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Studies on Homalomeneae (Araceae) of Borneo XIX: Three new species of geologically obligated Homalomena from Sabah, Malaysian Borneo

Abstract
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Three new geologically obligated species of Homalomena Schott are described from Sabah, Malaysian Borneo. Rheophytic H. gempal Kartini, P. C. Boyce & S. Y. Wong, sp. nov., restricted to rhyolite, belongs to the Chamaecladon clade and is compared to H. atrox P. C. Boyce & al. and H. paucinervia Ridl. Homalomena marasmiella Kartini, P. C. Boyce & S. Y. Wong, sp. nov., restricted to ultramafic substrates, forms an apparently natural grouping with H. stella P. C. Boyce & S. Y. Wong and H. vagans P. C. Boyce, and together these are termed the Vagans Complex. Homalomena simunii Kartini, P. C. Boyce & S. Y. Wong, sp. nov. is the third species of the Insignis clade to be described from Sabah and is restricted to basalt. All three species are illustrated from living plants.

Additional key words: aroids, Homalomena gempal, Homalomena marasmiella, Homalomena simunii, basalt, ultramafic, rheophyte

Introduction

Araceae-focused fieldwork on Borneo continues to bring to light undescribed locally endemic species correlated with geological obligation (see Boyce & Wong 2015 for a bibliography to date). Here we describe three taxonomic novelties belonging to Homalomena Schott, each restricted to a specific geology: H. marasmiella associated with ultramafic rocks at Telupid, C Sabah, H. gempal occurring on rhyolite waterfalls and H. simunii from forested basalts, the latter two at Tawau Hills N.P. (National Park), SE Sabah.

Homalomena is by far the most speciose and most poorly understood genus of aroids in tropical Asia. No modern monograph exists, the last being Engler (1912).

Geological interpretation of Tawau Hills N.P. was much assisted by reference to Sanudin & al. (2010). Interpretation of the geology of Borneo in general relies on Tate (2001).

Results and Discussion

Homalomena gempal Kartini, P. C. Boyce & S. Y. Wong, sp. nov. – Fig. 1.
Holotype: from plant cultivated at Institute for Tropical Biology and Conservation, Kota Kinabalu, 4 Jan 2015, Kartini BORH 2702 (BORH!) [original living collection: Malaysian Borneo, Sabah, Tawau, Tawau Hills N.P., Bukit Galas, Dec 2014, Kartini].

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Fig. 1. *Homalomena gempal* – A: plant in habitat; B: detail of extensive adhering roots; C: leaf blade, adaxial surface; D: leaf blade, abaxial surface; E: detail of flowering plant; F: inflorescence, spathe exterior; G: inflorescence at pistillate anthesis, part of spathe artificially removed to reveal spadix. – All from Kartini BORH 2702. – All photographs by Kartini Saibeh.
**Diagnosis** — *Homalomena gempal* differs from *H. atrox* P. C. Boyce & al. and *H. paucinervia* Ridl., the other described Bornean rheophytic species of the Chamaeladon clade, by its squat pistils, its subglobose sessile interpistillar staminodes and its longitudinally finely ridged petioles, peduncle and spathe limb exterior.

**Description** — Small rheophytic herbs c. 10 cm tall, although usually less. *Stem* epigean, erect, leafy, rooting from nodes and through petiole bases; *roots* tough, 1–3 mm in diam., strongly adhering to rocky substrate. *Leaves* up to 10 together, slightly spreading; *petiole* 4–10 cm long, c. 0.5 cm in diam., longitudinally channelled, matt bright maroon; *petiolar sheath* clasping, 1.5–3 cm long, c. ½ length of petiole, c. 0.1 cm wide between margins, persistent; *leaf blade* elliptic-oblong, 6–10 cm long, 1.5–2.5 cm wide, thinly coriaceous, microscopically velutinous, adaxially medium green, abaxially pale green, base cuneate, apex acute; *midrib* adaxially slightly impressed, abaxially slightly prominent; *primary lateral veins* c. 3 on each side of midrib, adaxially impressed, abaxially slightly prominent, alternating with much fainter regularly interspersed interprimaries and diverging at 20°–30° from midrib; *secondary venation* obscure, parallel-pinnate; *all veins* running into a slightly thickened intramarginal vein. *Inflorescences* up to 8 together, produced sequentially in a simple synflorescence; *peduncle* terete, slender, slightly longitudinally channelled, 2–3 cm long, c. 3 mm in diam., maroon tinged greenish brown; *spathe* narrowly ellipsoid, not constricted, at anthesis 2–3 cm long, 0.5–0.8 cm wide, with a terminal short macro 1–2 mm long, externally slightly longitudinally channelled, reddish green, interior smooth, glossy creamy green, margin and basalmost portion slightly maroon-stained, spathe opening at anthesis by inflation and then a broad slit with margins reflexing. *Spadix* 1.8–2.0 cm long, 0.3–0.4 cm in diam., sessile; *pistillate flower zone* c. 0.5 cm long; *pistils* somewhat distant, broadly squat ovoid, 0.8–0.9 mm tall, c. 1.1 mm in diam., pale greenish; *stigma* capitate, 0.3–0.4 mm in diam.; *interpistillar staminodes* 1 per pistillate flower, on ventral side relative to base of spadix, sessile, globose-ellipsoid, c. 0.2 mm long, cream; *staminate flower zone* c. 1.4 cm long, fertile to apex, apex acute; *staminate flowers* broadly dumbbell-shaped, each consisting of 2 stamens; *stamens* rounded, c. 0.5 mm tall, 1–1.5 mm long, 0.5–0.8 mm wide, creamy; *connective* hardly differentiated. *Inflorescence* not observed.

**Distribution** — *Homalomena gempal* is known only from a restricted area at the type locality.

**Ecology** — *Homalomena gempal* occurs as a strongly rooted rheophyte on exposed rhyolite under very wet lowland to lower hill forest at the base of waterfalls at an altitude of c. 380 m.

**Etymology** — The specific epithet, *gempal*, is a Malay adjective used as a noun in apposition, translating as “thickest”, and selected by way of allusion to the remarkably squat pistils and, so far uniquely for the Chamaeladon clade, sessile interpistillar staminodes.

**Discussion** — *Homalomena gempal* belongs to the Chamaeladon clade (sensu Wong & al. 2013), morphologically defined by the small, unconstricted spathe, staminate flowers each comprising two stamens with the connective much reduced and overtopped by the thecae, and by interpistillar staminodes much shorter than the associated pistils.

At the present time, including *Homalomena gempal*, there are only three published species for Bornean rheophytic species of the Chamaeladon clade. The others are *H. atrox* (Boyce & al. 2010) from riverine shales around Lubok Antu (SW Sarawak) and *H. paucinervia* (Ridley 1905) from sandstones in the vicinity of Matang (NW Sarawak).

*Homalomena marasmiella* Kartini, P. C. Boyce & S. Y. Wong, sp. nov. — Fig. 2 & 3A. Holotype: Malaysian Borneo, Sabah, Sandakan, Labuk & Sugut / Kinabatangan border, Telupid, Sungai Telupid, 05°35′49.1"N, 117°04′35.0"E, 128 m, 25 Mar 2015, M. Lo AR 5192 (SAN!; isotype: SAR!).

**Diagnosis** — *Homalomena marasmiella* differs from *H. stella* P. C. Boyce & S. Y. Wong (Fig 3B) and *H. vagans* P. C. Boyce (Fig. 3C), the two species it most closely resembles, by the mushroom-shaped interpistillar staminodes and cut tissues smelling of coriander leaves (vs columnar interpistillar staminodes and tissues with a smell reminiscent of turpentine). *Homalomena marasmiella* is further distinguished from *H. stella* and *H. vagans* by being restricted to ultramafic rocks (*H. stella* and *H. vagans* occur almost exclusively on shale). From *H. stella*, *H. marasmiella* is differentiated by having the leaves scattered along a creeping and rooting rhizome-like stem (vs a rosette of leaves on a compact, erect stem) and the presence of a naked interstice separating the pistillate and staminate flower zones. From *H. vagans*, *H. marasmiella* is differentiated additionally by chartaceous leaf blades. All observed plants of *H. marasmiella* have the leaf blades with fine broken stalks of pale grey variegation approximately coinciding with the primary lateral veins, whereas *H. stella* and *H. vagans* have plain green leaves.

**Description** — Creeping herbs c. 20 cm tall, with cut vegetative tissues strongly aromatic of coriander. *Stem* pleiananthic, creeping; *internodes* elongated to 2 cm long, c. 4 mm in diam. *Modules* subtended by a slender 2-keeled phyllry c. 3 cm long, c. 3 mm wide. *Leaves* individually somewhat scattered, but plants with multiple stems, thus leaves appearing dense; *petiole* 7–23 cm long, c. 3 mm
Fig. 2. *Homalomena marasmiella* – A & B: plants in habitat; C & D: inflorescence at pistillate anthesis; note extension and flexing of spadix. – All from *M. Lo AR* 5192. – Photographs: A & B by M. Lo; C & D by Peter C. Boyce.
Fig. 3. A: *Homalomena marasmiella*, inflorescence at pistillate anthesis, part of spathe artificially removed; B: *H. stella*, inflorescence at pistillate anthesis, part of spathe artificially removed; C: *H. vagans*, spadix post staminate anthesis, spathe artificially removed; D: *H. havilandii*, inflorescence at pistillate anthesis, part of spathe artificially removed. – A from M. Lo AR-5192; B from P. C. Boyce & S. Y. Wong AR-3001; C from P. C. Boyce AR-2272; D from P. C. Boyce & S. Y. Wong AR-3774. – All photographs by Peter C. Boyce.
in diam., portion of petiole distal to petiolar sheath weakly D-shaped in cross-section with edges minutely alate, semi-glossy medium to rather dark grey-green; petiolar sheath upper part with edges overlapping, lower part with wings spreading almost flat, 4–5.5 cm long, c. 1 cm wide between margins, c. ⅔ length of petiole, wings long persistent, margins rather membranous, slightly unequal with tips minutely auriculate, pale green with darker green longitudinal veins; leaf blade narrowly oblong-elliptic to very narrowly ovate, 6–16 cm long, 2–3 cm wide, chartaceous, adaxially semi-matt pale green with broken grey-green bands roughly following primary and interprimary lateral veins, abaxially pale green, base cuneate to rounded, apex acuminate and mucronate for c. 2 mm; midrib abaxially rounded-raised, particularly in portion of blade proximal to petiole, adaxially ± flush with surface of blade, to 3 mm wide; primary lateral veins c. 5 on each side of midrib, diverging at c. 35° from midrib, markedly pellucid, abaxially slightly raised, adaxially slightly impressed, with blade between somewhat quilled; interprimary veins almost invisible; secondary venation forming a faint tessellate reticulum; tertiary venation invisible; all veins running into an almost imperceptible intramarginal vein. Inflorescences paired in a simple synflorescence, each subtended by a small narrowly triangular 2-keeled prophyll, erect at anthesis, later declinate; peduncle c. 5 cm long, c. 1.5 mm in diam., pale green. Spatha thinly stiff, with a distinct constriction between lower portion and spreading limb, tightly furled prior to anthesis, c. 6 cm long; lower spathe c. 2 cm long, 1.4–2 cm wide, ellipsoid at pistillate anthesis, becoming globose at staminate anthesis, semi-glossy pale green externally, internally glossy medium green; limb c. 4 cm long, c. 1.5 cm wide, spreading at pistillate anthesis, narrowly ovate-ellipsoid, somewhat constricted at junction with convolute lower part, exterior pale green with darker longitudinal veins, interior medium green with darker veining, tipped with a rostrate mucro c. 5 mm long. Spadix straight and shorter than spathe during development, extending and flexing forward at pistillate anthesis, c. 5.5 cm long at pistillate anthesis; stipe oblong-globose, oblique, c. 4 mm long on longest side, c. 3 mm in diam., glossy medium green; pistillate flower zone c. 1.5 cm long, c. ⅔ spadix length, c. 5 mm wide; pistils rather lax, cylindric-globose, c. 1 mm tall, c. 0.6 mm in diam., bright medium green; style absent; stigma narrower than ovary, umbonate-capitate and impressed into ovary, bright green, producing a conspicuous stigmatic droplet at pistillate anthesis; interstigillar staminodes on a slender stalk, tops flattened, expanded and overhanging stipe, c. 1 mm in diam., shorter than associated pistil, waxy white; interstice c. 3 mm long, glossy medium green; staminate flower zone narrower than pistillate flower zone, with a single row of staminodes below first row of pistillate flowers, c. 3.5 cm long, c. 0.4 cm wide, cylindric, ivory-white; staminate flowers very densely packed, each consisting of 4 stamens; stamens each with 2 anthers, elongate globose; connective forming a slightly centrally impressed triangular synconnective c. 0.75 mm wide; thecae opening by a tiny lateral slit. Inflorescence with persistent spathe remaining green. Fruits not observed.

**Distribution** — Homalomena marasmiella is known only from the type locality

**Ecology** — Homalomena marasmiella occurs on lightly shaded vertical earth banks over ultramafic rock under moderately humid lowland forest at an altitude of c. 130 m.

**Etymology** — The specific epithet is an adjective derived from *Marasmiellus* Murrill, a genus of basidiomycete fungi in the family *Marasmiaceae* (from the Greek μαρασμός, *marasmos*, “decaying”, “withering” or “wasting” plus the diminutive -iellus). The epithet alludes to the striking similarity between the interstigillar staminodes of the new species and the fruiting bodies of the fungus.

**Discussion** — Homalomena marasmiella forms an apparently natural grouping with *H. stella* (Boyce & Wong 2014a) and *H. vagans* (Boyce 1994), and here called the Vagans Complex. As previously noted (Boyce & Wong 2014a), this assemblage would appear to be closest to *H. havidani* Ridl. (sensu Ng & al. 2011) on the basis of pistils each with an associated staminode (Fig. 3D) and the leaf blades lacking posterior lobes. The aroids of ultramafic geology on Borneo remain very poorly understood, although all so far known have proven to be taxonomically novel as well as restricted to this ecology. The following is a complete list of aroids described to date from ultramafics in Sabah, the only area that has received attention: *Alocasia melo* A. Hay & al., *Aridarium sabahense* S. Y. Wong & al., *Bucephalandra ultramafica* S. Y. Wong & P. C. Boyce, *Homalomena kinabaluensis* Furtado, *H. marasmiella*, *Schismatoglottis decipiens* A. Hay and *S. silamensis* A. Hay.

**Homalomena simunii** Kartini, P. C. Boyce & S. Y. Wong, sp. nov. — Fig 4.

Holotype: from plant cultivated at Institute for Tropical Biology and Conservation and at Tawau Hills N.P. Botanic Garden, 4 Jan 2015, Kartini BORH 2701 (BORH!; isotype: SAN!) [original living collection: Malaysian Borneo, Sabah, Tawau, Tawau Hills N.P., without exact locality, Dec 2014, Kartini; identical plants occur scattered on forested basalt at Tawau Hills N.P.].

**Diagnosis** — Homalomena simunii differs from all other species in the genus by the semi-horizontal inflorescences, lax pistils, naked interstice between the stamineate and pistillate flower zones and by being restricted to basalt.

**Description** — Small clustered mesophytic herbs c. 10 cm tall. Stem elongated but with congested nodes, erect to somewhat creeping, rooting along length, c. 0.5 mm in diam., lower part bare, upper part obscured by overlap-
Fig. 4. *Homalomena simunii* – A: plant in habitat; B: leaf blade, abaxial surface; C & D: inflorescence at pistillate anthesis; E: inflorescence at late pistillate anthesis, part of spathe artificially removed. – All from *Kartini BORH 2701*. – All photographs by *Kartini Saibeh*. 
ping leaf bases, internodes c. 0.2 cm long; roots tough, c. 0.2 cm in diam., emerging through splitting leaf sheath below petiole insertion. Leaves c. 12 together, reflexed, clustered toward apex of shoots; petiole 3–6 cm long, 0.3–0.5 cm wide, D-shaped in cross-section with dorsal angles rather sharp, velvety deep purple; petiolar sheath 3–3.5 cm long, ½–¾ petiole length, c. 1 cm wide between margins at base, narrowing toward apex, sheath margins c. 0.5 cm wide, equal, incurved, dark maroon, persistent; leaf blade c. 0.5 cm wide, equal, incurved, dark maroon, base cuneate, apex acute; rachis raphaceous, adaxially velvety dark green, abaxially deep velvety maroon, base cuneate, apex acute; midrib abaxially raised in proximal ½, adaxially slightly sunken; primary lateral veins c. 4 on each side, diverging at 50°–80° from midrib, curved slightly toward apex when near margin; interprimary veins c. ½ width of primary lateral veins, alternating irregularly with primaries; secondary venation very obscure, striate; all veins running into a slightly thickened intramarginal vein. Inflorescences solitary, each subtended by a prophyll, c. 2.5 cm long, peduncle erect, spathe sub-horizontal to somewhat nodding at anthesis, spadix curving; peduncle c. 5.5 cm long, c. 0.3 cm in diam., creamy green, tinged pink. Spathe c. 5.5 cm long, lowermost part of lower spathe creamy orange with slight pale pink staining, remainder waxy creamy, stained pink especially dorsally in area of constriction and at apex, internally waxy creamy flushed pink along margins and apex; lower spathe ovoid-ellipsoid, c. 2 cm long, c. 1 cm wide, constricted at junction of spathe limb, constriction coinciding with lower part of staminate flower zone; spathe limb exceeding lower spathe, c. 3.5 cm long, c. 1.5 cm wide, elliptic, opening wide at anthesis with margins recuring, apex cuspidate. Spadix shorter than spathe, c. 4.3 cm long, rather stoutly cylindric, sessile, blunt; pistillate zone c. 2 cm long, c. ½ spadix length, c. 0.5 cm wide; pistils lax, c. 1.5 mm tall, globose, pale cream; stigma c. 0.1 cm in diam., slightly capitpate, narrower than ovary; sterile interstice c. 0.3 cm long, c. 0.5 cm wide, upper part with staminodes at junction with staminate flower zone; staminodes irregularly polygonal, slightly globose, c. 0.1 cm in diam., pale orange; staminate zone c. 2 cm long, c. ½ spadix length, lowest part comprised of a very few staminodes, rich creamy yellow to pale orange; staminate flowers congested, c. 0.3 cm long, c. 0.1 cm wide, irregularly polygonal, rich creamy with slightly pale orange, each consisting of 4 or 5 truncate stamens and overtopped by large flat connective tissues. Infrcuctescence not observed.

Distribution — Homalomena simunii is known only from the type locality, where it is not abundant.

Ecology — Homalomena simunii occurs in lowland to lower hill evergreen perhumid forest on basalts at altitudes between 200–390 m.

Eponymy —Named for Mr Simun Limbang, the manager of Tawau Hills N.P., Sabah Parks, who initiated a propagation for this and many other representatives of the Tawau Hills flora at the Botanical Garden of Tawau Hills N.P.

Discussion — Homalomena simunii belongs to the Insignis clade (Ng & al. 2011; Wong & al. 2013) defined by the absence of interstipillar staminodes, leaf blades with little or no posterior lobe development and by a lower spathe exceeding, or at least equaling, the spathe limb in length. Currently the Insignis clade comprises ten described species, each geographically and, where known, geologically restricted (Boyce & Wong 2014b). Two species are described from NW Sabah: granite-favouring low-altitude H. gillii Furtado and high-altitude ultrabasic-associated H. kinabaluenensis Furtado (Furtado 1939). The second species is unusual in the genus by having the spathe and peduncle deep purple and is one of rather few ultrabasic-obligated aroids described to date.

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