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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, rhyolite, 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 Chamaecladon 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* epigeal, 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 mucro 1–2 mm long, externally slightly longitudinally channelled, reddish green, interior smooth, glossy creamy green, margin and basal-most 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. *Infructescence* 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 “thickset”, and selected by way of allusion to the remarkably squat pistils and, so far uniquely for the Chamaecladon clade, sessile interpistillar staminodes.

Discussion — *Homalomena gempal* belongs to the Chamaecladon 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 Chamaecladon 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 streaks 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* pleionanthic, creeping; *internodes* elongated to 2 cm long, c. 4 mm in diam. *Modules* subtended by a slender 2-keeled prophyll 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 marasmiiella*, 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. $\frac{1}{3}$ 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 \pm 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 in between somewhat quilted; *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. *Spathe* 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. $\frac{1}{3}$ 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; *interpistillar 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 triangu-

lar synconnective c. 0.75 mm wide; *thecae* opening by a tiny lateral slit. *Infructescence* 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 interpistillar 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. havilandii* 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., *Aridarum 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 staminate 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, $\frac{1}{2}$ – $\frac{2}{3}$ 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* ovate, 5–14 cm long, 4–7 cm wide, thinly coriaceous, adaxially velvety dark green, abaxially deep velvety maroon, base cuneate, apex acute; *midrib* abaxially raised in proximal $\frac{1}{2}$, 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. $\frac{1}{2}$ 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 subhorizontal 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 recurving, apex cuspidate. *Spadix* shorter than spathe, c. 4.3 cm long, rather stoutly cylindric, sessile, blunt; *pistillate zone* c. 2 cm long, c. $\frac{1}{2}$ 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 capitate, 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. $\frac{1}{2}$ 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. *Infructescence* 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 Limbawang, 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 interpistillar staminodes, leaf blades with little or no posterior lobe development and by a lower spathe exceeding, or at least equalling, 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. kinabaluensis* 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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References

- Boyce P. C. 1994: New species of *Araceae* from Brunei. – Kew Bull. **49**: 793–801.
- Boyce P. C. & Wong S. Y. 2014a: Studies on *Homalomeneae* (*Araceae*) of Borneo XIV – A new rheophytic species of *Homalomena* from Sarawak, Malaysian Borneo. – *Aroideana* **37**: 33–37.
- Boyce P. C. & Wong S. Y. 2014b: Studies on *Homalomeneae* (*Araceae*) of Borneo XVI: Three new shale-obligated *Homalomena* species. – *Webbia* **69**: 59–67.
- Boyce P. C. & Wong S. Y. 2015: Compendium genera *Aracearum malesianum*. – *Aroideana* **38**: 40–177.
- Boyce P. C., Wong S. Y. & Fasihuddin B. A. 2010: Studies on *Homalomeneae* (*Araceae*) of Borneo II: The *Homalomena* of Nanga Sumpa (Batang Ai) – Novel & pre-existing taxa, and notes on Iban Usages. – *Gard. Bull. Singapore* **61**: 269–317.
- Engler A. 1912: *Araceae–Philodendroideae–Philodendreae*. Allgemeiner Teil, *Homalomeninae* und *Schismatoglottidinae*. – In: Engler A. (ed.), *Das Pflanzenreich* **55(IV.23Da)**. – Leipzig: Wilhelm Engelmann.
- Furtado C. X. 1939: *Araceae* malesicae II. Notes on some Indo-Malaysian *Homalomena* species. – *Gard. Bull. Straits Settlements* **10**: 183–238.

- Ng K. K., Ahmad Sofiman O., Boyce P. C. & Wong S. Y. 2011: Studies on *Homalomenaeae* (*Araceae*) of Borneo VIII: Delimitation of additional informal suprageneric taxa for Sundaic *Homalomena*. – *Webbia* **66**: 21–28.
- Ridley H. N. 1905: The aroids of Borneo. – *J. Straits Branch Roy. Asiat. Soc.* **44**: 169–188.
- Sanudin T., Baba M. & Ismail A. R. 2010: Geological heritage feature of Tawau volcanic sequence, Sabah. – *Bull. Geol. Soc. Malaysia* **56**: 79–85.
- Tate R. B. 2001: The geology of Borneo island [CD-ROM]. – Kuala Lumpur: Geological Society of Malaysia / Persatuan Geologi Malaysia.
- Wong S. Y., Tan P. J., Ng K. K., Ahmad S. O., Lee H. B., Fasihuddin B. A. & Boyce P. C. 2013: Phylogeny of Asian *Homalomena* (*Araceae*) based on the ITS region combined with morphological and chemical data. – *Syst. Bot.* **38**: 589–599.