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Gastrodia takeshimensis (Orchidaceae), a new mycoheterotrophic species from Japan

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A new species, *Gastrodia takeshimensis* Suetsugu (Orchidaceae: Epidendroideae, Gastrodieae) from Takeshima Island, Kagoshima Prefecture, Japan, is described and illustrated. Its elongated corolla tube suggests a close affinity to *G. nipponica*, but it is easily distinguished from *G. nipponica* by its narrower and enclosed perianth tube, a lip that is joined with the perianth tube without any appendage, and a taller inflorescence during the flowering period.

The genus *Gastrodia* (Gastrodieae, Epidendroideae) is a group of mycoheterotrophic orchids distributed in temperate and tropical areas of Madagascar, Asia and Oceania (Chung & Hsu 2006). The genus contains ca. 50 species and is characterized by a fleshy tuber or coralloid underground stem, absence of leaves, union of sepals and petals, and two mealy pollinia without caudicles (Pridgeon *et al*. 2005: 672, Chen *et al*. 2009, Cribb *et al*. 2010, Hsu & Kuo 2010, 2011, Hsu *et al*. 2012).

Gastrodia shows extraordinary morphological diversity. Some species of the section *Gastrodia* (*sensu* Schlechter 1911), such as *G. elata*, reach 60–100 cm in height during the flowering period. In contrast, many species of the section *Codonanthus* (Schlechter 1911, Tuyama 1967), such as *G. verrucosa* (the *G. verrucosa* group), have inflorescences that are only 3–15 cm long during the flowering period, but 30–40 cm long during the fruiting period, with elongated pedicels (Chung & Hsu 2006).

Plants belonging to the latter group are rarely found during the flowering season, and thus they have not been studied intensively. In Japan, seven species belonging to the section *Codonanthus* (*G. boninensis*, *G. confusa*, *G. nipponica*, *G. pubilabiata*, *G. shimizuana*, *G. gracilis* and *G. clausa*) have been reported (Tuyama 1982, Suetsugu *et al*. 2012, 2013). During a research trip to Takeshima Island, Kagoshima Prefecture, Japan in late April 2012, I discovered a *Gastrodia* species with significantly different floral morphology from the seven species known from Japan.

Gastrodia takeshimensis Suetsugu, *sp. nova* (Figs. 1–2)

Holotype: Japan. Kyushu. Kagoshima Pref., Takeshima Island, 29 April 2012 *K. Suetsugu s.n.* (KYO). — Paratypes: Same locality, 10 April 2013 *K. Suetsugu s.n.* (KYO, TNS).

Etymology: The specific epithet is derived from Takeshima Island, the provenance of the species.

Terrestrial, mycoheterotrophic herb. Roots few, slender or occasionally thickened, mostly extending from apex of rhizome. Rhizome tuberous, fusiform or cylindrical, 2–9 cm long,

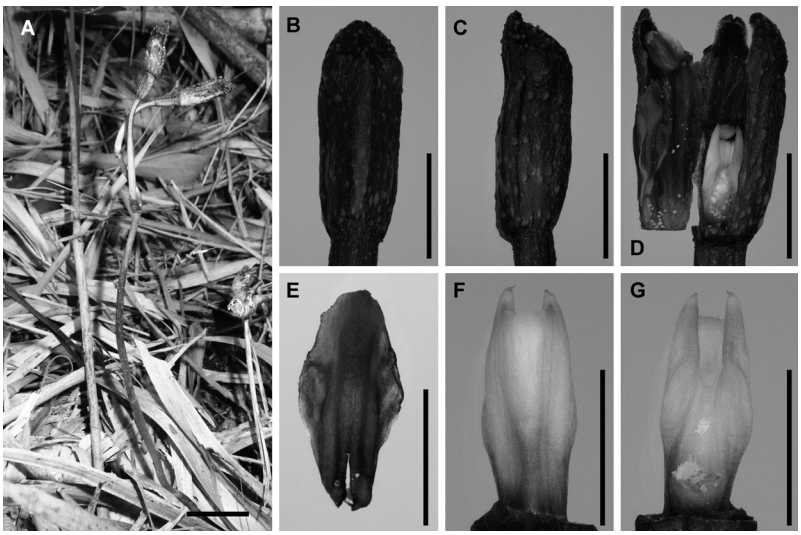

Fig. 1. *Gastrodia takeshimensis* (from the holotype). — **A**: Flowering plants. — **B** and **C**: Flower (**B**: front view; **C**: side view). — **D**: Dissected flower (longitudinal section). — **E**: Lip. — **F** and **G**: Column (**F**: front view; **G**: back view). Scale bars: **A** = 2 cm, **B–D** = 1 cm, **E–G** = 0.5 cm.

3–14 mm in diameter, pale brown, covered with numerous scales and unicellular hairs. Inflorescence erect, pale brown, 7–16 cm long, 2–3.5 mm in diameter, 3–4 nodes, with tubular, membranous sheaths. Bracts up to 3.5 mm long, 3 mm wide. Pedicel and ovary up to 15 mm long. Flowers 1–4, tubular, pointing slightly upwards or downwards, resupinate, 16–20 mm long, 6–7 mm in diameter. Sepals and petals united, forming a five-lobed perianth tube. Sepals subsimilar, fleshy, 16–20 mm long, connate ca. 3/4 of their length with petals, lateral ones connate ca. 2/3 with each other, outer surface dark brown, verrucous, margins entire; free portion of dorsal sepal straight, ovate-triangular, retuse, ca. 5 mm long, 5 mm wide; free portions of lateral sepals triangular, retuse, acute at apex. Free portions of petals ovate or elliptic, up to 3.5 mm long, 3 mm wide. Lip joined with perianth tube, ca. 10 mm long, hypochile pale green without any appendages or calli; epichile reddish orange, ovate-ellipse, base contracted, disc 2–4 ridged, central two ridges extending toward apex, margin slightly undulate; apical portion ligulate, red, ca. 1.5 mm wide. Column straight, semi-cylindrical, 7–8 mm long, ca. 2 mm wide, white; lateral wings (stelidia) distinct, narrow, the edges parallel to column, base slightly angled, apex acute; rostellum small at middle of column; stigma located at base. Anther hemispheric, 1–1.5 mm in diameter, pollinia 2. Capsule cylindrical, 3–3.5 cm long, pedicel elongating to ca. 30 cm long in fruit. Seeds fusiform, ca. 2 mm long.

Distribution: *G. takeshimensis* is restricted to Takeshima Island. The population is in a bamboo forest dominated by *Pleioblastus linearis*. About 1000 flowering individuals were found in an area of less than 1 km^2. Flowering takes place from late May to late April, fruiting from late April to late May.

Reproductive biology: The flowers of *G. takeshimensis* remained closed throughout the flowering period (late March to early April). In addition, by carefully dissecting the flowers in different growing stages, I realized that the pollinia rapidly fragment into massulae before the flowers mature. The massulae then drop onto the stigma surface. The species is therefore an obligate self-pollinator. Such a cleistogamous self-pollination system is known to occur in other species that belong to the section *Codonanthus* (i.e. *G. clausa*; Hsu & Kuo 2010). I also observed in the field that the pedicels elongate considerably (early April to early May) until the dehiscence of the capsules. This feature is commonly reported in species of the section *Codonanthus*, and is suggested to facilitate seed dispersal by wind (Pedersen *et al*. 2004).

Gastrodia takeshimensis is characterized by having an elongated perianth tube up to 16–20 mm long. An elongated corolla tube suggests a close affinity to *G. nipponica*, but *G. take-*

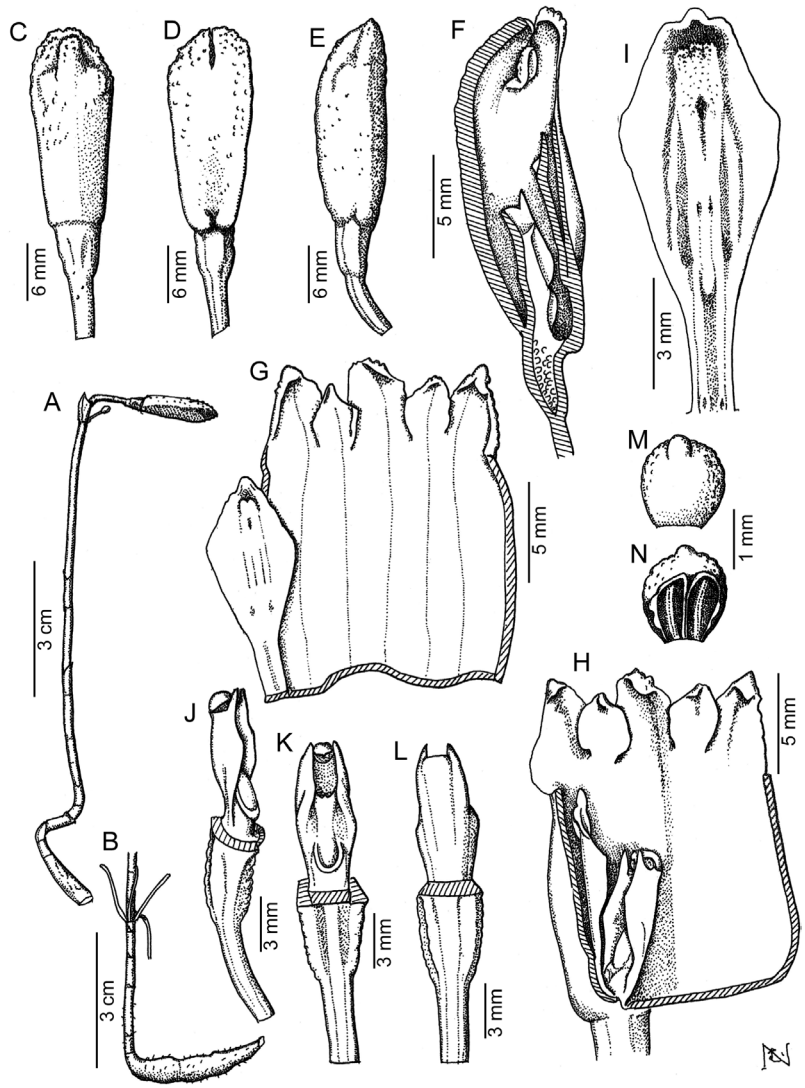

Fig. 2. *Gastrodia takeshimensis* (from the holotype). — **A**: Habit. — **B**: Rhizome. — **C**–**E**: Flower (**C**: front view; **D**: back view; **E**: side view). — B: Longitudinal section of the flower. — **G**: Flattened flower. — **H**: Flattened perianth tube with joined lip. — **I**: Lip. — **J**–**L**: Column (**J**: side view; **K**: front view; **L**: back view). — **M** and **N**: Anther cap.

shimensis is easily distinguished from *G. nipponica* (Table 1) especially by its taller inflorescence during the flowering periods (7–16 cm *vs*. 3–8 cm), a narrower and enclosed perianth tube

Table 1. Morphological difference between *Gastrodia takeshimensis* and *G. nipponica*. Data of the latter species from Hsu and Kuo (2010).

	G. takeshimensis	*G. nipponica*
Inflorescence size	7–16 cm	3–8 cm
Perianth tube	enclosed	open
Perianth tube size	16–20 mm long, 6–7 mm in diam.	18–24 mm long, 11–13 mm in diam.
Position of rostellum	middle of column	just below anther cap
Lip connection	joined with perianth tube	adnate to column foot
Number of ridges on the lip	2–4	4–6
Hypochile	without any appendages or calli	with two greenish, globose calli

(6–7 mm *vs*. 11–13 mm in diameter), a different position of rostellum (middle of the column vs. just below the anther cap), and different lip characteristics.

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