



Two new species of *Hanguana* (*Hanguanaceae*) from Kalimantan, Indonesia

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Key words

Borneo
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Abstract Two new *Hanguana* species from Kalimantan, Indonesian Borneo, are described here. *Hanguana karimatae* from Karimata Island, West Kalimantan province, is characterised by a stout habit, prominently oblique yellow fruits with raised stigma and 1- or 2-seeded fruits. *Hanguana nana* from Central Kalimantan province is the smallest species in the genus with the stem entirely covered by leaves, deflexed barely branched infructescences with only a few fruits, each with a single bowl-shaped seed with a large and incurved appendage. These are the first descriptions of new *Hanguana* species from Kalimantan (Indonesian Borneo). Colour plates as well as notes on distribution, ecology, habitat and conservation status are provided.

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INTRODUCTION

Hanguana is the sole genus of family *Hanguanaceae* (*Commelinales*), distributed from Sri Lanka, through Thailand and Indo-China to New Guinea and into NE Australia and eastwards to Palau in the Caroline Islands. To date, 19 species are recognized in the genus (POWO 2019). The stoloniferous helophytic *H. anthelminthica* (Blume ex Schult. & Schult.f.) Masam., previously misidentified as *H. malayana* (Jack) Merr. is the best-known and most wide-spread species so far, occurring from Sri Lanka to the Caroline Is. (Palau) (Leong-Škorničková & Niissalo 2017), while most of the species have much restricted distributions with many being endemic to certain locations and habitats.

Five *Hanguana* species have been confirmed as occurring in Borneo to date. Apart from *H. anthelminthica*, the remaining four species are restricted to the northern part of the island where they were described from, namely *H. major* Airy Shaw from Sabah (Airy Shaw 1981), and *H. bogneri* Tillich & E.Sill (Tillich & Sill 1999), *H. bakoensis* Siti Nurfazilah, Sofiman Othman & P.C.Boyce (Siti Nurfazilah et al. 2011) and *H. loi* Mohd Fahmi, Sofiman Othman & P.C.Boyce (Mohd Fahmi et al. 2012) from Sarawak. *Hanguana* species are not uncommon in Kalimantan, but remain poorly understood. Given that Kalimantan is much larger and more diverse in habitats than Sarawak, Sabah and Brunei, the states and country marking up the northern part of

Borneo, it is clear that many species are yet to be described. Based on field observations and the herbarium specimens in various herbaria (BO, E, K, L, P, SING, WAN; for acronyms see Thiers continuously updated) we estimate that between 20 and 30 species await description from Kalimantan and that the whole of Borneo may contain between 40 and 50 species.

Here we describe two species for which we have complete material of mature fruiting females as recommended by Leong-Škorničková & Boyce (2015). The descriptions follow the style and level of details outlined in Leong-Škorničková & Boyce (2015), while the general terminology is based on Beentje (2016). The preliminary conservation assessments are based on the most recent version of the guidelines of IUCN Standards and Petitions Subcommittee (2019). The Extent of Occurrence (EOO) and Area of Occupancy (AOO) were calculated with GeoCat (Bachman et al. 2011).

1. *Hanguana karimatae* Randi & Škorničková, *sp. nov.* — Fig. 1; Map 1

Similar to *Hanguana podzolicola* Siti Nurfazilah, Mohd Fahmi, Sofiman Othman & P.C.Boyce in general size and habit, but differs by smaller and sparser infructescences composed of 7 partial infructescences, the most basal partial infructescence composed of up to 8 branches and with median branches not exceeding 18 cm in length, larger pale yellow fruits to 10 mm diam with stigma strongly raised to 2 mm high, and 1 or 2 seeds per fruit, each with a small acute appendage (compared to infructescence composed of 9 partial infructescences, the most basal partial infructescence composed of up to 17 branches and with median branches up to 30 cm long, smaller dull pink fruits 5–7 mm diam with flat or only lightly raised stigma, and consistently single-seeded fruits with seeds having a broad and blunt appendage in *H. podzolicola*). — Type: *A. Randi* AR-689 (holo WAN!; iso BO!), Indonesia, Kalimantan Barat, Kayong Utara, Kepulauan Karimata (Karimata Island), Desa Betok, S1°35'36.60" E108°53'13.20", 260 m alt., 20 Mar. 2019, fruiting.

Etymology. The epithet of this species is derived from Latinised version of the Karimata Island, treated as feminine.

Large solitary dioecious herb, to 1.4 m tall, ascending crown of leaves; stem terete, to 3 m long, basal c. 1.6 m leafless,

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decumbent, 3–6 cm diam, dark brown, shiny, leaf scars conspicuous with fibres from the basal part of the leaf sheath, terminally ascending with spreading crown of up to 25 leaves; stolons absent. Leaves to 150 cm long, spreading then arching; bases imbricate; pseudopetiole 40–60 cm long, 1–2 cm wide at base, bluntly V-shaped in cross section, with sharp margins, covered with scattered floccose hairs on both sides; lamina elliptic, 70–100 by 15–25 cm, slightly undulate, base narrowly attenuate, margins entire, minutely recurved, apex narrowly attenuate with apicule to 2 cm long, adaxially dark green semi-glossy, abaxially paler green, shiny, very young

leaves with scattered floccose silky hairs, glabrescent on both sides; midrib weakly impressed, of the same colour as the rest of the lamina adaxially, round-raised, lighter green, shiny abaxially. *Staminate inflorescence* not observed. *Pistillate inflorescence/infructescence* erect, comprising c. 7 partial, alternate-secund, thyrsoid inflorescences plus a terminal spike; partial inflorescences spreading, lowermost sub-erect, perpendicular or slightly descending distally; peduncle and rachis together to 90 cm long, green when fresh, with scattered floccose silky hairs; visible portion of peduncle to 45 cm long, to 1.7 cm diam at the bottom; one sterile bract per peduncle,

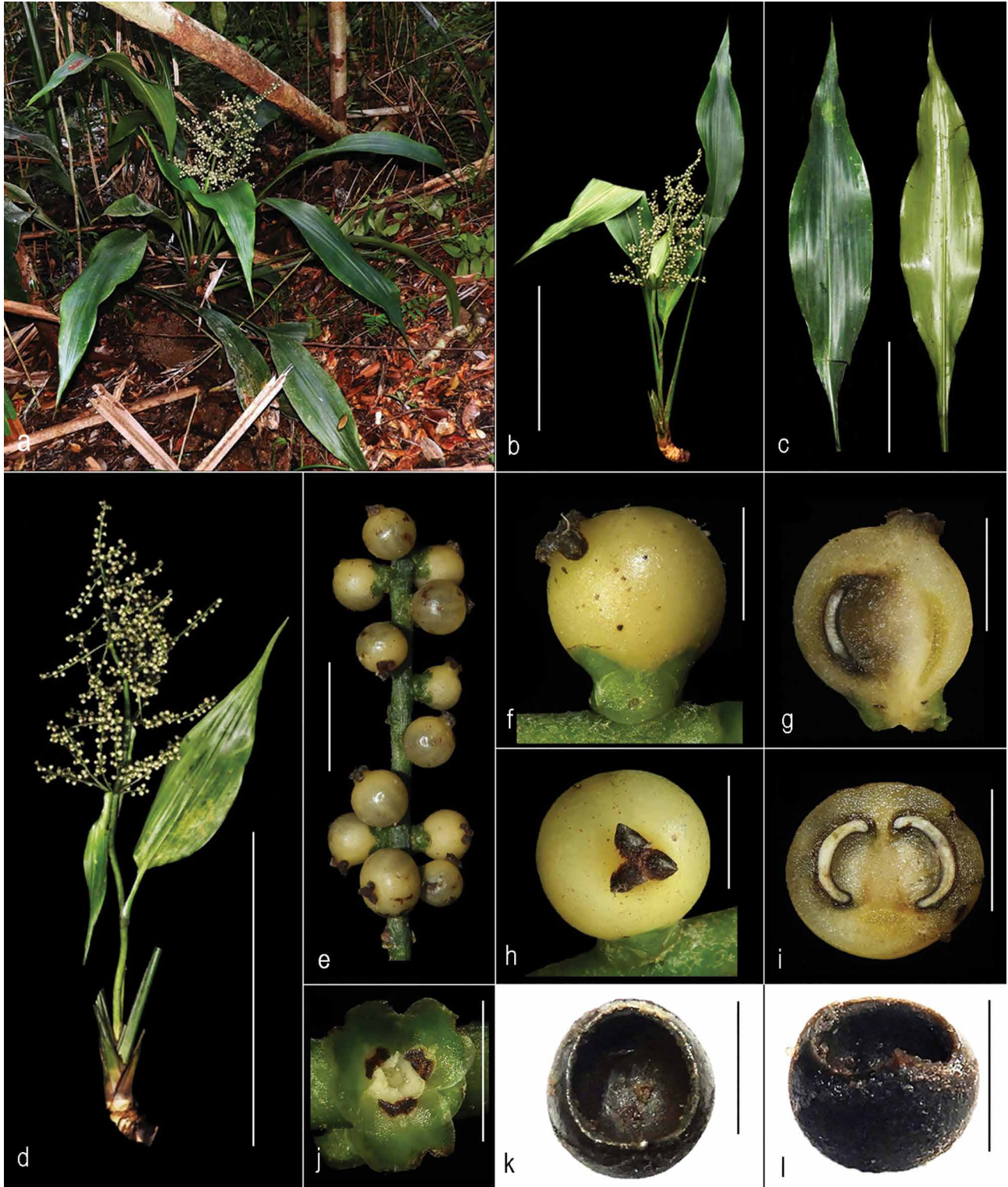


Fig. 1 *Hanguana karimatae* Randi & Škorničk. a. Habit *in situ*; b. habit of single plant; c. lamina, adaxial and abaxial surface; d. infructescence with sterile and fertile bracts; e. detail of inflorescence branch; f. fruit, side view; g. longitudinal section of fruit; h. fruit, semi-top view, showing detail of stigma; i. cross-section of fruit, showing two seeds; j. detail of inner tepals, staminodes and staminodial scales; k. seed, top view; l. seed, front view (all: A. Randi AR-689, WAN). — Scale bars: b, d = 50 cm; c = 20 cm; e = 2 cm; f–j = 5 mm; k–l = 3 mm. — Photos: A. Randi.

foliaceous, persistent, ovate, to 60 by 15 cm (including 10 cm long claw/pseudopetiole), base obtuse, apex narrowly acuminate, caudate; fertile bracts one for each partial inflorescence, similar to the sterile bract distally, the bract supporting the most basal partial inflorescence c. 27 by 5 cm (claw/pseudopetiole c. 3 cm long, winged), narrowly ovate to narrowly elliptic, rapidly diminishing in size and becoming narrowly triangular to linear distally, fully reduced in the uppermost partial inflorescence; partial inflorescences each comprising up to 8 branches at basal level, fewer towards the apex of the inflorescence, branches arising simultaneously from the axis of the subtending bract, lateral branches progressively shorter; median branches at basal level to 18 cm long (shorter in upper partial inflorescences), unbranched or further branched to one order (with bracteoles c. 3 by 6 mm). *Pistillate flowers* scattered, solitary or in a pair, sessile, all with an associated minute bracteole; perianth composed of 6 tepals in two whorls tightly clasping ovary/fruit in fresh material, all tepals thick and fleshy with prominent bulbous thickening at base (more prominent in outer whorl), light green when fresh, margin hyaline translucent white; outer tepals broadly ovate, 2–3 by 2.5–4 mm, slightly connate at base, sparsely arachnoid externally, glabrous internally; inner tepals circular or nearly so, 3–4 mm diam, free to base, externally with a few arachnoid hairs at apex, glabrous internally; staminodes 6, in two whorls, cream to pale green when fresh, outer staminodes triangular, 0.3–0.4 by 0.2–0.4 mm at base, inner staminodes narrowly triangular, 1.2–1.8 by 0.2–0.4 mm at base, basally sheathed with staminodial scale semi-circular, c. 1–1.5 by 1.2–1.8 mm, with somewhat retuse apex, dark brown with translucent margin, stigma 3-lobed, strongly raised, 1.3–2 mm high, in matured fruits positioned strongly obliquely, c. 3 mm diam, each lobe ovate to bluntly triangular, 1–2 by 0.8–1.2 mm, apex acute, dark brown (fruiting stage). *Ripe fruit* pale yellow (the dark seed colour is visible through the increasingly translucent pericarp), globose, 6–10 mm diam, glabrous or with sparse silky arachnoid hairs, pericarp 1–2 mm thick. *Seeds* 1 or 2 per fruit, 4–5 mm across, dark brown to nearly black, deeply bowl-shaped with incurved margins, with a small acute appendage positioned on the distal part of the rim; cavity filled with placental tissue.

Distribution — *Hanguana karimatae* is so far known only from Karimata Island, an isolated mountainous island off the coast of Kalimantan Barat province, Indonesia.

Habitat & Ecology — Occurring in primary lowland forest, on the sides of a small rocky stream with clear water at 250–500 m altitude.

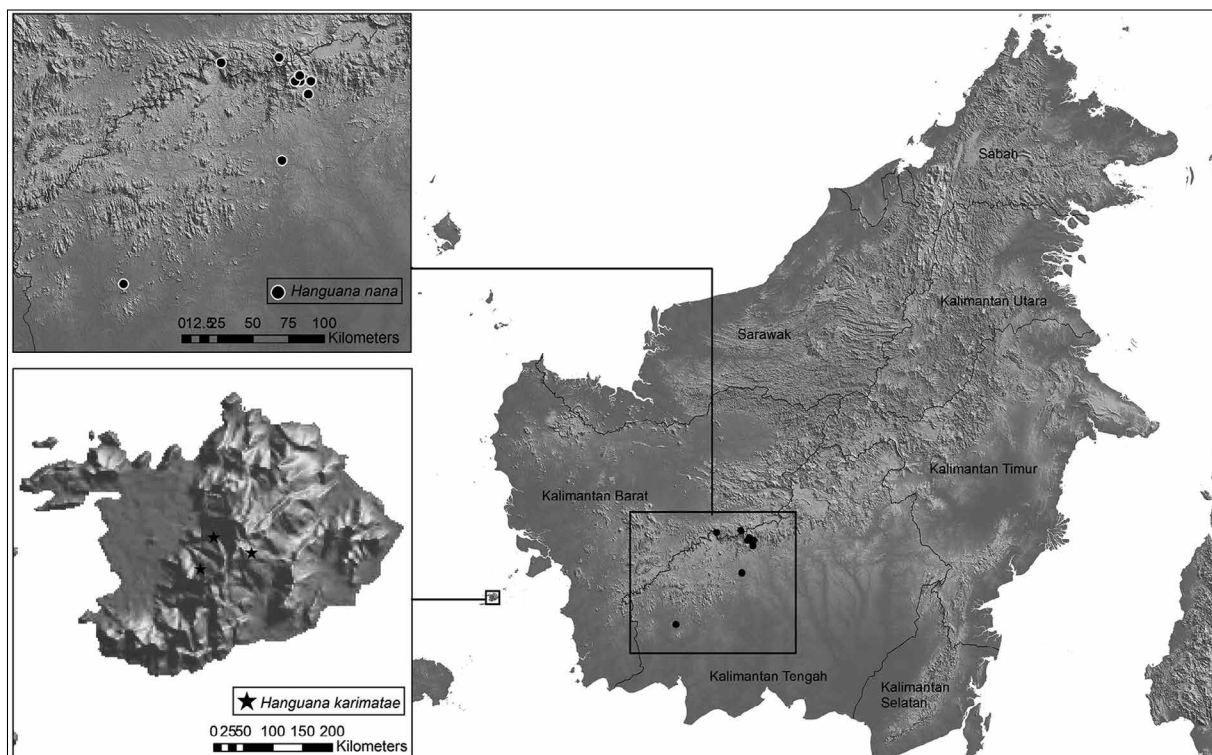
Conservation status — Only three mature individuals and one young individual are recorded for this species in suitable habitats in the same general area with EOO = 0.497 km² and AOO = 8 km². Although the island is surrounded by a marine conservation area, the habitat on the island is not totally protected by Indonesian law. Threats to habitat, such as logging and forest fires, were observed in the vicinity of the area where this species occurs. We therefore assess this species as Critically Endangered B1ab(iii) + B2ab(iii); D. Ex-situ conservation of this species is urgently needed.

Notes — *Hanguana karimatae* is morphologically most similar to *Hanguana podzolica*, a species known to occur in southernmost part of Peninsular Malaysia and Singapore (Siti Nurfaizilah et al. 2010, Niissalo & Leong-Škorničková 2017). In addition to the main morphologic differences outlined in the diagnosis, the two species are also very different in their habitat. *Hanguana karimatae* grows on the sides of small rocky streams with clear water at 250–500 m alt., while *H. podzolica* grows in seasonally swampy peat forests at 40–60 m alt. in Peninsular Malaysia while in Singapore it is strictly a swamp-forest species, occurring in locations with permanently wet or flooded soil.

2. *Hanguana nana* Randi & Škorničk., *sp. nov.* — Fig. 2; Map 1

Hanguana nana is the smallest species in the genus so far and unique from its congeners by a slender upright stem entirely covered by leaves, lack of distinct terminal crown of leaves, and by an inflorescence/infructescence composed of only 1–3 partial inflorescences/infructescences each composed of only 1 or 2 branches. — Type: A. Randi AR-711 (holo WAN!; iso BO!), Indonesia, Kalimantan Tengah, Kotawaringin Barat, Arut Utara, Desa Nanga Mua, Bukit Telawih, S2°1'56.44" E111°48'53.37", 80 m alt., 11 April 2019, fruiting. For paratypes see underneath description.

Etymology. The species epithet is derived from Latin *nanus* = dwarf, and refers to the small habit of the plant.



Map 1 Distribution map of *Hanguana karimatae* and *H. nana*.

Small solitary dioecious herb, erect, to 30 cm tall; stem terete, slender, 5–8 mm diam, cream to yellowish when fresh, with up to 20 more or less evenly distributed leaves (no formation of terminal crown); stolons absent. Leaves to 8–40 cm long (including pseudopetiole), smallest in the lowermost part of the stem, gradually larger distally, arching, bases imbricate; pseudopetiole 2–15 by 3–8 mm, accounting for 1/5–1/3 of entire leaf length, bluntly V-shaped in cross section, with sharp margins, winged 1/3–2/3 of the length, with grey floccose hairs on both sides; lamina elliptic, 6–27 by 2.5–6 cm (at widest point), base obtuse to attenuate, margins entire, slightly undulate, apex acuminate to caudate; adaxially mid to dark green,

with sparse floccose hairs, glabrescent, abaxially paler green to glaucous; midrib adaxially weakly impressed, of the same colour as the rest of the lamina, abaxially round-raised, lighter green, almost glabrous and shiny abaxially; secondary parallel veins 5–8 on each side, indistinct; intercostal venation indistinct, but visible when fresh at adaxial surface, tessellate. *Staminate inflorescence* not observed. *Pistillate inflorescence/infructescence* arching to semi-pendulous, consisting of 1–3 partial inflorescences and a terminal spike; partial inflorescences ascending to rachis; peduncle and rachis together up to 20 cm long, brown to dark purple when fresh, flocculose; peduncle 1–11 cm by 1.2–2.5 mm diam, one sterile bract per peduncle, foliaceous,

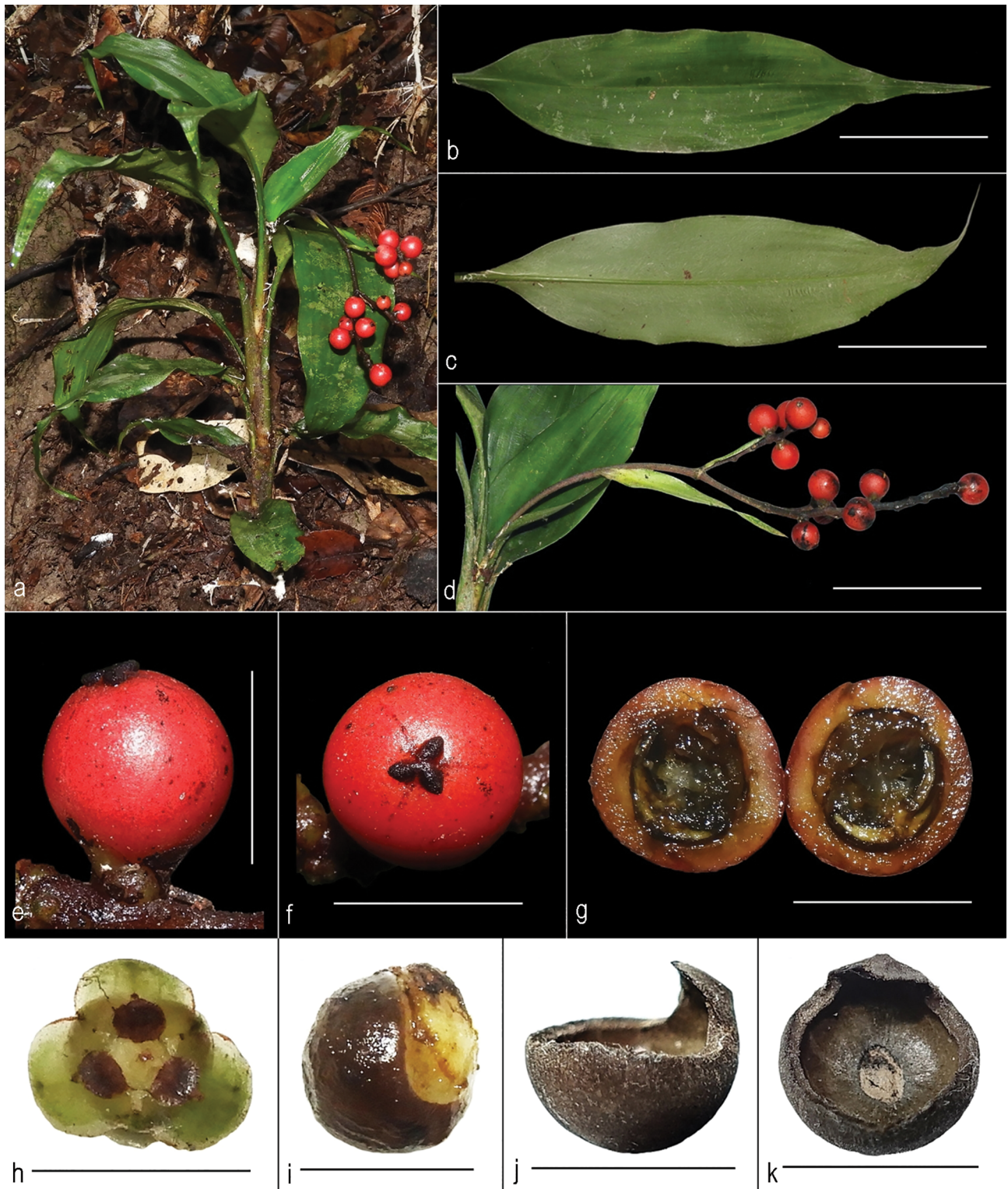


Fig. 2 *Hanguana nana* Randi & Škorničk. a. Habit *in situ*; b. lamina, adaxial surface; c. lamina, abaxial surface; d. inflorescence, showing sterile and fertile bracts; e. fruit, side view; f. fruit, top view; g. cross section of fruit; h. detail of inner tepals, staminodes and staminodial scales; i. seed with placental tissue; j. seed with large incurved appendage, side view; k. seed, top view (all: A. Randi AR-711, WAN). — Scale bars: b–d = 5 cm; e–g = 1 cm; h–k = 5 mm. — Photos: A. Randi.

green to yellowish, persistent, narrowly ovate to narrowly elliptic, to 6 by 0.6–2 cm, sessile or nearly so (shortly clawed), apex narrowly acuminate; fertile bracts one for each partial inflorescence, similar to the sterile bract but rapidly diminishing in size distally and narrowly triangular to almost linear, the bract supporting the most basal partial inflorescence 16–23 by 2–4 mm, upper ones 4–7 by 2–4 mm; partial inflorescences each comprising 1 or 2 branches arising simultaneously from the axil of the subtending bract, slightly zigzag, branches at basal level 2–4.5 cm long, branches at upper levels usually shorter. *Pistillate flowers* scattered, solitary, sessile; perianth c. 5 mm across, composed of 6 tepals arranged in two whorls tightly clasping the fruit in fresh material, all tepals fleshy with prominent bulbous thickening at base (more prominent in outer whorl), externally dull green to reddish brown, internally light green, margins translucent white; outer tepals, semi-circular, 1–2 by 2–3 mm at base, free to base, externally sparsely arachnoid, internally glabrous; inner tepals larger than outer ones, circular or nearly so, c. 3 by 3 mm, free to base, glabrous both sides; staminodes 6, in two whorls, cream when fresh with brown apex, outer staminodes narrowly triangular, 0.6–0.8 by 0.2–0.3 mm at base, inner staminodes narrowly triangular, 1.3–1.6 by 0.3–0.5 mm at base, each basally sheathed with a broadly ovate to almost circular staminodial scale, c. 1 by 1 mm, light to dark brown, stigma 3-lobed, raised, 0.7–1 mm high, in mature fruits positioned centrally or very slightly obliquely, 1.4–2.5 mm diam, each lobe ovate, 0.6–1 by 0.5–0.8 mm, with blunt apex, slightly connate at very base, dark brown to black (in fruiting material). *Ripe fruit* bright pink to bright red, globose, 7–12 mm diam, glabrous or sometimes with sparse minute hairs; pericarp 0.8–1.3 mm thick. *Seeds* 1 per fruit (2 seeds in a single fruit have not been observed), 5–6 mm across, dark brown when mature; deeply bowl-shaped with slightly incurved margins and with large incurved appendage positioned on the distal part of the rim, 2–3 by 3–4 mm, externally with pointy projection at the outer surface, cavity filled with semi-translucent placental tissue.

Distribution — Currently known only from the Schwaner mountain range in West and Central Kalimantan province.

Ecology — Grows in lowland tropical broad-leaved mixed dipterocarp forest at about 50–800 m altitude. It is locally abundant in fully shaded understorey on hill slopes, valleys and along small rivers and streams.

Conservation status — This species is locally abundant in certain parts of Central and West Kalimantan. Although based on the EOO = 7 296 834 km² and AOO = 36 km² this species potentially qualifies for the categories Vulnerable and Endangered, respectively. We have observed that *H. nana* is growing in relatively undisturbed forest in Bukit Baka Bukit Raya National Park and the other localities are protected by mandatory regulations for a private forestry concession. We therefore assess this species as Least Concern (LC). An ex-situ initiative has been started with plants being cultivated at Arboretum Sylva UNTAN Pontianak.

Paratypes studied. INDONESIA, Kalimantan Tengah, Katingan, upper Katingan river, NW of Tumbang Samba, E112°50' S1°15', 50 m alt., 16 Nov. 1982, fruiting, *J.P. Moge* & *W.J.J.O. de Wilde* 3498 (K000710092, L1418810); Kalimantan Tengah, Katingan, upper Samba river, NW of Tumbang Samba, E112°50' S0°50', 150 m alt., 23 Nov. 1982, fruiting, *J.P. Moge* & *W.J.J.O. de Wilde* 3578 (L1418814); Kalimantan Tengah, Katingan, upper Samba river, NW of Tumbang Samba, E112°50' S0°50', 350 m alt., 13 Dec. 1982, fruiting, *J.P. Moge* & *W.J.J.O. de Wilde* 4147 (L1419442); Kalimantan Tengah, Katingan, Tumbang Tubus, E112°51' S0°45', 150 m alt., 8 Aug. 1983, fruiting, *J.F. Veldkamp* 8133 (L1418830, L1418831, L1418832); Kalimantan Tengah, Katingan, Bukit Raya, E112°47' S0°45', 130 m alt., 5 Nov. 1982, *H. Nootboom* 4170 (L1419439); Kalimantan Tengah, Katingan, Bukit Raya, E112°45' S0°45', 130 m alt., 26 Nov. 1983, fruiting, *H. Nootboom* 4057 (L1419441); Kalimantan Tengah, Katingan, Tumbang Samba, Bukit Raya, E112°46'46.5" S0°42'56.6", 800 m alt., 17 Feb. 1995, fruiting, *J.K. Jarvie* & *A. Ruskandi* A. 6188 (L3893506); Kalimantan Barat, Sintang, Serawai, Bukit

Baka Bukit Raya NP, Ella river, E112°17' S0°38', 315 m alt., 13 Oct 1993, fruiting, *A.C. Church et al.* 9 (L3807708, SING0203910); Kalimantan Barat, Sintang, Serawai, upper Uut Labang river, E112°38'56.2" S0°36'06.1", 750 m alt., 15 Oct. 1995, flowering, fruiting, *A.C. Church et al.* 2544 (K000710099, L3807706).

Notes — All *Hanguana* species so far described from Borneo or elsewhere have a terminal crown of dense foliage with a leafless stem conspicuous especially in older plants. Apart of its small size, *H. nana* differs from all other species by an erect leaf-covered stem and by lacking a distinct terminal crown of leaves. The infructescence with only very few branches, each with only a few fruits and the bowl-shaped seeds with a large appendage curved inwards makes a unique set of characters for this species, easy to recognise even in herbarium material.

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