

## Short Communication

*Gastrodia exilis* (Orchidaceae), a newly recorded mycoheterotrophic genus and species in CambodiaSUETSUGU Kenji<sup>1,\*</sup>, HSU Tian-Chuan<sup>2</sup>, TAGANE Shuichiro<sup>3</sup>, CHHANG Phourin<sup>4</sup> & YAHARA Tetsukazu<sup>3</sup><sup>1</sup> Department of Biology, Graduate School of Science, Kobe University, 1-1 Rokkodai, Nada, Kobe, 657-8501, Japan.<sup>2</sup> Herbarium of Taiwan Forestry Research Institute, No. 53, Nanhai Road, Taipei 100, Taiwan.<sup>3</sup> Center for Asian Conservation Ecology, Kyushu University, 744 Motooka, Fukuoka, 819-0395, Japan.<sup>4</sup> Institute of Forest and Wildlife Research and Development, Forestry Administration, 40 Preah Norodom Boulevard, Phnom Penh, Cambodia.

\* Corresponding author. Email kenji.suetsugu@gmail.com

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The genus *Gastrodia* (Orchidaceae) comprises approximately 90 species of mycoheterotrophic orchids distributed throughout the temperate and tropical regions of Asia, Oceania, Madagascar and Africa (Govaerts *et al.*, 2016; Hsu *et al.*, 2016). Within Indochina, *Gastrodia* has been recorded from Thailand and Vietnam but not yet from Cambodia and Laos (Schuiteman & de Vogel, 2000; Suddee & Harwood 2009; Averyanov, 2011; Suddee, 2014; Schuiteman *et al.*, 2015). The genus is characterised by fleshy tubers, the absence of leaves, as well as the fusion of its sepals and petals, and the presence of two mealy pollinia that lack caudicles.

As is the case in most other mycoheterotrophic species, most *Gastrodia* species occur in small populations and appear above the soil surface only during their brief reproductive period (Suetsugu, 2016). Therefore, the diversity and distribution patterns of *Gastrodia* species are easily underestimated. Our recent botanical surveys have resulted in the discovery of many new species and distribution records for this genus (e.g., Suetsugu, 2012, 2013, 2014, 2015, 2016; Hsu & Kuo, 2010, 2011; Hsu *et al.*, 2012, 2016). We document the occurrence of *Gastrodia exilis* here as a newly recorded genus and species for Cambodia. The following description is based on our Cambodian material.

***Gastrodia exilis* Hook.f., *The Flora of British India*, 6, 123 (1890)**

*Gastrodia siamensis* Rolfe ex Downie, *Bulletin of Miscellaneous Information*, 1925, 416 (1925); *Gastrodia hayatae* Tuyama, *Journal of Japanese Botany*, 17, 580 (1941).

Terrestrial, mycoheterotrophic herb. Rhizome tuberous, fusiform or cylindrical, 7–12 mm long, 3–5 mm in diameter. Inflorescence erect, white to pale brown, glabrous, 14–17 cm long, 1.5 mm in diameter, with 4–6 nodes, with tubular, membranous sheaths. Bracts up to 3 mm long, 1.5 mm wide. Pedicel and ovary up to 10 mm long. Flowers 2–4, 7–9 mm long, white, tubular, slightly turned upwards, resupinate. Sepals and petals connate, forming a five-lobed perianth tube. Sepals ca. 7 mm long, connate basally 3/4–4/5 their length with petals, lateral ones connate basally 2/3–3/4 with each other; free tips of sepals ovate-triangular, ca. 2 mm long, 2 mm wide, apex obtuse, margins slightly undulate; free tip of petals ovate-triangular, ca. 1.5 mm long, 1.5 mm wide, apex obtuse, margins slightly undulate. Lip 4–4.5 mm long, 1.5–2.0 mm wide, hypochile with two globose calli; epichile ovate-elliptic, base contracted, disc 5-ridged with two parallel erect longitudinal keels extending toward apex in the distal half, margin slightly undulate. Column straight, semi-cylindrical, 4–4.5 mm long, white;

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**Fig. 1** Flowering and fruiting plant of *Gastrodia exilis* in Bokor National Park. A) Flowering plant, B) Flowers, C) Immature fruit.

lateral wings narrow, the edges parallel to column, acute; rostellum absent. Anther hemispherical, pollinia 2.

*Specimen examined:* Cambodia, Kampot Province, Bokor National Park, evergreen forest around sphagnum bog, 10°39'9.06"N, 104°03'38.68"E, alt. 935 m, 17 October 2012, Tagane S., Fuse K., Choeng HN 4275 (deposited in the Forestry Administration herbarium in Cambodia).

*Distribution:* Cambodia (new record), India, Thailand and Sumatra.

*Habitat and ecology:* Fewer than 10 individuals were found in a small population in the wet understorey of tropical lower montane forest on the plateau of Bokor National Park. The site is close to the collection locality of *Aphyllorchis pallida* Blume and dominant trees were reported by Tagane *et al.* (2015). The flowering time is in early to mid-October.

*Conservation status:* While *Gastrodia exilis* has not been assessed by the IUCN Red List of Threatened Species (IUCN, 2016), this species has been reported from only a few scattered localities in India, Thailand, and Sumatra (Hooker, 1890; Downie, 1925; Tuyama, 1941; Seidenfaden, 1978; Joseph *et al.*, 1980; Kumar & Kumar, 2001; Suddee, 2004). In addition, in Cambodia the species is only known from Mt Bokor (see also Note 2 below), where the aforemen-

tioned specimen was collected. Given that mycoheterotrophic plants are highly dependent on the activities of both the fungi and the trees that sustain them (e.g., Suetsugu *et al.*, 2014), they are particularly sensitive to environmental disturbance. Because deforestation for resort development is rapidly expanding very near to the locality of this species on Mt Bokor, urgent attention is needed to conserve the Cambodian population. This is also in the interest of many other rare plants growing nearby, such as *Nepenthes bokorensis* Mey and *Dipodium paludosum* (Griff.) Rchb.f.

Notes: 1) Compared with published descriptions and illustrations (Hooker, 1890; Downie, 1925; Tuyama, 1941; Seidenfaden, 1978, Joseph *et al.*, 1980; Kumar & Kumar, 2001; Pedersen *et al.*, 2004), the Cambodian plants we observed were smaller than those from previously reported localities (e.g., India and Thailand), producing shorter rhizomes (0.7–1.2 cm vs. 1.0–5.5 cm), shorter inflorescences (14–17 cm vs. 15.5–112 cm) and smaller number of flowers per inflorescence (2–4 vs. 3–25). However, there are no significant differences in the morphology of the lip and column, which are the most important characters used to classify *Gastrodia* species. Furthermore, given that plant size can be dramatically affected by the availability of nutrients, it would not be surprising to observe variability in plant size among different popula-

tions reflecting their different nutritional resources, such as the activity of their mycorrhizal fungi. Therefore, we consider that the differences most likely represent an example of intraspecific variation. The overlap in the size range of plants between the Cambodian and previously reported populations supports this assumption. 2) On 27 November 2016, Dr André Schuiteman and co-workers found another population of *G. exilis* nearby (in evergreen forest near Popokvil Waterfall): this consisted of at least a dozen plants, most growing close together, but some about 100 m away from the others. Most were in fruit, but one specimen still had flowers (voucher specimen: Schuiteman *et al.* 16-120A, spirit mat. K; Schuiteman, pers. comm.).

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