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Studies on *Hanguana* (Commelinales: Hanguanaceae) for Sunda IV: *Hanguana major* clarified, a new species from Sarawak, Malaysian Borneo, and description of male reproductive organs in *H. bakoensis*

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Summary. *Hanguana major* Airy Shaw, a highly distinctive but hitherto taxonomically confused species is re-delimited and shown to be restricted to a highland area centred on Gunung Kinabalu, Sabah, with a single collection from the highlands of Limbang, Sarawak. Airy Shaw's original Latin description is amended to omit spurious morphological data, and is presented in English. One element of the plate accompanying the original publication, determined by Airy Shaw as *Hanguana malayana* (Jack) Merr., is described as a novel species: *H. loi* Mohd Fahmi, Sofiman Othman & P. C. Boyce, endemic to SW Sarawak. A key to the described Bornean *Hanguana* species is provided; *H. major* and *H. loi* are illustrated. Lastly, the hitherto unknown male inflorescences and flowers of *H. bakoensis* Siti Nurfazilah, Sofiman Othman & P. C. Boyce are described.

Key Words. Borneo, endemic, Sabah.

Introduction

Previous papers of this series (Siti Nurfazilah *et al.* 2010, 2011) have highlighted the exceptionally poor species taxonomy which has long beset Sundaic *Hanguana*. In summary, the name *H. malayana* (Jack) Merr. (applicable only to a colonial helophytic species widespread in tropical Asia) has almost universally been applied to any *Hanguana* species regardless of ecology or morphology. The result is that a morphologically and ecologically well-defined species has been subsumed into morass of artificial taxonomic confusion and, furthermore, a considerable number of novel species has escaped detection. A notable exception to this taxonomic obfuscation was the recognition and publication of *Hanguana major* (Airy Shaw 1981). However, even this useful contribution is not without its complications. To begin with, Airy Shaw's species description includes morphological data harvested from 14 collections, of which only seven are actually referable to *H. major*.

As discussed by Siti Nurfazilah *et al.* (2011) there exists for *Hanguana* a suite of taxonomically significant morphologies, of which fruit size, shape, colour at ripeness, stigma morphology, and ecology, are of particular importance. On this basis, material included in Airy Shaw's species description falls into three distinct groups. One of these, comprising highland plants with large lageniform fruits with spreading stigma lobes, includes the type of *H. major* (*Chew & Corner* RSNB4233), together with *Ampon & Saikah* SAN71825, *Chew, Corner & Stainton* 299 & 2882, *Clemens & Clemens* 26035, all from Sabah; and one Sarawak collection (*Tong & Paie* S32759). A second, heterogeneous, group comprises plants mainly from low altitude and on a variety of ecologies, including ultrabasics, with small spherical fruits; the third group consists of a single lowland individual that while superficially similar to *H. major* differs in the shape of the fruit and stigma lobe morphology. The second and third groups together consist of seven collections, as detailed here. Four (*Chew, Corner & Stainton* 1715, *Clemens & Clemens* 30687 and *Clemens* 11108, and *Sam* 49860) belong to two undescribed species, of which one, represented by the first three cited specimens, is seemingly restricted to ultrabasic soils. Unfortunately none of this material is sufficient to enable description. The remaining thee collections (*Clemens & Clemens* 27575 = 29815, *Price* 147, and *Aban & Saikeh* SAN79389) are each too fragmentary to enable determination, although we are confident that none is conspecific with *H. major*.

The lowland collection (*Sam* 49860) cited by Airy Shaw from Sandakan (c. 180 km SE of Kinabalu), while superficially similar to *Hanguana major*, has ellipsoid, not lageniform fruits, and further differs by the rhizome with very dense fibrous leaf remains, the smaller clusters of fruits, and the sharply pointed erect, short stigma lobes. This appears to represent an additional new species, but further field observations and collections are required.

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An additional problem with the *Hanguana major* paper concerns the identity of element 'C' of the accompanying plate (Airy Shaw 1981: 820). Identified in the paper as *Hanguana malayana* (Jack) Merr. and included to demonstrate differences between *H. major* and the (at the time) only other accepted *Hanguana* species, element 'C' is in fact an undescribed species endemic to SW Sarawak. It is described below as *H. loi*, based on recently observed living plants with *Chai* S34089 nominated as the type. All so-far described Bornean *Hanguana* are keyed out below.

Removal of the data that the above specimens provide from the description of *Hanguana major* permitted the revised description below to be generated.

Hanguana major *Airy Shaw*, (Airy Shaw 1981: 819). Type: Malaysia, Sabah, [Bahagian Pantai Barat] Kota Belud, Mesilau river, 1,524 m [5,000 ft], 5 Feb. 1964, *Chew & Corner* RSNB4233 (holotype K!). Fig. 1.

Solitary, somewhat robust herbaceous, dioecious mesophyte to c. 1.2 m tall; *stem* not completely known, but probably (based on available material) a stout rhizome; *Leaves* about 6 together, semi-spreading, to 1.3 m long, expanded bases loosely imbricate; *leaf blade* to 60 – 90 × 8 – 10 cm, oblanceolate to narrowly elliptic, base long-decurrent, tip caudate-acuminate; semi-glossy adaxially, abaxially loosely flocculose-pilose and more or less glabrescent with age; *pseudopetiole* to 30 – 40 × c. 1.5 cm wide, accounting for nearly $^1/_3$ the entire leaf length, shallowly channelled, the margins sharp; *petiole* pronounced, the sheath margins wide, ovate, c. 4 cm on each side, glossy, drying medium brown, leaf tip attenuate; midrib somewhat prominently round-raised abaxially, c. 3 mm wide, drying, especially in the lower $^2/_3$ of the leaf blade, distally almost flush, mid-rib drying shallowly channelled for c. $^2/_3$ of the blade, flush distally adaxially and all other venation prominent minutely tessellate-striate in most specimens. *Female and male inflorescences* not observed, although based on fruiting material and observations of inflorescence architecture female inflorescences almost certainly erect at anthesis. *Infructescences* erect, thyrsoid-paniculate, not or only just exceeding the leaves, comprising up to 6 thyrsoid partial infructescences plus a terminal spike; *peduncle and scape* together to 1.2 m tall, conspicuously reddish brown-floccose, visible portion of peduncle to 25 cm long, with the start of fertile scape marked by a foliaceous, sterile, persistent narrowly to rather broadly lanceolate bract, narrow morphs with base decurrent, wider morphs with base clawed, apex long-attenuate; *partial infructescences* c. 6, in total the whole c. 15 × 8 cm, each subtended by a very narrowly triangular bract, these diminishing in size distally along the infructescence, the largest c. 15 × 6 cm, the smallest 1 cm × 3 mm, all infructescence bracts drying pale straw-coloured; partial infructescences each comprising 1 – 3 branches, arising simultaneously from the axil of the subtending bract, median branches c. 5 cm long, lateral branches up 3 cm long, both 1 – 1.5 mm wide, ascending. *Female flowers* dense, mainly on the distal portions of the branches; flowers sessile, each with an associated minute bracteole; *perianth* of 6 tepals, outermost 3 – 4 × c. 4 mm, ovate with the margins scarious, inner tepals c. 2.5 × 2 mm, ovate, tepals clasping the base of the fruit; *staminodia* not observed; *Fruits* lageniform, c. 2 × 1.5 cm, ripening black-brown to black, drying with the surface much-faceted but almost certainly smooth when fresh; *stigma* carried terminally on narrowed part of the fruit, comprising 3 spreading blunt-tipped lobes, these joined basally, each arm c. 2.5 mm long. *Seeds* not observed mature, immature seeds shallowly patelliform-elliptic, c. 10 × 7 mm.

DISTRIBUTION. Malaysian Borneo (Sabah and NE Sarawak). To date known only from the Gunung Kinabalu area, and one highland location in Limbang, Sarawak.

SPECIMENS EXAMINED. BORNEO. Sabah. Bahagian Pantai Barat: Ranau, Sosopodon F.R., along the NT trail (ridge), 4 Aug. 1971, *Ampon & Saikah* SAN71825 (K!, SAN!); Kota Belud, Mesilau river, 5 Feb. 1964, *Chew & Corner* RSNB4233 (holotype K!); Kota Belud, Gunung Kinabalu, eastern shoulder, 6°05'N, 116°36' – 40'E, 10 Aug. 1961, *Chew, Corner & Stainton* 299 (K!); Kota Belud, Gunung Kinabalu, Ulu Liwagu and Ulu Mesilau, 6°N, c. 116 35'E, 8 Aug. 1961, *Chew, Corner & Stainton* 2882 (K!); Kota Belud, Gunung Kinabalu, Dallas, 9 Aug. 1931, *Clemens & Clemens* 26035 (K!). **Sarawak.** Limbang: Lawas, Ulu Sungai Pandarasan, 7 March 1973, *Tong & Paie* S32759 (K!, L!, SAR!).

EXCLUDED MATERIAL. BORNEO. Sabah. Sandakan: Bahagian Sandakan, Jalan Kabili, Cpt 14, Sepilok F.R., 23 March 1965, 15 m [50 ft], *Sam* 49860 (K!) = **Hanguana prob. sp. nov. #A.** Bahagian Pantai Barat: Kota Belud, Gunung Kinabalu, Ulu Langanani, Mamut river, 6°04'N, 116°40' – 44'E, 1,158 m [3,800 ft], 10 Aug. 1961, *Chew, Corner & Stainton* 1715 (K!); Gunung Kinabalu, Penibukan, on ridge coming to camp from Dahobang river, 1,219 – 1,524 m [4,000 – 5,000 ft], 4 Jan. 1933, *Clemens & Clemens* 30687 (K!); Gunung Kinabalu, Marai Parai spur, 1 – 4 Dec. 1915, *Clemens* 11108 (K!) = **Hanguana prob. sp. nov. #B.** Bahagian Pantai Barat: Kota Belud, Gunung Kinabalu, Dallas – Tenompok ridge, 1,219 m [4,000 ft], 15 Dec. 1931, *Clemens & Clemens* 27575=29815 (K!); Gunung Kinabalu, Kinabalu F. R. HQ, 1,371 m [4,500 ft], 11 May 1967, *Price* 147 (K!). Bahagian Sandakan: Sandakan, trail to Ulu Sungai Tariau, Kampung Wonod Telupid, 14 March 1974, *Aban & Saikeh* SAN79389 (K!, SAN!) = **Hanguana indeterminable.**

Fig. 1. Holotype of *Hanguana major* Airy Shaw. *Chew & Corner RSNB4233* (holotype K!). IMAGE © OF THE TRUSTEES, ROYAL BOTANIC GARDENS, KEW. USED WITH PERMISSION.

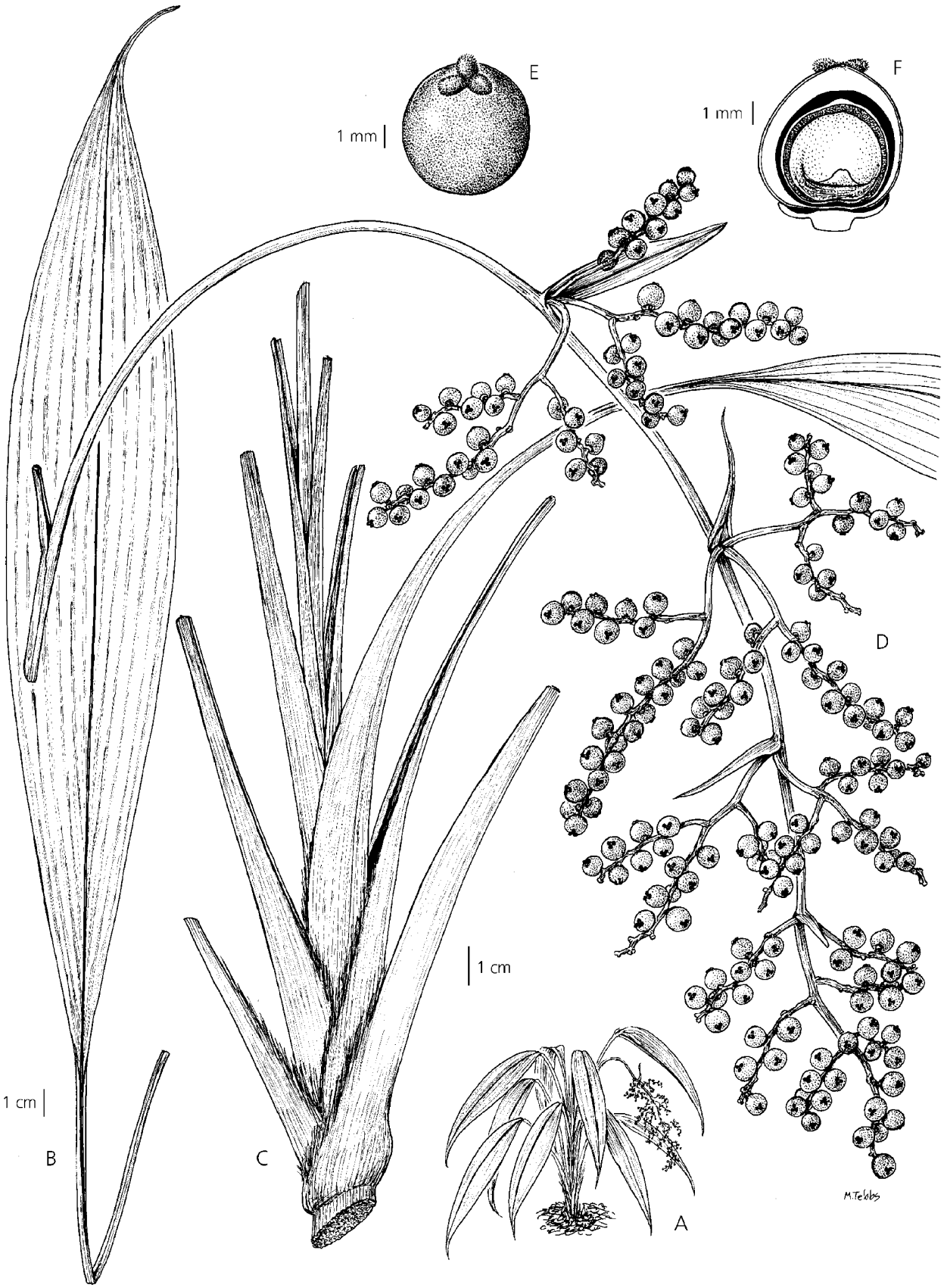

Fig. 2. *Hanguana loi.* **A** habit; **B** leaf; **C** leaf bases; **D** ripe infructescence; **E** ripe fruit; **F** T.S. ripe fruit. DRAWN BY MARGARET TEBBS.

HABITAT. The limited specimen data available suggests that *Hanguana major* occurs only in perhumid to moist upper hill and lower montane oak-chestnut-laurel forest on sandstone, with one collection (Sarawak: Limbang) reported from (presumably ridgetop) kerangas; 760 – 1,550 m asl.

NOTES. The original description includes erroneous data regarding the shape of the mature fruit, stating the ovary to be globose, and ripe fruit lageniform, implying the lageniform shape to be an artefact of drying. In fact, the globose fruits in the description belong to *Clemens & Clemens* 30687 (K), one of the seven originally cited collections here excluded from *Hanguana major*. Both the unfertilised ovary and the ripe fruit of *H. major* are lageniform; the narrowed part of the gynoecium is morphologically equivalent to a style.

Hanguana loi *Mohd Fahmi, Sofiman Othman & P. C. Boyce* **sp. nov.** Ab omnibus speciebus borneensibus laminis plicatis, inflorescentia diffusa inflorescentiarum partialium ramis gracilibus ascendentibus, fructibus maturescentibus rubris, lobis stigmaticis basaliter coherentibus elevatis differt. *Hanguanae nitenti* laminis plicatis accedens, habitu solitario (non coloniali), pseudopetiolo longo, lobis stigmaticis applanatis (non acutis), fructibus maturescentibus non atris differ. Typus: Borneo, Bahagian Sri Aman, Lubok Antu, near Sungai Kuap, Ulu Sungai Engkari, March 1974, *P. Chai* S34089 (holotypus K!, isotypi K!, SAR!).

http://www.ipni.org/urn:lsid:ipni.org:names:77118903-1

Solitary, medium-sized dioecious mesophyte to c. 1 m tall; *leaves* to 95 cm long, semi-erect, tips arching, many together in a somewhat loose rosette, lime green, somewhat flocculose abaxially; *petiole* deeply carinate, c. 10 cm long, internally pale green, margins not persistent, marcescent, drying deep brown; *pseudopetiole* to 25 × 0.6 cm wide, accounting for almost $^{1}/_{4}$ the entire leaf length, shallowly carinate, the margins persistent, somewhat sharp; *leaf blade* to 60 × 11 cm, c. twice as long as petiole + pseudopetiole combined, plicate, base long-decurrent, deep green when fresh, apex attenuate; *midrib* somewhat prominently round-raised abaxially, distal-most portion almost flush; *primary venation* dense, parallel, minutely tessellate; *higher order* venation drying conspicuously and densely raised-tessellate, especially abaxially. *Inflorescence* solitary; *peduncle* to 15 cm long, c. 0.5 cm diam., subterete, conspicuously and densely white-floccose, medium green when fresh, drying dark brown, with c. 7 peduncular bracts; *primary peduncular bract* marking scape base foliaceous, sterile, persistent, c. 40 × 8 cm, base clawed, apex long-attenuate, petiole very short; *rachis* c. 58 cm long; *partial inflorescence* c. 34 cm long; *fertile portion* with five whorled partial inflorescences; *fertile branch* c. 10, slender, c. 2 mm, panicle dense; flowers not seen. *Infructescence* erect, thyrsoid-paniculate, not exceeding the leaves; branches in each partial infructescence subequal, longest branches in the median partial infructescences c. 9 cm long; *perianth* consisting of three inner and three outer opposed pale green tepals, appressed to fruit when fresh; outer tepals c. 2.0 × 1.4 mm, ovate, cucullate; inner tepals c. 3.1 × 2.4 mm, ovate, weakly cucullate, all tepals clasping the base of the fruit; *fruits* globose, c. 5 mm diam., ripening semi-glossy bright red, drying dark brown; *stigma* sessile when fresh, 3-lobed, c. 2 mm wide, arms recurved, lobes connate to form a trilobed structure resembling a clover-leaf; *seeds* cucullate, c. 5 × 2 mm, dark brown. Figs 2 & 3.

DISTRIBUTION. Malaysian Borneo: Sarawak.

SPECIMENS EXAMINED. BORNEO. Sarawak. Bahagian Sri Aman: Lubok Antu, near Sungai Kuap, Ulu Sungai Engkari, March 1974, *Chai* S34089 (holotype K!, isotypes K!, SAR!). Bahagian Serian: Kg. Tepoi, 01°03'56.0"N, 110°16'41.5"E, 11 March 2011, *Michael Lo* HA-79 (SAR).

HABITAT. Wet lowland forest; c. 10 m asl.

ETYMOLOGY. Named for Michael Lo, whose extensive travelling and photography of Bornean wildlife has done so much to reveal the almost unimaginable biological richness of this remarkable island.

NOTES. *Hanguana loi* does not closely resemble any other *Hanguana* species so far described from Borneo. The plicate leaf blades are superficially similar to those of Peninsular Malaysian *H. nitens* Siti Nurfazilah, Mohd Fahmi, Sofiman Othman & P. C. Boyce, but the long pseudopetiole, solitary (not colonial) habit, very slender infructescence branches, fruit ripening red and conjoined, erect-pointing stigma lobes are quite different.

Additional notes on *Hanguana bakoensis*

When preparing the description of *Hanguana bakoensis* (Siti Nurfazilah *et al.* 2011) we were unable to find flowering male material. Since then, fieldwork by the first author has succeeded in locating fertile male plants at the type locality. These provide the following data:

Male flowers yellowish-white; 3 outer tepals short, c. 3 mm long, 3 inner sepals considerably longer, c. 1 cm, all fornicate. *Stamens* 6, on the base of the perianth, about as long as the inner tepals; *filaments* filiform from a broader base, c. 3 mm long; *anthers* small, c. 1 mm, with longitudinal slits, inserted in a basal cleft. *Partial inflorescences* of male plants thinner and longer (c. 16 cm long × 3 mm wide) than those of female plants, branches sub-terete, lateral branches c. 7.5 cm × 1.5 mm; *primary peduncular bract* marking start of scape foliaceous, sterile, persistent, c. 23.5 × 2 cm, base clawed, apex long-acute.

Fig. 3. *Hanguana loi*. Plant in habitat, Serian. **A** mature plant; **B** detail of the plicate leaf blade; **C** terminal portion of ripe infructescence, note the slender, ascending branches; **D** detail of ripe fruits, note the clover-leaf stigma with the lobes raised buy not distally ascending. IMAGES **A** – **B**, & **D** © PETER C. BOYCE; **C** © MICHAEL LO. Used with permission.

Key to Bornean *Hanguana*

1a. Colonial helophytes with massive, foliaceous stolons. Plants of open situations along muddy banks of large rivers, margins of freshwater bodies, and of freshwater swamp forest . . . . . **H. malayana**

1b. Clump-forming mesophytes lacking stolons. Plants of a variety of closed-canopy forest types, but never in freshwater swamp forest . . . . .

2a. Leaf blade plicate, with slender pseudopetiole (less than 1 cm wide); infructescence very loose; fruits bright red, stigma raised. SW Sarawak . . . . . **H. loi**

2b. Leaf blade not plicate; pseudopetiole stout (1 cm or more wide); infructescence dense; fruits various, if red, then stigma impressed into pericarp . . . . .

3a. Leaf blade broadly lanceolate to elliptic, abaxially floccose, at least in juveniles; fruits variable but never 3-lobed, ripening dull red or black . . . . .

4a. Flowering plants to 1.5 m tall, leaves to 90 × 10 cm wide; peduncle and scape together exceeding 1 m, conspicuously and extensively reddish brown-floccose; fruits c. 2 × 1.5 cm ripe, lageniform, with a large, prominently stipitate stigma, fruits ripening black. Montane. Sabah (Kinabalu) and NE Sarawak. . . . . **H. major**

4b. Flowering plants to 35 cm tall, leaves to 25 × 5 – 6 cm; peduncle and scape together not exceeding 35 cm, not or only very obscurely and sparsely grey-floccose; fruits c. 0.7 cm diam. globose, stigma impressed, minute, fruits ripening dull red. Lowlands. SW Sarawak. . . . . **H. bogneri**

3b. Leaf blade linear-lanceolate to very narrowly elliptic, all parts of the plant glabrous except the submicroscopically puberulent peduncle and scape; fruits weakly 3-lobed, ripening medium pink to magenta. Plants of kerangas. Bako National Park . . . . . **H. bakoensis**

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