Studies on Schismatoglottideae (Araceae) of Borneo LX: Preliminary notes on the *Schismatoglottis* Patentinervia Clade, including descriptions of three new species

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ABSTRACT

A review of the *Schismatoglottis* Patentinervia Clade is presented. Six species are accepted, of which three are pre-existing – *Schismatoglottis patentinervia* Engl. (Kalimantan Barat: Melawi), *S. pectinervia* A. Hay (NE Sarawak: Mulu; Brunei) and *S. retinervia* Furtado (Sabah: Kinabalu) – and three are taxonomic novelties: *S. belonis* S. Y. Wong, Aisahtul & P. C. Boyce (C Sarawak:

N & C Kapit), *S. gaesa* S. Y. Wong, Aisahtul & P. C. Boyce (Kalimantan Utara: Malinau), and *S. smaragdina* S. Y. Wong, Aisahtul & P. C. Boyce (C Sarawak: N Kapit). Morphological delimitation of the Patentinervia Clade is provided, all species are described and illustrated from living plants and pre-existing species also figured from their nomenclatural Types. An identification key is offered.

KEY WORDS

Patentinervia Clade, Nervosa Grade, Araceae

INTRODUCTION

The *Schismatoglottis* Patentinervia clade (sensu Low, 2016; Low et al., in prep.) comprises small mesophytic herbs with an epigeal erect to decumbent stem usually composed of pleionanthic modules (but see *S. pectinervia* A. Hay), with older portions of at least some species producing hapaxanthic reiterations. Leaf blades are lanceolate to oblong-elliptic to narrowly obovate, lack posterior lobes, and have numerous rather closely spaces primary lateral veins diverging from the mid-rib at about 90° and running more or less straight for much of the width of the blade before rather abruptly arching upwards to merge into one or two intramarginal veins, secondary venation mostly arising from the midrib and running parallel to the primary lateral veins, and tertiary venation abaxially forming a more or less obscure tessellate reticulum. Blades are often markedly discolorous with the abaxial surface much paler than the adaxial. A few species are able to propagate vegetatively from leaf blades, a trait shared with some species of the related Nervosa Grade (Wong et al., 2016a). The petiolar sheath is fully attached, membranous and long-persistent and occupies more than half the length of the petiole. Inflorescences are solitary, seldom paired, and erect on a short peduncle concealed by leaf bases. The spathe limb opens only slightly at anthesis and characteristically darkens and rots (although not deliquescing) during late staminate anthesis, while the lower spathe has remarkably thickened walls which in some species become semi-transparent during anthesis. The spadix has a pronounced appendix isodiametric to slightly wider than the staminate flower zone, stamens rather vaguely arranged into bistaminate flowers, powdery pollen, a well-differentiated interstice, pistillate flowers lacking interpistillar staminodes or if present then restricted to a single zone of large rectangular staminodes at the base of the pistillate flower zone, and erect infructescences with the thick walled persistent lower spathe orifice rather wide.

The Patentinervia Clade is entirely Bornean. Species in the allied Nervosa Grade are also almost wholly restricted to Borneo, with the exception of *Schismatoglottis brevicuspis* Hook. f. from Peninsular Malaysia, southern Thailand, and Sumatera.

Three species pertinent to the Patentinervia Clade have been described:

Schismatoglottis patentinervia Engl., described from a Hans Hallier collection from Nanga Raun, Kalimantan Barat ("Nanga Raoen" – see Anon, 1894; Hallier, 1895) was based on vegetatively distinctive sterile material, and has not yet been observed fertile. Plants of *S. patentinervia* in cultivation have highly characteristic thin, stiff leaf blades that are adaxially deep lustrous metallic blue-green with the innovations brilliant lime green (**Figure 3)**.

Schismatoglottis retinervia Furtado, restricted to the vicinity of Kinabalu, where it is locally abundant in moist mid-montane between 1000 and 1600 m asl, so far is the highest known altitude species in a genus.

Schismatoglottis pectinervia A. Hay is unusual not only by its large size but also in appearing to have entirely hapaxanthic modules, although hapaxanthic reiteration is recorded in older plants of two of the three taxonomic novelties proposed here.

This account is unquestionably preliminary. We are aware of at least another 15 novel species applicable to the Patentinervia Clade which will form part of a Masters study by the second author.

Dimensions in the descriptions are derived from fertile (i.e., mature) plants. Seedlings have overall smaller measurements.

Geological occurrences in this paper are verified using Tate (2001).

KEY TO SPECIES OF THE *SCHISMATOGLOTTIS* PATENTINERVIA CLADE

1. Leaf blades thin, stiff, adaxially deep lustrous metallic blue-green; innovations brilliant lime green; petioles and abaxial mid-rib minutely and densely puberulent with stiff short hair-like papillae. Kapuas Hulu, Kalimantan Barat . . . . . ***Schismatoglottis patentinervia***

– Leaf blades not stiff, adaxially never metallic blue-green; innovations not markedly different in colour to mature leaves and never brilliant lime green; petioles and abaxial mid-rib glabrous; if puberulent then leaf blades never stiff **2**

2. Interstice of spadix completely covered in rhomboidal-topped staminodes; spadix appendix sharp-tipped, stout curving-conic. N & C Kapit, Sarawak ***Schismatoglottis belonis***

– Interstice of spadix naked, if bearing staminodes these few, scattered, and round-topped; spadix appendix blunt, stout-fusiform to stoutly ovoid, or curving-cylindric **3**

3. Spadix appendix interstice naked **4**

– Spadix appendix interstice with scattered staminodes **5**

4. Spadix appendix and staminate flower zone together stoutly ovoid; spathe limb hardly opening at anthesis; petioles puberulent. Kinabalu, Sabah, above 1000 m asl . . . . . ***Schismatoglottis retinervia***

– Spadix appendix and staminate flower zone together curving-cylindric; spathe limb opening almost flat at anthesis; petioles glabrous. Pulausapi, Kalimantan Utara, low elevations . . . . . ***Schismatoglottis gaesa***

5. Leaf blades narrowly elliptic, c. 15 cm long × 2 cm wide, emerald green on both surfaces, innovations similarly coloured; petioles short, c. 5 cm max; spadix interstice long, mostly naked with a very few round-topped staminodes. N Kapit, Sarawak . . . . . ***Schismatoglottis smaragdina***

– Leaf blade broadly oblanceolate, c. 30 cm long × 7 cm, dark green adaxially, conspicuously paler abaxially, innovations reddish; petiole 15–21 cm long; spadix interstice short, partially obscured by flat-topped staminodes. Mulu, NE Sarawak & Brunei . . . . . ***Schismatoglottis pectinervia***

Schismatoglottis belonis S. Y. Wong, Aisahtul & P. C. Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Kapit, Pelagus Rapids, Rapids Trail to waterfall, 02°11'35.7"N 113°03'30.08"E, 15 Mar 2005, *P. C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-1066* (holotype SAR – alcohol!; isotype: SAR – alcohol!). **Figure 1.**

Figure 1. ***Schismatoglottis belonis*** S. Y. Wong, Aisahtul & P. C. Boyce
A. Plants in habitat. **B.** Leaf blade, abaxial view, showing the typical venation of species of the *Schismatoglottis* Patentinervia Clade. **C.** Inflorescence at late pistillate anthesis; note that the spathe limb hardly opens, and is now beginning to degrade. **D.** Spadix at pistillate anthesis, spathe artificially removed. The rhomboid staminodes of the interstice are clearly visible. **E.** Inflorescence at late staminate anthesis, spathe limb starting to rot; note that the peduncle and lowermost part of the spathe is obscured by the leaf bases and cataphylls. **A–E** from *AR–1066*. Images © P.C. Boyce.

Diagnosis

Schismatoglottis belonis differs from all other species of the *Schismatoglottis* Patentinervia clade by having the spadix interstice completely covered in rhomboidal-topped staminodes and by the stout curving-conic sharp-tipped spadix appendix.

Description

Small, sometimes colony-forming mesophytic herb to c. 15 cm tall. *Stem* epigeal, erect to sprawling, rather to markedly elongate, to c. 20 cm long, c. 0.5 cm diam., decumbent portions tending to rooting along their length, modules pleionanthic, older naked stem portions often producing hapaxanthic reiterations, internodes 0.5–2 cm long, reddish purple. *Leaves* several together along distal parts of stem and clustered at apex; *petiole* 8–13 cm long, D-shaped in cross-section, dorsal edges rather sharp and very slightly winged; sheathing in lower 1/3, rather bright pale reddish purple; *petiolar sheath wings* fully attached to petiole, tapering, membranous, long-persistent; *leaf blades* broadly elliptic to broadly lanceolate, 7–12 cm long × 2.5–4 cm wide, base obtuse to shallowly cordate, margins weakly undulate in larger leaves, apex acute and slightly acuminate for c. 5–8 mm, semi-glossy bright medium to rather dark green adaxially, somewhat glaucous abaxially; *midrib* abaxially prominent, adaxially slightly impressed with blade; *primary lateral veins* c. 11 on each side, mostly alternating with barely lesser interprimaries, diverging at 80–100° from midrib, then gradually up-curved more or less throughout their length across blade then abruptly up-curved, abaxially rather prominent; *secondary venation* mostly arising from midrib, occasionally from base of primary veins; *tertiary venation* forming a faint tessellate reticulum abaxially. *Inflorescence* solitary; *peduncle* to c. 1.5 cm long, not or only slightly exserted from leaf bases, more often peduncle and part of lower spathe obscured by leaf bases and subtending cataphylls. *Spathe* 2.5–3 cm long; *lower spathe* 1 cm long, ovoid, differentiated from limb by a constriction, inflating markedly at pistillate anthesis, pale green; *spathe limb* broadly ovate, c. 2.5 cm long, mucronate for 2–4 mm, degrading and then shedding. *Spadix* c. 2.7 cm long, sessile or dorsally briefly stout-stipitate; *pistillate flower zone* 6 – 8 mm long, rather stoutly conoid; *pistils* slightly lax, subglobose, 0.5 mm diam., pale green; *stigma* sessile, button-like, c. 1/2 diameter of ovary, pale green; *interpistillar staminodes* confined to a ring at base of staminate flower zone, oblong-clavate on a slender stipe, glassy greenish white; *sterile interstice* obscured by staminodes; *interstice staminodes* rhomboidal-topped on a stout stipe, glossy white; *staminate flower zone* rather stoutly obconoid, 6 – 8 mm long, 2.5 mm diam. at base, 4 mm diam. distally; *stamens* very crowded, not obviously arranged into discrete flowers, dumbbell-shaped, more or less truncate with connective flat between thecae; *pores* each with a heavily thickened rim, dull white; *appendix* isodiametric with staminate flower zone, curving conic, sharply pointed, c. 8 mm long; *appendix staminodes* composed of irregularly

polygonal, more or less flat-topped staminodes c. 0.75 mm diam., white. *Fruiting spathe* short-peduncled, erect, urceolate, c. 1 cm long; *fruits* and *seeds* not observed.

Ecology — Steep forested banks under moist to rather wet lowland forest on shales between 20 –190 m asl.

Distribution — Central Sarawak, Kapit, known from two localities c. 55 km apart.

Etymology — From Greek *βελόνης*, the genitive singular form of *βελόνη* – a needle – used in connotation with the sharply pointed spadix appendix.

Notes — In deep shade the stems elongate in such a manner as to be almost scandent. Similarly much-elongated stems occur in the unrelated species *S. erecta* M. Hotta and *S. convolvula* P. C. Boyce.

Other material examined: MALAYSIAN BORNEO: **Sarawak: Kapit.** Nanga Gaat, Rejang Wood Concession, km 65 road to Camp Gahada, 01°42'01.1"N 113°31'14.8"E, 12 May 2004, *P. C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-343* (SAR); Batang Baleh, Nanga Suptai, 02°01'0.0"N 113°01'0.0"E, 29 May 2013, *Kazuya Nakamoto AR-4167* (SAR).

Schismatoglottis gaesa S. Y. Wong, Aisahtul & P. C. Boyce, **sp. nov.** Type: Indonesian Borneo, Kalimantan Utara, Malinau, Mentarang, Pulausapi, 03°31'31.83"N 116°31'2.36"E, 29 Apr 2012, *Kazuya Nakamoto AR-3918* (holotype BO!; isotypes BO – alchohol!; SAR – alcohol!). **Figure 2.**

Diagnosis

Schismatoglottis gaesa is immediately distinguished from all other species of the Patentinervia Clade by the spadix appendix and staminate flower zone together curving-cylindric (vs straight) and the spathe limb opening almost flat at anthesis (vs hardly opening).

Description

Small mesophytic herb to c. 15 cm tall. *Stem* erect, older stems occasionally decumbent with tips ascending, to c. 20 cm long, c. 0.7 cm diam., epigeal, modules pleionanthic, internodes rather abbreviated c. 1 cm long. *Leaves* several together along distal parts of stem and clustered at apex; *petiole* 6–11 cm long, sheathing in lower 2/3 – 7/8, longitudinally with a few ridges, glossy deep reddish, distal portion occasionally paler or almost green; *petiolar sheath wings* fully attached to petiole, rather unequal, one side wider and somewhat wrapping-auriculate at tip, membranous, long-persistent; *leaf blades* elliptic, 7–12 cm long × 2.5–4 cm wide, base slightly decurrent and extending as two narrow wings to join with petiolar sheath, apex twisted-acuminate for c. 15 mm, glossy medium green adaxially, much paler and matte abaxially; *midrib* abaxially prominent, adaxially slightly impressed into blade; *primary lateral veins* c. 15 on each side,

Figure 2. ***Schismatoglottis gaesa*** S. Y. Wong, Aisahtul & P. C. Boyce
A. Cultivated plant. **B.** Leaf blade, abaxial view, showing the typical venation of species of the *Schismatoglottis* Patentinervia Clade. **C.** Inflorescence at just prior to pistillate anthesis; note the pileate spathe limb. **D.** Inflorescence at pistillate anthesis; note the spathe limb open almost flat. **E.** Spadix at pistillate anthesis, nearside spathe artificially removed, note the rhomboid staminodes of the interstice. E. Inflorescence at late staminate anthesis, spathe limb starting to rot. **A–E** from *AR–3918*. Images © P.C. Boyce.

alternating with slightly lesser interprimaries, diverging at 80–100° from mid-rib, gradually up-curved more or less throughout their length to spreading then rather abruptly up-curved, slightly impressed adaxially; *secondary venation* arising from midrib; *tertiary venation* forming a faint tessellate reticulum abaxially. *Inflorescence* solitary; *peduncle* to c. 2 cm long, obscured by leaf bases, pale red. *Spathe* c. 5 cm long; *lower spathe* 1 cm long, ovoid, differentiated from limb by a constriction, inflating at pistillate anthesis, glossy medium green; *spathe limb* broadly ovate, c. 4 cm long, conspicuously pileate and then mucronate for a total of 10 mm, opening almost flat during anthesis, later rotting-deciduous, semi-glossy medium green, interior paler. *Spadix* c. 4.5 cm long, sessile; *pistillate flower zone* 6 mm long, broadly conoid; *pistils* congested, rather narrowly columnar, 0.5 mm diam.; *stigma* sessile, button-like, about as wide as ovary; *interpistillar staminodes* confined to a ring at base of staminate flower zone, obellipsoid on a very short stipe, glassy greenish white; *sterile interstice* attenuate, naked, c. 5 mm long, green; *staminate flower zone* slightly obconoid, 10 mm long, 2.5 mm diam. at base, c. 4 mm diam. distally, lowermost whorls of flowers sterile and slightly lax; *stamens* very crowded, not obviously arranged into discrete flowers, dumbbell-shaped, more or less truncate with connective flat between thecae; *pores* each with a heavily thickened rim, dull white; *appendix* isodiametric with top of staminate flower zone, curving-cylindric c. 12 mm long, tip blunt; *appendix staminodes* composed of irregularly polygonal, more or less flat-topped staminodes c. 0.5 mm diam., creamy white. *Fruiting spathe*, *fruits* and *seeds* not observed.

Ecology — Lowland perhumid forest on Eocene sedimentaries, about 10 m asl.

Distribution — Known only from the Type locality.

Etymology — From Latin noun *gaesum,* a Gaulish javelin, and used to highlight the distinctive rostrate spathe limb.

Notes — To date *S. gaesa* is known only from the Type locality. A collection [*G. Murata et al. 1294* – BO!] from the Sungau Belyangm, near Tabang, c. 300 km to the south west (although still in Kalimantan Timur) may be conspecific but the collection is sterile.

Paratype: INDONESIAN BORNEO. **Kalimantan Utara**: **Malinau.** Mentarang, Pulausapi, 03°31'31.83"N 116°31'2.36"E, 29 Apr 2012, *Kazuya Nakamoto AR-3918* (holotype BO!; isotypes BO – alchohol!; SAR – alcohol!).

Schismatoglottis patentinervia Engl., Pflanzenr. 55 (IV.23Da): 90. 1912; Hay & Yuzammi, Telopea 9: 76. 2000. — Type: Indonesian Borneo, Kalimantan Barat, Kapuas Hulu, Nanga Raun ("Nanga Raoen"), Bukit Amaiambit or Bukit Liang Gagang ("Liang Gagang & Amai Ambit"), March – May 1894, *J. G. 'Hans' Hallier 3271* (holotype B!; isotype BO!). **Figures 3 & 4.**

Figure 3. ***Schismatoglottis patentinervia*** Engl.,
A, C & D. Plants in habitat. Note the colour of the leaf blades and the strong contrast of the innovation colour in **D. B.** Leaf blade, abaxial view, showing the typical venation of species of the *Schismatoglottis* Patentinervia Clade and the much paler undersurface as compared with the uppersurface. **A, C & D** from *AR–3560*; **B** from *AR-3560*. Images © P.C. Boyce.

Figure 4. ***Schismatoglottis patentinervia*** Engl.
Bogor Isotype. *J. G. 'Hans' Hallier 3271.* Image © Herbarium Bogoriense, Cibinong, Indoensia. Used with permission.

Description

Small colony-forming mesophytic herb to c. 15 cm tall. *Stem* erect, to c. 10 cm long, c. 10 mm diam., epigeal, rooting along its length, internodes c. 1 cm long. *Leaves* several together clustered at apex of stem; *petiole* 5–12 cm long, medium green, minutely and densely puberulent with stiff short hair-like papillae, sheathing in lower 2/3; *petiolar sheath wings* membranous, tapering, completely attached to petiole, medium green; *leaf blade* oblong to oblong-elliptic, 11–21 cm long × 2.5–6 cm wide, base broadly acute, tip obtuse and then apiculate for c. 2 mm, thinly stiff, adaxially deep lustrous metallic blue-green, abaxially paler whitish green with venation darker, innovations brilliant lime green, entire leaf blade, or portions of it, capable for spontaneous production of plantlets from the undersurface and damaged edges; *midrib* abaxially prominent and puberulent like petiole; *primary lateral veins* numerous and closely spaced, 15–20 on each side, alternating with lesser interprimaries (these and primary veins sometimes rather difficult to differentiate), diverging at (80–)90(–100)°, usually running more or less straight for much of width of blade then rather abruptly deflected towards tip before joining margin or upcurved rather gradually; *secondary venation* mostly arising from midrib, occasionally from near bases of primary veins; *tertiary venation* abaxially forming a rather conspicuous tessellate reticulum, especially near the margin, adaxially obscure. *Inflorescence* not seen.

Ecology — Lowland to mid-elevation rather wet hill forest on granite, recorded atlitude is 270 m asl but the Type locality (Anon 1894; Hallier 1895) probably at 450m or more.

Distribution — *Schismatoglottis patentinervia* is known from two localities c. 150 km distant, along the northern flanks of Muller Range.

Etymology — From the Latin adjective *patentibus* – spreading, diverging from the axis almost at right angles – derived from the adjective *patens* (open) + Latin *nervis* – nerves (i.e., veins) – coined to describe the primary and interprimary venation.

Notes — Vegetatively *Schismatoglottis patentinervia* is unmistakeable, even as dry material – no other species have thin stiff deep metallic blue-green leaf blades. In nature and cultivation entire still-attached leaf blades and broken portions of fallen blades readily produce plantlets from the undersurface or from damaged edges.

Schismatoglottis pectinervia A. Hay, Telopea 9(1): 138. 2000. Type: Brunei, Temburong District, Batu Apoi Forest Reserve, Sungei Batu, 04°33'N 115°09'E, 10 Jun 1991, *A. D. Poulsen 139* (holtype K!; isotype AAU, BRUN!). **Figures 5 & 6.**

Description

Solitary to slightly clumping mesophytic herb to 35 cm tall. *Stem* condensed, more or less hypogeal, modules hapaxanthic, c. 1 cm

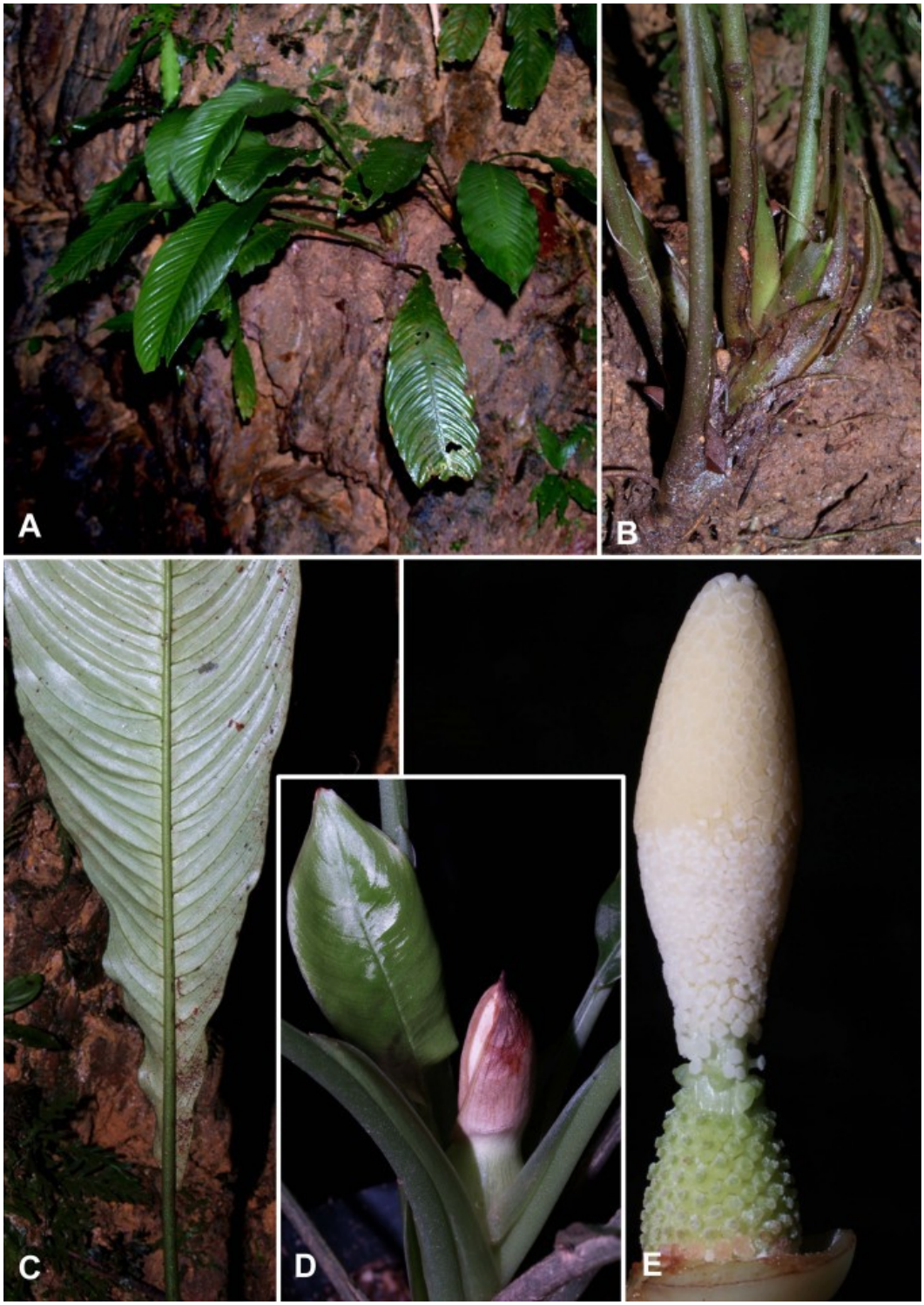

Figure 5. ***Schismatoglottis pectinervia*** A. Hay
A. Plants in habitat. **B.** Stem showing the stiff 2-keeled cataphylls and scabrid petioles. **C.** Leaf blade, abaxial view, showing the typical venation of species of the *Schismatoglottis* Patentinervia Clade. **D.** Inflorescence at late staminate anthesis; note that the spathe limb hardly opens, and is now degrading. **E**. **A–E** from *AR–1984*. Images © P. C. Boyce.

Figure 6. ***Schismatoglottis pectinervia*** A. Hay
Kew Holotype. *A. D. Poulsen 139*. Image © Trustees, Royal Botanic Gardens, Kew. Used with permission.

diam, deep brownish-tinged green, obscured by stiff somewhat fleshy 2-keel brownish green prophylls. *Leaves* 2–4 together; *petiole* 15–21 cm long, almost terete, sheathing in lower 1/2–1/3, minutely scabrid, medium green; *petiolar sheath wings* tapering, fully attached to petiole; *leaf blade* broadly oblanceolate, semi-glossy mid- to dark green adaxially, paler abaxially, c. 30 cm long × 7 cm wide at widest point, base cuneate to decurrent, tip acute and acuminate for c. 1.5 cm, innovations liver-coloured; *midrib* abaxially very prominent, slightly scabrid; *primary lateral veins* not prominent, numerous, c. 20 on each side of midrib, alternating with lesser interprimaries, diverging at 80–90° and more or less gradually and evenly curving up to meet margin; *secondary venation* arising from midrib; *tertiary venation* rather indistinct. *Inflorescence* solitary, occasionally up to three in sequence, subtended by several lanceolate strongly keeled stiff cataphylls to 5 cm long, these dull green; *peduncle* short, concealed by leaf bases and cataphylls, white. *Spathe* c. 4.5 cm long, subcylindric; *lower spathe* pale green, c. 1.5 cm long, differentiated from limb by a very weak constriction; *spathe limb* c. 3 cm long, oblong-lanceolate, creamy white, rather fleshy, rotting-deciduous. *Spadix* sub-equalling spathe, sessile; *pistillate flower zone* 1.2 cm long, conoid, obliquely inserted; *pistils* crowded at base of zone, distally increasingly lax, more or less subglobose, strongly longitudinally 4-lobed, c. 0.7 mm diam., pale green; *stigma* elevated on a very short style, button-like, about 1/2 diameter of ovary, pale green; *interpistillar staminodes* restricted to base of pistillate flower zone, absent from among pistils, more or less mushroom-shaped, about as wide as ovary, dull reddish; *sterile interstice* very attenuate to rather short, up c. 1 cm long (upper and lower limits somewhat indeterminate owing to lax arrangement of and intergradation between abortive and fertile elements), mostly naked, in lower half with scattered longitudinally (with respect to spadix) stretched partly abortive pistils and in upper half with scattered partly abortive anthers; *staminate flower zone* c. 8 mm long, obconic in lower part, remainder cylindric, c. 3 mm diam.; *stamens* crowded (except at base of zone), thickly hourglass shaped, c. 0.8 mm across, connective slender and very slightly raised between large (0.2 mm diam.) impressed *pores*, white; *appendix* subcylindric to conoid, apically tapering to a blunt point, base isodiametric with staminate flower zone, c. 1.2 cm long; *appendix staminodes* less flat-topped, irregularly polygonal, c. 0.7 mm diam, dull cream. *Infructescence* unknown.

Ecology —Terrestrial in wet forest on river banks or on steep rocky slopes near streams, over Setap shales, to about 70 m alt.

Distribution — Brunei and NE Sarawak (Miri).

Etymology — From Latin noun *pecten*, a comb, + Latin *nervis* – nerves (i.e., veins), and alluding to the venation arrangement, notably as visible on the abaxial surface of the leaf blade.

Notes — As Hay (Hay & Yuzammi 2000) noted the "shoot organisation appears to consist of hapaxanthic modules". We can confirm this to be the case and in itself this makes *S. pectinervia* unique in the Patentinervia Clade. Elsewhere in the genus *Schismatoglottis* hapaxanthic modules are otherwise restricted to species of the Calyptrata Clade (Wong et al., 2016b). Other species of the Patentinervia clade, however, produce hapaxanthic reiterations from older leafless portions of decumbent stems. Such growths often appear some considerable distance from the active shoot tips and only careful excavation reveals that they have arisen from buried portions of stem.

Other specimen examined: MALAYSIAN BORNEO. **Sarawak: Miri.** Marudi Long Lama Mulu N.P. Long Langsat, Sungai Langsat, draining into the Sungai Tutoh, 04°00'03.5"N 114°48'49.8"E, 9 Aug 2006, *P. C. Boyce et al. AR-1984* (SAR). BRUNEI: **Temburong**. Sg. Temburong at Kuala Belalong, bank of Sg. Belalong, 24 Jun 1989, *P. C. Boyce et al. 434* (BRUN, K).

Schismatoglottis retinervia Furtado, Gard. Bull. Straits Settlem. 8: 157. 1935; Beaman & Beaman, Pl. Mt Kinabalu 3: 83. 1998; Hay & Yuzammi, Telopea 9(1): 80. 2000. — Type: Malaysia, Sabah, Mt Kinabalu Tenompok, 26 Mar 1932*, C.X. Furtado sub J. & M. S. Clemens 29153* (holotype SING — 2 sheets; isotypes BO!, BM!, G, GH, K, L!, NY!). **Figures 7 – 9.**

Description

Small, colony-forming mesophytic herb to c. 20 cm tall. *Stem* creeping to sprawling and somewhat elongate, to c. 20 cm long, c. 0.5 cm diam., epigeal, rooting along its length, occasionally branching, modules pleionanthic with older naked portions often producing hapaxanthic reiterations, internodes 0.5–1 cm long, pale green less often reddish. *Leaves* several together along distal parts of stem and clustered at apex; *petiole* 8–12 cm long, sheathing in lower 1/3–1/2, green to somewhat dull reddish, minutely puberulent and weakly longitudinally ridged, slightly D-shaped in cross-section; *petiolar sheath wings* fully attached to petiole, tapering, membranous, long-persistent, pale green; *leaf blades* glossy medium green adaxially, paler abaxially, elliptic and slightly falcate, 7–12 cm long × 2.5–4 cm wide, base acute, apex acute and slightly acuminate for c. 5–8 mm; *midrib* abaxially prominent, adaxially flush with blade; *primary lateral veins* 8–9 on each side, mostly alternating with lesser interprimaries, diverging at 80–100°, then gradually up-curved more or less throughout their length to spreading most of way across blade then abruptly up-curved (variable to some extent even on same stem), abaxially prominent in older leaves; *secondary venation* mostly arising from midrib, occasionally from base of primary veins; *tertiary venation* forming a conspicuous tessellate reticulum abaxially. *Inflorescence* solitary; *peduncle* to c. 2 cm long, not or only slightly exserted from leaf bases. *Spathe* 2.5–3 cm long; *lower spathe* 1 cm long, ovoid, differentiated from limb by a constriction, inflating markedly at pistillate

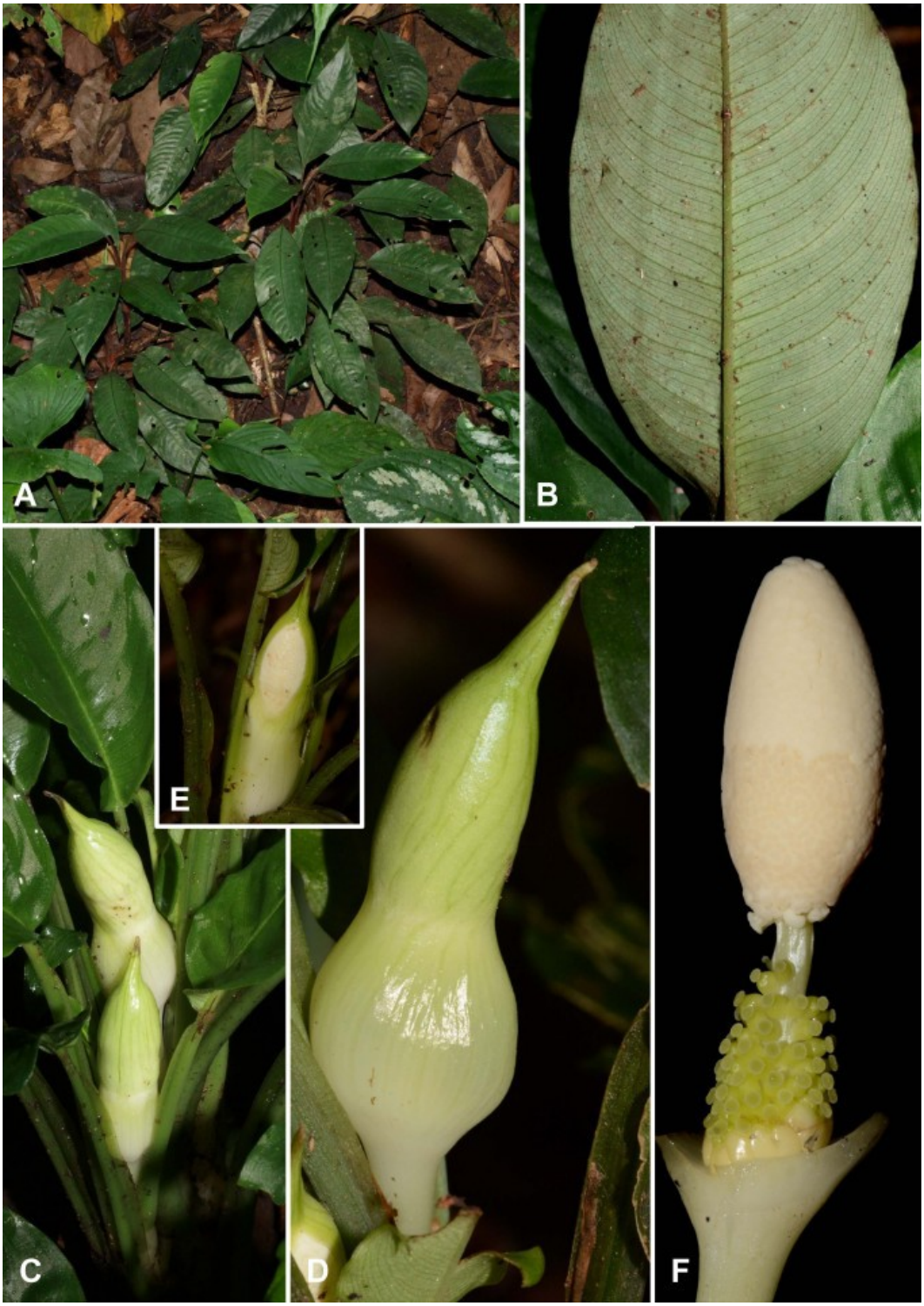

Figure 7. ***Schismatoglottis retinervia*** Furtado
A. Plants in habitat. **B.** Leaf blade, abaxial view, showing the typical venation of species of the *Schismatoglottis* Patentinervia Clade. **C.** Flowering shoots. **D & E.** Inflorescence at pistillate anthesis; note that the spathe limb hardly opens. **F.** Spadix at pistillate anthesis, spathe artificially removed. **A & B** from *AR–4691*; **C – F** from *AR-4714*. Images © P. C. Boyce.

Figure 8. ***Schismatoglottis retinervia*** Furtado
Singapore Holotype. *C.X. Furtado sub J. & M. S. Clemens*. Image © Herbarium, Singapore Botanic Gardens. Used with permission.

Figure 9. ***Schismatoglottis retinervia*** Furtado
Singapore Holotype. *C.X. Furtado sub J. & M. S. Clemens*. Image © Herbarium, Singapore Botanic Gardens. Used with permission.

anthesis, pale glossy semi-transparent whitish green; *spathe limb* broadly ovate, c. 1.8 cm long, mucronate for 2–4 mm, pale green, rotting-deciduous. *Spadix* c. 2.2 cm long, sessile; *pistillate flower zone* c. 6 mm long, narrowly conoid; *pistils* somewhat lax, subglobose, 0.5 mm diam.; *stigma* sessile, button-like, c. 1/2 diameter of ovary; *interpistillar staminodes* confined to a ring at base of pistillate flower zone, large with a wide top centrally impressed, pale glossy green; *sterile interstice* attenuate, partly to completed naked, 3–4 mm long, green, at base an irregular whorl of abortive pistils, distally these scattered, finally a loose group of abortive stamens; *staminate flower zone* obconoid, 6 mm long, 1.5 mm diam. at base, 4 mm diam. distally; *stamens* crowded, dumbbell-shaped, more or less truncate with connective slightly mounded between thecae; *pores* each with a heavily flanged rim, creamy; *appendix* conic-ellipsoid 5 mm long and wide at base, tip acute; *appendix staminodes* irregularly polygonal, more or less flat-topped staminodes c. 0.75 mm diam, white. *Fruiting spathe* short-peduncled, erect, urceolate, c. 1 cm long.

Ecology — Terrestrial in moist mid-montane forest over granite, often near streams between 1000 – 1650 m asl.

Distribution — Sabah, region of Kinabalu.

Etymology — From Latin noun *rēte* (*genitive* ***rētis***) – a net + Latin *nervis* – nerves (i.e., veins), and alluding to the tertiary venation arrangement.

Notes — *Schismatoglottis retinervia* seems to be the only species of the Patentinervia Clade present at Kinabalu. There is a vegetatively quite different undescribed species of the clade present at Tawau Hiils NP (E Sabah) but we have yet to see flowering material to enable description.

Other specimens examined: MALAYSIAN BORNEO. **Sabah: West Coast.** Kota Belud, Mt Kinabalu, Tenompok, towards Dallas, 26 Mar 1932, *Kiah bin Hadji Mohamed Salleh sub J. Clemens & M. S. Clemens 29154* (BM, G, K); Kinabalu NP, along rd between HQ and Tenompok, *S. Kokawa & M. Hotta 3050* (KYO), Kota Belud, Kinabalu N.P., main road to Timpohon Gate, just before lodges, 06°00'25.1"N 116°32'30.4"E, 10 May 2014, *Wong Sin Yeng & P. C. Boyce AR-4714* (SAN, SAR); Kota Belud, Kinabalu N.P., Silau-Silau Trail, 06° 01'06.3"N 116°32'13.1"E, 12 May 2014, *Wong Sin Yeng & P. C. Boyce AR-4737* (SAN, SAR). **Interior.** Tambunan, Patau, Mahua Waterfall, 05°47'48.6"N 116°24"'30.3E, 19 Apr 2014 *Wong Sin Yeng & P. C. Boyce AR-4691* (SAN; SAR).

Schismatoglottis smaragdina S. Y. Wong, Aisahtul & P. C. Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Kapit, Pelagus Rapids, Woodpecker Trail, 02°11'59"N 113°04'01"E, 1 Dec 2004, *P. C. Boyce & Jeland ak Kisai AR-782* (holotype SAR – alcohol!; isotype: SAR – alcohol!). **Figure 10.**

Figure 10. ***Schismatoglottis smaragdina*** S. Y. Wong, **Aisahtul** & P. C. Boyce
A. Plants in habitat, note the rather lax habit. **B.** Flowering shoot, inflorescence at late staminate anthesis, spathe limb already degraded. **C.** Inflorescence at pistillate anthesis; note that the spathe limb hardly opens. **D.** Spadix at pistillate anthesis, spathe artificially removed. **E.** Inflorescence at late staminate anthesis; note shed powdery pollen. **A & E** from *AR–1033*; **B – D** from *AR-782*. Images © P.C. Boyce.

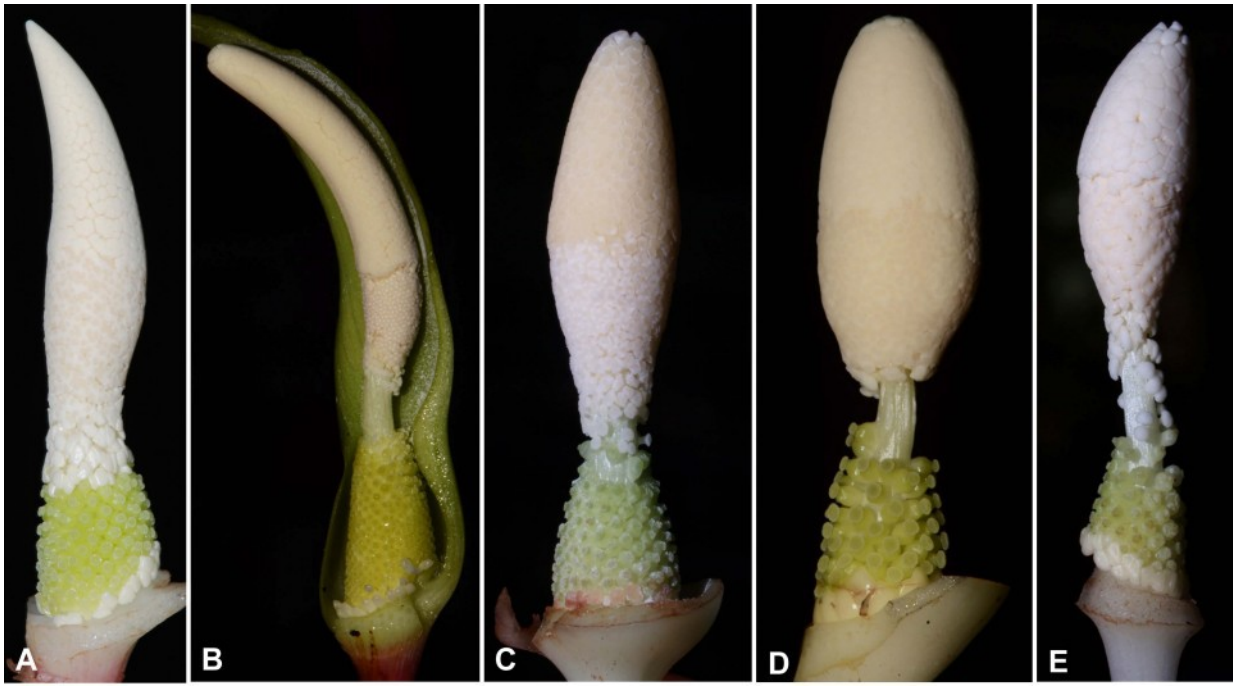

Figure 11. Spadix of *Schismatoglottis* Patentinervia Clade species compared.
A. *Schismatoglottis belonis* S. Y. Wong, **Aisahtul** & P. C. Boyce. ***Schismatoglottis gaesa*** S. Y. Wong, **Aisahtul** & P. C. Boyce. **C. *Schismatoglottis pectinervia*** A. Hay. **D. *Schismatoglottis retinervia*** Furtado. **E. *Schismatoglottis smaragdina*** S. Y. Wong, **Aisahtul** & P. C. Boyce. **A** from *AR-1066*; **B** from *AR–3918*; **C** from *AR-1984*. **D** from *AR-4714*. **E** from *AR-782*. All images © P. C. Boyce.

Diagnosis

Schismatoglottis smaragdina is diagnosed by narrowly oblong-elliptic glossy emerald-green leaf blades held in a loose rosette, and a sterile interstice covered with scattered mushroom-shaped staminodes.

Description

Small mesophytic herb to c. 15 cm tall. *Stem* erect, older stems occasionally decumbent with tips ascending, to c. 50 cm long, c. 1 cm diam., epigeal, modules pleionanthic, occasionally with hapaxanthic reiteration from the base of the plant in old individuals, internodes rather abbreviated c. 0.75 cm long. *Leaves* many together in a terminal rosette clustered at apex, only in larger plants leaves more scattered along the stem; *petiole* 3 – 5 cm long, sheathing in lower 1/2 – 2/3 , pale green; *petiolar sheath wings* fully attached to petiole, rather wide and tending to be flat, membranous, long-persistent; *leaf blades* narrowly oblong-elliptic, 3–11 cm long × 1.5–2.5 cm wide, base slightly decurrent, apex acute and mucronate for c. 1.5 mm, glossy bright emerald green adaxially, slightly glaucous and somewhat matte abaxially; *midrib* abaxially prominent, adaxially slightly impressed into blade; *primary lateral veins* c. 10 on each side, alternating with lesser interprimaries, diverging at 80–100° from mid-rib, gradually up-curved more or less

throughout their length to spreading then rather abruptly up-curved, slightly impressed adaxially; *secondary venation* arising from midrib and running more or less parallel to primaries; *tertiary venation* forming a faint tessellate reticulum abaxially. *Inflorescence* solitary; *peduncle* to c. 1 cm long, obscured by leaf bases, whitish. *Spathe* c. 3.5 cm long; *lower spathe* c. 1 cm long, ovoid, differentiated from limb by a constriction, inflating at pistillate anthesis, glossy medium green with longitudinal darker veining; *spathe limb* broadly ovate, c. 2.5 cm long, mucronate for c. 5 mm, hardly opening during anthesis, later rotting-deciduous, semi-glossy greenish white green. *Spadix* c. 3 cm long, sessile; *pistillate flower zone* c. 7 mm long, broadly conoid; *pistils* congested, rather squat-ellipsoid to oblageniform (notably upper pistils), 0.5 mm diam., dark green; *stigma* sessile, button-like, about half as wide as ovary; *interpistillar staminodes* confined to a two rings at base of staminate flower zone, occasionally absent, trapezoid with an flat, centrally depressed top, on a very short stipe, waxy white; *sterile interstice* attenuate, c. 5 mm long, green; *interstice staminodes* scattered, mushroom shaped, about as tall as pistils, white; *staminate flower zone* slightly obconoid, 10 mm long, 2 mm diam. at base, c. 4 mm diam. distally, lowermost whorls of flowers intergrading with interstice staminodes, slightly lax; *stamens* very crowded, not obviously arranged into discrete flowers, butterfly-shaped, with dome-like connective raised and somewhat overtopping thecae, dull waxy white; *pores* wide; *appendix* slighly wider than top of staminate flower zone, conoic c. 15 mm long, tip blunt; *appendix staminodes* composed of rather irregularly polygonal, more or less flat-topped staminodes c. 0.5 mm diam, creamy white. *Fruiting spathe* urceolate, c. 1 cm long, mid-green.

Ecology — Lowland moist forest on deep clay sedimentaries, often on almost vertical soil banks near streams, between 70 – 300 m asl.

Distribution — N Rejang basin, Sarawak, from two localities c. 130 km distant.

Etymology — The trivial epithet, derived from the Latin adjective smaragdīnus (feminine *smaragdīna*), emerald, denoting the colour rather than material, is used to highlight the remarkable colour of the leaf blades.

Notes — Plants in cultivation retain a very neat rosette habit. Plants in the wild, especially in heavily shaded sites, tend to become more lax with leaves arranged along an elongated stem.

Paratype: MALAYSIAN BORNEO. **Sarawak: Kapit.** Pelagus Rapids, Woodpecker Trail, 02°11'15.1"N 113°03'29.01"E, 14 Mar 2005, *P. C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-**1033*** **(SAR);** Pelagus Rapids, Nabau Trail to old longboat jetty, 02°11'10.9"N 113°03' 31.3"E, 15 Mar 2005, *P. C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-1079* (SAR).

Other specimens examined: MALAYSIAN BORNEO. **Sarawak: Kapit**. Belaga, Sungai Sekatong, tributary of Sungai Linau, Sekatong rapid area, 02°32'4.56"N 114°11'23.22"E, 28 Oct 2014, *Mike Lo AR-4956* (SAR).

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