



Begonia intermedia, a new species of Begoniaceae from Hainan, China

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Abstract

Begonia intermedia D.K. Tian & Y.H. Yan, a new species in *Begonia* sect. *Diploclinium* (Wright) A. DC (Begoniaceae) from Hainan, China, is described and illustrated. It differs from the morphologically similar *B. fimbristipula* Hance by its orchid-root-like rhizomes, later flowering and distinctive hairy bracts. Also, based on a molecular phylogenetic analysis, *B. intermedia* is distinct from *B. fimbristipula*.

Key words: China, Hainan, *Begonia*, new species

Introduction

Begonia is one of the most diverse plant taxa and is considered the sixth largest genus of vascular plants in the world (Hoover *et al.* 2004). Nearly 1600 species have been named so far (Sands 2001, Aitawade *et al.* 2012). China, after Brazil, has the second largest number of *Begonia* species, with 173 species recorded in *Flora of China* and 141 endemic in China (Gu *et al.* 2007). After publication of *Flora of China*, 14 new *Begonia* species, all endemic in China, are described and illustrated (Ku *et al.* 2008, Li *et al.* 2008, Liu *et al.* 2007, Ma *et al.* 2006, Peng *et al.* 2008a, 2008b, 2009, 2010, 2012, 2013, Shui 2007, Wei *et al.* 2007). There are still many potential new taxa under investigation, therefore, the total number of *Begonia* species in China could easily reach over 200.

During fieldwork on Yinggeling National Natural Reserve, Qiongzong, Hainan, in June 2012, we collected several specimens and living plants from an interesting species of *Begonia*. This species is very similar to *Begonia fimbristipula* Hance (1883: 202) but it has orchid-root-like rhizome without nodes and distinctive hairy bracts, and blooms late. After a further field investigation in September 2012 when the plants were in full bloom, we confirmed that this species should be recognized as a new taxon. In order to obtain more evidence for its taxonomic placement in distinctiveness, a molecular phylogenetic analysis based on the chloroplast *ndhA* intron region was conducted with 48 terminals representing a total of 44 species and eight sections of *Begonia* delimited in China based on Shui's treatment (Shui *et al.* 2007).

Begonia intermedia D.K. Tian & Y.H. Yan was mistreated as *B. fimbristipula* by the author of *The Coloured Illustrative Plates of Wild Plants in Diaoluoshan Hainan China* (Qin 2013).

Materials and methods

Taxonomic sampling

To position new species within the phylogeny of the *Begonia*, the sequence data of all sections except sect. *Leprosae* (T.C. Ku) Y.M. Shui delimited in Chinese *Begonia* were used for analysis. Partial data were sequenced by us including all species except *B. howii* Merrill & Chun (1940: 138) distributed in Hainan and three morphologically similar species outside Hainan (*B. fimbristipula*, *B. labordei* Lévl. (1904: 323), *B. augustinei* Hemsl. (1900: 286)). The others were downloaded from NCBI to ensure at least three species from each section of Chinese *Begonia*, except one species for sect. *Alicida* C.B. Clarke. Three species from Africa were chosen as outgroup based on molecular phylogenetic studies. The related information of all species used in phylogenetic analysis is listed in Table 1.

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References

- Aitawade, M.M. & Yadav, S.R. (2012) Taxonomic status of *Begonia aliciae* (Begoniaceae). *Rheedea* 22: 111–115.
- Dryander, M.A. & Libr, R.S. (1791) Observations on the genus of *Begonia*. *Transactions of the Linnean Society of London* 1: 155–173.
<http://dx.doi.org/10.1111/j.1096-3642.1791.tb00396.x>
- Felsenstein, J. (1985) Confidence limits on phylogenies: an approach using the bootstrap. *Evolution* 39: 783–791.
<http://dx.doi.org/10.2307/2408678>
- Gu, C.Z., Peng, C.I. & Turland, N.J. (2007) Begoniaceae. In Wu, C.Y. & Raven, P. H. (eds.) *Flora of China*. Science Press, Beijing, pp. 153–207.
- Hall, T.A. (1999) BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symposium Series* 41: 95–98.
- Hance, H.F. (1883) Three new Chinese *Begonia*. *Journal of Botany* 21: 202–203.
- Hemsley, W.B. (1900) New or noteworthy plants. *The Gardeners' Chronicle* 2: 286.
- Hoover, W.S., Karegeannes, C., Wiriadinata, H. & Hunter, J.M. (2004) Notes on the geography of South-East Asian *Begonia* and species diversity in montane forests. *Telopea* 10: 749–764.
- Irmscher, E. (1939) *Begonia* L. *Mitteilungen aus dem Institut für Allgemeine Botanik in Hamburg* 10: 488–557.
- IUCN. (2001) *IUCN Red List Categories and Criteria*, version 3.1. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. <http://www.iucnredlist.org/> (accessed: 1 September 2013).
- Ku, S.M., Kono, Y. & Liu, Y. (2008) *Begonia pengii* (sect. *Coelocentrum*, Begoniaceae), a new species from limestone areas in Guangxi, China. *Botanical Studies* 49: 167–175.
- Léveillé, M.H. (1904) Bouquet de fleurs de Chine. *Société d'agriculture, sciences et arts de la Sarthe* 59: 316–326.
- Li, H.L. (1944) Additions to our knowledge of the flora of Hainan. *Journal of the Arnold Arboretum* 25: 206–214.
- Li, H.Z., Ma, H., Zhou, Z.K. & Guan, K.Y. (2008) A new species of *Begonia* (Begoniaceae) from Guangxi, China. *Botanical Journal of the Linnean Society* 157: 83–90.
<http://dx.doi.org/10.1111/j.1095-8339.2008.00771.x>
- Liu, Y., Ku, S.M. & Peng, C.I. (2007) *Begonia bamaensis* (sect. *Coelocentrum*, Begoniaceae), a new species from limestone areas in Guangxi, China. *Botanical Studies* 48: 465–473.
- Ma, H. & Li, H.Z. (2006) *Begonia guaniana* (Begoniaceae), a new species from China. *Annales Botanici Fennici* 43: 466–477
- Peng, C.I., Ku, S.M., Kono, Y. & Liu, Y. (2012) *Begonia chongzuensis* (sect. *Coelocentrum*, Begoniaceae), a new calciphile from Guangxi, China. *Botanical Studies* 53: 283–290.
- Peng, C.I., Yang, H.A., Kono, Y., Chung, K.F., Huang, Y.S., Wu, W.H. & Liu, Y. (2013) Novelties in *Begonia* sect. *Coelocentrum*: *B. longgangensis* and *B. ferox* from limestone areas in Guangxi, China. *Botanical Studies* 54: 1–9.
<http://dx.doi.org/10.1186/1999-3110-54-44>
- Peng, C.I., Shui, Y.M., Liu, Y. & Ku, S.M. (2005) *Begonia fangii* (sect. *Coelocentrum*, Begoniaceae), a new species from limestone areas in Guangxi, China. *Botanica Bulletin Academic Sinica* 46: 83–89.
- Peng, C.I., Ku, S.M., Kono, Y., Chung, K.F. & Liu, Y. (2008a) Two new species of *Begonia* (sect. *Coelocentrum*, Begoniaceae) from limestone areas in Guangxi, China: *B. arachnoidea* and *B. subcoriacea*. *Botanical Studies* 49: 405–418.
- Peng, C.I., Liu, Y. & Kono, Y. (2010) *Begonia* × *breviscapa* (Begoniaceae), a new intersectional natural hybrid from limestone areas in Guangxi, China. *Botanical Studies* 51: 107–117.
- Peng, C.I. & Ku, S.M. (2009) *Begonia* × *chungii* (Begoniaceae), a new natural hybrid in Taiwan. *Botanical Studies* 50: 241–250.
- Peng C.I., Liu, Y. & Ku, S.M. (2008b) *Begonia aurantiflora* (sect. *Coelocentrum*, Begoniaceae), a new species from limestone areas in Guangxi, China. *Botanical Studies* 49: 83–92.
- Qin, X.S. (2013) *The Coloured Illustrative Plates of Wild Plants in Diaoluoshan Hainan China*. China Forestry Press, Beijing, pp. 89.
- Sands, M.J.S. (2001) Begoniaceae in the Flora Malesiana region. In Saw, L.G., Chua, L.S.L. & Khoo, K.C. (eds.) *Taxonomy: the cornerstone of biodiversity. Proceedings of the Fourth International Flora Malesiana Symposium*. Forest Research Institute Malaysia, Kuala Lumpur, pp. 161–168.
- Shaw, J., Lickey, E.B., Schilling, E.E. & Small, R.L. (2007) Comparison of whole chloroplast genome sequences to choose noncoding regions for phylogenetic studies in angiosperms: the tortoise and the hare III. *American Journal of Botany* 94: 275–288.

- Shui, Y.M. (2007) *Begonia tetralobata* (Begoniaceae), a new species from China. *Annales Botanici Fennici* 44: 76–79.
- Shui, Y.M., Peng, C.I. & Wu, C.Y. (2002) Synopsis of the Chinese species of *Begonia* (Begoniaceae), with a reappraisal of sectional delimitation. *Botanical Bulletin of Academia Sinica* 43: 313–327.
- Swofford, D.L. (2003) PAUP*: Phylogenetic analysis using parsimony (* and other methods), version 4. Sunderland: Sinauer Associates. Available from: <http://paup.csit.fsu.edu/> (accessed: 1 March 2013).
- Thomas, D., Hughes, M., Phutthai, T., Rajbhandary, S., Rubite, R., Ardi, W.H. & Richardson, J.E. (2011) A non-coding plastid DNA phylogeny of Asian *Begonia* (Begoniaceae): evidence for morphological homoplasy and sectional polyphyly. *Molecular Phylogenetics and Evolution* 60: 428–444.
<http://dx.doi.org/10.1016/j.ympev.2011.05.006>
- Thompson, J.D., Gibson, T.J., Plewniak, F., Jeanmougin, F. & Higgins, D.G. (1997) The CLUSTAL X windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. *Nucleic Acids Research* 25: 4876–4882.
<http://dx.doi.org/10.1093/nar/25.24.4876>
- Wei, Z.D., Shui, Y.M., Zhang, M.D. & Zhang, R.M. (2007) *Begonia coelocentroides* YM Shui & ZD Wei, a new species of Begoniaceae from Yunnan, China. *Acta Phytotaxonomica Sinica* 45: 86–89.