



Aphyllorchis maliauensis (Orchidaceae), a new species from the Maliau Basin, Sabah, Borneo

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Aphyllorchis Blume (1825: 16) comprises approximately 30 species distributed from Sri Lanka, the western Himalayas, and China through Indochina, Malaysia, Indonesia, Taiwan and the Philippines eastward to New Guinea and Australia (Hsieh *et al.* 2013, Tian *et al.* 2013). *Aphyllorchis* species are leafless and mycoheterotrophic, with erect, unbranched stems, racemose inflorescences, multiple resupinate flowers, petals similar to sepals but shorter and narrower and lips divided into hypochile and epichile (Tian *et al.* 2013). As in most other mycoheterotrophs (Suetsugu 2017, Suetsugu & Nishioka 2017, Suetsugu *et al.* 2017), the diversity of *Aphyllorchis* species could be underestimated since the short flowering season and inconspicuous habit make them easily overlooked in the wild (Hsieh *et al.* 2013).

In August 2015 and August 2017, we conducted two botanical surveys in the Imbak Canyon Conservation Area and the Maliau Basin Conservation Area (Sabah, Borneo). During these two surveys, we encountered an unknown *Aphyllorchis* species. A thorough review of the literature, herbarium specimens in BORH, BO, KYO, and TI and online digitized plant collections, such as JSTOR Global Plants (<http://plants.jstor.org/>), allowed us to determine that the specimens possessed unique morphological features and represented a new species. The new species, *Aphyllorchis maliauensis*, is described here.

Taxonomic Treatment

Aphyllorchis maliauensis Suetsugu, M. Suleiman & Tsukaya, *sp. nov.* (Figs. 1–3)

Type:—MALAYSIA. Sabah: Maliau Basin Conservation Area, from Agathis Camp (N4°41'49"; E116°54'40", 525 m alt.) to Ginseng Camp (N4°44'44"; E116°55'05", 680 m alt.), Maliau Basin, Sabah, Borneo, Malaysia, 15 August 2017, Tsukaya, Suetsugu & Anthony TSA-1 (holotype: BORH; isotype: KYO, a flower in spirit collection).

Aphyllorchis maliauensis is similar to *A. montana* Reichenbach (1876: 57) but differs in having larger narrowly ovate to lanceolate sepals and larger lanceolate lateral petals.

Terrestrial, mycoheterotrophic herbs. Inflorescence 80–100 cm tall, dark brownish purple, 3–6 mm in diameter, bearing 20–30 scale-like leaves. Rhizome condensed, producing, numerous, horizontally or downwardly elongate roots. Rachis 10–20 cm, glabrous to subglabrous, with c. 30 flowers; floral bracts (linear-)lanceolate, acute, 15–25 × 1–3 mm. Pedicel and ovary slightly tilted upwards or downwards, 24–32 mm long, 2 mm, pubescent. Flowers opening widely. Dorsal sepal ivory, often with purple veins, cymbiform, narrowly ovate to lanceolate, entirely pubescent on the dorsal side, margin entire, 17.0–18.0 × 4.7–4.9 mm, acute at the apex; lateral sepal ivory, narrowly ovate to lanceolate, entirely pubescent on the dorsal side, margin entire or minutely denticulate, 17.0–18.0 × 4.2–4.4 mm, slightly outwardly curved and acute at the apex. Lateral petals ivory with purple veins, lanceolate pubescent on the base of the dorsal side, margin entire or minutely denticulate, 16.0–16.5 × 2.7–2.9 mm, slightly outcurved and acute at the apex. Labellum ivory white, often with maroon marking; hypochile trapezoid, 4.1–4.2 mm × c. 2.5 mm wide, with well developed, erect, obliquely triangular, obtuse to acute side lobes, 2.3–2.5 × 3.8–4.2 mm when flattened; epichile 10.7–11.2 mm × 6.2–6.4 mm when flattened, trilobed, sidelobes c. 4 × 2 mm, rounded, midlobe narrowly triangular 10.7–11.2 mm × 2.2–2.4 mm, thickened, erose at the apex. Column pale yellow, incurved, ca. 12 mm long, with slightly protruding

or bearing a hook-shaped appendage on ventral side; stigma oblong concave; anther ovate in upper view, 2.0–2.2 mm long, apex obtuse; pollinia 2, soft and mealy, devoid of caudicles. Capsule not seen.

Additional specimen examined:—Malaysia. Sabah: Imbak Canyon Conservation Area, from Kuli Station (N05°06'48"; E117°02'25", 312 m.) to N05°01'09"; E117°02'01", along the slope trail, 12 August 2015, *Tsukaya, Okada, Hayashi, & Suleiman TOH-21* (BORH).

Notes:—*Aphyllorchis maliauensis* is similar to *A. montana* but differs in the shape and length of the dorsal sepal (narrowly ovate to lanceolate, 17.0–18.0 × 4.7–4.9 mm, acute at the apex vs. oblong to obovate, 9–13 × 3–5 mm, rounded to obtuse at the apex), lateral sepal (narrowly ovate to lanceolate, 17.0–18.0 × 4.2–4.4 mm, acute at the apex vs. (elliptic-) oblong, 9–12 × 3–5 mm, obtuse at the apex), and lateral petals (lanceolate, 16.0–16.5 × 2.7–2.9 mm, slightly out curving and acute at the apex vs. falcately linear-oblong 8.0–11.0 × 2.8–3.5 mm, rounded to obtuse at the apex) and the colour of the tepals (ivory white often with purple veins vs. yellowish white; Seidenfaden 1978, Su 2000).

In addition, *A. maliauensis* also differs clearly from the taxa that are now considered synonyms of *A. montana*, i.e., *A. benguetensis* Ames (1908: 48), *A. borneensis* Schlechter (1906: 299), *A. odoardii* Reichenbach (1886: 345), *A. prainii* Hooker (1890: 117), *A. purpurea* Fukuyama (1934: 431), *A. tanegashimensis* Hayata (1911: 344) and *A. unguiculata* Rolfe ex Downie (1925: 415)], all of which are morphologically similar to *A. montana*.

Distribution, phenology, and conservation status:—Fewer than 10 individuals of *Aphyllorchis maliauensis* were observed at two locations in the wet understory of a kerangas forest in the Maliau Basin Conservation Area, which is dominated by *Agathis* species and dipterocarps. In addition, only one individual of *A. maliauensis* was observed in the Imbak Canyon Conservation Area, Sabah, under a lowland dipterocarp forest. *Aphyllorchis maliauensis* flowers in mid-August in both populations. Furthermore, it is likely that *A. maliauensis* is distributed more widely because it seems to have sometimes been misidentified as the more widespread species, *A. montana*, which has similar gross morphology. For example, the *Aphyllorchis* sp. recorded as *A. montana* by Beaman *et al.* (2001; Sarawak, Borneo) and Wood (2003; Sabah, Borneo) appears identical to *A. maliauensis*, judging from their photographs.

However, the original descriptions and subsequent literature clearly indicate that there is little morphological variation in *A. montana sensu* Reichenbach (1876), despite its extensive distribution, which includes Sri Lanka, Assam, southern India, the Philippines, Borneo, Thailand, Taiwan, Japan and Indonesia (Reichenbach 1886, Hooker 1890, Schlechter 1906, Ames 1908, Hayata 1911, Downie 1925, Fukuyama 1934, Roy *et al.* 2009, Aravindhan *et al.* 2013, Rao & Kumar 2015, Fig. 4). Because the morphological differences between *A. maliauensis* and *A. montana* are clear and stable, *A. maliauensis* should be treated as an independent species rather than as an infraspecific taxon of *A. montana*. Conducting additional surveys for *A. maliauensis* during the flowering season would reveal its precise distribution.

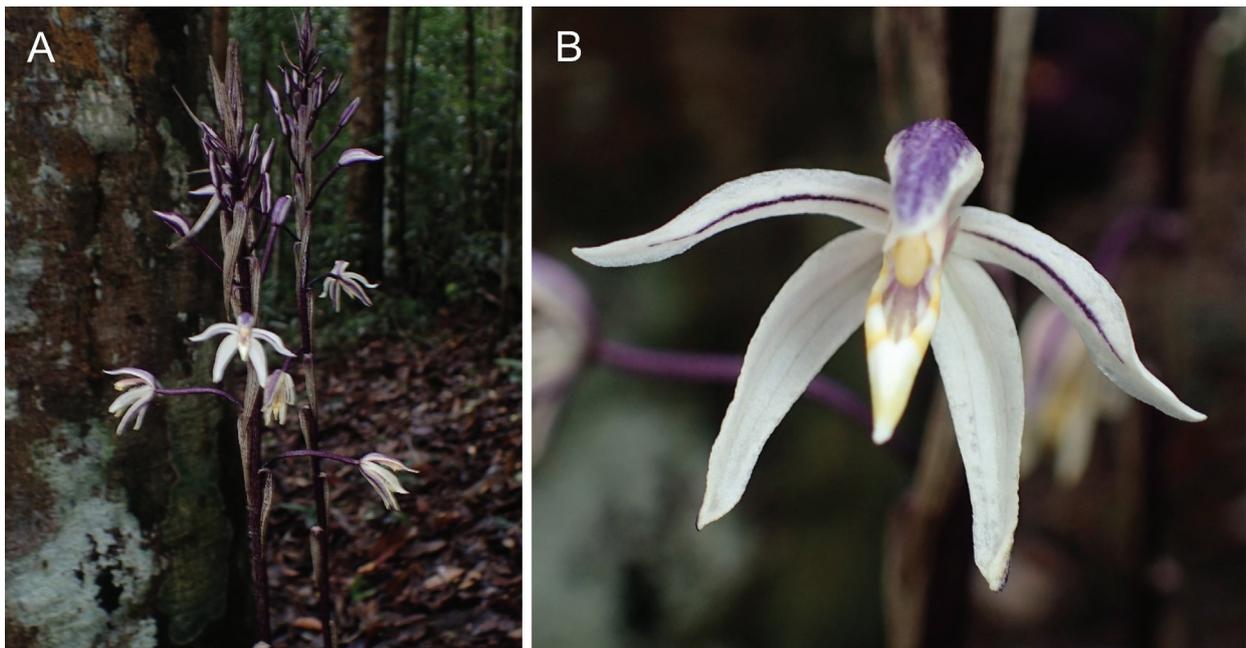


FIGURE 1. *Aphyllorchis maliauensis* (from the holotype). A. Flowering plant. B. Flower. Photographed by Kenji Suetsugu.



FIGURE 2. *Aphyllorchis maliauensis* (from the holotype). A. Flowering plant. Bar = 3cm. Drawings by Kumi Hamasaki.

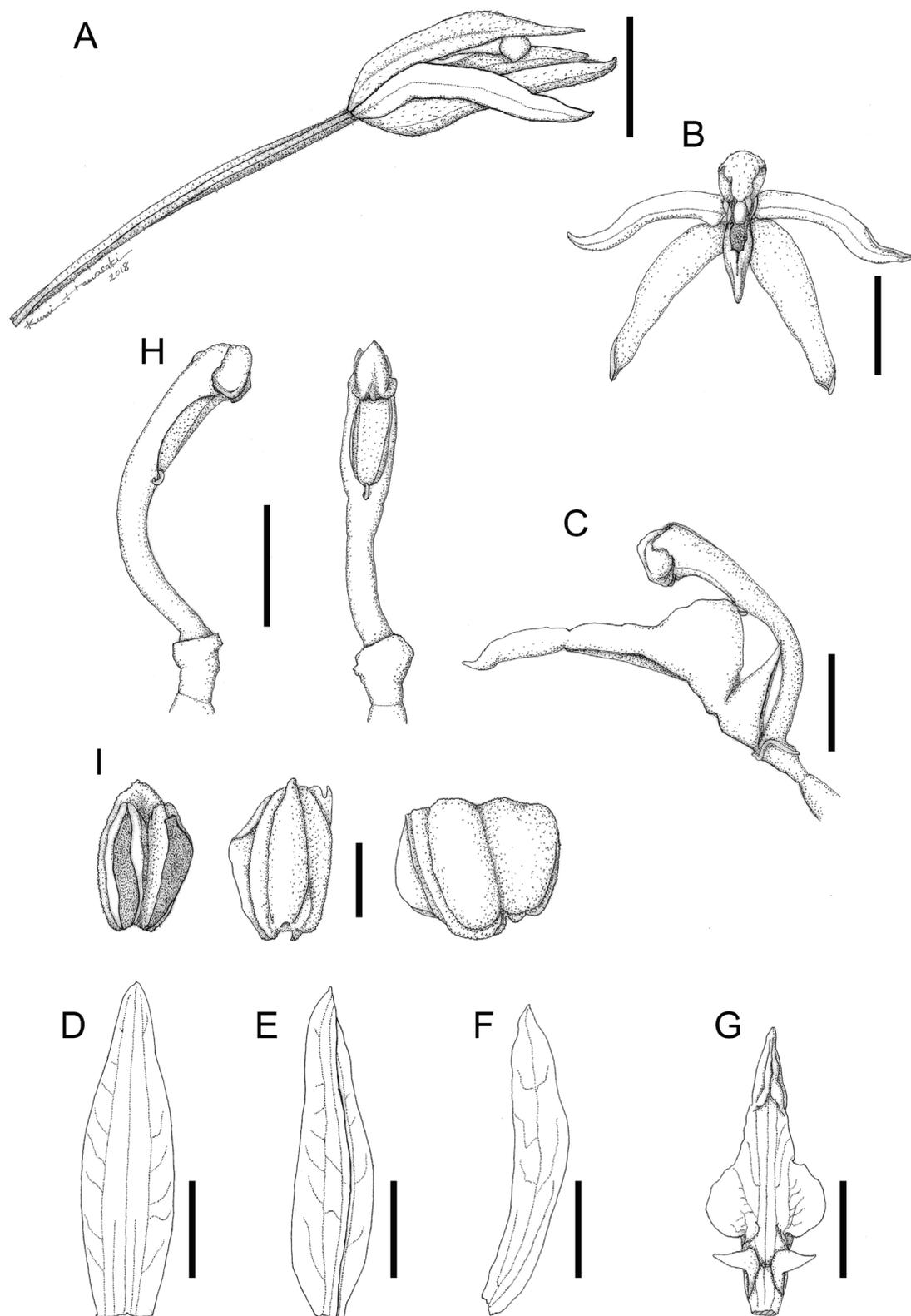


FIGURE 3. *Apyllorchis maliauensis* (from the holotype). A. Flower and ovary. B. Flower. C. Lip and column. D. Dorsal sepal. E. Lateral sepal. F. Lateral petal. G. Lip. H. Column. I. Anther cap. A–B. Scale bar = 1 cm. C–H = 5 mm. I = 1 mm. Drawings by Kumi Hamasaki.



FIGURE 4. *Aphyllorchis montana* in Okinawa Prefecture, Japan on 25 August 2009 (Obara KS217, TNS). A. Flowering plant. B. Flower. Photographed by Yuji Obara.

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