

Studies on Homalomeneae (Araceae) of Borneo VIII: Delimitation of additional informal suprageneric taxa for Sundaic *Homalomena*

NG KIAW KIAW¹, SOFIMAN OTHMAN¹, PETER C. BOYCE¹, WONG SIN YENG²

¹ Pusat Pengajian Sains Kajihayat [School of Biological Sciences]
Universiti Sains Malaysia - 11800 USM, Pulau Pinang, Malaysia

² Department of Plant Science & Environmental Ecology, Faculty of Resource Science & Technology
Universiti Malaysia Sarawak - 94300 Kota Samarahan, Sarawak, Malaysia

Accepted 21 February 2011

Studi sulle Homalomeneae (Araceae) del Borneo VIII: delimitazione e ulteriori taxa informali per il genere Homalomena del Borneo — Viene proposto un complesso di taxa costituito da un supergruppo con otto specie informali per il genere *Homalomena* (Araceae: Homalomeneae) per l'area del Borneo. Le caratteristiche differenziali sono enumerate, illustrate, e supportate da chiavi analitiche relative ai gruppi suggeriti.

Key words: *Araceae*, *Homalomena*, informal taxa, Sunda, Borneo.

Earlier papers of this series (Boyce & Wong, 2008; Boyce & Wong 2009; Boyce, Wong & Fasihuddin, 2010) highlighted *Homalomena* Schott to be by far the largest, taxonomically most complex and least well understood aroid genus in tropical Asia. Recent estimates for the size of the genus have ranged from ca 150 species (Hay, 1999) to ca 300 species (Tung, Wong & Boyce, 2010), however continuing fieldwork in Borneo, a recently initiated field programme in Peninsular Malaysia (Baharuddin & Boyce, 2010a,b), and examination of the exceptionally rich herbarium collections of Herbarium Bogoriense (BO) and Leiden (L) force us now to estimate that *Homalomena* comprises somewhat in excess of 500 species, making it the third-largest genus of the family after *Anthurium* Schott and *Philodendron* Schott. Furthermore the majority of *Homalomena* species have yet to be formally described.

A genus of such magnitude lacking a comprehensive recent taxonomic account is extremely unwieldy, the more so given the considerable percentage of taxonomic novelties. To provide more manageable taxonomic units from which to tackle the fine taxonomy, Boyce & Wong

(2008) circumscribed three somewhat coarsely-delimited informal Supergroups (Homalomena, Chamaecladon, and Cyrtocladon). Subsequently, it has become apparent that a cluster of species centred on *H. punctulata* Engl. are not comfortably accommodated by any of these Supergroups. To rectify this we are here adding a fourth informal Supergroup: Geniculata, corresponding very approximately to Hotta's Section *Geniculatae* (see Hotta, 1967). Boyce & Wong (2008) subsumed *Geniculatae* in to the Cyrtocladon Supergroup, but it is now apparent that this was too hasty. The four Supergroups are defined morphologically as per the following key.

Notes on morphologies

Posterior lobe definition follows Mayo, Bogner & Boyce (1997, p. 8, Fig. 6) while the leaf blade shapes are based upon the largest leaf on a flowering plant.

The lower spathe – upper spathe length comparisons are taken from inflorescences at anthesis.

Key to Supergroups of *Homalomena* in Sunda

- 1a. Leaf blade usually with pronounced posterior lobes, blade base cordiform to sagittate, if posterior lobes reduced then blade base at least broadly truncate. Staminate flowers each comprising 3-4 (rarely 5-6, very rarely 1) stamens united by a conspicuous common connective (Fig. 3E) 2
- 1b. Leaf blade lacking pronounced posterior lobes, base ovate, acute or decurrent. Staminate flowers either each comprising 2-3 stamens not united by a common connective *or* with 4 stamens united by a conspicuous common connective 3
- 2a. Spathe divided by a moderate to pronounced constriction into a well-defined upper (limb) and a lower portion (Fig. 2C). Inflorescences during anthesis with complex spathe and spadix movements and often spadix elongation **Cyrtocladon**
- 2b. Spathe not divided into a lower and upper portion by a constriction (Fig. 2B). Inflorescence movement during anthesis comprising simple gaping and closing of the spathe limb, with virtually no spadix movement **Homalomena**
- 3a. Spathe at most 1.5cm long, often much less, without a constriction (Fig. 2A). Staminate flowers each comprising 2-3 stamens not united by a common connective (Figs. 3B, C). Pistillate flower zone with interpistillar staminodes. Ovary 2-3 locular. Mostly small plants and often rheophytic **Chamaecladon**
- 3b. Spathe more than 2cm long, divided into an upper and lower portion by a weak or moderate constriction (Fig. 2E). Staminate flowers each comprising 3-4 stamens. Pistillate flower zone without interpistillar staminodes (Fig. 3G). Ovary 4-locular. Medium-sized plants, never rheophytic **Geniculata**

As work progresses, additional, more finely defined morphotaxa become apparent. While formal recognition of all nascent higher taxa awaits phylogenetic analyses, it is nonetheless useful to assign them a nomenclature to provide convenient tools for discussing and comparing the groups of taxa they comprise. To this end we are here proposing eight species' complexes.

The use of terms 'Supergroup' and 'Complex' intentionally implies a hierarchical distinction between these informal taxa that will later enable nesting as necessary within Supergroup-subordinate as yet undefined 'Groups'.

It should be noted that the informal taxa here proposed by no means account for all *Homalomena* species in Sunda. In particular, virtually none of the predominantly continental Asian *Homalomena* Supergroup has been assigned to a Complex.

Neotropical *Homalomena* species are intentionally excluded; they are currently the subject of combined molecular and morphological study by Croat and co-workers (Croat, *pers comm.*)

Homalomena Supergroup

Expedita Complex

Stoloniferous colonial helophytes. *Inflorescences* solitary or paired. *Spadix* with a conspicuous naked interstice separating the staminate and pistillate flower zones (Fig. 3A), and interpistillar staminodes absent.

Typical Species: Homalomena expedita A.Hay & Hersh.

DISTRIBUTION: A single species currently considered endemic in N Borneo, but with circumstantial evidence (plants frequently cultivated as ornamentals in rural kampongs) that it may also be present in Peninsular Malaysia and southernmost peninsular Thailand.

Selaburensis Complex

Mesophytic solitary or clumping herbs. *Petioles* minutely scabriusculus. *Leaf blade* abaxially with numerous conspicuous pellucid vein-like glands running parallel to the primary lateral veins. *Inflorescences* paired.

Typical Species: Homalomena selaburensis ined.

DISTRIBUTION: All but one of the six so far identified species is restricted to Borneo.

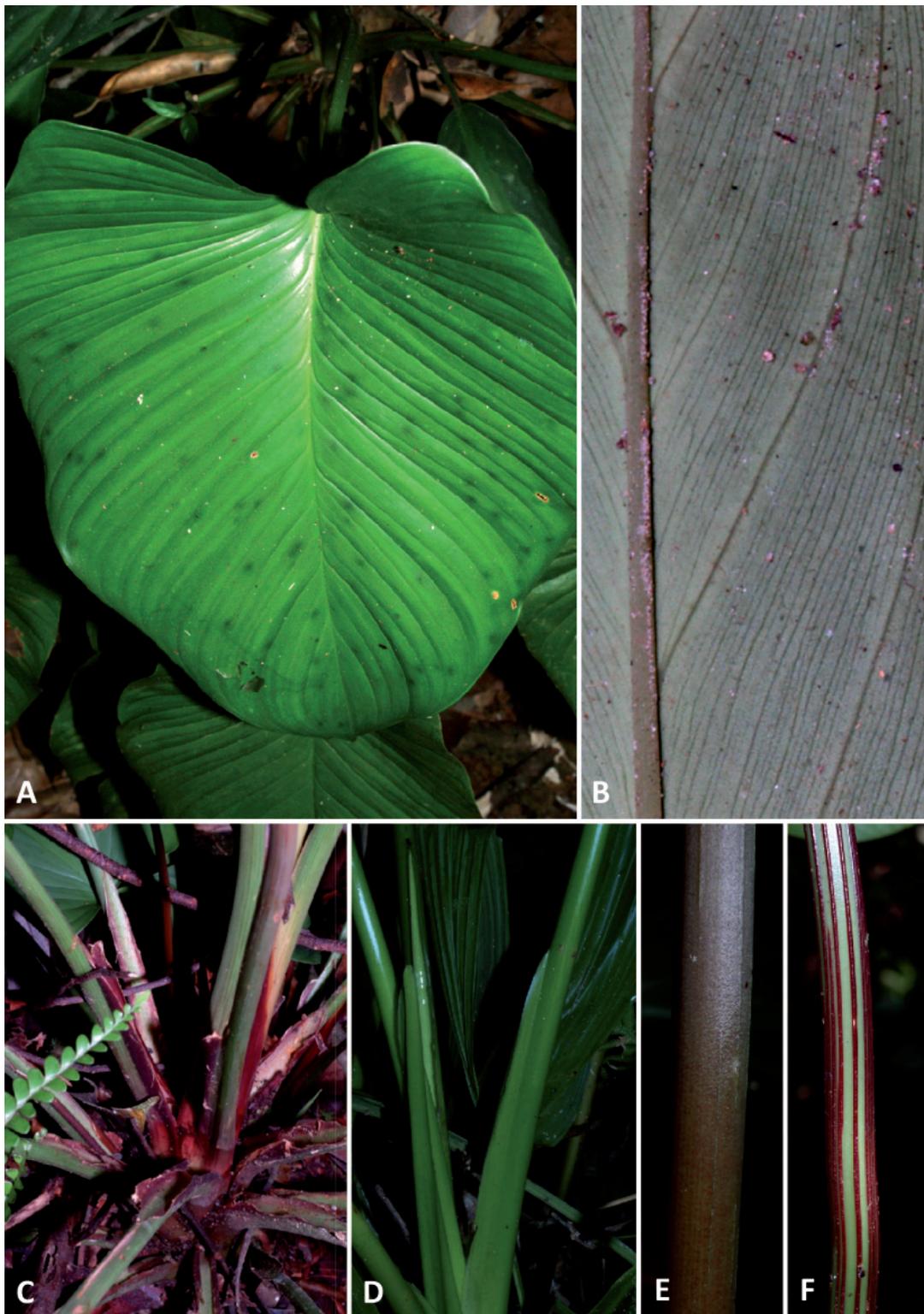


Fig. 1 – Vegetative Morphologies. A. Leaf blade with punctate glands (Hanneae Complex). B. Leaf blade showing vein-line pellucid glands (Havilandii Complex). C. Marcescent petiolar sheath. Note too that the red petiolar sheaths contrast to the green petioles (Hanneae Complex). D. Persistent petiolar sheath (Giamensis Complex). E & F. Petioles with longitudinal raised striae (Hanneae Complex). A & C. *Homalomena hanneae* (AR-2543); B. *Homalomena sp. nov.* (AR-1541); D. *Homalomena giamensis* (AR-1691); E. *Homalomena sp. nov.* (AR-2136); *Homalomena striatepetiolata* (AR-1936). Images © P.C.Boyce.



Fig. 2 – Inflorescence Morphologies. A. Inflorescence at female anthesis (Chamaecladon Supergroup). Scale bar = 1 cm. B. Inflorescence at female anthesis (Homalomena Supergroup). Scale bar = 3 cm. C. Inflorescence at male anthesis. Note strong constriction between the lower and upper spathe, the spathe limb length exceeding that of the lower spathe, and the resin droplets on the staminate flower zone (Cyrtocladon Supergroup: Hanneae Complex). D. Inflorescence at female anthesis. Note strong constriction between the lower and upper spathe, and the lower spathe length exceeding that of the spathe limb (Cyrtocladon Supergroup: Giamensis Complex). E. Inflorescence at female anthesis. Note weak constriction between the lower and upper spathe, and the lower spathe length equalling that of the spathe limb (Geniculata Supergroup). F. Inflorescences from the same plant at male (left) and female (right) anthesis. Note the changes in spathe colour and shape that occurs during anthesis. A. *Homalomena paucinervia* (AR-2121); B. *Homalomena expedita* (AR-211); C. *Homalomena hanneae* (AR-2543); D. *Homalomena giamensis* (AR-1691); E. *Homalomena punctulata* (AR-2127); F. *Homalomena* sp. nov. (AR-1782). Images © P.C.Boyce.

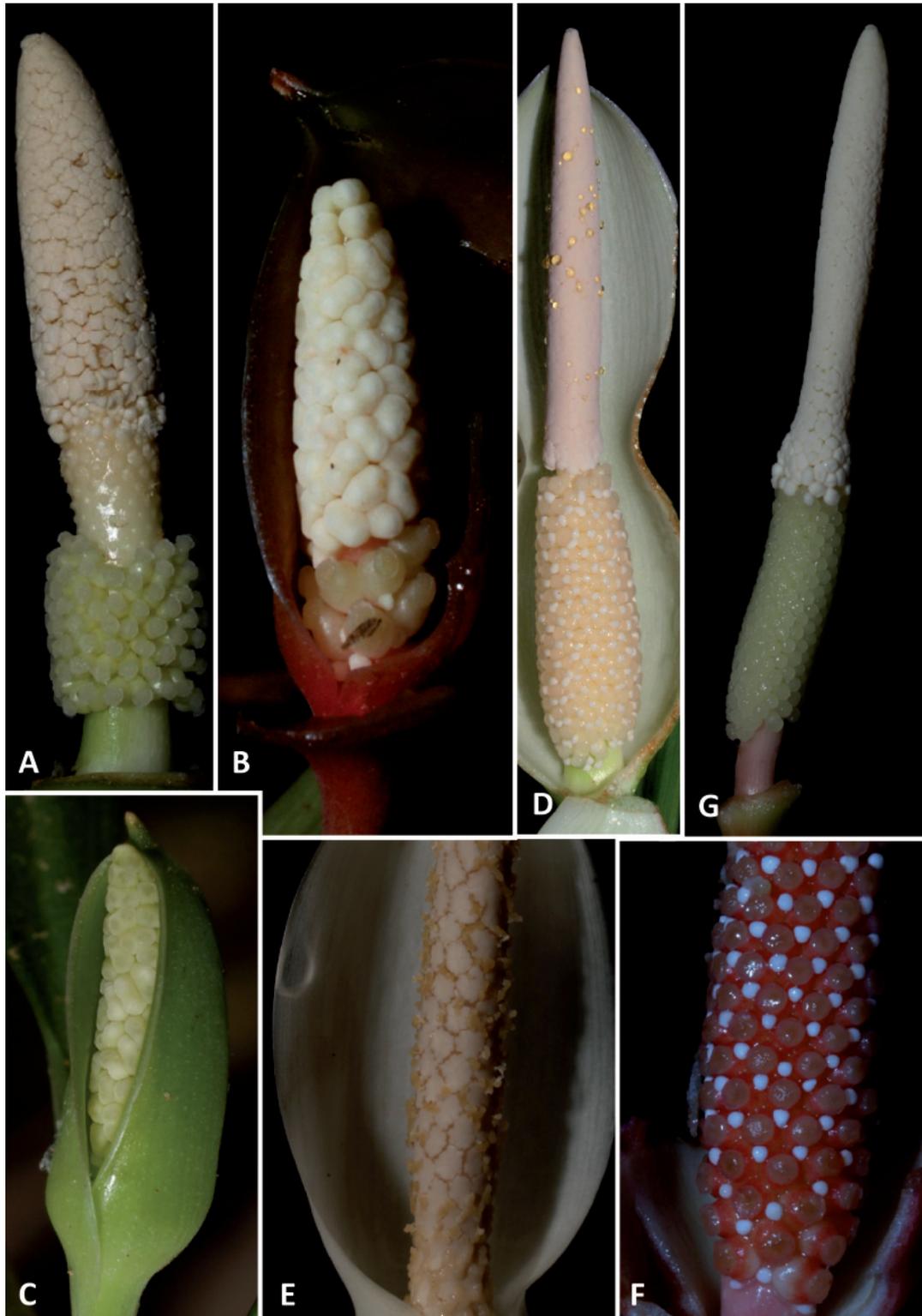


Fig. 3 – Spadix Morphologies. A. Expedita Complex. Note the conspicuous naked interstice separating the staminate and pistillate flower zones, absence of interstillar staminodes. B & C. Chamaecladon Supergroup. Note each flower comprises two stamens and that the connective is inconspicuous. D-F. Cyrtocladon Supergroup: Hanneae Complex. Note the resin droplets on the staminate flower zone (D: female anthesis), the conspicuous interstillar staminodes, and that each staminate flower is overtopped by a conspicuous synconnective (E: male anthesis). G. Geniculata Supergroup. Note the pistillate flower zone lacks interstillar staminodes. A. *Homalomena expedita* (AR-211); B. *Homalomena atrox* (AR-2375); C. *Homalomena paucinervia* (AR-2121); D & E. *Homalomena hanneae* (AR-2543); F. *Homalomena* sp. nov. (AR-1782); G. *Homalomena punctulata* (AR-2127). Images © P.C.Boyce.

Cyrtocladon Supergroup

Borneensis Complex

Mesophytic solitary or clumping herbs. *Petiolar sheath* margins eventually marcescent. *Leaf blade* with little or no posterior lobe development, and base broadly truncate, stiffly leathery. often adaxially matte medium green, and weakly glaucous abaxially; *primary lateral veins* rather few. *Lower spathe* longer than *spathe limb*.

Typical Species: Homalomena borneensis Ridl.

DISTRIBUTION: Currently five assigned species; all restricted to Borneo.

Giamensis Complex

Mesophytic solitary herbs. *Petiolar sheath* persistent (Pl. 1D). *Leaf blade* rather rubbery, cordiform, glossy bright green. *Primary lateral veins* rather few. *Lower spathe* longer than *spathe limb* (Fig. 2D). *Staminate flower zone* producing amber-coloured resin droplets. *Fruiting spathe* remaining green.

Typical Species: Homalomena giamensis L.S.Tung, S.Y.Wong & P.C.Boyce

DISTRIBUTION: Currently ca. 8 species, all novel, all restricted to Borneo.

Hanneae Complex

Mesophytic solitary to clumping herbs. *Petiole* with conspicuous longitudinal raised striae, these often contrastingly coloured (Figs. 1E, 1F); *petiolar sheath* red (or at least conspicuously darker than the petiole in melanistic plants), with soon-marcescent margins (Fig. 1D). *Leaf blade* cordate-sagittate, thinly leathery, semi-glossy dark to medium green, adaxially with scattered conspicuous punctate glands (? extraflora nectaries - Fig. 1A); *primary lateral veins* adaxially impressed and the blade appearing strongly quilted.

Spathe limb length exceeding the *lower spathe*. *Staminate flower zone* producing amber resin droplets at anthesis (Figs. 2C, 3D). *Pistillate flower zone* with interpellillar staminodes. *Spathe* turning pink during anthesis (Fig. 2F) and red as fruits develop.

Typical Species: Homalomena hanneae P.C.Boyce & S.Y.Wong

DISTRIBUTION: At least 100 species; the majority novel, many restricted to Borneo, but at least three new species in Peninsular Malaysia.

Havilandii Complex

Mesophytic lithophytes with conspicuous erect epigeal stems. *Leaf blade* lacking posterior lobes, base broadly truncate, abaxially with conspicuous pellucid striate vein-like glands (Fig. 1B) running parallel to the primary lateral veins.

Typical Species: Homalomena havilandii Ridl.

DISTRIBUTION: About 5 species, all but one new; all restricted to Borneo.

Insignis Complex

Loosely clumping mesophytic herbs; *stem* hypogaeal. *Leaf blade* oblong to oblong-elliptic, rather softly leathery. *Lower spathe* equalling upper spathe. *Pistillate flower zone* without interpellillar staminodes.

Typical Species: Homalomena insignis N.E.Br.

DISTRIBUTION: One widespread species (with an extensive synonymy – Wong & Boyce, in prep.) and one (*H. gillii* Furtado) locally endemic, both restricted to Borneo.

Rostrata complex

Stoloniferous colonial helophytes.

Typical Species: Homalomena rostrata Griff.

DISTRIBUTION: 1 species widespread in Sunda.

Key to species complexes

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 1a. Stoloniferous colonial helophytes | 2 |
| 1b. Solitary or clumping terrestrial or lithophytic mesophytes | 3 |
| | |
| 2a. 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 |
| 2b. Spathe divided into a lower and upper portion by a constriction. Staminate and pistillate flower zones contiguous | Rostrata Complex |

- 3a. Spathe not divided into a lower and upper portion by a constriction **Selaburensis Complex**
 3b. Spathe divided by a weak to pronounced constriction into a well-defined upper (limb) and a lower portion 4
- 4a. Leaf blade abaxially with conspicuous pellucid striate vein-like glands running parallel to the primary lateral veins **Havilandii complex**
 4b. Leaf blade without pellucid striate vein-like glands 5
- 5a. Lower spathe longer than spathe limb 6
 5b. Spathe limb longer than or equalling lower spathe 7
- 6a. Petiolar sheath persistent. Leaf blade cordiform, rather rubbery, glossy bright green, abaxially very slightly paler. Staminate flower zone producing amber-coloured resin droplets **Giamensis complex**
 6b. Petiolar sheath margins eventually marcescent. Leaf blade stiffly leathery, with little or no posterior lobe development, and base broadly truncate, often adaxially matte medium green, and weakly glaucous abaxially. Staminate flower zone not producing resin droplets **Borneensis Complex**
- 7a. Stem epigeal. Leaf blade cordate-sagittate, quilted, adaxially with scattered conspicuous punctate glands. Petiolar sheath red (or at least darker than petiole), margins soon marcescent (observe leaf immediately below flowering event). Lower spathe shorter than upper spathe. Spathe turning pink during anthesis. Staminate flower zone producing amber-coloured resin droplets. Interpistillar staminodes present **Hanneae Complex**
 7b. Stem hypogeal. Leaf blade oblong to oblong-elliptic, not quilted, lacking punctate glands. Petiolar sheath the same colour as the petiole, persistent. Lower spathe equalling upper spathe. Spathe remaining white during anthesis. Staminate flower zone without resin. Interpistillar staminodes absent **Insignis Complex**

Acknowledgements

The first author's research and fieldwork in Peninsular Malaysia was supported by a Research University Grant 1001/PBIOLOGI/811132 from the Universiti Sains Malaysia, Penang. The first author is also grateful for financial support supplied by a USM Fellowship. Study visits to the herbaria mentioned in this paper were funded under the final author's ITTO Fellowship (Ref. 026/09A). Thanks

are extended to the Directors or Curators of FI, K, L, M and BO for allowing access to the material, and to their staff for kindly facilitating observations. Research and fieldwork in Borneo was funded by MOSTI E-Science: 05-01-09-SF0006, under Sarawak Forestry Department Research Permit No. NPW.907.4.4(V)-77 & Park Permit No. 34/2009. The continuing collaboration and support of the Forest Department Sarawak and Sarawak Forestry Corporation are gratefully acknowledged.

REFERENCES

- BAHARUDDIN S. & BOYCE P.C., 2010a – *Studies on Homalomeneae (Araceae) of Peninsular Malaysia I: Homalomena asmae, a new species from Perak*. Acta Phytotax. Geobot. 60(3): 163-166.
- BAHARUDDIN S. & BOYCE P.C., 2010b – *Studies on Homalomeneae (Araceae) of Borneo V: A new species and new super-group record of Homalomena from Sabah, Malaysian Borneo*. Tropical Life Sciences Research 21(2): 89-94.
- BOYCE P.C. & WONG S.Y., 2008 – *Studies on Homalomeneae (Araceae) of Borneo I: Four new species and speculation on informal species groups in Sarawak*. Gardens' Bull. Sing. 60(1): 1-29.
- BOYCE P.C. & WONG S.Y., 2009 – *Studies on Homalomeneae (Araceae) of Borneo IV: Homalomena specimens in the Herbarium Beccarianum-Malesia (FI-B) of the Museo di Storia Naturale - Sezione Botanica "F. Parlatore" dell'Università di Firenze*. Webbia 64(2): 169-173.
- BOYCE P.C., WONG S.Y. & FASIHUDDIN B.A., 2010 – *Studies on Homalomeneae (Araceae) of Borneo II: The Homalomena of Nanga Sumpa (Batang Ai) - Novel & pre-existing taxa, and notes on Iban Usages*. Gardens' Bull. Sing. 61(2): 269-317.

- HAY A. 1999 – *A revision of Homalomena (Araceae-Homalomeneae) in New Guinea, the Bismarck Archipelago and Solomon Islands*. Blumea 44: 41-71.
- HOTTA M. 1967 – *Notes on Bornean plants, II*. Acta Phytotax. Geobot. 22: 153-162.
- MAYO S.J., BOGNER J. & BOYCE P.C., 1997 – *The Genera of Araceae*. The Trustees, Royal Botanic Gardens, Kew, UK.
- TUNG L.S., WONG S.Y. & BOYCE P.C., 2010 – *Studies on Homalomeneae (Araceae) of Borneo VI: Homalomena giamensis, a new species from Sarawak, Malaysian Borneo, with notes on its pollination*. Aroideana 33: 201-211.

Summary: One new informal Supergroup and eight informal species' Complexes are proposed for Sundaic *Homalomena* (Araceae: Homalomeneae). Defining characters are enumerated and illustrated, and keys to all informal groups provided.