

Studies on Schismatoglottideae (Araceae) of Borneo VII: *Schottarum* and *Bakoa*, two new genera from Sarawak, Malaysian Borneo

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ABSTRACT. *Schottarum* P.C. Boyce & S.Y. Wong and *Bakoa* P.C. Boyce & S.Y. Wong are described as new genera from Sarawak, each with one species: *Schottarum sarikeense* (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong based upon *Schismatoglottis sarikeensis* (Bogner & M. Hotta) Bogner & A. Hay and *Bakoa lucens* (Bogner) P.C. Boyce & S.Y. Wong based upon *Piptospatha lucens* (Bogner) Bogner & A. Hay. Both species were formerly placed in now-defunct *Hottarum* (= *Piptospatha*). A key to the genera and principle subgeneric divisions of Tribe Schismatoglottideae in Borneo is presented. Both species are illustrated.

Keyword: Araceae; Borneo; Rheophytic; Schismatoglottideae.

INTRODUCTION

As treated in *The Genera of Araceae* (Mayo et al., 1997) the Schismatoglottideae comprised seven genera (*Schismatoglottis* Zoll. & Moritzi, *Piptospatha* N.E. Br, *Hottarum* Bogner & Nicolson, *Bucephalandra* Schott, *Phymatarum* M. Hotta, *Aridarum* Ridley and *Heteroaridarum* M. Hotta) with generic boundaries based on the presence or absence of morphologies such as constricted spathes, motile staminodes, thecae with horn-like or needle-like structures, placentation and seed micropylar appendages.

The most recent species-level revision of the tribe (Hay and Yuzammi, 2000; Bogner and Hay, 2000) although recognizing numerous novel species reduced the number of genera to five by synonymizing *Hetroaridarum* with *Aridarum* (Bogner and Hay, 2000) and *Hottarum* with *Piptospatha* (Bogner and Hay, 2000; Hay and Yuzammi, 2000).

In dismantling *Hottarum* and the subsequent transferal of the constituent species into *Piptospatha* (most) and *Schismatoglottis* (one) placement problems arose with two species: *H. sarikeense* Bogner & M. Hotta and *H. lucens* Bogner. Due to their unique inflorescences and infructescences, especially spathe senescence and fruit dispersal mechanics, placement in *Schismatoglottis* (*H. sarikeense*) and *Piptospatha* (*H. lucens*) is at best weakly supported and our subsequent observations of plants in the wild and in cultivation, especially noting spathe senescence me-

chanics and anther function, morphologies that, by plotting onto recent molecular phylogenetic results, to be published elsewhere (Wong, in prep.), are now known to be of considerable significance in the tribe, has confirmed the long-held suspicion that neither species fits unreservedly into any pre-existing genus and that both are best accommodated in new, separate, genera. These novel genera are hereby described and the necessary new combinations made.

Schottarum P.C. Boyce & S.Y. Wong, gen. nov.

Herba rheophytica, foliorum petiolus in vaginum supra in pertem liberam triangularis persistenti productus. Pedunculus semierectus vel patens vel declinatus. Flores unisexuales nudi. inflorescentia femina in toto spatham adnate. Flores masculi fertiles ad apice acicularis post-florescentia feminiis producens. Ovula pleura, orthotropa ad basim loculi inserta. Spadicis quam pars superior pistillodiis instructa. Spathae tubus in fructiferorum inaquilatera infundibuliformis, persistens.

Typus: *Schottarum sarikeense* (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong, comb. nov.

Small rheophytic herbs. *Stem* usually condensed (very rarely elongated and forming a decumbent to weakly creeping rhizome). *Leaves* several together; petiole, sheathing only at extreme base and thence with a coriaceous persistent ligular portion; blade very narrowly elliptic, thinly but somewhat stiffly coriaceous, primary lateral veins extremely fine abaxially (barely differentiated from secondary venation in dry material; flush with but darker than surrounding tissue in fresh state); secondary venation faintly prominent adaxially, fine and dense; tertiary vena-

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tion obscure. *Inflorescence* solitary per shoot but plants usually bearing several inflorescences in sequence from separate but densely aggregated shoots; peduncle long, stiffly arching-spreading. *Spathe* weakly nodding; lower spathe narrowly ovoid, slightly down-curved, weakly differentiated from the limb by a constriction but lower and upper spathe differing in texture: lower spathe stiffly coriaceous, spathe limb somewhat softly coriaceous; limb marcescent from the margins inwards and downwards and then, with the portion closest to the abscission layer still fresh, the spathe limb shedding, ovate-lanceolate, spathe slightly inflated and gaping during female anthesis, then spreading during male anthesis, narrowed into a beaked tip throughout. *Spadix* subcylindric; dorsal (in relation to spathe) side of female zone adnate to the spathe; pistils subglobose; stigma sessile, discoid; ovules orthotropous, micropyle shortly beaked but not extended into an appendage; placentation basal; interpistillar staminodes absent from among the pistils, confined to a row along the spathe/spadix adnation and occasionally a scattered individual amongst the two lowermost rows of pistils, sterile interstice confined to about 2 irregular whorls of sterile stamens at the base of the male zone; male zone rather narrower than the female zone; stamens crowded, partially to completely connate into groups of 2-3, truncate and flat-topped at female anthesis with a transverse to oblique hyaline ridge ending in an oblique disk, but at anthesis each theca erecting this structure into a needle-like projection terminating with a weakly peltate ovate-triangular flap; occasionally a scattered pistillode among the stamens; appendix absent to bullet-shaped, when present comprised on pistillodes, tapering and narrowly obtuse; distal-most pistillodes often united to the top into curved or sinuous groups. *Fruiting spathe* unequally funnel-form, the margins obliquely declined towards the convolution; fruiting peduncle arching/declinate with lower spathe mouth held laterally or slightly downwards with the convolution ventral in respect to the peduncle; berry gibbous-cylindric to ellipsoid-oblong, with rather few seeds; seed ellipsoid, 1-2 mm long, 0.25-0.3 mm diam., very pale brown, minutely scabrid, micropyle beaked but lacking a micropylar appendage.

Distribution. Malesia: endemic to Sarawak in Sarikei and Sri Aman Districts; at both localities it is scattered and rare.

Habitat. Old secondary and fragments of primary lowland riparian evergreen moist forest on shales. *Schottarum* is rheophytic on vertical clay-loam riverbanks. 55-80 m asl.

Notes. The unique combination of morphologies displayed by *Schottarum* is smooth thecae with a hyaline ridge that becomes erect into a needle-like projection at the onset of male anthesis, an unstricted spathe, a spadix frequently with distal pistillodes and seeds lacking a micropylar appendage and carried on a basal placenta.

Schottarum is most remarkable for the needle-like structures, tipped with a weakly peltate ovate-triangular flap,

emerging from the thecae (one per theca) only at the onset of male anthesis. Such a structure emerging in this manner is unique in the family—in all other species such thecae structures are present from well before the inflorescence opens and are not topped with flap of any sort. Although yet to be confirmed by direct observation we speculate that these flap-like structures are associated with pollen dispersal and that a pollen droplet forms on the surface of the flap. The very slender nature of these needle-like structures recalls those of *Phymatarum* although in that genus the structures are present well before the onset of female anthesis; further the thecae of *Phymatarum* are notably verrucate (uniquely so in the tribe) while those of *Schottarum* are smooth. *Schottarum* shares basal placentation with *Phymatarum* but the ovules and seeds of *Schottarum* lack the characteristic micropylar appendage of *Phymatarum*.

Basal placentation also occurs in *Piptospatha* but seeds of that genus also have a pronounced micropylar appendage; *Piptospatha* differs from *Phymatarum* in having truncate stamens lacking a needle-like process.

The spadix with distal pistillodes in *Schottarum* is unique for the tribe; in all other Schismatoglottideae the terminal part of the spadix, and an appendix, if present, is comprised of staminodes. We ascribe the distal organs as pistillodes based on observations of living plants where the highly distinctive pink pistils are clearly homologous with the structures forming the terminal part of the spadix are quite different to the stipitate-clavate white staminodes associated with the pistils and the interstice between the male and female flower zones.

Schottarum spathe limb senescence mechanics is unusual, although not unique, in the tribe by the spathe limb marcescent from the margins inwards and downwards and then, with the portion closest to the abscission layer still fresh, the spathe is shed. Similar (but probably not homologous) marginal marcescence occurs in the shoot-architecturally quite different *Schismatoglottis tectorata* (Schott) Engl. with only the margin marcescent and later shedding while the greater portion of the spathe is persistent, turning green and remaining more-or-less closed at the orifice and then shedding by abscission at the insertion of the peduncle by splitting and recurving basipetally at maturation of the fruits.

The spathe during fruiting of *Schottarum* is peculiar in that while it is almost certainly a splash-cup, the margins of the persistent lower margins do not form a level rim but instead are obliquely declined towards the convolutions such that we speculate that the fruits/seeds are ejected forwards and away from the front of the cup rather than upwards and out as is known to be the instance in orthodox splash-cup dispersers, e.g., *Aridarum*. This view is further reinforced by the fruiting peduncle being arching/declinate thus presenting the lower spathe opening laterally or downwards rather than the peduncle being erect and the lower spathe held erect as is the situation in *Bucephalandra*, *Aridarum* and the *Piptospatha elongata* Group—all orthodox splash-cup dispersers.

Etymology. The generic name honours the Austrian botanist and plantsman Heinrich Wilhelm Schott (1794-1865), one of the founding fathers of Araceae systematics, the first monographer of the family, and the first botanist to make careful comparative studies of aroid inflorescences, flowers and fruits by which he created the basis of Araceae taxonomy for succeeding generations. A notable aspect of Schott's work was the combination of herbarium material, living plants and fieldwork in the study of a largely tropical plant group at a time when such a wide-ranging approach was most unusual.

Schottarum sarikeense (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong, comb. nov. Basionym: *Hottarum sarikeense* Bogner & M. Hotta, Bull. Mus. Natl. Hist. Nat., B, Adansonia 5 (1983) 27, Pl. 1-3; Mayo et al., Genera of Araceae (1997) 188, Pl. 51, F-J.—Type: Malaysia, Sarawak, Sarikei Division, near Sarikei, Sept. 1978, *J. Bogner 1553* Cult. Botanischer Garten München (holotype: KYO; isotype: K, M, P, US). Figures 1 and 2

Synonym: *Schismatoglottis sarikeensis* (Bogner & M. Hotta) A. Hay & Bogner, Telopea 9(1): 100 (2000).

Small rheophytic herbs up to c. 20 cm tall. *Stem* condensed (very rarely elongated and forming a decumbent to weakly creeping rhizome), 0.5-1.2 cm diam.; roots arising adventitiously from the lower parts of an otherwise erect stem (rarely arising along the length of a decumbent rhizome) *Leaves* several together, spreading to arching; petiole 6-12 cm long, slender, adaxially canaliculate especially in distal part, sheathing only at extreme base, the wings extended into a coriaceous very narrowly triangular persistent ligular portion 4-7 cm long, dark green tinged red, drying brown; blade very narrowly elliptic, 10-14 cm long × 1-2.5 cm wide, thinly but somewhat stiffly coriaceous, adaxially glossy dark green, paler abaxially, the base cuneate, the apex acuminate to caudate for 1.5-3 cm; midrib abaxially prominent, adaxially flush to slightly impressed with the lamina, with 5-6 extremely fine (barely differentiated from secondary venation in dry material; flush with but darker than surrounding tissue in fresh state) primary lateral veins on each side, diverging at c. 45°; secondary venation faintly prominent adaxially, fine and dense; tertiary venation obscure. *Inflorescence* solitary per shoot although plants usually bearing several inflorescences in sequence from separate but densely aggregated shoots; peduncle 3-8 cm long, stiffly arching-spreading in nature (where plants occur on vertical mud banks) but erect in cultivated plants grown in pots. *Spathe* weakly nodding by slight down-curving of lower part, 4-6 cm long; lower spathe narrowly ovoid, slightly down-curved, deep green, 1.5-2 cm long, and in the main differentiated on colour and texture (lower spathe stiffly coriaceous, spathe limb somewhat softly coriaceous) from the limb and weakly differentiated by a constriction; limb pale to mid-pink or less often white, caducous, ovate-lanceolate, spathe slightly inflated and gaping during female anthesis, then spreading during male anthesis, narrowed into a beaked tip through-

out, during late anthesis limb marcescent from the margins inwards and downwards and then, with the portion closest to the abscission layer still fresh, the spathe limb shedding. *Spadix* subcylindric, 3-3.5 cm long; female zone 1-1.2 cm long, dorsal (in relation to spathe) side of female zone adnate to the spathe, c. 5 mm diam.; pistils gibbous-cylindric to ellipsoid-oblong, c. 1 mm diam.; stigma sessile, discoid, c. 1 mm diam. and slightly overtopping the ovary, papillate at anthesis, deep pink; interpistillar staminodes absent from among the pistils, confined to a row along the spathe/spadix adnation and occasionally a scattered individual amongst the two lowermost rows of pistils, stipitate, weakly clavate, slightly exceeding the pistils, white; sterile interstice confined to about 2 irregular whorls of sterile stamens at the base of the male zone, white; male zone c. 1 cm long, rather narrower than the female zone, c. 3 mm diam.; stamens crowded, rather irregular in shape and size, ellipsoid to dumbbell-shaped from above, c. 0.5 mm across, partially to completely connate into groups of 2-3, truncate and flat-topped at female anthesis but at anthesis each theca extending a needle-like projection c. 2 mm long and terminating with a weakly peltate ovate-triangular flap through which pollen is extruded; occasionally a scattered deep pink pistillode among the stamens; appendix absent to bullet-shaped, basally isodiametric with top of male zone, distally tapering and finally narrowly obtuse, up to c. 0.5 cm long; pistillodes of appendix columnar, flat topped, faintly impressed, c. 0.5 mm diam., often united to the top into curved or sinuous groups, mid-deep pink - very small inflorescences with spadix fertile to the apex and pistillodes absent. *Fruiting spathe* unequally funnel-form, c. 1.5-2 cm long, c. 1 cm wide across the mouth, the margins obliquely declined towards the convolution; fruiting peduncle arching/declinate with lower spathe mouth held laterally or slightly downwards with the convolution ventral in respect to the peduncle; berry gibbous-cylindric to ellipsoid-oblong, 1-1.8 mm long, 1-1.5 mm diam., with rather few seeds, mid-green with stigmatic remains dull brown and just overtopping the ovary; seed ellipsoid, 1-2 mm long, 0.25-0.3 mm diam., very pale brown, minutely scabrid, lacking a micropylar appendage.

Distribution. As for genus.

Habitat. As for genus.

Notes. The leaf venation is remarkable for the extreme reduction of the primary venation so that it is almost not differentiated from the secondary; indeed the primary veins are virtually impossible to recognise in the dry plant.

The collection cited below from Sri Aman (*P.C. Boyce et al. AR-1161*) is an interesting extension to the known range of *Schottarum*. It was collected sterile and in leaf form and general shoot architecture matches *S. sarikeense* it has a stem forming a creeping rhizome producing stout roots from the leaf bases; such a growth habit has not been observed at the Sarikei populations of *S. sarikeense*. but on flowering in cultivation proved to be without doubt *S. sarikeense*.

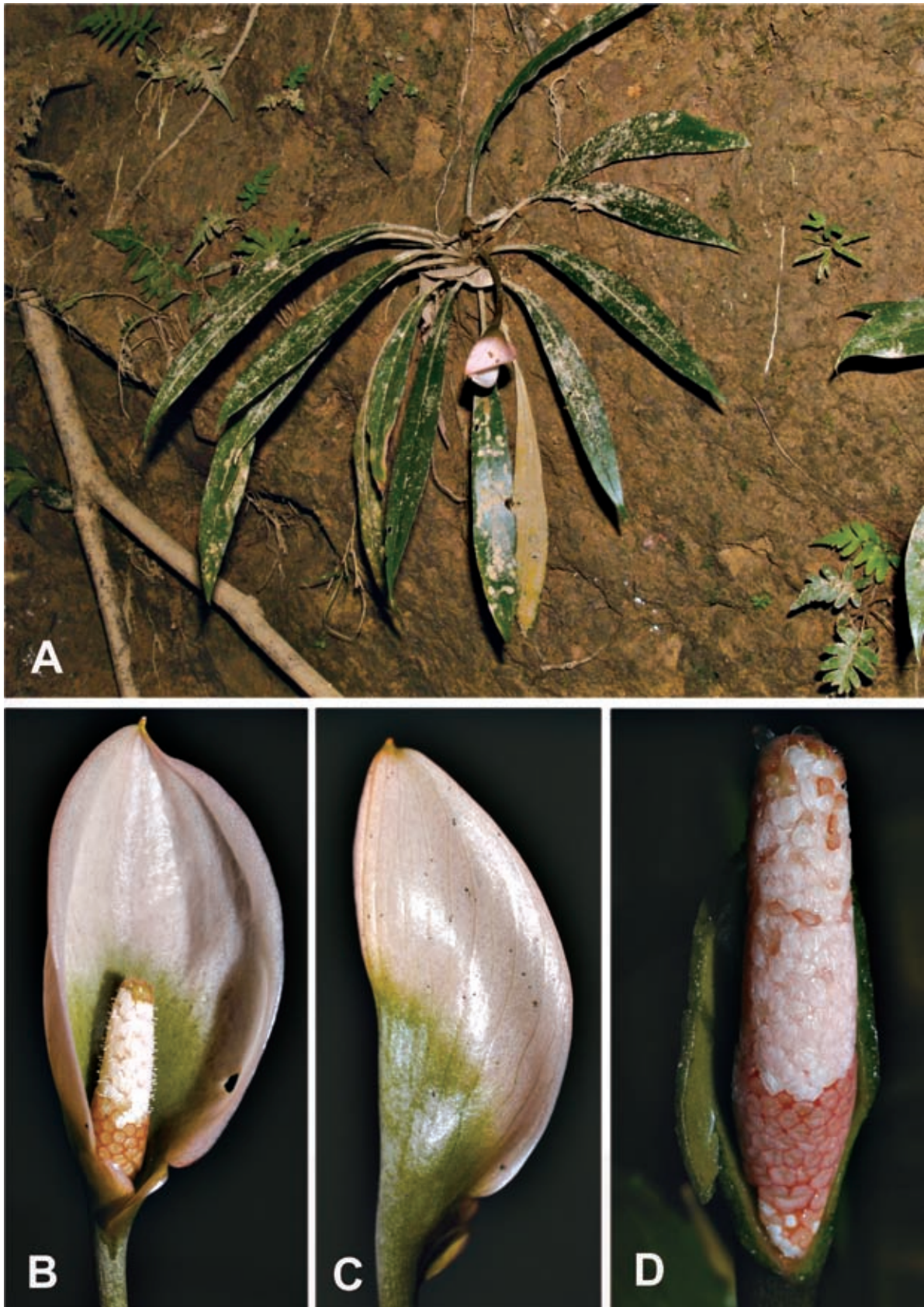


Figure 1. *Schottarum sarikeense* (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong. A, Plant in habitat, Sarikei; B, Inflorescence at the onset of male anthesis with the thecae horns erect; C, Side view of spathe showing the lower spathe (green); D, Inflorescence (spathe artificially removed) showing spadix at female anthesis. Note that the needle-like structures are still flat against the thecae have yet to become erect.

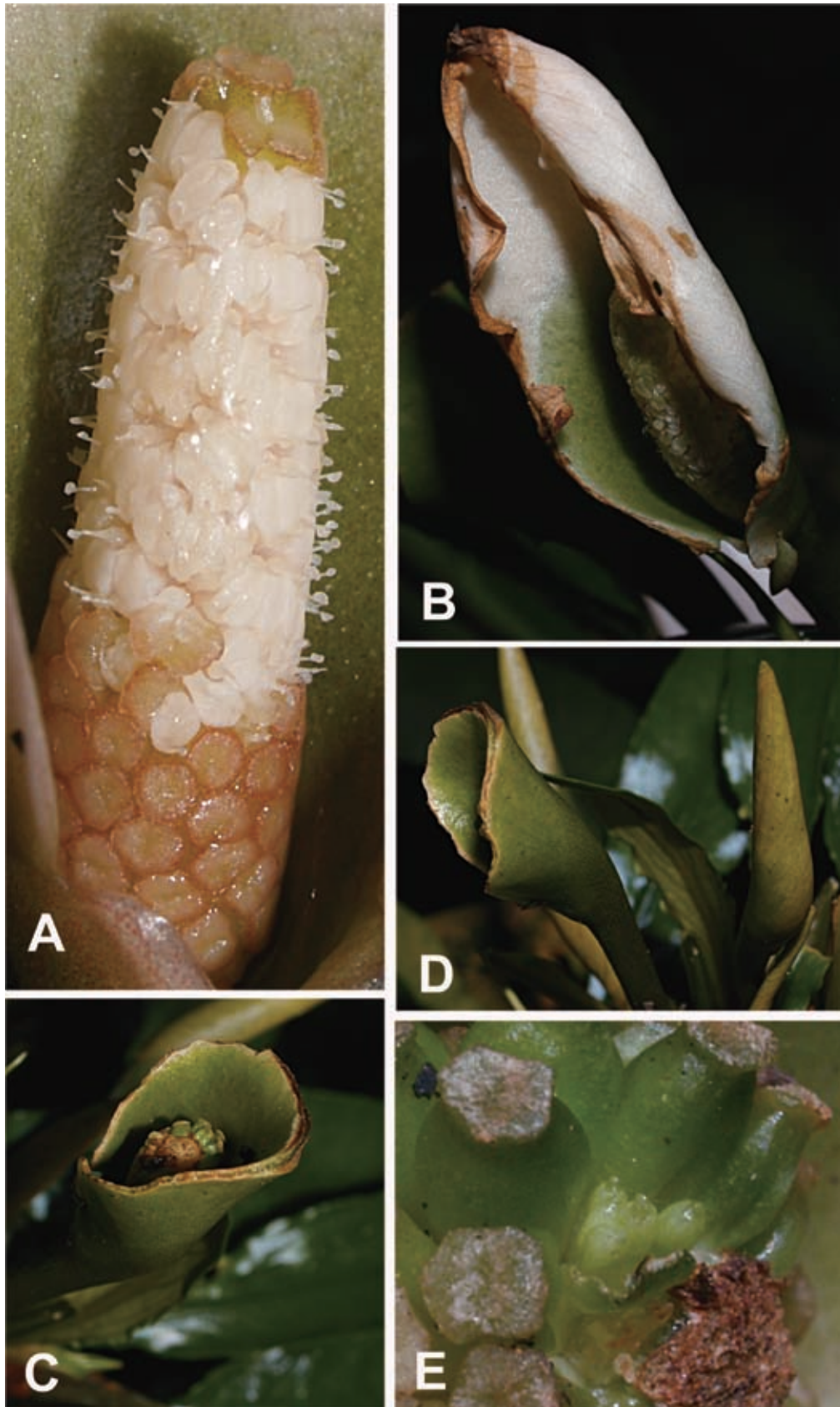


Figure 2. *Schottarum sarikeense* (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong. A, Inflorescence at the onset of male anthesis; note the needle-like structures associated with the stamens and the distal pistillodes; B, Inflorescence at late male anthesis. Note the spathe limb beginning to become marcescent; C & D, Persistent lower spathe at early fruit maturity. Note the margins obliquely declined towards the convolution; E, Ovary at late developmental stage. Note the basal ovules with a short micropylar beak but no appendage.

The Sarikei habitat of *Schottarum* is particularly rich in aroids, notably *Bucephalandra motleyana* Schott, *Homalomena griffithii* (Schott) Hook. f., *H. vagans* P.C. Boyce, *Rhaphidophora elliptifolia* Merr., *R. lobbii* Schott, *R. typha* P.C. Boyce, *Schismatoglottis conoidea* Engl., *S. erecta* M. Hotta, *S. jelandii* P.C. Boyce & S.Y. Wong, *S. josefii* A. Hay, *S. motleyana* (Schott) Engl. and *S. tectorata*. At Batang Ai (Sri Aman) common local associated aroids include *Homalomena hostiifolia* Engl., *H. humilis* (Jack) Hook. f., *H. insignis* N.E. Br., *Podolasia stipitata* N.E. Br., *Pothos barberianus* Schott, *Rhaphidophora beccarii* Engl., *R. megasperma* Engl., *Schismatoglottis ciliata* A. Hay, *S. clarae* A. Hay, *S. conoidea* Engl., *S. erecta* M. Hotta, *S. jipomii* P.C. Boyce & S.Y. Wong, *S. josefii* A. Hay, *S. tectorata*, *Scindapsus glaucescens* (Engl. & K. Krause) Alderw., *S. longipes* Engl. and *S. pictus* Hassk.

Other specimens examined. **SARAWAK:** Sri Aman Division, Lubok Antu, Batang Ai, Nanga Sumpa, Sungai Pedali, 01°11'58.9"; 112°03'27.0", 7 April 2005, P.C. Boyce et al. AR-1161 (SAR). Sarikei Division, near Sarikei, Sept. 1978, J. Bogner 1530 (K). Sarikei, Maradong, Sungai Matob, 01°52'06.1"; 111°55'30.7", 8 Dec 2005. P.C. Boyce, Wong Sin Yeng et al. AR-1609 (SAR); *ibid.* AR-1615 (SAR).

Bakoa P.C. Boyce & S.Y. Wong, gen. nov.

Herba rheophytica, foliorum petiolus in vaginum supra in pertem liberam triangularis marcescenti productus. Pedunculus semierectus vel patens. Flores unisexuales nudi. Spatha spadici usque ad medium parties inflorescentia masculina adnata. Staminiis non ad apicalem partem spadicum limitatis sed etiam in latere spathae adverso locum florum masculinorum explantibus et partem masculinam a parte feminea spadicum disjungentibus. Spathae fructiferorum persistens spathae tum omnino marcescens et fructus spargens.

Typus: *Bakoa lucens* (Bogner) P.C. Boyce & S.Y. Wong, comb. nov.

Small rheophytic herbs. *Stem* condensed. *Leaves* several to many together; petiole sheathing only at the extreme base, thence extended into a very narrowly triangular marcescent ligular portion; blade very narrowly elongate-elliptic, rather coriaceous; midrib abaxially prominent with 4-6 very fine but well-differentiated (darker than surrounding tissue) primary lateral veins on each side, these hardly differentiated in thickness from the secondary venation and diverging at c. 30°; secondary veins adaxially more or less obscure, abaxially fine and rather faint, running to a thicker marginal vein; tertiary venation forming an inconspicuous tessellate reticulum abaxially. *Inflorescence* solitary to three together on a single shoot; peduncle erect to arching at anthesis with the spathe slightly down-turned and the spathe opening ventral, declinate post anthesis and during fruiting. *Spathe* weakly nodding; more or less oblanceolate, hardly constricted, with a long apiculate tip. *Spadix* adnate to the spathe in the lower 1/2-2/3; female zone completely adnate to the spathe on the dorsal side;

ovary depressed globose and weakly angular, placentation basal, ovules orthotropous, long-beaked; stigma sessile, narrower than the ovary, button-like, papillate; interstillar staminodes absent from the female zone; sterile interstice somewhat thicker than the female zone, dorsally adnate to the spathe, composed of large truncate mostly irregularly polygonal staminodes, these also distributed up the dorsal side of the male zone to the spadix apex; male zone subcylindric-ellipsoid, apically narrowly acute and sterile, basally adnate to the spathe on the dorsal side, mostly with only the ventral-most stamens (those exposed by gaping spathe limb) fertile, sometimes more extensively fertile, but always sterile on the dorsal side; stamens crowded, truncate, dumbbell-shaped to irregularly rectangular from above, often with the connective irregularly broadened on one side; thecae each opening through a conspicuous, broad-rimmed pore. *Fruiting spathe* persistent, at fruit maturity very swiftly drying and thence by reflexing of the spadix the spathe recurving and opening basally and also tearing at the peduncle insertion to expose the fruits, at the same time spathe limb remaining distally convolute and still clasping the spadix appendix remains; fruiting peduncle initially declinate, later twisting through 180° and becoming arching-erect; berry depressed globular; seed ellipsoid, micropyle blunt, testa slightly ribbed.

Distribution. Malesia: endemic to Borneo (Sarawak & West Kalimantan)

Habitat. Lithophytic in forest, and rheophytic near streams or waterfalls, c. 30 m alt.

Notes. The combination of a spadix more than half adnate to the spathe, fertile male flowers mostly restricted to a small zone coincidental with the area exposed by the gaping spathe during anthesis, a fully persistent spathe becoming wholly marcescent at fruiting and seeds with a blunt micropyle borne on a basal placenta is unique in the Schismatoglottideae.

Post pollination the persistent spathe turns green and thickens slightly while the peduncle becomes declinate, holding the spathe with the free margins downwards; as also occurs in *Piptospatha grabowskii* (Engl.) Engl. At the onset of fruit maturity the peduncle of *Bakoa* twists through 180° and once more becomes semi-erect, to bring the spathe free margins to a dorsal position after which the spathe dries and turns brown very swiftly and thence by reflexing of the spadix the spathe recurves and opens, tearing at the peduncle insertion to exposes the fruits while at the same time spathe limb remains distally convolute and clasps the remains of the spadix appendix. This is in marked contrast to other species in the *P. grabowskii* group in which at fruit maturity there is no peduncle movement and the persistent spathe is shed while still in a fresh condition seemingly to play little or no role on the dispersal mechanics of the fruits. The fruiting mechanics of *Bakoa* are unique in the tribe.

Reports that the seeds have a micropylar appendage are erroneous. Dissection of several ripe and near-ripe fruits demonstrates that the micropyle is blunt and the seeds are

attached to a ring-like basal placenta by a short, dark funicle.

Incidentally, our observations of the stamens is not in accordance with those of Bogner and Hay (2000) who stated that the “stamens are more similar to those of many *Schismatoglottis*..., having large rims to the pores and a generally narrow connective”; all material we have examined has a wide connective.

Etymology. *Bakoa* is named for Bako National Park, Kuching Division. Established in 1957, Bako is Sarawak's oldest national park and despite its comparative small size is an extraordinarily beautiful and rich reserve of plants and animals.

Bakoa lucens (Bogner) P.C. Boyce & S.Y. Wong, comb. nov. Basionym: *Hottarum lucens* Bogner, Pl. Syst. Evol. 142 (1983) 49, fig. 1-3; Mayo et al., Genera of Araceae (1997) 188, pl. 51, A-E.—Type: Malaysia, Sarawak, Kuching Division, Bako National Park, Sg. Tajor, 19 Sep 1978, *J. Bogner 1439* (holotype: K; isotype: K, US). Figures 3, 4 and 5

Synonym: *Piptospatha lucens* (Bogner) Bogner & A. Hay, *Teloepa* 9(1): 217 (2000).

Small rheophytic herbs to c. 30 cm tall. *Stem* condensed, with stiff roots 1-1.5 mm diam. adhering strongly to rocks. *Leaves* several to many together; petiole (5-)6-10 cm long, 0.2-0.3 cm diam., slightly flattened adaxially, sheathing only at the extreme base, the wings extended into a very narrowly triangular marcescent ligular portion 3.5-6.5 cm long drying dark brown; blade very narrowly elliptic, slightly coriaceous, 8-22 cm long × 1-3 cm wide, very shiny dark green adaxially, abaxially paler, the base cuneate, the apex narrowly acute, slightly acuminate and tubular-apiculate for 2-3 mm; midrib abaxially prominent with 4-6 very fine primary but well-differentiated (darker than surrounding tissue) lateral veins on each side, these hardly differentiated in thickness from the secondary venation and diverging at c. 30°; secondary veins adaxially more or less obscure when dry but conspicuous in living material, abaxially fine and rather faint, running to a thicker marginal vein; tertiary venation forming an inconspicuous tessellate reticulum abaxially. *Inflorescence* solitary to three together on a single shoot; peduncle 4-8 cm long, arching to semi-erect, green; spathe weakly downturned. *Spathe* 3.5-5 cm long, more or less oblanceolate, hardly constricted, lower part green, limb white, apiculate for 6-8 mm, apicule green. *Spadix* 2.5-4 cm long, adnate to the spathe in the lower 2/3; female zone completely adnate to the spathe on the dorsal side, c. 1 cm long, 0.4 cm diam.; ovary depressed globose and weakly angular, 1-1.5 mm diam., light green, placentation basal, ovules long-beaked; stigma sessile, narrower than the ovary, c. 0.4 mm diam., button-like, papillate, whitish; interstitial staminodes absent from the female zone; sterile interstice robust, 6-9 mm long, somewhat thicker than the female zone, 5-7 mm diam., dorsally adnate to the spathe, composed of large truncate mostly irregularly polygonal

staminodes 0.8-1.5 mm diam. and these also distributed up the dorsal side of the male zone to the spadix apex; male zone subcylindric-ellipsoid, to c. 2 cm long, apically narrowly acute and sterile, basally adnate to the spathe on the dorsal side, sometimes with only the ventral-most stamens (those exposed by gaping spathe limb) fertile, or more extensively fertile, but always sterile on the dorsal side; stamens crowded, truncate, dumbbell-shaped to irregularly rectangular from above, often with the connective irregularly broadened on one side, 0.9-1.2 mm across; thecae each opening through a conspicuous, broad-rimmed pore. *Fruiting spathe* more or less persistent in entirety; berry depressed globular, 2-2.5 mm diam.; seed ellipsoid, 1.2-1.5 mm long, micropyle blunt, testa slightly ribbed.

Distribution. Malesia: West Borneo (known only from and Bako National Park, Sarawak and Sanggau in W Kalimantan).

Habitat. Rheophytic near streams or waterfalls, 30-90 m asl. *Elsener* 184 reports that the habitat is lithophytic under forest; in Sarawak the species is only known from rheophytic ecology on hard sandstones in almost full sun.

Notes. The very glossy deep green leaf laminae are striking; similarly lustrous leaves occur in rather few rheophytic Schismatoglottideae, exceptions include *Schismatoglottis roseospatha* Bogner and *Aridarum crassum* S.Y. Wong & P.C. Boyce.

Other specimens examined. **SARAWAK:** Kuching Division, Bako National Park, Telok Tajor, mouth of Sg. Tajor, *Ashton S17945* (GH, K, L, SING); Bako National Park, Telok Tajor, *Purseglove P4944* (K, L, SING); Bako National Park, Tajor waterfall, 01°43'21.4"; 110°28'15.1", 14 July 2007, *P.C. Boyce & Wong Sin Yeng AR-2097* (SAR). **KALIMANTAN:** W Kalimantan, Sanggau, *Elsener 184* (K, L).

Key to genera of Schismatoglottideae and their principle subgeneric divisions in Borneo

- 1a. Wings of leaf sheath fully or almost completely attached to the petiole; seeds never with a micropylar appendage.....*Schismatoglottis*
- 1b. Wings of leaf sheath extended into a ligular portion; seeds various 2
- 2a. Spathe not constricted; plants glabrous..... 3
- 2b. Spathe constricted or if not constricted then plant variously to coarsely hairy (*Schismatoglottis barbata*; *S. pyrrias*)..... 9
- 3a. Thecae of anther never with horn- or needle-like projections 4
- 3b. Thecae of anther each with a horn- or needle-like projection, although sometimes developing only after female anthesis..... 6
- 4a. Spadix almost completely adnate to spathe; male flowers mostly sterile with a narrow zone of fertile flowers



Figure 3. *Bakoia lucens* (Bogner) P.C. Boyce & S.Y. Wong. A, Plants in habitat, Bako N.P.; B, Plant with inflorescence at the onset of female anthesis. Note that spathe opening is facing downwards; C, Inflorescence at female anthesis. Note the spathe barely opens; D, Inflorescence (spathe artificially removed). Note that the greater portion of the spadix is adnate to the spathe.

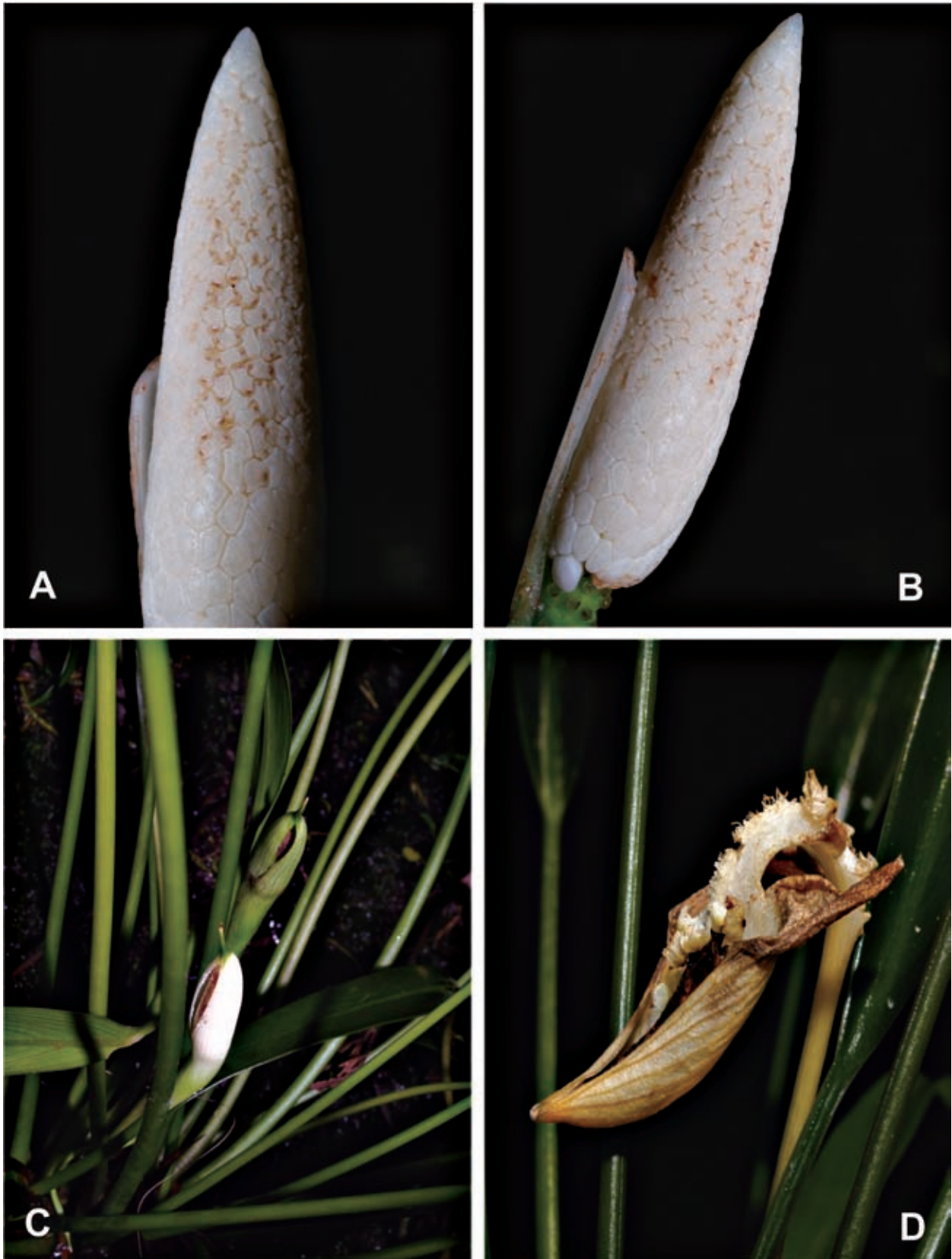


Figure 4. *Bakoa lucens* (Bogner) P.C. Boyce & S.Y. Wong. A & B, Spadix just prior to male anthesis. Note that the fertile male flowers occupy only a small portion of the spadix, roughly adjacent to the opening of the spathe limb; C, Plant with inflorescence at late anthesis (white with green acuminate tip; spadix brown) and at fruit mid-maturation (spathe green and thickened); D, Inflorescence c. half way through fruit dispersal. Note that spathe reflexed and torn away from the peduncle but is distally still convolute and clasps the spent spadix.

adjacent to spathe opening; peduncle declinate during fruit maturation but twisting to become semi-erect at fruit maturity; spathe persistent into fruiting, at fruit maturity swiftly drying, reflexing and opening basally by tearing at peduncle insertion to expose fruits but remaining distally convolute and there clasping spadix. Seeds with micropyle blunt..... *Bakoa*

4b. Spadix entirely free or only part of the female flower zone adnate to spathe; male flowers all fertile; pedun-

cle erect (and then spathe limb caducous) or declinate (and spathe persistent) throughout fruit dispersal; spathe limb either caducous early in anthesis or persistent until fruit maturity and then falling still fresh to reveal entire spadix and ripe fruits. Seeds with a pronounced, hooked, micropylar appendage.....

..... *Piptospatha* 5

5a. Spathe limb caducous early in anthesis (generally between female and male anthesis); peduncle erect at

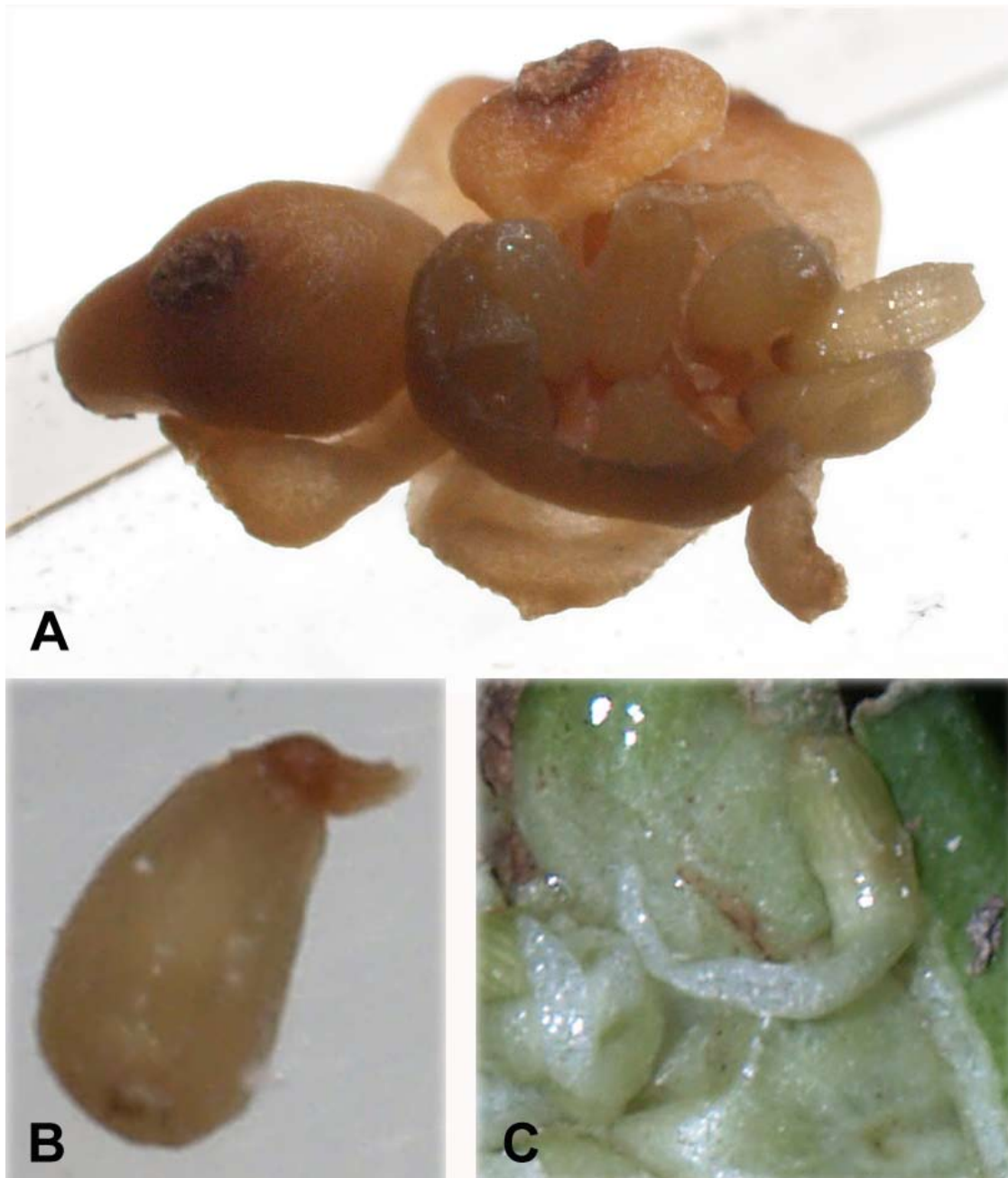


Figure 5. *Bakoa lucens* (Bogner) P.C. Boyce & S.Y. Wong. A, Dissected fruits showing ovules on a basal placenta. Note that blunt-tipped micropyle; B, A single seed. Note that the dark, beak-like structure (uppermost) is the funicle. The micropyle is blunt. *Phymatarum borneense* M. Hotta; C, Ripe infructescence with one fruit opened and a single seed extracted to show the long, hooked, micropylar appendage.

- fruit dispersal; fruiting spathe a funnel-form splash-cup.....*Piptospatha elongata* group
- 5b. Spathe limb persistent; peduncle declinate at fruit dispersal; fruiting spathe caducous prior to fruit dispersal, not forming a splash-cup.....
.....*Piptospatha grabowskii* group
- 6a. Thecae with needle-like projection extending only after female anthesis; projection tipped with a weakly pel-tate ovate-triangular flap. Spadix with distal pistillodes.....*Schottarum*
- 6b. Thecae with a horn- or needle-like projection present prior to female anthesis; projection pointed and never with a terminal flap. Appendix, where present, comprised of staminodes..... 7
- 7a. Sterile interstice of spadix with flattened scale-like staminodes; anthers not excavated *Bucephalandra*
- 7b. Sterile interstice absent or with truncate staminodes; anthers nearly always with the top excavated (but not in *A. incavatum*)..... *Aridarum* 8
- 8a. Thecae on each end of the anther (seen from above)....
..... *Aridarum* Sect. *Aridarum*
- 8b. Thecae together on one side of the anther (seen from above).....*Aridarum* Sect. *Caulescentia*
- 9a. Thecae of anther without horn- or needle-like projections; ovules parietal; seeds without a micropylar appendage*Schismatoglottis* 10
- 9b. Thecae of anther each with horn- or needle-like projections; ovules basal; seeds with a long, hooked micropylar appendage*Phymatarum*
- 10a. Stem pleioanthic 11
- 10b. Stem hapaxanthic ..*Schismatoglottis calyptrata* group
- 11a. Spathe limb mostly caducous 12
- 11b. Spathe limb marcescent to crumbling and/or deliquescent 13
- 12a. Leaf sheath fully attached to petiole
.....*Schismatoglottis calyptrata* group
- 12b. Leaf sheath ligular.....
.....*Schismatoglottis multiflora* group
- 13a. Petiole sheathing only at base; foliage leaves alternating with cataphylls .. *Schismatoglottis tectorata* group
- 13b. Petiole usually sheathing for at least a third of its length (rarely less); foliage leaves not alternating with cataphylls..... 14
- 14a. Spathe limb irregularly crumbling and breaking away at or after male anthesis.....
.....*Schismatoglottis asperata* group
- 14b. Spathe limb clasping the spadix and more or less marcescent after anthesis, finally falling with spent parts of spadix 15
- 15a. Leaf sheath wings persistent; inflorescence nodding; male and female zones of spadix more or less contiguous.....*Schismatoglottis corneri* group
- 15b. Leaf sheath wings usually (but not always) deciduous; inflorescence more or less erect; male and female zones separated by a conspicuous partly naked interstice..... *Schismatoglottis rupestris* group

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婆羅洲天南星科落檐族之研究 VII：馬來西亞沙勞越二新屬—
Schottarum 屬與 *Bakoa* 屬

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本文報導產於沙勞越的天南星科兩個單種新屬：*Schottarum* 屬與 *Bakoa* 屬，前者是根據 *Schismatoglottis sarikeensis* (Bogner & M. Hotta) Bogner 成立，並更名為 *Schottarum sarikeense* (Bogner & M. Hotta) P.C. Boyce & S.Y. Wong；後者根據 *Piptospatha lucens* (Bogner) Bogner & A. Hay，現更名為 *Bakoa lucens* (Bogner) P.C. Boyce & S.Y. Wong，上述兩種皆曾置於現已廢止的 *Hottarum* 屬 (= *Piptospatha*)。本文就以上二新屬進行分類處理，製作婆羅洲產落檐族各屬與主要之屬下類群的檢索表，並提供此二新屬植物彩色圖片以資辨識。

關鍵詞：天南星科；婆羅洲；溪生型；落檐族。