

Studies on Homalomeneae (Araceae) of Borneo XIII – New Species of *Homalomena*

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ABSTRACT

Five new *Homalomena* species are described from Sarawak, Malaysian Borneo: *H. baangongensis* L.S.Tung & Y.C.Hoe, *H. gastrofructa* S.Y.Wong, Y.C.Hoe & P.C.Boyce, *H. ibanorum* S.Y.Wong & P.C.Boyce, *H. passa* S.Y.Wong & P.C.Boyce, and *H. velutipedunculata* S.Y.Wong, Y.C.Hoe & P.C.Boyce. Based on morphological characteristics they are assigned to the Giamensis Complex [*H. baangongensis*], Hanneae Complex [*H. gastrofructa*, *H. velutipedunculata*], and Borneensis Complex [*H. ibanorum*] of the Cyrtocladon Supergroup, and to the Selaburensis Complex [*H. passa*] of the Homalomena Supergroup. Keys to informal taxa of Bornean *Homalomena*, and to the species of the above mentioned species complexes are provided. All described

novelties are illustrated from living plants, and a comparative plate of the spadix of the five described species of the Borneensis Complex is provided.

KEY WORDS

Araceae, *Homalomena*, Borneo, Sarawak.

INTRODUCTION

Fieldwork on Borneo continues to reveal additional taxonomically novel *Homalomena* species that bring increased support for the informal groups proposed in earlier papers (Baharuddin & Boyce, 2010; Boyce & Wong, 2008; Boyce et al., 2010; Hoe et al., 2011a, 2011b; Kurniawang et al., 2011; Ng et al., 2011a, 2011b; Ni Putu et al., in press; Wong & Boyce, 2011). We here describe five such new species.

KEY TO THE SUPERGROUPS OF BORNEAN *HOMALOMENA*

1. Spathe divided by a moderate to pronounced constriction into a well-defined upper limb and a convolute lower portion; inflorescences during anthesis with complex spathe and spadix movements and often spadix elongation 2
 - Spathe not divided into a lower and upper portion by a constriction; inflorescence movement during anthesis comprising simple gaping and closing of the spathe limb, with virtually no spadix movement 3
2. Leaf blades narrowly lanceolate, bases cuneate; interpistillar staminodes absent **Geniculata Supergroup**
 - Leaf blades mostly sagittate or cordate, never narrowly lanceolate; interpistillar staminodes present, only very rarely absent **Cyrtocladon Supergroup**
3. Spathe at most 1.5 cm long, usually much less; staminate flowers each comprising 2(–3) stamens without an expanded flat connective; interpistillar staminodes much shorter than pistils; mostly small plants and often rheophytic **Chamaecladon Supergroup**
 - Spathe more than 2 cm long and usually much longer; staminate flowers each comprising 4 stamens, almost always with a flat, expanded connective; interpistillar staminodes equalling or longer than pistils; mostly medium to large plants, never rheophytic **Homalomena Supergroup**

KEY TO THE SPECIES COMPLEXES OF BORNEAN *HOMALOMENA*

1. Stoloniferous colonial helophytes . . 2
 - Solitary or clumping terrestrial or lithophytic mesophytes 3
2. Spathe not divided into a lower and upper portion by a constriction; staminate and pistillate flower zones separated by a conspicuous naked interstice **Expedita Complex**
 - Spathe divided into a lower and upper portion by a constriction; staminate and pistillate flower zones contiguous **Rostrata Complex**
3. Spathe not divided into a lower and upper portion by a constriction; stamens without a conspicuous, flat connective; leaf blades abaxially with conspicuous pellucid striate vein-like glands running parallel to the primary lateral veins. **Selaburensis Complex**
 - Spathe divided by a weak to pronounced constriction into a well-defined upper (limb) and a lower portion; stamens with a conspicuous flat connective; leaf blades lacking pellucid vein-like glands (if present, then leaf blades lacking posterior lobes, weakly peltate, and interpistillar staminodes absent *or* leaf blades cordiform and interspistillar staminodes present) 4
4. Leaf blades abaxially with pellucid vein-like glands 5
 - Leaf blade without pellucid striate vein-like glands 6
5. Leaf blade weakly peltate, lacking posterior lobes, blade pendulous from the petiole; petiolar sheath margins persistent; interpistillar staminodes absent **Havilandii complex**
 - Leaf blade cordiform, spreading; petiolar sheath with margins marcescent; interpistillar staminodes present **Wongii Complex**
6. Lower spathe longer than spathe limb 7
 - Spathe limb longer than or equalling lower spathe 8
7. Leaf blade rubbery, cordiform, glossy bright green, primary lateral veins rather numerous; staminate flower zone producing amber-coloured resin droplets **Giamensis complex**
 - Leaf blade leathery, with little or no posterior lobe development, base broadly truncate, often adaxially

matte medium green, and weakly glaucous abaxially; primary lateral veins few; staminate flower zone not producing resin droplets
 **Borneensis Complex**

8. Leaf blade cordate-sagittate, somewhat to much quilted between the primary lateral veins, adaxially with scattered conspicuous punctate glands; petiolar sheath margins soon marcescent (observe leaf immediately below flowering event); staminate flower zone (almost always) producing amber-coloured resin droplets; interpistillar staminodes present
 **Hanneae Complex**
- Leaf blade oblong to oblong-elliptic, not quilted, and lacking punctate glands; petiolar sheath persistent; staminate flower zone without resin; interpistillar staminodes absent
 **Insignis Complex**

**KEY TO SPECIES OF THE
 HOMALOMENA
 BORNEENSIS COMPLEX**

1. Pistillate flower zone accounting for nearly 1/2 of the entire spadix; staminate and pistillate flower zones contiguous, not separated by a naked interstice 2
- Pistillate flower zone accounting for 1/3 or less of the entire spadix; staminate and pistillate flower zones separated by a naked interstice . . . 3
2. Spathe green at anthesis; pistils somewhat lax, with stigma rather clearly 3-lobed, wider than pistil; interpistillar staminodes shorter than pistils. Kalimantan Timur. **H. tirtae**
- Spathe white at anthesis; pistils very dense with stigma not 3-lobed, narrower than pistil; interpistillar staminodes equalling or slightly longer than pistils. W Sarawak. . . **H. ovata**
3. Staminate and pistillate flower zones separated by a zone with staminodes scattered along a short naked interstice 4
4. Leaf blades adaxially glossy with margins conspicuously red; pro-

phylls, cataphylls and petiolar sheath wings with red margins; spathe limb internally white with a red margin, exterior glossy pale green with margins and the distal part of the spathe limb stained red; spadix stipe ca. half as long as the pistillate flower zone; C–NE Sarawak, SW Brunei.

- **H. ibanorum**
- Leaf blades adaxially matte; no organs of the plant with red-margins; spathe exterior never stained red; spadix stipe no more than one third the length of the pistillate flower zone; W Sarawak 5
5. Pistils and stigmas yellowish, directed outwards; interpistillar staminodes with the clavate portion papillate; pistillate flower zone weakly fusiform; spadix somewhat sinuous; leaf blade glaucous abaxially.
 **H. borneensis**
- Pistils white with grey stigmas, directed upwards; interpistillar staminodes with the clavate portion smooth; pistillate flower zone markedly fusiform; spadix straight; leaf blade not glaucous abaxially.
 **H. clandestina**

**KEY TO SPECIES OF THE
 HOMALOMENA GIAMENSIS COMPLEX**

1. Spathe exterior lacking extrafloral nectaries; base of staminate zone much narrower than top of pistillate zone, transition between the zones abrupt; staminate portion of spadix with a constriction c. 1/2 way along from the base, not coinciding with the spathe constriction, staminate flowers distal to constriction well-defined; pistillate zone cylindrical; inflorescences smelling of anise (anethol). Siburan (SW Sarawak), limestone **H. giamensis**
- Spathe exterior, especially the lower spathe, with conspicuous extrafloral nectaries drying pale brown or yellowish, transition between the pistillate and staminate zones gradual. . . 2

2. Base of staminate zone about the same width as the top of the pistillate zone; staminate constriction coinciding with the spathe constriction, staminate flowers distal to spadix constriction ill-defined; pistillate zone fusiform; spathe limb not hooded at pistillate anthesis; peduncle lacking extrafloral nectarines; inflorescences smelling of lemon. Matang (NW Sarawak), sandstones. ***H. matangae***
- Base of staminate zone much narrower than top of the pistillate zone; staminate constriction not coinciding with the spathe constriction, staminate flowers distal to spadix constriction well-defined; pistillate zone cylindrical; spathe limb hooded at pistillate anthesis; peduncle with conspicuous extrafloral nectarines; inflorescences smelling of lemon and *Mangifera odorata* fruit. Siburan (SW Sarawak), limestones. ***H. baangongensis***
4. Inner side of the posterior lobes (i.e., facing across the sinus) rounded, the edges almost touching in robust specimens; leaf blade glossy dark reddish green adaxially, dark purple-red abaxially; stipe of spadix strongly dorso-ventrally flattened, c. 8.5 mm long × 4.5 mm diam. Mulu (NE Sarawak), alluvial forest. ***H. ardua***
- Inner side of the posterior lobes (i.e., facing across the sinus) straight, their edges divergent; leaf blade glossy medium green adaxially, somewhat paler abaxially; stipe of spadix cylindrical. 5
5. Leaf blade not or only very weakly quilted between the primary lateral veins; petiole and peduncle dull purple red (at least the basal part but more usually the whole organ, with conspicuous paler longitudinal ridges, spathe limb with red margin. Bintulu (N Sarawak), alluvium in seasonally flooded forest. ***H. josefii***
- Leaf blade conspicuously quilted between the primary lateral veins . . . 6

**KEY TO SPECIES OF THE
HOMALOMENA HANNEAE COMPLEX**

1. Petioles green or reddish, with inconspicuous paler longitudinal striae 2
- Petiole proximally green and distally white with very conspicuous prominently raised glossy cherry-red ridges; leaf blade abaxially glaucous. Mulu (NE Sarawak), shales ***H. striatieopetiolata***
2. Pistillate flower zone abruptly wider than staminate flower zone; pistils pale orange. Batang Ai (Sarawak) and N part of Ulu Sungai Kapuas (Kalimantan Timur), sandstones ***H. hanneae***
- Pistillate flower zone imperceptibly merging with, or slightly narrower than, staminate flower zone; pistils not pale orange 3
3. Pistillate flowers green. Batang Ai (Sarawak), sandstones ***H. sengkenyang***
- Pistillate flowers white or yellowish . . . 4
6. Peduncle minutely puberulent (appearing velvety); leaf blade glaucous abaxially. Santubong (NW Sarawak), Paleogene hard sandstones ***H. velutipedunculata***
- Peduncle glabrous, glossy or somewhat matte; leaf blade not glaucous abaxially 7
7. Staminate zone not producing resin droplets, resin remaining in the fissures between individual flowers; lower part of persistent spathe during fruiting ventrally much expanded, with dorsal side almost flat; unpollinated pistils remaining yellowish white at early stage of staminate anthesis. Siburan (SW Sarawak), limestones ***H. gastrofructa***
- Staminate zone producing droplets of resin; lower part of persistent spathe during fruiting expanding more-or-less equally ventrally and dorsally, eventually fusiform; unpollinated pistils turning dark orange at early stage of staminate anthesis.

Matang (W Sarawak), Paleogene soft sandstones. *H. debilicrista*

**KEY TO SPECIES OF THE
HOMALOMENA
SELABURENSIS COMPLEX**

1. Petioles and peduncles glossy, smooth 2
 - Petioles and peduncles matte, scabridulous 3
2. Leaf blades hastate, posterior lobes directed outwards; blade smooth, or only very weakly quilted; peduncle slender, up to 20 cm × 1.5 mm; pistillate zone equalling the staminate zone; spathe interior white at anthesis; Mulu (NE Sarawak), shales *H. passa*
 - Leaf blades sagittate, posterior lobes directed inwards; blade quilted between the primary lateral veins; peduncle rather stout, up to 12.5 cm × 3 mm; pistillate zone ca. ½ as long as the staminate zone; spathe interior yellow at anthesis. Malinau basin (Sabah) *H. galbana*
3. Leaf blades semi-glossy, primary veins flush; W. Malaysia, granites *H. curvata*
 - Leaf blades highly polished, primary veins impressed; W. Sarawak, limestone *H. selaburensis*

Homalomena baangongensis L.S.Tung & Y.C.Hoe, **sp. nov.** Type: Malaysian Borneo, Sarawak, Kuching, Siburan, Kampung Sikog, Air Terjun Baan Gong, 01 20 16.1 N 110 20 09.6 E, 26 July 2009, *P.C.Boyce & Wong Sin Yeng AR-2574* (holotype SAR, alcohol preserved). **Figure 1.**

Diagnosis

Homalomena baangongensis is most similar in overall appearance to *H. matangae*, with which it shares extrafloral nectaries on the spathe exterior, but from which it differs by having extrafloral nectaries on the peduncle (absent in *H. matangae*), by

the base of the staminate flower zone much narrower than the top of the pistillate flower zone, the constriction between the fertile zones of the spadix not coinciding with the spathe limb/lower spathe constriction, a fusiform, not cylindrical, pistillate flower zone, a spathe limb hooded (vs. erect) at pistillate anthesis, and inflorescences with a resinous odour. From *H. giamensis*, *H. baangongensis* is readily separated by the presence of extrafloral nectaries on the spathe, and the gradual (vs. abrupt) transition between the pistillate and staminate flower zones. The inflorescences of *H. giamensis* smell strongly of anise, in marked contrast to the resinous smell produced by inflorescences of *H. baangongensis*.

Description

Medium to moderately robust, evergreen, glabrous, weakly aromatic (lime-oil) **herbs** to 1.2 m tall. **Stem** pleioanthic, erect to ascending, leafless portion reddish brown, with conspicuous pale yellow adventitious roots penetrating the petiole bases, 3.5–5 cm thick, internodes to ca. 2.5 cm long. **Leaves** up to 11 together, modules beginning with a conspicuous 2-keeled short-duration glossy pale green **prophyll**; **petiole** erect to spreading, up to ca. 82 cm long × 9–15 mm wide, weakly pulvinate ca. $\frac{3}{4}$ way from leaf blade insertion, turgid in living state, slightly spongy when dried, smooth, subterete with the distal-most portion channelled, glossy bright green with scattered weak longitudinal medium-green ridges; **petiolar sheath** 30–34 cm long, slightly less than c. 1/3 of petiole length, wings equal at both side, persistent, to ca. 1 cm wide, convolute, rounded and weakly decurrent at apex, margins slightly incurved, glossy green; **leaf blade** broadly ovato-cordate to cordiform, occasionally ovato-sagittate, ca. 44 cm length × ca. 33 cm width, thinly leathery, conspicuously quilted between the primary lateral veins, glossy green adaxially, paler abaxially, drying uniformly pale yellow, base cordate, few sagittate, posterior lobes subtriangular



Fig. 1. *Homalomena baangongensis* L.S.Tung & Y.C.Hoe. **A.** Flowering plant in habitat, Type locality. **B.** Leaf blade (adaxial view) to show bright green, rubbery texture. **C.** Inflorescence at late pistillate anthesis. Note the conspicuous amber resin droplets on the staminate portion of the spadix. **D.** Inflorescence at early pistillate anthesis. Three types of insect pollinator are present: The smallest and most numerous are nitidulid beetles, and the solitary deep blue beetle (left top margin of the spathe limb) is a chrysomelid; both are pollen robbers. The large brown beetle on the spadix tip is *Parastasia*, a ruteline scarab, and the confirmed pollinator. **E.** Spadix (spathe artificially removed) at early pistillate anthesis. **A–H** from un-vouchered images. Images © Y.C.Hoe.

to ca. 15 cm long, tip obtuse and to somewhat cuspidate for c. 1 cm, ultimately aristate green mucronate to ca. 3 mm long; **midrib** raised abaxially and gradually less conspicuous when near blade tip, ca. 10.5 mm wide at the base, 6 mm wide at the centre; adaxially flush with blade, ca. 1.3 cm at the base, 5 mm at the centre; ca. 9 primary lateral veins on each side, diverging at 40°–90° from the midrib, adaxially impressed, abaxially raised, curved sharply towards the apex when near the margin; interprimary veins flush with blade, ca. 1.5 mm in width, alternating irregularly with primaries, posterior lobes each with ca. 3 primary lateral veins; secondary venation and tertiary venation not visible, all veins running into a intermarginal vein. **Inflorescences** up to 6 together in a gorgonoid synflorescence, erect at anthesis, later declinate, at pistillate anthesis, smelling of lemon and *Mangifera odorata* resin at pistillate anthesis, this smell reduced during transition period, and very faint during staminate anthesis; first inflorescence subtended by foliage leaf, next by 2-keeled 7–20 cm pale green prophyll, soon degrading; **peduncle** ca. 18 cm long \times c. 8 mm wide, terete, glossy green with obscure pale white longitudinal striate, smooth. **Spathe** up to 11.5 cm long, white, middle portion faintly yellowish green, spathe exterior with few drops of extrafloral nectaries, conspicuously quilted, smooth, turning green at post-anthesis, tightly furled prior to anthesis, lower spathe inflating and margin loosening, subsequently spathe limb inflating and margin gaping loosing and partially reveal the spadix, spathe limb then opening wide at the onset of pistillate anthesis, exterior with very few extrafloral nectaries; **lower spathe** ovoid-ellipsoid, ca. 6 cm long \times ca. 3.3 cm width at pistillate anthesis; **spathe limb** ca. 5 cm long \times ca. 3.25 cm wide at pistillate anthesis, ovato-triangular, green mucro to ca. 1.5 mm, slightly furled at the onset of pistillate anthesis, tip hooded at female anthesis. **Spadix** stipitate, ca. 10.7 cm long, exceeding spathe ca. 1.5 cm by the time of pistillate anthesis, persistently enclosed by spathe after anthesis until

the end of fruiting stages; **stipe** ca. 7 mm long \times 5–8 mm width, fusiform-cylindrical, inserted obliquely on peduncle, glossy pale yellowish with tiny white dots, dark brown in alcohol; **pistillate zone** c. 3.7 cm long \times ca. 1.1 cm wide, ca. 1/3 length of spadix, yellowish white, cylindrical; **pistils** globose-cylindrical, densely arranged when fresh, ca. 2.5 mm in diam., yellowish white, turning pale grey in alcohol, each pistil associated with 3–4 waxy white **interpistillar staminodes**, slender stipitate, the top globose, ca. 1 mm in diam., waxy white; **style** barely differentiated; **stigma** globose-capitate, truncate and smaller than ovary, ca. 1.2 mm in diam., yellowish, staining pale grey in alcohol; **suprapistillar interstice zone** absent; **staminate zone** ca. 6.5 cm long \times ca. 7.5 mm wide, ca. $\frac{3}{5}$ length of spadix, with a constriction ca. 1/3 way along from the base, not coinciding with the spathe constriction; amber resin-like droplets produced on staminate zone during early pistillate anthesis, and later exudates along the whole staminate zone; **staminate flowers** size equal throughout staminate zone, ca. 1.9 mm long \times 1.3 mm wide \times 1 mm tall, hexagonal, each comprising 3–4 truncate stamens, each overtopped by a large flat connective, white, turning pale yellowish grey in alcohol; **pollen** extruded in strands, white, mixed with the resin to form a yellowish paste. **Infructescence** ca. 8 together, ultimately pendent, persistent spathe turning green, the spathe limb eventually abscising and tearing upwards to reveal mature fruit; **fruit** 2.8–5 mm diam., 3–4.2 mm tall, ca. 4 \times larger than unfertilized ovaries, globose or slightly cylindrical polygonal, green or rarely reddish before maturity, turning translucent yellowish when ripe. Seed 0.4–0.6 mm in diam., ellipsoid, pale green.

Distribution—*Homalomena baangongensis* is known only from the Type locality, where it is abundant and occurs sympatrically with *Homalomena gastrofructa* Y.C.Hoe, S.Y.Wong & P.C.Boyce (see below).

Ecology—Lowland moist to wet evergreen forest on karst limestone, occurring

along muddy trail margins and in shaded areas along and beside streams; 70–75 m asl.

Etymology—Derived from the name of the Type locality plus the Latin suffix, *-ensis*, to indicate coming from.

Notes—*Homalomena baangongensis* is very closely similar to *H. giamensis* L.S.Tung, P.C.Boyce & S.Y.Wong, which is also restricted to karst limestone (Tung et al., 2010) and to sandstone-obligated *H. matangae* Y.C.Hoe, S.Y.Wong & P.C.Boyce (Hoe et al., 2011b), but is separated from both by suites of consistent characters, as detailed in the above diagnosis. Work by the second author (HYC) has revealed significant differences in pollination biology (Hoe et al., in prep).

Homalomena gastrofructa Y.C.Hoe, S.Y.Wong & P.C.Boyce, **sp. nov.** TYPE: Malaysian Borneo, Sarawak, Kuching, Siburan, Kampung Sikog, Air Terjun Baan Gong, ca. 2 km from Kampung Sikog, ca. 01 20 16.1 N 110 20 09.6 E, 9 Mar. 1994, *P.C.Boyce* 789 (holotype K; isotypes M, SAR). **Figure 2.**

Diagnosis

Homalomena gastrofructa is unique in the Hanneae Complex by the not producing resin droplets from the staminate flower zone, and by the lower part of the persistent spathe during fruiting ventrally much expanded, with dorsal side almost flat, as compared with all other species (e.g., *H. banneae*, *H. debilicrista*, etc.) in which the expansion occurs symmetrically, producing an ellipsoid lower spathe at fruit maturity.

Description

Medium to moderately robust, evergreen, glabrous, strongly aromatic (lime and anethol) herbs 80–120 cm tall. **Stem** pleioanthic, erect to decumbent, ca. 4 cm thick, reddish brown, with few conspicuous adventitious brownish roots penetrating the petiole bases, internodes to ca.

1.7 cm long. **Leaves** 4–8 together, modules beginning with a conspicuous 2-keeled short-duration **prophyll**, pale pink, rarely pale green; **petiole** erect to spreading, ca. 88 cm long × 8–11 mm wide, terete, adaxially slightly grooved, pulvinate ca. 1/5 way back from leaf blade insertion, pale red, red, dark red, rarely medium green, with obscure scattered longitudinal pale green ridges, slightly matte; bases clasping, pink or green; **petiolar sheath** ca. 25 cm long, ca. $\frac{1}{3}$ of petiole length, pale to dark red, rarely medium green, wings up to 12 mm wide, open, convolute, rounded and weakly decurrent at apex, sheath initially persistent, soon marcescent along the margin, eventually whole sheath marcescent; **blade** broadly ovato-cordate to cordiform, 35–40 cm long × 25–35 cm wide, thinly rubbery-leathery, conspicuously quilted between the primary lateral veins, with conspicuous areolate-punctate glands notably visible on the young leaf blades, blade medium green adaxially, paler abaxially, drying uniformly pale yellow, base cordate, posterior lobes subtriangular, ca. 16 cm long, tip obtuse to somewhat acuminate or cuspidate for ca. 1.5 cm, then mucronate for ca. 0.5 mm, mucro red; midrib raise abaxially, ca. 12 mm wide at the base, ca. 3 mm wide at the centre, adaxially flush with blade, ca. 8 mm at the base, ca. 4 mm at the centre; primary lateral veins ca. 12 on each side, diverging at 30°–90° from the midrib, adaxially impressed, abaxially raised, curved sharply towards the apex when near the margin; interprimary veins raised, ca. 1 mm in width, alternating irregularly with primaries, posterior lobes each with ca. 3 primary lateral veins; secondary venation rather obscure; tertiary venation not visible, all veins running into a thickened intermarginal vein. **Inflorescences** 1–7 together, erect, odour anethole, intense at onset of pistillate and staminate anthesis, reducing during inter-anthesis and post-anthesis, the first inflorescence subtended by a green foliage leaf, subsequently each subtended by a soon degrading pale red prophyll, 5–7 cm long × ca. 7 mm wide, wing ca. 9.5 mm wide, ca. 2.5 mm red mucro;

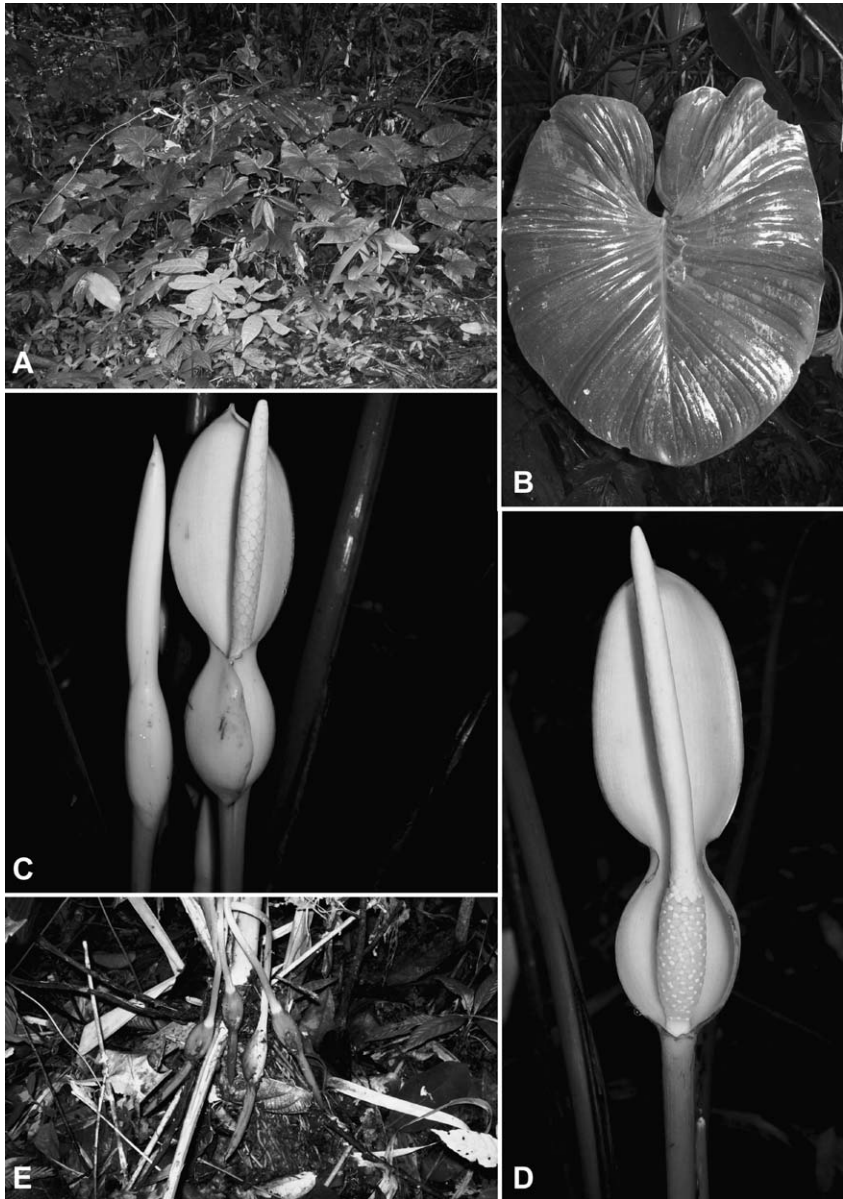


Fig. 2. *Homalomena gastrofructa* S.Y.Wong, Y.C.Hoe & P.C.Boyce. **A.** Plants in habitat, Type locality. **B.** Leaf blade (adaxial view). **C.** Inflorescence (RH) at late pistillate anthesis. **D.** Inflorescence, spathe artificially opened, to reveal spadix at onset of pistillate anthesis. Note the relation of the spathe constriction to the junction of the pistillate and staminate flower zones. **E.** Semi-mature infructescences, in habitat. Note the strongly asymmetrical expansion of the persistent lower spathe. **A & B** from un-vouchered images; **C–E** from P.C.Boyce & W.S.Yeng AR-2575. Images A & B © Y.C.Hoe; C–E © P.C.Boyce.

peduncle 7.5–13 cm long \times 5–8 mm wide, pale red, red rarely medium green, with obscure pale white longitudinal striate, matte, terete. **Spathe** up to 12 cm long, lower spathe inflating with margin partially loosening, subsequently spathe limb loosening, inflating and then opening almost flat at the onset of pistillate anthesis, turning pale pink immediately after staminate anthesis, spathe exterior white, the centre faintly yellowish green, inner spathe glossy white; **lower spathe** ovoid-ellipsoid, ca. 5 cm long \times ca. 3.2 cm wide at pistillate anthesis; **spathe limb** ca. 5.5 cm long \times ca. 2.8 cm wide at pistillate anthesis, ovato-triangular, slightly furled at pistillate anthesis, ca. 4 mm pale red mucro. **Spadix** 7–12 cm, stipitate, cylindrical, slightly sigmoid, shorter than spathe limb prior to pistillate anthesis but 4–10 mm exceeding the spathe limb by the time of pistillate anthesis; **stipe** 5–8 mm long \times ca. 4.5 mm width, slightly fusiform-cylindrical, inserted slightly obliquely on peduncle, glossy greenish; **pistillate zone** 2.5–3 cm long \times ca. 8 mm wide, ca. $\frac{1}{4}$ length of spadix, weakly fusiform-cylindrical; **pistils** weakly globose-cylindrical, 1.3–2 mm in diam., densely arranged when fresh, yellowish white, pale brown in alcohol, covered with pale grey stigmatic exuding; each pistil associated with 3–4 interpistillar staminodes; **style** barely differentiated; **stigma** globose-capitate, smaller than ovary diam., slightly truncate, ca. 0.9 mm in diam., wet and yellowish white at pistillate anthesis, staining grey in alcohol; **interpistillar staminodes** slender stipitate, tip abruptly globose, ca. 0.5 long \times c. 0.1 mm wide, waxy white, remaining waxy white in alcohol; **suprapistillar interstice zone** absent; **staminate zone** ca. 8 cm long \times ca. 5.5 mm wide, ca. $\frac{3}{4}$ length of spadix, staminate constriction $\frac{1}{8}$ way along from the base, not coinciding with the spathe constriction; **staminate flowers** ca. 1.2 mm in diam., polygonal, each comprising 4–5 truncate stamens, rarely up to 8, overtopped by white flat connective tissue, flower size much large in the upper half of the staminate flower zone, white, slightly pale brown in alcohol; resin secreted in the

cavities between the individual flowers but never forming droplets on the surface of the staminate flowers; **pollen** in strings, white, mixing with resin to form a yellowish past. **Infructescences** 1–7, declinate to pendent, spathe entirely persistent, red, dark red and rarely medium green; base of peduncle green to pale pink, with pale green longitudinal striate, matte; lower fruiting spathe 4.5–5.3 cm long \times ca. 2.4 cm wide, splitting upwards from base to reveal the ripen fruits; fruiting spathe limb ca. 6 cm long \times ca. 8.7 mm wide, dark red; **fruits** 2–3 \times larger than ovary, 4–5.8 mm height, 2.5–5.3 mm diam., pale green, ripening pale red; stigma impressed, 9–1.3 mm in diam., rounded, orange brown; stipe white; staminate zone becoming greyish brown, then degrading into a viscous liquid, smelling of fermenting fruit (decaying banana); pistillate zone smelling of lime; **seeds** ca. 0.3 mm diam., ellipsoid, pale green.

Distribution—Known only from the type locality, where it is abundant and occurs sympatrically with *Homalomena baangongensis* (see above).

Ecology—Lowland moist to wet evergreen forest on karst limestone, occurring along muddy trail margins and in shaded areas along and beside streams; 70–75 m asl.

Etymology—The trivial epithet is formed from Greek, *gastros* (belly, stomach), and Latin *fructus*, a fruit, in allusion to the shape of the mature fruiting spathe.

Notes—*Homalomena gastrofructa* clearly belongs to the Hanneae complex on the basis of the leaf blades with extrafloral nectaries, and the spathe turning pink soon after staminate anthesis, and later becoming red into fruiting. However, it is unique in the Complex in not producing resin droplets on the staminate portion of the spadix, with the resin instead forming in the cavities between the staminate flowers. The significance of this to pollination strategies is currently under investigation by the second author (HYC).

Homalomena ibanorum S.Y.Wong & P.C.Boyce, **sp. nov.** TYPE: Malaysian Borneo, Sarawak, Betong, Roban, Jalan Ulu Awit, Nanga Risau, Rumah Bawa, 01 49 57.1 N 111 24 28.2 E, 27 Dec. 2011, *P.C.Boyce & Wong Sin Yeng AR-3732* (SAR, holo; alcohol preserved). **Figures 3 and 4.**

Diagnosis

Homalomena ibanorum differs from all other species of the Borneensis Complex by the combination of the leaf blades adaxially glossy green with both surfaces with a red margin, the red margins to the petiolar sheaths, prophylls and cataphylls, and spathe limb, the spathe limb exterior distally stained red spathe and spadix stipe ca. one half (vs. no more than one quarter) the length of the pistillate flower zone.

Description

Moderately stout evergreen herbs to ca. 1.5 m tall, vegetative tissues very weakly aromatic. **Stem** pleioanthic, oldest portions creeping and rooting, partially subterranean, active portion erect, ca. 3 cm thick, pale green; internodes to ca. 5 mm long, obscured by overlapping petiole bases. **Leaves** up to 20 together, rather erect; each shoot module subtended by single **prophyll**, ca. 10 cm long, medium green, margin deep red, persistent; **petiole** 18–55 cm long \times ca. 5 mm diam., adaxially shallowly grooved, the groove extending to the insertion of the blade, rounded abaxially, D-shaped in cross section, semi-glossy medium green; **petiolar sheath** open, 8–20 cm long, 1/3–1/2 length of petiole, wings long-persistent, rather membranous, pale green, the margins red; **blade** broadly cordate to almost deltoid, 15–29 cm long \times 12–20 cm wide, coriaceous, glossy medium green adaxially, paler green and matte abaxially, with a ca. 1–2 mm wide red margin, apex acuminate and then mucronate for ca. 4 mm, base weakly cordate to almost truncate; midrib prominently rounded-raised abaxially, adaxially slightly impressed, up to 4 mm wide; with 6–8

primary lateral veins on each side, diverging at 30° (distal) to 90° (proximal) from the midrib, primary lateral veins abaxially raised, adaxially impressed; interprimary veins ca. 1/3 width of the primary lateral veins, regularly interspersed, flush with the blade adaxially, abaxially almost raised or faint; secondary venation somewhat conspicuous to weakly flush with the blade on both sides, tertiary venation invisible; all veins running into a weakly defined thickened intermarginal vein; intermarginal vein somewhat inconspicuous abaxially, adaxially almost invisible. **Inflorescences** up to 6 together, each subtended by a small narrowly triangular prophyll, sub-erect at anthesis, later declinate; **peduncle** to ca. 12 cm long \times ca. 4 mm diam., medium green. **Spathe** stiff, somewhat fleshy, tightly furled prior to anthesis, lower spathe inflating and spathe limb gaping at pistillate anthesis, spathe limb opening wide at staminate anthesis and spadix extending and slightly protruding; spathe later closing to enclose spadix, ca. 7.5 cm long \times ca. 1.75 cm wide at anthesis, exterior semi-glossy pale green, the ventral sides paler than the dorsal, and with the margins and distal-most part of the limb red-stained, interior white with red margins; **lower spathe** broadly ovoid, shorter than the limb, ca. 7 cm long; **spathe limb** narrowly ovoid with a terminal mucro 4–5 mm long, in all ca. 5 cm long. **Spadix** ca. 7 cm long \times ca. 5 mm diam., stipitate; **stipe** ca. 1 cm long (i.e., ca. half the length of the pistillate flower zone), glossy white; **pistillate zone** cylindrical, nearly 1/2 the length of the spadix, ca. 3.2 cm long; **pistils** densely arranged, globose, ca. 1.5 mm tall \times ca. 1 mm diam., greenish white, **style** not differentiated; **stigma** convex-topped, much wider than the pistil, ca. 1 mm tall \times 1.5–2 mm diam., mostly three-lobed, semi-translucent, glossy greenish; most pistils associated to a single interpistillar staminode, occasionally (basal-most flowers) with 2–3 staminodes; **interpistillar staminodes** with a very slender stalk and an expanded top, ca. 0.5 mm long, ivory white; **suprapistillar interstice zone** 1–2 mm long, partly naked above for <1 mm;

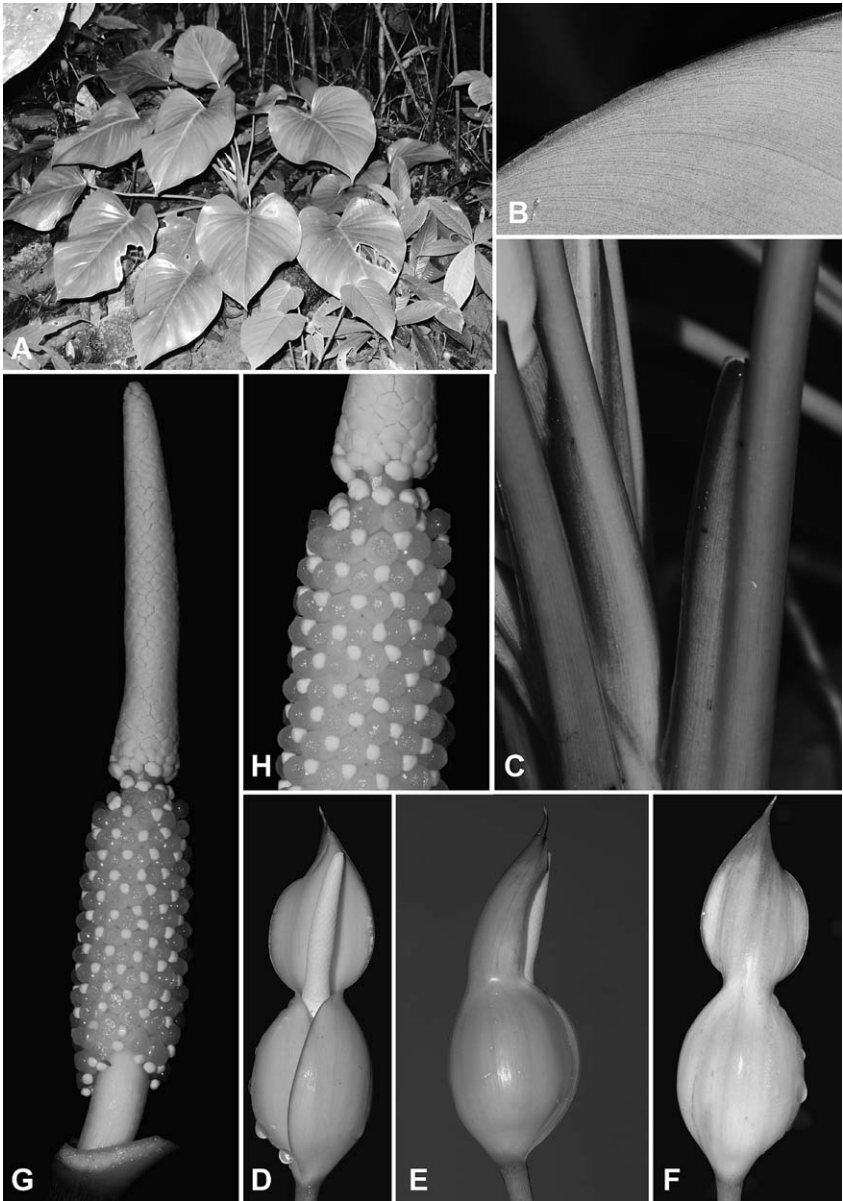


Fig. 3. *Homalomena ibanorum* S.Y.Wong & P.C.Boyce. **A.** Flowering plant in habitat, Kapit, C.Sarawak. Note the glossy leaf blades. **B.** Detail of leaf blade (abaxial view) to show the conspicuous red margin. **C.** Detail of petiolar sheaths showing the conspicuous red staining. **D–F.** Inflorescence at pistillate anthesis in ventral, lateral, and dorsal views. **G.** Spadix (spathe artificially removed) at pistillate anthesis. **H.** Detail of the upper pistillate and lower staminate flower zones, showing the short interstice with sterile stamens (staminodes) separating the fertile zones. **A.** from un-vouchered images; **B–H** from P.C.Boyce & Wong *Sin Yeng AR-3732*. Images © P.C.Boyce.

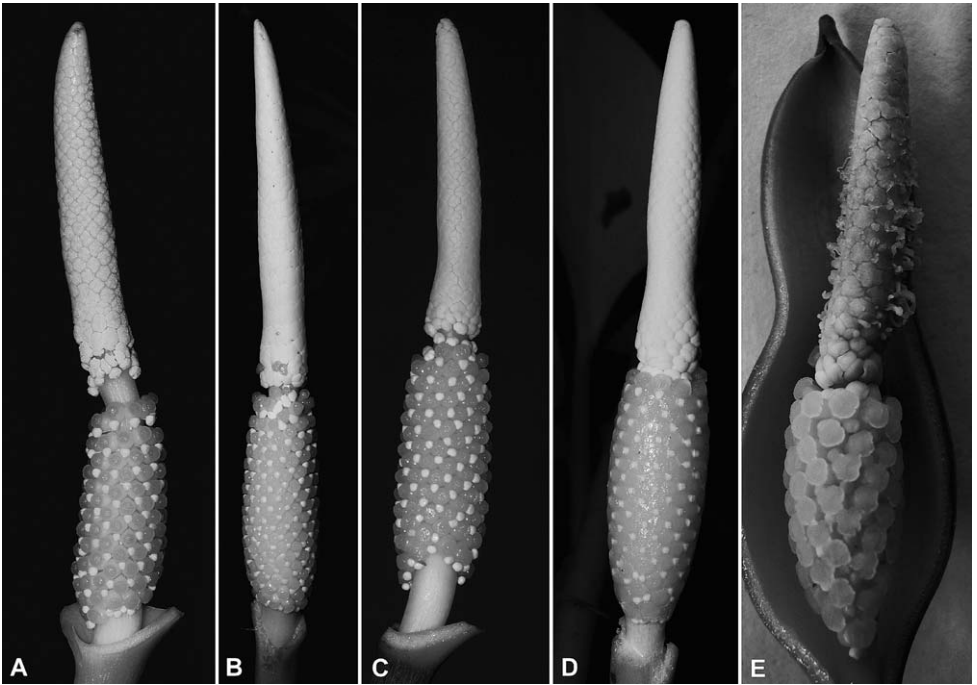


Fig. 4. **A:** *Homalomena borneensis* Ridl. **B:** *Homalomena clandestina* P.C.Boyce, S.Y.Wong & Fasih. **C:** *Homalomena ibanorum* S.Y.Wong & P.C.Boyce. **D:** *Homalomena ovata* Engl. **E:** *Homalomena tirtae* Asih, A.Kurniawan & P.C.Boyce. **A.–E.** Spadix (spathe artificially removed) at pistillate anthesis (A–D), and to provide comparison of the five described species of the *Homalomena* Borneensis Complex. **A.** from P.C.Boyce et al. AR-2559; **B.** from P.C.Boyce et al. AR-2385; **C.** from P.C.Boyce & Wong Sin Yeng AR-3732; **D.** from P.C.Boyce et al. AR-2361; **E.** from *I Gede Tirta GT.2105*. Images A–D © P.C.Boyce; E. © Ni Putu Sri Asih, used with permission.

staminate zone narrowly conic, about half the length of the spadix, $1/4$ – $1/3$ held within lower spathe chamber, ca. 2.7 cm long, apex obtuse, ivory white; **staminate flowers** densely arranged, trapezoid to hexagonal in plan view, each flower consisting of 4 stamens, lowermost 1–2 rows of flowers sterile, and uppermost also sterile, each stamen over-topped by a large, flat connective. **Infructescence** with spathe turning green with the red margins and staining darkening. **Fruits** exposed by basal tearing and upward splitting of the persistent spathe; fruits oblong-ovoid, c. 5 mm long \times 3 mm wide, initially green, ripening semi-translucent dirty yellowish, fruits smelling and pulp tasting of overripe

pineapple; seeds many, ellipsoid, ca. 1.5 mm long, longitudinally weakly ribbed.

Distribution—*Homalomena ibanorum* is restricted to east of the Lupar Line (see, e.g., Heads, 2003), occurring from the eastern half of Betong Division (W central Sarawak) to the northern part of Miri Division (NE Sarawak), and also into SW Brunei.

Ecology—Lowland moist evergreen forest primarily on yellow clays, only very infrequently occurring on shales (e.g., near Kapit); below 200 m sl.

Etymology—The trivial epithet, literally ‘honouring the Iban’. The Iban constitute the largest of the about 200 groups of

indigenous peoples of Borneo. The Iban are the dominant human population of much of the wild range of *H. ibanorum*.

Notes—*Homalomena ibanorum* is assigned to the Borneensis Complex by the possession of open petiolar sheaths with the wing margin eventually marcescent, the leathery leaf blade with little or no posterior lobe development, and the base broadly truncate, the few primary lateral veins, and the lower spathe longer than spathe limb. The spadix most closely resembles that of *H. borneensis* Ridl., but is differentiated by the longer stipe (ca. $\frac{1}{2}$ vs. ca. $\frac{1}{3}$ the length of the pistillate flower zone), interpistillar staminodes with smooth (not papillate) clavate tops, and less well-demarcated, smaller staminate flowers (ca 1.7 mm vs ca 2.5 mm wide). In the obscure small staminate flowers *H. ibanorum* approaches *H. clandestina* P.C.Boyce, S.Y.Wong & Fasih., with which *H. ibanorum* also shares interpistillar staminodes with smooth clavate tops, but from which it differs by a blunt-tipped (not pointed) staminate flower zone, and a much shorter spadix stipe.

Homalomena ibanorum appears to be genuinely widespread, with a confirmed range of 450 km SW–NE. This is in marked contrast to other described species of the Borneensis Complex (indeed, in contrast to most other *Homalomena*) which are much more restricted in their distributions. One possible explanation is that *H. ibanorum* appears most often associated with lowland yellow clays, one of the most widespread ecologies in Sarawak whereas other species are either associated with specific geologies (shales: *H. clandestina*; volcanic derived clays: *H. tirtae* Asih, Kurniawan & P.C.Boyce), or occur on isolated mountain blocks (*H. borneensis*; *H. ovata* Engl.).

A plant closely resembling *H. ibanorum* is known from the basalts of Bukit Quoin, Tawau, E Sabah, but has yet to be observed fertile. It is most likely a localized undescribed endemic.

Homalomena passa S.Y.Wong & P.C.Boyce, **sp. nov.** TYPE: Malaysian Borneo, Sarawak, Miri, Marudi, Long

Lama, Mulu N.P., Long Langsat, Sungai Langsat, draining into the Sungai Tutoh, 04 00 03.5 N 114 48 49.8 E, 9 Aug. 2006, P.C.Boyce et al., AR-1987 (SAR, holo; alcohol preserved). **Figure 5.**

Diagnosis

Homalomena passa shares smooth, glossy (not scabridulous, matte) petioles and peduncles with *H. galbana*, but is readily differentiated by the narrowly triangular leaf blades with the posterior lobes spreading (i.e., leaf blade hastate) vs. broadly triangular blades with posterior lobes incurved (i.e., leaf blade sagittate), the proportionally much longer petioles, and longer peduncles, and the spathe limb white (vs. yellow) at anthesis.

Description

Moderate, clumping evergreen, aromatic (reminiscent of pine) mesophytic herbs to 55 cm tall. **Stem** epigeal, erect, leafy, rooting from the nodes and from through the petiole bases. **Leaves** ca. 10 per module, ca. 12–16 together; modules subtended by a conspicuous **prophyll** up to 12 cm long, this conspicuously 2-keeled; **petioles** up to 55 cm long, although usually much less, sheathing for ca. $\frac{1}{3}$ their length, ascending to slightly spreading, flexing either upwards or downwards at the 2–3 cm long pulvinus occurring ca. $\frac{2}{3}$ along the petiole length, with $\frac{1}{3}$ of the petiole lying distal to the pulvinus, petiole above the petiolar sheath terete in cross section, with the distal-most ca. 5 cm shallowly dorsally grooved, the dorsal edges bluntly rounded, petiole glossy medium green with faint longitudinal striae; **petiolar sheath** conspicuous, persistent, margins incurved except for the distal 2 cm where margins flaring and very slightly auriculate, sheath coloured as for petiole, the margins hyaline; **blade** 12–26 × 8–20 cm; triangular hastate, posterior lobes spreading, triangular to rounded triangular, sinus acute, apex acute, tubular-mucronate for ca. 2 mm, glossy medium green adaxially, matte subglaucous pale green with darker pellucid

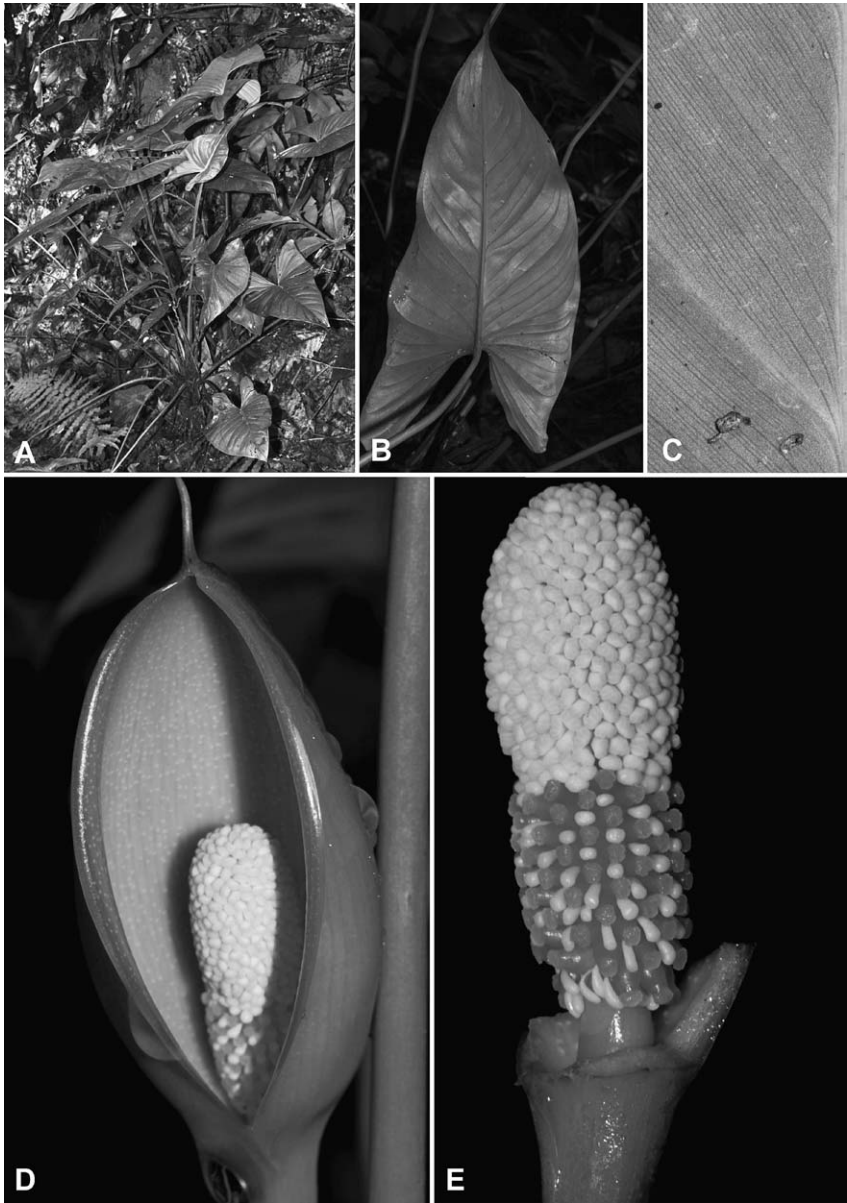


Fig. 5. *Homalomena passa* S.Y.Wong & P.C.Boyce. **A.** Type plant in habitat. **B.** Leaf blade, abaxial view. **C.** Detail of leaf blade, abaxial view, showing the vein-like pellucid glands. **D.** Inflorescence at pistillate anthesis. **E.** Spadix (spathe artificially removed) at pistillate anthesis. Note the pendent interpistillar staminodes. **A–E** from P.C.Boyce et al. *AR-1987*. Images © P.C.Boyce.

striate interprimary venation especially near the blade margin, these more conspicuous on younger leaves, blade very slightly quilted between the primary veins;

midrib moderately conspicuous, flush to very slightly raised adaxially, rounded-raised abaxially, notably basally; primary lateral veins up to 8 per side, the lower 3

arising simultaneously and associated with the posterior lobes, impressed adaxially, raised abaxially; *interprimary veins* of two types, one type alternating with primaries and only slightly less conspicuous, the second type comprising conspicuous pellucid darker veins, these very numerous and sometimes branching just after they exit the midrib; secondary and tertiary venation \pm invisible. **Inflorescences** up to 6 together, produced sequentially in a simple synflorescence; **peduncle** slender, up to 20 cm \times 1.5 mm, bright green, erect later pendent, inflorescence slightly nodding and spathe opening ventrally relative to the peduncle; **spathe** broadly fornicate at pistillate anthesis, broadly ovate-ellipsoid, not constricted, ca. 5 \times 3 \times 2 cm deep at anthesis, tipped with a rostrate mucro 5 mm long, margins reflexing during anthesis, spathe medium green in bud, at anthesis with exterior green and interior white with minute paler glands. **Spadix** under ca. 2/3 length of the spathe, ca. 3 cm long including the stipe, obliquely inserted on the peduncle; *stipe* oblique and partially dorsally adnate to the spathe/peduncle insertion, ca. 5 mm long on its longest side, ca. 3 mm diam., pale green with scattered paler longitudinal glands; **pistillate flower zone** ca. 1/3 the length of the spadix, ca. 0.8 \times 1 cm; **pistils** somewhat loosely arranged, globose, ca. 1 \times 0.6 mm, green; **style** very short, conspicuously narrower than the ovary; **stigma** wider than the style, umbonate-capitate, greyish white, producing a conspicuous stigmatic droplet at pistillate anthesis; **interpistillar staminodes** clavate, slightly exceeding the height of the associated pistil, ivory-white, all staminodes directly downwards, the lowermost reflexing markedly against the stipe; **staminate flower zone** contiguous with the pistillate flower zone, with a single incomplete row of staminodes intercalated between the first row of pistillate flowers, ca. 1.7 \times 1.1 \times 0.8 cm, bluntly ellipsoid, ivory; **staminate flowers** 4-staminate, stamens each with two anthers, rarely 3; stamens elongate-globose, connective minutely prominent, and not forming a synconnective; thecae opening by a con-

spicuous lateral slit. **Inflorescence** declinate, spathe fully persistent and turning deep green, ellipsoid, ca. 5.5 \times 2 cm; *fruit* and *seeds* not observed.

Distribution—Known only from the Long Langsat drainages of Mulu, NE Sarawak, where it is rare.

Ecology—Lowland moist riverine evergreen forest on exposed shales; ca. 30 m asl.

Etymology—Latin, *passa* (extended) referring to the posterior lobes of the leaf blade.

Notes—*Homalomena passa* is highly distinctive in overall appearance, with the long petioles and prominently triangular hastate leaf blades being diagnostic on Borneo. Inflorescences of *H. passa* are very similar in gross morphology to those of Sabah *H. galbana* Baharuddin S. & P.C.Boyce – **Figure 6**, although *H. passa* is distinguished by pistillate zone equalling the staminate zone (vs. ca. 1/2 as long), the ellipsoid (not oblong) staminate zone, white (not yellow) spathe limb and green (not yellow) pistils.

Homalomena velutipedunculata Y.C. Hoe, S.Y.Wong & P.C.Boyce, **sp. nov.** TYPE: Malaysian Borneo, Sarawak, Kuching, Santubong, Waterfall Point F5 on Summit Trail, 01 44 34.8 N 110 19 19.9 E, 22 July 2007, P.C.Boyce, Wong Sin Yeng & S.Maclean AR-2103 (SAR, holo). **Figures 7 and 8.**

Diagnosis

Homalomena velutipedunculata is unique in the Hanneae Complex by the combination of velvety, dark maroon peduncle, and leaf blade abaxially glaucous.

Description

Medium to moderate robust, evergreen, glabrous, strongly aromatic of lime **herbs** to ca. 1.50 m tall. **Stem** pleioanthic, erect to decumbent with the active tip ascending, 3.5–5 cm thick, green, pale red, dried parts

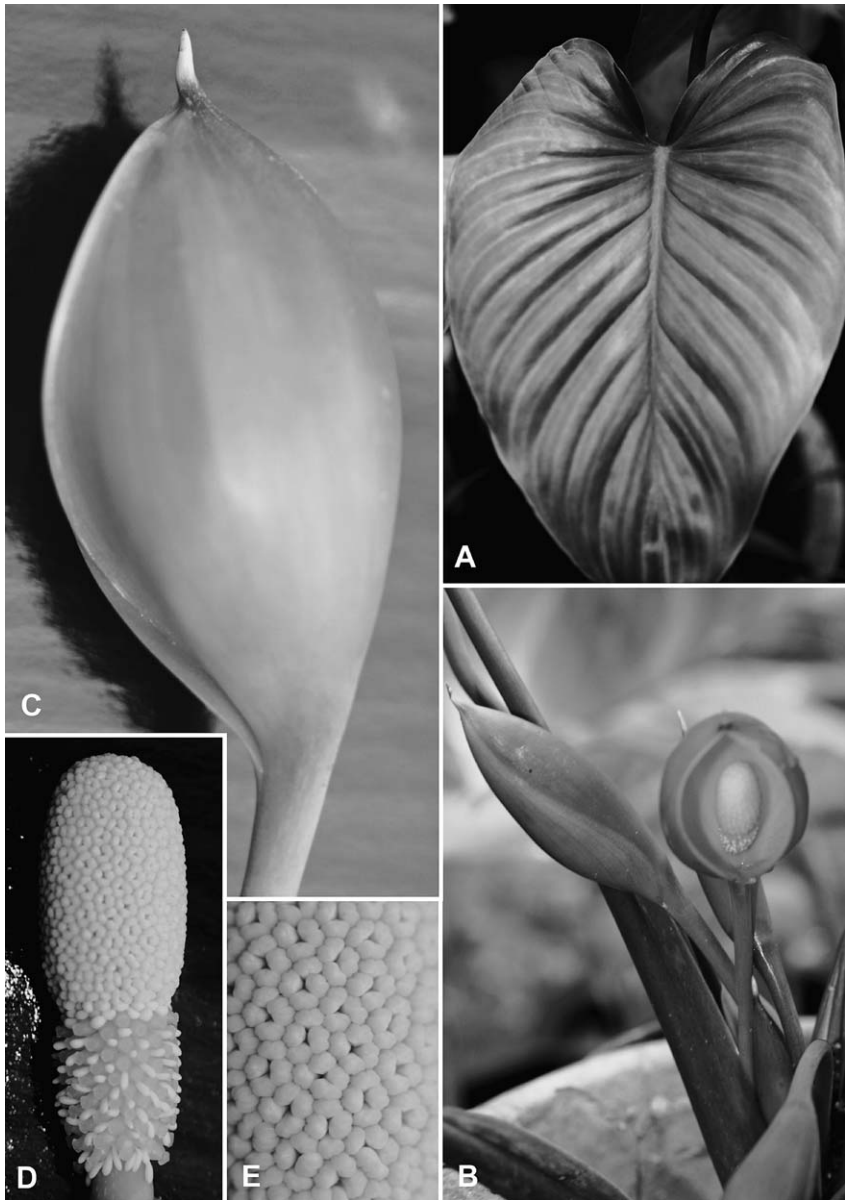


Fig. 6. *Homalomena galbana* Baharuddin S. & P.C.Boyce. **A.** Leaf blade, adaxial view. Note the distinct quilting of the leaf blade between the primary lateral veins. **B.** Detail of synflorescence. The inflorescence in the foreground is in the early stage of fruiting, that to the left is at post anthesis, and beginning to become declinate. The open inflorescence is at pistillate anthesis, the one directly behind will be open in three or four days. Just visible is a newly emerging inflorescence, with the rostrum already conspicuously bicoloured. **C.** Spathe. Note that it is deeply fornicate, and that the margins are recurved. **D.** Inflorescence at pistillate anthesis with spathe artificially removed. Note that the interstaminate staminodes exceed the associate pistil. Note, too, that the staminodes are directed downwards, and that the lowermost ones are appressed to the stipe. **E.** Detail of staminate zone. The clusters of 4 stamens per flower are easily seen. All images © Baharuddin Sulaiman.



Fig. 7. *Homalomena velutipedunculata* S.Y.Wong, Y.C.Hoe & P.C.Boyce. **A.** Plant in habitat, Type locality. **B.** Detail of petiole bases. **C.** Developing infructescences. Note the velvety texture. All from P.C.Boyce, Wong Sin Yeng & S.Maclean. Images © P.C.Boyce & Y.C.Hoe.

brown, with conspicuous adventitious roots, laxly arrange and penetrating the petiole bases; internodes 1.5–2.5 cm long. **Leaves** up to ca. 14 together, modules starting with a conspicuous 2-keeled short-

duration pale red **prophyll**; **petiole** 65–82 cm long × 8–13 mm wide, erect to spreading, pulvinate $\frac{1}{4}$ – $\frac{1}{3}$ way back from leaf blade insertion, adaxially slightly grooved, pale red, dark purplish red, rarely

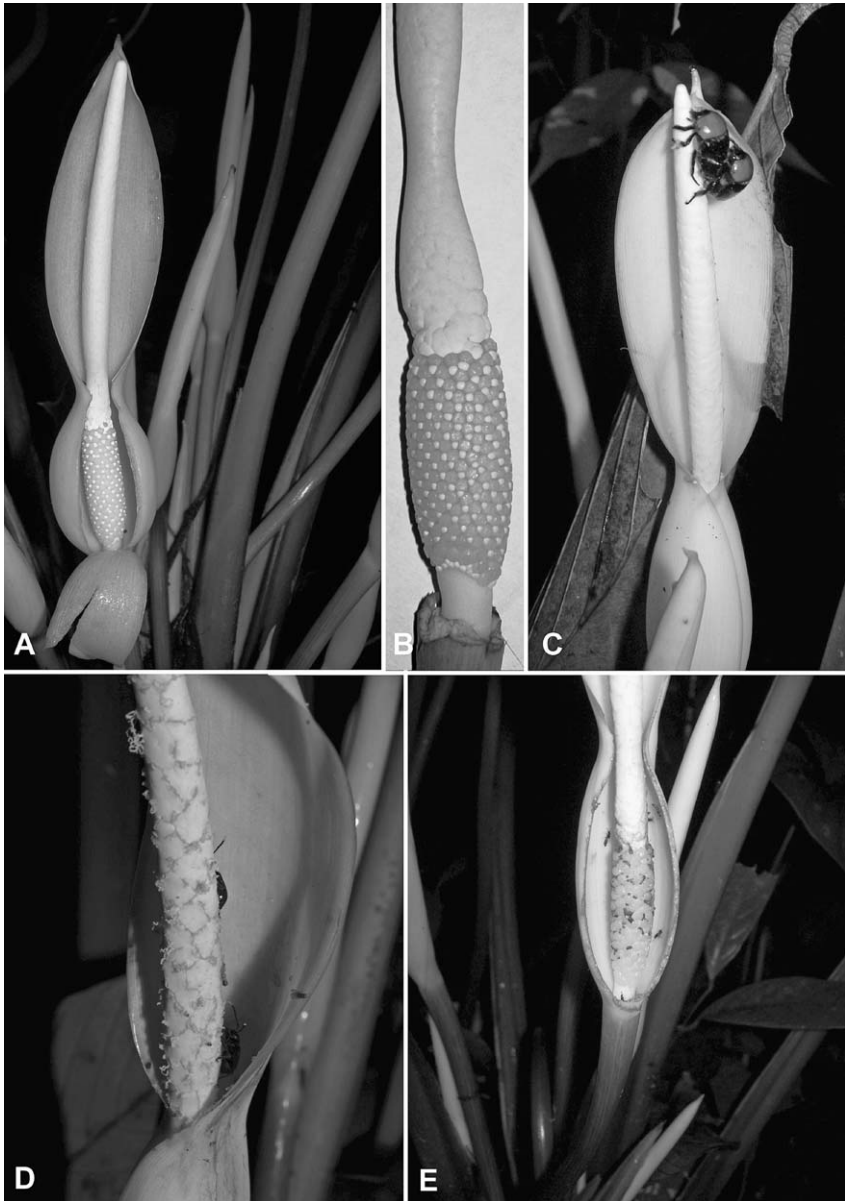


Fig. 8. *Homalomena velutipedunculata* S.Y.Wong, Y.C.Hoe & P.C.Boyce. **A.** Inflorescence at onset of pistillate anthesis, lower spathe artificially opened to reveal spadix. **B.** Detail of pistillate portion and interstice of spadix (spathe artificially removed) at onset of pistillate anthesis. **C.** Inflorescence at pistillate anthesis with mating pair of *Parastasia* beetles (Coleoptera: Rutelinae) on the spadix. **D.** Inflorescence at staminate anthesis. Note the pollen strands covering the staminate portion of the spadix. The beetle just visible behind the spathe is a chrysomelid, *Chaloenus*, scavenging pollen. **E.** Inflorescence at staminate anthesis, lower spathe artificially removed. Note that the interstilar staminodes have been eaten and that that the pistillate zone is covered with beetle excrement. All from P.C.Boyce, Wong Sin Yeng & S.Maclean. Images © P.C.Boyce & Y.C.Hoe.

medium green with scattered dark red or green longitudinal ridges, bases clasping, red; **petiolar sheath** 15–23 cm long, ca. $\frac{1}{4}$ of petiole length, wings up to 1 cm wide, open, rounded and weakly decurrent at apex, the margins slightly incurved, tapering to apex sheath initially persistent, soon marcescent along the margin, eventually whole sheath marcescent, pale red, dark purplish red, rarely medium green; **blade** broadly ovato-sagittate or ovato-cordate, 42–49 cm long \times 31–42 cm wide, thinly leathery, somewhat quilted, conspicuous areolate-punctate glands (? extrafloral nectaries) present on the leaf blade, green adaxially, paler abaxially and slightly glaucous when fresh, drying uniformly pale yellow, base cordate or sagittate, posterior lobes subtriangular, ca. 14 cm long, tip obtuse or some short-cuspidate for ca. 2 cm, ultimately apiculate mucronate for ca. 4 mm; midrib raised abaxially, ca. 7 mm wide at the base, 4 mm wide at the centre, adaxially flush with blade, ca. 5.5 mm at the base, ca. 2.5 mm at the centre; primary lateral veins ca. 13 on each side, diverging at 30°–90° from the midrib, adaxially impressed, abaxially raised, curved sharply towards the apex when near the margin; interprimary veins slightly impressed, alternating irregularly with primaries, posterior lobes each with 3–4 primary lateral veins; secondary venation rather obscure, raised on both surface; tertiary venation not visible, all veins running into a thickened intermarginal vein. **Inflorescence** usually up to 8 together, very rarely up to 20, erect, smelling intensely anethole at pistillate anthesis and again staminate anthesis, the smell much reduced during inter-anthesis and post-staminate anthesis, first inflorescence subtended by a foliage leaf, next by a 2-keeled pale red prophyll, ca. 7 cm long \times 1.5 cm wide; **peduncle** 16–18 cm long \times 5–7.5 mm wide, velvety, pale red, dark maroon, rarely medium green with obscure red longitudinal striae, terete, matte. **Spathe** ca. 15 cm long \times ca. 3.7 cm wide, lower spathe inflating with partially margin loosening, spathe limb loosening, inflating and then opening across, white, middle portion yellowish; **lower spathe** ovoid-

ellipsoid, ca. 5.5 cm long \times ca. 2.7 cm wide at pistillate anthesis, spathe constriction coinciding with the staminate constriction; **spathe limb** longer than lower spathe, ca. 9.5 cm long \times ca. 3.7 cm wide at pistillate anthesis, ovato-triangular, red mucro to ca. 4 mm, slightly furled at staminate anthesis. **Spadix** stipitate, 12–16 cm, ca. 1.4 cm exceeding spathe limb at pistillate anthesis, persistently enclosed by spathe after anthesis until the end of fruiting stages; **stipe** ca. 6.3 mm long \times ca. 6.5 mm width, fusiform, inserted obliquely on peduncle, yellowish white, chocolate brown in alcohol, few staminodes present on its upper portion; **pistillate zone** ca. 3.5 cm long \times 1.3 cm wide, ca. $\frac{1}{4}$ length of spadix, slightly fusiform-cylindrical, yellowish; **pistil** 1.4–2.2 mm in diam., ca. 1.5 mm tall, globose-cylindrical, arrangement slightly lax when fresh, yellowish, turned brown and laxly arranged in alcohol, each pistil associated with three to four waxy white **interpistillar staminodes**, these stipitate, 0.8–1.0 mm in diam., yellowish white in alcohol; **style** barely differentiate; **stigma** globose-capitate, truncate and smaller than ovary, wet and white yellowish at pistillate anthesis; **suprapistillar interstice zone** absent; **staminate zone** 9–10.5 cm long \times ca. 7.7 mm wide at staminate anthesis, ca. $\frac{5}{8}$ length of spadix, weekly constricted ca. $\frac{1}{6}$ way along from the base, coinciding with the spathe constriction; amber droplets of **resin** secreted on the staminate zone close to onset of staminate anthesis and few exudates among the staminate zone; **staminate flower** polygonal, 3.2–5 mm in diam., each comprising 3–8 truncate stamens which overtopped by a large and flat connective tissues, size dramatically different (larger) after $\frac{1}{2}$ of staminate zone along toward base, pale brown and slightly grey in alcohol; **pollen** string white, turned yellowish and somewhat paste form when mixed with resin. **Infructescence** 1–8 together, rarely up to 20, declinate to pendent; spathe entirely persistent, pale red, dark purplish red, rarely medium green; peduncle pale red, dark purplish red, rarely medium green with red longitudinal striate, matte; lower fruiting spathe ca.

10 cm long \times 2.1 cm wide; fruiting spathe limb ca. 6.5 cm long \times ca. 1.1 cm wide; fruits size ca. 3 times larger than ovaries, ripen red, slightly salty sour plum smell; stigma slightly impress with cross sign, 1.2–1.6 mm in diam., rounded, pale red and pale yellow; stipe white and pale green; staminate zone ripen banana smell when degraded; seeds 0.2 mm in diameter, slightly oval, pale green.

Distribution—Endemic on Mount Santubong, NW Sarawak.

Ecology—Perhumid to moist evergreen forest, abundant along, but not restricted to, forested edges of waterfalls.

Etymology—From Neo-Latin *velutinus* (velvety), derived from Latin *villous* (shaggy hair), and Neo-Latin *pedunculus* [equivalent to Latin *ped-* (a foot) + *-unculus* (the diminutive suffix); thus *peduncle* = a small foot]; in allusion to the surface texture of the peduncle of this species.

Notes—Santubong and Bako are situated respectively on Tanjung Sipang and Tanjung Po, opposing promontories forming the mouth of a bay, and no more than 15 km apart (straight line measurement) and support remarkably different aroid floras. Part of the explanation is very likely linked to Santubong being higher and much of it considerably wetter than more easterly Bako. There is also a significant difference in the geological histories of these promontories. The sandstones that form Santubong are of Paleogene origin whereas those of Bako are Miocene.

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