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Studies on Homalomeneae (Araceae) of Borneo XVI: three new shale-obligated *Homalomena* species

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Homalomena cowleyae P.C. Boyce & S.Y. Wong, *Homalomena imitator* P.C. Boyce & S.Y. Wong, and *Homalomena mutans* P.C. Boyce & S.Y. Wong are described and illustrated as new species obligated to tropical forested shales.

Keywords: Araceae; Homalomeneae; *Homalomena*; Malaysian Borneo; Brunei; shales

Introduction

The influence of geology in the occurrence of localized species diversity and species richness of aroids on Borneo has previously been highlighted by Boyce and Wong (2013a, b, c), Ni Putu Sri Asih et al. (2012), Wong and Boyce (2011, 2012, 2013), and Wong et al (2012). Here we describe three novel species of *Homalomena* each restricted to one of the richest ecological habitats on the island, lowland forest over shales. Geological confirmation for this and all of our fieldwork is much assisted by Hutchison (1989, 2005) and Tate (2001).

Homalomena cowleyae P.C. Boyce & S.Y. Wong, **sp. nov.**

Diagnosis

Homalomena cowleyae is most similar to *Homalomena imitator* (this paper) although simple to differentiate by the lower spathe rich pink (versus spathe entirely white), by the much shorter spadix stipe, the smaller and more numerous pistils, and the tapering, not fusiform, spadix. *Homalomena cowleyae* approaches *Homalomena insignis* N.E. Br., by lacking interpistillar staminodes, a rare occurrence among larger-growing *Homalomena* species, but is distinguished by the overall larger and more robust habit, the proportionately much longer petioles, and by the stiffer, glossy (versussomewhat softly leathery and minutely velvety) leaf blades, the pink lower spathe, and by the much shorter spadix stipe.

Typus: Brunei, Temburong, Amo, Apan Sungai Baki, downstream from camp, 4°31′ N, 115°11′ E, 45 m, 16 July 1993, *J.Cowley JC78* (holo K!; iso BRUN B008067 [+spirit]). Figures 1, 2.

Description

Medium, evergreen, glabrous, strongly aromatic mesophytic herbs to c.60 cm tall. Stem pleionanthic, congested, erect, ca 2.5 cm thick, green, internodes to ca 1.5 cm long, green, later becoming pale brown, adventitious roots few, penetrating the leaf bases. Leaves c.10 together; petiole 30–40 cm long × 9–12 mm wide, adaxially very shallow wide-grooved, weakly D-shaped in cross-section, sub-erect to spreading, medium glossy green, the lowermost part sometimes suffused reddish; a weak pulvinus always present, about one-fifth of the petiole length from blade base; petiole bases clasping; petiolar sheath to c.10 cm long, one-quarter to one-fifth of petiole length, width between both margins c.1 cm at the base, narrowing towards the apex, sheath margins 0.5–1 cm, equal, involute, clasping, weakly truncate, green, persistent; blade broadly oblong-ovate, 20–35 cm long × 12–18 cm wide, somewhat stiffly coriaceous, semi-glossy medium green adaxially (fresh), drying pale brown, abaxially sub-glaucous green (fresh), drying pale brown, base shallowly cordate, posterior lobes straight, rounded, c.2 long, blade tip acute, short-acuminate for c.2.5 cm, apiculate for c.3 mm; midrib raised abaxially (fresh and dry), c.6 mm wide at the base and 4 mm wide at the centre, adaxially impressed (fresh and dry), c.8 mm at the base and 3 mm at the centre; 10–13 primary lateral veins on each side, diverging at 60°–80° from the midrib, adaxially impressed (fresh and dry), abaxially raised (fresh and dry), curved towards the apex when near the margin; interprimary veins impressed, alternating irregularly with primaries, posterior lobes each with one or two primary lateral veins; secondary venation visible abaxially as conspicuous pellucid-striate vein-like glands running parallel to the primary lateral veins; tertiary venation not visible, all veins running into a slightly thickened intramarginal vein. Inflorescences up

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Figure 1. *Homalomena cowleyae* P.C. Boyce & S.Y. Wong. Isotype specimen: Brunei, Temburong, Amo, Apan Sungai Baki, downstream from camp, 4°31′N 115°11′E, 45 m, 16 July 1993, *J.Cowley JC78* (BRUN B008067). Photo credits © BRUN Herbarium, Sungai Liang Brunei, used with permission.

to five together in a simple sympodium, erect at anthesis, when strongly fragrant of coconut, each subtended by a prophyll, 3–5 cm long; peduncle 11–15 cm long × c.4 mm wide, semi-glossy medium green. Spathe c.7 cm long, lowermost part of lower spathe pale green, the remainder externally rich pink, internally somewhat paler, lower part of spathe limb suffused pale pink, the remainder white except for the bright green terminal rostrum; lower spathe ovoid-ellipsoid, 4–4.5 cm long × 2 cm wide at staminate anthesis, constricted at the junction of the spathe limb, the constriction coinciding with the lower-part of the staminate flower zone, spathe limb about half the length of the lower spathe, c.2.3 cm long × 2 cm wide at pistillate anthesis, mucro c.5 mm long. Spadix almost equal to spathe at pistillate anthesis, c.6.6 cm long, elongate-cylindrical, narrowing in the lower part of staminate zone coinciding with the constriction of the spathe; stipe c.3 mm long × 3 mm wide, oblique-cylindrical, lime green; pistillate zone c.1.6 cm long × 5 mm wide, about one-third length of spadix, weakly fusiform; ovary c.1.1 mm tall, shortly cylindrical, pale creamy white; stigma c.1.5 mm in diameter,

Figure 2. (**A–E)** *Homalomena cowleyae* P.C. Boyce, S.Y. Wong & Y.C. Hoe. **(A, B)** Plants in habitat, Mulu N.P. (**C)** Emerging inflorescences. Note the distinctive spathe limb colouration. (**D)** Inflorescences at onset of staminate anthesis, (nearside spathe artificially removed). Note that the interstice staminodes, visible in have been consumed. The orange-red frass is excrement for the beetles that ate the staminodes. (**E)** Spadix at pistillate anthesis, spathe artificially removed. Note that the pistillate flowers lack interpistillar staminodes. Note, too, the well-developed zone of staminodes at the interstice between the pistillate and staminate flower zones. All from *Hoe Yin Chen et al. AR-3704*. Photo credits: © Hoe Yin Chen, used with permission.

rounded, overtopping ovary, densely arranged, wet and glossy-grey when fresh; style barely differentiated; interstice c.6 mm long × 7 mm wide, densely clothed with irregularly polygonal-globose staminodes, these c.2 mm long, waxy white; staminate zone tapering-cylindrical, c.4 cm long × 4 mm wide (widest part), about one-half length of spadix; staminate flowers, dirty-white to slightly pinkish, c.3.5 mm diameter, regularly polygonal, comprising four or five truncate stamens, each overtopped by large and flat connective tissues, turning pale brown in alcohol. Infructescences not seen.

Distribution

Homalomena cowleyae is restricted to Setap shales in Brunei and across the Sarawak border in Limbang. Plants occur as scattered individuals or in small groups, and are decidedly uncommon.

Ecology

Homalomena cowleyae occurs along riverbanks above the flood levels under lowland humid mixed dipterocarp forest on Setap shales, at an altitude of about 40–50 m.

Eponymy

Named for Jill Cowley, formerly of the Herbarium, Royal Botanic Gardens, Kew, where she specialized in *Zingiberaceae*, in particular *Roscoea*.

Notes

Homalomena cowleyae has potential as an ornamental plant although given its apparent wild scarcity, introduction into tissue culture should be attempted.

Other collections seen

Malaysia, Sarawak, Miri, Marudi, Long Lama, Mulu N.P., trail to Paku Waterfall, Sungai Paku waterfall, 04°02′11.8″ N, 114°49′45.0″ E, 10 December 2011, *Hoe Yin Chen et al. AR-3704* (SAR); Sarawak, Miri, Marudi, Long Lama, Mulu N.P., Long Langsat, Sungai Langsat, draining into the Sungai Tutoh, 04°01′12.4″ N, 114°49′06.6″ E, 13 March 2012, *P.C. Boyce & Wong Sin Yeng AR-3802* (SAR, SBC).

Homalomena imitator P.C. Boyce & S.Y. Wong, **sp. nov.**

Diagnosis

Homalomena imitator is most similar to *H. cowleyae* (this paper) but differentiated by the elongated, hypogeal to sub-epigeal rhizome-like stem, entirely white spathes (versus lower spathe rich pink), also by the proportionately longer spadix stipe, the larger and less numerous pistils, and by the fusiform (versus cylindric-tapering) spadix.

Typus: Malaysian Borneo, Sarawak, Kapit, Taman Rekreasi Sebabai, 01°56′45.6″ N, 112°54′16.8″ E, 3 April 2009, *P. C. Boyce & Wong Sin Yeng AR-2425* (holo SAR!; iso SBC!). Figure 3.

Description

Medium-sized, evergreen, glabrous, strongly aromatic mesophytic herbs to c.40 cm tall. Stem pleionanthic, initially erect, later creeping-elongated, c.2 cm thick, internodes to c.2.5 cm long, green to reddish; adventitious roots many, penetrating the leaf bases, and also produced from shoots arising from older, otherwise leafless portions of the stem. Leaves about six together; petiole 20–25 cm long × c.10 mm wide, sub-erect to spreading, bases weakly clasping, D-shaped in cross-section, adaxially very shallow wide-grooved, medium semi-glossy green, the lowermost part suffused dark glossy red; pulvinus very weak, one-third to one-half of petiole length from blade base; petiolar sheath to c.10 cm long, about one-third of petiole length, margins 0.5–1 cm long, equal, involute, mostly open c.1 cm apart at the base, narrowing towards the apex, weakly truncate, green, persistent; blade ovate-elliptic, 15–28 cm long × 9–11 cm wide, somewhat softly coriaceous, semi-glossy to somewhat satiny medium green adaxially (fresh), drying medium brown, abaxially paler green (fresh), drying pale brown, base cuneate, blade tip somewhat obtuse, short-acuminate for c.2.5 cm, apiculate for c.4 mm; midrib raised abaxially (fresh and dry), c.5 mm wide at the base and 3 mm wide at the centre, adaxially flush to weakly impressed (fresh and dry), c.6 mm at the base and 3 mm at the centre; primary lateral veins about seven on each side, diverging at 60°–80° from the midrib, adaxially impressed (fresh and dry), abaxially raised (fresh and dry), curved towards the apex when near the margin; interprimary veins impressed, weaker than and alternating rather regularly with primaries; secondary venation visible abaxially as conspicuous pellucid-striate vein-like glands running parallel to the primary lateral veins; tertiary venation not visible, all veins running into a slightly thickened intramarginal vein. Inflorescences up to five together in a simple sympodium, erect at anthesis, each subtended by a 2–4 cm long prophyll; peduncle 11–16 cm long × c.4 mm wide, semi-glossy medium green. Spathe c.11 cm long, white with the basal-most part of the lower spathe flushed lime green and the terminal rostrum green; lower spathe ovoid-ellipsoid, c.3 cm long × 1.5 cm wide at staminate anthesis, constricted at the junction of the spathe limb, the constriction coinciding with the lower-part of the staminate flower zone, spathe limb sub-equalling the length of the lower spathe, c.2.3 cm long × 2 cm wide at pistillate anthesis, mucro c.5 mm long. Spadix almost equal to spathe at pistillate anthesis, c.6 cm long, elongate-

Figure 3. (**A–F**) *Homalomena imitator* P.C. Boyce & S.Y. Wong. **(A)** Plants in Type habitat, Kapit. (**B**) Mature leaf blade are part of petiole. Note that the blade lacks posterior lobes. (**C**) Detail of the leaf blade abaxial venation, showing the translucent gland-like veins. (**D**) Emerging inflorescences. Note the wholly white spathes. (**E**) Inflorescence just prior to anthesis. (**F**) Spadix at pistillate anthesis, spathe artificially removed. Note that the pistillate flowers lack interpistillar staminodes. Note, too, the well-developed zone of staminodes at the interstice between the pistillate and staminate flower zones. (**G**) Detail of the interstice. All from *P.C. Boyce & Wong Sin Yeng AR-2425*. Photo credits: © P. C. Boyce.

cylindrical-fusiform, narrowing in the lower part of staminate zone coinciding with the constriction of the spathe; stipe c.6 mm long × 3 mm wide, compressed-cylindrical, glossy white; pistillate zone c.1.6 cm long × 5 mm wide, about one-third length of spadix, compressed cylindrical; ovary c.1.2 mm tall, shortly cylindrical, pale creamy white; stigma c.1 mm in diameter, capitate-rounded, overtopping ovary, wet and glossy-grey when fresh, pale brown in alcohol; style barely differentiated; interstice c.6 mm long × 7 mm wide, densely clothed with irregularly polygonal-globose staminodes, these c.2 mm long, waxy white; staminate zone fusiform c.3.3 cm long × 4 mm wide (widest part), about half length of spadix; staminate flowers, white, 2.5–4 mm diameter, rather equally polygonal, comprising four or five truncate stamens, each overtopped by large and flat connective tissues, turning pale brown in alcohol. Infructescences not seen.

Distribution

Homalomena imitator is so far known only from the Type locality, where it is scattered although not notably rare.

Ecology

Homalomena imitator grows on steep slopes of somewhat open per-humid lowland gallery forest over shales at about 50 m above sea level.

Etymology

From Latin, *imitator* (masc.), a mimic or impersonator, and here used to reflect on the similarity of this species to *H. cowleyae*.

Notes

Homalomena cowleyae and *H. imitator* are very probably part of the widespread and taxonomically rich *Homalomena insignis* complex, sharing with species in this complex no interpistillar staminodes, leaf blades with little or no posterior lobe development, and a lower spathe exceeding, or at least equalling, the spathe limb in length. Other species are the limestone-obligated *Homalomena sarawakensis* Ridl. (northwest Sarawak), granite-associated *Homalomena lunduensis* Furtado (northwest Sarwak), sandstone-restricted *H. intermedia* Ridl. (northwest Sarawak), granite-favouring low-altitude *Homalomena gillii* Furtado (Kinabalau) and high-elevation *Homalomena kinabaluensis* Furtado, and *Homalomena schismatoglottoides* Engl. and *Homalomena nieuwenhuisii* Engl. ex Alderw., neither of which is specifically located but both originate from the geologically diverse upper reaches of the Kapaus river of northwest Kalimantan.

Homalomena mutans P.C. Boyce & S.Y. Wong, **sp. nov.**

Diagnosis

By the matte dark green leaves with sparse extrafloral nectaries *Homalomena mutans* most resembles *Homalomena sengkenyang* P.C. Boyce, S.Y. Wong & Fasih., from which it may be distinguished by the red or yellow (not green) pistils, and by the persistent or only slightly marginally-marcescent (not entirely marcescent-degrading) petiolar sheathes. From all other species of the *Homalomena* Hanneae complex *H. sengkenyang* and *H. mutans* together are distinguished by the matte medium to dark green leaf blades with sparse extrafloral nectaries.

Type: Malaysian Borneo, Sarawak, Kapit Taman Rekreasi Sebabai, 01°56′45.6″ N, 112°54′16.8″ E, 16 March 2005, *P.C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-1086* (holo SAR!; iso SBC!). Figure 4.

Description

Medium, evergreen, glabrous, strongly aromatic (juniperus/mango resin) weakly clumping mesophytic herbs to c.50 cm tall. Stem pleionanthic, erect to somewhat ascending, c.2.5 cm thick, internodes to c.2 cm long, matte medium green or matte deep red, adventitious roots plentiful, often penetrating the leaf bases. Leaves about 10 together; petiole terete, erect, 25–30 cm long, medium matte green or matte red, bases clasping; pulvinus obscure, c.2.5 cm long, about two-thirds along petiole length; petiolar sheath c.19–13 cm long, about one-quarter of petiole length, slightly unequal, decurrent at apex, margin erect to somewhat incurved, persistent; blade narrowly triangular-sagittate, 10–26 cm long × 8–13 cm wide, thinly leathery, matte dark green adaxially (fresh) with a few scattered darker glands, drying medium olive-brown, abaxially pale green (fresh), drying medium brown, base shallowly and narrowly, cordate, posterior lobes short, straight, ovato-triangular 1–3 cm long, tip acute, acuminate for c.2 cm thence tubular-apiculate for c.3–5 mm; midrib raised abaxially (fresh and dry), green when fresh, drying reddish brown, adaxially sunken slightly into blade, c.2 mm wide; primary lateral veins seven to nine on each side, diverging at 30°–80° from the midrib, adaxially slightly impressed, almost flush with blade when dry, abaxially slightly raised (fresh and dry), distal-most veins curved slightly towards the apex when near the margin; interprimary veins about half width of the primary lateral veins, alternating irregularly with primaries; secondary venation very obscure, striate; tertiary venation not visible, all veins running into a slightly thickened intramarginal vein. Inflorescences up to seven together in a simple synflorescence, erect and smelling powerfully of anise at anthesis, declinate during fruiting, each subtended by prophyll, to c.14 cm long soon marcescent, peduncle to c.13 cm long × c.3 mm diameter, matte medium green or

Figure 4. (**A–H)** *Homalomena mutans* P.C. Boyce & S.Y. Wong. **(A, B)** Plants in Type habitat, Kapit. The larger, quilted leaves in the front of belong to an undescribed species of *Homalomena*. **(C)** Detail of the bases of infructescence peduncles. (**D)** Synflorescence, development is spiral from left to right. The open inflorescence is at late staminate anthesis, and has released pollen. The next most mature inflorescence is immediately to the right. **(E)** Flowering plant viewed from above with developing infructescences to the front, a post-anthesis inflorescence (with the spathe becoming pink) in the middle, and a freshly opened inflorescence at the back. (**F)** Two inflorescences from the same individual. Inflorescence on the left is at the end of staminate anthesis. Note the spathe colour, and shed pollen. On the right at pistillate anthesis. Note the different spathe shape and colour. **G.** & **H.** Spadix from the two colour morphs at onset of staminate anthesis, spathe artificially removed. **I.** Detail of the staminate flower zone with pollen being released. **A, C-H** from *P. C. Boyce & Wong Sin Yeng AR-1782*; **B** from *P. C. Boyce et al. AR-875* Photo credits: © P. C. Boyce.

matte red. Spathe 10–13 cm long, tightly furled before anthesis, at pistillate anthesis lower spathe inflating to become ellipsoid-globose, and spathe limb loosening, then opening wide, at staminate anthesis lower spathe becoming narrower and spathe limb also narrowing; entire spathe white at pistillate anthesis; lower spathe ovoid-ellipsoid, 3–3.5 cm long, constricted at the junction of the spathe limb, the constriction coinciding with junction of the staminate and pistillate flower zones; spathe limb ovato-triangular, c.7–6.5 cm long × c.2.5 cm wide (at pistillate anthesis), apex mucronate to c.4 mm long. Spadix sub-equalling the spathe, c.9–9.5 cm long, stipitate; stipe c.3 mm long × 2 mm diameter, weakly obconical, glossy pale green; pistillate flower zone c.3 cm long × c.1 cm wide, about one-third length of spadix, fusiform; pistils c.1.5 mm × 0.75 mm, densely arranged, globose, bright yellow or bright red, red pistils always associated with plants with red peduncles and petioles; stigma capitate, slightly exceeding the ovary, translucent greyish white, each pistil associated with one interpistillar staminode; interpistillar staminodes clavate with a faint central depression, on a slender stipe c.1 mm diameter, sub-equalling the associated pistil, waxy white; interstice to c.1 cm long × 1 cm wide, contiguous with and equalling diameter of pistillate flower zone, covered with large scattered staminodes, these intergrading to the lowermost fertile flowers of the staminate flower zone; staminate flower zone to c.5 cm long, c.1/3 length of spadix; staminate flowers c.3 mm × 3 mm trapezoid, comprising three to five truncate stamens, each overtopped by a large, flat connective. Infructescence declinate, spathe entirely persistent, deep reddish, peduncle matte dark green or matte dark red, with paler longitudinal striae. Fruits and seeds not observed.

Distribution

Homalomena mutans is known only from forest remnants in the environs of Kapit town. Extensive fieldwork in the greater surrounding area as far as Batang Balleh to the east and Pelagus to the north has failed to locate further populations of this species, although one of its associated species, *H. ibanorum*, commonly occurs throughout this area.

Ecology

Homalomena mutans forms extensive patches, often intermixed with *Homalomena ibanorum* S.Y. Wong & P.C. Boyce and an as yet to be described species of the *Homalomena* Hanneae Complex, on open areas of the floor of humid to per-humid lowland dipterocarp forest over shales at between 50 and 100 m.

Etymology

From Latin, *mutans* (masc.), changing, used in reference to both the manner in which the spathe changes colour as anthesis proceeds, and also by way of allusion to the two distinct pistil colour morphs occurring within a population.

Notes

In sharing matte dark green leaves with rather few and scattered glands *H. mutans* is evidently allied to *H. sengkenyang* P.C. Boyce, S.Y. Wong & Fasih., a species so far known only from alluvial shales at Batang Ai (Boyce et al., 2010).

In the Key presented in Wong et al (2013) *H. mutans* will track to couplet 3 – *H. sengkenyang*, but may be distinguished as per the above diagnosis.

Other collections seen

Malaysia, Sarawak, Kapit, Taman Rekreasi Sebabai, 01°56′45.6″ N, 112°54′16.8″ E, 13 December 2004, *P.C. Boyce, Jeland ak Kisai & M. Gibernau AR-866* (SAR, SBC) & *P.C.Boyce, Jeland ak Kisai & M.Gibernau AR-875* (SAR, SBC); Sarawak, Kapit, Taman Rekreasi Sebabai, 01°56′45.6″ N, 112°54′16.8″ E, 16 March 2005, *P.C. Boyce, Jeland ak Kisai & Jepom ak Tisai AR-1099* (SAR, SBC); Sarawak, Kapit, Taman Rekreasi Sebabai, 01°56′45.6″ N, 112°54′16.8″ E, 18 April 2006, *P.C. Boyce, Jeland ak Kisai & Wong Sin Yeng AR-1781* (SAR, SBC) & *P.C. Boyce, Jeland ak Kisai & Wong Sin Yeng AR-1782* (SAR, SBC); Sarawak, Kapit, Kapit town, Sungai Tapang, 02°00′49.2″ N, 112°56′16.3″ E, 28 August 2011, *P.C. Boyce & Wong Sin Yeng AR-3630* (SAR, SBC).

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