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Gastrodia damingshanensis (Orchidaceae: Epidendroideae): a new myco-heterotrophic orchid from China

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Abstract

A new fully myco-heterotrophic orchid**,** *Gastrodia damingshanensis*, is described and illustrated from Damingshan National Nature Reserve in Guangxi, China. The new species is significantly distinct from the otherwise similar *G. uraiensis* and *G. fontinalis* by its much longer peduncle, the shortened column hidden by the lip, and the reddish brown, rhombic-elliptic lip with a slightly retuse apex. This new species is predicted to be obligatory self-pollinated due to the specialized column structure which allows the pollinia directly touching the stigma.

Key words: China, *Gastrodia*, new species, orchids, self-pollination

Introduction

The fully myco-heterotrophic orchid genus *Gastrodia* Brown (1810: 330) comprises around 50 species distributed from northeastern India through the eastern Himalayas and southern China to Japan and eastern Siberia, southwards to Malesia and Australia, eastwards to the Pacific Islands as far as Samoa, and westwards to Madagascar, Mascarene Islands and tropical Africa (Pridgeon *et al.* 2005; Bosser 2006; Cribb *et al.* 2010). Australia and China are two diversity hotspots for this genus, with 15 (Johns & Molloy 1983) and 20 species (Chen *et al.* 2009; Hsu & Kuo 2010, 2011; Yeh *et al.* 2011; Hsu *et al.* 2012; Tan *et al.* 2012), respectively. Here we add another new species to this genus. *Gastrodia damingshanensis* was discovered during a floristic survey of Damingshan National Nature Reserve, Guangxi Zhuangzu Autonomous Region, China, in March 2013. A detailed description, ecological information and a discussion of its likely self-pollination mechanism are presented as follows.

Gastrodia damingshanensis A.Q. Hu & T.C. Hsu, *sp. nov*. (Fig. 1–3)

This new species is close to G. uraiensis T.C. Hsu & C.M. Kuo and to G. fontinalis T.P. Lin, but can be distinguished by its longer inflorescence, the short column hidden under the lip, without well-developed column wings and rostellum, and the reddish brown, rhombic-elliptic lip with a retuse apex.

Type:—CHINA. Guangxi: Nanning, Damingshan National Nature Reserve, evergreen broad-leaved monsoon forest, by the roadside, 1100–1200 m, 31 March 2013, *T.C. Hsu & A.Q. Hu 6407* (holotype: TAIF!; isotype: IBK!).

Terrestrial, leafless, achlorophyllous *herbs*. Roots few, slender, extending from apex of rhizome. Rhizome tuberous, fusiform, 40–70 mm long, 5–8 mm in diameter, grayish brown, covered with verticillate, lanceolate scales and finely unicellular hairs. *Inflorescence* erect, terminal, 1–2(–3)-flowered, 9–25 cm long, ca. 2 mm in diameter, glabrous, grayish brown; peduncle 7–23 cm long, with 3–4 sterile bracts; sterile bracts sheathing, membranous, ovate to broadly ovate, 4.5–10.0 mm; rachis up to 2 cm long. *Bracts* membranous, glabrous, ovate to ovate-oblong, apex acute, 3.0–4.0 × 2.0–2.5 mm. *Pedicel and ovary* 7–10 mm long, pedicel slightly curved, ovary 2.0–3.5 mm in diameter, slightly

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Pollination Biology:—Dissections of fresh flowers revealed that the anther and pollinia of *Gastrodia damingshanensis* are in direct contact with the stigma because of the strongly incumbent column apex. Hence, we predict that this new species is obligatory self-pollinated. Such a specialized column structure is unusual but not unique in the genus *Gastrodia*, since similar cases are found in *G. minor* Petrie (1893: 273) and G. *cunninghamii* Hooker (1852: 251) from New Zealand, which are also regarded as self-pollinated (Hatch 1949, 1954; Molloy 1990). This unusual structure seems to be a result of convergent evolution among *G. damingshanensis* and the two New Zealand species as suggested by the dissimilarity of other vegetative and floral characters and very distant geographic distribution. Aphids were observed living inside the flowers of *G. damingshanensis*, damaging perianth tubes in three of the five reported populations. Lehnebach *et al.* (2005) also reported aphids visiting *G. cunninghamii* in New Zealand. However, the status of these aphids as efficient pollinators is doubtful and they may not contribute to the high natural fruit-set of *G. cunninghamii* (up to 92%). There are several other *Gastrodia* species documented to show morphological and functional adaptions to promote self-pollination, such as the absence of a prominent rostellum (referring to median stigma lobe, the concept of which follows Dressler (1993) in *G. albida* Hsu & Kuo (2011: 272), *G. appendiculata* Leou & Chung (1991: 138), *G. clausa* Hsu, Chung & Kuo (2012: 271), *G. confusoides* Hsu, Chung & Kuo (2012: 273) and *G. theana* Averyanov (2005: 90; Hsieh *et al*. 2012), a strongly incurved column in *G. flexistyla* Hsu & Kuo (2010: 243) leading the anther to its direct contact with the stigma (Hsu & Kuo 2010), and cleistogamy in *G. peichatieniana* Ying (1987: 690) and *G. clausa*. Several factors may contribute to these evolutionary transitions, such as resource limitation of myco-heterotrophic plants and comparatively short above-ground life cycle, which at the same time leads to the shortage of sufficient pollinators. It would be intriguing to test the hypotheses of morphological adaptations to harsh environment and resource constraints in these myco-heterotrophic orchids.

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References

Averyanov, L.A. (2005) New orchids from Vietnam. *Rheedea* 15: 1–19.

Bosser, J. (2006) Contributions to the study of Orchidaceae from Madagascar, the Comoro Islands and the Mascarenes. 35. Description of a new *Oeceoclades* from Madagascar, and notes on three new genera for the Mascarenes. *Adansonia* 28: 45–54.

Brown, R. (1810) *Prodromus Florae Novae Hollandiae, et Insulae van Diemen*. Johnson, London, 446 pp. http://dx.doi.org/10.5962/bhl.title.52309

Chen, S.C., Gale, S.W. & Cribb, P.J. (2009) *Gastrodia*. *In:* Wu, Z.Y., Raven, P.H. & Hong, D.Y. (Eds.) *Flora of China. Vol. 25.* Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, pp. 201–205.

Cribb, P., Fischer, E. & Killmann, D. (2010) A revision of *Gastrodia* (Orchidaceae: Epidendroideae, Gastrodieae) in tropical Africa. *Kew Bulletin* 65: 315–321. http://dx.doi.org/10.1007/s12225-010-9193-4

Dressler, R.L. (1993) *Phylogeny and Classification of the Orchid Family*. Cambridge University Press, Cambridge, 43 pp.

Hatch, E.D. (1949) *Lyperanthus antiarcticus* Hook. f. and the New Zealand forms of *Gastrodia* R. Br. *Transactions of the Royal Society of New Zealand* 77(2): 230–233, t. 16–17.

Hatch, E.D. (1954) Further notes on *Gastrodia* R. Brown and *Spiranthes* L.C. Richard. *Transactions of the Royal Society of New Zealand* 82(2): 613–615.

Hooker, J.D. (1852) *Flora Novae-Zelandiae,* 1. Lovell Reeve, London. 251 pp.

Hsieh, S.I., Lee, C.T., Leou, C.S., Yeh, C.R., Yeh, C.L. & Wu, J.H. (2012) *Gastrodia theana* Aver. (Orchidaceae) a newly recorded species from the Central Taiwan. *Taiwania* 57(4): 399–402.

Hsu, T.C. & Kuo, C.M. (2010) Supplements to the orchid flora of Taiwan (IV): Four additions to the genus *Gastrodia*. *Taiwania* 55(3): 243–248.

Hsu, T.C. & Kuo, C.M. (2011) *Gastrodia albida* (Orchidaceae), a new *s*pecies from Taiwan. *Annales Botanici Fennici* 48: 272–275.

http://dx.doi.org/10.5735/085.048.0308

Hsu, T.C., Chung, S.W. & Kuo, C.M. (2012) Supplements to the orchid flora of Taiwan (VI). *Taiwania* 57: 271–277.

Johns, J. & Molloy, B. (1983) *Native orchids of New Zealand*. Reed, Wellington, 124 pp.

Lehnebach, C.A., Robertson, A.W. & Hedderley, D. (2005) Pollination studies of four New Zealand terrestrial orchids and the implication for their conservation. *New Zealand Journal of Botany* 43: 467–477.
http://dx.doi.org/10.1080/0028825x.2005.9512968

Leou, C.S. & Chung, N.J. (1991) *Gastrodia appendiculata* — a new orchid species from Taiwan. *Quarterly Journal of Experimental Forestry, National Taiwan University* 5: 137–140.

Lin, T.P. (1987) *Native Orchids Taiwan*, 3. Southern Materials Centre, 129 pp.

Molloy, B. (1990) Pollination systems of New Zealand native orchids. *In:* St George, I. & McCrae, D. (Eds) *The New Zealand orchids: natural history and cultivation. Dunedin*, Southern Colour Print, pp 36–56.

Petrie, D. (1893) Description of a new genus and of new species of native plants. *Transactions and Proceedings of the New Zealand Institute* 15: 269–275.

Pridgeon, A.M., Cribb, P.J., Chase, M.W. & Rasmussen, F.N. (2005) Genera *Orchidacearum* 4, *Epidendroideae (part one)*. Oxford University Press Oxford, 444 pp.

Tan, Y.H., Hsu, T.C., Pan, P., Li, J.W., & Liu, Q. (2012) *Gastrodia albidoides* (Orchidaceae: Epidendroideae), a new species from Yunnan, China. *Phytotaxa* 66: 38–42.

Yeh, C.L., Leou, C.S., Hsu, T.C. & Yeh, C.R. (2011) *Gastrodia sui sp. nov.* (Orchidaceae) from Taiwan. *Nordic Journal of Botany* 29: 417–419.
http://dx.doi.org/10.1111/j.1756-1051.2011.01147.x

Ying, S.S. (1987). *Colour Illustrated Flora of Taiwan. 2.* Published by the author. Taipei, Taiwan, 690 pp., 404 t.