



Gastrodia bambu (Orchidaceae: Epidendroideae), A New Species from Java, Indonesia

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Abstract

Gastrodia bambu Metusala, a new species of *Gastrodia* (Orchidaceae: Epidendroideae, Gastrodieae) from Mount Merapi, Yogyakarta Province, Java, Indonesia, is described and illustrated. This new species is morphologically close to *Gastrodia abscondita* J.J.Sm, but differs in having a larger dark brown flower, a longer perianth tube, ovate petals, a longer and oblong-lanceolate lip, a different shape keels on lip, and a different shape column.

Key words: *Gastrodia*, Java, Mount Merapi, holomycotrophic

Introduction

The genus *Gastrodia* R.Br (Brown 1810: 330) (Orchidaceae: Epidendroideae) is a genus of holomycotrophic terrestrial orchids that consists of approximately 80 accepted names, most of them being endemic species (Govaerts *et al.* 2017). This genus is characterized by having an underground fleshy rhizome, lacking functional leaves and chlorophyll, with sepals and petals connate into a 5-lobed tube, and having two mealy pollinia that lack caudicles (Seidenfaden & Wood 1992; Pridgeon *et al.* 2005; Cribb *et al.* 2010). It is widely distributed from northeastern India across southern China to Japan, eastern Siberia, the Southeast Asia, Australia, New Guinea, Solomon islands, and westwards to Madagascar, Mascarene Islands and tropical Africa (Pridgeon *et al.* 2005; Cribb *et al.* 2010). Southeast Asia is its center of diversity region with 24 existing species (Govaerts *et al.* 2017; Tsukaya & Hidayat 2016; Pelsner *et al.* 2016), with China (20 species) and Australia (15 species) being another two diversity hotspots (Johns & Molloy 1983; Chen *et al.* 2009; Hsu & Kuo 2010; Hsu & Kuo 2011; Yeh *et al.* 2011; Hsu *et al.* 2012; Tan *et al.* 2012; Hu *et al.* 2014).

Prior to this article, Indonesia was known to host nine species of *Gastrodia* (Govaerts *et al.* 2017). Three of these were recorded from Sumatra (*G. exilis* Hook.f (Hooker 1894: 123), *G. javanica* (Blume) Lindl (Lindley 1840: 384), and *G. verrucosa* Blume (1856: 175)); six species were recorded from Java (*G. abscondita* J.J.Sm (Smith 1903: 13), *G. callosa* J.J.Sm (Smith 1931: 248), *G. crispa* J.J.Sm (Smith 1921: 248), *G. javanica*, *G. selabintanensis* Tsukaya & A.Hidayat (2016: 77) and *G. verrucosa*); and one species (*G. celebica* Schltr (Schlechter 1911a: 6)) from Sulawesi. Only the widely distributed *G. javanica* has been found in Lesser Sunda Islands, and this species probably also occurs in Indonesian Borneo. There is still no record from the Moluccas Islands. Only one species was recorded from the Indonesian part of New Guinea island (*G. crassisejala* L.O.Williams (1942: 211)); while another New Guinea species, *G. papuana* Schltr (Schlechter 1911b: 45), is so far recorded only from Papua New Guinea.

In recent years, many new species of *Gastrodia* have been discovered, mostly from eastern Asia, particularly Taiwan, Japan and China (Meng *et al.* 2007; Hsu & Kuo 2010; Hsu & Kuo 2011; Yeh *et al.* 2011; Tan *et al.* 2012; Suetsugu 2013; Suetsugu 2014; Hu *et al.* 2014; Huang *et al.* 2015; Suetsugu 2016; Suetsugu 2017). In the Malesian region (but excluding Indonesia), there have been 4 new species described from Peninsula Malaysia, Sabah and Philippines (Ong & O'Byrne 2012; Pelsner *et al.* 2016). Only *G. selabintanensis* (Tsukaya & Hidayat 2016) has been described from Indonesia since the publication of *G. callosa* in 1931.

The recent taxonomical study of *Gastrodia* in Indonesia has been very limited. *Gastrodia* species are difficult to find due to their most of life cycle being underground; they only emerge when flowering (Lok *et al.* 2009), and very few orchid-collecting expeditions have coincided with *Gastrodia*'s blooming periods. Other difficulties include: plants often occur in small scattered populations, they have a relatively short blooming period (which may shift from year to

year), inconspicuous flower colors, and they are difficult (or impossible) to cultivate ex-situ, so it cannot be obtained from a local nursery.

Local botanical surveys of Mount Merapi have applied the name *Gastrodia crispa* to *Gastrodia* specimens living on the mountain (Muriyanto 2015; BiOSC 2016). Our study found that this is a misidentification; these specimens represent an undescribed species that has flower characteristics morphologically closer to *Gastrodia abscondita* than *G. crispa*. Here we describe it as new *Gastrodia* species from Java-Indonesia and provide the pictures of true *Gastrodia crispa* for comparison (Fig 4).

Taxonomic Treatment

Gastrodia bambu Metusala, *sp. nov.* (Figs. 1,2,3)

Type:—INDONESIA. Java: Yogyakarta Province, Sleman Regency, Mount Merapi, Turgo. c. 800 m, 20 March 2016, RIO 8997 (holotype: BO!).

Diagnosis:—*Gastrodia bambu* is close to *Gastrodia abscondita* J.J.Sm., but differs in having larger dark brown flowers (17–20 mm × 14–16 mm), a longer perianth tube (≥ 17 mm), ovate petals, a longer oblong-lanceolate lip (≥ 10 mm), different shape keels on the lip, and a different shape column.

Terrestrial, holomycotrophic. Rhizome tuberous, succulent, cylindrical, 3.5–9 cm long × 5–9 mm in diameter, dark brown, covered with numerous scales. Roots few, slender, usually extending from base or middle part of the rhizome. **Inflorescence** erect; peduncle greenish brown to pale brown, 3–13 cm tall × 0.3–0.5 cm in diameter, glabrous, 2–5 nodes, a tubular sheath on each internodes; sheaths triangular to ovate, light brown to reddish brown, 6–9 mm long × 6–11 mm wide, thin, membranous, apex acute; 1–8 flowers, spreading, several flowers open simultaneously; flower bract narrowly triangular, 5–7 mm long × 2.5–3 mm wide, acute. **Pedicel and ovary** slender, light brown or cream to reddish brown, 15–20 mm long. **Flower** resupinate, tubular, campanulate, 17–20 mm long × 14–16 mm wide at front, not opening widely, smelling of rotten fish; slightly glossy, sepals and petals dark brown to blackish brown; lip orange at base, whitish-brown in middle, tinged orange at apex, basal callus white; column greenish brown, apical half suffused white-orange; anther-cap white to yellowish-white. **Sepals and petals** connate, forming a 5-lobed tube, 17–20 mm long, outer surface slightly verrucose, inner surface wrinkled/rugose. **Sepals** subsimilar, fleshy; lateral sepals connate to each other for c. 50–55 % of their length and connate to dorsal sepal for c. 65–75 % of their length; lateral sepals free part obliquely triangular, 6–10 mm long × 9–11 mm wide, margins slightly undulate, apex obtuse to acute; dorsal sepal free part broadly triangular, 6–10 mm long × 9–12 mm wide, margins slightly undulate, apex rounded to slightly retuse. **Petals** adnate to sepals, forming a floral tube, slightly fleshy, free part ovate, base slightly contracted, 5–6 mm long × 3–4 mm wide, margins irregular and slightly undulate, apex obtuse. **Lip** adnate to column-foot apex, enclosed within perianth tube, fleshy, oblong-lanceolate, 10–12 mm long × 3.5–4 mm wide; basal area with 2 verrucose ovoid calli; disc convex, pubescent except for glabrous apex; with three longitudinal keels, the low median keel extending from between basal calli to about halfway along the lip where it elevates gradually become an erect thin plate-like keel that terminates near the lip apex, the outer two keels are lower and less distinct, usually extending along the apical half of the lip; lip lateral margins irregular and slightly ascending; lip apex slightly canaliculate, obtuse to acute. **Column** elongate, slightly arcuate, canaliculate, narrowly winged along its length, 10–12 mm long × 2–2.5 mm wide at base, broadening to c. 3 mm wide near the middle then narrowing gradually to c. 2 mm near the truncate apex; steldia indistinct, very small, tooth-like, acute; stigma borne on a raised projection at column base, semi-circle to ovate; anther-cap subrectangular, 1–1.2 mm × 1 mm; pollinia 2. **Capsule** erect, cylindrical, 1.8–3 cm long × 0.5–0.7 cm in diam., brown; pedicel elongates up to 26 cm long during fruit maturation.

Distribution and phenology:—The distribution of *Gastrodia bambu* appears to be restricted to Java. Populations have been discovered in Yogyakarta Province on Mount Merapi at c. 800 m., and more recently (28 January 2017) in West Java Province, Sukabumi, Bodogol, Mount Gede Pangrango, at c. 800 m. All these populations were found very close to old bamboo clumps, growing in wet soil containing partly-decomposed bamboo leaf litter, in the very deep shade cast by the bamboo plant's canopy. Flowering recorded from mid February to mid March (Mount Merapi) and mid January to mid February (Mount Gede Pangrango).

Etymology:—The specific epithet “bambu” refers to the Indonesian name for bamboo, the dominant plant associated with this new species.

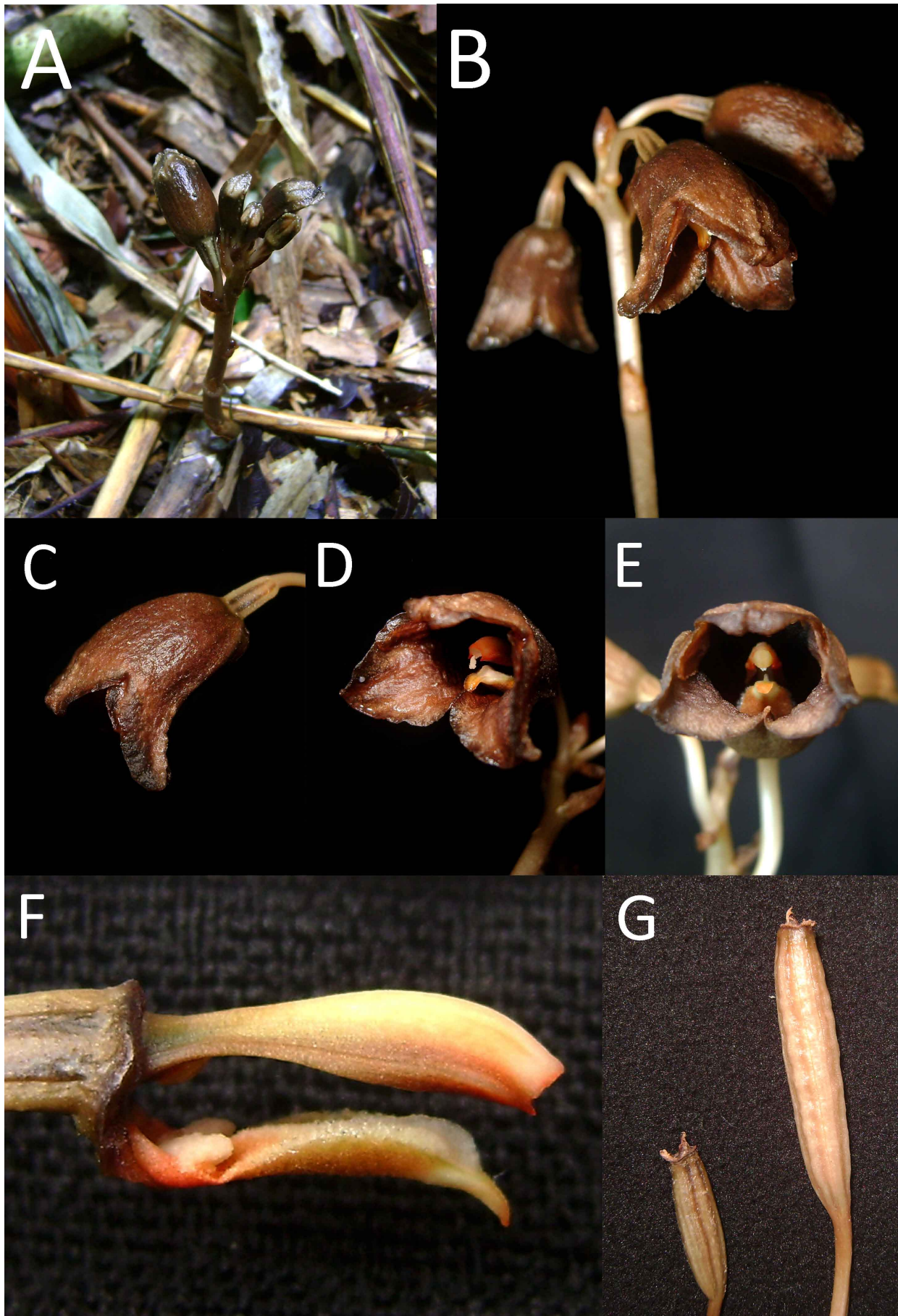


FIGURE 1. *Gastrodia bambu*. **A**, flowering individual in the type locality (Mount Merapi). **B**, inflorescence. **C–E**, flower (side view, oblique view and front view). **F**, column and lip (side view). **G**, capsules. Photographs by Destario Metusala.

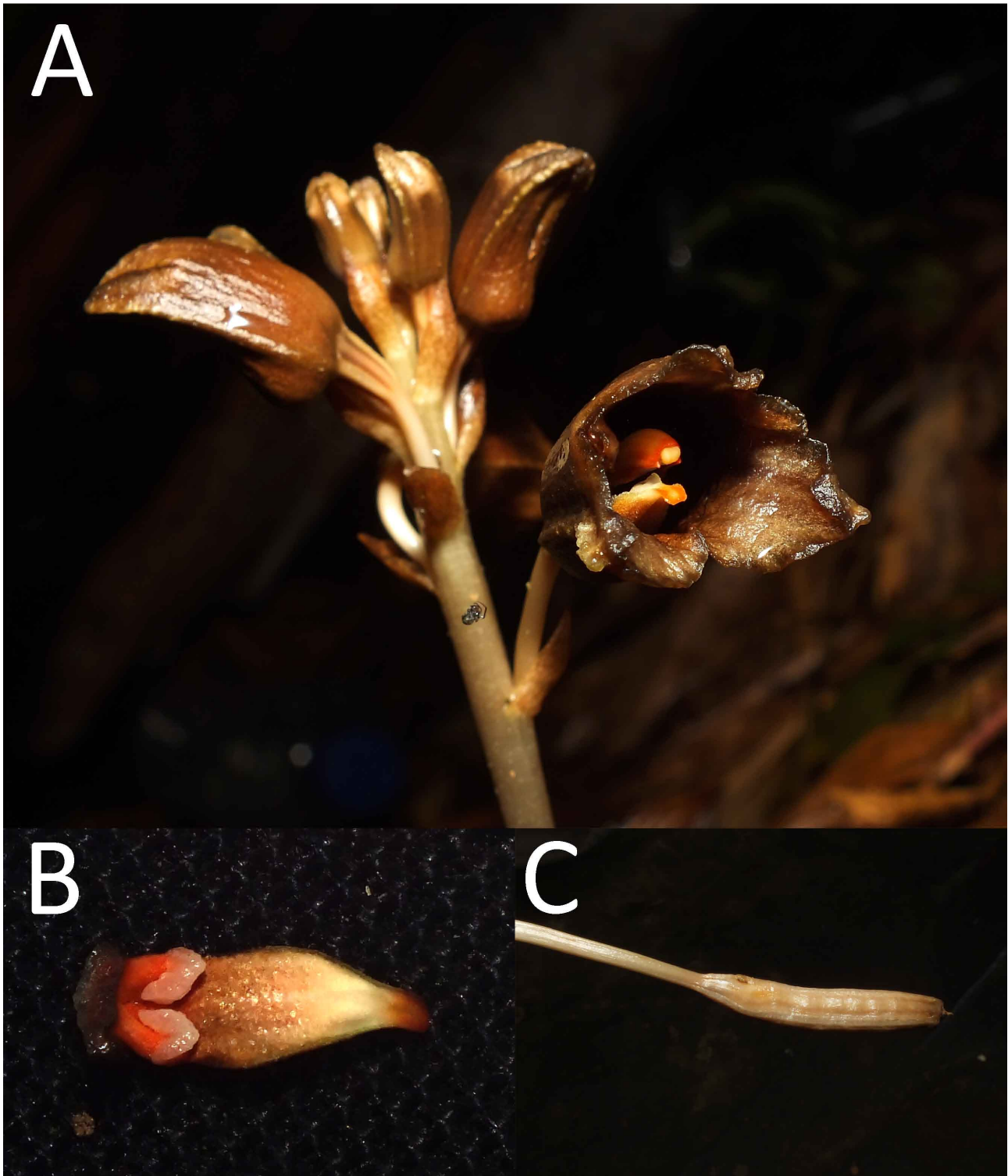


FIGURE 2. *Gastrodia bambu*. **A**, flowering individual from Mount Gede Pangrango. **B**, lip (upper view) **C**, capsule. (Photographs by Reza Saputra).

Discussion:—*Gastrodia bambu* is morphologically close to *Gastrodia abscondita*, but differs in having larger (17–20 mm × 14–16 mm) dark brown flowers, a longer perianth tube (17–20 mm), petals with an ovate free part (5–6 mm long × 3–4 mm wide), an oblong-lanceolate lip that is longer (10–12 mm) and has three longitudinal keels, a longer column (10–12 mm) with narrow column wings along its length, and very small tooth-like stelidia. By contrast, *Gastrodia abscondita* has smaller (13 mm × 11 mm) pale gray flowers, a shorter perianth tube (13 mm), petals with a 3.7 mm × 1.7 mm oblong free part, a shorter (6 mm) sub-sagittate lip with an ovate-triangular blade and 5 longitudinal ridges, a shorter column (5.5 mm) with wider column wings only in the apical half, and large triangular stelidia. Morphological comparison between *G. bambu*, *G. abscondita*, and *G. crispa* are shown in Table 1.

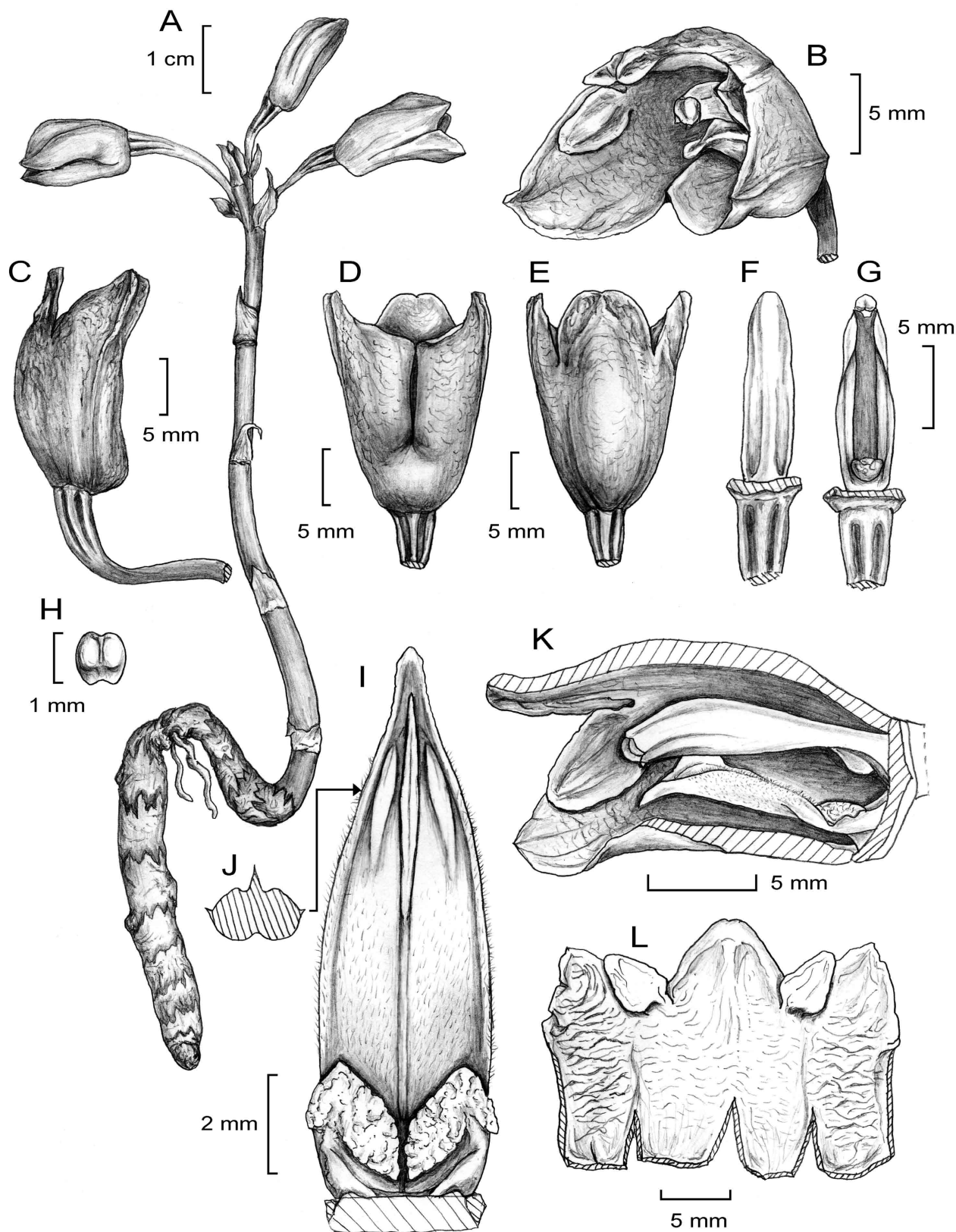


FIGURE 3. *Gastrodia bambu*. A, habit. B–E, flower (B, oblique view; C, side view; D, ventral view; E, dorsal view). F–G, column (F, dorsal view; G, ventral view). H, anther cap. I–J, lip (I, flattened; J, cross section at indicated point). K, longitudinal section through flower showing lip and column. L, flattened perianth tube (sepals and petals). Drawn by Destario Metusala.

TABLE 1. Morphological comparison between *G. bambu*, *G. abscondita*, and *G. crispa*.

No	Characters	<i>G. bambu</i>	<i>G. abscondita</i> (Smith 1903: 103)	<i>G. crispa</i> (Smith 1921: 248; personal observation)
1	Flower size	17–20 × 14–16 mm	13 × 11 mm	18–21 × 9–13 mm
2	Flower color	Dark brown	Pale gray	Greenish brown
3	Perianth tube length	17–20 mm	13 mm	18.5–21 mm
4	Petals shape	Ovate	Oblong	Quadragular-ovate
5	Lip length	10–12 mm	6 mm	7–7.6 mm
	Lip color	Orange at base, whitish-brown in middle, tinged orange at apex	Green with orange at the apex	White suffused pale yellowish green near apex
6	Lip shape	Oblong-lanceolate	Sub-sagittate	Ovate
7	Column length	10–12 mm	5.5 mm	6.5–7 mm
	Column color	Greenish brown, apical half suffused white-orange	Sepia brown at base and pale gray brown near apex	Greenish at base and white at apical half
8	Stelidia	Very small, tooth-like	Large-triangular	Small-triangular



FIGURE 4. *Gastrodia crispa*. **A**, flowering individual. **B**, inflorescence. **C**, flower (front view). **D**, longitudinal section through flower showing lip and column. (Photographs by Destario Metusala).

Conservation:—It seems that the *Gastrodia bambu* requires very specific ecological conditions and is very sensitive to environmental changes. Previous studies have shown that *Gastrodia* species have specific mycorrhizal associations throughout their life cycle, making them very vulnerable to habitat disturbance (Martos *et al.* 2009; Selosse *et al.* 2010; Martos *et al.* 2015). The extent of occurrence of this species has been estimated at less than 5000 km². The population in Gede Pangrango Mountain is inside the National Park and therefore protected, but in Merapi Mountain the species is known from few locations, all outside the National Park boundary, where the quality of habitat is rapidly declining due to clear-cutting of bamboo clumps for logs. It is also threatened by the hot clouds released intermittently by Mount Merapi, a highly active volcano. Its population size is estimated fewer than 1000 individuals. Therefore, we consider this species to be a category of “Endangered” according to the IUCN Red List Categories and Criteria (IUCN, 2016).

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