



Gastrodia flexistyloides (Orchidaceae), a new mycoheterotrophic plant with complete cleistogamy from Japan

KENJI SUETSUGU

Graduate School of Human and Environmental Studies, Kyoto University, Yoshida-Nihonmatsu-cho, Sakyo, Kyoto 606-8501, Japan.
e-mail: kenji.suetsugu@gmail.com

Abstract

A new species, *Gastrodia flexistyloides* (Orchidaceae: Epidendroideae, Gastrodieae) from Takeshima Island, Kagoshima Prefecture, Japan, is described and illustrated. In its trilobed column with a strongly incurved central lobe, this species shows a close affinity to *G. flexistyla* from Taiwan, but it is easily distinguished from *G. flexistyla* by several characteristics, including taller stature during the flowering period and completely cleistogamous flowers with a smaller and narrower perianth tube.

Introduction

The genus *Gastrodia* Brown (1810: 330; Gastrodieae, Epidendroideae) constitutes a group of mycoheterotrophic orchids distributed throughout the temperate and tropical regions of Asia, Oceania, and Madagascar (Chung & Hsu 2006, Tan *et al.* 2012). It contains approximately 50 species, which are characterized by their fleshy tuber or coralloid underground stem, as well as the absence of leaves, the union of sepals and petals, and two mealy pollinia lacking caudicles (Pridgeon *et al.* 2005, Meng *et al.* 2007, Chen *et al.* 2009, Cribb *et al.* 2010, Hsu & Kuo 2010, 2011, Hsu *et al.* 2012).

The genus shows considerable morphological diversity. For example, some species of section *Gastrodia* can reach 60–100 cm in height during flowering, while most species of section *Codonanthus* (Schlechter 1911, Tuyama 1967) produce inflorescences that are only 3–15 cm during flowering, but extend to 30–40 cm during the fruiting period as a consequence of their elongated pedicels (Chung & Hsu 2006).

Plants belonging to the latter group, including the new species described below, are rarely found during the flowering season, and as such have not been studied in detail. However, recent floral research in southern Japan has revealed several new species, as well as new distributional records for the genus, indicating that there may still be undiscovered species hidden in this area (Tuyama 1982, Suetsugu *et al.* 2012, 2013, Suetsugu 2013a). As expected, a new *Gastrodia* species, with significantly different floral morphology compared to other known species, was discovered during a research trip to Takeshima Island, Kagoshima Prefecture, Japan in March to April 2014.

Gastrodia flexistyloides Suetsugu, *sp. nov.* (Figs. 1–2)

Type:—JAPAN. Kyushu: Kagoshima Pref., Takashima Island, 25 March 2014, K. Suetsugu *s.n.* (holotype KYO; isotype TNS).

Diagnosis:—*Gastrodia flexistyloides* differs from its close relative *G. flexistyla* T.C. Hsu & C.M. Kuo (2010: 243), in that it has a larger inflorescence, a completely cleistogamous flower, and a smaller, narrower perianth tube.

Terrestrial, mycoheterotrophic herb. Roots few, slender or occasionally thickened, mostly extending from apex of the rhizome. Rhizome tuberous, fusiform or cylindrical, 2–8 cm long, 4–12 mm in diameter, pale brown, covered with numerous scales and unicellular hairs. Inflorescence erect, pale brown, 9–18 cm long, 3–5 mm in diameter, 3–4 nodes, with tubular, membranous sheaths. Bracts up to 8 mm long, 5 mm wide. Pedicel and ovary up to 15 mm long. Flowers 1–6, tubular, slightly upwards or downwards, resupinate, 15–18 mm long, 5–6 mm in diameter. Sepals and petals united

Gastrodia flexistylodes is also similar in appearance to *G. takeshimensis* Suetsugu (2013: 375), since both species have completely cleistogamous flowers and elongated corolla tubes. However, the two species differ greatly with regard to their lip and column morphology (Suetsugu 2013a). In addition, *G. flexistylodes* can also be distinguished from *G. takeshimensis* without dissection of the perianth tube as the perianth tube differs in colour (pale brown vs. dark brown for *G. flexistylodes* and *G. takeshimensis*, respectively). Furthermore, the flowering season of *G. flexistylodes* (mid-March to early April) is somewhat earlier than that of *G. takeshimensis* (late March to late April).

Reproductive biology:—*G. flexistylodes* adopts an autonomous self-pollination system. Reports of autonomous self-pollination are fairly common in Orchidaceae (e.g. Suetsugu 2013a, b, c, 2014). The usual mechanism of autonomous self-pollination involves the pollinia falling onto the stigma surface, allowing contact between the pollinia and stigma (e.g. Liu *et al.* 2006, Chen *et al.* 2012, Suetsugu 2013a, b, c, 2014, but also see Gamisch *et al.* 2013). However, the autogamous system of *G. flexistylodes* is notable because the central lobe of the column, which is strongly incurved, also contributes to the pollination process, allowing the anther to contact with stigma directly and thus facilitate self-pollination. So far, this selfing strategy has only been reported in *G. flexistylodes* and the closely related species *G. flexistyla*.

The flowers of *G. flexistylodes* remain closed throughout the flowering period (mid-March to early April). Although cleistogamous plants usually adopt a mixed pollination strategy, also bearing chasmogamous flowers for open pollination (reviewed by Culley & Klooster 2007), it was found that *G. flexistylodes* only produced cleistogamous flowers, which indicates that it is an obligate self-pollinating species. Complete cleistogamy is also known to occur in several *Gastrodia* species belonging to section *Codonanthus* (e.g. *G. clausa* T. C. Hsu, S. W. Chung & C. M. Kuo (2012: 271) and *G. takeshimensis*). In addition, *G. flexistylodes* also shares a common characteristic with section *Codonanthus*, producing pedicels that elongate considerably until the dehiscence of the capsules, a feature that is theorized to facilitate the wind dispersal of seeds in *Codonanthus* (Pedersen *et al.* 2004).

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