

Recent changes to generic delimitations in the Schismatoglottideae

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ABSTRACT

A summary of recent far-reaching changes to generic delimitations in Tribe Schismatoglottideae is provided. Thirty genera are now recognised, comprising 13 pre-existing genera (*Apoballis*, *Aridarum*, *Bakoa*, *Bucephalandra*, *Fenestratarum*, *Galantharum*, *Ooia*, *Phymatarum*, *Pichinia*, *Piptospatha*, *Schismatoglottis*, *Schottariella* and *Schottarum*), five resurrected genera (*Colobogynium*, *Gamogyne*, *Heteroaridarum*, *Hottarum* and *Rhynchopyle*) and 11 newly recognised genera: *Bakoaella*, *Bidayuba*, *Burtianthus*, *Gosong*, *Hera*, *Kiewia*, *Nabalu*, *Pursegloveia*, *Naiadia*, *Tawaia* and *Toga*.

The genus *Hestia* is now renamed *Vesta* in light of the discovery that *Hestia*(Araceae), is preoccupied by *Hestia*, a fossil lycopsid. All genera are illustrated from living plants.

INTRODUCTION

Recent combined molecular and morphological analyses of Schismatoglottideae has revealed the need for marked changes in the delimitation of the genera. Given the importance to the horticultural and aquarists trade of several genera affected by these changes it was felt that a summary paper of the resulting taxonomy would be a worthwhile exercise to provide the framework of changes in a more concise form for hobbyists and the trade. The technical paper with the necessary taxonomic reshuffling (Low et al., 2018) should be consulted for the detailed methodology and discussions.

While resolving the delimitations of the so-called satellite genera related to *Schismatoglottis*, Low et al. (2018) did not tackle in any significant manner the largest

genus, *Schismatoglottis*, other than revealing (as we long suspected) that the genus is not a natural assemblage. Further research is currently underway.

TAXONOMIC PART

KEY TO the genera of Schismatoglottideae (excluding *Schismatoglottis*)

1. Thecae with needle- or horn-like extensions from tips of which pollen is extruded as a droplet or exceptionally (*Burtianthus*) pollen in strings 2
 - Thecae without needle- or horn-like extensions; thecae surface flat or with a deep pit; pollen extruded in powdery masses or as strings 12
2. Staminate flowers each composed of one stamen with thecae on proximal side of flower (with respect to spadix axis) 3
 - Staminate flowers each comprised of two stamens; thecae on ends, or on inner face of each anther of stamen pair 7
3. Spathe limb separated from lower spathe by an abrupt constriction; staminate flowers and staminodes conspicuously tuberculate; interstice staminodes static, closely resembling staminate flowers; fruiting spathe urceolate, actively splitting to reveal fruits *Phymatarum*
 - Spathe not or only very faintly constricted; staminate flowers and staminodes smooth or only weakly tuberculate; interstice staminodes motile, flattened, dissimilar to staminate flowers; fruiting spathe a tubular, salverform or funnellform splash-cup 4
4. Inflorescence nodding; infructescence erect by post-anthesis flexing of peduncle, or pendulous 5
 - Inflorescence and infructescence erect 6
5. Inflorescence on a pendent peduncle; persistent part of spathe narrowly tubular with a slightly flared rim; peduncle pendulous throughout *Toga*

- Inflorescence on an arching peduncle; persistent part of spathe salverform; peduncle of developing infructescence twisting and flexing to bring splash-cup erect **Tawaia**

- 6. Interstice staminodes (if present) static, deciduous post-anthesis; stamen connective expanded on the distal side into a conspicuous rim **Pursegloveia**

- Interstice staminodes shield-like, erect during pistillate anthesis, reflexing during staminate anthesis, persisting post-anthesis, becoming photosynthetic, and functioning to seal orifice of splash-cup and protect developing fruits; stamen connective not expanded into a conspicuous rim **Bucephalandra**

- 7. Thecae extensions needle-like, embedded in thecae tissue during pistillate anthesis, becoming erect at staminate anthesis 8

- Thecae extensions needle- or horn-like, erect from early in inflorescence development 9

- 8. Persistent spathe trulliform, pendulous; fruits dehiscent; seeds individually enclosed by a fleshy white aril c. 0.5 mm thick, chalaza with a conspicuous hyaline extension; pollen in a droplet on the peltate scale at the tips of thecae extensions
Schottariella

- Persistent spathe salverform, erect; fruits not dehiscent, decomposing to release seeds; seeds without an aril; chalaza blunt; pollen in irregular masses at tips of thecae extensions **Naiadia**

- 9. Thecae on ends of each anther of stamen pair; anther connective solid or excavated; pollen released in droplet 10

- Thecae on inner face of each anther of stamen pair; anther connective deeply excavated; pollen released in strings **Burtianthus**

- 10. Anther connective solid, slightly umbonate **Aridarum**

- Anther connective deeply excavated 11

- 11. Thecae extensions erect, peg-like; interstice staminodes deeply excavated, filling with amber-yellow sticky fluid; placentation basal **Hera**
- Thecae extensions inwards-curved over excavated connective, pointed; interstice staminodes solid, or middle only very slightly impressed, dry; placentation apical and basal, apical placenta sterile **Heteroaridarum**

- 12. Massive arborescent pachycaul to c. 4 m tall; peduncle very stout, to c. 45 cm long, 3 cm thick, apically down-turned so inflorescences abruptly pendulous; spathe to 36 cm long; spadix c. 29 cm long; staminate and pistillate flower zones contiguous **Nabalu**
- Not this combination 13

- 13. Stem deeply hypogeal in podzols, modules hapaxanthic, peduncle very slender, wiry, inflorescence pendulous, spathe limb hardly opening **Vesta**
- Stem epigeal, plants never podzols-associated; modules pleionanthic 14

- 14. Most of spadix adnate to spathe; spathe fully persistent until fruit dispersal 15
- Spadix free, or at most only pistillate flower zone adnate to spathe; spathe limb caducous, rotting, or marcescent during or shortly after anthesis, if limb at all persisting then spadix entirely free 16

- 15. Staminate flower zone with only the ventral-most stamens (those exposed by gaping spathe limb) fertile, the remainder sterile; fruits maturing to a caryopsis **Bakoa**
- Staminate flower zone entirely fertile; fruits a dehiscent berry **Bakoella**

- 16. Inflorescence nodding; spathe limb with large transparent areas; lower spathe margins fused; petiole with a conspicuous basal pulvinus **Fenestratarum**
- Inflorescence posture various; spathe limb wholly opaque; lower spathe margins free; petiole without a basal pulvinus 17

- 17. Leaves congested in a distichous arrangement; shoot modules monophyllous; petiolar sheath with a long-persistent, long ligular portion **Pichinia**
- Leaves never distichous; shoot modules polyphyllous, or if modules monophyllous then petiolar sheath reduced to a very short collar with its protective role taken on by a long subtending prophyll 18
- 18. Shoot modules monophyllous; petiolar sheath reduced to a very short collar; persistent lower spathe splitting at peduncle/spathe insertion, spathe walls curling acroscopically to release fruits **Colobogynium**
- Shoot modules polyphyllous; petiolar sheath extensive; persistent lower spathe splitting at the top or middle, spathe walls curling basiscopically or medioscopically to release fruits, or forming a splash-cup or a non-splitting tubular structure with a restricted orifice 19
- 19. Petiolar sheath fully attached, deciduous; spathe limb semi-persistent and barely opening during anthesis, then clasping spadix, falling with spent parts of spadix; pistillate and staminate flower zones separated conspicuous swollen mostly naked interstice **Apoballis**
- Petiolar sheath attached at base only, remainder a free ligular extension; spathe limb caducous or decaying, opening wide during anthesis and falling independently of spent parts of spadix; pistillate and staminate flower zones contiguous or separated by a zone of sterile flowers 20
- 20. Pistillate flowers connate, berries forming a syncarpium **Gamogyne**
- Pistillate flowers free, berries free 21
- 21. Entire spadix axis persistent until after fruit dispersal; spent flowers individually shedding to leave conspicuous scars **Ooia**
- Pistillate portion of spadix persistent after anthesis, rest of axis shed 22
- 22. Thecae pores set in deep pits 23

- Thecae pores not set in deep pits 24
23. Spadix fertile to tip; inflorescence very strongly nodding with peduncle deflexed almost 180°; inflorescence powerfully fragrant of vanilla ***Galantharum***
- Spadix with a sterile appendage; inflorescence at right-angles to peduncle; inflorescence odourless ***Hottarum***
24. Anther connective extended into a pronounced beak at least as long as the anther, thecae pores one on each side at base ***Piptospatha***
- Anther connective flat or domed 25
25. Staminate flowers pubescent, connective domed; inflorescences powerfully fragrant of isoamyl acetate ***Kiewia***
- Staminate flowers glabrous, connective flat or slightly raised; inflorescences odourless or smelling weakly esteric 26
26. Spathes deep pink to magenta, nodding on erect peduncle; spathe orifice with pronounced rostral keels; placentation parietal; persistent spathe a splash-cup ***Rhynchopyle***
- Spathes white to greenish, erect or arching; placentation basal; persistent spathe urceolate 27
27. Pistillate flower zone free from spathe; leaves stiffly erect, thickly leathery, inflorescences erect; peduncle short, stout, obscured by leaf bases; spathe thickly fleshy, limb decaying post-anthesis; infructescence erect, persistent lower spathe narrowly campanulate ***Gosong***
- Pistillate flower zone adnate to spathe; leaves arching to pendent, thinly leathery; inflorescences arching; peduncle long, slender, not obscured; spathe thin, limb caducous during staminate anthesis; infructescence pendulous persistent lower spathe urceolate 28

28. Pistillate flower zone isodiametric to remainder of spadix, free; distal quarter of spadix composed of fully developed but sterile (no pollen produced) staminate flowers; spathe limb thick, interior with waxy/oily texture; persistent lower spathe splitting basiscopically at fruit maturity; seeds with a conspicuous micropylar appendage ***Bidayuha***

– Pistillate flower zone much narrower remainder of spadix, fully adnate to spathe; distal quarter of spadix composed of obvious staminodes; spathe limb membranous; persistent lower spathe reflexing and opening along the free margins at fruit maturity; seeds lacking conspicuous micropylar appendage ***Schottarum***

Apoballis Schott, Oesterr. Bot. Zeit. 8: 318 (1858); Wong & Boyce, Bot. Stud. (Taipei) 51: 253 (2010); Ulrich et al., Taxon 61: 281 (2012); Boyce & Wong, Aroideana 38: 58, (2015); Low et al. Webbia 72(2): 18 (2018). Type: *Apoballis neglecta* Schott.

Schismatoglottis *Rupestris* group *sensu* Hay & Yuzammi (2000: 31).

Schismatoglottis rupestris Zoll. & Moritzi ex Zoll., *Apoballis rupestris* (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce. **Figure 1.**

Diagnostic characters — *Apoballis* has a fully attached deciduous petiolar sheath, a spadix with a prominently inflated naked interstice bearing sparse staminodes, a thickly spongy spathe limb barely opening at anthesis and semi-persistent into fruiting, a persistent lower spathe splitting at the base (at peduncle insertion) when the fruits are ripe, ovaries with parietal placentation. Inflorescences smell of almond oil (benzaldehyde), and pollen is echinate, both unique for Schismatoglottideae (Ulrich et al., 2012).

Distribution — Southern Myanmar through southern Thailand and the Malay Peninsula, Sumatera (the centre of diversity), south and east to Jawa and Nusa Tenggara. To date not recorded from Borneo, Sulawesi and the Philippines.

Ecology — Mesophytes of perhumid lowland to moist upper hill-forest, less often in wet lower montane forest, rarely obligate rheophytes.

Note — For individual species' synonymy & typification see Wong & Boyce (2010) & Low et al. (2018).

Apoballis acuminatissima (Schott) S.Y. Wong & P.C. Boyce, Webbia 72(2): 21 (2018).

Apoballis belophylla (Alderw.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 253 (2010).

Apoballis brevipes (Hook.f.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 253 (2010).

Apoballis grandiflora (Alderw.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 253 (2010).

Apoballis hastifolia (Hallier f. ex Engl.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 253 (2010).

Apoballis javanica (Engl.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 253 (2010).

Apoballis longicaulis (Ridl.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 254 (2010).

Apoballis mutata (Hook.f.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 254 (2010).

Apoballis okadae (M. Hotta) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 254 (2010).

Apoballis ovata (Schott) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 254 (2010).

Apoballis rupestris (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 254 (2010).

Apoballis sagittifolia (Alderw.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51: 254 (2010).

Aridarum Ridl., J. Bot. 51: 201 (1913); Boyce & Wong, Gard. Bull. Singapore 65(1): 1 (2013) & Aroideana 38: 60 (2015) &

Aroideana 40: 15 (2017); Low et al., Webbia 72(2): 24 (2018).

Type: *Aridarum montanum* Ridl. **Figure 2.**

Diagnostic characters — *Aridarum* has paired stamens with thecae horns on the distal and proximal ends (with respect to spadix axis) of anther, thecae bases occupying the entire upper part of the anther, an umbonate (not excavated) connective, basal placentation, a free ligular petiolar sheath, erect splash-cup dispersal and seeds with a short micropylar extension.

Distribution — Endemic on Borneo, occurring in southwestern and central Sarawak and northwestern Kalimantan Barat west of the Rejang basin and north of the Kapuas River.

Ecology — Obligate rheophytes on shale, sandstone or basalt waterfalls and cascades under perhumid to very wet lowland forest.

Aridarum chamaesyce S.Y. Wong & P.C. Boyce, Aroideana. 40: 20 (2017).

Type: Malaysian Borneo, Sarawak, Sarikei, Ulu Sarikei, Wong Ruan, 27 Dec 2012, P.C. Boyce & S.Y. Wong AR-4100 (holo SAR spirit!; iso SAR spirit!).

Aridarum incavatum H. Okada & Y. Mori, Acta Phytotax. Geobot. 51: 1 (2000).

Type: Indonesian Borneo, Kalimantan Barat, Singkawang, Sanggau Ledo, Dawar

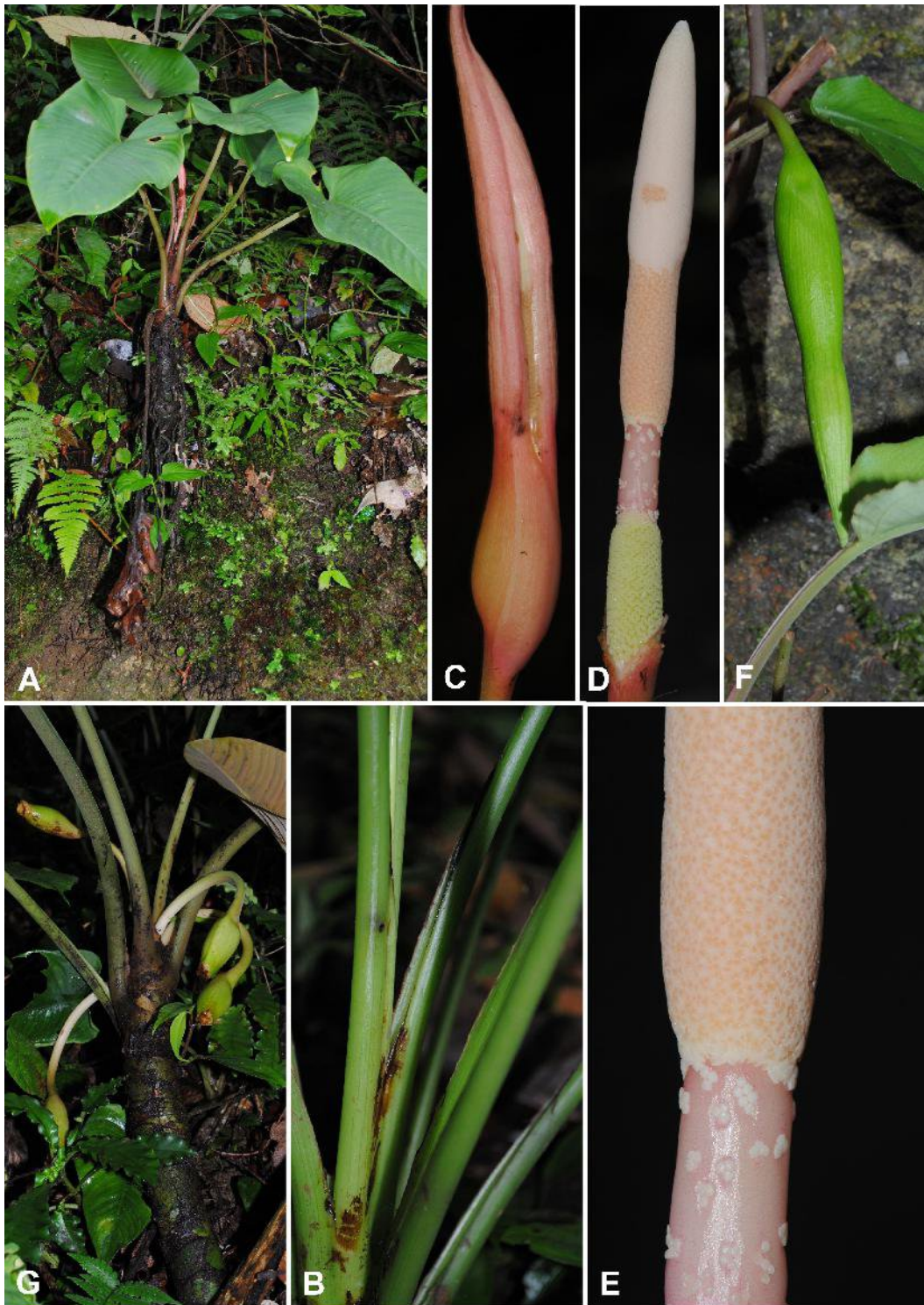


Figure 1. *Apoballis mutata* **A.** Plant in habitat. **B.** Petiole with fully attached persistent petiolar sheaths. **C.** Inflorescence at pistillate anthesis, note that spathe limb hardly opens. **D.** Spadix at pistillate anthesis. **E.** Diagnostic inflated and almost naked interstice, and staminate flower zone. **F.** Post anthesis inflorescences. **G.** Mature infructescences with diagnostic persistent spathe limb. A, C–E & G from AR-3595; B from AR-3587; F from AR-3573.

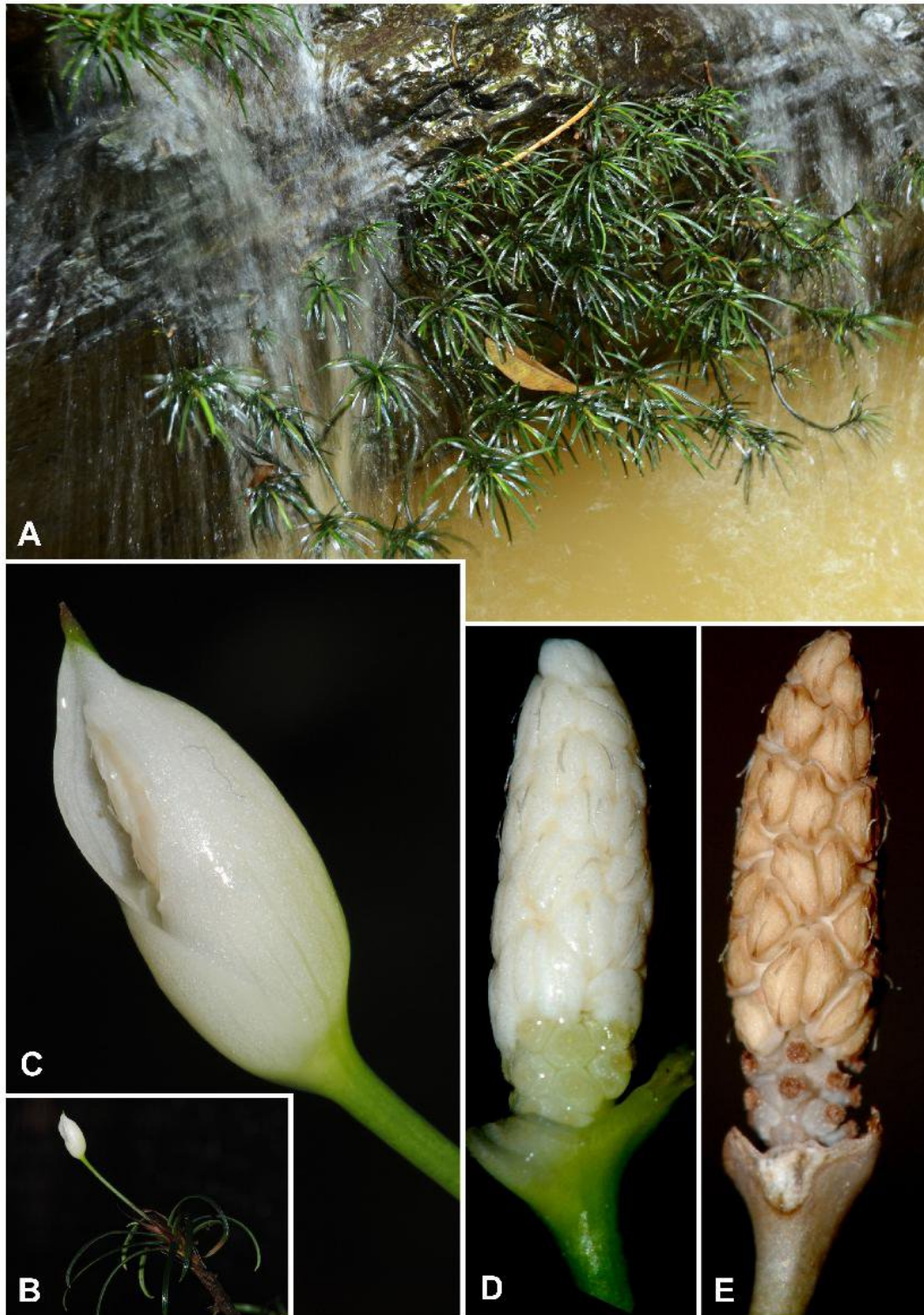


Figure 2. *Aridarum chamaesyce*. **A.** Plants in habitat on shale waterfall. **B.** Flowering shoot; note conspicuous ligules, and netted fibre covering naked stem **C.** Inflorescence at pistillate anthesis, with spathe gaping. **D.** Spadix, with spathe artificially removed; note convex connective and very long setiform extension to thecae. **E.** Alcohol-preserved spadix. All from AR-3728.

Village, Sg. Pisak, 15 Dec 1991, *M. Kato et al.* 30486 (holo T!; iso BO!).

Aridarum montanum Ridl., J. Bot. 51: 201, Pl. 527 (1913). Type: Malaysian Borneo, Sarawak, Kuching, Santubong, Oct 1909, *C.J. Brooks 1035* (holo BM!).

Aridarum pendek S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana*, 37: 21 (2014).

Type: Malaysian Borneo, Sarawak, Kapit, Batang Baleh, Nanga Suptai, 29 May 2013, *P.C. Boyce & S.Y. Wong AR-4163* (holo SAR spirit!).

Bakoa P.C. Boyce & S.Y. Wong, *Bot. Stud.* (Taipei) 49: 398 (2008) & *Aroideana* 38: 66 (2015); Low et al., *Webbia* 72(2): 26 (2018). Type: *Bakoa lucens* (Bogner) P.C. Boyce & S.Y. Wong (\equiv *Hottarum lucens* Bogner, *Piptospatha lucens* (Bogner) Bogner & A. Hay). **Figure 3.**

Diagnostic characters — *Bakoa* has the spadix almost fully adnate dorsally to spathe, fertile staminate flowers restricted to a small ventral zone coincidental with the area exposed by the slightly gaping spathe during anthesis, with the majority of staminate flowers sterile, verrucose pollen grains, a spathe fully persistent until fruit dispersal, basal placentation, seeds with a blunt micropyle and fruits maturing to a caryopsis.

Distribution — Borneo, western Sarawak, endemic to Bako National Park, Kuching.

Ecology — Obligate rheophytes on exposed Miocene sandstone waterfalls among kerangas forest.

Bakoa lucens (Bogner) P.C. Boyce & S.Y. Wong, *Bot. Stud.* (Taipei) 49: 399 (2008); Low et al., *Webbia* 72(2): 26 (2018).

Hottarum lucens Bogner, *Pl. Syst. Evol.* 142: 49 (1983).

Piptospatha lucens (Bogner) Bogner & A. Hay, *Telopea* 9: 217 (2000).

Type: Malaysian Borneo, Sarawak, Kuching, Bako National Park, Sg. Tajor, 19 Sep 1978, *J. Bogner 1439* (holo K!; iso K!, M!, US!).

Bakoaella S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 27 (2018).

Type: *Bakoaella nakamotoi* (S.Y. Wong) S.Y. Wong & P.C. Boyce (\equiv *Bakoa nakamotoi* S.Y. Wong). **Figure 4.**

Diagnostic characters — *Bakoaella* is defined by a staminate flower zone fertile almost to tip, berries dehiscent from base, with the pericarp tearing into irregular segments that curl acroscopically to release the pericarp from its spadix attachment point and expose the seeds.

Distribution — *Bakoaella* is confined to Kalimantan Barat, south of the Kapuas. The two described species occur in restricted localities little more than 100 km apart, although on differing geology with

Bakoella sicula (S.Y. Wong) S.Y. Wong & P.C. Boyce growing on Cretaceous granites of the Schwaner Mountains, while *B. nakamotoi* (S.Y. Wong) S.Y. Wong & P.C. Boyce is restricted to Oligocene sandstones of the Kapuas river valley.

Ecology — Obligate rheophytes on sandstone or granite waterfalls under tropical moist lowland to lower hill forest.

Bakoella nakamotoi (S.Y. Wong) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 28 (2018).

Bakoella nakamotoi S.Y. Wong, *Malayan Nat. J.* 64: 111 (2012).

Type: Indonesian Borneo, Kalimantan Barat, Sanggau, 1 Jul 1968, *A. Elsenner* 164 (holo L!; iso BO!).

Bakoella sicula (S.Y. Wong) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 28 (2018).

Bakoella sicula S.Y. Wong, *Aroideana* 36: 4 (2013).

Type: Indonesian Borneo, Kalimantan Barat, Sekadai, Melawi, 115 km south of Nanga Pinoh, 22 May 2012, *K. Nakamoto AR-3953* (holo BO spirit!).

Bidayuha S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 28 (2018).

Type: *Bidayuha crassispatha* S.Y. Wong & P.C. Boyce. **Figure 5.**

Diagnostic characters — *Bidayuha* has the distal quarter of the spadix composed of fully developed but sterile (no pollen produced) staminate flowers, a spathe limb with a thick waxy/oily texture, pistillate flower zone equalling the width of rest of spadix, basal placentation, a persistent lower spathe splitting basiscopically at fruit maturity, pollen in fine strings and seeds with a conspicuous micropylar appendage.

Distribution — Borneo, known only from the headwaters of the Batang Kayang, Kuching, northwestern Sarawak.

Ecology — Rheophytic on exposed Paleogene sandstone waterfalls in lowland perhumid forest.

Bidayuha crassispatha S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 28 (2018).

Type: Malaysian Borneo, Sarawak, Kuching, Lundu, Batang Kayang, Ulu Batang Kayang, 17 Jun 2012, *P.C. Boyce, S.Y. Wong & Jepom anak Tisai AR-3976* (holo SAR!; iso SBC).

Bucephalandra Schott, *Gen. Aroid.*: t. 56 (1858); Beccari, *Bull. Reale Soc. Tosc. Ort.* 4: 179 (1879); Bogner, *Aroideana* 3: 134. (1980) & *Pl. Syst. Evol.* 145: 159 (1984); Boyce et al., *Bot. Mag.* 12: 150 (1995); Mayo et al., *The Genera of Araceae* 189, Pl. 52 (1997); Boyce et al., *Aroideana* 33: 41 (2010); Bogner & Hay, *Telopea* 9: 195–198 (2000); Boyce & Wong, *Webbia* 67: 139 (2012); Wong & Boyce, *Newslett. Int. Aroid Soc.* 35(2): 11 (2013); Boyce & Wong,



Figure 3. *Bakoia lucens*. **A.** Plants in habitat, Bako N.P. **B.** Plant with inflorescence at onset of pistillate anthesis. **C.** Inflorescence at pistillate anthesis; note spathe barely opens. **D.** Inflorescence, spathe artificially removed, showing that most of dorsal side of spadix is adnate to spathe.

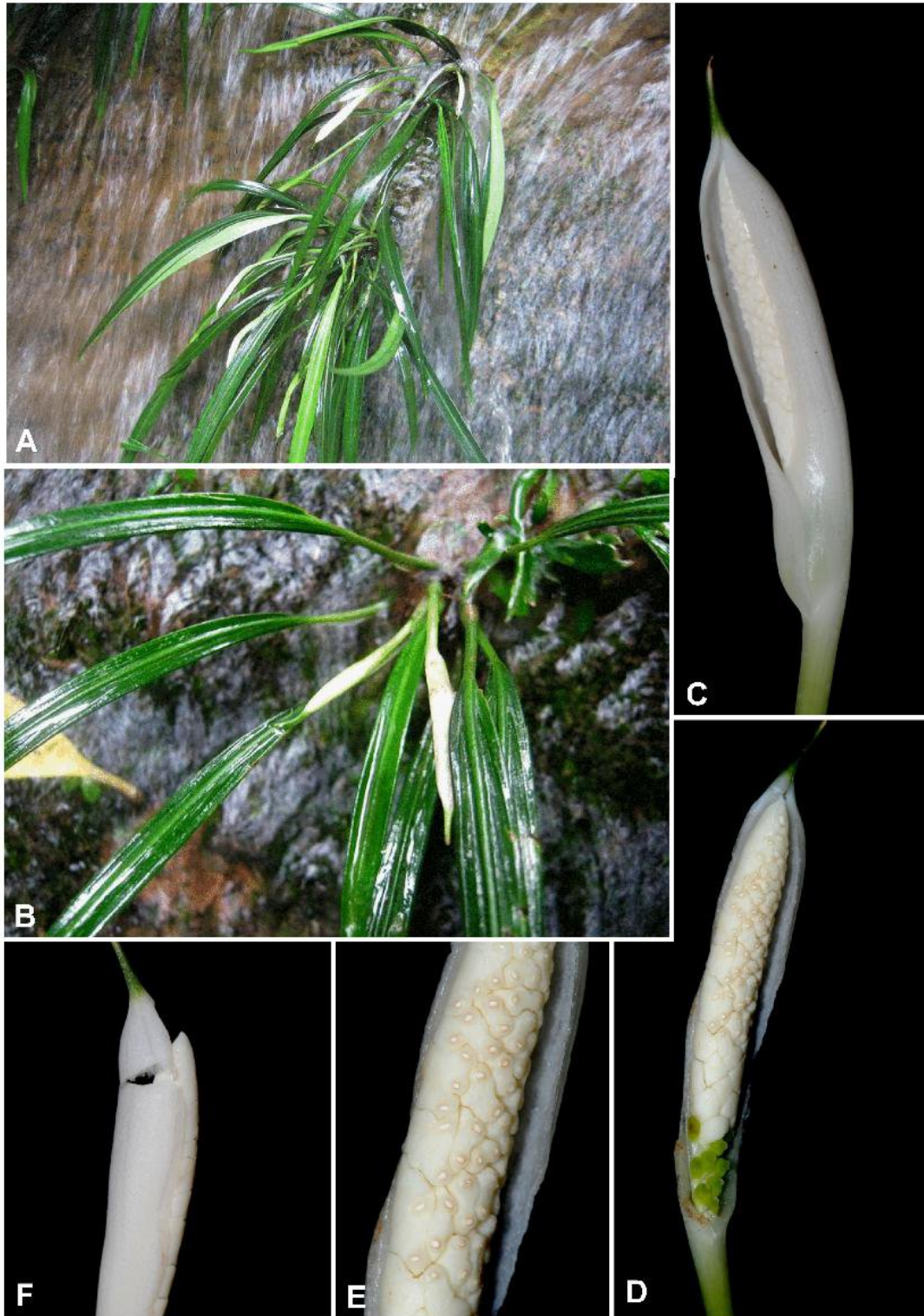


Figure 4. *Bakoella nakamotoi* **A & B.** Flowering plants in habitat; Note pendent habit and leaf blade prominent marginal vein. **C.** Inflorescence at pistillate anthesis. **D.** Inflorescence at pistillate anthesis, nearside part of spathe artificially removed to reveal spadix; note stamens with annulate pores and lax pistils. **E.** Detail of staminate flowers; note annulate pore. **F.** Spathe artificially broken to show extent of spadix adnation to spathe All from AR-3663.

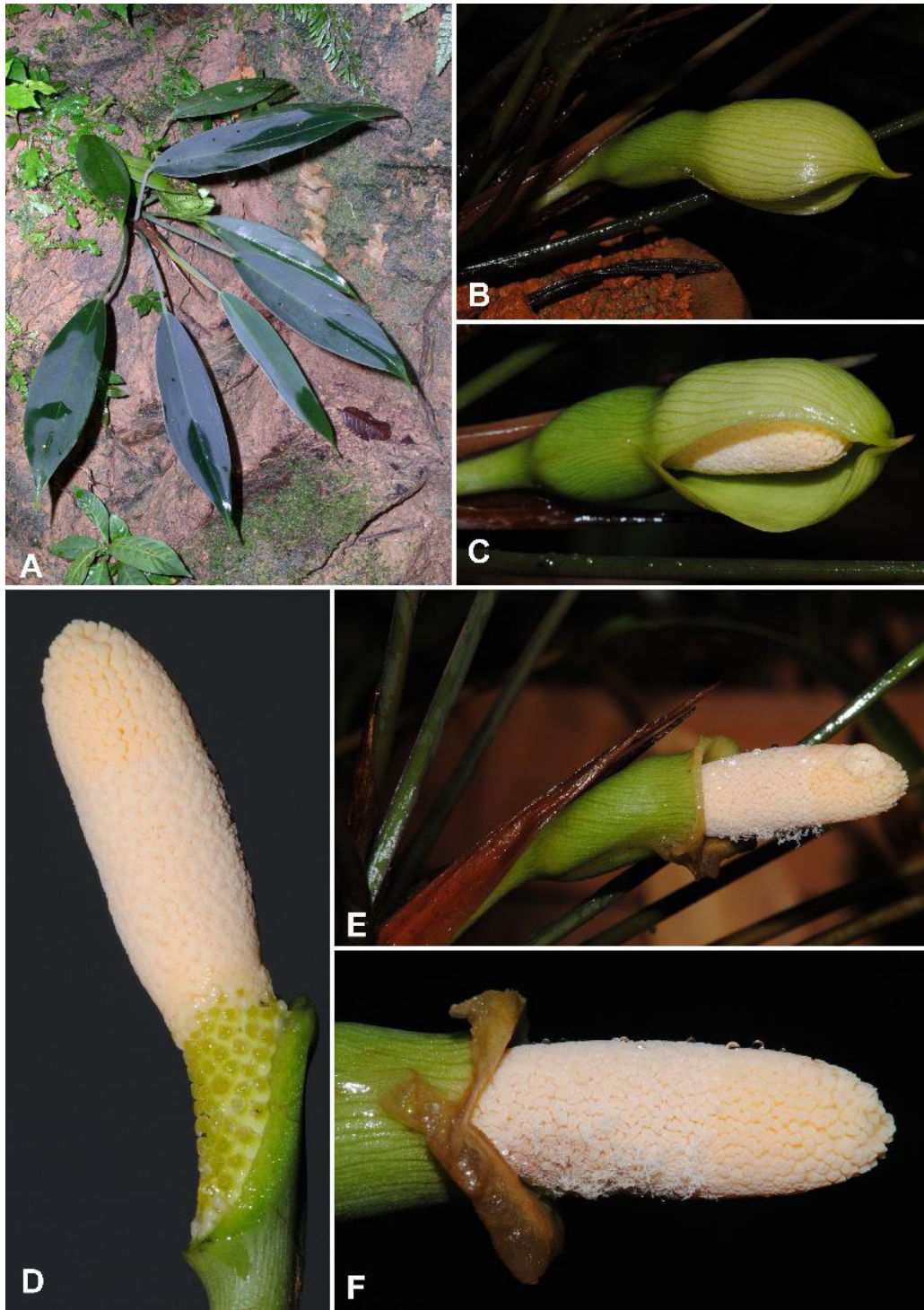


Figure 5. *Bidayuba crassispatha*. **A.** Plants in habitat, shale riverbank. **B & C.** Inflorescence at onset of pistillate anthesis. **D.** Inflorescence at onset of staminate anthesis, spathe artificially removed; differentiation of staminate flowers (paler, shedding pollen) and appendix staminodes (darker, no pollen released) is readily seen. **E.** Inflorescence late staminate anthesis, with spathe limb shed. **F.** Inflorescence late staminate anthesis; pollen is clearly visible; note collar of deliquesced tissue remaining after fall of spathe limb. All from AR-3976.



Figure 6. *Bucephalandra pygmaea*. **A.** Extensive population in habitat on shales. **B.** Detail of plants, middle specimen in early fruit. **C.** Detail of fruiting, spathe limb has been shed to leave persistent funnel-form lower spathe; note that shield-shaped staminodes have become green and persist to protect developing fruits, spent portion of spadix has fallen. All from unvouchered field images.

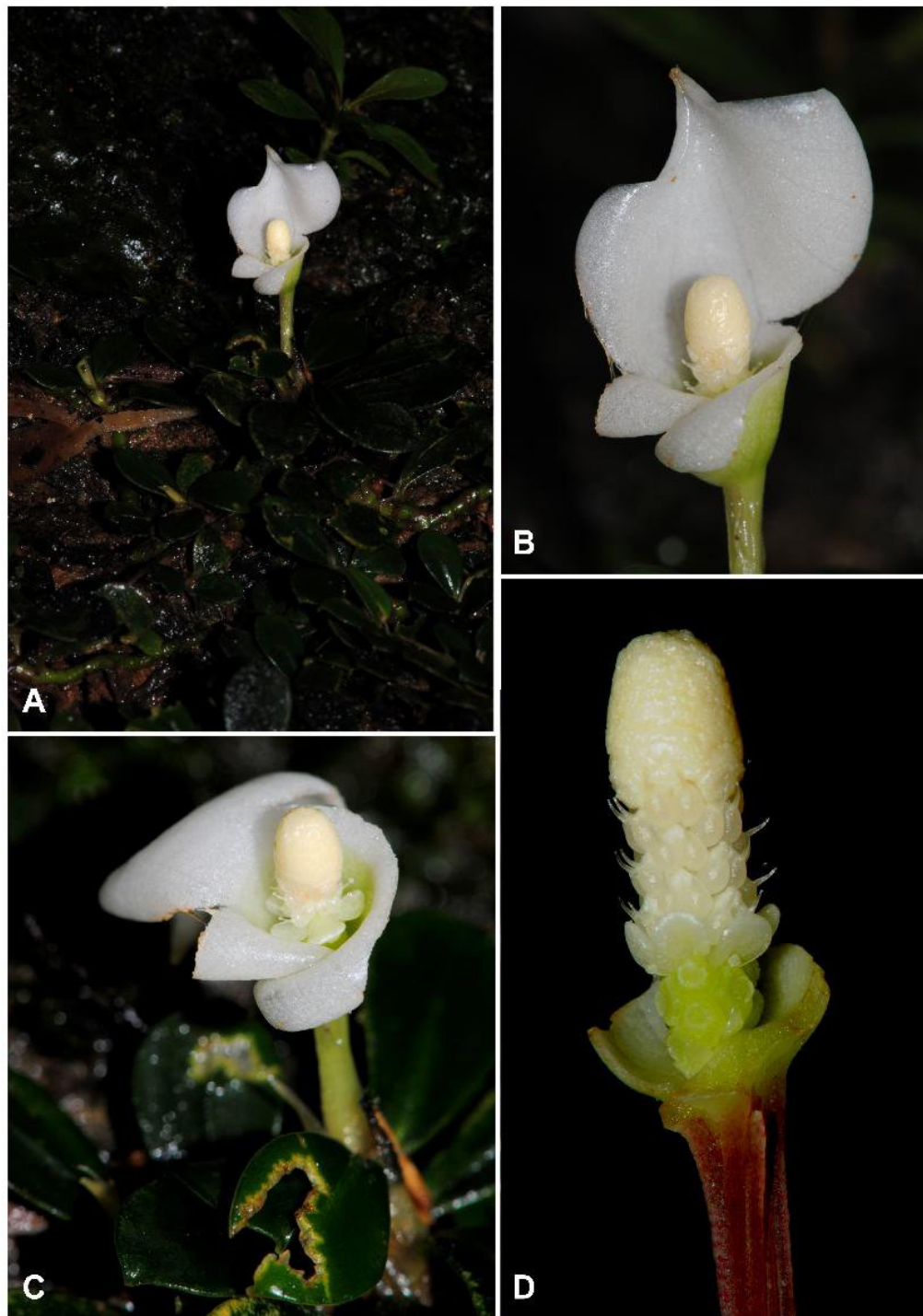


Figure 7. *Bucephalandra pygmaea*. **A.** Flowering plant in habitat on shale. **B.** Close up of inflorescence at late pistillate anthesis; note that spathe limb is beginning to shed; long thecae horns are clearly visible just below appendix. **C.** Flowering plant at onset of staminate anthesis; spathe limb has reflexed and is nearly completely detached; note that shield-shaped staminodes have reflexed to close access to pistillate flowers. **D.** Spadix at pistillate anthesis, spathe artificially removed; note shield-shaped staminodes are still erect. All from *AR-3632*.

Willdenowia 44: 149 (2014) & 44: 415 (2014) & Aroideana 38: 68 (2015); Wong & Boyce, Aroideana 39(2): 56 (2016); Low et al., Webbia 72(2): 30 (2018).

Type: *Bucephalandra motleyana* Schott.
Figures 6 and 7.

(=) *Microcasia* Becc., Bull. Reale Soc. Tosc. Ort. 4: 180, Figure 8 (1879); Engl. in A. & C. DC., Monogr. Phanerogam. 2: 299 (1879) & in Becc., Malesia 1: 290, t. 22, Figures 21–24 & t. 25, Figures 2–8 (1883); N.E. Br., Gen. Pl. 3(2): 986 (1883); Engl., Nat. Pflanzenfam. 2(3): 132, Figure 85 (1889); Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 183 (1905); Engl., Pflanzenr. 55(IV.23Da): 128, Figure 77 (1912); Hotta, Mem. Coll. Sci. Univ. Kyoto, Ser. B, 32: 20–22, Figure 1 (1965). Type: *Microcasia pygmaea* Becc. (\equiv *Bucephalandra pygmaea* (Becc.) P. C. Boyce & S. Y. Wong).

Distribution — Endemic on Borneo; most species restricted in distribution and all geologically obligated.

Ecology — Obligate, very seldom facultative, rheophytes on stream and riverside rocks in lowland to lower montane perhumid to moist tropical forest.

Bucephalandra akantha S.Y. Wong & P.C. Boyce, Willdenowia 44: 151 (2014).

Type: Malaysian Borneo, Sarawak, Kuching, Padawan, Annah Rais, Kampung Sadir, Air Terjun Sadir, 6 Apr 2012, P.C. Boyce et al. AR-3863 (holo SAR!; iso SBC!, SING!).

Bucephalandra aurantiithecata S.Y. Wong & P.C. Boyce, Willdenowia 44: 153 (2014). Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Nanga Taman, southeast of Manterahidup, 22 May 2012, K. Nakamoto AR-3937 (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra belindae S.Y. Wong & P.C. Boyce, Willdenowia 44: 155 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Melawi, Nanga Pinoh, 33 km south of Nanga Pinoh and 11 km before Kotabaru junction of logging road to Kalimantan Tengah, 3 Feb 2012, K. Nakamoto AR-3531 (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra bogneri S.Y. Wong & P.C. Boyce, Willdenowia 44: 157 (2014).

Bucephalandra motleyana sensu Bogner, Aroideana 3: 134 (1980), non Schott (1858).

Bucephalandra motleyana sensu Boyce, Bot. Mag. 12: 131, Pl. 272 (1995), non Schott (1858).

Type: Malaysian Borneo, Sarawak, Kuching, Penrissen Road, 18 miles south of Kuching,

on rock along the Sungai Retien, 7 Sep 1978, *J. Bogner 1366* (holo M!; iso K!, US!).

Bucephalandra catherineae P.C. Boyce, Bogner & Mayo, *Bot. Mag.* 12: 152 (1995).

Type: Indonesian Borneo, Kalimantan Utara, Malinau, Kayan Hulu, Apo Kayan, east of Long Nawan, Gunung Sungai Pandan, eastern ridge, 14 Oct 1991, *E.F. de Vogel & P.J. Cribb 9210* (holo L!; iso K – spirit coll. no. 57575!).

Bucephalandra chimaera S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 159 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Nanga Taman, environs of Nanga Taman, 4 Apr 2012, *K. Nakamoto AR-3846* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra chrysokoupa S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 161 (2014).

Type: Indonesian Borneo, Kalimantan Utara, Nunukan, Mentarang Hulu, Long Berang, 18 Jun 2012, *K. Nakamoto AR-3977* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra diabolica S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 163 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Melawi, Sayan, Bukit Baka-Bukit Raya National Park, Bukit Baka, 1 Sep 2012, *M. Lo AR-4027* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra elliptica (Engl.) S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 165 (2014).

Microcasia elliptica Engl., *Bull. Reale Soc. Tosc.ortic.* 4: 299 (1879).

Type: Malaysian Borneo, Sarawak, Nov 1866, *O. Beccari p.b. 2817* (holo FI-B!).

Bucephalandra filiformis S.Y. Wong & P.C. Boyce, *Aroideana* 39E: 57 (2016).

Type: Malaysian Borneo, Sarawak, Limbang, Lawas, Maligan Range, Air Terjun Payeh Maga, below Camp 2, 9 Sep 2014, *P.C. Boyce et al. AR-4915* (holo SAR spirit!).

Bucephalandra forcipula S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 167 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Nanga Taman, southeast of Nanga Taman, Gunung Tajam, eastern slope, 5 Feb 2012, *K. Nakamoto AR-3772* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra gigantea Bogner, *Pl. Syst. Evol.* 145: 159 (1984); Bogner & Hay, *Telopea* 9: 196 (2000). Type: Indonesian Borneo, Kalimantan Timur ('Central East Borneo'), Kutai Barat ('W. Koetai'), Kiau River, 25 Oct 1925, *F. H. Endert 4580* (holo K!; iso BO!, L!).

Bucephalandra goliath S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 169 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Melawi, Nanga Pinoh, Jalan 28, 8 km east of Kampong Nyangai, Landau Garong, logging road 25 km south of Nanga Pinoh, Ulu Sungai Reret and Ulu Sungai Sentulang, 16 Oct 2012, *K. Nakamoto AR-4040* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra kerangas S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 171 (2014).

Type: Malaysian Borneo, Sarawak, Samarahan, Simumjan District, Sebuyau, logging road at Sabal, 7 Feb 1995, *Runi ak Pungga et al. S.71313* (holo SAR!; iso KI, KEP!, LI, MO!, SAN).

Bucephalandra kishii S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 173 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Melawi, Nanga Taman, Kampung Entebah, Gunung Saran, 25 Aug 2012, *K. Nakamoto AR-4019* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra magnifolia H. Okada & Y. Mori, *Acta Phytotax. Geobot.* 51: 4 (2000).

Type: Indonesian Borneo, Kalimantan Utara ('East Kalimantan'), Nunukan ('Bulungan'), Krayan, Long Bawan, Gunung Malim, 11 Sep 1990, *H. Okada & D. Komara 5024* (holo TII!; iso BO!).

Bucephalandra micrantha S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 415 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sintang, Sepauk, Kayu Lapis, village at km 46 on road to southeast of Kayu Lapis, 10 Dec 2012, *H. Kishi AR-4080* (holo BO spirit!; iso SAR spirit!).

Bucephalandra minotaur S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 175 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sekadau/ Melawi regencies boundary, 115 km south of Nanga Pinoh, 22 May 2012, *K. Nakamoto AR-3951* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra motleyana Schott, *Gen. Aroid.* t. 56 (1858) & *Prodr. Syst. Aroid.* 319 (1860); *Engl. in A. & C. DC., Monogr. Phanerogam.* 2: 354 (1879) & *Nat. Pflanzenfam.* 2: 132 (1889) & *Pflanzenr.* 55 (IV.23Da): 122 (1912); *Bogner & Hay, Telopea* 9: 196 (2000); Wong & Boyce, *Willdenowia* 44: 177 (2014).

Type: Indonesian Borneo, Kalimantan Selatan (?), *J. Motley 404* (holo KI).

Bucephalandra muluensis (M. Hotta) S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 177 (2014).

Microcasia muluensis M. Hotta, *Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol.* 32(1): 20 (1965).

Type: Malaysian Borneo, Sarawak, Miri ('4th Divn'), along Sungai Payau from Sungai Melinau Paku to Rubang Payau, foot of

Gunung Mulu, 22 Mar 1964, *M. Hotta* 15329 (holo KYO!).

Bucephalandra oblanceolata (M. Hotta) S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 179 (2014).

Microcasia oblanceolata M. Hotta, *Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol.* 32: 21 (1965).

Type: Brunei Darussalam, Temburong Prov., vicinity of Labu, Bukit Peradayan, 25 Jan 1964, *M. Hotta* 13586 (holo KYO!; iso L!, SAR!).

Bucephalandra oncophora S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 181 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Nanga Taman, nickel mine, 22 May 2012, *K. Nakamoto* AR-3932 (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra pubes S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 181 (2014). Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Sekadau, 3 Feb 2012, *K. Nakamoto* AR-3760 (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra pygmaea (Becc.) S.Y. Wong & P.C. Boyce, *Webbia* 67(2): 142 (2012).

Microcasia pygmaea Becc., *Bull. Reale Soc. Tosc. Ort. 4*: 180 (1879); Engl. in Becc., *Malesia* 1: 290, t. 22, f. 21–

24 (1883) & *Nat. Pflanzenfam.* 2(3): 132, Figure 85. (1889) & *Pflanzenr.* 55(IV.23Da): 128, Figure 77A–D (1912).

Type: Malaysian Borneo, Sarawak, Sarikei, Julau, Sungai Entabai, 28 Oct 1867 (annotated on FI-B sheet), or Sep 1867 (annotated on B sheet, and stated in Beccari 1879), or 26 Oct 1867 (stated in Beccari 1902, 1904), *O. Beccari p.b. 3883* (holo FI-B!; iso B!).

Bucephalandra sordidula S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 184 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Melawi, Nanga Pinoh, 33 km south of Nanga Pinoh and 11 km before Kotabaru junction of logging road to Kalimantan Tengah, 16 Oct 2012, *K. Nakamoto* AR-4042 (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra spathulifolia Engl. ex S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 417 (2014). Type: 'Borneo, Exp. Nieuwenhuis, 1898–1899', Soengai Boeleng [?Sungai Boeloengan = Sungai Kajan, see Nieuwenhuis 1900, p. 262], 28 Oct. 1898, *Amdjah* 127 (holo BO 1563010!).

Bucephalandra tetana S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 186 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sintang, Serawai, Gunung Alat, north of Nanga Serawai and 120 km east of

Nanga Pinoh, 17 May 2013, *K. Nakamoto AR-4146* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra ultramafica S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 188 (2014). Type: Malaysian Borneo, Sabah, Sandakan, Kinabatangan, Telupit, Gunung Tawai, 18 Dec 2012, *M. Lo AR-4094* (holo SAN!; iso SAR!, SBC!, SING!).

Bucephalandra vespula S.Y. Wong & P.C. Boyce, *Willdenowia* 44: 190 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Sekadau Hilir, Kayu Lapis, south of Kayu Lapis, 20 Sep 2011, *K. Nakamoto AR-3664* (holo BO!; iso SAR!, SBC!, SING!).

Bucephalandra yengiae P.C. Boyce, *Willdenowia*, 44: 192 (2014).

Type: Indonesian Borneo, Kalimantan Timur, Kutai Kartanegara, Tabang, 17 Oct 2012, *K. Nakamoto AR-4050* (holo BO!; iso SAR!, SBC!, SING!).

Burttianthus S.Y. Wong S.L. Low & P.C. Boyce, *Webbia* 72(2): 36 (2018).

Type: *Burttianthus caulescens* (M. Hotta) S.Y. Wong & P.C. Boyce (\equiv *Aridarum caulescens* M. Hotta). **Figure 8.**

(\equiv) *Aridarum* Sect. *Caulescentia* M. Hotta

Diagnostic characters — *Burttianthus* is defined by glabrous or pubescent staminate flowers arranged in longitudinally aligned pairs, anthers with a deeply excavated connective, thecae paired together on the inner (with respect to the stamen pairs) side of the anther, short to medium-length needle-like thecae extensions overhanging the excavation, pollen produced in long strings, basal placentation, seeds with a pronounced micropylar appendage, and splash-cup dispersal. Leaf blades have a pronounced midrib with two main lateral veins arising from the blade-petiole insertion and running along the blade margin, with all other venation obscure. *Burttianthus* is unique in the Schismatoglottideae by needle-like thecae extensions producing pollen strings.

Distribution — Central and northeastern Sarawak and Brunei.

Ecology — Boulders or waterfalls on various geologies (each species is geologically restricted) under perhumid to very wet lowland to lower montane forest.

Burttianthus caulescens (M. Hotta) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 36 (2018).

Aridarum caulescens M. Hotta, *Mem. Coll. Sci. Univ. Kyoto, Ser. B*, 32: 25 (1965).

Type: Malaysian Borneo, Sarawak, Bintulu, eastern ridge of Bt. Kana, on wet sandstone

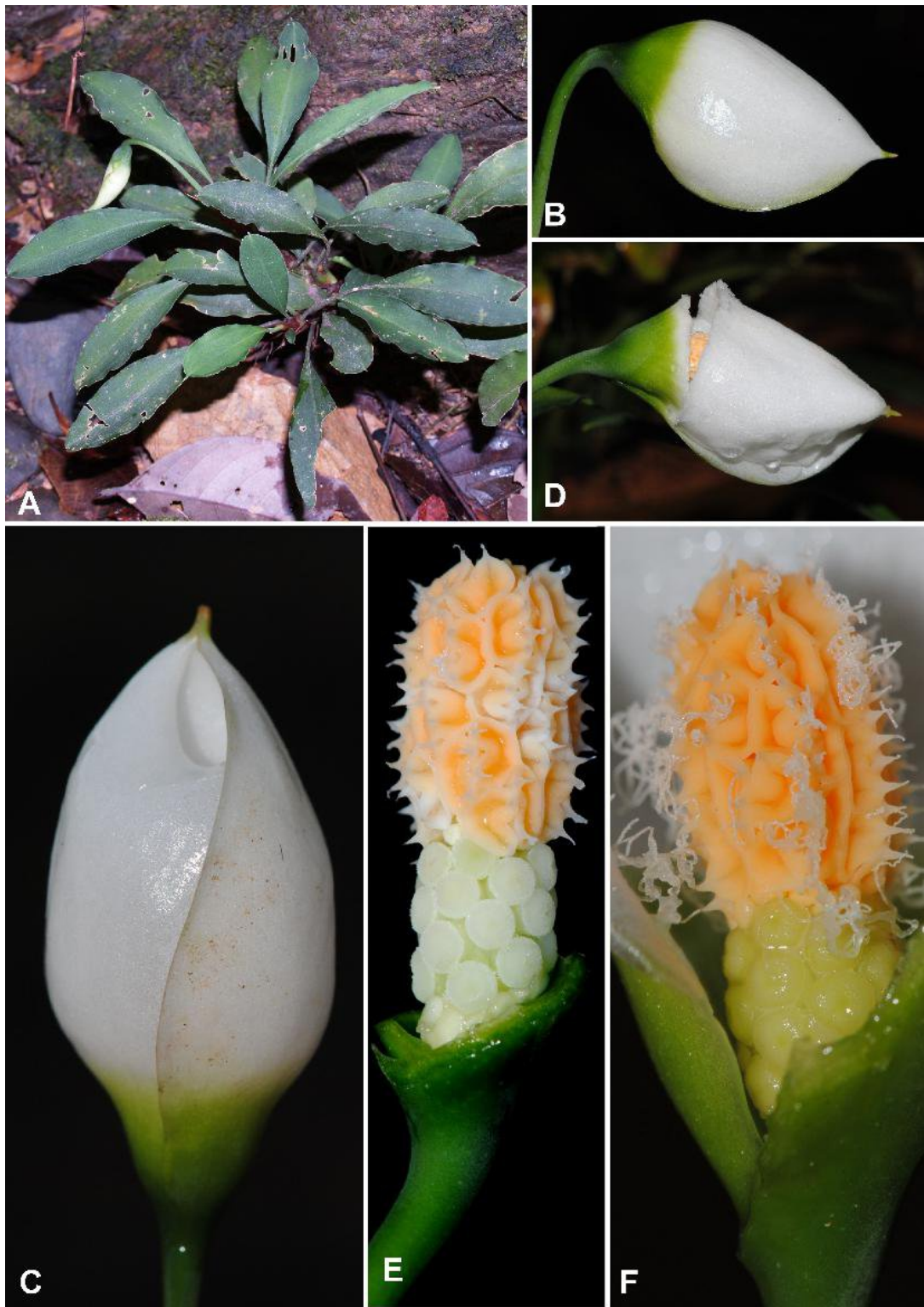


Figure 8. *Burttianthus purseglovei*. **A.** Plants in habitat, shale riverbank. **B & C.** Inflorescence during pistillate anthesis. **D.** Inflorescence at onset of staminate anthesis, spathe beginning to shed naturally. **E.** Spadix at pistillate anthesis, spathe artificially removed. **F.** Spadix at staminate anthesis, spathe artificially removed; note pollen strings. All from *AR-1977*.

forming steep cliff in open forest, 20 Nov 1963, *M. Hirano* & *M. Hotta* 1468 (holo KYO!; iso L!, SAR!).

Burttianthus hansenii (Bogner) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 37 (2018). *Aridarum hansenii* Bogner, *Blumea* 28: 403 (1983).

Type: Malaysian Borneo, Sarawak, Miri, Gunung Mulu National Park, Camp 3, 14 Mar 1978, *C. Hansen* 451 (holo K!; iso C, M!, SAR!).

Burttianthus longipedunculatus (M. Hotta) S.Y. Wong & P.C. Boyce *Webbia* 72(2): 37 (2018).

Aridarum longipedunculatum M. Hotta, *Mem. Coll. Sci. Univ. Kyoto, Ser. B*, 32: 26 (1965).

Type: Malaysian Borneo, Sarawak, Bintulu, along the valley of Ulu S. Bejangan, eastern part of Bukit Kana, on wet mossy rock in moist dense forest, 21 Nov 1963, *M. Hotta* 15381 (holotype KYO!; isotype L!).

Burttianthus orestus (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 37 (2018).

Aridarum orestum S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 18 (2014).

Aridarum caulescens var. *angustifolium* Bogner & Nicolson, *Aroideana* 2: 119 (1979).

Type: Malaysian Borneo, Sarawak, Miri, Marudi, Ulu Sungai Chipidi, Ulu Tinjar, 12 Aug 1974, *P. Chai* S.34798 (holo K!; iso L!, KEP!, MO!).

Burttianthus purselovei (Furtado) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 38 (2018).

Microcasia purselovei Furtado, *Gard. Bull. Singapore* 17: 276 (1959).

Aridarum purselovei (Furtado) M. Hotta, *Mem. Coll. Sci. Univ. Kyoto, Ser. B*, 32: 25 (1965).

Type: Malaysian Borneo, Sarawak, Bintulu, Tau Range, Sg. Mayeng, 4 Jun 1956, *J.W. Purseglove* P.5344 (holo SING!; iso K!, L!).

Burttianthus spissus (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce *Webbia* 72(2): 38 (2018).

Aridarum spissum S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 47 (2014).

Type: Malaysian Borneo, Sarawak, Limbang, Lawas, Long Spangan, along the Lawas–Dawit road, 15 Feb 2014, *P.C. Boyce* & *S.Y. Wong* AR-4349 (holo SAR spirit!; iso SBC spirit!)

Burtianthus velutandrus (S.Y. Wong, S.L. Low & P.C.Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 38 (2018).

Aridarum velutandrum S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 25. (2014).

Type: Malaysian Borneo, Sarawak, Bintulu, Similajau N.P., Batu Anchau trail, 16 Jul 2006, *P.C. Boyce et al. AR-1915* (holo SAR spirit!).

Colobogynium Schott in *Oesterr. Bot. Z.* 15: 34 (1865); Low et al., *Webbia* 72(2): 38 (2018).

Type: *Colobogynium tecturatum* Schott (\equiv *Schismatoglottis tecturata* (Schott) Engl.). **Figure 9.**

Diagnostic characters — *Colobogynium* has mono(-folia)phyllous modules, a petiolar sheath reduced to a very short thickened collar, with the protective role of the sheath is taken on by the cataphylls which alternate with the foliage leaves, a spathe with marginal and distal parts of spathe limb withering after anthesis, but with remainder persisting well into fruiting, with the persistent spathe protecting the infructescence splitting acroscopically to expose and liberate the ripe berries, and few-seeded fruits with sub-basal placentation.

Distribution — Borneo where widespread (Sarawak, Brunei, northern Kalimantan; not

yet recorded from Sabah); with a disjunct extension to the Riau Archipelago (Sumatera).

Ecology — Mesophytes on a variety of rocks in and by streams and on steep soil banks; occasionally facultatively rheophytic, occurring from sea level to c. 1250 m elevation.

Colobogynium tecturatum Schott, *Oesterr. Bot. Z.* 15: 34 (1865).

For synonymy & typification see Low et al. (2018).

Fenestratarum P.C. Boyce & S.Y. Wong, *Aroideana* 37E(2): 8 (2014); Low et al. *Webbia* 72(2): 40 (2018). Type: *Fenestratarum culum* P.C. Boyce & S.Y. Wong, **Figures 10 & 11.**

Diagnostic characters — *Fenestratarum* is diagnosed by the combination of a nodding inflorescence on a very slender erect peduncle, an unconstricted spathe limb, with the portion equating to the limb having large translucent areas separated by opaque veins, and the portion equating to the lower spathe uniformly opaque, by completely fused lower spathe margins reducing access to the spadix to a narrow opening on the median ventral side of the spathe, thecae in deep pits and lacking thecae horns, sterile appendix staminodes, basal placentation, orthotropous ovules with a beak-like micropylar appendage, funnelform splash-cups held erect by straightening of the distal



Figure 9. *Colobogynium tecturatum*. **A.** Plant in habitat. **B.** Overall view of petiole bases; brown cataphyll surrounding petiole of most recently-emerged leaf is clearly visible. **C.** Inflorescence at late pistillate anthesis; insects are *Colocasiomyia* (Diptera). **D.** Spadix at pistillate anthesis, spathe artificially removed. **E–H** changes in spathe appearance during and post anthesis, E = late pistillate anthesis, F = late staminate anthesis, with spathe limb margins degrading, G & H = mid-way though fruit development, spathe limb margins have fallen and remainder of spathe thickened and persistent. **I.** Spathe at ripe fruiting, splitting from peduncle/spathe insertion, with spathe walls curling acroscopically. A & B from AR-39; C–F from AR-1737; G & H from AR-2075; I from AR-1606.

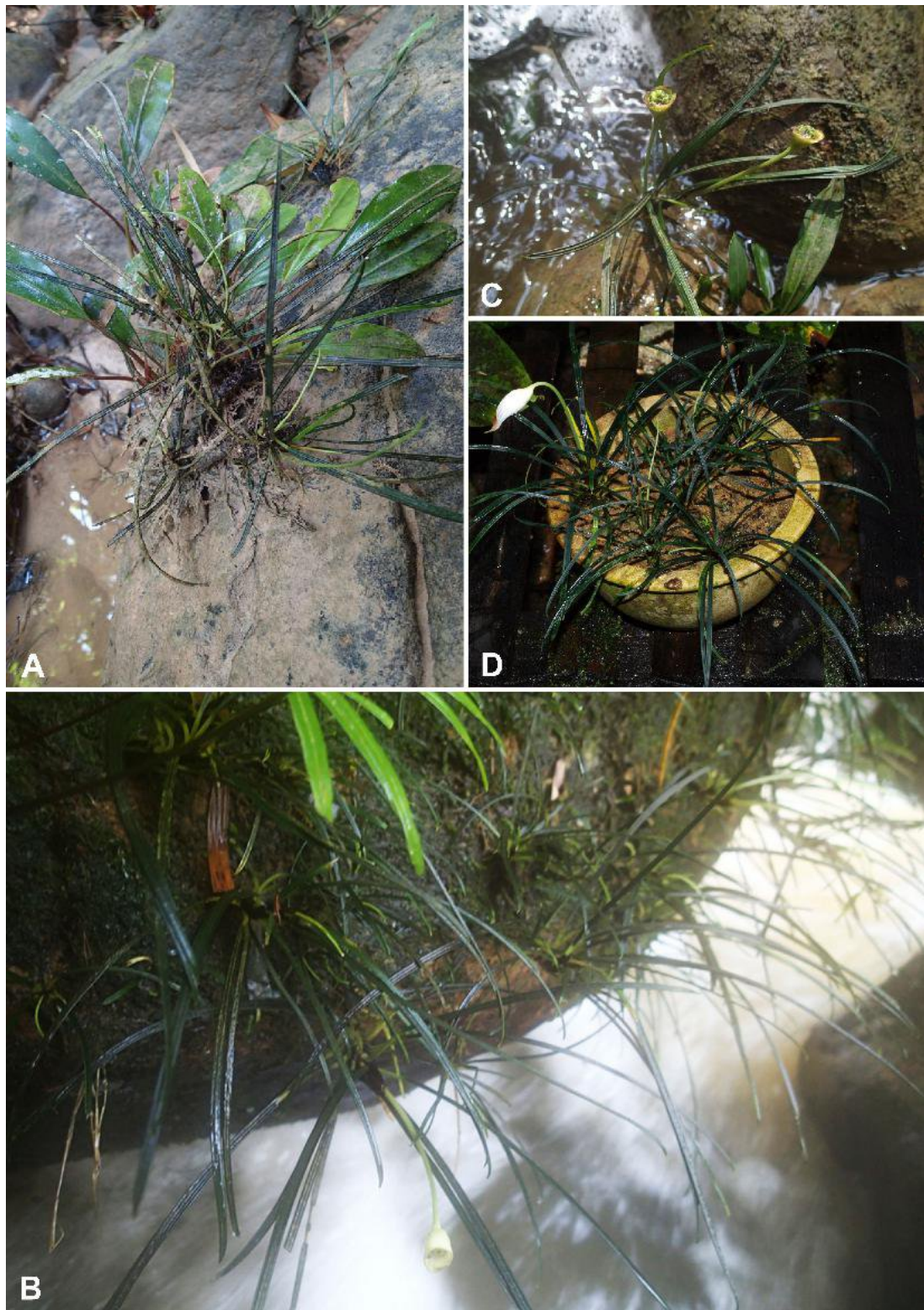


Figure 10. *Fenestratarum culum*. **A, B. & C.** Plants in habitat, Type locality; note post-anthesis inflorescence with spathe limb and spent part of spadix fallen, and erect splash-cups with developing fruits. **D.** Plants in cultivation. All from *AR-4300*.

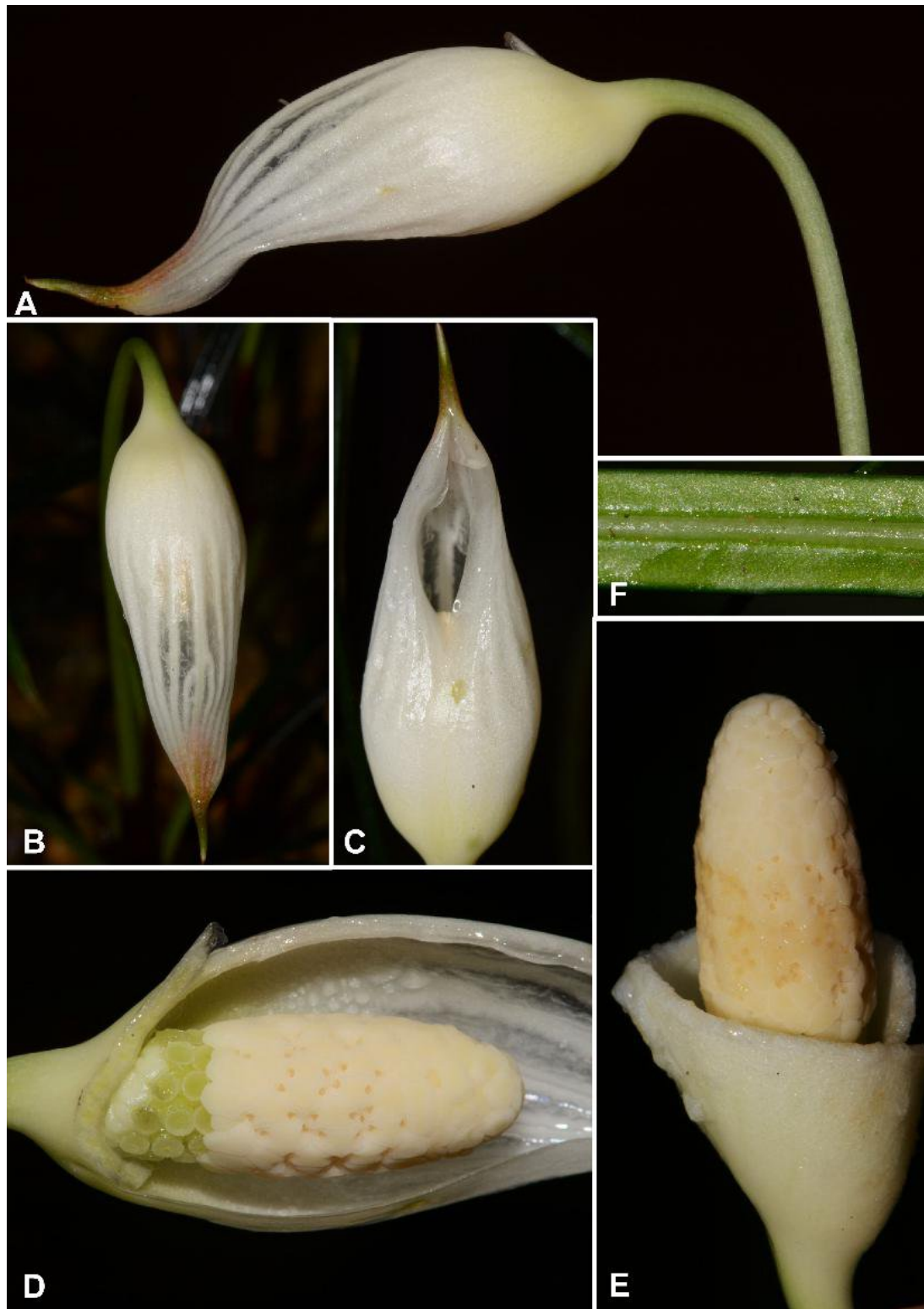


Figure 11. *Fenestratarum culum*. **A–C.** Inflorescence at pistillate anthesis; note lower spathe margins are fused. **D.** Inflorescence at pistillate anthesis, nearside spathe artificially removed. **E.** Inflorescence at late staminate anthesis, caducous part of spathe removed prematurely. **F.** Leaf blade, abaxial view. All from *AR-4300*.

portion of the peduncle, and indehiscent berries. The swollen petiole bases are unique for the tribe.

Distribution — Borneo, one species (*Fenestratarum culum* P.C. Boyce & S.Y. Wong) in west Borneo and another (*F. mulyadii* P.C. Boyce & S.Y. Wong) occurring over 600 km away in east Borneo.

Ecology — *Fenestratarum culum* is rheophytic on riverside Cretaceous sandstone rocks and boulders under open perhumid lowland forest; *Fenestratarum mulyadii* is rheophytic on mossy Neogene basalt river boulders under rather open perhumid lowland forest.

Fenestratarum culum P.C. Boyce & S.Y. Wong, *Aroideana* 37E(2): 8 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Ngabang, Landak, Desa Sungai Durian, Riam Desa Sungai Durian, 1 Nov 2013, *H. Kishi AR-4300* (holo BO!; iso SAR spirit!).

Fenestratarum mulyadii P.C. Boyce & S.Y. Wong, *Aroideana* 38E(2): 5 (2015).

Type: Indonesian Borneo, Kalimantan Timur, Kutai Barat, Laham, Long Ma Au, Sungai Mahakam, *Mulyadi AR-5000* (holo BO!; iso SAR spirit!).

Galantharum P.C. Boyce & S.Y. Wong, *Aroideana* 38E(2): 25 (2015); Low et al., *Webbia* 72(2): 42 (2018). Type: *Galantharum*

kishii P.C. Boyce & S.Y. Wong. **Figures 12 & 13.**

Diagnostic characters — *Galantharum* is diagnosed by the combination of a very strongly nodding (peduncle deflexed almost 180°) powerfully fragrant (vanilla) inflorescence with an unconstricted spathe limb, spadix fertile to the tip, thecae in deep pits and lacking thecae horns, pollen released in oblong packages, basal-annular placentation, orthotropous ovules with a slender micropylar appendage, funnellform splash-cups held erect by straightening of the distal portion of the peduncle, and indehiscent berries.

Distribution — Borneo, Kalimantan Utara, known from a single locality.

Ecology — Growing in large clumps on mud-coated basalt rocks in rather exposed streams in open perhumid lowland forest.

Galantharum kishii P.C. Boyce & S.Y. Wong, *Aroideana* 38E(2): 25 (2015); Low et al., *Webbia* 72(2): 43 (2018). Type: Indonesian Borneo, Kalimantan Utara, Bulungan Regency, Sekatak, 29 May 2013, *Mulyadi AR-4160* (holo BO!; iso SAR spirit!).

Gamogyne N.E. Br., *J. Bot.* 20: 195 (1882); Low et al., *Webbia* 72(2): 43 (2018).

(≡) *Piptospatha* sect. *Gamogyne* (N.E. Br.) M. Hotta.

Type: *Gamogyne burbidgei* N.E. Br. (≡)
Piptospatha burbidgei (N.E. Br.) M.
Hotta). **Figure 14.**

Diagnostic characters — *Gamogyne* is defined by connate pistils, a pistillate flower zone with a conspicuous zone of pistillodes at base, a spadix fertile to the tip, thecae not set in deep pits, parietal placentation, the spathe remaining tubular with an oblique terminal orifice during most of pistillate anthesis, and only inflating at staminate anthesis, by the spathe limb rostrum not reflexing at staminate anthesis and lacking rostral keels, and by roots producing with copious plantlets.

Distribution — Northern central and northeastern Borneo, from northwestern Kalimantan Barat to southwestern Sabah.

Ecology — Obligate rheophytes in shaded to rather bright locations on sandstones or shales, rarely on consolidated mud, under perhumid to moist lowland to upper hill forest.

Gamogyne bella (S.Y. Wong & P.C. Boyce)
S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 45
(2018).

Piptospatha bella S.Y. Wong & P.C.
Boyce, *Aroideana* 39E(2): 62 (2016).

Type: Malaysian Borneo, Bintulu, Tatau,
Sungai Bawang,, 9 May 2012, *M. Lo* AR-
3909 (holo SAR!).

Gamogyne burbidgei N.E. Br., *J. Bot.* 20:
196 (1882).

Piptospatha burbidgei (N.E. Br.) M.
Hotta, *Mem. Coll. Sci. Univ. Kyoto*,
Ser. B, 32: 27 (1965).

Type: Malaysian Borneo, Sabah, Bukit
Sagan, *F.W.T. Burbidge s.n.* (holo K!).

Gamogyne colata (S.Y. Wong & P.C.
Boyce) S.Y. Wong & P.C. Boyce, *Webbia*
72(2): 45 (2018).

Piptospatha colata S.Y. Wong & P.C.
Boyce, *Gard. Bull. Singapore* 65: 9
(2013).

Type: Indonesian Borneo, Kalimantan
Barat, Sekadau, Nangataman, west of
Nangataman, Gunung Canayang east slope,
4 Feb 2012, *K. Nakamoto* AR-3780 (holo
SAR!; iso BO!).

Gamogyne deceptrix (S.Y. Wong & P.C.
Boyce) S.Y. Wong & P.C. Boyce, *Webbia*
72(2): 46 (2018).

Piptospatha deceptrix S.Y. Wong & P.C.
Boyce, *Gard. Bull. Singapore* 65: 14
(2013).

Type: Indonesian Borneo, Kalimantan
Utara, Malinau Selatan, Mentarong village,
near the confluence of Sungai Mentarang
and Sg. Malinau, 18 Jun 2012, *K. Nakamoto*
AR-3980 (holo SAR!; iso BO!).

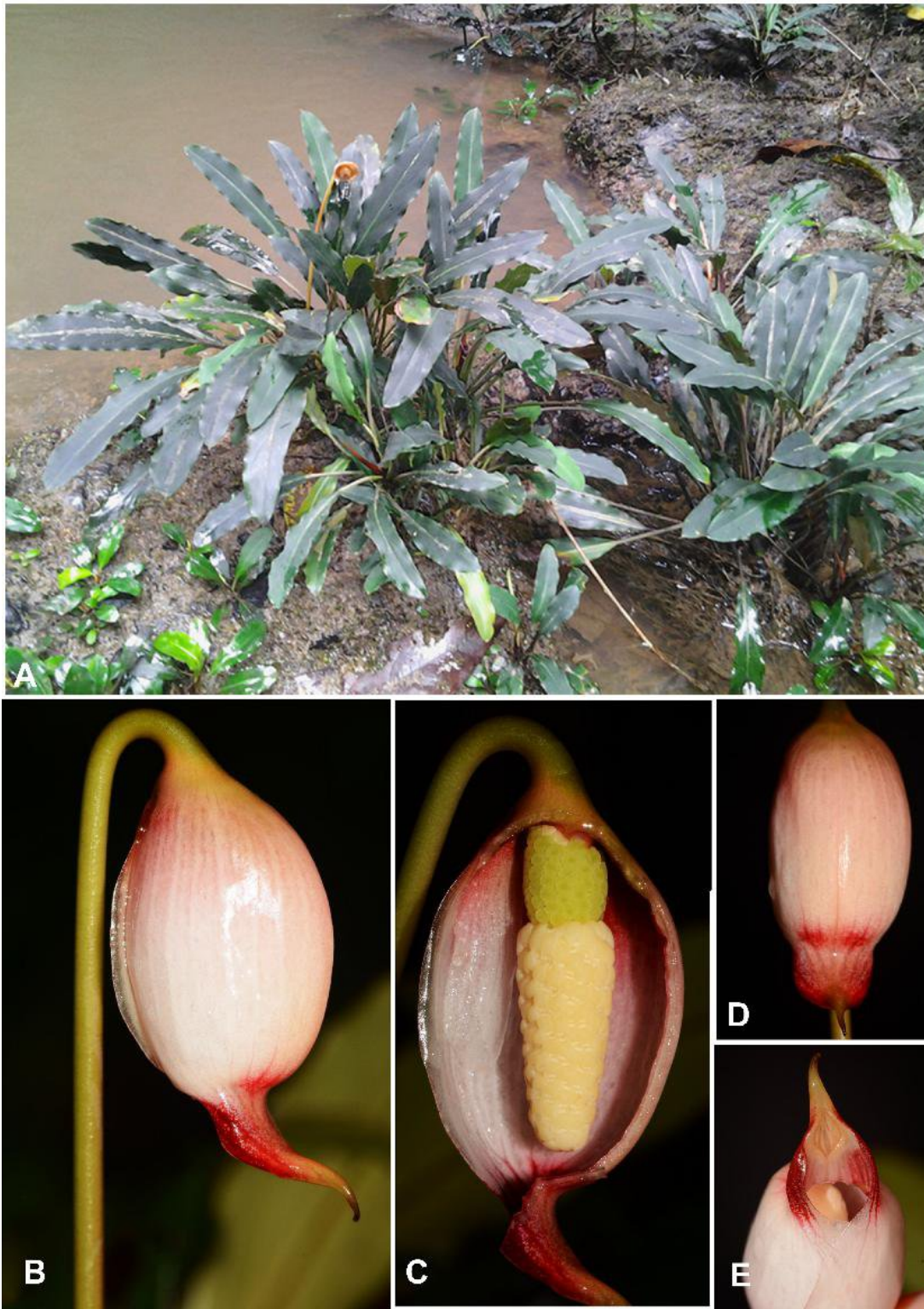


Figure 12. *Galantharum kishii*. **A.** Plants in habitat, Type locality; note post-anthesis inflorescence with spathe limb and spent part of spadix fallen. **B–E.** Inflorescence at pistillate anthesis; note more-or-less straight terminating rostrum. All from AR-4160.

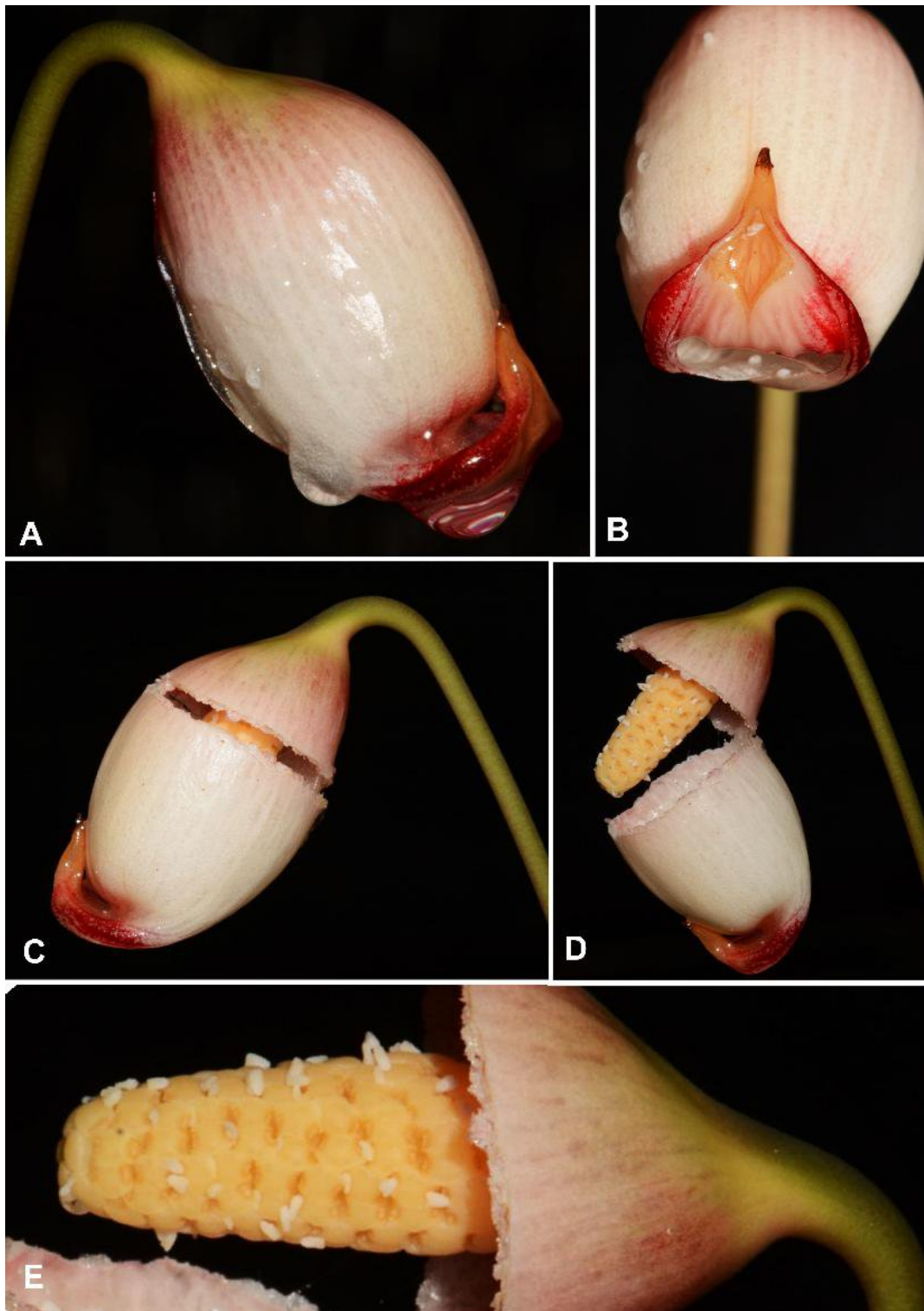


Figure 13. *Galanthbarum kishii*. **A–B.** Inflorescence at staminate anthesis; note terminating rostrum is strongly reflexed. **C.** Inflorescence at staminate anthesis, spathe limb beginning to shed. **D.** Inflorescence at late staminate anthesis, spathe limb almost fallen; note pollen packages. **E.** Detail of spadix, staminate anthesis with oblong pollen packages clearly visible. All from *AR-4160*.



Figure 14. *Gamogyne burbidgei*. **A.** Flowering plant in habitat, on shales. **B.** Inflorescence at pistillate anthesis. **C.** Inflorescence at onset of staminate anthesis; note that spathe limb has begun to senesce and has partly separated from lower, persistent spathe. **D.** Inflorescence towards end of staminate anthesis. **E.** Spadix, spathe artificially removed, at pistillate anthesis. All from *AR-1973*.

Gamogyne helix (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 46 (2018).

Piptospatha helix S.Y. Wong & P.C. Boyce, *Aroideana* 39(1): 9 (2015).

Type: Indonesian Borneo, Kalimantan Barat: Kapuas Hulu, Putissibau, Harongan Betung Kerihun National Park, River, upper Mendalam river, Feb 2015, *K. Sidiyasa et al.* 1929 (holo BO!; iso L!).

Gamogyne lurida (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 46 (2018).

Piptospatha lurida S.Y. Wong & P.C. Boyce, *Aroideana* 39(2): 66 (2016).

Type: Malaysian Borneo, Sarawak: Limbang, Lawas, Maligan, Air Terjun Payeh Maga, near Camp, 9 Sep 2014, *M. Lo* 4917 (holo SAR!).

Gosong S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 47 (2018). Type: *Gosong brevipedunculata*

(H. Okada & Y. Mori) S.Y. Wong & P.C. Boyce. (\equiv) *Hottarum brevipedunculatum* H. Okada & Y. Mori, *Bakoa brevipedunculata* (H. Okada & Y. Mori) S.Y. Wong, *Piptospatha brevipedunculata* (H. Okada & Y. Mori) Bogner & A. Hay). **Figure 15.**

Diagnostic characters — *Gosong* is defined by erect leathery leaves, very deep-penetrating rope-like roots, inflorescences situated at the base of the leaves with the peduncle and part of lower spathe obscured by fleshy cataphylls, a fleshy spathe limb with senescence mechanics in which the upper one-third of the limb is deliquescent/rotting post-anthesis and the lower two-thirds forms a narrow erect splash-cup persistent into fruit, stamens mostly not arranged into obvious floral units, pollen in fragile strings, and basal placentation.

Distribution — A few widely scattered localities in Kalimantan Barat and Kalimantan Tengah.

Ecology — Rheophytic, deeply rooted into sandbars along and in swift-flowing rivers under evergreen perhumid lowland forest.

Gosong brevipedunculata (H. Okada & Y. Mori) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 47 (2018).

Hottarum brevipedunculatum H. Okada & Y. Mori, *Acta Phytotax. Geobot.* 51: 7 (2000).

Piptospatha brevipedunculata (H. Okada & Y. Mori) Bogner & A. Hay, *Telopea* 9: 203 (2000).

Bakoa brevipedunculata (H. Okada & Y. Mori) S.Y. Wong, *Acta Phytotax. Geobot.* 60: 128 (2011).

Type: Indonesian Borneo, West Kalimantan, Putussibau, a branch of upper stream of Sungai (River) Kapuas, Sungai Keriau, Salim village, 13 Jan 1992, *H. Okada & D. Komara 32321* (holo TI; iso BO!).

Hera S.Y. Wong, S.L. Low & P.C. Boyce, *Webbia* 72(2): 47 (2018).

Type: *Hera hebe* (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce (\equiv *Aridarum hebe* S.Y. Wong, S.L. Low & P.C. Boyce). **Figure 16.**

Diagnostic characters — *Hera* is defined by anthers arranged in longitudinally aligned pairs, thecae opposite on the distal and proximal sides of the erect short peg-like thecae extensions, deeply excavated interstice staminodes filling with amber-yellow sticky fluid, and basal placentation.

Distribution — Kalimantan Utara, known only from the type locality.

Ecology — *Hera hebe* is an obligate rheophyte on very hard shale waterfalls and river boulders under extremely wet lower hill forest.

Hera hebe (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 49 (2018).

Aridarum hebe S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 15 (2014).

Type: Indonesian Borneo, Kalimantan Utara, Malinau, Sembakung 70 km southwest of Malinau, 80 km southwest of Long Loreh Coalmine Village, Riam Marthin Billa, 4 May 2012, *K. Nakamoto AR-3922* (holo BO spirit!; iso SAR spirit!).

Heteroaridarum M. Hotta, *Acta Phytotax. Geobot.* 27: 63 (1976); Low et al. *Webbia* 72(2):49 (2018). Type: *Heteroaridarum borneense* M. Hotta (\equiv *Aridarum borneense* (M. Hotta) Bogner & A. Hay). **Figure 17.**

Diagnostic characters — *Heteroaridarum* is defined by stamens arranged in longitudinally aligned pairs, thecae opposite on the distal and proximal sides of the anthers, short pointed thecae extensions inwards-curved over a deeply excavated connective; solid, or with middle slightly impressed interstice staminodes; placentation apical and basal, with the apical placenta sterile.

Distribution — Endemic to northwestern Borneo and to date known only from Sarawak.

Ecology — Rheophytes on large sandstone boulders and waterfalls in humid lowland forest, on wet sandstone cliffs surfaces in upper hill forest.

Heteroaridarum borneense M. Hotta, *Acta Phytotax. Geobot.* 27: 63 (1976).

Aridarum borneense (M. Hotta) Bogner & A. Hay, *Telopea* 9: 185 (2000).

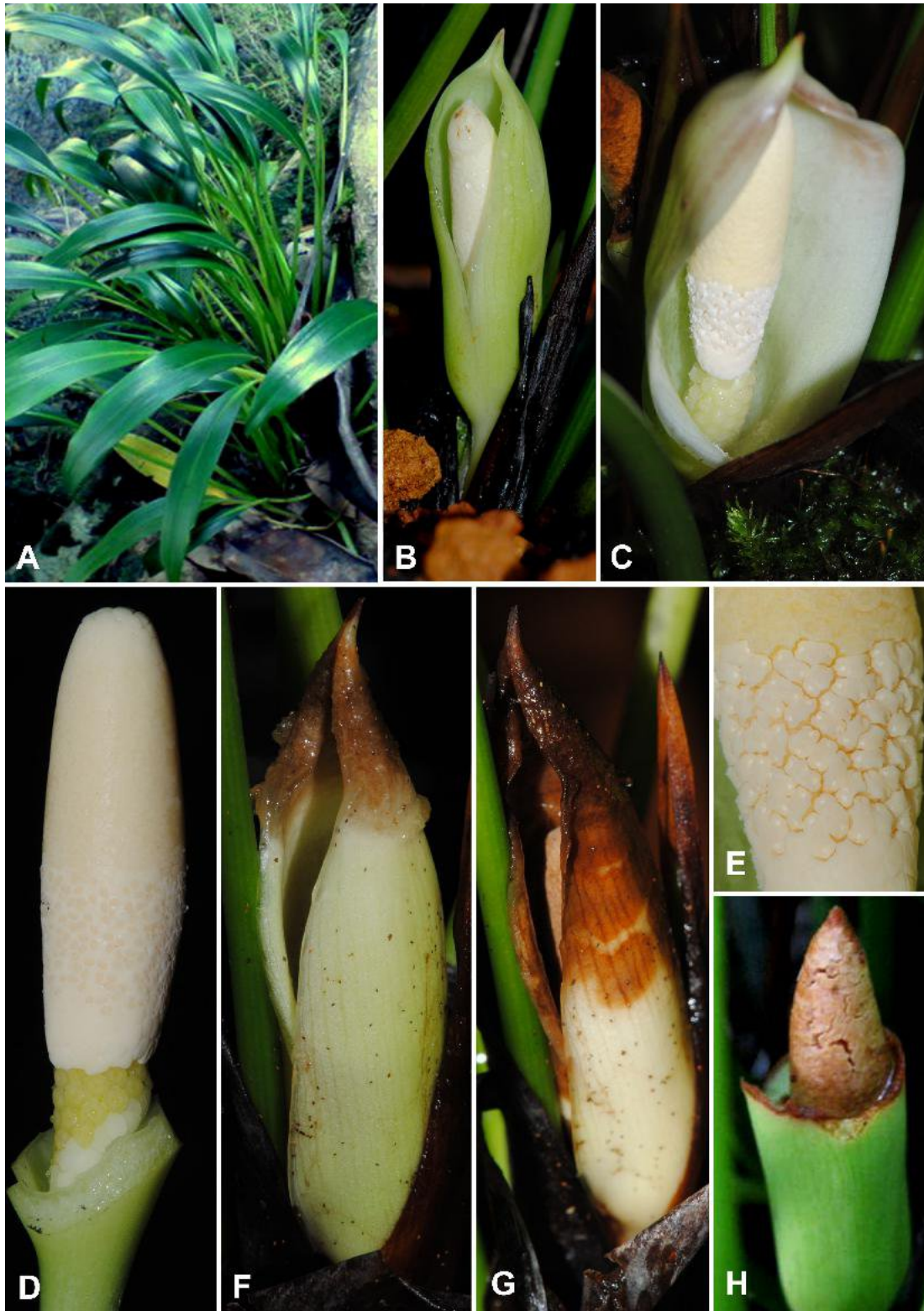


Figure 15. *Gosong brevipedunculata*. **A.** Plants in habitat. **B.** Inflorescence at pistillate anthesis. **C.** Inflorescence at staminate anthesis. **D.** Spadix at pistillate anthesis, spathe artificially removed. **E.** Detail of staminate flower zone. **F–H.** Chronological stages of post-anthesis spathe limb decay. All from *AR-3562*.

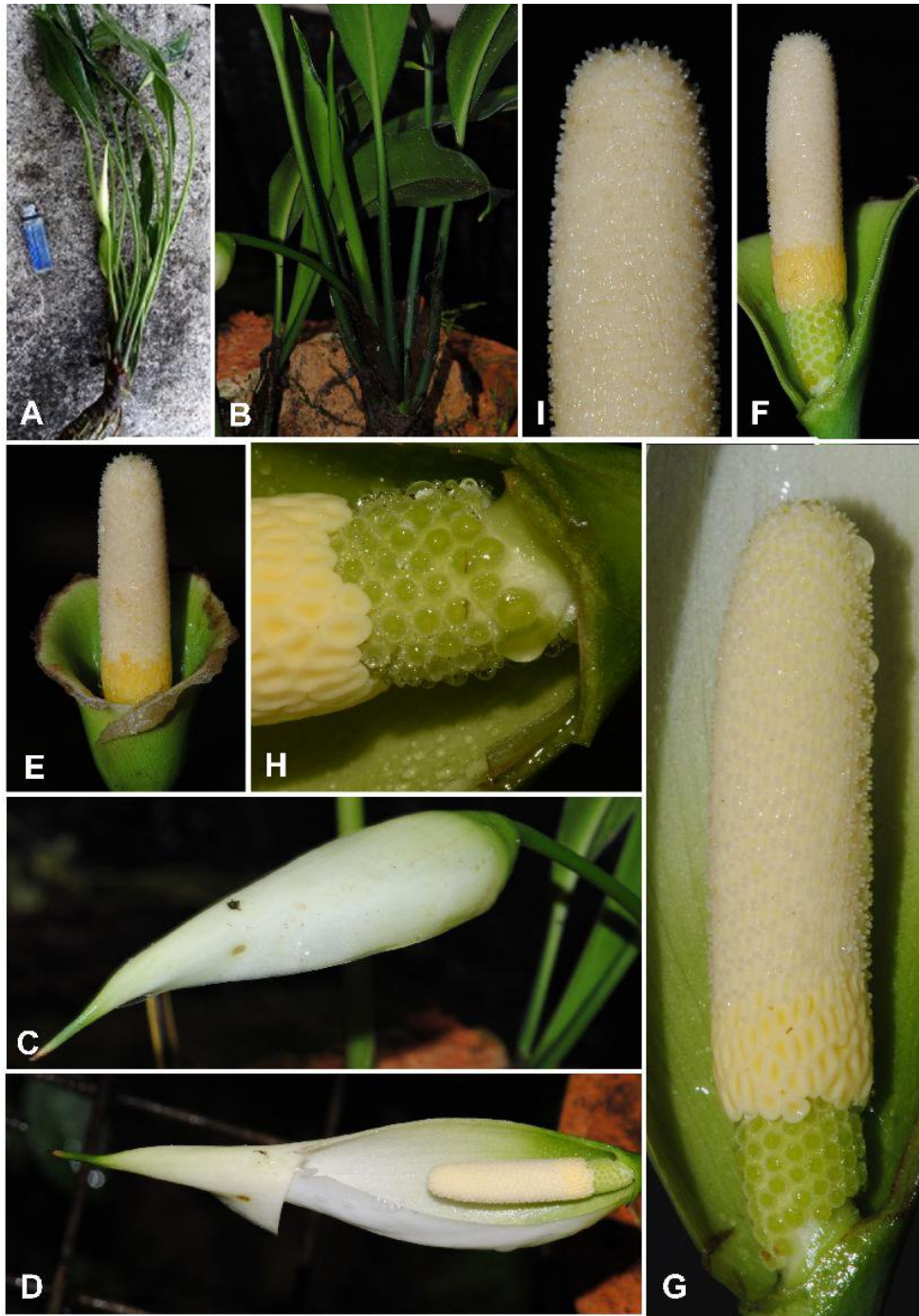


Figure 16. *Hera hebe*. **A.** Flowering plant from habitat, Type locality. **B.** Cultivated specimen from same plant showing long ligular portion of petiolar sheath and developing new shoot (to right of peduncle). **C & D.** Inflorescence at onset pistillate anthesis with nearside spathe artificially removed; note that spadix is less than half length of spathe. **E & F.** Inflorescence at late staminate anthesis, spathe limb naturally shed at its junction with persistent lower spathe, with nearside of lower persistent spathe artificially removed (F); note sticky fluid filling interstice staminodes. **G.** Detail of pistillate flower zone and lower part of interstice at pistillate anthesis; note conspicuous stigmatic droplet, and beginning of fluid secretion into excavated interstice staminodes. **H.** Inflorescence at onset of staminate anthesis, nearside spathe artificially removed; note that interstice staminodes are beginning to fill with sticky fluid. All from AR-3922.

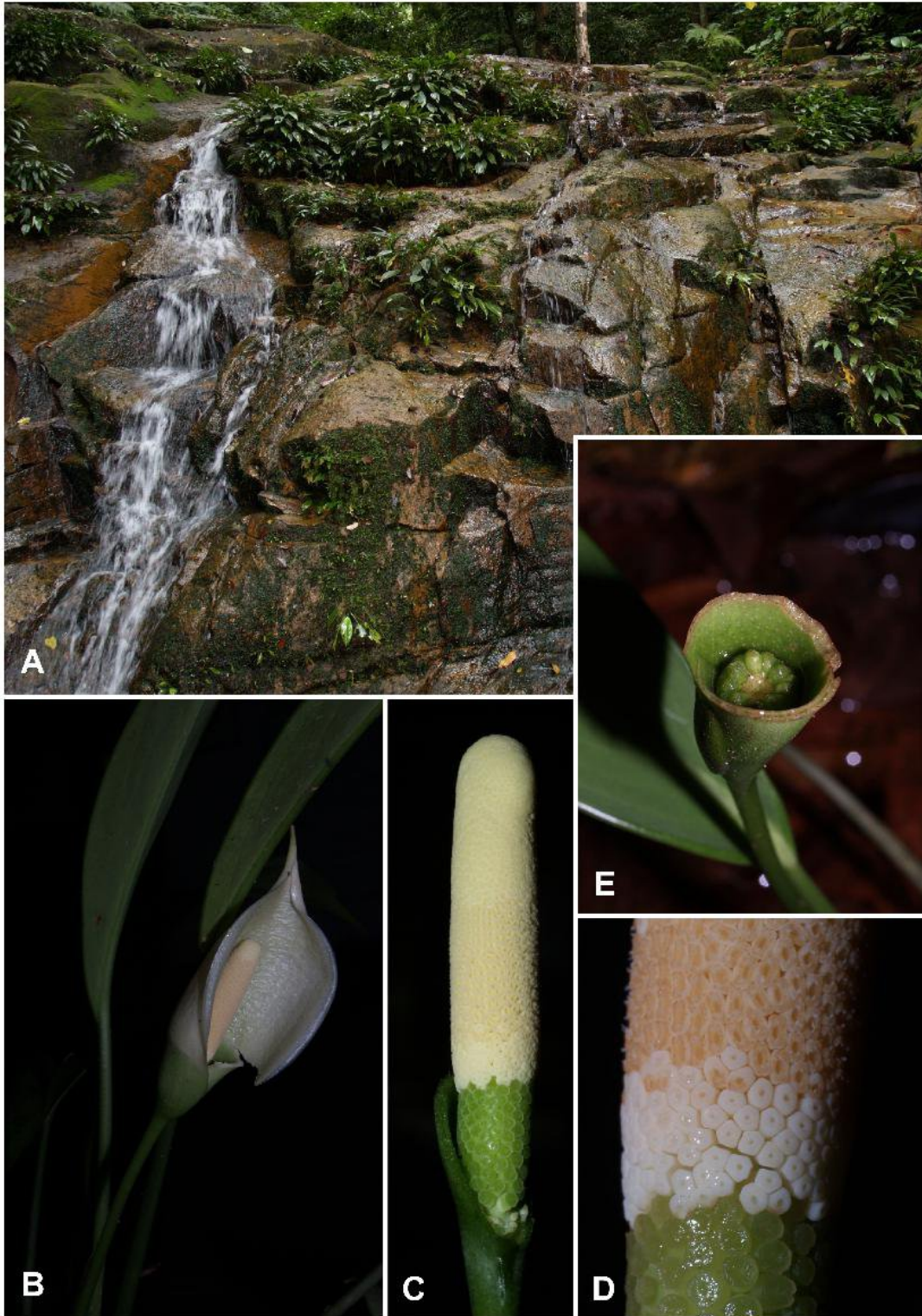


Figure 17. *Heteroaridarum nicolsonii*. **A.** Plants in habitat, Bako NP. **B.** Inflorescence at early staminate anthesis; note spathe limb beginning to shed. **C.** Spadix at pistillate anthesis, spathe artificially removed. **D.** Detail of spadix showing upper part of pistillate flower zone, interstice with staminodes, and lower part of staminate flower zone. **E.** Developing splash-cup infructescence. A from AR-2105; B from AR-480; C & D from AR-215; E from AR-2437.

Type: Malaysian Borneo, Sarawak, [Kuching, Matang], Sg Bungen, c. 20 miles west of Kuching, 27 Apr 1960, L.B. & E.C. Abbe, B.E. Smythies & Asah 9845 (holo SAR!).

Aridarum annae Bogner, Aroideana 4: 57 (1981). Type: Malaysian Borneo, Sarawak, Kuching ('1st Divn'), Sg. Cina ('China'), 11 Sep 1978, J. Bogner 1400 (holo M!; iso Kl!).

Heteroaridarum crassum (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce, Webbia 72(2): 51 (2018).

Aridarum crassum S.Y. Wong & P.C. Boyce, Gard. Bull. Singapore 58: 281 (2007).

Type: Malaysia, Sarawak, Sri Aman, Pantu, Gunung Gaharu, 23 Sep 2004, P.C. Boyce & Jeland A. K AR-692 (holo SAR!).

Heteroaridarum nicolsonii (Bogner) S.Y. Wong & P.C. Boyce, Webbia 72(2): 52 (2018).

(≡) *Aridarum nicolsonii* Bogner, Aroideana 2: 111 (1979). Type: Malaysian Borneo, Sarawak, Bako National Park, lower Sg. Delima, 8 Aug 1961, D. H. Nicolson 1335 (holo US!; iso L!, SAR!, M!).

Hottarum Bogner & Nicolson, Aroideana 1: 72 (1978 '1979'); Low et al. Webbia 72(2): 52 (2018). Type: *Hottarum truncatum* Bogner & Nicolson (≡ *Microcasia truncata* M. Hotta,

Piptospatha truncata (M. Hotta) Bogner & A. Hay). **Figure 18.**

Diagnostic characters — *Hottarum* is defined by a briefly stipitate spadix with a conspicuous sterile appendix, an absence of interpistillar staminodes, thecae pores set in deep pits, pollen produced in oblong packages, basal placentation, an odourless inflorescence with the spathe held at right angles to the peduncle and hardly inflating during anthesis, and with distinct rostral keels.

Distribution — Borneo, known with certainty from only two localities in central Sarawak.

Ecology — Obligate rheophytes of black-water systems on hard shales under lowland perhumid forest.

Hottarum truncatum (M. Hotta) Bogner & Nicolson, Aroideana 1: 72 (1978 '1979')

Microcasia truncata M. Hotta, Mem. Coll. Sci. Univ. Kyoto, Ser. B, 32: 22 (1965). *Piptospatha truncata* (M. Hotta) Bogner & A. Hay, Telopea 9: 213 (2000).

Type: Malaysian Borneo, Sarawak, Bintulu, along Ulu Sg. Kakus, between Sg. Biyah and Sg. Mubong, 11 Nov 1963, M. Hirano & M. Hotta 1012 (holo KYO; iso K (image)!).

Kiewia S.Y. Wong & P.C. Boyce, Webbia 72(2): 52 (2018). Type: *Kiewia ridleyi* (N.E. Br. ex Hook.f.) S.Y. Wong & P.C. Boyce (≡

Piptospatha ridleyi N.E. Br. ex Hook.f.).
Figure 19.

Diagnostic characters — *Kiewia* is defined by having paired staminate flowers with an umbonate pubescent connective, pollen in strings, basal placentation and inflorescences powerfully fragrant of isoamyl acetate.

Distribution — West Sunda: Southern peninsular Thailand through Peninsular Malaysia to Riau Archipelago.

Ecology — Rheophytes on exposed granite stream boulders and rocky stream banks, and waterfalls under lowland to lower montane perhumid to moist forest.

Kiewia perakensis (Engl.) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 54 (2018).

Piptospatha elongata var. *perakensis* Engl., *Pflanzenr.* 55(IV.23Da): 125 (1912).

Rhynchopyle perakensis (Engl.) Ridl., *J. Bot.* 51: 202 (1913).

Piptospatha perakensis (Engl.) Engl., *Pflanzenr.* 71(IV.23E): 2* [i.e. supplementary pages] (1920).

Lectotype (selected by Bogner & Hay 2000, p. 208): Malaysia, Malacca, Tampin Hill, waterfall, May 1894, *J.S. Goodenough 1850* (lecto SING!; isolecto CAL).

Kiewia ridleyi (N.E. Br. ex Hook.f.) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 54 (2018).

Piptospatha ridleyi N.E. Br. ex Hook.f., *Curtis's Bot. Mag.* 51 t. 7410 (1895).

Type: Cult. RBG Kew ex Malaysia, Johor, (orig. coll. *H.N. Ridley*) ?1893, *N.E. Brown s.n.* (holo K!).

Piptospatha ridleyi var. *lanceolata* Ridl., *Fl. Mal. Pen.* 5: 114 (1925). Type: Malaysia, Johore, Ulu Kahang, 1 Jun 1923, *R.E. Holttum 10865* (holo SING!).

Kiewia teijsmannii (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 54 (2018).

Piptospatha teijsmannii P.C. Boyce & S.Y. Wong, *Webbia* 68: 81 (2013).

Type: Indonesia, Kepulauan Riau Province, Lingga Regency, Pulau Lingga, Sungai Banda, 1872, *J.E. Teijsmann 16705* (holo BO!).

Nabalu S.Y. Wong & P.C. Boyce, Low et al., *Webbia* 72(2): 54 (2018).

Type: *Nabalu corneri* (A. Hay) S.Y. Wong & P.C. Boyce (\equiv *Schismatoglottis corneri* A. Hay).
Figures 20 & 21.

Diagnostic characters — *Nabalu* is defined by being a massive arborescent pachycaul, leaf



Figure 18. *Hottarum truncatum*. **A.** Plants in habitat. **B.** Inflorescence at pistillate anthesis. **C.** Post-anthesis inflorescence, spathe limb fallen. **D.** Spadix at pistillate anthesis, spathe artificially opened; note thecae with deep pits. All from AR-4137.

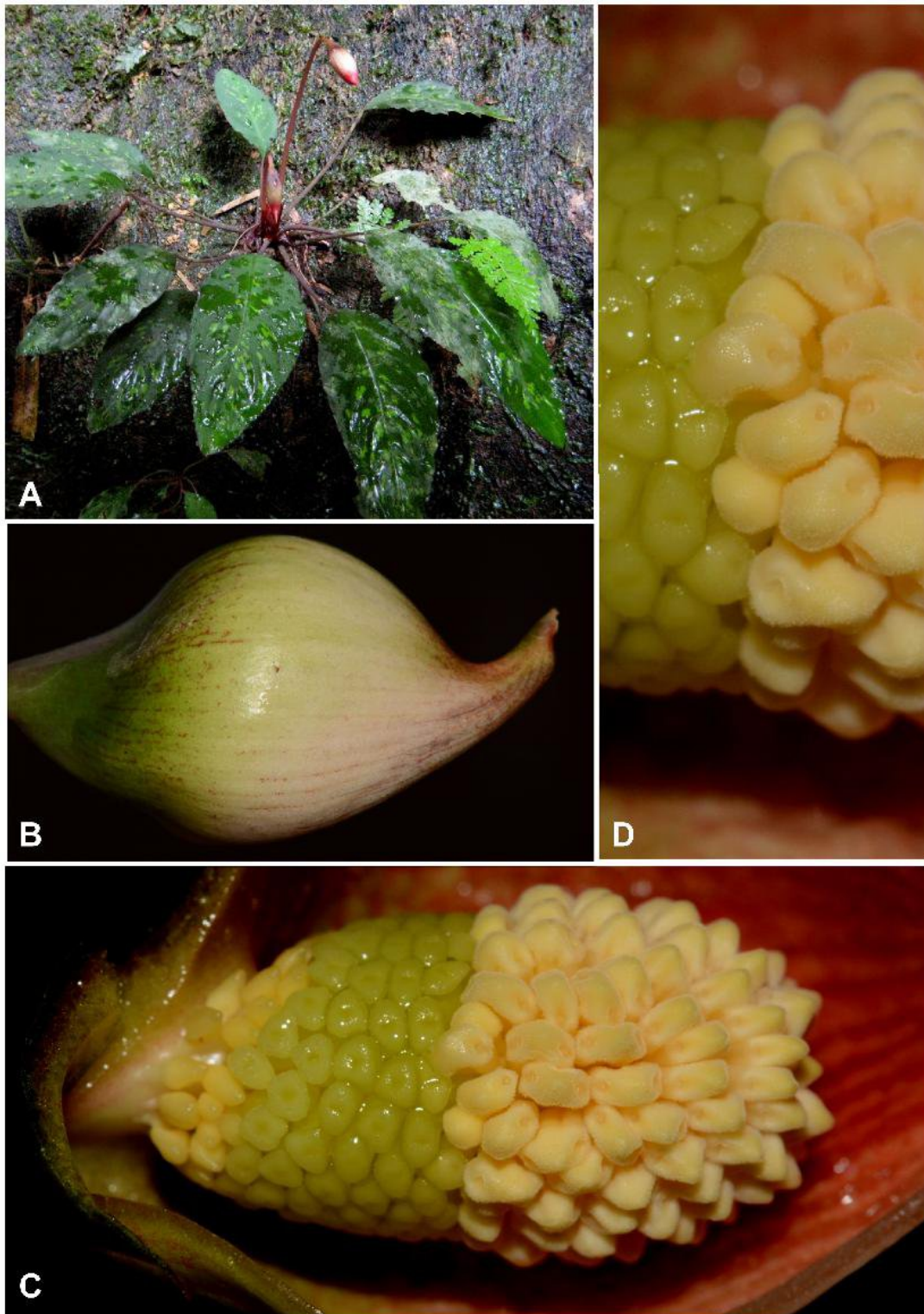


Figure 19. *Kiewia ridleyi*. **A.** Plant in habitat. **B.** Inflorescence at pistillate anthesis; note contrast in colour between lower spathe and spathe limb. **C.** Spadix at pistillate anthesis, nearside spathe artificially removed; note conspicuous stipe, colour and shape of stigmas, and elongated stamen connectives. **D.** Detail of junction of pistillate and staminate flower zones; note displaced anther pores. All from AR-4021.



Figure 20. *Nabalu corneri*. **A.** Plant in habitat. **B.** Inflorescence at pistillate anthesis. **C.** Inflorescence at pistillate anthesis, nearside spathe artificially removed; mass of beetles associated with pistillate flower zone are Chrysomelidae.

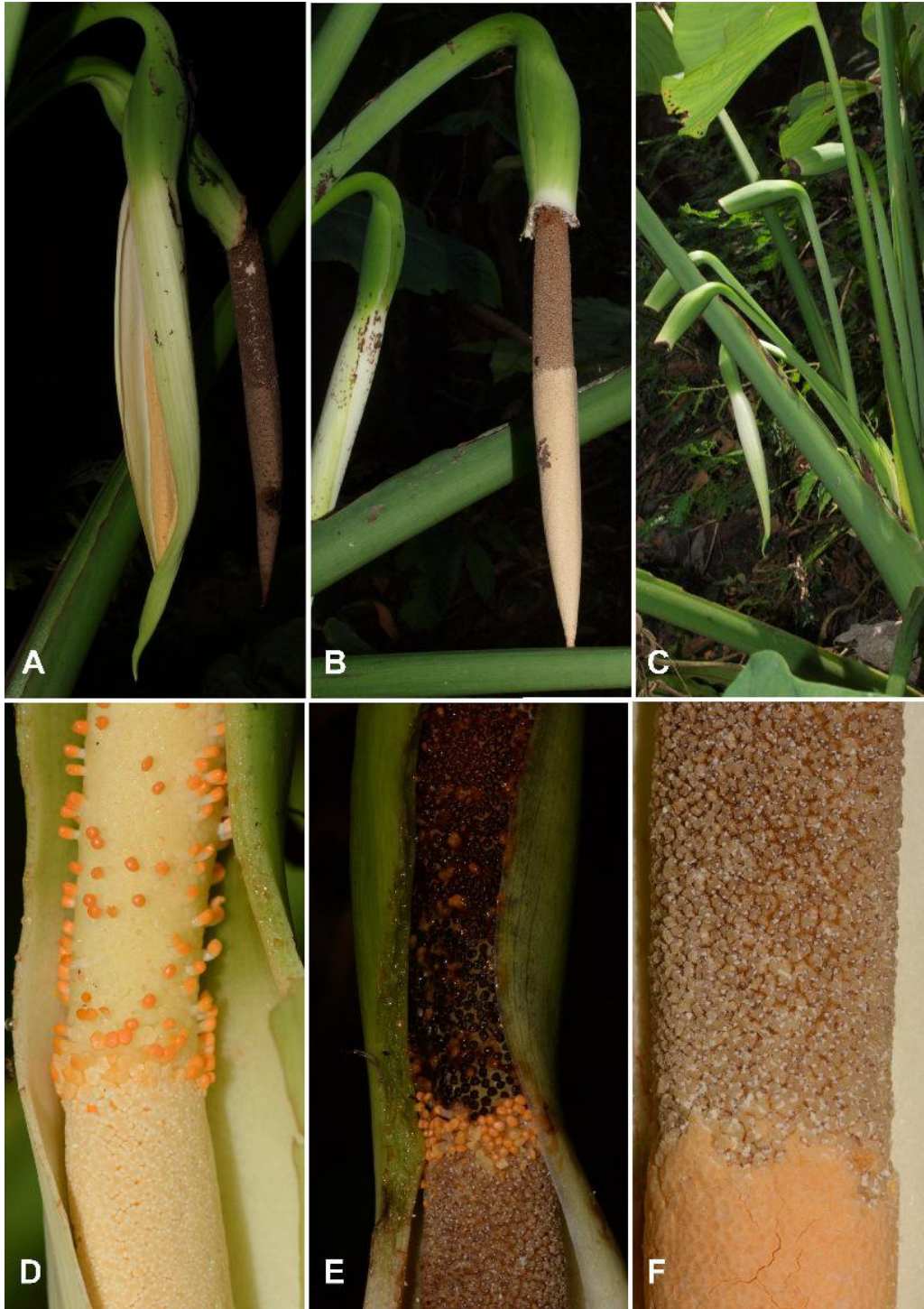


Figure 21. *Nabalus corneri*. **A.** Inflorescence at pistillate anthesis (front) and post-anthesis (rear). **B.** Inflorescence at late staminate anthesis, spathe limb shed. **C.** Developing infructescences and one pre-anthesis inflorescence. **D.** Detail of pistillate flower zone with conspicuous scattered staminodes, interstice, and lower part of staminate flower zone. **E.** Post-anthesis inflorescence with interstice now clearly visible above dark withered stigmas. **F.** Staminate flower zone at late staminate anthesis, and lower part of spadix appendix. All from *AR-4683*.

sheath wings persistent; inflorescence nodding, spathe hardly opening, staminate and pistillate flower zones more-or-less contiguous.

Distribution — Borneo, where in Sabah primarily on the wetter west flanks of the Kinabalu and Crocker ranges above 550 m asl, and seemingly absent from the James Brooke Range, elsewhere on Borneo occurring as small scattered populations in northern and central Sarawak. Additionally occurring on the Anambas Islands and the Natuna Islands.

Ecology — Disturbed forest or open sites by rivers among rocks, sometimes in great quantity together, (380–)550–1000 m elevation.

Nabalu corneri (A. Hay) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 56 (2018).

Schismatoglottis corneri A. Hay, *Telopea* 9: 29 (2000).

Type: Malaysia, Sabah, Kinabatangan Distr., Maliau Basin, Gunung Rara Forest Reserve, 2.5 km up-river from main Maliau Falls, 15 Apr 1996, A. Hay, K. M. Wong & Ahmad 12095 (holo SAN + spirit; iso K!, KEP!, L!, NSW).

Naiadia S.Y. Wong, S.L. Low & P.C. Boyce, *Webbia* 72(2): 56 (2018).

Type: *Naiadia zygosea* (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce (≡

Aridarum zygoseum S.Y. Wong, S.L. Low & P.C. Boyce). **Figures 22 & 23.**

Diagnostic characters — *Naiadia* is defined by having staminate flowers composed of paired stamens and thecae each with a pair of long setiform thecae extensions appressed to the stamen/connective during pistillate anthesis, and becoming erect at staminate anthesis, then with the tips of each extension pair overlapping, by a large zone of staminodes at the interstice, and pollen in irregular masses.

Distribution — *Naiadia* is known from two discrete populations c. 150 km distant at Nanga Taman (Kalimantan Barat) and Kudangan (Kalimantan Tengah).

Ecology — Obligate rheophytes on exposed riverside granite boulders under perhumid lowland to lower hill forest.

Naiadia zygosea (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 60 (2018).

Aridarum zygoseum S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 27 (2014).

Type: *K. Nakamoto AR-3843* (holo BO spirit!; iso SAR spirit!).

Ooia S.Y. Wong & P.C. Boyce, *Bot. Stud. (Taipei)* 51: 545 (2010); *Webbia* 68: 87(2013) & *J. Jpn. Bot.* 91: 137 (2016); Low et al., *Webbia* 72(2): 60 (2018).

Type: *Ooia grabowskii* (Engl.) S.Y. Wong & P.C. Boyce (\equiv *Rhynchopyle grabowskii* Engl., *Piptospatha grabowskii* (Engl.) Engl.). **Figure 24.**

Diagnostic characters — *Ooia* is defined by (usually) fragrant inflorescences, a persistent spadix axis, deciduous flowers with the pistillate flowers inserted on a conspicuous swollen cushion, parietal placentation, a spathe completely persistent to persistent more than half its length, with the persistent portion ovoid-subcylindric to fusiform or funnellform, and never flaring, and (in most species) production of copious plantlets from the finer roots. All species have a conspicuous mucigel cap to the roots. All except three species have pendulous infructescences.

Distribution — Throughout Borneo with individual species locally restricted, often acutely so.

Ecology — Obligate, rarely facultative, rheophytes, mostly lithophytic and geologically obligated, occasionally on constantly water-splashed boulders or permanent waterfalls, less often in deep riverbank sand, under lowland to lower montane perhumid to wet forest between 50 and 2300 m elevation.

Ooia basalticola S.Y. Wong & P.C. Boyce, J. Jpn. Bot. 91: 143 (2016).

Type: Indonesian Borneo, Kalimantan Barat, Bengkayang, Sanggau Ledo, foothills

and approaches to Gunung Niut, Riam Pangar, 15 Aug 2013, P.C. Boyce & Wong Sin Yeng AR-4211 (holo BO!; iso BO spirit!, SAR spirit!).

Ooia glans S.Y. Wong & P.C. Boyce, J. Jpn. Bot. 91: 145 (2016).

Type: Malaysian Borneo, Sarawak, Kuching, Matang, Kubah N. P., Sungai Bungen, *Ooi Im Hin* AR-2339 (holo SAR!; iso SAR spirit!).

Ooia grabowskii (Engl.) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51(4): 545 (2016).

Rhynchopyle grabowskii Engl., Bot. Jahrb. Syst. 25: 20 (1898).

Piptospatha grabowskii (Engl.) Engl., Pflanzenr. 55(IV.23Da): 125 (1912).

Type: Indonesian Borneo, Southeast Kalimantan, Mindai-Pramassamalai hills, on rocks of waterfalls of the Pitanakan, 17 Jun 1882, F. Grabowski s.n. (holo B!).

Ooia havilandii (Engl.) S.Y. Wong & P.C. Boyce, J. Jpn. Bot. 91: 149 (2016).

Rhynchopyle havilandii Engl., Bot. Jahrb. Syst. 37: 125 (1905).

Piptospatha havilandii (Engl.) Engl., Pflanzenr. 55(IV.23Da): 128 (1912).



Figure 22. *Naiadia zygosea*. **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 fruits have decomposed. Later these will be washed from splash-cup by rain or water spate. **E.** Spadix at late staminate anthesis, spathe artificially removed; note staphylinids, a likely pollinator. A from AR-3774; B–C from AR-3987; D & F from AR-3843; E from AR-3771.

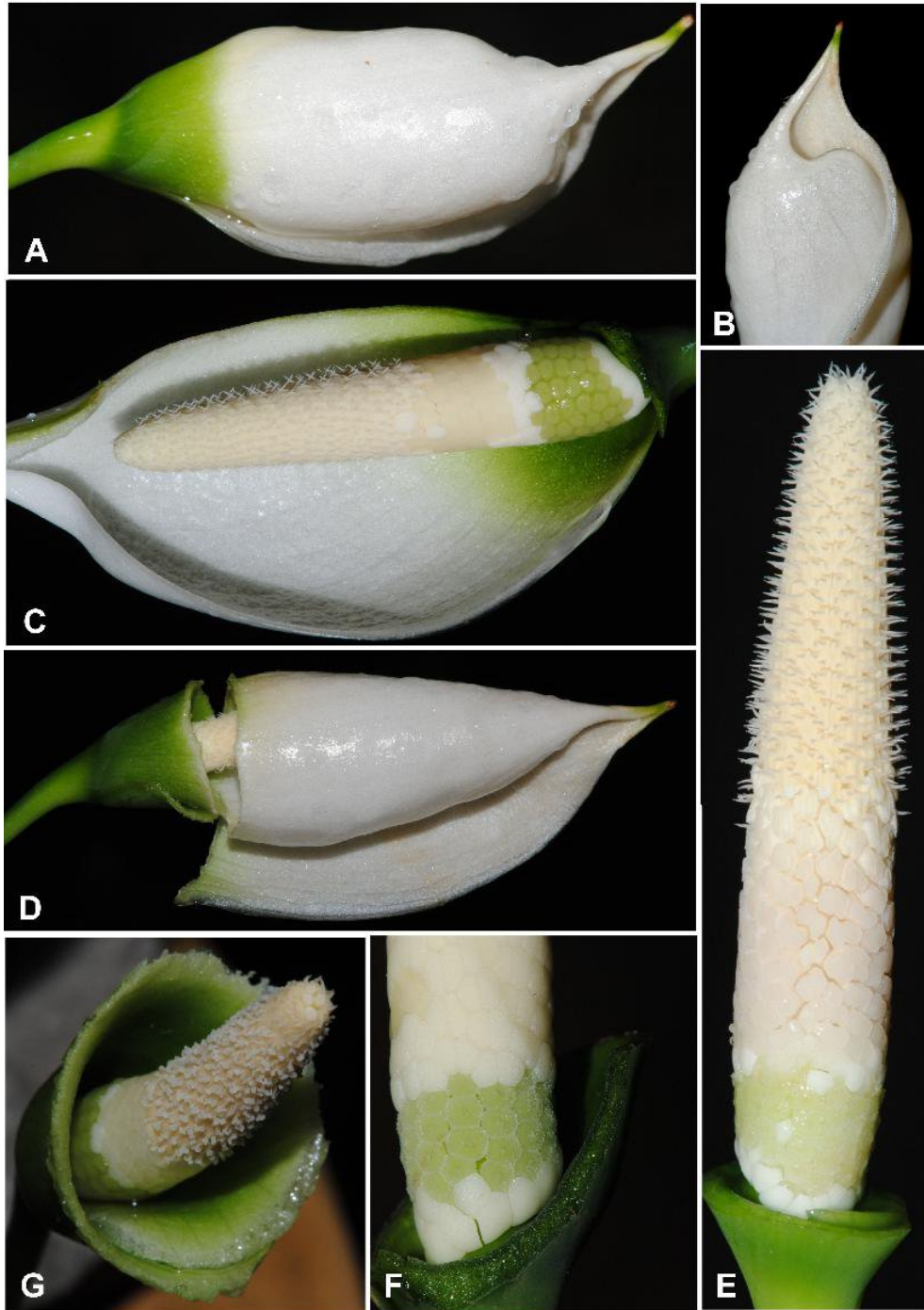


Figure 23. *Naiadia zygosea*. **A & B.** Inflorescence at pistillate anthesis. Note (B) manner of spathe limb inflation and unfurling. **C.** Inflorescence at late pistillate anthesis, nearside spathe artificially removed; note that pistils are still wet and thecae extensions are becoming erect. **D.** Inflorescence at staminate anthesis with spathe limb separating from persistent lower part. **E.** Spadix at staminate anthesis with thecae extensions fully erect. **F.** Detail of lower part of spadix, showing interpistillar staminodes at base, pistillate flower zone, and lower part of interstice. **G.** Inflorescence at staminate anthesis with spathe limb shed to leave a ragged margin to persistent lower spathe; note pollen masses at tips of thecae extensions. 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.



Figure 24. *Ooia grabowskii*. **A.** Plant in habitat. **B.** Inflorescence at early staminate anthesis, spathe limb falling. **C.** Inflorescence at staminate anthesis, spathe limb fallen. **D.** Spadix at early pistillate anthesis, nearside spathe artificially removed. All from AR-4997.

Schismatoglottis havilandii (Engl.) M. Hotta, Mem. Coll. Sci. Univ. Kyoto, Ser. B 32: 233 (1966).

Type: Malaysian Borneo, Sarawak, Kapit, Rejang, Belaga, Nov1892, *G.D. Haviland 2191* (holo BMI; iso CAL, K!, SING!).

Ooia kinabaluensis (Bogner) S.Y. Wong & P.C. Boyce, Bot. Stud. (Taipei) 51(4): 548 (2010).

Hottarum kinabaluense Bogner, Pl. Syst. Evol. 145: 161 (1984).

Piptospatha kinabaluensis (Bogner) Bogner & A. Hay, Telopea 9(1): 216 (2000).

Type: Malaysian Borneo, Sabah, Pantai Barat, Kota Belud, south slope of Mt. Kinabalu, east tributary of sungai Mesilau, at old trail between Mesilau Cave and Janet's Halt, 7 Sep 1963, *S. Collette 21634* (holo L!; iso K!).

Ooia manduensis (Bogner & A. Hay) S.Y. Wong & P.C. Boyce, J. Jpn. Bot. 91: 156 (2016).

Piptospatha manduensis Bogner & A. Hay, Telopea 9: 207 (2000), Boyce & Wong, Aroideana 36: 98–103 (2013).

Type: Indonesian Borneo, Kalimantan Timur, Sangkulirang, Kutai Timur, Sungai Mandu region, north of Sangkulirang, 14

Aug 1957, *A.J.G.H. Kostermans 13493a* (holo L!; iso BO!; K!, SING!).

Ooia paxilla S.Y. Wong & P.C. Boyce, Webbia 68: 87 (2013).

Type: Indonesian Borneo, Kalimantan Utara, Malinau, Malinau Selatan, Sembakung, 80 km southwest of Malinau, Tempat Wisata Riam Loreh, 3 km north of Long Loreh, 3 May 2012, *K. Nakamoto AR-3926* (holo BO!; iso SAR spirit!).

Ooia secta S.Y. Wong & P.C. Boyce, J. Jpn. Bot. 91: 161 (2016).

Type: Malaysian Borneo, Sarawak, Sarikei, Sungai Lepong, 27 Dec 2012, *P.C. Boyce & Wong Sin Yeng AR-4099* (holo SAR spirit!; iso SAR spirit!).

Ooia suavis S.Y. Wong & P.C. Boyce, J. Jpn. Bot. 91: 163 (2016).

Type: Indonesian Borneo, Kalimantan Tengah, Murung Raya, Puruk Cahu, sungai Barito, 4 Apr 2012, *K. Nakamoto AR-3844* (holo BO!; iso SAR!).

Phymatarum M. Hotta, Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol. 32: 29 (1965); Mayo et al., The Genera of Araceae 189, Pl. 53, 118C (1997); Bogner & Hay, Telopea 9: 198–200 (2000); Low et al., Webbia 72(2): 62 (2018). Type: *Phymatarum borneense* M. Hotta. **Figure 25.**

Diagnostic characters — *Phymatarum* is defined by a constricted spathe, with the lower persistent part actively splitting-opening at fruit maturity, unistaminate flowers with large densely papillate thecae, sharply downturned needle-like thecae extensions dehiscing by an apical pore, and pollen in droplets.

Distribution — Endemic to northern central Borneo, from central and northern Sarawak, into northern Kalimantan Barat, and Brunei.

Ecology — Rheophytic, occasionally terrestrial on very wet forest floor, in moderate to dappled shade at low elevations.

Phymatarum borneense M. Hotta, Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B, Biol. 32: 29 (1965). Type: Brunei, Tembrong, en route from Kpg. Biang to Bt. Biang, c. 20 m, on muddy floor of riparian forest, 20 Jan 1964, *M. Hotta 13314* (holo KYO; iso SAR!).

Phymatarum montanum M. Hotta, Mem. Coll. Sci. Univ. Kyoto, Ser. B, 32: 29 (1965). Type: Malaysia, Sarawak, Mardi, foot of G. Mulu, along Sg. Payau between Sg. Melinau Paku and Rubang Payau, 22 Mar 1964, *M. Hotta 15268* (holo KYO).

Pichinia S.Y. Wong & P.C. Boyce, Gard. Bull. Singapore 61: 544 (2010); Low et al., *Webbia* 72(2): 64 (2018).

Type: *Pichinia disticha* S.Y. Wong & P.C. Boyce. **Figure 26.**

Diagnostic characters — *Pichinia* is unique by its shoot architecture with individual modules monofoliate, comprising a prophyll, a cataphyll, both long-persistent, and a foliage leaf. While similar to module architecture of *Colobogynium*, *Pichinia* differs by having the petiolar sheath elongated into a greatly lengthened persistent ligule, which would seem to have some protective role associated with the emerging shoots as compared with *Colobogynium* wherein the petiolar sheath is reduced to a minute ridge at the petiole base with the protective role of the sheath homeotically taken by the cataphylls. Pollen in *Pichinia* is shed in strings as compared with powdery pollen in *Colobogynium*.

Distribution — Borneo, known from two localities in southwestern Sarawak.

Ecology — Lithophytic on heavily shaded Karst limestone boulders under moist lowland forest.

Pichinia disticha S.Y. Wong & P.C. Boyce, Gard. Bull. Singapore 61: 545 (2010).

Type: Malaysian Borneo, Sarawak, Samarahan, Serian, Pichin, Gunung Kedadum, Sugun Karang, 29 Jun 2006, *P.C. Boyce, Simon Kutub A. P. & Wong Sin Yeng AR-1860* (holo SAR spirit!).



Figure 25. *Phymatarum borneense*. **A.** Plants in habitat on a muddy river bank; note colonial habit resulting from creeping rhizomes. **B.** Inflorescence at pistillate anthesis; visible insects are *Colocasiomyia* (Diptera) while spathe limb damage to is caused by *Chrysomelidae* beetles chewing to gain access to spadix. **C.** Inflorescence at staminate anthesis, spathe limb shed naturally. **D.** Spadix at pistillate anthesis; spathe artificially removed. A from *AR-196*; B–D from *AR-3717*.

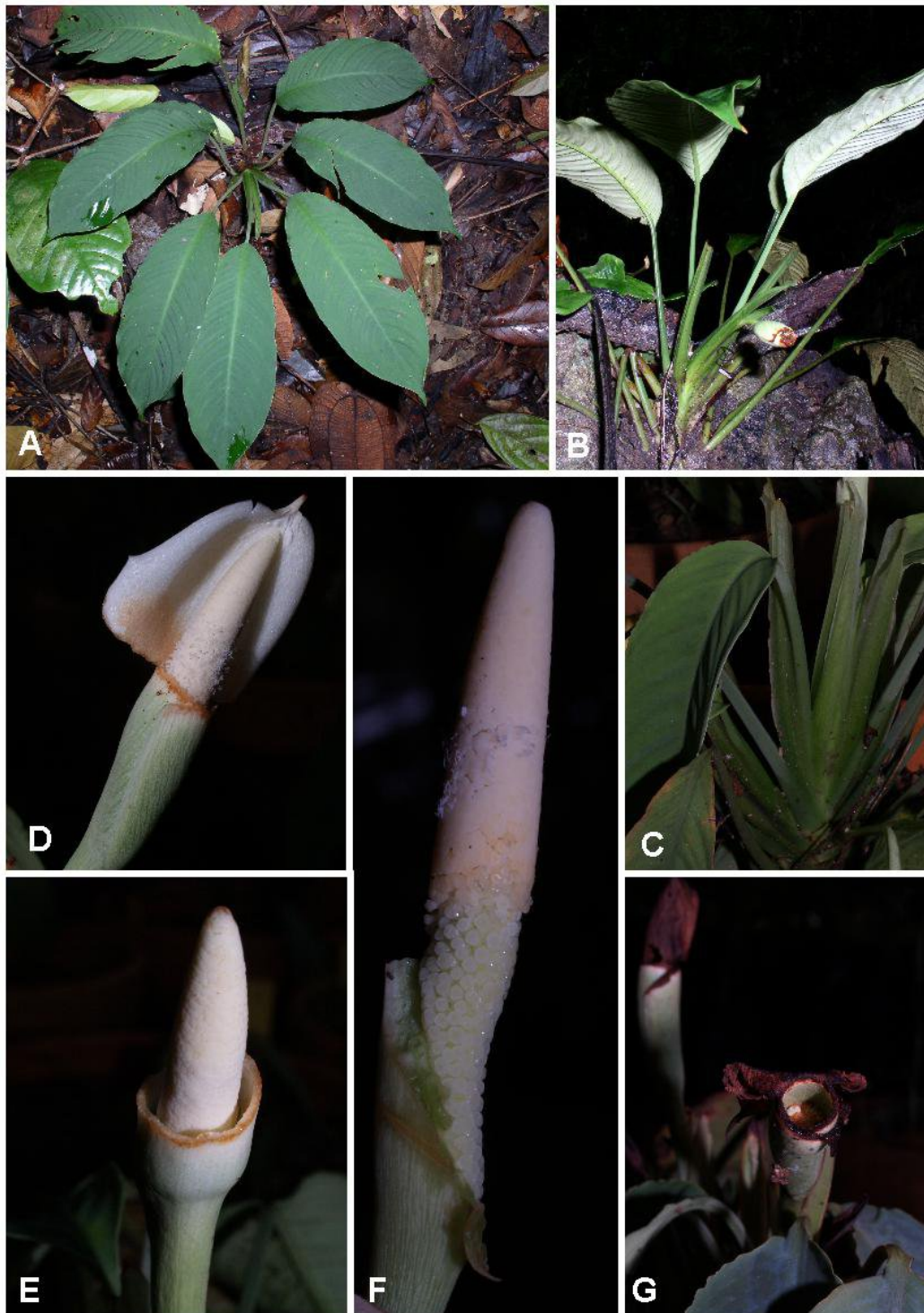


Figure 26. *Pichinia disticha*. **A.** Plant in habitat on Karst limestone. **B.** Plant habit showing leaf fan projecting from rocks. **C.** Detail of leaf arrangement; note keeled prophylls and very long persistent petiolar sheath ligules. **D.** Inflorescence at staminate anthesis, spathe limb shedding naturally. **E.** Inflorescence at very late staminate anthesis, spathe limb shed naturally. **F.** Spadix at early staminate anthesis, spathe artificially removed. **G.** Young infructescences.



Figure 27. *Piptospatha insignis*. **A.** Plants in habitat. **B & C.** Inflorescence at pistillate anthesis. **D.** Inflorescence at pistillate anthesis, nearside spathe artificially removed. **E.** Staminate flower zone, showing detail of extended connectives; terminal-most flowers are sterile. All from *AR-4120*.

Piptospatha N.E. Br., Gard. Chron., Ser. 2, 11: 138 (1879); Boyce & Wong, Newslett. Int. Aroid Soc. 35(2): 6 (2013); Low et al., *Webbia* 72(2): 66 (2018).

Type: *Piptospatha insignis* N.E. Br. **Figure 27.**

Diagnostic characters — *Piptospatha insignis* is unique by stamens with a long-projecting connective with the thecae pores at the base, one on each side.

Distribution — Borneo, known with certainty only Limbang, Sarawak.

Ecology — Open areas on Miocene sandstone waterfalls under lowland perhumid forest.

Piptospatha insignis N.E. Br., Gard. Chron., Ser. 2, 11: 138 (1879).

Type: Cult. RBG Kew ex ‘North Borneo’, *F.W. Burbidge* 95 sub *N.E. Brown s.n.* (holo K!; iso BM!, FI-B!).

Pursegloveia S.Y. Wong, S.L. Low & P.C. Boyce, *Webbia* 72(2): 66 (2018).

Type: *Pursegloveia burttii* (Bogner & Nicolson) S.Y. Wong & P.C. Boyce (\equiv *Aridarum burttii* Bogner & Nicolson). **Figure 28.**

Diagnostic characters — *Pursegloveia* is defined by staminate flowers comprised of one stamen with an obliquely excavated expanded connective, very slender short thecae extensions, pollen in droplets, clavate

to hemispherical interstice staminodes, a spathe limb deliquescent acropically from its junction with the lower persistent portion, leaf blades with adaxially prominently raised primary lateral veins; pollen initially produced in a droplet, this later extending into a very fine viscous string.

Distribution — Borneo, central Sarawak to Kalimantan Timur; all species are locally distributed, some strongly so.

Ecology — On shales or exposed sandstone river boulders and the margins of waterfalls, or on mossy riverside boulders, under wet to perhumid lowland forest or lower montane heath forest (kerangas).

Pursegloveia ashtonii (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 69 (2018).

Aridarum ashtonii S.Y. Wong & P.C. Boyce, *Aroideana* 38E: 12 (2015).

Type: Malaysian Borneo, Sarawak, Kapit, Hose Mts, Mujong, Ulu [Sungai] Amau, Bukit Lumut, 18 Apr 1964, *P.S. Ashton* S21256 (holo SING!; iso K!, L!, SAR!).

Pursegloveia burttii (Bogner & Nicolson) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 69 (2018).

Aridarum burttii (*‘burttii?’*) Bogner & Nicolson, *Aroideana* 2: 116 (1979).

Type: Malaysia, Sarawak, Hose Mountains, 1964, *B.L. Burtt & A. Martin 5116* (holo US!; iso E, M).

Pursegloveia kazuyae (S.Y. Wong, P.C. Boyce & S.L. Low) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 69 (2018).

Aridarum kazuyae S.Y. Wong, P.C. Boyce & S.L. Low, *Willdenowia* 42: 261 (2012).

Type: Indonesian Borneo, Kalimantan Timur, Malinau, Malinau Selatan, Sembakung, 80 km SW of Malinau, Tempat Wisata Loreh, 3 km north of Long Loreh village, 3 May 2012, *K. Nakamoto AR-3927* (holo BO!; iso SAR!).

Pursegloveia minima (H. Okada) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 69 (2018).

Aridarum minimum H. Okada, *Jap. Soc. Plant Sys.* 57: 61 (2006).

Type: Indonesia, Central Kalimantan, Dist. Murung Raya, near to Tumbang Naan, 20 Dec 2004, *H. Okada et al. TK-21* (holo BO!; iso L!, K, KYO, M, TI).

Pursegloveia orientalis (S.Y. Wong, P.C. Boyce & S.L. Low) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 69 (2018).

Aridarum orientale S.Y. Wong, P.C. Boyce & S.L. Low, *Willdenowia* 42: 262 (2012).

Type: Indonesian Borneo, Kalimantan Timur, Tana Tidung, Sesayap, Kampung Rian, Air Terjun Gunung Rian, 45 km southeast of main road to Tanjung Selor, 19 Apr 2011, *K. Nakamoto AR-3539* (holo BO!).

Rhynchopyle Engl., *Bot. Jahrb. Syst.* 1: 183 (1880 '1881'); Low et al., *Webbia* 72(2): 69 (2018).

Type: *Rhynchopyle elongata* (Engl.) Engl. (\equiv *Schismatoglottis elongata* Engl., *Piptospatha elongata* (Engl.) N.E. Br.). **Figures 29 & 30.**

Diagnostic characters — *Rhynchopyle* is defined by weakly nodding odourless inflorescences with pink to magenta, rarely white, pileate spathe limb with the rostrum internally with pronounced keels, and with the distal-most portion reflexing strongly during staminate anthesis, free pistillate flowers, thecae flat or with a slight pore-pit, connective not expanded, pollen in strings and erect salverform splash-cups.

Distribution — *Rhynchopyle* species occur in an arc extending from northwestern through central to northeastern Borneo.

Ecology — Obligate rheophytes with individual species obligated to particular geologies (granite, sandstone, basalt or limestone) mostly on rocky river banks in perhumid lowland to upper hill forest.

Rhynchopyle elongata (Engl.) Engl., *Bot. Jahrb. Syst.* 1: 184 (1881).

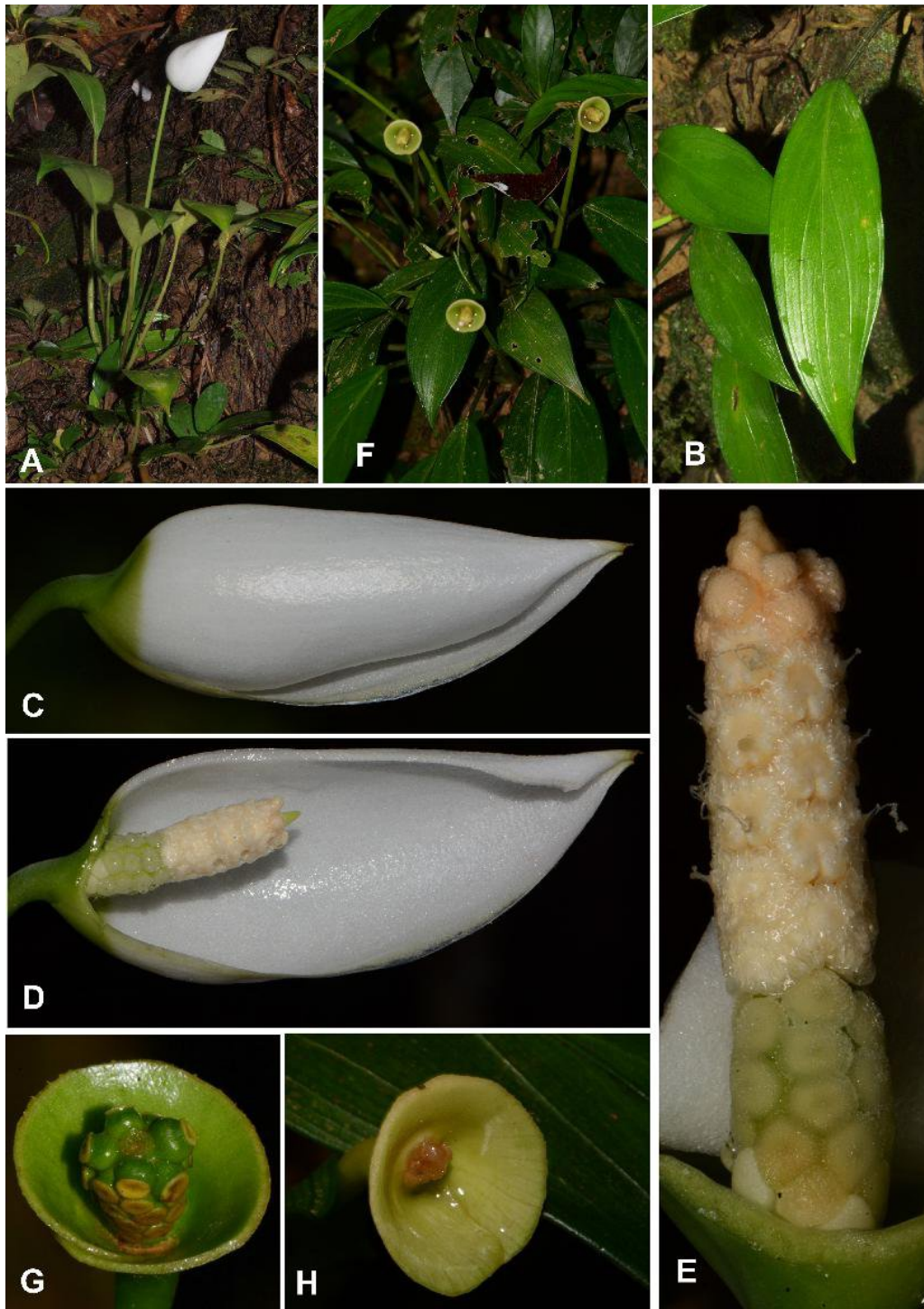


Figure 28. *Pursegloveia burtii*. **A.** Flowering plant in habitat. **B.** Leaf blade showing distinctive raised primary lateral veins. **C.** Inflorescence at pistillate anthesis, gaping spathe is typical. **D.** Spadix at pistillate anthesis, nearside spathe artificially removed. **E.** Spadix at staminate anthesis, spathe limb artificially removed; note pollen droplets (upper part of staminate flower zone), extending to very fine pollen strings (lower part of staminate flower zone). **F.** Fruiting plant in habitat. **G.** Sub-mature infructescence with associated splash-cup. **H.** Post-dispersal infructescence with splash-cup beginning to decay. All from AR-5116.



Figure 29. *Rhynchosypyle elongata*. **A.** Flowering plant in habitat. **B.** Inflorescence at pistillate anthesis. **C.** Spadix at pistillate anthesis, spathe artificially removed. All from *AR-3601*.

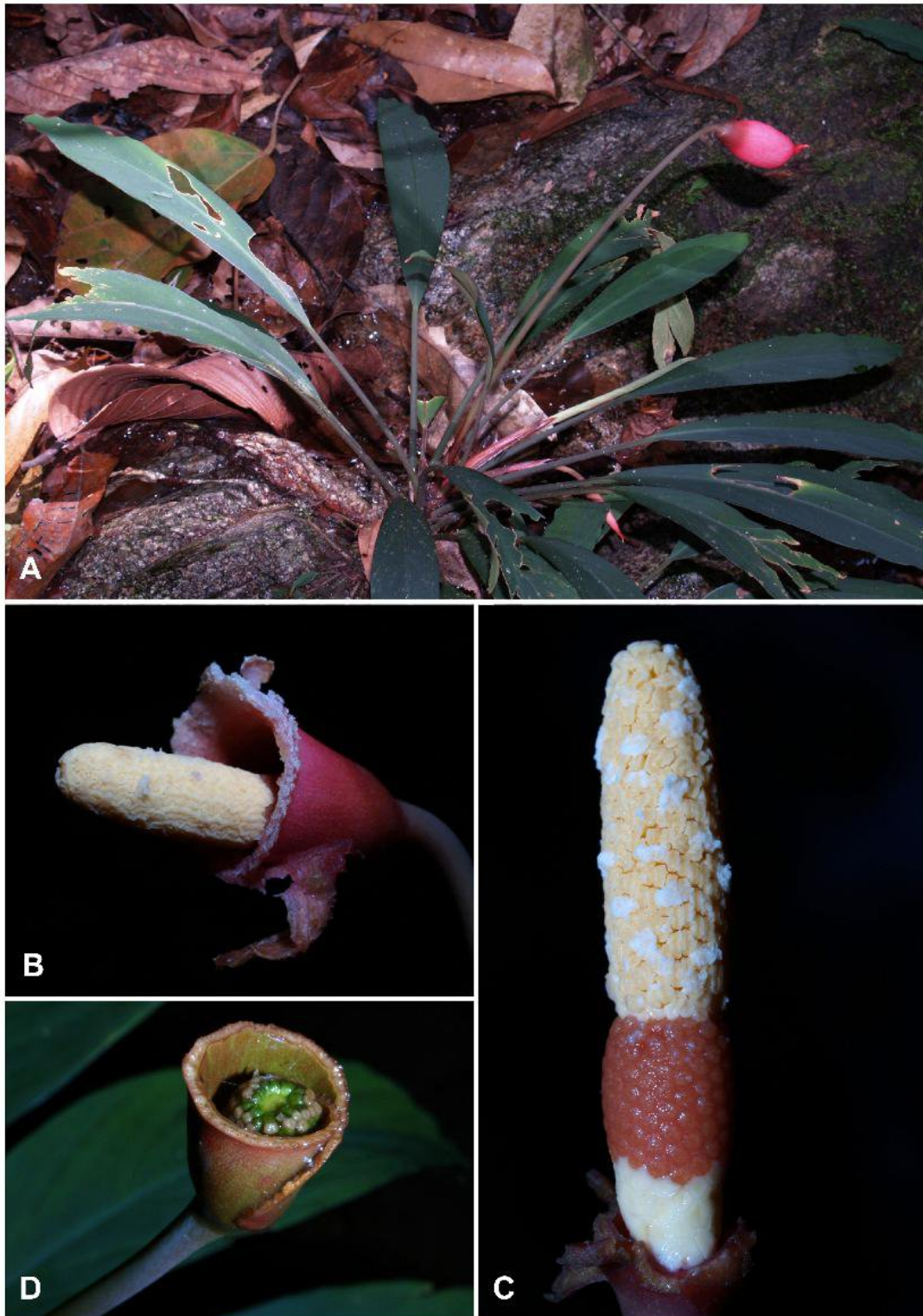


Figure 30. *Rhynchophyle elongata*. **A.** Flowering plant in habitat. **B.** Inflorescence at late staminate anthesis, spathe limb already shed and pollen visible on staminate flower zone. **C.** Spadix at staminate anthesis, spathe limb artificially removed; note pollen masses. **D.** Sub-mature infructescence with associated splash-cup. All from *AR-5116*. A & C from *AR-2338*; B & D from *AR-2052*.

Schismatoglottis elongata Engl., Bull. Soc. Tosc.ortic. 298 (1879).

Piptospatha elongata (Engl.) N.E. Br., Bot. Mag. 121: t. 7410 (1895).

Gamogyne pulchra N.E. Br., Bull. Misc. Inform. Kew. 6: 197 (1910).

Type: Malaysian Borneo, Sarawak, Lundu, G. Gading, Jun 1867, *O. Beccari p.b. 2308* (holo FI-B!).

Rhynchopyle impolita (S.Y. Wong, P.C. Boyce & Bogner) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 71 (2018).

Piptospatha impolita P.C. Boyce, S.Y. Wong & Bogner, *Gard. Bull. Singapore* 61: 227 (2009).

Type: Malaysian Borneo, Sarawak, Kuching, Lundu, Sempadi, Sg. Limau, Bukit Kankar, 25 Aug 2007, *P.C. Boyce, S.Y. Wong & Jipom A.T. AR-2141* (holo SAR; iso SAR spirit!).

Rhynchopyle loi (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 71 (2018).

Piptospatha loi P.C. Boyce & S.Y. Wong, *Webbia* 68: 3 (2013).

Type: Malaysian Borneo, Sabah, Tawau, Lahad Datu, Ulu Segama-Malua F.R., Air Terjun Bilong, 26 Jun 2012, *M. Lo AR-3992* (holo SAN spirit!).

Rhynchopyle marginata (Engl.) Engl., *Bot. Jahrb. Syst.* 1: 184. 1880 Becc., *Malesia* 1: 288, (1882).

Schismatoglottis marginata Engl., *Bull. Soc. Tosc.ortic.* 4: 298 (1879).

Piptospatha marginata (Engl.) N.E. Br., *Curtis's Bot. Mag.* 51 (1895), in descr. ad tab. 7410; Engl., *Pflanzenr.* 55(IV.23Da): 125 (1912); Aldewer., *Bull. Jard. Bot. Buitenzorg* 3(4): 194 (1922); Wong et al., *Webbia* 66: 29 (2011).

Type: Malaysian Borneo, Sarawak, Kapit, Rejang, Balleh, 1867, *O. Beccari p.b. 3838* (holo FI-B!).

Rhynchopyle nivea (P.C. Boyce, S.Y. Wong & Sahal) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 72 (2018).

Piptospatha nivea P.C. Boyce, S.Y. Wong & Sahal, *Aroideana* 37E(2): 52 (2014).

Type: Indonesian Borneo, Kalimantan Tengah, Kapuas, Kuala Kapuas, 1 Nov 2013, *A. Sahal AR-4300* (holo BO!).

Rhynchopyle pileata (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 72 (2018).

Piptospatha pileata S.Y. Wong & P.C. Boyce, *Willdenowia* 42: 248 (2012).

Type: Indonesian Borneo, Kalimantan Timur, Punjangan, Kayan Mentarang Reserve, Puak River valley, N of 'Batu Mayo', c. 8 km northwest of Puak valley, 25 Jul 1992, *J.A. McDonald & Ismail 3615* (holo L!; iso BO!, GH).

Rhynchopyle viridistigma (S.Y. Wong, P.C. Boyce & Bogner) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 73 (2018).

Piptospatha viridistigma S.Y. Wong, P.C. Boyce & Bogner, *Gard. Bull. Singapore* 61(1): 224 (2009).

Type: Malaysian Borneo, Sarawak, Kuching, Siburan, Kampung Giam, Air Terjun Giam, 7 Feb 2006, *P.C. Boyce, Jeland A.K. & S.Y. Wong AR-1687* (holo SAR spirit!).

Schottariella P.C. Boyce & S.Y. Wong, *Bot. Stud. (Taipei)* 50: 269. 2009 Boyce & Wong, *Bot. Stud. (Taipei)* 50: 269–271 (2009) & *Aroideana* 35: 24 (2012) & *Aroideana* 37E(1): 11 (2014); Low et al., *Webbia* 72(2): 73 (2018).

Type: *Schottariella mirifica* P.C. Boyce & S.Y. Wong. **Figures 31–34.**

Diagnostic characters — *Schottariella* is unique by the combination of smooth thecae with a hyaline ridge that becomes erect into a needle-like projection tipped with a weakly peltate ovate-triangular flap on which the pollen droplet is presented, emerging from the thecae (one per theca) at the onset of staminate anthesis, an unconstricted spathe,

a spadix frequently with distal pistillodes, dehiscent fruits, seeds each completely enclosed in a fleshy white with a conspicuous hyaline extension at the chalazal end, and the shovel-shaped persistent lower spathe in which the margins do not form a level rim but instead are obliquely declined such fruits/seeds are probably ejected forwards and away from the front of the cup rather than upwards, this is further reinforced by the arching/declinate fruiting peduncle presenting the lower spathe opening laterally or downwards.

Distribution — Borneo, restricted to Sarikei and Sri Aman Districts, central southern Sarawak.

Ecology — *Schottariella* is rheophytic on vertical clay-loam riverbanks under old secondary and fragments of primary lowland riparian evergreen moist forest on shales.

Schottariella mirifica P.C. Boyce & S.Y. Wong, *Bot. Stud. (Taipei)* 50: 270 (2009).

Type: Malaysian Borneo, Sarawak, Sarikei, Maradong, Sungai Matob, 8 Dec 2005, *P.C. Boyce et al. AR-1615* (holo SAR!).

Schottarum P.C. Boyce & S.Y. Wong, *Bot. Stud. (Taipei)* 49: 393. 2008 Low et al., *Pl. Syst. Evol.* 300: 607 (2014); Low et al., *Webbia* 72(2): 77 (2018).

Type: *Schottarum sarikeense* (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong (\equiv *Hottarum sarikeense* Bogner & M. Hotta, *Schismatoglottis sarikeensis* (Bogner & M. Hotta) A. Hay & Bogner). **Figure 35.**

Diagnostic characters — *Schottarum* is defined by basal placentation, three to six ovules, seeds without a micropylar appendage, a spathe with a constriction, a narrowly campanuliform persistent lower spathe and a pistillate flower zone almost completely adnate to the spathe.

Distribution — Sarawak, endemic to Kanowit-Song-Ai drainages, Sarawak, and probably beyond to the Bentuang Karimum National Park in Kalimantan. The recognition of the genus gives added weight to the presence of a newly delimited phytochore (a specific spatial distributional region defined by the plants that uniquely occur within it) based on these areas.

Ecology — Rheophytes on vertical clay-loam or exposed shale riverbanks under old secondary and fragments of primary lowland riparian evergreen moist forest on shales.

Schottarum sarikeense (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong, Bot. Stud. (Taipei) 49(4): 395 (2008).

Hottarum sarikeense Bogner & M. Hotta, Bull. Mus. Natl. Hist. Nat., B, Adansonia 5: 27, Pl. 1–3 (1983).

Schismatoglottis sarikeensis (Bogner & M. Hotta) A. Hay & Bogner, Telopea 9: 100 (2000).

Type: Malaysia, Sarawak, Sarikei, near Sarikei, Sep 1978, *J. Bogner 1553*, Cult. Botanischer Garten München (holo KYO; iso K!, M!, P!, US).

Schottarum josefii (A. Hay) P.C. Boyce, S.Y. Wong & S.L. Low, Pl. Syst. Evol. 300: 614 (2014).

Schismatoglottis josefii A. Hay, Telopea 9: 89 (2000).

Type: Malaysian Borneo, Sarawak, Sarikei, Entabai, 3 Sep 1978, *J. Bogner 1353* (holo M!).

Tawaia S.Y. Wong, S.L. Low & P.C. Boyce, Webbia 72(2): 78 (2018).

Type: *Tawaia sababensis* (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce (\equiv *Aridarum sababense* S.Y. Wong, S.L. Low & P.C. Boyce). **Figure 36.**

Diagnostic characters — *Tawaia* is unique by the combination of globose thecae and spatulate interpistillar staminodes. In overall aspect, by the nodding spathe on a long, slender peduncle, and by the spathe limb hardly opening at pistillate anthesis and deliquescing acroscopically, spathe recurved and abscises, remained with a 5 mm rim beyond the junction of upper spathe and the persistent lower spathe, upper spathe

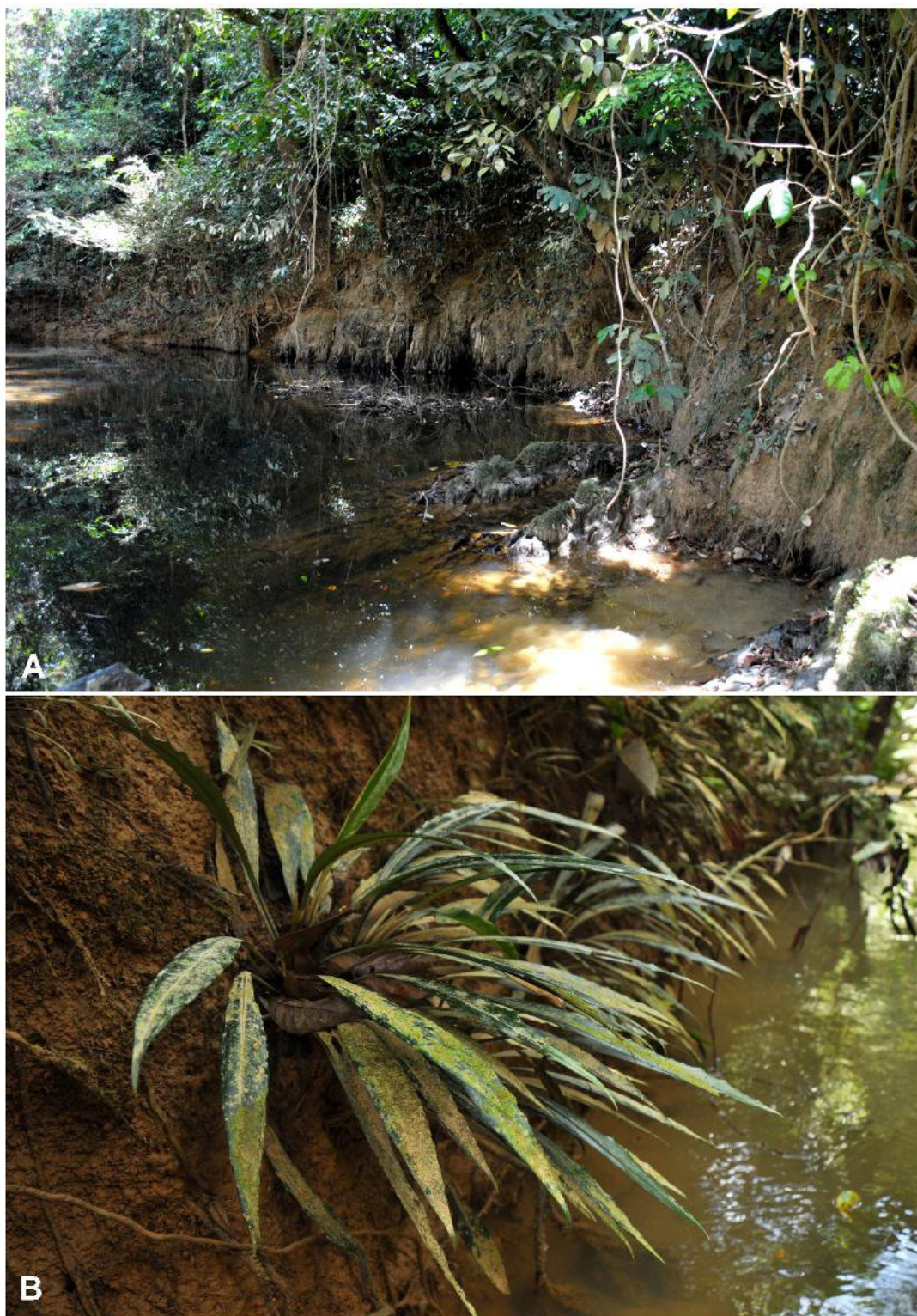


Figure 31. *Schottariella mirifica*. **A.** Type locality habitat at low water, Sungai Matob. *Schottariella* occurs on vertical mud banks, at high water river overtops these banks. **B.** Plants in locality at Pakan; note silt deposition on leaves. A & B unvouchered images.



Figure 32. *Schottariella mirifica*. **A.** Flowering plant in habitat on vertical clay river bank. **B–D.** Inflorescence at staminate anthesis. All from *AR-1615*.



Figure 33. *Schottariella mirifica*. **A.** Inflorescence at staminate anthesis; note peltate flaps on tips of thecae extensions. **B.** Detail of staminate flower zone showing terminal pistillodes; **C.** Inflorescence at end of anthesis, spathe limb degrading. **D.** Infructescence at early stage of development; note broad scar left by fallen spathe limb and that oblique ventral margins are now downwards-facing. All from *AR-1161*.



Figure 34. *Schottariella mirifca*. **A.** Young infructescences with peduncle arching. **B.** Plant with ripe infructescence; note peduncle has extended considerably as compared with immature infructescence (top middle), and is pendent. Note, too, scoop-shaped persistent spathe. **C.** Dorsal view of persistent spathe of mature infructescence; note strongly oblique, impressed peduncle insertion strongly oblique. **D.** Ripe infructescence, ventral view; sunken stigmatic remains are clearly visible. All from AR-1609.

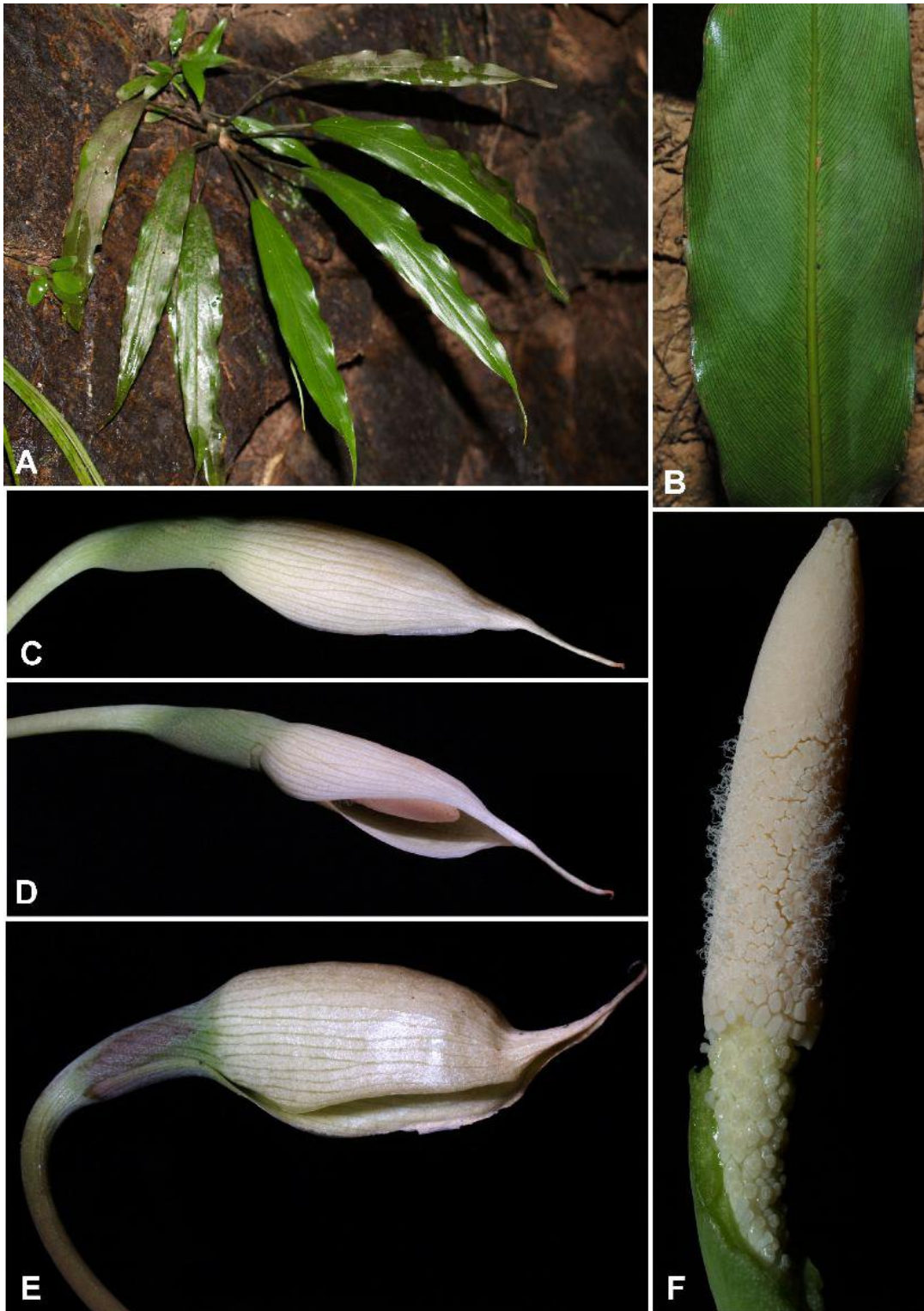


Figure 35. *Schottarum sarikeense*. **A.** Plant in habitat. **B.** Abaxial surface of leaf blade. **C & D.** Inflorescence, early pistillate anthesis. **D.** Inflorescence at staminate anthesis, note that spathe limb is now inflated. **E.** Spadix at staminate anthesis, pollen strings visible. **F.** Spadix at staminate anthesis, pollen strings visible. A from AR-1548; B–E from AR-1605.

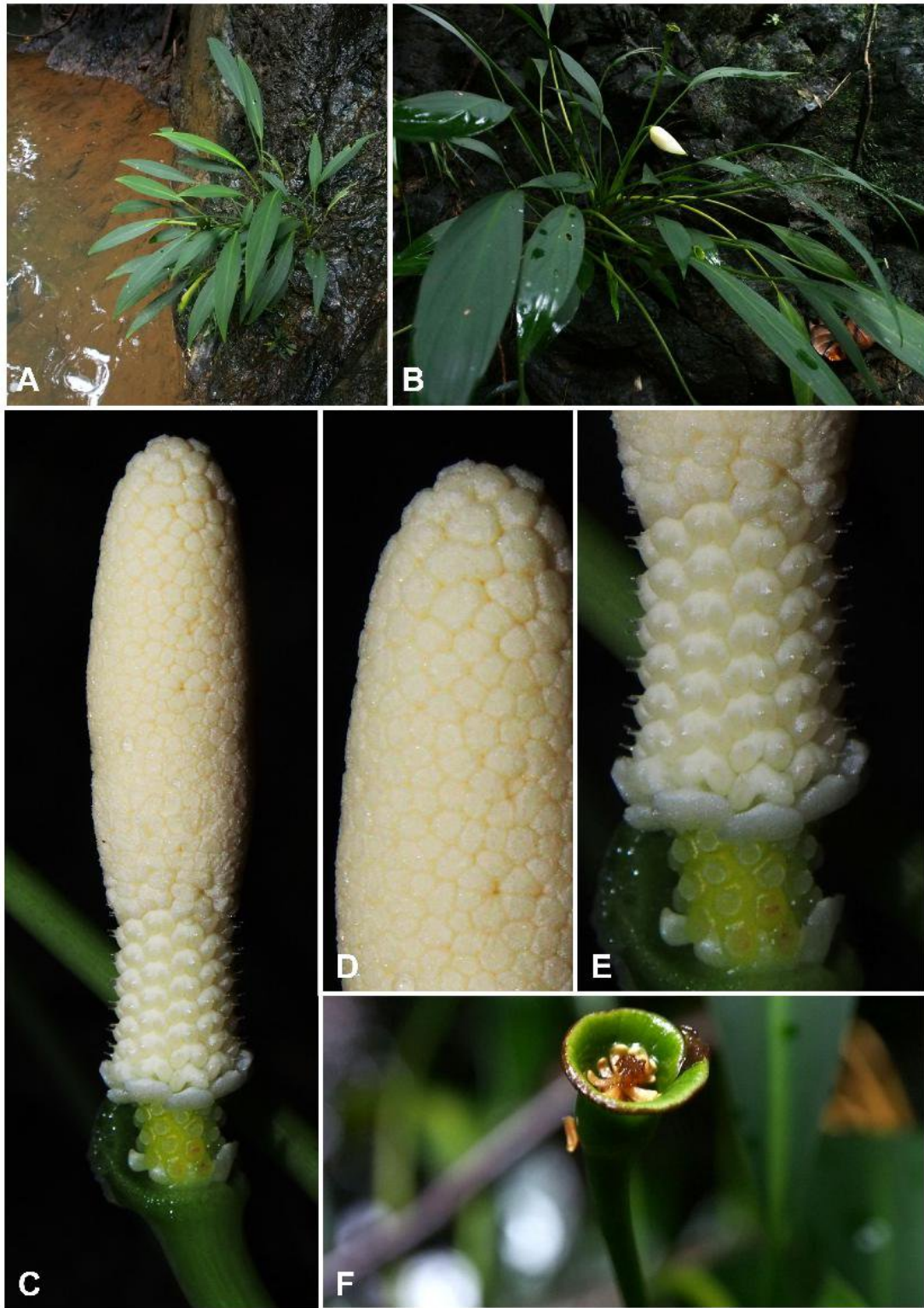


Figure 36. *Tawaia sababensis*. **A & B.** Plants in habitat, Type locality. **C.** Spadix at onset of staminate anthesis, spathe artificially removed. **D.** Detail of appendix staminodes. **E.** Detail of fertile flower zones and interpistillar staminodes. **F.** Sub-mature infructescence; note that interpistillar staminodes are beginning to be lost. All from AR-4093.

then marcescent and was partially attached on the persistent lower spathe, thence browning and marcescent during staminate anthesis. *Tawaia* approaches *Toga*, from which it differs, in addition to the aforementioned characteristics, by possessing an erect salverform (vs nodding, narrowly campanuliform) persistent lower spathe.

Distribution — Sabah, Malaysian Borneo, known from the type locality and nearby Bidu-Bidu F.R. where it co-occurs with *Bucephalandra ultramafica*.

Ecology — Rheophytic on ultramafic (ultrabasic) river boulders and waterfalls under perhumid lowland and lower hill forest.

Tawaia sabahensis (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 79 (2018).

Aridarum sabahense S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37E(2): 43 (2014).

Type: Malaysian Borneo, Sabah, Sandakan, Kinabatangan, Telupit, Gunung Tawai, *M. Lo AR-4093* (holo SAN!; iso SAR!).

Toga S.Y. Wong, S.L. Low & P.C. Boyce, *Webbia* 72(2): 79 (2018).

Type: *Toga rostrata* (Bogner & A. Hay) S.Y. Wong & P.C. Boyce (\equiv *Aridarum rostratum* Bogner & A. Hay). **Figure 37.**

Diagnostic characters — *Toga* is defined by pendent inflorescences on an arching to pendent wiry peduncle, by the presence of horseshoe-shaped interstice staminodes expanding laterally post-pistillate anthesis and prior to staminate anthesis, by the spathe limb more than twice the length of the spadix, hardly opening at pistillate anthesis, and deliquescing acroscopically during staminate anthesis, and by the narrowly campanuliform (not salverform) persistent lower spathe. *Toga* is differentiated from *Burttianthus* by the stamens lacking a distally expanded connective and spathe limb caducous by simple lesion from the lower persistent part (not deliquescing acroscopically). It differs further by the leaf blades lacking the adaxially conspicuously raised primary lateral veins that are characteristic of *Burttianthus*.

Distribution — Borneo, northern Kalimantan Barat, north of the Schwaner and east of the Muller mountains.

Ecology — Rheophytic on sandstone waterfalls, and along rocky river banks in perhumid hill or upper hill forest.

Toga alatensis (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 81 (2018).

Aridarum alatense S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 12 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sintang, Serawai, northern flanks of the Schwaner Mountains, Gunung Alat, north of Nanga Serawai and 120 km east of Nanga Pinoh, 17 May 2013, *K. Nakamoto AR-4156* (holo BO spirit!; iso SAR spirit!).

Toga hippocrepis (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 81 (2018).

Aridarum hippocrepis P.C. Boyce & S.Y. Wong, *Willdenowia* 43: 43: 91 (2013).

Type: Indonesian Borneo, Kalimantan Barat, Sekadau, Nanga Taman, 4 Apr 2012, *K. Nakamoto AR-3842* (holo BO spirit!; iso SAR spirit!).

Toga perplexa (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia*

72(2): 81 (2018).

Aridarum perplexum S.Y. Wong, S. L. Low & P.C. Boyce, *Aroideana* 37E: 41 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Sintang, Sepauk, Kayu Lapis, Nanga Pari, 68 km south of Kayu Lapis, 23 Oct 2013, *K. Nakamoto AR-4299* (holo BO spirit!; iso SAR spirit!).

Toga rostrata (Bogner & A. Hay) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 81 (2018).

Aridarum rostratum Bogner & A. Hay, *Telopea* 9: 191 (2000).

Type: Indonesian Borneo, Kalimantan Barat, Bidang Menabei, 1924/5, *H. K.A. Winkler 1066* (holo L!; holo HBG).

Toga surukensis (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 81 (2018).

Aridarum surukense S.Y. Wong, S.L. Low & P.C. Boyce, *Aroideana* 37: 23 (2014).

Type: Indonesian Borneo, Kalimantan Barat, Kapuas Hulu, Bunut Hulu, Nanga Suruk, 24 Sep 2013, *K. Nakamoto AR-4218* (holo BO spirit!; iso SAR spirit!).

Toga unca (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce, *Webbia* 72(2): 82 (2018).

Aridarum uncum P.C. Boyce & S.Y. Wong, *Willdenowia* 43: 96 (2013).

Type: Indonesian Borneo, Kalimantan Barat, Kapuas Hulu, Putussibau, Gunung Sepangin, 31 km south of Putussibau, Gua Maria Lourdes Burongkong, 10 Ap 2012, *K. Nakamoto AR-3901* (holo BO spirit!; iso SAR spirit!).

Vesta S.Y. Wong, *Webbia* 72(2): 82 (2018).

Hestia S.Y. Wong & P.C. Boyce 2010, non *Hestia* R.M. Bateman, Kenrick &



Figure 37. *Toga rostrata*. **A–C.** Plants in habitat; note pendent inflorescences visible (B, centre and mid right); **D.** Inflorescence at early pistillate anthesis. **E & F.** Inflorescence at staminate anthesis; note majority of spathe limb has already shed. **G.** Spadix, spathe artificially removed, at onset of staminate anthesis. **H.** Detail of spadix fertile zones at onset of staminate anthesis; note interpistillar staminodes are beginning to expand laterally. A from AR-3538; B–H from AR-3532.

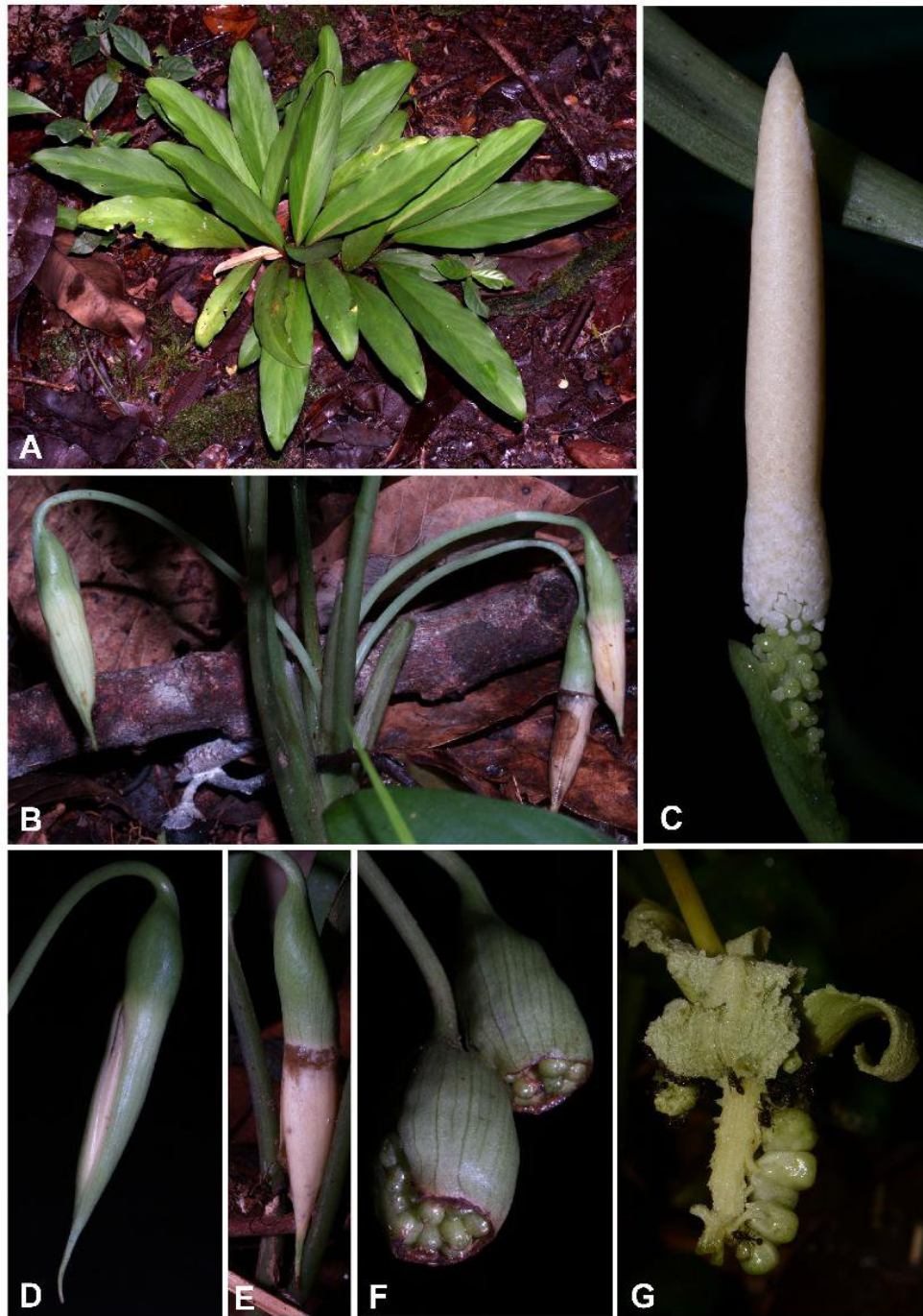


Figure 38. *Vesta longifolia*. **A.** Plant in habitat on podzol. **B.** Nodding inflorescences, inflorescence to left at pistillate anthesis; upper right at staminate anthesis, lower right post-anthesis with spathe beginning to degrade prior to being shed. **C.** Spathe slightly gapping at pistillate anthesis. **D.** Spadix with spathe removed artificially to reveal pistillate and staminate flower zones. **E.** Inflorescence post-anthesis with spathe limb rotting at junction of lower spathe, later to be shed together with spent part of spadix. **F.** Infructescences with distinctive narrowly campanulate persistent lower spathe. **G.** Ripe fruits dispersing from splitting basiscopically lower spathe. A & B from *AR-2133*; C from *AR-233*; D – F from *AR-2133*; G from *AR-4924*.

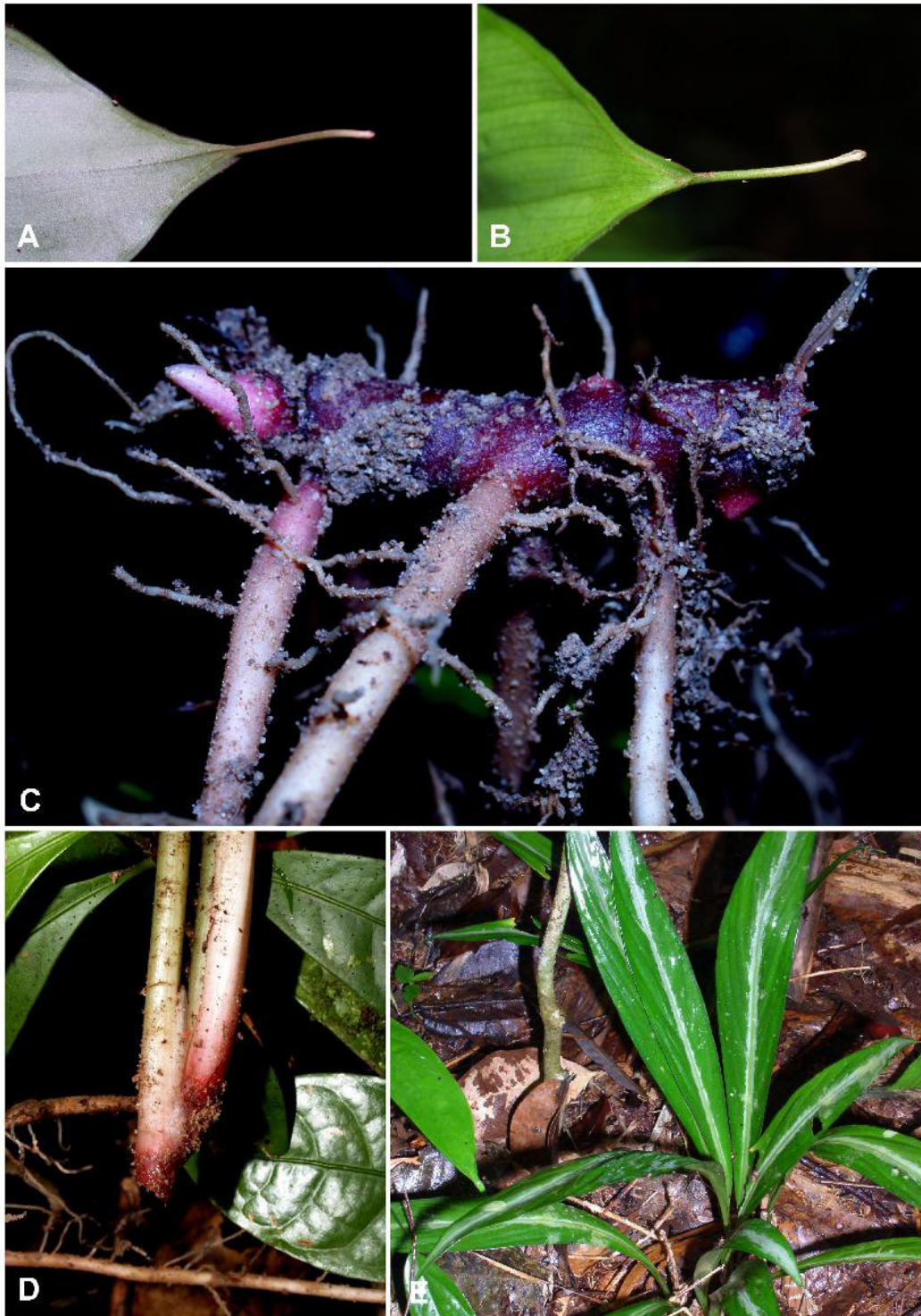


Figure 39. *Vesta longifolia*. **A & B.** Leaf blade tip showing abaxial (A) and adaxial (B) view of long, solid terminal mucro. **C.** Excavated portion of a rhizome to show dimorphic roots; bases of tap-roots are clearly visible. Bud (on left) was revealed by disarticulation of leafy shoot shown in D. **D.** Basal portion of a disarticulated shoot. **E.** Plant with silver banded leaves. To date such plants are only known from Sarawak. A–D from AR-2133; E from AR-960.

Rothwell 2007 [= Lycopodiales or Drepanophycales].

Type: *Vesta longifolia* (Ridl.) S.Y. Wong (≡ *Schismatoglottis longifolia* Ridl.; *Hestia longifolia* (Ridl.) S.Y. Wong & P.C. Boyce).

Figures 38 & 39.

Diagnostic characters — *Vesta* is a distinctive genus easily recognised by rather numerous nodding inflorescences on relatively very long slender wiry peduncles, a weak constriction present between the lower spathe and upper spathe and the orifice of the lower spathe is open during fruiting. The entire non-pistillate portion of the spadix dries and adheres to the spathe limb with the whole combined unit shedding, and has vegetative modules readily disarticulating from a deep-seated rhizome.

Distribution — *Vesta* occurs in a disjunction between the Malay Peninsula, where it is recorded only from Perak, and Borneo where it is known from numerous but widely scattered localities in Sarawak and Brunei. It is not implausible that the Bornean plants comprise one or more additional species.

Ecology — In kerangas and kerapah formations in lowland moist forest and lowland hill forest, and regrowth, usually occurring on raised podzols in otherwise swampy areas, sometimes near streams.

Vesta longifolia (Ridl.) S.Y. Wong, *Webbia* 72(2): 84 (2018).

Schismatoglottis longifolia Ridl., *J. Bot.* 40: 37 (1902).

Hestia longifolia (Ridl.) S.Y. Wong & P.C. Boyce, *Bot. Stud. (Taipei)* 51: 250 (2010).

Lectotype (selected by Hay 1996, p. 26): Malaysia, Perak, Bukit Larut, *H. H. Kunstler* ('*Dr King's Collector*') 1967 (lecto K!).

Species listing

Names in **bold** are accepted; names in *light italics* are synonyms.

Apoballis Schott

Apoballis acuminatissima (Schott) S.Y. Wong & P.C. Boyce

Apoballis belophylla (Alderw.) S.Y. Wong & P.C. Boyce

Apoballis brevipes (Hook.f.) S.Y. Wong & P.C. Boyce

Apoballis grandiflora (Alderw.) S.Y. Wong & P.C. Boyce

Apoballis hastifolia (Hallier f. ex Engl.) S.Y. Wong & P.C. Boyce

Apoballis javanica (Engl.) S.Y. Wong & P.C. Boyce

Apoballis longicaulis (Ridl.) S.Y. Wong & P.C. Boyce

Apoballis mutata (Hook.f.) S.Y. Wong & P.C. Boyce

Apoballis neglecta Schott = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Apoballis okadae (M. Hotta) S.Y. Wong & P.C. Boyce

Apoballis ovata (Schott) S.Y. Wong & P.C. Boyce

Apoballis rupestris (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Apoballis sagittifolia (Alderw.) S.Y. Wong & P.C. Boyce

Aridarum Ridl.

Aridarum alatense S.Y. Wong, S.L. Low & P.C. Boyce = **Toga alatensis** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Aridarum annae Bogner = **Heteroaridarum borneense** M. Hotta

Aridarum ashtonii S.Y. Wong & P.C. Boyce = **Pursegloveia ashtonii** (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Aridarum burttii Bogner & Nicolson = **Pursegloveia burttii** (Bogner & Nicolson) S.Y. Wong & P.C. Boyce

Aridarum caulescens M. Hotta = **Burttianthus caulescens** (M. Hotta) S.Y. Wong & P.C. Boyce

Aridarum caulescens var. *angustifolium* Bogner & Nicolson =

Aridarum chamaesyce S.Y. Wong & P.C. Boyce

Aridarum crassum S.Y. Wong & P.C. Boyce = **Heteroaridarum crassum** (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Aridarum hansenii Bogner = **Burttianthus hansenii** (Bogner) S.Y. Wong & P.C. Boyce

Aridarum hebe S.Y. Wong, S.L. Low & P.C. Boyce = **Hera hebe** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Aridarum hippocrepis P.C. Boyce & S.Y. Wong = **Toga hippocrepis** (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce

Aridarum incavatum H. Okada & Y. Mori

Aridarum kazuyae S.Y. Wong, P.C. Boyce & S.L. Low = **Pursegloveia kazuyae** (S.Y.

Wong, P.C. Boyce & S.L. Low) S.Y. Wong & P.C. Boyce

Aridarum longipedunculatum M. Hotta = **Burttianthus longipedunculatus** (M. Hotta) S.Y. Wong & P.C. Boyce

- Aridarum minimum* H. Okada = **Pursegloveia minima** (H. Okada) S.Y. Wong & P.C. Boyce **Aridarum montanum** Ridl.
- Aridarum nicolsonii* Bogner = **Heteroaridarum nicolsonii** (Bogner) S.Y. Wong & P.C. Boyce
- Aridarum orestum* S.Y. Wong, S.L. Low & P.C. Boyce = **Burttianthus orestus** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Aridarum orientale* S.Y. Wong, P.C. Boyce & S.L. Low = **Pursegloveia orientalis** (S.Y. Wong, P.C. Boyce & S.L. Low) S.Y. Wong & P.C. Boyce
- Aridarum pendek** S.Y. Wong, S.L. Low & P.C. Boyce
- Aridarum perplexum* S.Y. Wong, S. L. Low & P.C. Boyce = **Toga perplexa** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Aridarum rostratum* Bogner & A. Hay = **Toga rostrate** (Bogner & A. Hay) S.Y. Wong, S.L. Low & P.C. Boyce
- Aridarum sabahense* S.Y. Wong, S.L. Low & P.C. Boyce = **Tawaia sabahensis** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Aridarum spissum* S.Y. Wong, S.L. Low & P.C. Boyce = **Burttianthus spissus** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Aridarum surukense* S.Y. Wong, S.L. Low & P.C. Boyce = **Toga surukensis** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Aridarum unicum* P.C. Boyce & S.Y. Wong = **Toga unca** (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce
- Aridarum velutandrum* S.Y. Wong, S.L. Low & P.C. Boyce = **Burttianthus velutandrus** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Aridarum zygosetum* S.Y. Wong, S.L. Low & P.C. Boyce = **Naiadia zygoseta** (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Bakoa** P.C. Boyce & S.Y. Wong
- Bakoa brevipedunculata* (H. Okada & Y. Mori) S.Y. Wong = **Gosong brevipedunculata** (H. Okada & Y. Mori) S.Y. Wong & P.C. Boyce
- Bakoa lucens** (Bogner) P.C. Boyce & S.Y. Wong
- Bakoa nakamotoi* S.Y. Wong = **Bakoella nakamotoi** (S.Y. Wong) S.Y. Wong & P.C. Boyce
- Bakoa sicula* S.Y. Wong = **Bakoella sicula** (S.Y. Wong) S.Y. Wong & P.C. Boyce

- Bakoaela** S.Y. Wong & P.C. Boyce
- Bakoaela nakamotoi** (S.Y. Wong) S.Y. Wong & P.C. Boyce
- Bakoaela sricula** (S.Y. Wong) S.Y. Wong & P.C. Boyce
- Bidayuha** S.Y. Wong & P.C. Boyce
- Bidayuha crassispatha** S.Y. Wong & P.C. Boyce
- Bucephalandra** Schott
- Bucephalandra akantha** S.Y. Wong & P.C. Boyce
- Bucephalandra aurantiithecra** S.Y. Wong & P.C. Boyce
- Bucephalandra belindae** S.Y. Wong & P.C. Boyce
- Bucephalandra bogneri** S.Y. Wong & P.C. Boyce
- Bucephalandra catherineae** P.C. Boyce, Bogner & Mayo
- Bucephalandra chimaera** S.Y. Wong & P.C. Boyce
- Bucephalandra chrysokoupa** S.Y. Wong & P.C. Boyce
- Bucephalandra diabolica** S.Y. Wong & P.C. Boyce
- Bucephalandra elliptica** (Engl.) S.Y. Wong & P.C. Boyce
- Bucephalandra filiformis** S.Y. Wong & P.C. Boyce
- Bucephalandra forcipula** S.Y. Wong & P.C. Boyce
- Bucephalandra gigantea** Bogner
- Bucephalandra goliath** S.Y. Wong & P.C. Boyce
- Bucephalandra kerangas** S.Y. Wong & P.C. Boyce
- Bucephalandra kishii** S.Y. Wong & P.C. Boyce
- Bucephalandra magnifolia** H. Okada & Y. Mori
- Bucephalandra micrantha** S.Y. Wong & P.C. Boyce
- Bucephalandra minotaur** S.Y. Wong & P.C. Boyce
- Bucephalandra motleyana** Schott
Bucephalandra motleyana sensu Bogner (1980) =

Bucephalandra bogneri S.Y. Wong & P.C. Boyce

Bucephalandra motleyana sensu Boyce (1995) =
Bucephalandra bogneri S.Y. Wong & P.C. Boyce

Bucephalandra muluensis (M. Hotta) S.Y. Wong & P.C. Boyce

Bucephalandra oblanceolata (M. Hotta) S.Y. Wong & P.C. Boyce

Bucephalandra oncophora S.Y. Wong & P.C. Boyce

Bucephalandra pubes S.Y. Wong & P.C. Boyce

Bucephalandra pygmaea (Becc.) S.Y. Wong & P.C. Boyce

Bucephalandra sordidula S.Y. Wong & P.C. Boyce

Bucephalandra spathulifolia Engl. ex S.Y. Wong & P.C. Boyce

Bucephalandra tetana S.Y. Wong & P.C. Boyce

Bucephalandra ultramafica S.Y. Wong & P.C. Boyce

Bucephalandra yengiae P.C. Boyce

Burttianthus S.Y. Wong, S.L. Low & P.C. Boyce

Burttianthus caulescens (M. Hotta) S.Y. Wong & P.C. Boyce

Burttianthus hansenii (Bogner) S.Y. Wong & P.C. Boyce

Burttianthus longipedunculatus (M. Hotta) S.Y. Wong & P.C. Boyce

Burttianthus orestus (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Burttianthus purseglovei (Furtado) S.Y. Wong & P.C. Boyce

Burttianthus spissus (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Burttianthus veluntandrus (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Colobogynium Schott

Colobogynium tecturatum Schott

Fenestratarum P.C. Boyce & S.Y. Wong

Fenestratarum culum P.C. Boyce & S.Y. Wong

Fenestratarum mulyadii P.C. Boyce & S.Y. Wong

Galantharum P.C. Boyce & S.Y. Wong

Galantharum kishii P.C. Boyce & S.Y. Wong

Gamogyne N.E. Br.

Gamogyne bella (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Gamogyne burbidgei N.E. Br.

Gamogyne colata (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Gamogyne deceptrix (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Gamogyne helix (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Gamogyne lurida (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Gamogyne pulchra N.E. Br. = **Rhynchopyle elongata** (Engl.) Engl.

Gamogyne nivea (P.C. Boyce, S.Y. Wong & Sahal) S.Y. Wong & P.C. Boyce

Gosong S.Y. Wong & P.C. Boyce

Gosong brevipedunculata (H. Okada & Y. Mori) S.Y. Wong & P.C. Boyce

Hera S.Y. Wong, S.L. Low & P.C. Boyce

Hera hebe (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Hestia S.Y. Wong & P.C. Boyce = **Vesta** S.Y. Wong

Hestia longifolia (Ridl.) S.Y. Wong & P.C. Boyce = **Vesta longifolia** (Ridl.) S.Y. Wong

Hestia R.M. Bateman, Kenrick & Rothwell = Lycopodiales or Drepanophycales

Hestia eremosa Bateman, Kenrick & Rothwell = Lycopodiales or Drepanophycales

Heteroaridarum M. Hotta

Heteroaridarum borneense M. Hotta

Heteroaridarum crassum (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Heteroaridarum nicolsonii (Bogner) S.Y. Wong & P.C. Boyce

Homalomena fasciata Ridl. = **Colobogonium tecturatum** Schott

Hottarum Bogner & Nicolson

Hottarum brevipedunculatum H. Okada & Y. Mori = **Gosong brevipedunculata** (H. Okada & Y. Mori) S.Y. Wong & P.C. Boyce

Hottarum kinabaluense Bogner = **Ooia kinabaluensis** (Bogner) S.Y. Wong & P.C. Boyce

Hottarum lucens Bogner = **Bakoa lucens**
(Bogner) P.C. Boyce & S.Y. Wong

Hottarum sarikeense Bogner & M. Hotta =
Schottarum sarikeense (Bogner & M.
Hotta) P.C. Boyce & S.Y. Wong

Hottarum truncatum (M. Hotta) Bogner
& Nicolson

Kiewia S.Y. Wong & P.C. Boyce

Kiewia perakensis (Engl.) S.Y. Wong &
P.C. Boyce

Kiewia ridleyi (N.E. Br. ex Hook.f.) S.Y.
Wong & P.C. Boyce

Kiewia teijsmannii (P.C. Boyce & S.Y.
Wong) S.Y. Wong & P.C. Boyce

Microcasia Becc. = **Bucephalandra** Schott

Microcasia elliptica Engl. = **Bucephalandra**
elliptica (Engl.) S.Y. Wong & P.C. Boyce

Microcasia muluensis M. Hotta =
Bucephalandra muluensis (M. Hotta) S.Y.
Wong & P.C. Boyce

Microcasia oblanceolata M. Hotta =
Bucephalandra oblanceolata (M. Hotta)
S.Y. Wong & P.C. Boyce

Microcasia purseglovei Furtado = **Burttianthus**
purseglovei (M. Hotta) S.Y. Wong & P.C.
Boyce

Microcasia pygmaea Becc. = **Bucephalandra**
pygmaea (Becc.) S.Y. Wong & P.C. Boyce

Microcasia truncata M. Hotta = **Hottarum**
truncatum Bogner & Nicolson

Nabalu S.Y. Wong & P.C. Boyce

Nabalu corneri (A. Hay) S.Y. Wong & P.C.
Boyce

Naiadia S.Y. Wong, S.L. Low & P.C. Boyce

Naiadia zygoseta (S.Y. Wong, S.L. Low &
P.C. Boyce) S.Y. Wong & P.C. Boyce

Ooia S.Y. Wong & P.C. Boyce

Ooia altar S.Y. Wong & P.C. Boyce

Ooia basalticola S.Y. Wong & P.C. Boyce

Ooia glans S.Y. Wong & P.C. Boyce

Ooia grabowskii (Engl.) S.Y. Wong & P.C.
Boyce

Ooia havilandii (Engl.) S.Y. Wong & P.C.
Boyce

Ooia kinabaluensis (Bogner) S.Y. Wong &
P.C. Boyce

Ooia manduensis (Bogner & A. Hay) S.Y.
Wong & P.C. Boyce

Ooia paxilla S.Y. Wong & P.C. Boyce

- Ooia secta** S.Y. Wong & P.C. Boyce
- Ooia suavis** S.Y. Wong & P.C. Boyce
- Phymatarum** M. Hotta
- Phymatarum borneense** M. Hotta
- Phymatarum montanum* M. Hotta = **Phymatarum borneense** M. Hotta
- Pichinia** S.Y. Wong & P.C. Boyce
- Pichinia disticha** S.Y. Wong & P.C. Boyce
- Piptospatha** N.E. Br.
- Piptospatha bella* S.Y. Wong & P.C. Boyce = **Gamogyne bella** (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Piptospatha brevipedunculata* (H. Okada & Y. Mori) Bogner & A. Hay = **Gosong**
- brevipedunculata** (H. Okada & Y. Mori) S.Y. Wong & P.C. Boyce
- Piptospatha burbidgei* (N.E. Br.) M. Hotta = **Gamogyne burbidgei** N.E. Br.
- Piptospatha colata* S.Y. Wong & P.C. Boyce = **Gamogyne colata** (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Piptospatha deceptrix* S.Y. Wong & P.C. Boyce = **Gamogyne deceptrix** (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Piptospatha elongata* (Engl.) N.E. Br. = **Rhynchopyle elongata** (Engl.) Engl.
- Piptospatha elongata* var. *perakensis* Engl. = **Kiewia perakensis** (Engl.) S.Y. Wong & P.C. Boyce
- Piptospatha grabowskii* (Engl.) Engl. = **Ooia grabowskii** (Engl.) S.Y. Wong & P.C. Boyce
- Piptospatha havilandii* (Engl.) Engl. = **Ooia havilandii** (Engl.) S.Y. Wong & P.C. Boyce
- Piptospatha helix* S.Y. Wong & P.C. Boyce = **Gamogyne helix** (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce
- Piptospatha insignis** N.E. Br.
- Piptospatha kinabaluensis* (Bogner) Bogner & A. Hay = **Ooia kinabaluensis** (Bogner) S.Y. Wong & P.C. Boyce
- Piptospatha loi* P.C. Boyce & S.Y. Wong = **Rhynchopyle loi** (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce
- Piptospatha lucens* (Bogner) Bogner & A. Hay = **Bakoa lucens** (Bogner) P.C. Boyce & S.Y. Wong
- Piptospatha lurida* S.Y. Wong & P.C. Boyce = **Gamogyne lurida** (S.Y. Wong & P.C. Boyce)

Boyce) S.Y. Wong & P.C. Boyce

Piptospatha manduensis Bogner & A. Hay =
Ooia manduensis (Bogner & A. Hay) S.Y.
Wong & P.C. Boyce

Piptospatha marginata (Engl.) N.E. Br. =
Rhynchopyle marginata (Engl.) Engl.

Piptospatha nivea P.C. Boyce, S.Y. Wong &
Sahal = **Gamogyne nivea** (P.C. Boyce, S.Y.
Wong & Sahal), S.Y. Wong & P.C. Boyce

Piptospatha perakensis (Engl.) Engl. = **Kiewia**
perakensis (Engl.) S.Y. Wong & P.C. Boyce

Piptospatha pileata S.Y. Wong & P.C. Boyce =
Rhynchopyle pileata (S.Y. Wong & P.C.
Boyce) S.Y. Wong & P.C. Boyce

Piptospatha ridleyi N.E. Br. ex Hook.f. =
Kiewia ridleyi (N.E. Br. ex Hook.f.) S.Y.
Wong & P.C. Boyce

Piptospatha ridleyi var. *lanceolata* Ridl. =
Kiewia ridleyi (N.E. Br. ex Hook.f.) S.Y.
Wong & P.C. Boyce

Piptospatha teijsmannii P.C. Boyce & S.Y.
Wong = **Kiewia teijsmannii** (P.C. Boyce &
S.Y. Wong) S.Y. Wong & P.C. Boyce

Piptospatha truncata (M. Hotta) Bogner & A.
Hay = **Hottarum truncatum** Bogner &
Nicolson

Piptospatha viridistigma S.Y. Wong, P.C. Boyce
& Bogner = **Rhynchopyle viridistigma**
(S.Y. Wong, P.C. Boyce & Bogner) S.Y.
Wong & P.C. Boyce

Piptospatha impolita P.C. Boyce, S.Y. Wong &
Bogner = **Rhynchopyle elongata** (Engl.)
Engl.

Pursegloveia S.Y. Wong, S.L. Low & P.C.
Boyce

Pursegloveia ashtonii (S.Y. Wong & P.C.
Boyce) S.Y. Wong & P.C. Boyce

Pursegloveia burtii (Bogner & Nicolson)
S.Y. Wong & P.C. Boyce

Pursegloveia kazuyae (S.Y. Wong, P.C.
Boyce & S.L. Low) S.Y. Wong & P.C. Boyce

Pursegloveia minima (H. Okada) S.Y.
Wong & P.C. Boyce

Pursegloveia orientalis (S.Y. Wong, P.C.
Boyce & S.L. Low) S.Y. Wong & P.C. Boyce

Rhynchopyle Engl.

Rhynchopyle elongata (Engl.) Engl.

Rhynchopyle grabowskii Engl. = **Ooia**
grabowskii (Engl.) S.Y. Wong & P.C. Boyce

Rhynchopyle havilandii Engl. = **Ooia**
havilandii (Engl.) S.Y. Wong & P.C. Boyce

Rhynchopyle impolita (S.Y. Wong, P.C. Boyce & Bogner) S.Y. Wong & P.C. Boyce

Schismatoglottis beccariana var. *angustifolia* Engl. = **Colobogynium tecturatum** Schott

Rhynchopyle loi (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce

Schismatoglottis beccariana var. *cuspidata* Engl. = **Colobogynium tecturatum** Schott

Rhynchopyle marginata (Engl.) Engl.

Schismatoglottis beccariana var. *oblonga* Engl. = **Colobogynium tecturatum** Schott

Rhynchopyle perakensis (Engl.) Ridl. = **Kiewia perakensis** (Engl.) S.Y. Wong & P.C. Boyce

Schismatoglottis belophylla Alderw. = **Apoballis belophylla** (Alderw.) S.Y. Wong & P.C. Boyce

Rhynchopyle pileata (S.Y. Wong & P.C. Boyce) S.Y. Wong & P.C. Boyce

Schismatoglottis brevipes Hook.f. = **Apoballis brevipes** (Hook.f.) S.Y. Wong & P.C. Boyce

Rhynchopyle viridistigma (S.Y. Wong, P.C. Boyce & Bogner) S.Y. Wong & P.C. Boyce

Schismatoglottis brooksii Alderw. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce

Schismatoglottis Zoll. & Moritzi

Schismatoglottis acuminatissima Schott = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis concinna Schott = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis acuminatissima var. *concinna* (Schott) Engl. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis concinna var. *immaculata* (N.E. Br.) Engl. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis batoensis Engl. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce

Schismatoglottis concinna var. *purpurea* (N.E. Br.) Engl. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis beccariana Engl. = **Colobogynium tecturatum** Schott

Schismatoglottis corneri A. Hay = **Nabalu corneri** (A. Hay) S.Y. Wong & P.C. Boyce

Schismatoglottis beccariana var. *albolineata* Engl. = **Colobogynium tecturatum** Schott

Schismatoglottis crassifolia Engl. = **Colobogynium tecturatum** Schott

Schismatoglottis elongata Engl. = **Rhynchopyle elongata** (Engl.) Engl.

Schismatoglottis fasciata (Ridl.) Engl. = **Colobogynium tecturatum** Schott

Schismatoglottis forbesii Engl. = **Apoballis longicaulis** (Ridl.) S.Y. Wong & P.C. Boyce

Schismatoglottis grandiflora Alderw. = **Apoballis grandiflora** (Alderw.) S.Y. Wong & P.C. Boyce

Schismatoglottis hastifolia Hallier f. ex Engl. = **Apoballis hastifolia** (Hallier f. ex Engl.) S.Y. Wong & P.C. Boyce

Schismatoglottis havilandii (Engl.) M. Hotta = **Ooia havilandii** (Engl.) S.Y. Wong & P.C. Boyce

Schismatoglottis homalomenoidea M. Hotta = **Colobogynium tecturatum** Schott

Schismatoglottis javanica Engl. = **Apoballis javanica** (Engl.) S.Y. Wong & P.C. Boyce

Schismatoglottis josefii A. Hay = **Schottarum josefii** (A. Hay) P.C. Boyce, S.Y. Wong & S.L. Low

Schismatoglottis kurimana Alderw. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis latifolia Miq. = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Schismatoglottis latifolia var. *rubescens* Engl. = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Schismatoglottis latifolia var. *viridis* Engl. = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Schismatoglottis lavalleyi L. Linden = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis lavalleyi var. *immaculata* N.E. Br. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis lavalleyi var. *lansbergiana* L. Linden ex N.E. Br. = **Apoballis**

acuminatissima (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis lavalleyi var. *purpurea* N.E. Br. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce

Schismatoglottis leptophylla Alderw. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce

Schismatoglottis linguiformis Engl. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce

- Schismatoglottis longicaulis* Ridl. = **Apoballis longicaulis** (Ridl.) S.Y. Wong & P.C. Boyce
- Schismatoglottis longifolia* Ridl. = **Vesta longifolia** (Ridl.) S.Y. Wong
- Schismatoglottis marginata* Engl. = **Rhynchopyle elongata** (Engl.) Engl.
- Schismatoglottis minor* Hook.f. = **Apoballis brevipes** (Hook.f.) S.Y. Wong & P.C. Boyce
- Schismatoglottis monticola* Alderw. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce
- Schismatoglottis mutata* Hook.f. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce
- Schismatoglottis okadae* M. Hotta = **Apoballis okadae** (M. Hotta) S.Y. Wong & P.C. Boyce
- Schismatoglottis opaca* Engl. = **Colobogynium tecturatum** Schott
- Schismatoglottis ornata* Alderw. = **Colobogynium tecturatum** Schott
- Schismatoglottis ovata* Schott = **Apoballis ovata** (Schott) S.Y. Wong & P.C. Boyce
- Schismatoglottis parviflora* M. Hotta = **Colobogynium tecturatum** Schott
- Schismatoglottis ridleyana* Engl. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce
- Schismatoglottis rotundifolia* Engl. = **Apoballis mutata** (Hook.f.) S.Y. Wong & P.C. Boyce
- Schismatoglottis rubrocincta* Engl. = **Apoballis acuminatissima** (Schott) S.Y. Wong & P.C. Boyce
- Schismatoglottis rupestris* Zoll. = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce
- Schismatoglottis sagittifolia* Alderw. = **Apoballis sagittifolia** (Alderw.) S.Y. Wong & P.C. Boyce
- Schismatoglottis sarikeensis* (Bogner & M. Hotta) A. Hay & Bogner = **Schottarum sarikeense** (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong
- Schismatoglottis sylvestris* Alderw. = **Apoballis ovata** (Schott) S.Y. Wong & P.C. Boyce
- Schismatoglottis sylvestris* var. *subcordata* Alderw. = **Apoballis ovata** (Schott) S.Y. Wong & P.C. Boyce
- Schismatoglottis tecturata* (Schott) Engl. = **Colobogynium tecturatum** Schott
- Schismatoglottis treubii* f. *viridipes* Alderw. = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Schismatoglottis wigmannii Engl. = **Apoballis rupestris** (Zoll. & Moritzi ex Zoll.) S.Y. Wong & P.C. Boyce

Schottariella P.C. Boyce & S.Y. Wong

Schottariella mirifica P.C. Boyce & S.Y. Wong

Schottarum P.C. Boyce & S.Y. Wong

Schottarum josefii (A. Hay) P.C. Boyce, S.Y. Wong & S.L. Low

Schottarum sarikeense (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong

Tawaia S.Y. Wong, S.L. Low & P.C. Boyce

Tawaia sabahensis (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Toga S.Y. Wong, S.L. Low & P.C. Boyce

Toga alatensis (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Toga hippocrepis (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce

Toga perplexa (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Toga rostrata (Bogner & A. Hay) S.Y. Wong & P.C. Boyce

Toga surukensis (S.Y. Wong, S.L. Low & P.C. Boyce) S.Y. Wong & P.C. Boyce

Toga unca (P.C. Boyce & S.Y. Wong) S.Y. Wong & P.C. Boyce

Vesta S.Y. Wong

Vesta longifolia (Ridl.) S.Y. Wong

Unplaced taxa

Piptospatha angustifolia Engl. ex Alderw., Bull. Jard. Bot. Buitenzorg, III, 4: 193 (1922).

Piptospatha remiformis Ridl., J. Straits Branch Roy. Asiat. Soc. 49: 52 (1908).

Piptospatha rigidifolia Engl., Pflanzenr. 55(IV.23Da): 127 (1912).

Piptospatha repens H. Okada & Tsukaya, Acta Phytotax. Geobot. 61(2): 87 (2010).

References

Low S.L. [et al., 2018], Wong S.Y. & Boyce, P.C. 2018. Naming the chaos: generic redelimitation in Schismatoglottideae (Araceae) *Webbia* 72(2): 1–100.