

Studies on Homalomeneae (Araceae) of Borneo I. Four New Species and Preliminary Thoughts on Informal Species Groups in Sarawak

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Abstract

Four new species of *Homalomena* (Araceae: Homalomeneae) are described from Sarawak. The current supraspecific taxonomy of the genus is reviewed and reasons for not recognizing at this time formal supraspecific units are justified although the need for species groupings is restated. In line with other large, taxonomically intractable groups, informal groups are proposed and circumscribed. All new species are illustrated.

Introduction

Homalomena Schott is a genus of in excess of 150 species distributed in the new and old world tropics with the majority of species and greatest diversity centred on perhumid South East Asia where there are three centres of diversity: Sumatera, Borneo and New Guinea.

Phylogenetically *Homalomena*, together with *Furtadoa* M.Hotta (two species, west Malesia, differing from *Homalomena* by male flowers each associated with a pistillode), comprises the tribe Homalomeneae M.Hotta, which is sister to tribe Philodendreae Schott and part of a clade containing otherwise African genera *Culcasia* P.Beauvois and *Cercestis* Schott (together comprising tribe Culcasieae Engl.).

Since the now long out-of-date full revision of Engler (1912) there have been fragmentary floristic accounts by Ridley (1905), Merrill (1922), Alderwerelt (1922a, b) and Furtado (1939, 1940), an uncritical species listing for Malesia focusing primarily on Sumatera (Hotta, 1985), a revision for New Guinea and the Bismark Archipelago (Hay, 1999), and various *ad hoc* new taxa published by Hotta (1986, 1993), Boyce (1994), Hay

& Herscovitch (2002) and Sulaiman & Boyce (2005), but no attempt to undertake a full revision of *Homalomena*. The lack of a reliable taxonomy poses considerable problems for field workers since *Homalomena* is one of the most speciose and taxonomically intractable aroid genera in the Asian tropics.

The problems presented by a lack of reliable a taxonomy are compounded by the poor state of preservation of many of the historical types, the cryptic nature of most of the systematically significant morphologies, notably the presence, absence and disposition of sterile flowers, the generally large and complex vegetative structures that do not lend themselves readily to traditional herbarium vouchering methodologies, and the fleeting anthetic period such that even well prepared herbarium specimens are frequently taxonomically useless because inflorescences were prepared post anthesis by which time many significant structures have deliquesced or been subjected to pre-preservation damage by the most frequent inflorescence visitors, chrysomelid beetles, and post-preservation destruction by herbarium beetles.

Homalomena is a taxonomically complex group and notwithstanding the above difficulties, is in urgent need of a rigorous study aimed at resolving the taxonomy and phylogeny. This is imperative not only because *Homalomena* is one of the most abundant, speciose and least understood of the mesophytic aroid genera in tropical Asia, but also because the genus is now becoming the focus of interest for pharmaceutical research due to the terpenoids and flavonoids occurring in the plant tissues; such studies must have a basis in sound taxonomic understanding or risk being futile. That a taxonomic study is required is no better exemplified than by the work of Hanne Christensen (Christensen, 2000) in which five *Homalomena* species are highlighted as having moderate to significant importance as medicinal plants among indigenous people in Sarawak; four of the five species are scientifically novel.

In conclusion, *Homalomena* requires a worldwide revision including investigation of its phylogeny. However, current restraint on available taxonomic expertise means it is unlikely that *Homalomena* will be so studied in the near future. Nonetheless, as noted by Hay and Herscovitch (2002) and reiterated by Sulaiman and Boyce (2005) there remains a need to be able to identify at least the more distinctive taxa and, thus, although it is undesirable to encourage *ad hoc* description of new species in taxonomically chaotic genera, at least for the moment description of the more distinctive taxa is desirable to enable some reliable parameters to be set.

The genus *Homalomena* Schott

Homalomena Schott in H.W.Schott & S.L.Endlicher, Melet. Bot.: 20 (1832).

Homalonema Endl., Gen. Pl.: 238 (1837), *orth. var.*

Spirospatha Raf., Fl. Tellur. 4: 8 (1838).

Cyrtocladon Griff., Not. Pl. Asiat. 3: 147 (1851).

Chamaecladon Miq., Bot. Zeitung (Berlin) 14: 564 (1856).

Adelonema Schott, Prodr. Syst. Aroid.: 316 (1860), *syn. prov.*

Curmeria Linden & André, Ill. Hort. 20: 45 (1873), *syn. prov.*

Diandriella Engl., Nova Guinea 8: 20 (1910).

Minute to very large evergreen **herbs**, erect to decumbent, less often creeping, usually strongly aromatic (terpenoids – frequently reminiscent of mango or citrus peel, or ginger in Asian tropics; anise in the Neotropics). **Stems** solitary, clustering or creeping and rooting with the terminal portion erect, physiognomically unbranched or rarely pseudodichotomous. **Leaves** spirally arranged, less often spiro-distichous, very rarely distichous, sometimes together with petioles with conspicuous reddish extrafloral nectaries; petioles longer to shorter than the lamina, channelled to terete or D-shaped, the lower part sheathing, petiolar sheath persistent to marginally marcescent; laminae simple cordate to oblanceolate, glabrous in tropical Asia (but spiny and/or pubescent in most Neotropical species); primary veins arising in a cluster at base of the lamina also distributed along the midrib, veins of the posterior lobes (where present) arcuate, the remainder running distally to the marginal vein; secondary and tertiary veins poorly differentiated from one another, striate. **Inflorescences** several together, terminal but displaced as to appear to be arising from the axils of the leaves, each synflorescence with inflorescences developing sequentially, individual inflorescences erect before and during anthesis, then becoming decumbent to declinate during fruit development; **spathe** persistent through to maturation of fruit, mostly simple boat shape or constricted into a lower convolute and distal variously opening limb, exterior smooth or externally ribbed and keeled along the dorsal midline, apex apiculate to strongly mucronate. **Spadix** divided into two zones: female proximally, male distally with the zones occasionally separated by a naked to staminode-bearing interstice, male part often secreting reddish to brown resin prior to or during anthesis; **female flowers** naked, often accompanied by a single staminode arising from its base on the side nearest to the base of spadix (hereafter referred to as interpistillar staminodes); ovary incompletely two- to fully four-locular, style apparently absent or extremely short; stigma

smaller than to exceeding the ovary diam., button like to discoid, sometimes weakly lobed, sometimes impressed, minutely papillate before and during anthesis, often sunken afterwards; placentation basal to central, ovules anatropous, several per locule. **Male flowers** with two to four, very rarely a solitary stamen, filaments very short to \pm absent; anthers opening by short apical longitudinal slits usually concealed by the expanded connective forming a flat cap over the top of the stamen. **Infructescences** pendant during development and at maturity, fruits contained within the persistent and somewhat enlarged spathe; fruiting spathe dehiscent from the base upwards, usually the spathe circumscissile at the insertion of the peduncle, then splitting into a few irregular strips and these curling upwards to reveal the ripe fruit. **Fruit** where known, a small translucent greenish berry, usually smelling of overripe fruits. **Seeds** albuminous, very small, ca 1 mm or less long, longitudinally ridged.

Distribution: Indo-Malesia to southern China eastwards to the Solomon Islands with centres of diversity in Sumatera, Borneo and New Guinea; ca 8 Neotropical species (section *Curmeria* but generic status doubtful).

Habitat: Primarily understory herbs in lowland evermoist tropical forest, but also reaching mid-montane zone; sometimes rheophytic, very rarely helophytic, occasionally relictual in regrowth and along road cuttings.

Note: Formerly the generic circumscription of *Homalomena* was considerably narrower than currently accepted, with seven genera recognized: *Adelonema* Schott, *Chamaecladon* Miq., *Curmeria* Linden & André, *Cyrtocladon* Griff., *Diandriella* Engl. and *Spirospatha* Raf. Some of these former genera are currently employed as subordinal taxa, as discussed below.

Proposed informal groupings in Asian *Homalomena*

Current sectional groupings in *Homalomena* are based upon the work of Schott (1860) and Engler (1912), with additions by Furtado (1939) and Hotta (1967). Five sections are presently recognised: *Curmeria* (Linden & André) Engl. & K.Krause (including *Adelonema* Schott) restricted to the Neotropics, and presently the focus of molecular phylogenetic research by Barabé and co-workers; *Homalomena* ('*Euhomalomena*' of Engl. & K.Krause); *Cyrtocladon* (Griff.) Furtado; *Chamaecladon* (Miq.) Engl. & K.Krause, and *Geniculatae* M.Hotta. All except *Curmeria* are restricted

to the Asian tropics, distributed from North East India, eastwards to the tropical Western Pacific, and, with the exception of *Geniculatae*, all have been recognised as genera at some point in their history.

Of the remaining former generic taxa, *Spirospatha* Raf. (based on *Calla occulta* Lour.) is referable to *Homalomena occulta* (Lour.) Schott (a species of dubious identity although provisionally placed in section *Homalomena*), while monospecific New Guinean *Diandriella* Engl. was reduced to a generic and species synonym by Hay (1999) as *Homalomena stollei* Engl. & K.Krause.

The present sectional boundaries are based upon overall inflorescence shapes and sizes, the morphology of the sterile and fertile flowers, placentation and micropyle direction. Hay (1999) noted that in several of the New Guinea species these distinctions break down and he declined to utilize any generic subordinal taxa. However, our observations have suggested that these simplified inflorescence characters overlay a complex series of vegetative architectures, including the presence of hapaxanthic and pleionanthic shoot modules in section *Homalomena*, presence and absence of aromatic tissues, in section *Geniculatae* a complicated shoot arrangement not paralleled in any other species yet described, and in section *Cyrtocladon* complex spathe and spadix movements during anthesis. As in the case of *Schismatoglottis* (Schismatoglottideae) another large and diverse mesophytic genus also distributed in the new and old world tropics although phylogenetically distant from *Homalomena*, it seems likely that vegetative architecture and, particularly, the spathe movement mechanics during anthesis, are phylogenetically more significant than inflorescence gross morphology and that the maintenance of the formally recognised higher taxa is not useful until such time as a comprehensive phylogenetic study is undertaken.

Nonetheless, in such a large and diverse genus with many novelties yet to be described, subordinal units are a useful tool to facilitate taxonomic study. In other taxonomically intractable groups (e.g. *Alocasia* G.Don., *Schismatoglottis* Zoll. & Moritzi, the Pothoeae Engl. and *Rhaphidophora* Hassk.) the establishment of informal groups has become a standard approach until such time as phylogenetic testing can be undertaken leading to the establishment of evolutionarily robust groups (see Boyce 2000a, b, c, 2001a, b; Boyce & Hay 2001; Hay 1998; Hay & Wise 1991; Hay & Yuzammi 2000). We are following this methodology here in proposing the reduction of the four currently recognised Asian subgeneric groupings into three informal supergroups: **Homalomena**, **Cyrtocladon** and **Chamaecladon**, while reducing *Geniculatae* to **Cyrtocladon**.

The supergroups are defined by the following characters -

The **Homalomena** supergroup comprises medium to large creeping to erect plants with strongly aromatic tissues, pleioanthic, or rarely hapaxanthic, shoot modules and spathes greater than 1.5 cm long, with no or only a very weak constriction between the upper and lower spathe. Spathe movement during anthesis, where known, comprises simple gaping and then closing of the spathe limb, no spadix movements have been recorded. Ovary three to four locular. Male flowers with three to four, rarely five to six, anthers.

The **Chamaecladon** supergroup comprises small to minute often creeping, less often erect plants with odourless, or very rarely aromatic, tissues; as far as is known only pleioanthic shoot modules, and spathes less than 1 cm, very rarely up to 1.5 cm long, with no constriction between the upper and lower spathe. Spathe movement during anthesis, where known, comprises simple gaping and closing of the spathe limb. No spadix movement recorded. Ovary two to three locular. Male flowers with two to three anthers.

The **Cyrtocladon** supergroup comprises medium to very large erect to creeping plants with strongly aromatic tissues, pleioanthic (but very few studied) shoot modules and spathes greater than 2 cm long, with weak to moderate to pronounced constriction between the upper and lower spathe. All of the several species so far studied undergo a complex series of spathe and spadix movements during anthesis. Ovary three to four locular. Male flowers with three to four, rarely five to six, anthers.

Previously described Bornean taxa in relation to the four new species of *Homalomena*

The four new species described in this paper all belong to the **Cyrtocladon** supergroup. Based on our literature review and examination of problematic types, we are confident that despite the current chaotic state of *Homalomena* taxonomy in Borneo, none of our proposed novelties have been featured in the literature on Bornean *Homalomena*.

I. The publication of Ridley (1905) -

The first attempt to bring order to *Homalomena* specifically in Borneo was that of Ridley (1905). Ridley listed 23 species for Borneo, of which eight [*H. griffithii* (Schott) Hook.f., *H. intermedia* Ridl., *H.*

ovatifolia Ridl., *H. paucinervia* Ridl., *H. pumila* Hook. (= *H. humilis* (Jack) Hook.f.), *H. saxorum* (Schott) Engl. & *H. truncata* Hook.f.] can be dismissed immediately from this discussion as they belong to the **Chamaecladon** supergroup. Of the remaining 15 species, taxonomic and/or nomenclatural problems exclude three from further discussion.

H. aromatica Schott var. *cordata* (Schott) Ridl. is based upon a plant of unknown origin; the superior taxon is endemic to NE India and Bangladesh and belongs to the **Homalomena** supergroup.

H. fasiata Ridl. is a synonym of *Schismatoglottis tectorata* (Schott) Engl. (Tribe Schismatoglottideae).

H. sagittifolia Jungh. is here regarded as a Javan endemic with much of the modern interpretation of it as a widespread species in Sunda based upon a series of misinterpretations of the additional specimens cited by Schott, and latterly by Engler (1912). The numerous cordato-saggitate *Homalomena* species in Sarawak that are commonly referred to as '*H. sagittifolia*' will be the subject of a paper in preparation by the authors.

Of the remaining 12 species treated by Ridley, three (*H. beccariana* Engl., *H. miqueliana* Schott, and *H. paludosa* Griff.) are helophytes, often in oligotrophic water systems and not at all related to the species proposed here. Of the rest, five (*H. havilandii* Ridl., *H. insignis* Ridl., *H. lancea* Ridl., *H. ovata* Engl. and *H. sarawakensis* Ridl.) are all with oblong to lanceolate leaves, lacking posterior lobes, and while in this morphology approaching *H. pseudogeniculata*, all differ in lacking a pulvinus at the insertion of the lamina on the petiole.

Of the remaining four species, *Homalomena borneensis* Ridl. has sagittate, not cordate leaves and a partially naked interstice between the female and male zones. To date *H. borneensis* is known with certainty only from the Kuching type. *Homalomena crassinervia* Ridl., *H. punctulata* Engl. and *H. subcordata* Engl. are all based upon Matang (Kuching Division) types, and given their morphological differences coupled with the high levels of local endemism, which has proven in the work on *Schismatoglottis* (e.g., Hay & Yuzammi, 2000) and in mesophytic terrestrial aroids in general to be of great importance in delimitating taxa, they can be effectively dismissed from consideration.

Regarding the status of *H. propinqua* Schott there exist two problems. First, Ridley's (1905) interpretation allies the plants more closely to *H. sagittifolia* sensu Ridl. (see above), whereas Schott's original description appears to belong to the **Chamaecladon** supergroup. Secondly, the type of *H. propinqua* is from Java.

2. The publications of Alderwerelt (1922) -

Alderwerelt (1922a, b) described and discussed 37 species of Bornean *Homalomena*, of which 19 are members of the **Chamaecladon** supergroup and 10 are in the **Homalomena** supergroup. Of the remaining eight species treated by Alderwerelt, *H. raapii* Engl. is a Sumateran endemic, while *H. miqueliana* is, as noted above, a helophyte, and *H. propinqua* has the problems as outlined earlier. Of the remainder, only two (*H. latifrons* Engl & *H. sulcata* Engl.) are Bornean (both from Kalimantan) and are narrowly endemic.

3. The publication of Furtado (1939) -

Furtado's comprehensive treatment made in 1939 was an attempt to bring order to the chaotic state of *Homalomena* primarily in Peninsular Malaysia and Sumatera. Aside from systematic notes, including complete synonymy, references and citations, and localities with exsiccatae covering 58 species, his publication included a review of the sections, together with key and summary, list of collections seen, and index to all names included, and the description of a new section, *Cyrtocladon*. Regrettably the work is beset by a number of problems, no least a tendency to recognize extremely finely defined subordinal taxa and in several instances heterodox definitions of taxa in order to 'mop-up' problematic plants. Many of the names that can be applied to Sumateran taxa only are thus 'stretched' to fit species from Borneo and elsewhere. In our opinion, aside from a very few widespread species (e.g., *H. griffithii* Hook.f.) Furtado's work does not apply to Borneo.

4. The publication of Hotta (1967) -

The only relevant species published by Hotta (1967) is *Homalomena geniculata* M.Hotta, which is discussed below under the description of *H. pseudogeniculata* P.C.Boyce & S.Y.Wong.

New species of *Homalomena*

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

Homalomena ardua differt ab speciebus ceteris Borneensibus laminis foliorum adaxiali atro-viride, nitentibus, subtus atrorubidus cum nervus centralis et nervis lateralibus primariis prominentibus, petiolis atrorubidus vel viride, forma rubidus cum petioli demum viridescens usque ad $\frac{2}{3}$ partem longitudinis petiolo, petioli vagina longa (usque ad $\frac{1}{2}$ partem longitudinis petiolo). Inflorescentia mascula gracilis, $\frac{2}{3}$ longitudinis inflorescentia

occupatus. Ab *H. josefii* (*nuper descripto subtus similis*) sed *stipiteque longiore* (ca 8.5 mm longus versus ca 3.5 mm longus), *floribus femineis ad basin spadice bis magnis et stigmatibus parum impresso et cum alcoholis atrobrunneus* (*stigmatii S. josefii elevatus cum alcoholis brunneus pallide*), *inflorescentiae feminae staminodiis cum alcoholis brunneus pallides* (vs *griseus cum S. josefii*), *inflorescentia mascula longiore* (ad $\frac{2}{3}$ versus $\frac{1}{2}$ partem longitudinis spadice) et *petioli vagina proportione longa* ($\frac{1}{2}$ partem longitudinis petiolo *H. ardua* versus $\frac{1}{4}$ to $\frac{1}{3}$ partem longitudinis petiolo *H. josefii* differt. – **Typus:** Malaysia, Sarawak, Miri Division: Mulu, Long Lama, Mulu National Park, National Park Headquarters, 04° 02' 29.4", 114° 48' 44.3", 5 Aug 2007, P.C. Boyce et al. AR-1938 (Holo, SAR+ spirit). **Plates 1 & 2.**

Medium to robust **herbs**, strongly aromatic (mango peel), evergreen, glabrous, to ca 80 cm tall. **Stem** pleioanthic, erect to ascending, ca 3 cm thick, dark red to green, internodes to ca 1 cm long. **Leaves** up to ca 20 together; petiole terete, erect to decumbent with the terminal portion ascending, the laminae held flat, up to 50 cm long, petiole bases clasping, petioles dark reddish to green, reddish forms with the $\frac{2}{3}$ lower part of petiole ageing to dark green, matte, drying dark brown, petiolar sheath to ca 31 cm long, near to $\frac{1}{2}$ of petiole length, unequal, broader side rounded at apex, narrower side, weakly decurrent at apex, sheath initially long-persistent with the marginal 1.5 mm soon drying paler, eventually the whole sheath marcescent; lamina broadly ovato-sagittate, 40-50 cm long x 28-34 cm wide, thinly leathery, glossy dark green adaxially (fresh), drying pale olive green, abaxially dark red (fresh), drying pale brown, base cordate, posterior lobes spreading, subtriangular 6-11 cm long, lamina tip obtuse, short-acuminate for ca 1 cm, thence, apiculate for ca 3.5 mm, sometimes red; midrib raised abaxially (fresh and dry), dark red when fresh, drying reddish brown, adaxially flush with lamina (fresh and dry), ca 3 mm wide, with ca 10 primary lateral veins on each side, diverging at 50°-90° from the midrib, adaxially impressed (fresh), flush with lamina when dry, abaxially raised (fresh and dry), curved sharply towards the apex when near the margin, interprimary veins ca $\frac{1}{2}$ width of the primary lateral veins, alternating irregularly with primaries, posterior lobes each with 3-4 primary lateral veins; secondary venation rather obscure, striate; tertiary venation not visible, all veins running into a thickened intermarginal vein, this particularly conspicuous at the leaf tip, drying paler than the lamina. **Inflorescences** 1-5 together, erect at anthesis, later declinate, peduncle to ca 10 cm long x ca 3 mm diam, white, matte. **Spathe** 9-15 cm long, tightly furled prior to anthesis, lower spathe inflating at female anthesis, spathe limb loosening at female anthesis,



Plate 1. *Homalomena ardua* P.C.Boyce & S.Y.Wong. A. Overall plant; B. Abaxial leaf lamina dark red with equally coloured midrib; C. Red petiole bases; D. Inflorescence shedding pollen at male anthesis; E. Inflorescences with emerging inflorescence bud; note the sequential emergence. The inflorescence at the back is at female anthesis; that next is at male anthesis.

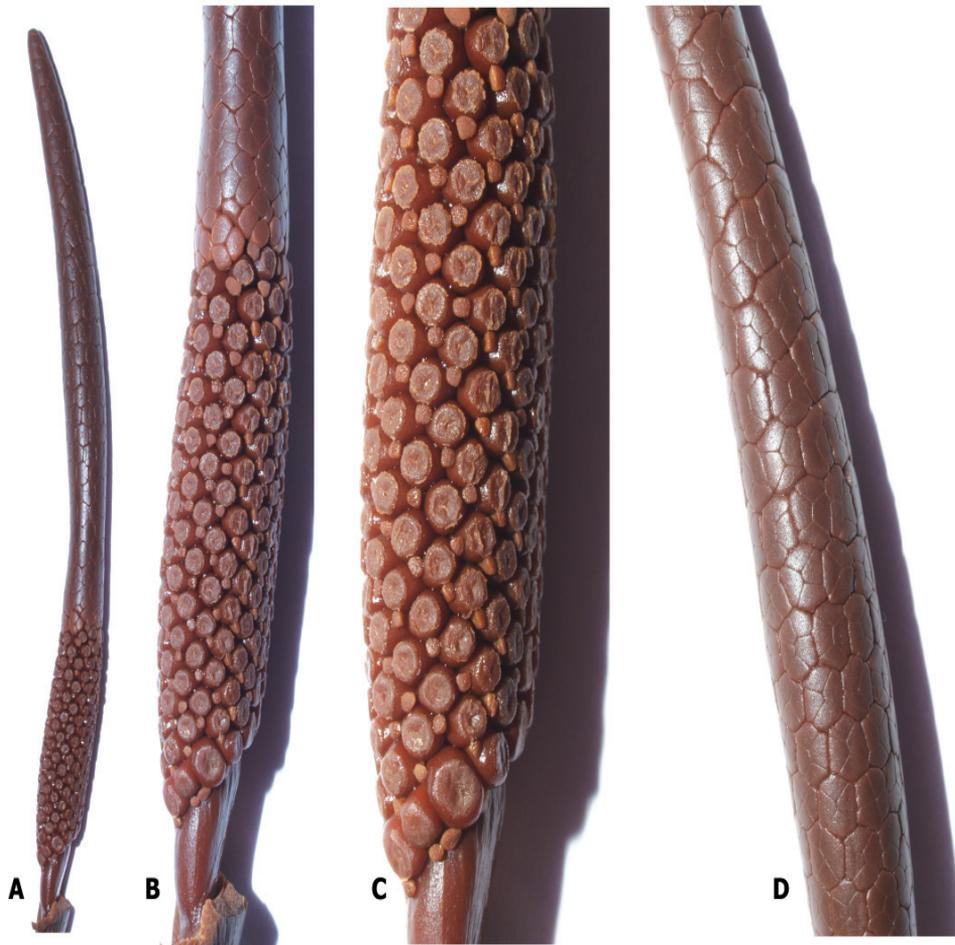


Plate 2. *Homalomena ardua* P.C.Boyce & S.Y.Wong. A. Whole spadix, spathe removed, from alcohol collection; B. Close up of female zone; C. Detail of female zone, note especially the enlarged lowermost female flowers; D. Male zone.

thence, inflating and then opening wide, lower spathe pale green, stained red at insertion of peduncle, white above, spathe limb white at anthesis, with apex and mucro shading to dark pink during anthesis; lower spathe ovoid-ellipsoid, ca 5.3–6.5 cm long, moderately constricted at the junction of the spathe limb, the constriction coinciding with the lower-most fertile male flowers, spathe limb narrowly elliptic, ca 8.5 cm long x 2.3 cm wide (at male anthesis), prominently keeled along the exterior midline, spathe limb margins with the middle ca $\frac{2}{3}$ reflexing slightly at male anthesis, apex mucronate to ca 3.5 mm long. **Spadix** equalling the spathe, ca 13

cm long, elongate cylindrical-fusiform, narrowing in the lower part male zone coinciding with the constriction of the spathe and there intergrading with staminodes, stipitate; stipe ca 8.5 mm long x 4.5 mm diam., strongly dorso-ventrally flattened, female zone ca 3.6 cm long x ca 1 cm wide, ca $\frac{1}{4}$ length of spadix, weakly fusiform, the surface adjacent to the spathe limb flattened, **female flowers** ca 1.5 mm x 0.75 mm, laxly arranged, squat-cylindrical, stigma as broad or slightly smaller than ovary, impressed and weakly trisulcate, stained light brown, interpistillar staminodes truncate on a very slender stipe, ca 0.3 mm diameter, equalling or slightly overtopping the associated female flower, stained greyish in alcohol, lower-most female flowers ca twice the size of fertile females, mostly associated with two or more interpistillar staminodes and seemingly sterile, suprapistillar staminodes each comprising a single sterile anther; male zone ca 8 cm long, ca $\frac{2}{3}$ length of spadix, lower part weakly constricted, clothed with fertile male flowers intergrading into a single row of staminodes., distal- and proximal-most flowers apparently sterile; **male flowers**, ca 3 mm x 2 mm trapezoid, comprising 3-7 truncate stamens, each overtopped by a large, slightly raised connective. **Infructescence** declinate, spathe entirely persistent, pale green stained reddish pink, peduncle dark red, matte. **Fruits** and **seeds** not observed.

Distribution: Borneo: Sarawak - endemic, Miri Division. Known only from the type collection.

Habitat: Not known in the wild, planted at the headquarter of Mulu National Park, 65 m asl, but plants originating from the surrounding areas.

Notes: *Homalomena ardua* is a distinctive plant with the leaf laminae glossy dark green adaxially and dark red abaxially with the midrib red and prominently raised abaxially. Petioles are dark reddish to green, with the reddish forms having petioles ageing to dark green at the lower $\frac{2}{3}$ of petiole. Petiolar sheathes are long, extending to nearly $\frac{1}{2}$ of the petiole length. The male zone is long and slender which occupies $\frac{2}{3}$ of the inflorescence.

Homalomena ardua differs from *H. josefii* but the spadix being longer stipitate (ca 8.5 mm in *H. ardua*) vs. ca 3.5 mm (*H. josefii*), the female flowers at the lower part of the zone are twice the size those in the upper zone vs. uniform size of flowers throughout the female zone in *H. josefii*. It is speculated that the enlarged female flowers of *H. ardua*, which appear to be functionally sterile, may be adapted to attracting or maintaining pollinators. There are also differences in the stigma, which is slightly impressed and stains dark brown in alcohol in *H. ardua*, but is

raised and remains pale brown in alcohol in *H. josefii*. Further, interpistillar staminodes stain greyish in alcohol in *H. ardua* but light brown in *H. josefii*. Lastly, the male flower zone is much longer in *H. ardua* (occupying $\frac{2}{3}$ length of spadix), as compared with that of *H. josefii* ($\frac{1}{2}$ length of spadix). Vegetatively *H. ardua* is notable by virtue of its leaves dark red abaxially (green adaxially in *H. josefii*) and the proportionately longer petiolar sheath ($\frac{1}{2}$ of petiole length in *H. ardua* vs. $\frac{1}{4}$ to $\frac{1}{3}$ of petiole length in *H. josefii*).

One of the inflorescences (see AR-1900) was collected at late male anthesis (based on observation, male anthesis lasts for two to three days). It was observed that the staminodes at the base of insertion and interpistillar staminodes were eaten by visiting chrysomelid beetles.

Etymology: The specific epithet is from the Latin *arduous* – hard work – in fanciful allusion to the fact that there is much hard work to be done in this genus!

Other specimens seen: Sarawak, Miri Division: Mulu, Long Lama, Mulu National Park, National Park Headquarter, 04° 02' 29.4", 114° 48' 44.3", 11 Aug 2007, P.C. Boyce et al. AR-2002 (SAR).

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

*Planta magna usque ad 100cm alta quam foliorum laminii ad vena submarginali abaxialiter valde prominentibus. Ad H. ardua (nuper descripto leviter similis) sed stipiteque brevior (ca 3.5 mm longus versus ca 8.5 mm longus), floribus femineis in toto consimilis, stigmatibus elevatus cum alcoholis brunneus pallide (stigmatii H. ardua parum impresso et cum alcoholis atrobrunneus), inflorescentiae feminae staminodiis cum alcoholis griseus (versus brunneus pallides cum H. ardua), inflorescentia mascula brevior (ad $\frac{1}{2}$ versus $\frac{2}{3}$ partem longitudinis spadice) et petioli vagina proportione brevior ($\frac{1}{4}$ to $\frac{1}{3}$ partem longitudinis petiolo H. josefii versus $\frac{1}{2}$ partem longitudinis petiolo H. ardua differt. – **Typus**: Malaysia, Sarawak, Bintulu Division: Bukit Satiam, 02° 59' 10.0", 112° 55' 42.8", 14 July 2006, P.C.Boyce et al. AR-1894 (Holo, SAR + spirit). **Plates 3 & 4.***

Medium to robust **herbs**, strongly aromatic (ginger/resin), evergreen, glabrous, to ca 100 cm tall. **Stem** pleioanthic, erect to ascending, ca 5 cm thick, dark red to green, internodes to ca 1 cm long. **Leaves** up to ca 15 together, ca 5-7 per module; petiole terete, erect to decumbent, 50-70 cm long, petiole bases clasping, eventually falling to leave a conspicuous lunate scar, petioles dark reddish to green, dark reddish forms with longitudinal ridges, green forms always with pinkish red bases, matte, drying dark



Plate 3. *Homalomena josefii* P.C.Boyce & S.Y.Wong. A. Overall plant; B. Abaxial leaf lamina pale green, with red petiole; C. Red petiole bases; D. Petioles in green form with inflorescences and infructescences; E. Emerging inflorescence bud with declinate infructescences.



Plate 4. *Homalomena josefii* P.C.Boyce & S.Y.Wong. A. Whole spadix, spathe removed, from alcohol collection; B. Close up of female/male zone transition; C. Detail of female zone, note evenly sized female flowers; D. Male zone and spadix tip; note the vestigial naked appendix at the tip.

brown, petiolar sheath ca 16-21 cm long, ca $\frac{1}{4}$ to $\frac{1}{3}$ of petiole length, equal, sometimes unequal, broader side rounded at apex, narrower side, weakly decurrent at apex, margin always convolute when fresh, sometimes wide open with broader petiolar sheath, sheath initially long-persistent with the marginal 1.5 mm, soon drying paler, eventually the whole sheath marcescent; lamina broadly ovato-sagittate, 25-45 cm long x 18-32 cm wide, thinly leathery, glossy dark to pale green adaxially (fresh), drying pale olive green, abaxially matte green (fresh), drying pale brown, base cordate, posterior lobes spreading, subtriangular 7-9 cm long, lamina tip obtuse, short-acuminate for ca 1 cm, thence, stiffly apiculate for ca 2-7 mm; midrib raised abaxially (fresh and dry), green when fresh, drying reddish brown, adaxially flush with lamina, ca 1.5 mm wide, with 6-9 primary lateral veins on each side, diverging at 50° - 90° from the midrib, adaxially impressed (fresh), flush with lamina when dry, abaxially slightly raised (fresh and

dry), curved sharply towards the apex when near the margin, interprimary veins ca $\frac{1}{2}$ width of the primary lateral veins, alternating irregularly with primaries, posterior lobes each with 3-4 primary lateral veins; secondary venation rather obscure, striate; tertiary venation not visible, all veins running into a thickened intermarginal vein, often red when fresh, this particularly conspicuous at the leaf tip and there drying paler than the lamina. **Inflorescences** 1-7 together, erect at anthesis, later declinate, each subtended by prophyll to ca 9 cm long, followed by cataphyll, ca 2-8 cm long, peduncle to ca 15 cm long x ca 5 mm diam, deep red, matte. **Spathe** 6.5-15.3 cm long, tightly furled prior to anthesis, lower spathe inflating at female anthesis, spathe limb loosening at female anthesis, thence inflating and then opening wide, lower spathe pale green, stained deep red at insertion of peduncle, flushed pink above, spathe limb white at anthesis, with apex and mucro shading to dark pink during anthesis; lower spathe ovoid-ellipsoid, 2.5-6.5 cm long, moderately constricted at the junction of the spathe limb, the constriction coinciding with the lower-most fertile male flowers, spathe limb narrowly to broadly elliptic, ca 3.3-8.5 cm long x 2.3 cm wide (at male anthesis), prominently keeled along the exterior midline, spathe limb margins with the middle ca $\frac{2}{3}$ reflexing slightly at male anthesis, apex mucronate to ca 3.5 mm long. **Spadix** equalling the spathe, ca 6-15.3 cm long, elongate cylindrical-fusiform, narrowing in the lower male zone coinciding with the constriction of the spathe and there intergrading with staminodes, stipitate; stipe ca 3.5 mm long x 5 mm diam., short fusiform, few staminodes present at the insertion of peduncle, similar to interpistillar staminodes, female zone ca 2 cm long x ca 1 cm wide, ca $\frac{1}{3}$ length of spadix, weakly fusiform, **female flowers** ca 1.3 mm x 0.75 mm, densely arranged, round, stigma as broad or slightly exceeding the ovary, raised and weakly trisulcate, staining pale brown in alcohol, extending beyond the ovary as the translucent collar, mostly associated with two or more interpistillar staminodes and seemingly sterile, staminodes truncate on a very slender stipe, ca 0.3 mm diameter, equalling or slightly overtopping the associated female flower, few pistillodes at the base of interstice, similar size to female flowers, suprapistillar staminodes zone, to ca 1 cm long x 5 mm wide, sometimes wider than female zone, staminodes each comprising a single anther; male zone to ca 4 cm long, ca $\frac{1}{2}$ length of spadix, separated from interstice by weakly constricted lower part of male zone, clothed with fertile **male flowers** intergrading into a single row of staminodes., distal- and proximal-most flowers apparently sterile; male flowers, ca 3 mm x 2 mm, trapezoid, comprising 3-5 truncate stamens, each overtopped by a large, flat connective, terminal-most flowers sterile and spadix often topped with a vestigial naked appendix. **Infructescence** declinate, spathe entirely

persistent, pale green stained reddish pink, sometimes wholly reddish pink, peduncle dark red, matte. **Fruits and seeds** not observed.

Distribution: Borneo: Sarawak, Bintulu Division – endemic.

Habitat: Terrestrial on shales and seasonally inundated alluvium, 7-120 m asl.

Notes: *Homalomena josefii* differs from *H. ardua* by the much shorter spadix stipe to ca 3.5 mm in *H. josefii* vs. 8.5 mm in *H. ardua*, the uniform size of the female flowers, the stigma raised and staining pale brown in alcohol in *H. josefii* (stigma impressed and staining dark brown in *H. ardua*). Additionally, the male zone is much shorter, occupying $\frac{1}{2}$ of spadix length in *H. josefii*, but longer ($\frac{2}{3}$ length of spadix) and more slender in *H. ardua*. Vegetatively *H. josefii* is distinctive by its large, robust form up to ca 100 cm, shorter petiolar sheath ($\frac{1}{4}$ to $\frac{1}{3}$ of petiole length) as compared to $\frac{1}{2}$ of petiole length in *H. ardua*, and leaf laminae always with a red, markedly thickened intermarginal vein running to the leaf tip.

Leaf colour is variable in *H. josefii*, with petioles ranging from green with red bases to more rarely, petioles red with concolorous longitudinal ridges present, and leaf laminae green adaxially as compared to red adaxial leaf laminae in *H. ardua*.

Etymology: The specific epithet is named for Dr Josef Bogner (Botanischer Garten München), one of the foremost experts on the aroids and perhaps the only person to have seen all currently recognized aroid genera in the field.

Other specimens seen: SARAWAK: Bintulu Division, Bukit Satiam, 02° 59' 13.3", 112° 55' 57.5", 14 Jul. 2006, P.C. Boyce et al. AR-1900 (SAR); Bukit Satiam, 02° 59' 07.4", 112° 55' 47.0", 15 Jul. 2006, P.C. Boyce et al. AR-1908 (SAR); Bintulu, road to Kampung Jepak, ca 3.3 km after bridge over Batang Kemena en route to Sibul from Bintulu, 03° 08' 32.3", 113° 03' 24.3", 15 Jul. 2006, P.C. Boyce et al. AR-1911 (SAR).

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

Ab omnibus speciebus generis ceteris combinatio caulibus longis repentibus valde robusti, petiolo ad apicem pulvinato, lamina foliorum pro ratione oblongo-elliptica vel ovato, in stato vivo aliquando abaxiali punctis pellucidis instructa distinguitur. Ab H. geniculata follis spiro-distichis, coriaciis (non chartaceis), sine staminodiis ad basin inflorescentia feminis et interstitio

quam inflorescentia mascula et femina plus late prompte distinguibilis est.
– **Typus:** Malaysia, Sarawak, Sarikei Division, Ulu Sarikei, 01° 55' 05.4", 111° 29' 35.8", 7 Dec 2005, *P.C. Boyce et al. AR-1583* (Holo, SAR). **Plates 5 & 6.**

Medium to moderately robust **herbs**, strongly aromatic (pine resin), evergreen, glabrous, to ca 50 cm tall. **Stem** pleionanthic, decumbent with apex erect, frequently creeping for several metres and branching laterally while still continuing a physiognomically unbranched primary axis, green, internodes to ca 1 cm long. **Leaves** ca 8-12 together, ca 5 per module, each module subtended by prophyll, up to ca 12 cm long; petiole terete, erect to decumbent, up to ca 30 cm long, pulvinate, ca 3-13 cm from lamina base, roots penetrating petiole bases, petioles green when fresh, matte, drying light brown, petiolar sheath to ca 14 cm long, ca 1/2 of petiole length, sheath convolute, initially persistent, eventually the whole sheath marcescent; lamina oblongo-lanceolate, sometimes oblongo-elliptic to ovate, 18-33 cm long x 6-15 cm wide, rather thinly coriaceous, matte mid-green adaxially, sometime the mid-rib paler (fresh), drying pale olive green, abaxially matte pale green, sometimes with conspicuous pellucid dots when fresh, very occasionally red (fresh), drying pale brown, base decurrent to truncate, tip obtuse, acuminate for ca 2 cm, thence, apiculate to ca 9 mm; midrib raised abaxially (fresh and dry), drying straw-coloured, adaxially flush with lamina, but slightly channelled towards the leaf base, ca 2.5 mm wide, with 6-9 primary lateral veins on each side, diverging at 45°-55° from the midrib, adaxially impressed (fresh), flush with lamina when dry, abaxially slightly raised (fresh and dry), curved towards the apex when near the margin, interprimary veins ca 1/2 width of the primary lateral veins, alternating irregularly with primaries, secondary venation rather obscure, striate; tertiary venation not visible, all veins drying in intermittent raised and flush strips especially when near to leaf margin, all veins running into intermarginal vein. **Inflorescences** 1-5 together, erect, each subtended by a prophyll up to ca 6.2 cm long, peduncle to ca 12-15 cm long x 1.5- 1.6 cm diam, yellowish green. **Spathe** ca 10.6 cm long, tightly furled prior to anthesis, loosening at female anthesis and yet further at male anthesis, lower spathe yellowish green to white at maturity, spathe limb white prior to and at anthesis, with apex and mucro pale green at anthesis; lower spathe narrowly ellipsoid, ca 3.5 cm long, weakly constricted at the junction of the spathe limb, the constriction coinciding with the lowermost fertile male flowers, spathe limb narrowly lanceolate, ca 7 cm long, mucronate to ca 7 mm long. **Spadix** shorter than the spathe, ca 8.3 cm long, stipitate, stipe ca 4.5 mm long, weakly dorso-ventrally flattened, obliquely inserted on peduncle; female zone ca 2.2 cm long x 6.5 mm wide, ca 1/4 length



Plate 5. *Homalomena pseudogeniculata* P.C.Boyce & S.Y.Wong. A. Overall plant; B. Pulvinate petioles; C. Declinate infructescences; D. Emerging inflorescence with distinctive mucro; E. Two synflorescences.



Plate 6. *Homalomena pseudogeniculata* P.C.Boyce & S.Y.Wong. A. Whole spadix, spathe removed, from alcohol collection; B. Close up of female and stipe; C. Detail of female/sterile interstice/male zone, note the interstice width exceeds that of the male and female zones; D. Male zone and spadix tip.

of spadix, weakly fusiform, **female flowers** densely arranged, ca 1.3 mm diam. x 1 mm tall, round-cylindrical, lower-most female flowers ca twice the size of fertile females, stigma exceeding the ovary, coherent to adjacent stigma, slightly raised, staminodes absent at the base of insertion, and female flowers with no associated interpistillar staminode, interstice zone wider in diameter than the rest zones, staminodes truncate, ca 1.5 mm wide, slightly overtopping the female flowers, male zone ca 4.8 cm long x 5.2 mm wide, ca $\frac{1}{2}$ length of spadix, cylindrical and tapering to a sharp end, distal and proximal most flowers apparently sterile, narrowing in the lower part coinciding with the constriction of the spathe; **male flowers** ca 3 mm x 1.6 mm, trapezoid, comprising (3)4-7 truncate stamens, overtopped by a large connective, seemingly fertile to the tip. **Infructescence** declinate, spathe

entirely persistent, lower spathe dark red, limb green, peduncle green. **Fruits and seeds** not observed.

Distribution: Borneo, endemic: Sarawak, Kuching, Sarikei, Kapit and Miri Divisions; Brunei.

Habitat: Always terrestrial mostly under full shade in deep soil on various substrates, frequently on shales, rarely on granite. 62 m – 600 m asl.

Notes: *Homalomena pseudogeniculata* is distinctive by its pulvinate petioles and remarkable decumbent-creeping stem giving rise to short leafy side shoots while maintaining a primary axis. Plants frequently occur growing down steep forested slopes giving the impression of several individual plants in a row but on investigation revealing a single creeping stem/rhizome with numerous short lateral branches.

Homalomena pseudogeniculata is the third pulvinate-petioled *Homalomena* species to be formally described. The first was *Homalomena geniculata* M.Hotta from which *H. pseudogeniculata* differs by spiro-distichous leaves, with coriaceous leaf laminae and overall, much more massive habit. *Homalomena pseudogeniculata* is further characterised by having laminae mostly oblongo-lanceolate, sometimes oblongo-elliptic to ovate, sometimes with conspicuous pellucid dots at abaxial surface when fresh, all veins drying in intermittent raised and flush strips especially those near the margins. Inflorescences of *H. pseudogeniculata* differ in lacking basal staminodes, the female flowers densely arranged and without associated interpistillar staminodes, and an interstice wider than the fertile zones. Interestingly both species have a decumbent rhizome-like stem and a predilection for growing down slopes. The pulvinus is at the petiole/lamina insertion in *H. geniculata*; mid-way along the petiole in *H. pseudogeniculata*.

The other currently recognized species with geniculate (pulvinate) petioles is the Sumateran endemic *H. elegantula* A.Hay, which differs from *H. pseudogeniculata*, among other characters, by hapaxanthic shoots, overall much smaller and less robust habit and smaller (1 cm long) spathes with only a very weak constriction between the limb and lower part.

A note on the application of the terms pulvinate and geniculate seems appropriate. Currently these terms are used interchangeably in the aroids to define a swelling or cushion-like structure, most often at the base or apex of a petiole; such a presence is frequently used to define several of the major generic divisions in the aroids, notably the subfamilies Pothoideae and Monsteroideae. In fact, numerous genera outside of these

families have some or all species with such structures. The strict definition of geniculate is bent as in a knee whereas that of pulvinate is a swelling or cushion. It is the latter definition that more accurately fits the situation in *H. pseudogeniculata*. A more detailed paper on these terms is being prepared by the first author.

Etymology: The specific epithet is coined from the superficial similarity of the leaves of this species to *H. geniculata* – hence *pseudo* – false.

Other specimens seen: SARAWAK: Kuching Division: Lundu, Gunung Gading, trail to Waterfall, trail above Batu Apek, 01° 41' 48.2", 109° 50' 20.5", 14 Dec 2006, *P.C. Boyce et al. AR-2064* (SAR); Kapit Division: Nanga Gaat, Rejang Wood Concession, stream below Camp Gahada, 01° 41' 49.4", 113° 26' 16.3", 15 Oct 2003, *P.C. Boyce & Jeland ak Kisai AR-141.1* (SAR); Nanga Gaat, Rejang Wood Concession, km 65 road to Camp Gahada, 01° 42' 01.1", 113° 31' 14.8", 12 May 2004, *P.C. Boyce et al. AR-363* (SAR); Nanga Gaat, Rejang Wood Concession, km 55 road to Camp Gahada, 01° 44' 44.5", 113° 28' 32.3", 13 May 2004, *P.C. Boyce et al. AR-385* (SAR); Nanga Gaat, Rejang Wood Concession, trail to water catchment behind main camp, 01° 53' 00.2", 113° 26' 53.9", 14 Dec 2004, *P.C. Boyce et al. AR-882* (SAR); Nanga Gaat, Rejang Wood Concession, km 65 road to Camp Gahada, 01° 41' 59.7", 113° 31' 13.7", 16 Dec 2004, *P.C. Boyce et al. AR-907* (SAR); Kapit, Pelagus, Pelagus Rapids, Woodpecker Trail, 02° 11' 15.1", 113° 03' 29.01", 14 Mar 2005, *P.C. Boyce et al. AR-1034* (SAR); Kapit, Belaga, Belaga road, 02° 43' 45.8", 113° 45' 37.1", 12 Oct 2005, *P.C. Boyce et al. AR-1455* (SAR); Kapit, Belaga, Belaga road, 02° 42' 55.9", 113° 45' 29.3", 12 Oct 2005, *P.C. Boyce et al. AR-1457* (SAR); Kapit, Belaga, Belaga road, 02° 42' 55.9", 113° 45' 29.3", 12 Oct 2005, *P.C. Boyce et al. AR-1461* (SAR + spirit); Kapit, Belaga, km 10 Bakun, Bintulu-Miri road junction, 02° 50' 51.7", 114° 01' 57.6", 11 Oct 2005, *P.C. Boyce et al. AR-1481* (SAR, + spirit); Miri Division: Mulu, Long Lama, Mulu N.P., Trail to Gunung Mulu Summit, 04° 02' 18.7", 114° 49' 44.2", 7 Aug 2006, *P.C. Boyce et al. AR-1955* (SAR); Mulu, Long Lama, Mulu N.P., Trail to Long Lansat, Sungai Licat, 04° 00' 03.5", 114° 48' 49.8", 9 Aug 2006, *P.C. Boyce et al. AR-1985* (SAR); Miri, Marudi, Sungai Silat Basin, Sungai Palutan, 02° 49.59', 115° 00.30', 25 Mar 2003, *Lim S.P. S.90424* (SAR). BRUNEI: Temburong District: Sungai Temburong at Kuala Belalong, banks of Sungai Belalong. 4°32'N, 225°9'E, 24 Jun 1989, *P.C. Boyce 431* (BRUN, K, L)

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

Ab allis Homalomenae borneensibus petiolis dimidium distalis eborinus cum

striae longitudinalis atrorubra vel atrochermesinus, petioli vagina brevissimo (usque ad 3 cm longa; ca 1/10 partem longitudinis petiolo), inflorescentiis pedunculis brevissimo brevissimo (usque ad 3 cm longa), mucro et marginae inflorescentiis chermesinus coloratus et connectivo antherae pubescenti differt. – **Typus:** Malaysia, Sarawak, Miri Division; Mulu, Long Lama, Mulu N.P., trail to Long Lansat, Sungai Licat, 04° 00' 03.5", 114° 48' 49.8", 9 Aug 2007, P.C. Boyce et al. AR-1988 (Holo, SAR+ spirit). **Plates 7 & 8.**

Medium to robust **herbs**, strongly aromatic (mango peel), evergreen, glabrous, to ca 100 cm tall. **Stem** pleionanthic, erect to ascending, ca 3 cm thick, green, internodes to ca 1 cm long. **Leaves** few, up to ca 8 together; petiole terete, erect to decumbent, 50-70 cm long, petiole bases clasping, petioles with the lower ½ green and upper ½ white with prominently striate-raised glossy dark to cherry red ridges, longer petioles tending to spread, and these with a somewhat weakly defined pulvinus-like articulation ca 25-35 cm long usually ca ½ way along petiole, both portions of petioles drying dark brown, petiolar sheath to ca 3 cm long, ca 1/10 of petiole length, equal at both side, sheath initially long-persistent, eventually the whole sheath marcescent; lamina broadly ovato-sagittate, 27-45 cm long x 22-36 cm wide, thinly leathery, glossy green adaxially (fresh), drying dark brown, abaxially pale green (fresh), glaucous, drying paler brown, base cordate, posterior lobes spreading, unequal, one side round (ca 5.4-8 cm long), shorter than subtriangular side (ca 5.7-11 cm long), lamina tip obtuse, short-acuminate for ca 2 cm, acuminate up to ca 2 cm, apiculate up to ca 1.8 mm; midrib raised abaxially (fresh and dry), drying dark brown, adaxially slightly channelled when fresh, flush with lamina when dry, ca 2-5 mm wide, with 8-10 primary lateral veins on each side, diverging at 40°-90° from the midrib, adaxially impressed (fresh), flush with lamina when dry, abaxially slightly raised (fresh and dry), drying dark brown, curved sharply towards the apex when near the margin, interprimary veins ca ½ width of the primary lateral veins, alternating irregularly with primaries, arising from the primary lateral veins near petiole insertion, but further up the lamina, arising from midrib, posterior lobes each with 2-4 primary lateral veins; secondary venation rather obscure, striate; tertiary venation not visible, all veins running into a thickened intermarginal vein. **Inflorescences** 1-4 together, erect, each subtended by prophyll, ca 3 cm long, marcescent, followed by cataphyll, marcescent, peduncle to ca 3 cm long x 3 mm diam. **Spathe** ca 12.8 cm long, tightly furled prior to anthesis, lower spathe inflating at female anthesis, spathe limb loosening at female anthesis, thense, inflating and then opening wide, lower spathe white prior to and at anthesis, spathe limb white prior to and during anthesis, with spathe tip, mucro and spathe



Plate 7. *Homalomena striatiepetiolata* P.C.Boyce & S.Y.Wong: A. Overall plant with decumbent petioles; B. Leaf lamina glossy green; C. Abaxial leaf lamina pale green with striate-raised ridges on petiole; D. Striking striate-raised ridges on petiole; E. Synflorescence with spathe mucro and margin stained striking cherry red, note the marcescent prophyll.



Plate 8. *Homalomena striatieopetiolata* P.C.Boyce & S.Y.Wong. A. Whole spadix, spathe removed, from alcohol collection; B. Close up of female/male zone transition; C. Detail of female zone; D. Male zone.

margin cherry red; lower spathe narrowly ellipsoid, ca 4.6 cm long, weakly constricted at the junction of the spathe limb, the constriction coinciding with the lower-most fertile male flowers, spathe limb narrowly lanceolate, ca 8.2 cm long, bluntly mucronate to ca 5 mm long. **Spadix** equalling the spathe, ca 12 cm long, shape, stipitate, stipe to ca 4.4 mm long, obliquely inserted on peduncle, obpyramidal, female zone ca 2.7 cm long x 9.5 mm wide, ca $\frac{1}{4}$ length of spadix, weakly fusiform, **female flowers** densely arranged, ca 1.5 mm diam. x 1.3 mm tall, squat-cylindrical, stigma exceeding the ovary, coherent to adjacent stigma, umbonate and weakly tetrasulcate, interpistillar staminodes clavate, on a very slender stipe, remaining pale brown in alcohol, ca 0.5 mm wide x 1.1 mm long, slightly overtopping the female flowers, lower most female flowers ca twice the size of fertile females mostly associated with two or more interpistillar staminodes and seemingly sterile, suprapistillar pistillodes in three rows and merging with the lower most **male flowers** these seemingly sterile, male zone ca 8 cm long x 7.7 mm wide, ca $\frac{2}{3}$ length of spadix, very weakly fusiform and

minutely pubescent, distal and proximal most flowers apparently sterile, narrowing in the lower part coinciding with the constriction of the spathe and there intergrading with staminodes, male flowers, ca 3 mm x 1.6 mm trapezoid comprising (3)-4 truncate stamens each overtopped by a large, minutely pubescent, connective. **Infructescence** unknown.

Distribution: Sarawak, Miri Division. Known only from the type locality.

Habitat: Terrestrial under full shade on seasonally inundated alluvium and shale mud banks mostly in deep soil of riverine forest. 32-60 m asl.

Notes: *Homalomena striatieopetiolata* is immediately distinctive by the distal half of the petioles white with dark to cherry red striate-raised glossy longitudinal ridges; in this feature it is one of the most attractive *Homalomena* species yet described. Plants individually carry few leaves, normally ca 8 together, with these tending to spread. Other notable features include the very short petiolar sheath (ca 3 cm, ca $\frac{1}{10}$ of petiole length), leaf laminae with distinctly oblique base, one round posterior lobe and one subtriangular, the very short, peduncle (ca 3 cm) and the spathe mucro and margins are stained cherry red when fresh. The minutely pubescent connective of the male flowers is noteworthy.

Etymology: The specific epithet alludes to the strikingly striate petioles.

Other specimens seen: Miri Division: Mulu, Long Lama, Mulu N.P., Trail to Deer Cave, 04° 02' 23.8", 114° 48' 54.6", 5 Aug 2007, *P.C. Boyce et al. AR-1936* (SAR); Mulu, Long Lama, Mulu N.P., Trail to Deer Cave, 04° 02' 02.0", 114° 49' 00.0", 6 Aug 2007, *P.C. Boyce et al. AR-1945* (SAR).

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References

- Alderwerelt van Rosenburgh, C.R.W.K. van. 1922a. New or noteworthy Malayan Araceae II. *Bulletin du jardin botanique de Buitenzorg* **3**: 163-229.
- Alderwerelt van Rosenburgh, C.R.W.K. van. 1922b. New or noteworthy Malayan Araceae III. *Bulletin du jardin botanique de Buitenzorg* **3**: 320-347.
- Boyce, P.C. 1994. New species of Araceae from Brunei. *Kew Bulletin* **49**: 793-801.
- Boyce, P.C. 2000a. The genus *Rhaphidophora* Hassk. (Araceae-Monsteroideae-Monstereae) in the southern and western Indonesian archipelago. *Gardens' Bulletin Singapore* **52**: 101-183.
- Boyce, P.C. 2000b. The genus *Rhaphidophora* Hassk. (Araceae-Monsteroideae-Monstereae) in the Philippines. *Gardens' Bulletin Singapore* **52**: 213-256.
- Boyce, P.C. 2000c. The genus *Pothos* (Araceae: Pothoideae: Potheae) of Thailand and Indochina. *Blumea* **45**: 147-204.
- Boyce, P.C. 2001a. The genus *Rhaphidophora* Hassk. (Araceae-Monsteroideae-Monstereae) in Borneo. *Gardens' Bulletin Singapore* **53**: 19-74.
- Boyce, P.C. 2001b. The genus *Rhaphidophora* Hassk. (Araceae-Monsteroideae-Monstereae) in New Guinea, Australia and the tropical western Pacific. *Gardens' Bulletin Singapore* **53**: 75-183.
- Boyce, P.C. and A. Hay. 2001. A taxonomic revision of Araceae tribe Potheae (*Pothos*, *Pothoidium* and *Pedicellarum*) for Malesia, Australia and the tropical Western Pacific. *Telopea* **9**: 449-571.

- Christensen, H. 2002. *Ethnobotany of the Iban & the Kelabit*. Forest Department Sarawak, Malaysia, NEPCon Denmark & University of Aarhus, Denmark. 384 pp.
- Engler, A. and K. Krause. 1912. *Homalomena*, pp. 25–81. In: A. Engler (ed.), *Das Pflanzenreich*, IV (Heft 55.) (Araceae-Philodendroideae-Philodendreae, [I]: Allgemeiner Teil, Homalomeninae und Schismatoglottidinae). Leipzig.
- Furtado, C.X. 1939. Notes on some Indo-Malaysian *Homalomena* species. *Gardens' Bulletin Straits Settlement* **10**: 183–238.
- Furtado, C.X. 1940 (published 1941). The variability and distribution of the Indo-Malaysian species of *Homalomena*. *Proceedings of 6th Pacific Science Congress (California, 1939)* **4**: 577-578.
- Hay, A. and R. Wise. 1991. The genus *Alocasia* (Araceae) in Australasia. *Blumea* **35**: 499-545
- Hay, A. 1998. The genus *Alocasia* (Araceae-Colocasieae) in West Malesia and Sulawesi. *Gardens's Bulletin Singapore* **50**: 221-334.
- Hay, A. 1999. A revision of *Homalomena* (Araceae-Homalomeneae) in New Guinea, the Bismarck Archipelago and Solomon Islands. *Blumea* **44**: 41-71.
- Hay, A. and C. Herscovitch. 2002. Two Remarkable New West Malesian *Homalomena* (Araceae) Species. *Gardens' Bulletin Singapore* **54**: 171-178.
- Hay, A. and Yuzammi. 2000. Schismatoglottideae in Malesia I – *Schismatoglottis*. *Telopea* **9**: 1-178.
- Hotta, M. 1967. Notes on Bornean plants, II. *Acta Phytotaxonomica Geobotanica* **22**: 153-162.
- Hotta, M. 1985. New species of the genus *Homalomena* (Araceae) from Sumatra with a short note on the genus *Furtadoa*. *Gardens' Bulletin Singapore* **38**: 43-54.

- Hotta, M. 1986. Species list and cited specimens of the genus *Homalomena* (Araceae) in Malesia, pp. 73-120. In: Hotta, M. (ed.), *Diversity and Dynamics of Plant Life in Sumatra*. Sumatra Nature Study (Botany), Kyoto University.
- Hotta, M. 1993. *Homalomena monandra*, a new species of aroid from West Sumatra. *Acta Phytotaxonomica Geobotanica* **44**(2): 93-96.
- Merrill, E.D. 1921. Araceae, pp. 86-109. In: Bibliographic Enumeration of Bornean P1. *Journal of Straits Branch Royal Asiatic Society* (Special edition, September 1921).
- Miquel, F.A.W. 1856a. *Flora van Nederlandsch Indië*. **vol. 3**. Van der Post, Amsterdam.
- Miquel, F.A.W. 1856b. *Orontiaceae, Aroideae*, pp. 148-153. In: W.H. de Vriese, *Plantae Indiae Batiae Orientalis*. Brill, Leiden.
- Ridley, H.N. 1905. The Aroids of Borneo. *Journal of Straits Branch Royal Asiatic Society* **41**: 169-188.
- Schott, H.W. 1860. *Prodromus Systematis Aroidearum. Typis congregationis mechitharisticae*, Vienna. 602 pp.
- Sulaiman, B. and P.C. Boyce. 2005. A remarkable new species of *Homalomena* (Araceae: Homalomeneae) from Peninsular Malaysia. *Gardens' Bulletin Singapore* **57**: 7-11.