Studies on Schismatoglottideae (Araceae) of Borneo XXXX: *Schismatoglottis petradoxa* and *S. tseui*, new shale-obligate rheophytes of uncertain affinity

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ABSTRACT

Two taxonomically new rheophytic species of *Schismatoglottis* of uncertain affinity, *S. petradoxa* S. Y. Wong & P. C. Boyce **sp. nov.** and *S. tseui* S. Y. Wong & P. C. Boyce **sp. nov.,** are described and illustrated from forested shale waterfalls in central North Borneo.

KEY WORDS

Araceae, Malaysian Borneo, *Schismatoglottis*

INTRODUCTION

Shale geology, in particular riverine shales, are unfailingly one of the richest and most diverse habitats for terrestrial and rheophytic aroids on Borneo. Here we

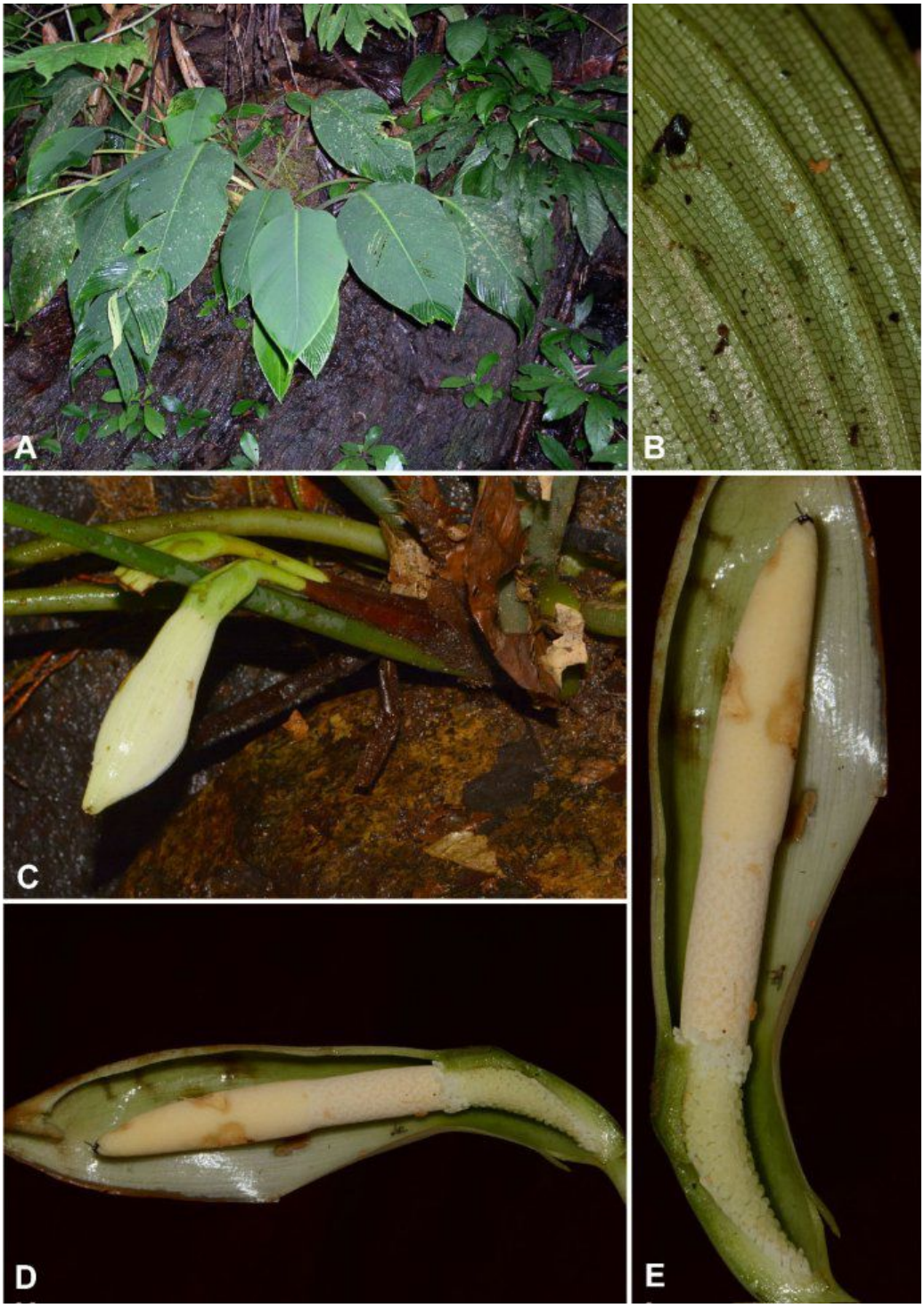

Figure 1. ***Schismatoglottis petradoxa*** S. Y. Wong & P. C. Boyce
A. Plants in habitat. **B.** Detail of tessellate secondary venation. **C.** Inflorescence at pistillate anthesis. **D & E.** Inflorescence at late pistillate anthesis, nearside spathe artificially removed. Note that the interstice staminodes have lengthened. **A** from *AR-464*; **B - E** from *AR-4894*. Images © P.C.Boyce.

describe two new species of *Schismatoglottis* from the shales of central North Borneo.

Schismatoglottis petradoxa S. Y. Wong & P. C. Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Kapit, Taman Rekreasi Sebabai, 01°56′45.6″N 112°54′16.8″E, 19 Apr. 2006, *P. C. Boyce, Jeland ak Kisai & Wong Sin Yeng AR-1787* (holo SAR!; isotypes: SBC!, SBC! [alcohol], SING!). **Figure 1.**

Diagnosis

Schismatoglottis petradoxa is defined by the combination of condensed pleionanthic shoots composed of many single leaved modules, each subtended by a soon-degrading prophyll, leaf blades abaxially with conspicuous tessellate secondary venation, and a synflorescence of pendent inflorescences, each on a long peduncle. In the shoot organization *S. petradoxa* is reminiscent of species of the *Schismatoglottis* Tecturata Group, but otherwise differs by the above mentioned characteristics.

Description

Pendent rheophytic herb to ca. 50 cm. **Stem** much-condensed, creeping-erect in older plants, with internodes to 1 cm long, 1–2 cm diam., densely rooting along its length. **Leaves** several together alternating soon-marcescent, somewhat brittle tapering lanceolate weakly scabrid cataphylls to 10 cm long; **petiole** shorter than blade, arching to almost pendent, 8–25 cm long, sub-terete, proximal third dorsally very slightly flattened, dull green, minutely scabrid, sheathing only at very base, with the petiolar sheath reduced to an obscure ridge; **blade** broadly lanceolate to elliptic, 12–30 cm long × 3–11 cm wide, thick, brittle, adaxially matte medium green, much paler and matte abaxially, base cuneate to narrowly rounded, apex acuminate and apiculate for ca. 1 cm; **midrib** adaxially more or less flush with blade and contrasting cream, especially visible on newer leaves, abaxially prominent; **primary lateral** veins ca. 25 on each side, up to 40 on largest leaf blades, diverging at 45–60°, abaxially conspicuously raised, adaxially slightly impressed, although more deeply impressed in leaves of seedlings; **secondary venation** adaxially visible as a tessellate reticulum in seedlings but obscure in leaves of mature plants, abaxially forming a highly conspicuous dark green tessellate reticulum; **tertiary venation** invisible. **Inflorescence** pendulous, ca. 3 in a simple synflorescence subtended by lanceolate fleshy cataphylls, with a moderate sweet esteric odour at pistillate anthesis; **peduncle** cylindric, subtended by a conspicuous prophyll or cataphyll, up to 20 cm long × 5 mm wide, bright pale green. **Spathe** with a moderate constriction between the lower part and the limb, limb inflating and gaping at pistillate anthesis, opening further at staminate anthesis, 8–9 cm long; **lower spathe** narrowly ovoid and asymmetric, dorsally shallowly flattened-convex corresponding to the adnation of the pistillate flower zone, pale green with very fine darker longitudinal veins, dorsally ca. 1.5 cm long, ventrally ca. 2 cm long, persistent; **spathe limb** exterior white with very fine darker longitudinal lines at

pistillate anthesis, interior dirty whitish-green shading dorsally to glossy green broadly lanceolate 5.5–7.5 cm long, bluntly rostrate for ca. 1 cm, upper half opening at pistillate anthesis and initially via a narrow terminal slit, then wide-gaping (ca. 2.5 cm wide), and weakly fornicate, limb margins reflexing during staminate anthesis, then whole limb degrading-caducous with the rim remaining above the lower spathe insertion reflexing somewhat. **Spadix** 5–6 cm long, subcylindric; **pistillate zone** 1.5 (dorsal side) to 2 cm long (ventral side), narrowly conic, obliquely inserted, distally ca. 6 mm diam., very pale green; **pistils** small, crowded, ca. 1 mm diam., barrel-shaped, pale creamy green; **stigma** sessile, discoid, slightly narrower than top of pistil, ca. 1.5 mm tall × 0.8 mm wide, papillose; **interpistillar pistillodes** forming a row at junction with peduncle, ca. 1.2 mm long, slimmer than pistils, slender-cylindric with a pale orange-brown tip; **sterile interstice** with about 3 rows of staminodes; **interstice staminodes** weakly columnar-polygonal ca. 1 mm across, dull-white, initially equalling the height of pistils, later (late pistillate anthesis) staminodes lengthening to form a ring ca 1/3 wider than fertile zones; **staminate zone** cylindric, ca. 1.5 cm long × 0.4–0.5 cm diam., cream; **stamens** irregularly densely crowded, individual flowers difficult to distinguish, rectangular-dumbbell shaped from above, truncate with thick connective slightly elevated above thecae, thecae opening by a single pore; **appendix** narrowly fusiform, blunt, proximally slightly wider than top of staminate zone, 2.5–3 cm long, widest part ca. 8 mm diam., distally tapering and narrowly obtuse, white; **appendix staminodes** very dense and individually barely differentiated, rectangular-dumbbell shaped from above, much resembling stamens in shape and size, but more regularly arranged. **Fruiting spadix** not seen.

Distribution – Widespread but localized in central North Borneo.

Ecology – *Schismatoglottis petradoxa* occurs as a rheophyte on shaded vertical permanently wet shale waterfalls and rocks in forest streams between 30 – 190 m a.s.l.

Etymology – From Greek *petra*, a rock or stone, and *doxa*, glory – hence, glory of the rocks.

Notes – *Schismatoglottis petradoxa*, appears ostensibly to belong to the *Schismatoglottis* Multiflora Group (Hay & Yuzammi, 2000), but differs by shoot modules consisting of a single foliage leaf subtended by a large, marcescent-deciduous prophyll, and by a much reduced petiolar sheath lacking the extended ligules diagnostic for species of the Multiflora Group. Furthermore, tessellate secondary venation prominently visible on the abaxial surface of the blades is unknown in the Multiflora Group (all species with striate secondary venation), although similar venation patterning occurs in several other species' groups in *Schismatoglottis*.

Figure 2. ***Schismatoglottis tseui*** S. Y. Wong & P. C. Boyce
A. Flowering plant in habitat, Type locality. **B.** Developing infructescence. Note the declinate peduncle. **C.** Leaf blade, abaxial view. **D.** Inflorescence at pistillate anthesis, with chrysomelid beetles and *Colocasiomyia* (Diptera) in attendance. **E.** Inflorescence at pistillate anthesis, spathe limb artificially opened. F. Inflorescence at end of staminate anthesis, spathe artificially removed. **G.** Developing infructescence. **A–G** from *AR-4883*. Images © P.C.Boyce.

By shoot modules consisting of a solitary foliage leaf, with the role of the vestigial petiolar sheath taken over by the prophyll subtending the shoot, *S. petradoxa* is similar to species of the Tecturata Group (Boyce & Wong, 2013), although in all other respects *S. petradoxa* is not clearly placed in the Group.

Other material examined: INDONESIAN BORNEO: Kalimantan Barat: Kabupaten Kapuas Hulu, Kecamatan Embaloh Hulu, 20 km NW of Mataso, 01°19′0.44″N 112°15′4.40″E, 17 May 2013, *Kazuya Nakamoto AR- 4149* (BO!, SAR!); Kabupaten Kapuas Hulu, Kecamatan Embaloh Hulu, Mataso, 01°08′28.13″N 112°23′36.61″E, 17 May 2013, *Kazuya Nakamoto AR- 4152* (BO!, SAR!). MALAYSIAN BORNEO: Sarawak: Sri Aman: Lubok Antu, Batang Ai, Nanga Sumpa, Wong Ensalai, 01°11′00.9″N 112°04′20.8″E, 6 Apr 2005, *P.C.Boyce et al. AR-1148* (SAR!, SBC!); Lubok Antu, Sungai Kelaweh to Sungai Morek, 01°02′04.6″N 111°46′12.5″E, 11 Jun 2014, *Ooi Im Hin & Sunang ak Empin AR-4796* (SAR!, SBC!); Lubok Antu, Batang Ai, Sungai Sepipit, 01°11′54.9″N 111°57′29.4″E, 27 Jul 2014, *S.Y.Wong & P.C.Boyce AR-4894* (SAR!, SBC!). Sarikei: Ulu Sarikei, Air Terjun Ruan, 01°55′02.0″N 111°29′10.7″E, 27 Dec 2012, *P.C.Boyce & Wong Sin Yeng AR-4108* (SAR!, SBC!). Kapit: Taman Rekreasi Sebabai, 01°56′45.6″N 112°54′16.8″E, ca. 50 m a.s.l., 13 Dec 2004, *P. C. Boyce, Jeland ak Kisai & M. Gibernau AR-864* (SAR!) & 16 Mar 2005, *P. C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-1089* (SAR!); Nanga Gaat, Rejang Wood Concession, km 65 road to Camp Gahada, 01°41′59.7″N 113°31′13.7″E, 16 Dec 2004, *P.C.Boyce, Jeland ak Kisai & M.Gibernau AR-920* (SAR!, SBC!); Kg Nanga Septi, Upper Batang Baleh, ca 1hr speedboat west of Kapit*, K. Nakamoto AR-3561* (SAR!).

Schismatoglottis tseui S. Y. Wong & P. C. Boyce, **sp. nov.** Type: Malaysian Borneo, Sarawak, Sri Aman, Lubok Antu, Batang Ai, Musing, 01°11′58.6″N 111°57′14.9″E, 110m asl, 27-July 2014, *S.Y.Wong & P.C.Boyce AR-4883* (holo SAR!; isotypes: SBC!, SBC! [alcohol], SING!). **Figure 2.**

Diagnosis

Schismatoglottis tseui is distinguished from all published *Schismatoglottis* species by the branched vermiform interstice staminodes. In the persistent ligular portion to the petiolar sheath and pellucid interprimary veins *S. tseui* is reminiscent of species in the *Schismatoglottis* Hottae Complex, from which it differs by the pendent (vs erect) infructescences and in being wholly glabrous.

Description

Tufted rheophytic herb to ca. 15 cm tall but most a third of this tall. **Stem** erect, congested, internodes to 5 mm long, ca 3 mm in diam., rooting along its length in mud. **Leaves** several together; **petiole** approximately equalling to slightly shorter than blade, 6–8 cm long, sub-terete, dorsally very slightly flattened with angles very weakly alate, sheathing only at extreme base,

wings extended into a triangular ligular persistent portion ca. 3 cm long; **blade** broadly elliptic to broadly lanceolate, 6–10 cm long × 3–5.75 cm wide, thinly coriaceous, adaxially semi-glossy medium green, abaxially paler matte olive-green, base broadly cuneate to rounded, apex bluntly acute and apiculate for ca. 2 mm; **midrib** adaxially more or less very slightly raised, abaxially slightly prominent; **primary lateral veins** ca. 6 on each side arising at 45–60°, conspicuously darker than surrounding tissue; **interprimary veins** much finer than primaries although still conspicuous, somewhat translucent; **secondary venation** adaxially more or less obscure, abaxially very fine and comprised of somewhat dense pellucid veins; **tertiary venation** abaxially forming an obscure sub-tessellate reticulum. **Inflorescence** ca. 3 in a simple synflorescence subtended by one or two lanceolate fleshy cataphylls resembling the ligules, with a weak esteric odour at pistillate anthesis; **peduncle** cylindric, ca. 3 cm long × 3 mm wide. **Spathe** erect at pistillate anthesis, ca 3 cm long, at anthesis lower spathe almost imperceptibly narrower than the spathe limb, without an obvious constriction at the junction of the spathe limb with the lower spathe; **lower spathe** narrowly funnel-form asymmetric, glossy white-yellowish green, dorsally ca. 1 cm long, persistent; **spathe limb** pale yellow-green with darker veining at pistillate anthesis, becoming glossy-white with faint darker longitudinal veins during staminate anthesis, broadly lanceolate, ca 2 cm long, rostrate for ca. 2 mm, inflating at pistillate anthesis and opening via a narrow slit, hardly opening more during staminate anthesis, then degrading and semi-deliquescent. **Spadix** ca 2.5 cm long, subcylindric; **pistillate zone** obliquely inserted on spathe, 7 mm (dorsal side) to 1.7 cm long (ventral side), cylindric, distally ca. 6 mm diam., very pale green; **pistils** comparatively large, rather lax, ca. 1.5 mm diam., stoutly flask-shaped with a slight constriction below the stigma, almost white; **stigma** sessile, discoid, wider than the top of the pistil, ca. 1.8 mm wide, papillose; **interpistillar staminodes** forming a sparse row at the junction with the peduncle, ca. 2 mm long, ascending-aristate, shorter than pistils, translucent very pale green; **sterile interstice** well-defined, with a single row of branched staminodes; **interstice staminodes** comprising a thick base each with 2–5 aristate-vermiform 'arms' ca. 2 mm long, semi-translucent glossy white; **staminate zone** cylindric, ca. 5 mm long × 4 mm wide, white; **stamens** crowded, individual flowers tiny and somewhat difficult to individuate, but seemingly consisting of two anthers each with two thecae, ca. 0.5 mm diam., thecae sub-globose with a single comparatively large terminal pore; **appendix** weakly conic-cylindric, blunt, proximally very slightly wider than the top of the staminate zone, ca 1.3 cm long, widest part ca. 5 mm diam., distally tapering and narrowly obtuse, creamy white; **appendix staminodes** sub-columnar-globose, much resembling stamens in shape but larger, ca 1 mm in diam. **Fruiting spathe** pendulous, narrowly cylindrical, green with a conspicuous scar at the orifice. **Fruits & seeds** not seen.

Distribution – Known only from the Type locality.

Ecology – *Schismatoglottis tseui* occurs as a rheophyte on shaded vertical permanently wet shale waterfalls and rocks in forest streams at between 110–140 m a.s.l.

Eponymy – Named for Robert Tseu, through whose photographic records of the flora and wildlife of Borneo we were first alerted to the existence of this remarkable species.

Notes – The branched, vermiform interstice staminodes are unique for the genus *Schismatoglottis*. The long-persistent ligular portion of the petiolar sheath and the leaf blades abaxially pellucid interprimary veins suggest an affinity with the *Schismatoglottis* Hottae Complex (Wong et al., 2012), although the pendent fruiting spathe and entirely glabrous plants are entirely anomalous for the Hottae Complex.

Plants at pistillate anthesis were observed to attract a species of chrysomelid beetle that chewed through the spathe limb, and at least one species of *Colocasiomyia* (Diptera) which entered the inflorescence though the gap formed in the spathe.

Other material examined: MALAYSIAN BORNEO: Sarawak: Sri Aman, Lubok Antu, Batang Ai, Musing, 01°11′59.94″N 111°57′14.46″E, 12 July 2014, *R.Tseu AR-4861* (SAR!).

References

Boyce, P. C & S. Y. Wong. 2013: Studies on Schismatoglottideae (Araceae) of Borneo XXXIII – A review of the Schismatoglottis Tecturata Group, including description of a new species, *Schismatoglottis evelyniae*. *Aroideana* 36E(1): 4–15.

Hay A. and Yuzammi. 2000: Schismatoglottideae (Araceae) in Malesia I – *Schismatoglottis*. *Telopea* 9(1): 1–177.

Wong [et al., 2012] S.Y., P.C. Boyce & S.L. Low. 2012: Studies on Schismatoglottideae (Araceae) of Borneo XVII: The *Schismatoglottis hottae* Complex, a new informal taxon, and three new species from Sarawak, Malaysian Borneo. *Gard. Bull. Singapore* 64(1): 257–269.

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