Studies on Schismatoglottideae (Araceae) of Borneo XXIX—*Piptospatha manduensis*— The Ultimate Aroid Calciphile?

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ABSTRACT

Piptospatha manduensis A. Hay & Bogner is highlighted as a truly calciphilous aroid obligated to travertine in north eastern Indonesian Borneo. Based on new collections and cultivated plants an updated description is offered. A brief overview of the other very few calciphilous aroids in Borneo is presented, and, together with *P. manduensis*, all are illustrated.

KEY WORDS

Araceae, *Piptospatha*, Schismatoglottideae, Geology, Limestone, Travertine, Borneo.

INTRODUCTION

Limestone obligation coupled with a highly localized distribution is a well established phenomenon for Araceae species (e.g. Bogner & Hay, 2000; Boyce & Wong, 2009; Gonçalves, 2010; Hay & Yuzammii, 2000; Kiew et al., 2004; Wong & Boyce, 2006; Wong & Boyce, 2007a, 2007b). However, our extensive field observations on Borneo have revealed that the majority of 'limestone species' actually grow in crevices or on ledges with significant deposits of organic material, the pH testing of which reveals as moderately to highly acidic (pH 5–4.2). Thus, although many aroids are indeed limestone obligated (we estimate about 100 species on Borneo alone, many still to be described), primarily on forested karst formations, so far only three have been found that habitually grow directly on a limestone substrate.

These very few exceptions include *Schismatoglottis monoplacenta* M.Hotta from karst limestone riverside cliffs at Mulu N.P., NW Sarawak (Fig. 1), and *S. bauensis* A. Hay & Chi.C.Lee (Fig. 2), which occurs on drier limestone stacks at Bau, SW Sarawak. Leaf blades of both species are invariably coated in habitat with limestone powder or paste resulting from deposition of decomposed limestone by constant dripping of rock-percolated water (Figs. 1C & 2B). This limestone coating, however, is readily removed by rubbing.

A third and still yet more remarkable exception is *Piptospatha manduensis* A. Hay & Bogner, a highly localized rheophyte obligated to bare travertine stream beds and waterfalls in northeastern Indonesian Borno (Kalimantan Timur) which is frequently encountered in habitat with much of the creeping rhizome and roots encased by mineralized limestone (Fig. 3A, B). The coating can only be removed by flexing the stems, at which time the limestone shatters into small pieces.

Described in 2000 based on a collection by 'Doc' Kostermans, *P. manduensis* has recently been refound at the type locality, enabling recording of several additional

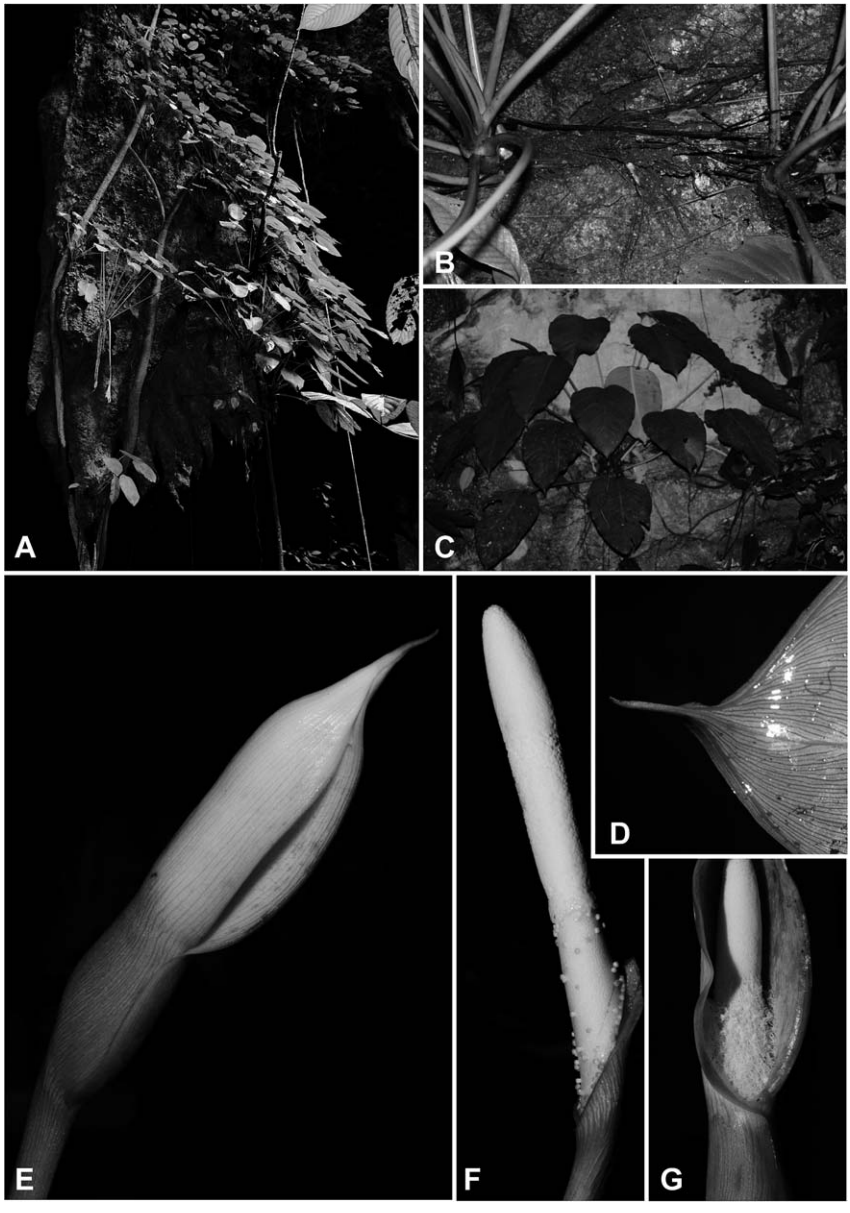

Fig. 1. ***Schismatoglottis monoplacenta*** **M.Hotta. A.** Plants in habitat on karst limestone formations en route to Clearwater Cave, Mulu N.P., Sarawak. **B.** Detail of plants growing on bare limestone. **C.** Limestone deposits (dark green leaf blades, owing to algae growing on the limestone coating) as compared with a newly expanded (bright green leaf blade, centre) leaf. Plants in cultivation retain bright green leaf blades. **D.** Detail of leaf tip (abaxial view), showing the pronounced drip-tip (ca. 1.5 cm long) and the conspicuous pellucid veins. **E.** Inflorescence at pistillate anthesis. **F.** Spadix at pistillate anthesis (spathe artificially removed). **G.** Inflorescence at staminate anthesis, just after pollen release. The strings of pollen are clearly visible on the fertile (staminate) portion of the spadix. Note that the spathe limb has discoloured by the onset of staminate anthesis. **C–G** from *P.C.Boyce* et al. *AR-1966.* All images © Peter C. Boyce.

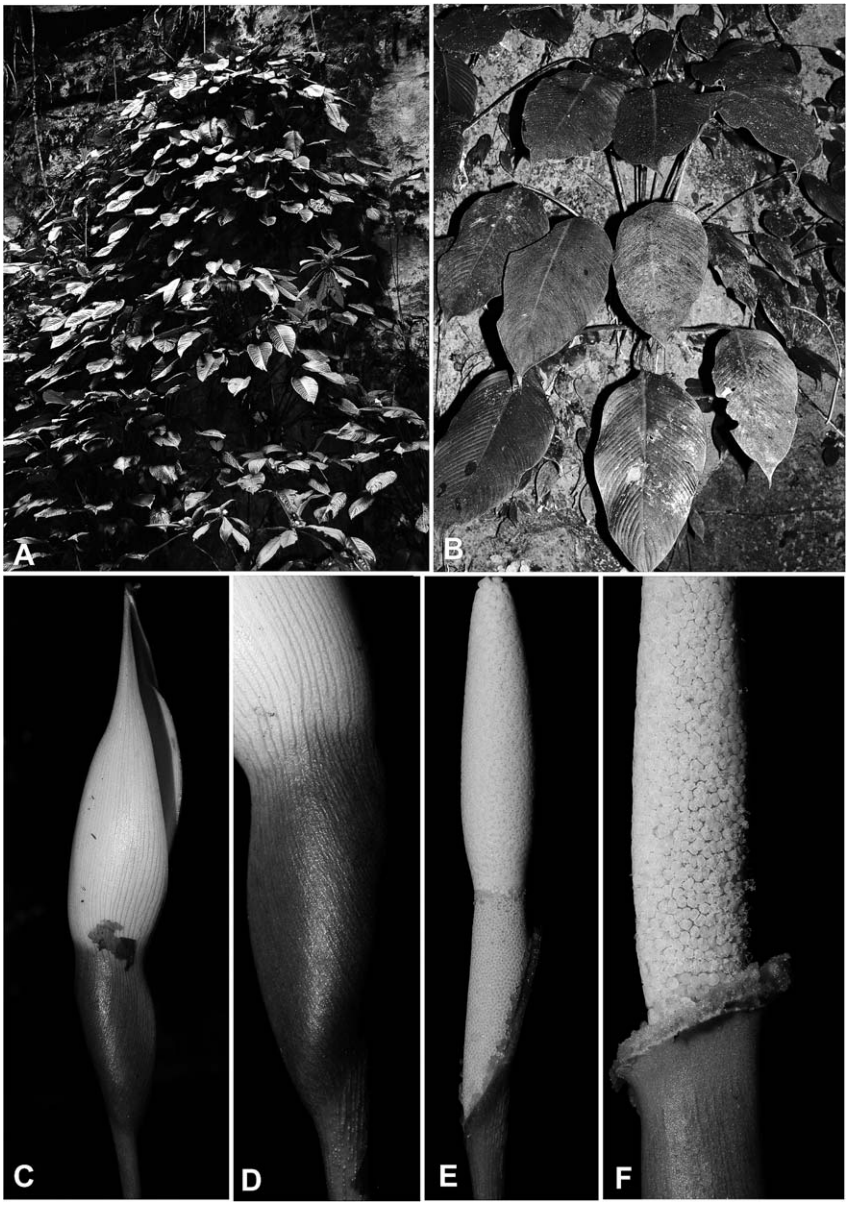

Fig. 2. ***Schismatoglottis bauensis*** **A.Hay & Chi. C.Lee. A.** Plants in habitat on karst limestone formations at the type locality, Gua Peri Peri ('Fairy Caves') near Bau, Sarawak. **B.** Limestone deposits on plant in habitat. Note that the deposits are whitish. It appears that the habitat is not wet enough to allow algae to grow on the leaf surface deposits. **C.** Inflorescence at pistillate anthesis. **D.** Detail of the junction of the spathe limb and lower spathe. **E.** Spadix at pistillate anthesis (spathe artificially removed). **F.** Inflorescence at staminate anthesis, just after pollen release. Note that the spathe limb has by now been shed. **B–F** from *P.C.Boyce & Wong Sin Yeng AR-2053*. All images © Peter C. Boyce.

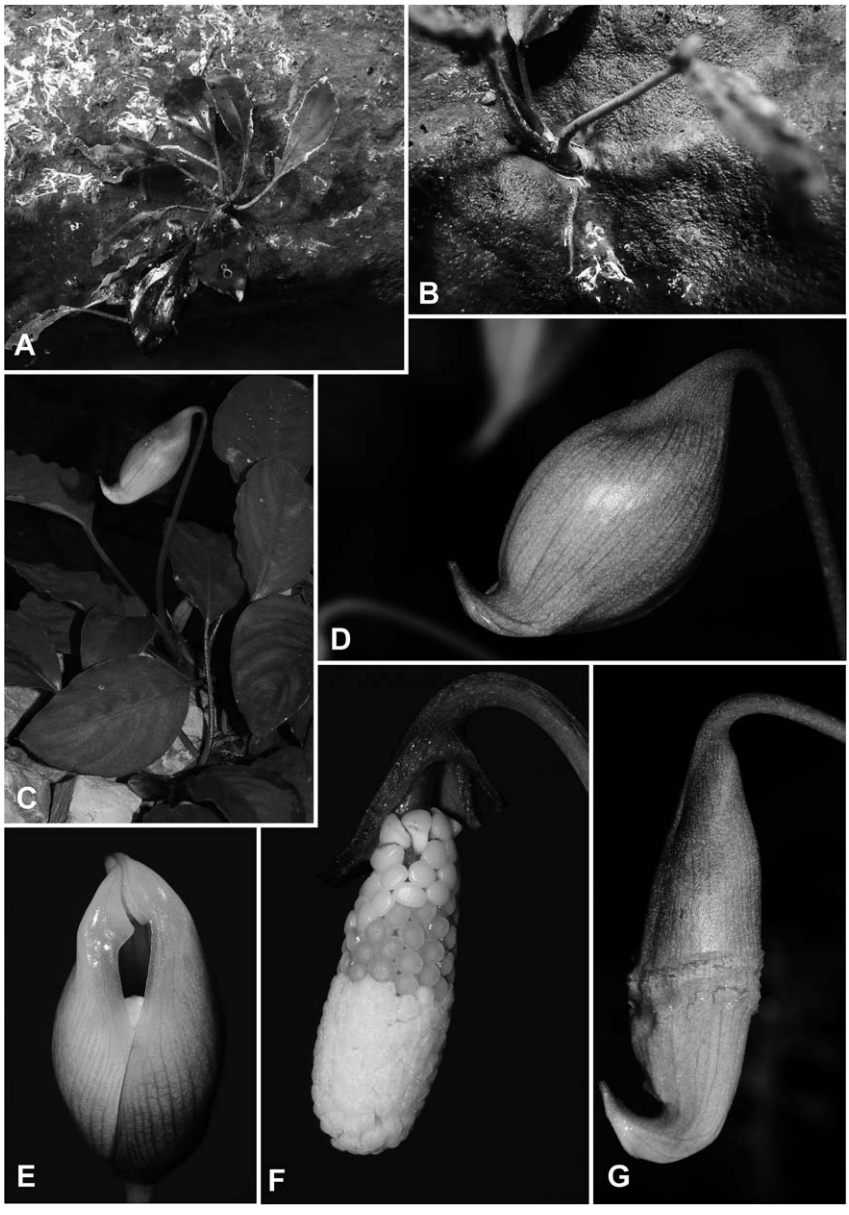

Fig. 3. ***Piptospatha manduensis*** **A.Hay & Bogner. A & B.** Plants in habitat on travertine, type locality. Note (**B**) that the creeping stem and roots are encrusted with limestone deposits. **C.** Cultivated plant. Note the limestone chips 1 cm (c. ½ inch) chips. **D.** Inflorescence at pistillate anthesis. **E.** view of the end of the spathe, pistillate anthesis; **F.** Spadix at pistillate anthesis (spathe artificially removed). **G.** Inflorescence at end of staminate anthesis with the distal half of the spathe beginning to be shed. **A & B** imaged © K.Nakamoto, used with permission; **C–G** *P.C.Boyce* et al. *AR-3757,* images © Peter C. Boyce.

details of the plant morphology, and details of its unique ecology to be established.

Piptospatha manduensis A.Hay & Bogner, *Telopea* 9(1): 207, Fig. 4 (2000); Boyce & Wong, *Aroideana* 35: 11, Fig. 3 (2012) & www.flickr.com/photos/indomalayan_aroids/sets/72157631965506031/. Type: Indonesian Borneo, Kalimantan Timur, Kecamatan ("District") Sangkulirang, [Kabupaten Kutai Timur], Sungai Mandu region, north of Sangkulirang, 14 Aug 1957, *A.J.G.H.Kostermans 13493a* (holo L!; iso BO!; K!, SING!). Figure 3.

Diminutive rheophytic herb to c. 14 cm tall. *Stem* decumbent-creeping, much-branched with individual stems to c. 15 cm long, c. 3 mm diam., internodes 2–6 mm long, reddish brown, rooting profusely from the undersurface. *Leaves* to 15 together, loosely clustered at shoot tips and also distributed along the stem; petiole 3–8 cm long, c. 1.3 mm diam., adaxially somewhat canaliculate and narrowly crisped-alate, reddish brown, sheathing at the extreme base, the wings extended into a narrowly triangular somewhat persistent-drying ligular portion to 2 cm long; blade weakly coriaceous, elliptic, 4–6 cm long × 2–3 cm wide, margins somewhat undulate, the base broadly acute to obtuse, the apex acute and apiculate for 1–2 mm, blade adaxially slightly glossy medium green, abaxially whitish green with mid-rib and major veins reddish; midrib slightly prominent abaxially, adaxially flush with the blade, with 2–3 primary lateral veins on each side, irregularly alternating with lesser interprimaries, diverging at 45–60° and joining a conspicuous submarginal vein; secondary venation adaxially obscure, abaxially fine and somewhat distant (c. 1 mm apart); tertiary venation adaxially obscure, abaxially obscure or forming a very faint tessellate reticulum (most easily seen in dry material). *Inflorescence* solitary, but up to four produced in sequence each interspersed by a foliage leaf; peduncle (subequalling to) exceeding the leaves, 7–11 cm long, reddish brown. *Spathe* narrowly ovoid at onset of anthesis, inflating to become ovoid globose during staminate anthesis, 2–2.5 cm long, apex constricted with an up-turned rostrum with incurved margins, c. 3 mm long, spathe pale to medium pink with darker red stripes comprised of dense, minute speckles, lower part of spathe (equating to the adnation of the stipe) reddish brown and very slightly scabrid, the upper c. half caducous. *Spadix* 0.8–1.2 cm long, subcylindric, shortly stipitate, stipe mostly adnate to the spathe, terminal part of stipe and fertile portion of spadix free, dark red; pistillate flower zone 2–3.5 mm long; ovary ovoid, 1–1.2 mm diam., white; stigma sessile, discoid, about as wide as the ovary, papillate at anthesis, pale pink, drying dark brown; staminodes confined to 3–5 congested to rather lax oblique whorls at the base of the pistillate zone, individually flat-topped, shortly stipitate, the tops irregularly polygonal, slightly wider than the ovaries, glossy deep yellow, stipe much paler; sterile interstice between fertile flower zones absent; staminate flower zone shortly cylindric, apically obtuse, fertile throughout, c. 0.6 cm long, c. 4 mm diam., ivory; stamens crowded, truncate, rectangular ellipsoid from above, 0.9–1 mm across, apically minutely and densely hairy; theca opening through an apical pore. *Fruiting peduncle* erect, not much elongating, reddish brown; fruiting spathe initially narrowly conical, later broadly funnel-shaped, to 1 cm long and wide; berries clustered, free, subcylindric to obovoid with persistent stigma remnant, 3–3.3 mm long; seed subcylindric with a curved micropylar appendage as long as the body of the seed, appendages interlinked in the fruit holding the seeds together; testa light brown and slightly longitudinally ribbed.

Distribution

Indonesian Borneo, Kalimantan Timur; known only from the type locality.

Ecology

Mineral spring-fed streams and exposed waterfalls under lowland perhumid to moist forest. Plants are obligated to travertine deposits, with the creeping stems and roots frequently encrusted with limestone deposits; alt. c. 50 m asl.

Notes

Bogner & Hay (2000) noted the general similarity of the spadix of *P. manduensis* to that of *Piptospatha* (now *Ooia*) *kinabalunesis*, particularly the pubescent stamens, the lack of a sterile interstice separating the staminate and pistillate flower zones, and the zone of robust staminodes situated below the pistillate flowers. To this can be added the stipitate spadix with the greater portion of the stipe adnate to the spathe. However, *P. manduensis* has a spathe caducous during anthesis, and a funnelform persistent lower fruiting spathe carried on an erect peduncle—typical of *Piptospatha*.

Etymology

The species epithet is contrived from the Sungai Mandu, the Type locality, with the termination *–ensis* (originating from).

Cultivation Observations

The three species detailed here have proved easy to grow but experience has taught that they really need an alkaline growing medium in order to prosper. This is in notable contrast to the majority of limestone-obligated aroid species occurring on humus deposits, which prefer an acid planting medium. In cultivation in Kuching *Schismatoglottis bauensis* and *S. monoplacanta* are content with a liberal addition of 1 cm (c. ½ inch) limestone chips to our standard planting mixture of three parts volcanic red soils (pH 4.5) and one part washed river sand (pH 6.5). After some experimentation, *Piptospatha manduensis* appears to grow best under automated misting in small pots of pure limestone chips.

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