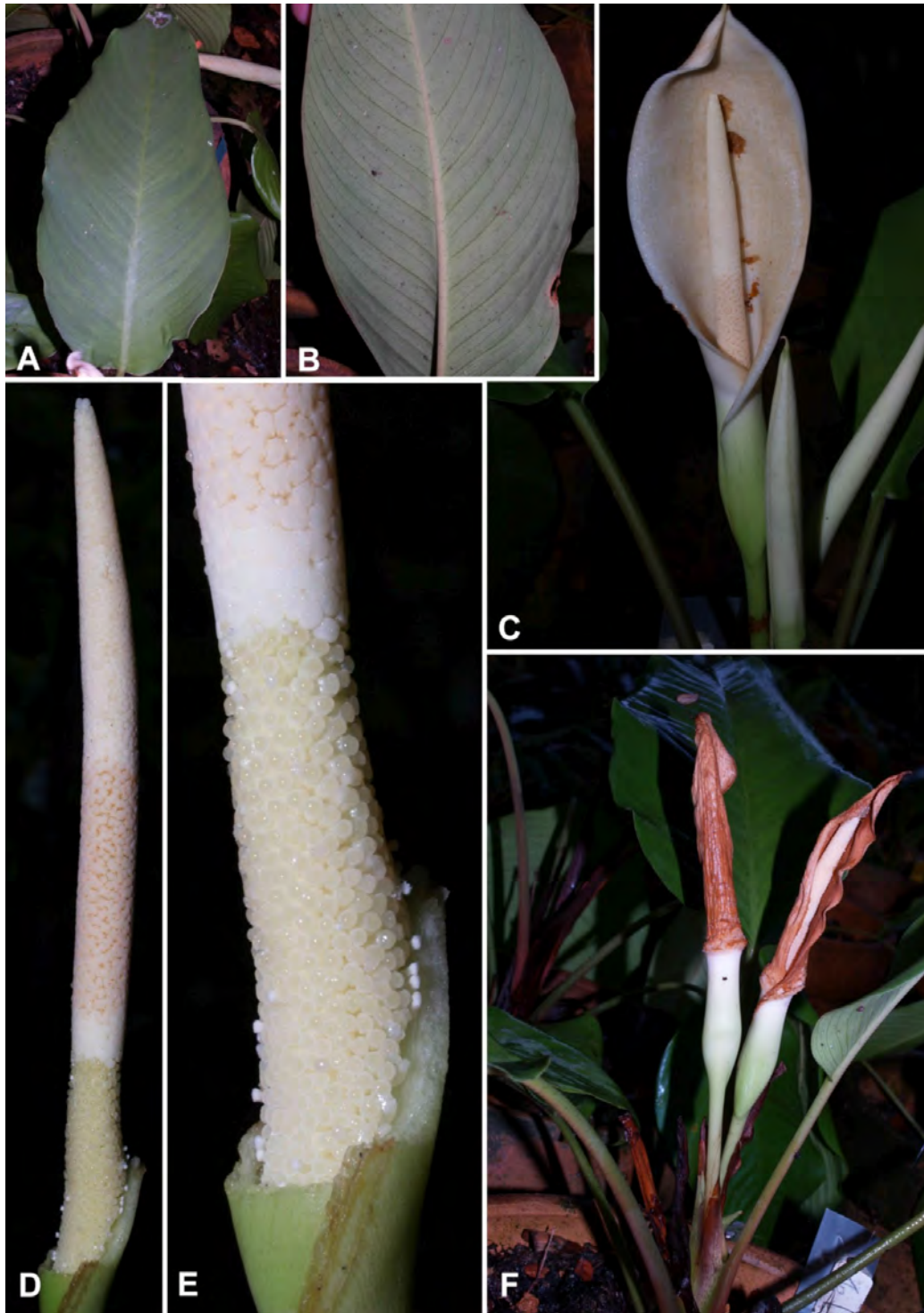


Figure 3. *Schimatoglottis dulosa* S.Y.Wong. **A.** & **B.** Adaxial (**A**) and abaxial (**B**) views of leaf blade. **C.** Inflorescence at late pistillate anthesis, with two developing inflorescences. **D.** Spadix at pistillate anthesis, spathe artificially removed. **E.** Detail lower portion of spadix showing pistillate flower zone, interstice, and lowermost part of staminate flower zone. **F.** Flowering plant in cultivation showing diagnostic erect inflorescences and marcescent spathe limb. **A–F** from *P.C. Boyce & Jeland ak Kisai AR-279*. Images © P.C. Boyce.

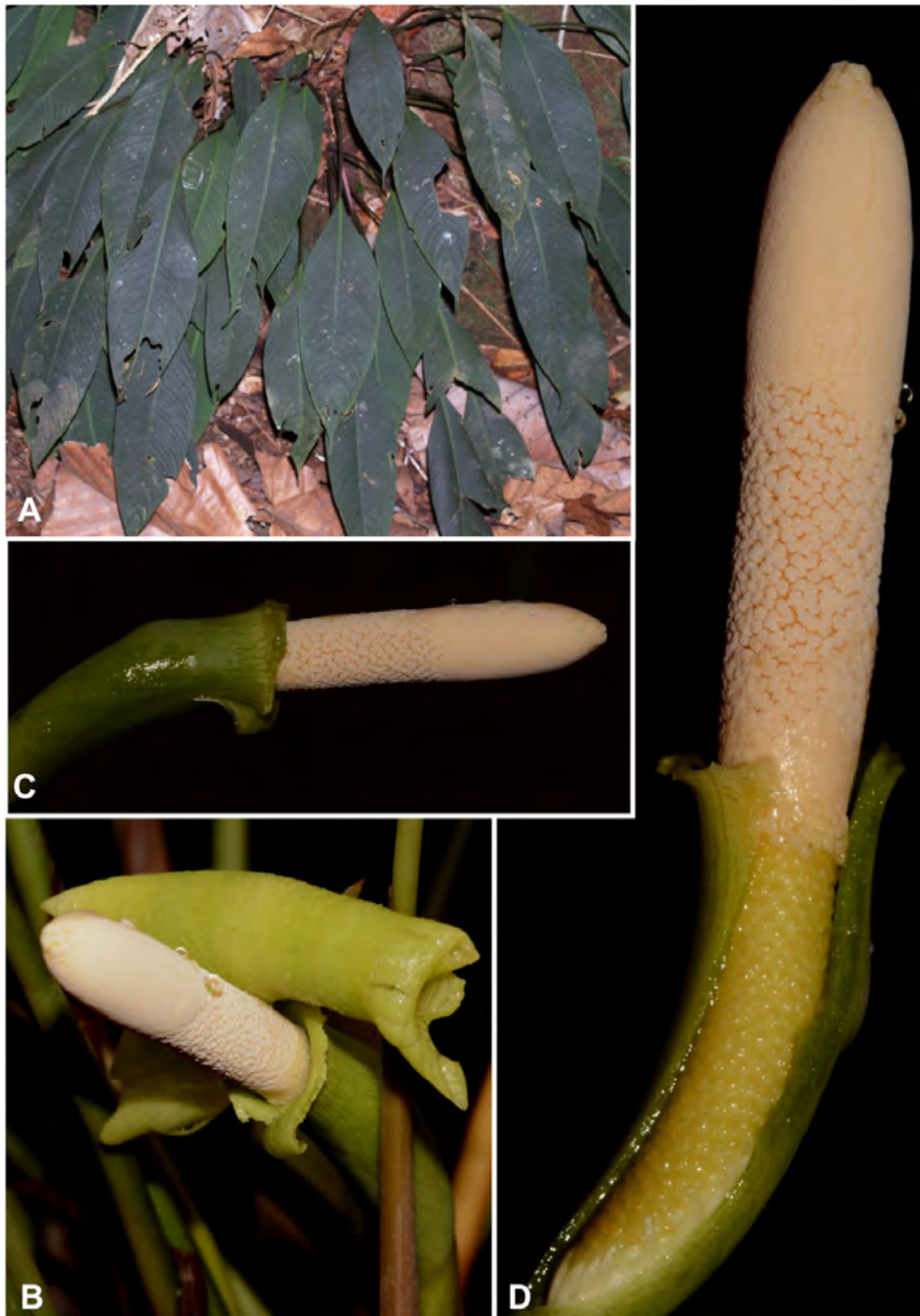


Figure 4. *Schismatoglottis iliata* S.Y.Wong & P.C.Boyce. **A.** Plants in type habitat, shaded sandstone bluff above upper reaches (Ulu) of Batang Kayang. Note pendent leaf blades. **B.** Inflorescence at onset of staminate anthesis, with spathe limb caducous and lower spathe top edges flaring. **C.** Inflorescence at staminate anthesis, with spathe limb fallen. **D.** Spadix at onset of staminate anthesis, with nearside part of lower spathe artificially removed. Note that spathe zones of spadix are uniform in width, but interstice staminodes (just below upper edge of lower spathe) have expanded laterally. **A–D** from *Jepom ak Tisai AR-3972*. Images © P.C. Boyce.

Notes — *Schismatoglottis iliata* forms a clade with *S. mayoana* and *S. nicolsonii* (Low et al., in prep.; Wong & Boyce 2014b), morphologically defined by pendulous leaf blades abaxially with crowded fine pellucid secondary veins, a matt olive green adaxial surface, and stamen thecae each with two pores.

Schismatoglottis jitinia S.Y.Wong, Gard. Bull. Singapore 61(2): 532[–535], Pl. 3 (2010). Type: Malaysia, Sarawak, Kuching, Bau, Kampung Jugan, 01°28'46.4"N; 110°05'08.5"E, 26 Mar 2004, *P.C. Boyce & Jeland ak Kisai AR–279* (holotype SAR!). **Figure 5.**

Notes — *Schismatoglottis jitinia* is distinctive by its elongated and erect aerial stem, the leaf blades basally attenuate and usually unequal, and softly leathery, with the midribs of the innovations longitudinally bright pink abaxially and basally adaxially. Cataphylls are also always pink.

Schismatoglottis jitinia approaches *S. erecta* and *S. schottii* by having erect, elongated stems, but differs by oblanceolate leaf blades with long-decurrent bases, erect stout inflorescences, succulent lower spathe, and the spathe constriction coinciding with the middle part of the male zone.

Schismatoglottis maelii P.C.Boyce & S.Y.Wong, Gard. Bull. Singapore 58(1): 14[–18], **Figure 2** (2006). Type: Malaysian Borneo, Sarawak, Kuching Division, Bau, Segong, Ulu Sungai Adis, Sungai Bronand, 4

May 2004, *Jeland ak Kisai & Jepom ak Tisai AR–47* (holotype SAR!). **Figure 6.**

Notes — The bright green leaf blades adaxially with very close raised veins have no equal in the genus and are immediately diagnostic. Floral fragrance, reminiscent of crushed raspberries, is quite unlike the strongly esteric odour produced by all other fragrant species of the Multiflora Group.

Schismatoglottis mayoana Bogner & M.Hotta, Acta Phytotax. Geobot. 34(1–3): 48[–50], **Figures 1–2** (1983); Hay & Yuzammi, Telopea 9(1): 91–61, **Figure 12** (2000); Wong & Boyce, Willdenowia 44: 8, **Figure 2.** (2014). Type: Malaysian Borneo, Sarawak, near Matang, 1979, *J. Bogner 1606* (holotype M!; isotypes K!, KYO!, M!, US!). **Figure 7.**

Heterotypic Synonyms

Schismatoglottis beccariana var. *cuspidata* Engl., Bull. Soc. Tosc.ortic. 4: 297 (1879). Type: Malaysian Borneo, Sarawak, Matang, *O. Beccari P.B. 1648* (holo FI!; iso GH!, K!).

Schismatoglottis multiflora var. *latifolia* Ridl., J. Straits Br. Roy. Asiat. Soc. 49: 50 (1907). Type: Malaysian Borneo, Sarawak, Matang, 21 Jun 1893, *E.W. Bartlett 2* (holotype SING!, 2 sheets).

Notes — *Schismatoglottis mayoana*, *S. iliata* and *S. nicolsonii* form a clade (Low et al., in prep.; Wong & Boyce 2014b), morphologically defined by pendulous leaf blades abaxially

with crowded fine pellucid secondary veins, a matt olive green adaxial surface, and stamen thecae each with two pores.

Schismatoglottis monoplacenta M.Hotta, Mem. Coll. Sci. Univ. Kyoto, Ser. B, 32: 227[–229], **Figure 2**, A–H. (1966); Hay & Yuzammi, *Telopea* 9: 93–94 (2000). Type: Malaysian Borneo, Sarawak, Marudi ('Mardi'), along Sg. Melinau, between Sg. Tutoh and Lubang Bungan, at foot of G. Mulu, 14 Mar 1964, *M.Hotta 14404* (holotype KYO!). **Figure 8.**

Notes — *Schismatoglottis monoplacenta* is immediately distinguishable by the very long, stiff, persistent ligules of the petiolar sheath. Molecular data (Low et al., in prep.) places *S. monoplacenta* outside of *Schismatoglottis* s.s.

Schismatoglottis nicolsonii A.Hay, *Telopea* 9: 95[–97], **Figure 13** (2000); Wong & Boyce, *Willdenowia* 44: 9, **Figure 3**. (2014). Type: Malaysian Borneo, Sarawak, Bako National Park, path to Telok Paku, 7 Aug 1961, *D.H. Nicolson 1308* (holotype US!; isotypes K!, L!). **Figure 9.**

Notes — *Schismatoglottis nicolsonii*, *S. iliata* and *S. mayonana* are related and delimited morphologically by pendulous leaf blades abaxially with crowded fine pellucid secondary veins, a matt olive green adaxial surface, and stamen thecae each with two pores.

Schismatoglottis persistens S.Y.Wong & P.C.Boyce, *Willdenowia* 44: 247[–250], **Figure 1 & Figure 2B**, D & F (2014). Type: Malaysian Borneo, Sarawak, Sri Aman, Lubok Antu, Batang Ai, Nanga Sumpa, Sungai Pedali, 01°11'58.9"N, 112°03'27.0"E, 25 May 2008, *P.C.Boyce, Wong Sin Yeng & Jepom ak Tisai AR-2383* (holotype SAR!; isotypes SAR! [alcohol], SBC! [alcohol], SING!). **Figure 10.**

Notes — It is not readily evident to what *S. persistens* is closely related (see Wong & Boyce 2014c). Although vegetatively most similar to the genus *Phymatarum* M.Hotta, the pistillate and staminate flowers are very different. Persistent ligules are also found in three other species of the *Schismatoglottis* Multiflora Group – *S. erecta*, *S. monoplacenta* and *S. schottii* – but these species are not otherwise obviously similar to *S. persistens*.

MULTIFLORA GROUP –THE EXAPPENDICULATE SPECIES

Schismatoglottis bauensis A.Hay & Chi. C. Lee, *Telopea* 9(1): 84[–85], **Figure 10** (2000); Wong & Boyce, *Gard. Bull. Singapore* 60(1): 156–159, **Figure 1** (2008). Type: Malaysian Borneo, Sarawak, Kuching Division ('1st Division'), Bau, Gua Peri Peri ('Fairy Caves'), ca. 7 km from Bau, 3 Oct. 1994, *P.C. Boyce 790* (holotype K!; isotype SAR!). **Figure 11.**

Notes — *Schismatoglottis bauensis* and *S. confinis* are evidently very closely similar, although the characteristics given below (under *S.*



Figure 5. *Schismatoglottis jitinia* S.Y.Wong. **A.** Plants in habitat, gallery forest. **B.** Purple-veined form with inflorescence at staminate anthesis; note splitting spathe limb and chrysomelid beetle in attendance. **C.** Inflorescence at pistillate anthesis, with spathe limb gapping. **D.** Spadix at pistillate anthesis, with spathe artificially removed. **E.** Detail of lower portion of spadix showing pistillate flower zone, interstice, and lowermost part of staminate flower zone. **A** from Wong Sin Yeng *et al.* AR-5151; **B** from P.C.Boyce *et al.* AR-1038; **C–E** from P.C.Boyce & Wong Sin Yeng AR-3624. Images © P.C. Boyce.



Figure 6. *Schismatoglottis maelii* P.C.Boyce & S.Y.Wong. . **A.** Plants in habitat. **B.** Detail of leaf blade adaxial surface showing the close, finely raised veins. **C.** Inflorescence at pistillate anthesis, with spathe limb gaping. **D.** Spadix at pistillate anthesis, with spathe artificially removed. **A–D** from *Jeland ak Kisai & Jepom ak Tisai AR-47*. Images © P.C. Boyce.

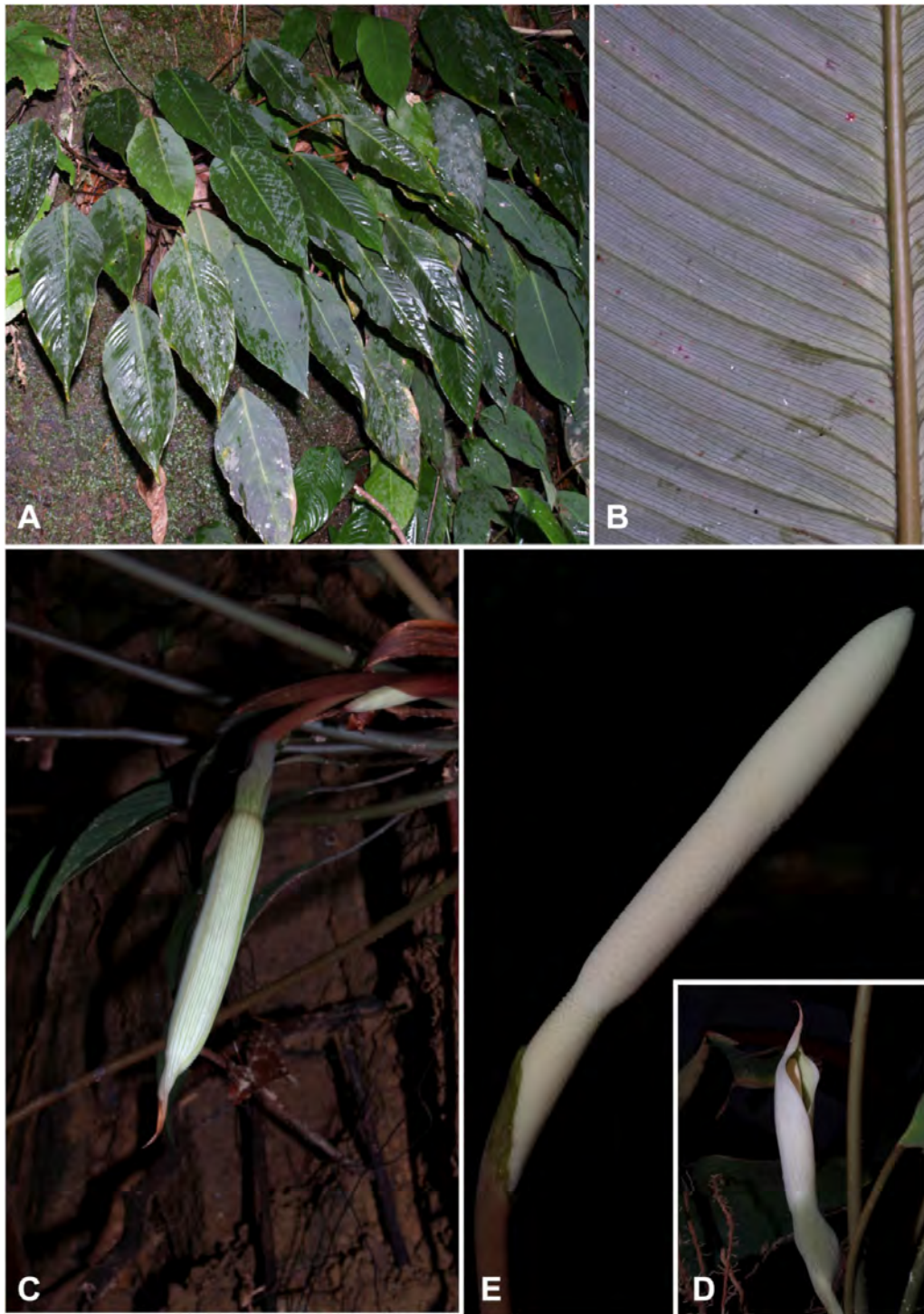


Figure 7. *Schismatoglottis mayoana* Bogner & M.Hotta. **A.** Plants in habitat, edge of sandstone waterfall, Kubah N. P. **B.** Detail of abaxial surface of leaf blade, showing dense pellucid secondary venation. **C.** Plant flowering (very early pistillate anthesis) in habitat. Note matt reddish-suffused peduncle and white spathe limb. **D.** Inflorescence at late pistillate anthesis. Note that in nature inflorescence would be pendent. **E.** Spadix at late pistillate anthesis, with spathe artificially removed. Note that top of pistillate zone is markedly narrower than other zones of spadix. **A–D** from *P.C.Boyce & S.Y.Wong AR-1828*. Images © P.C. Boyce.

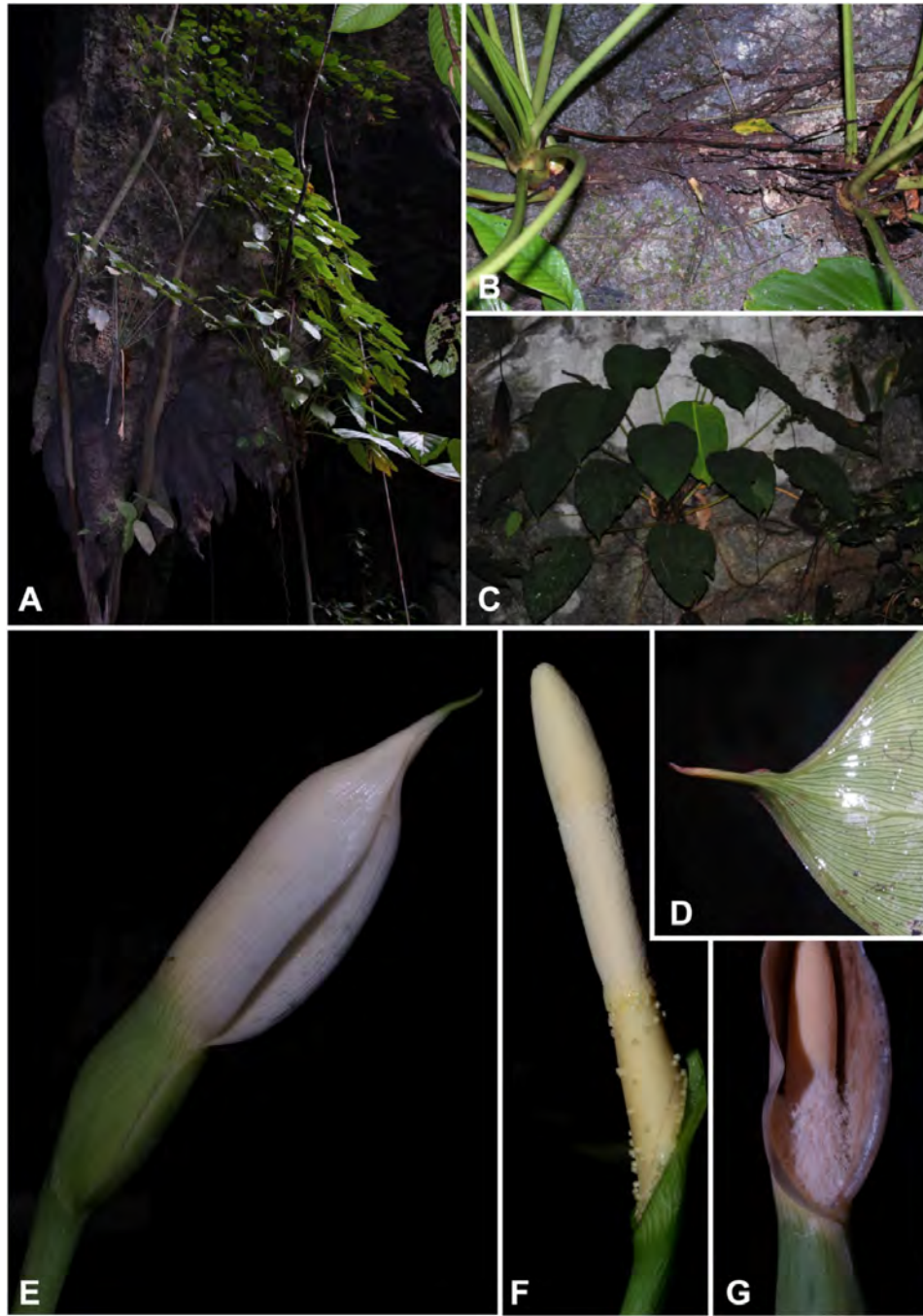


Figure 8. *Schismatoglottis monoplocenta* M.Hotta. **A.** Plants in habitat on karst limestone formations en route to Clearwater Cave, Mulu N.P., Sarawak. **B.** Detail of plants growing on bare limestone. **C.** Limestone deposits (dark green leaf blades, owing to algae growing on limestone coating) as compared with a newly expanded (bright green leaf blade, centre) leaf. Plants in cultivation retain bright green leaf blades. **D.** Detail of leaf tip (abaxial view), showing pronounced drip-tip (ca. 1.5 cm long) and conspicuous pellucid veins. **E.** Inflorescence at pistillate anthesis. **F.** Spadix at pistillate anthesis (spathe artificially removed). **G.** Inflorescence at staminate anthesis, just after pollen release. Strings of pollen are clearly visible on fertile (staminate) portion of spadix. Note that spathe limb has discoloured by onset of staminate anthesis. C–G from *P.C.Boyce et al. AR-1966*. Images © Peter C. Boyce.

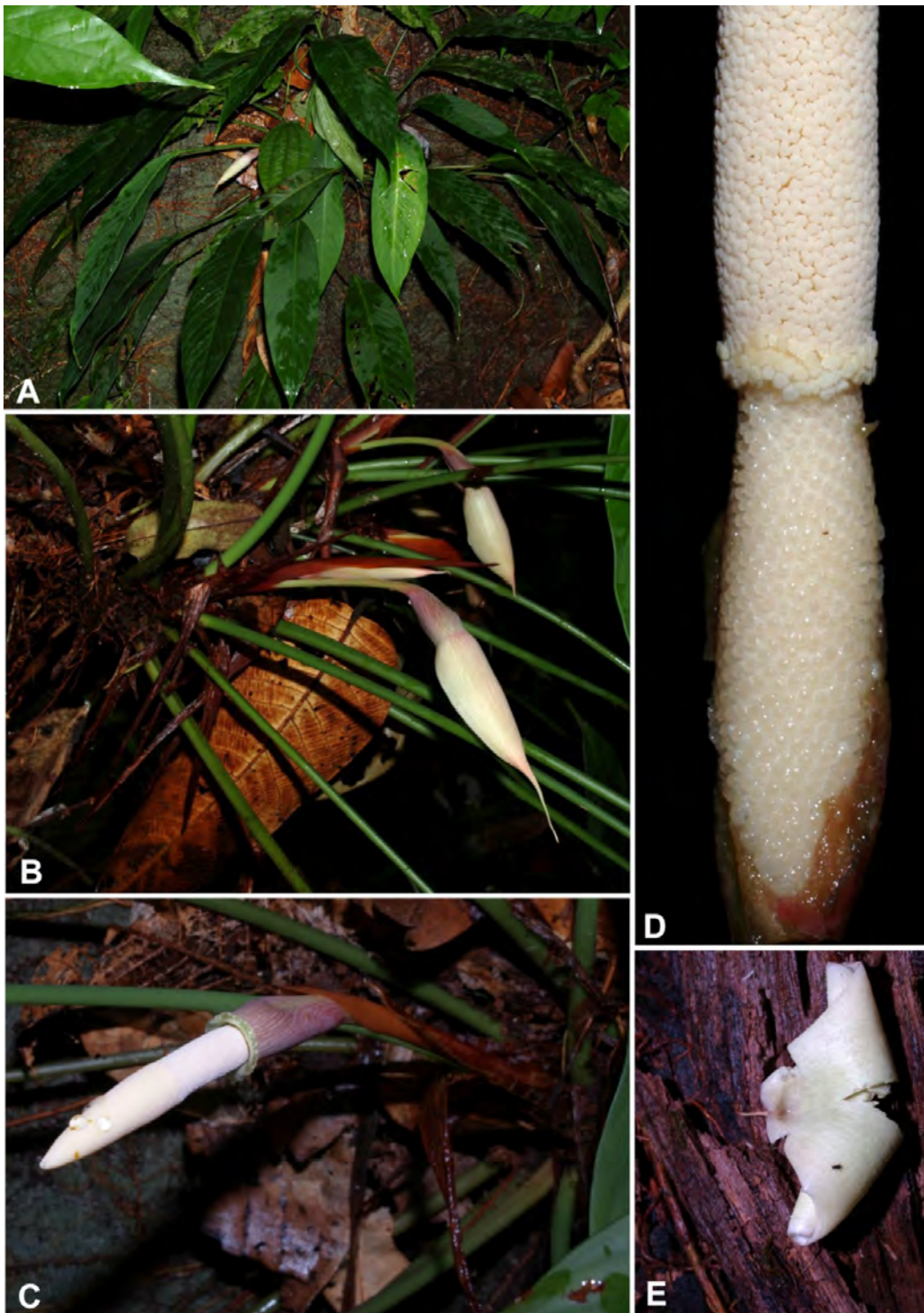


Figure 9. *Schismatoglottis nicolsonii* A.Hay. **A.** Plants in habitat, edge of sandstone waterfall, Bako N. P. **B.** Flowering plant in habitat. **C.** Inflorescence at onset of staminate anthesis, with spathe limb shed. **D.** Detail of pistillate zone and lower part of staminate zone. Note that staminate zone is fertile to base. **E.** Spathe limb shed during onset of staminate anthesis. **A–D** from P. C. Boyce & al. AR-2106. Images © Peter C. Boyce.

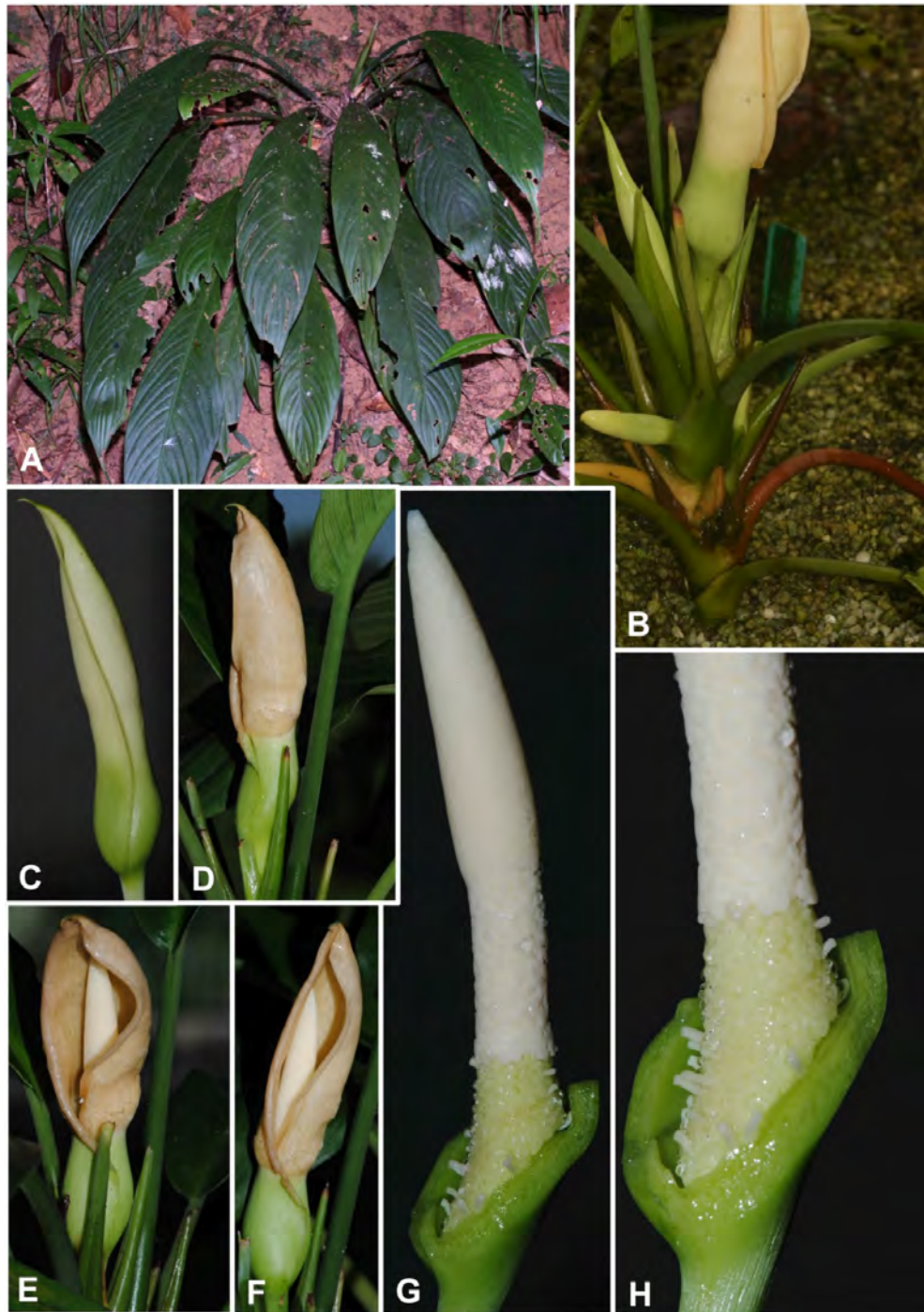


Figure 10. *Schismatoglottis persistens* S.Y.Wong & P.C.Boyce. **A.** Plant in habitat, type locality. **B.** Flowering shoot of cultivated plant at early staminate anthesis; note prophylls and cataphylls alternating with inflorescences; note, too, spathe limb colour. **C.** Inflorescence at pistillate anthesis; note slit-like opening below terminal rostrum. **D, E & F.** Inflorescence at late staminate anthesis; note spathe limb has darkened and is beginning to degrade (cracking) at junction with lower spathe. **G.** Spadix at pistillate anthesis, spathe artificially removed. **H.** Detail from **G**, showing pistillate and staminate flower zones. **A–H** from *P. C. Boyce & al. AR-2383*. Images © Peter C. Boyce.



Figure 11. *Schismatoglottis bauensis* A.Hay & Chi.C.Lee. **A & B.** Plants in habitat, karst limestone, Bau. **C.** Flowering plant in habitat with one inflorescence at staminate anthesis (spathe limb shed) and one developing inflorescence. **D & E.** Inflorescence at onset of pistillate anthesis. **A–D** from P. C. Boyce *AR-1503*. Images © Peter C. Boyce.

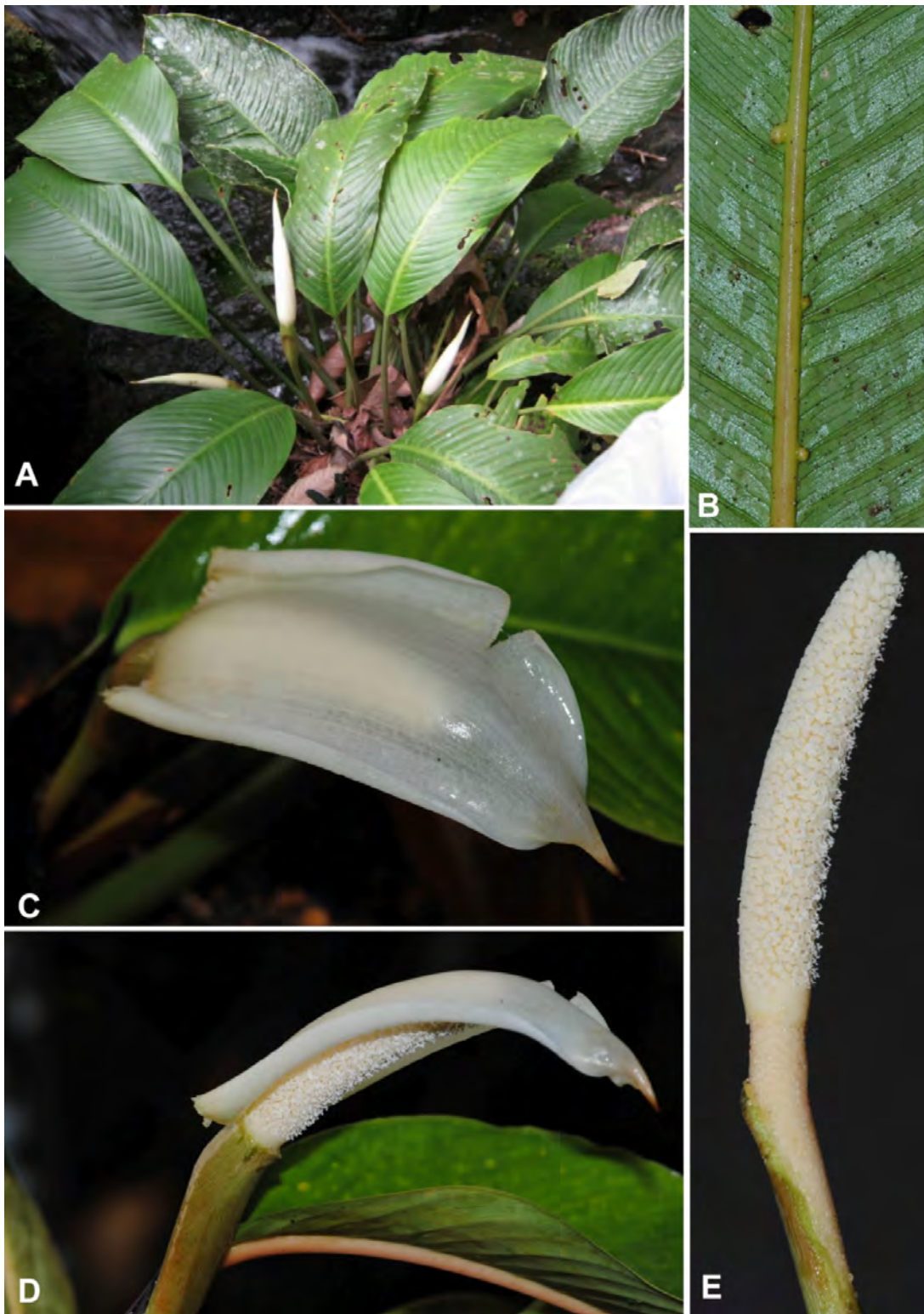


Figure 12. *Schismatoglottis bulbifera* H.Okada, H.Tsukaya & Y.Mori. **A.** Plant in habitat. **B.** Leaf blade abaxial surface showing bulbil development along mid-rib. **C & D.** Inflorescence at staminate anthesis. **D.** Spadix at staminate anthesis, spathe artificially removed. **A–G** from *P.C.Boyce & Wong Sin Yeng AR-3672*. Images © P.C. Boyce.



Figure 13. *Schismatoglottis confinis* S.Y.Wong & P.C.Boyce. **A & B.** Plants in habitat, karst limestone, Serian. **C.** Inflorescence at pistillate anthesis. **D.** Detail of persistent lower spathe and lowest part of spathe limb. **E.** Spadix at staminate anthesis, spathe artificially removed. **F.** Detail of inflorescence at end of staminate anthesis – note the spathe limb has been shed to leave a ragged rim to lower spathe orifice. **A–F** from *Simon Kutub ak Paru AR-926*. Images © Peter C. Boyce.

confinis) are consistently reliable in differentiating them.

Schimatoglottis bulbifera H. Okada, H. Tsukaya & Y. Mori, Syst. Bot. 24(1): 62[–63], **Figure 1–5** (1999). Type: Indonesian Borneo, West Kalimantan, Singkawang, G. Poteng, 12 Dec 1991, *M. Kato et al.* 30432 (holotype TI!; isotypes BO!). **Figure 12.**

Notes — Hay & Yuzammi (2000: 94) treated *S. bulbifera* as a synonym of *S. multiflora*. We have now re-collected *S. bulbifera* from several localities in SW Sarawak and can attest that it differs substantially from *S. multiflora* in floral particulars, including an erect inflorescence, and a spathe limb opening almost flat at staminate anthesis and then becoming marcescent, in addition to the leaf blades abaxially producing bulbils & plantlets along the mid-rib.

Schimatoglottis confinis S.Y.Wong & P.C.Boyce, Gard. Bull. Singapore 60(1): 159[–162], **Figure 2** (2008). Type: Malaysian Borneo, Sarawak, Samarahan Division, Serian, Pichin, Tubih Durud, Ampon Siribu, 15 Dec. 2004, *Simon Kutub ak Paru AR–926* (holotype SAR!). **Figure 13.**

Notes — *Schimatoglottis confinis* appears to be closely allied to *S. bauensis* but can be distinguished by the leaf abaxial surface, which is glaucous in *S. confinis* but not in *S. bauensis*. The leaf base is always decurrent in *S. confinis* but obtuse to slightly decurrent in *S. bauensis*, while secondary venation is prominent in *S. confinis* but obscure in *S.*

bauensis. The tertiary venation of *S. confinis* is often tessellate. *Schimatoglottis confinis* has pores that are oblong (ca 0.3 mm), deep and located on the inner surface of stamens as compared punctiform pores (ca 0.15 mm) with protruding tissue from innermost surface and located at the edges of stamens in *S. bauensis*. The anther connective is flat in *S. confinis* but elevated in *S. bauensis* while the male zone of *S. confinis* stains brown in alcohol but remains white basally and stains brown distally in *S. bauensis*.

Although *S. confinis* can be found on limestones it always occurs terrestrially in deep soil as compared to *S. bauensis* which occurs lithophytically in humus and litter pockets on limestone boulders and cliffs. *Schimatoglottis confinis* can be found as well on the sandstones of Gunung Ampungan; the distance between this locality and Padawan/Serian limestones is only ca 30 km. Additionally, based on known collections, *S. confinis* occurs at much higher altitudes (near to 600 m asl) as compared to *S. bauensis* which occurs at most at 100 m asl.

Schimatoglottis erecta M.Hotta, Mem. Coll. Sci. Univ. Kyoto, Ser. B, 32: 233, **Figure 5**, A–F, (1966); Hay & Yuzammi, *Telopea* 9(1): 87–88 (2000); Boyce, *Sarawak Mus. J.* 87: 348 – 350, Pl. 7 (2009). Type: Malaysian Borneo, Sarawak, Bintulu (‘4th Division’), valley of Sg. Keyan, Ulu Sg. Kakus, 9 Nov. 1963, *M.Hirano & M.Hotta* 479 (holotype KYO!). **Figure 14.**

Notes — The erect and ultimately climbing stems of *Schismatoglottis erecta* and *S. schottii* are immediately distinctive. Both share a nodding inflorescence in which the spathe limb inflates while remaining distally abruptly acuminate, and a clavate staminate flower zone, but readily separable by the differences in the anther connective (deeply 1-grooved from theca to theca in *S. erecta* vs slightly raised between the thecae in *S. schottii*). *Schismatoglottis schottii* consistently has the spathe exterior coppery-orange whereas *S. erecta* has green spathes.

Schismatoglottis hayana Bogner & P.C.Boyce, Gard. Bull. Singapore 60(2): 1[–7], **Figure 1–3.** (2009). holotype Type: Malaysian Borneo, Sarawak, Kuching, Sematan, Teluk Selabang, 10 June 2004, P.C.Boyce *et al.* AR-703 (holotype SAR!; isotypes SING!). **Figure 15.**

Notes — *Schismatoglottis hayana* is readily distinguished from both *S. bauensis* and *S. multiflora* by the thecae, each with two pores. *Schismatoglottis hayana* is further distinctive from *S. bauensis* by the preference of shale (vs. limestone) and rheophytic (vs. lithophytic/chasmophytic) ecology, while *S. hayana* differs additionally from *S. multiflora* by the inflated (vs. only loosened/unfurled) spathe limb, the proportionately shorter, thicker cylindrical spadix and the larger pistillodes situated at the base of the pistillate flowers. Thecae each with two pores also occur in *S. nicolsonii* and *S. mayoana* (both in West Sarawak) but these differ from *S. hayana* by the presence of a sterile appendix and in having leaves

adaxially matte (vs. glossy in *S. hayana*). *Schismatoglottis nicolsonii* and *S. mayoana* are lithophytic on sandstones.

Schismatoglottis multiflora Ridl., J. Straits Br. Roy. Asiat. Soc. 44: 181 (1905); Engler, Pflanzenr. 55 (IV.23Da): 90 (1921); van Steenis, Rheophytes of the World 196. (1981); Hay & Yuzammi, Telopea 9(1): 94–95 (2000). Type: Malaysian Borneo, Sarawak, Matang, July 1903, H.N. Ridley 11582 (holotype SING!; isotype K!). **Figure 16.**

Notes — As here defined *Schismatoglottis multiflora* is restricted to the Matang Massif and adjacent areas in Bau (Kuching, NW Borneo), where it occurs as an obligate rheophyte on rather soft sandstones. The spathe limb barely opens at anthesis and the spathe limb is soon caducous.

Schismatoglottis roseospatha Bogner, Aqua-Planta 88: 96[–97] (3 un-numbered plates) (1988); Hay & Yuzammi, Telopea 9(1): 99; Bogner, Aqua-Planta 3–2004: 86–87 (2004). Type: Malaysian Borneo, Sarawak, Gaad [= Gaat] River, [without date] J. Knüppel & H. Linke, *s.n.* (holotype M!; isotypes K!, KYO!). **Figure 17.**

Notes — *Schismatoglottis roseospatha* is distinctive by the deep green highly glossy leaf blades and usually pink (occasionally white) spathe limbs. In nature plants either occur as rheophytes, mostly on sunny but constantly water-splashed rocks, or as permanently submerged plants with much smaller and more membranous leaves. The

submerged morph has yet to be found flowering, although plants brought into cultivation and grown emersed will revert to the rheophytic morph and flower.

Schismatoglottis schottii Bogner & Nicolson, *Aroideana* 2: 120 (1979); Hay & Yuzammi, *Telopea* 9(1): 101 (2000). — *Piptospatha acutifolia* Engl., *Pflanzenr.* 55 (IV.23Da): 128, **Figure 76.** (1912). — *Schismatoglottis acutifolia* (Engl.) M.Hotta, *Mem. Coll. Sci. Univ. Kyoto, Ser. B*, 32: 233 (1966) [non *S. acutifolia* Engl. (1912)]. Type: Indonesian Borneo, Kalimantan Barat, Sungei Doho [?= Long Deho], 1896 [? 1897], *A. W. Nieuwenhuis 1585* (holotype BO!; isotype B!). **Figure 18.**

Notes — *Schismatoglottis schottii* and *S. erecta* are clearly closely allied, although their different anther connectives reliably separate them (slightly raised between the thecae in *S. schottii* as compared with deeply 1-grooved from theca to theca in *S. erecta*).

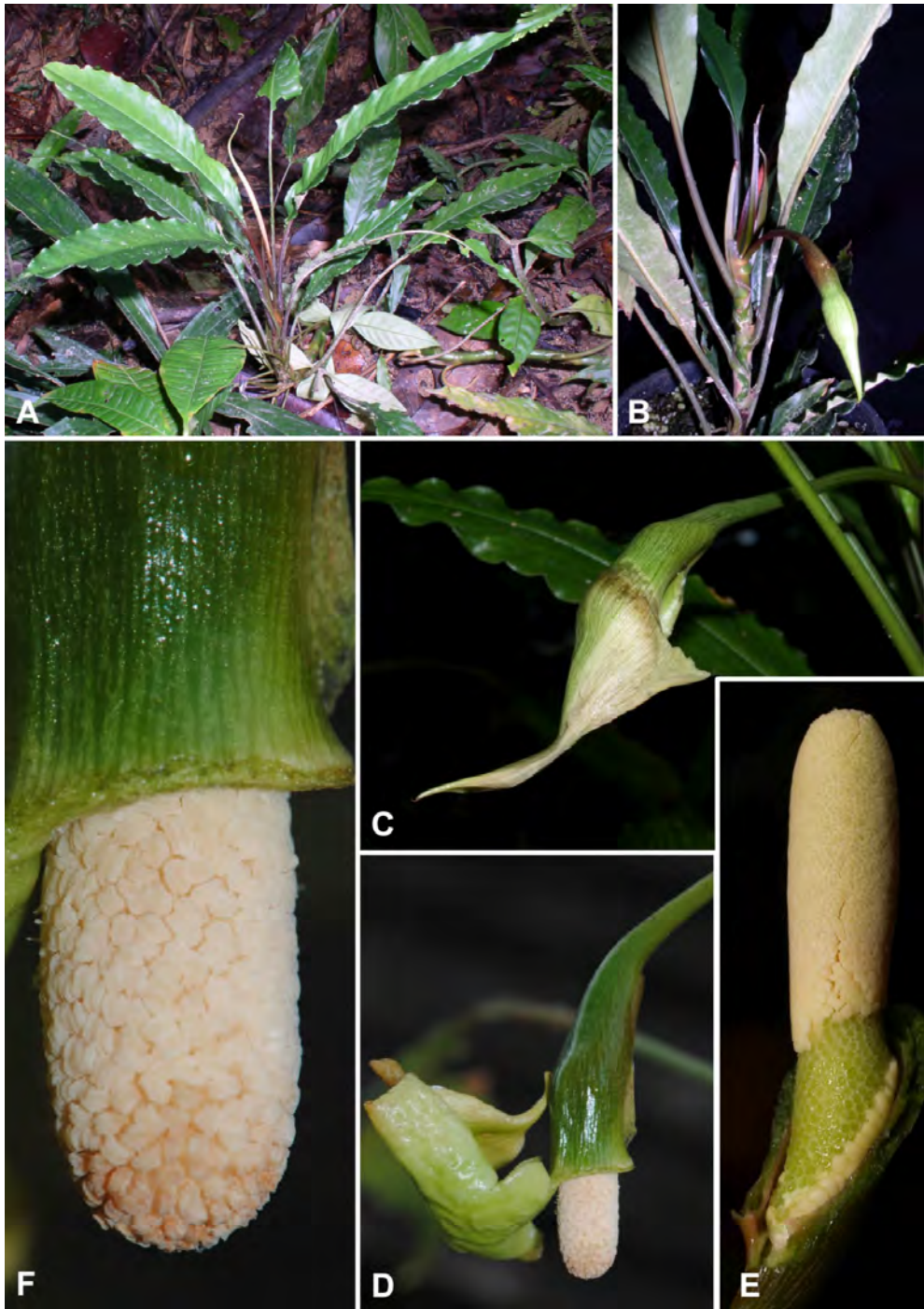


Figure 14. *Schismatoglottis erecta* M.Hotta. **A.** Plants in habitat, gallery forest. **B.** Flowering cultivated plant; note the nodding inflorescence and persistent ligular portion to the petiolar sheath. **C.** Inflorescence at staminate anthesis, with spathe limb beginning to shed. **D.** Inflorescence at end of staminate anthesis, with spathe limb almost fallen; note the groove running between thecae of each stamen. **E.** Spadix at pistillate anthesis, spathe artificially removed. **F.** Detail of staminate flowers with anther connectives deeply 1-grooved from theca to theca. **A & B** from *P.C.Boyce et al. AR-551*; **C** from *P.C.Boyce et al. AR-1452*; **D & F** from *P.C.Boyce et al. AR-2046*; **E.** from *P.C.Boyce et al. AR-1610*. Images © P.C. Boyce.



Figure 15. *Schimatoglottis hayana* Bogner & P.C.Boyce. **A & B.** Plants in habitat on shale rocks. **C & D.** Inflorescence at staminate anthesis; note decayed spathe limb. **E.** Detail of inflorescence at end of staminate anthesis, nearside spathe artificially removed. **A–E** from *P.C.Boyce et al. AR-703*. Images © Peter C. Boyce.



Figure 16. *Schimatoglottis multiflora* Ridl. **A & B.** Plants in habitat on sandstone rocks. **C.** Inflorescence at pistillate anthesis; note spathe limb not opening wide. **D.** Inflorescence at onset of staminate anthesis; note spathe limb beginning to degrade. **E.** Spadix at pistillate anthesis, spathe artificially removed. **F.** Detail of lower portion of spadix showing pistillate flower zone, interstice, and lowermost part of staminate flower zone. **G.** Terminal portion of spadix at staminate anthesis; note pollen strings. **A–F** from *P.C.Boyce et al. AR-240*. Images © Peter C. Boyce.

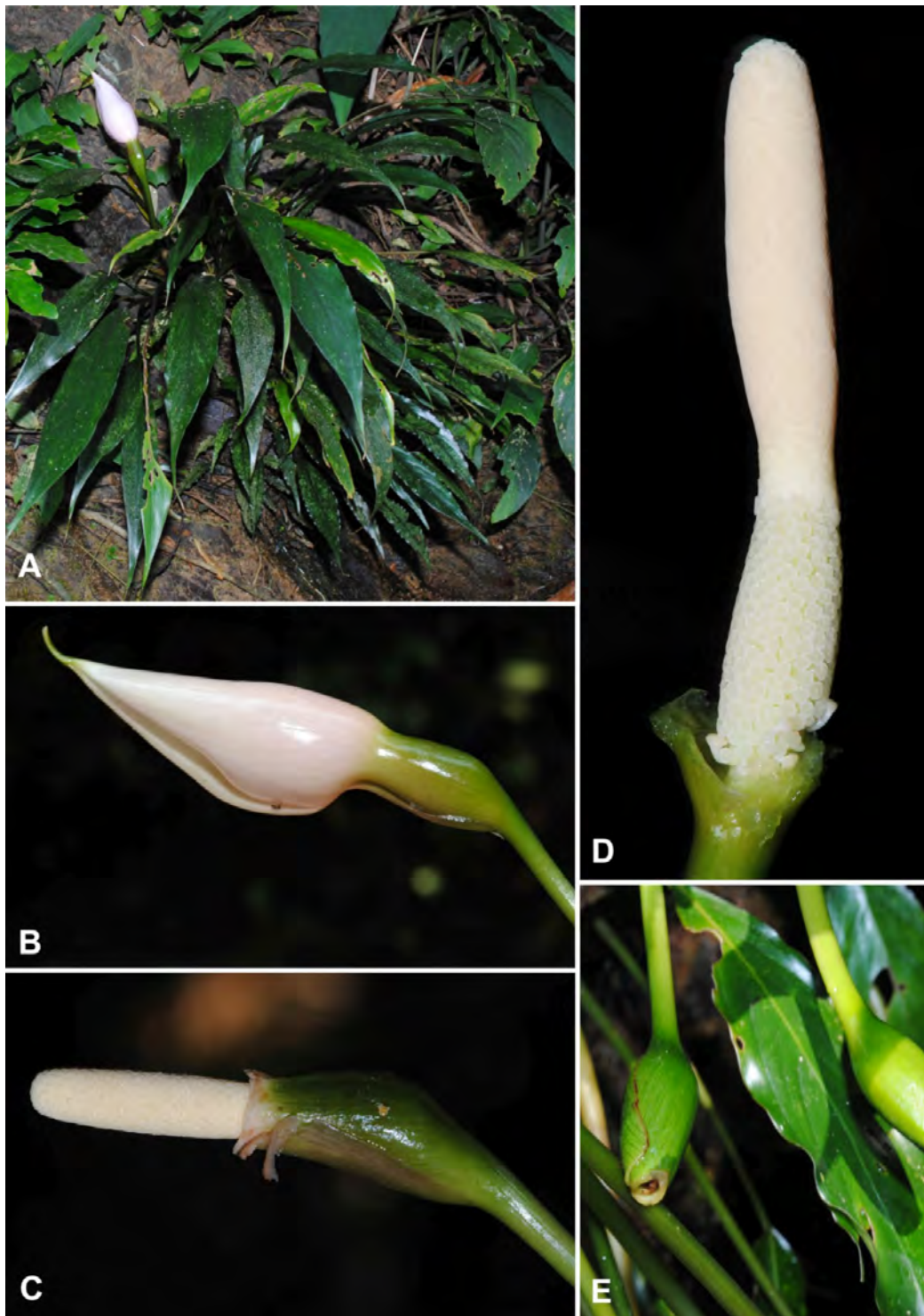


Figure 17. *Schismatoglottis roseospatha* Bogner. **A.** Plants in habitat on shale rocks. **B.** Inflorescence at pistillate anthesis. **C.** Inflorescence at late staminate anthesis; note spathe limb already shed. **D.** Spadix at pistillate anthesis, spathe artificially removed. **E.** Developing infructescences enclosed in persistent lower spathe. **A–E** from *P.C.Boyce et al. AR-1790*. Images © Peter C. Boyce.

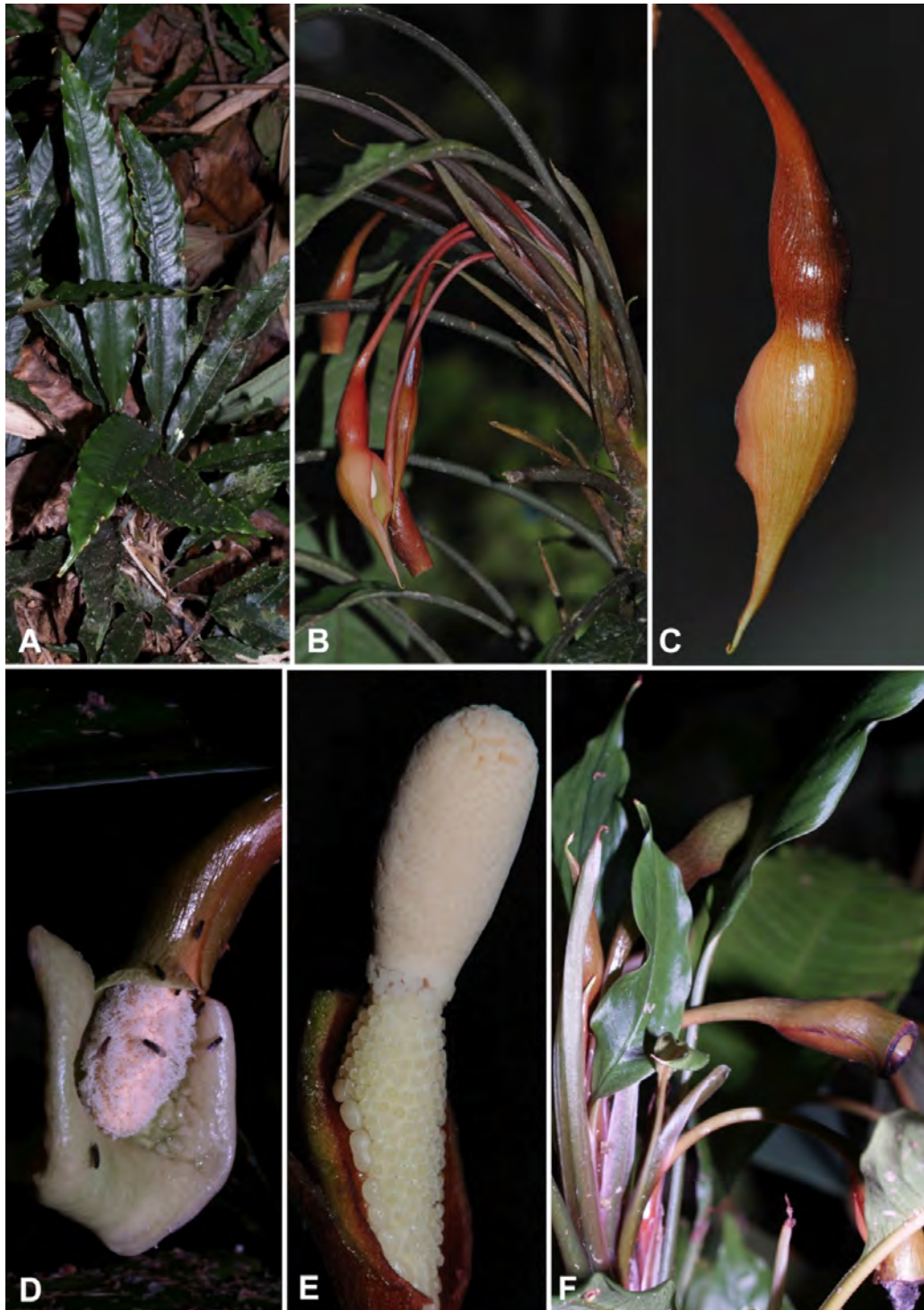


Figure 18. *Schismatoglottis schottii* Bogner & Nicolson. **A.** Plants in habitat, gallery forest. **B.** Flowering cultivated plant; note the nodding inflorescence and persistent ligular portion to the petiolar sheath. **C.** Inflorescence at pistillate anthesis. **D.** Inflorescence at staminate anthesis, with spathe limb shedding; note pollen. **E.** Spadix at pistillate anthesis, spathe artificially removed. **F.** Fruiting cultivated plant; note the persistent lower spathe and persistent ligular portion to the petiolar sheath. **A & F** from *P.C.Boyce & Wong Sin Yeng AR-3695*. Images © P.C. Boyce.

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