



## Two New Species of *Sciaphila* (Triuridaceae) from Sarawak (Borneo, Malaysia)

HIROKAZU TSUKAYA<sup>1\*</sup> & KENJI SUETSUGU<sup>2</sup>

<sup>1</sup>Department of Biological Sciences, Faculty of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan.

<sup>2</sup>Graduate School of Human and Environmental Studies, Kyoto University, Yoshida Nihonmatsu-cho, Sakyo, Kyoto 606-8501, Japan.

\*author for correspondence, [tsukaya@bs.s.u-tokyo.ac.jp](mailto:tsukaya@bs.s.u-tokyo.ac.jp)

### Abstract

Borneo is known to have the greatest diversity of the mycoheterotrophic genus *Sciaphila* (Triuridaceae), harboring nine species, with three endemics. Here, we report two previously undescribed species of *Sciaphila* discovered during botanical surveys in Lambir Hills (Sarawak, Borneo, Malaysia) and provide detailed morphological accounts of these new species: *S. alba* and *S. inouei*. We also provide a key to the species of *Sciaphila* in Sarawak.

**Keywords:** Mycoheterotrophic plants, new species, taxonomy

### Introduction

The mycoheterotrophic genus *Sciaphila* Blume (1826: 514), which is the largest group in the family Triuridaceae, consists of *ca.* 40 species (van de Meerendonk 1984). Recently, its centre of distribution was determined to be located in Borneo, where more than nine species have been recorded (Tsukaya & Okada 2013a). Key characters of the species of *Sciaphila* include bisexual or unisexual flowers, number and shape of stamens and perianth segments, apex shape of perianth segments and shape and length of the style. As with most mycoheterotrophs, they are very small, have small populations and are recognised at the time of flowering only. Consequently, few specimens of this genus have been collected. Moreover, important key characters of male flowers cannot be described for some specimens, particularly if they are too young when collected. Given such difficulties in precise identification, adequate taxonomic studies of this genus have not been conducted in Borneo. Recently, this genus was re-examined in various countries in Asia, and several new species were discovered (Chantanaorrapint & Thaitong 2004; Averyanov 2007; Xu *et al.* 2011). In Borneo, we have conducted botanical surveys of mycoheterotrophs in Betung Kerihun National Park, West Kalimantan, Borneo, Indonesia, arranged by the Research Center for Biology, Indonesian Institute of Sciences (LIPI), which resulted in the discovery of many new taxa of mycoheterotrophs, *viz.* a new genus [*Kalimantanorchis* Tsukaya, Nakajima & Okada (2011: 52)], several new species [*Sciaphila betung-kerihunensis* Tsukaya & Okada (2013a: 600), *S. brevistyla* Tsukaya & Okada (2013a: 602), *Thismia betung-kerihunensis* Tsukaya & Okada (2012a: 56), *T. mullerensis* Tsukaya & Okada (2005: 129)], a new variety [*Didymoplexis cornuta* var. *betungkerihunensis* Tsukaya & Okada (2012b: 92)] and new forma [*Epirixanthes papuana* f. *alba* Tsukaya & Okada (2012c: 97) and *E. elongata* f. *alba* Tsukaya & Okada (2012c: 97)]. It also revealed that three species of the genus *Sciaphila* are endemic to Borneo (Tsukaya & Okada 2013a): *S. brevistyla*, *S. betung-kerihunensis* and *S. micranthera* Giesen (1938: 54).

Lambir Hills National Park is located in Sarawak (Malaysia), close to Betung Kerihun National Park in West Kalimantan (Indonesia). After launching Long-term Ecological Research of Tropical Rain Forest in Sarawak (LTER), a collaboration between the Forest Department of Sarawak (SAR) and universities in Japan and the United States, extensive studies have examined the flora, fauna, physiology and ecosystems in the area (reviewed by Yamakura 1995; Ichie *et al.* 2009). Considering the richness of the mycoheterotroph flora in Betung Kerihun National Park, re-examination and comparative studies of mycoheterotrophs in the neighbouring regions are expected to be fruitful for understanding the mycoheterotroph flora of Borneo. During a botanical survey of this area in March 2013, one of the authors (KS) collected three species of *Sciaphila*: *S. densiflora* Schlechter (1912: 87) and two undescribed *Sciaphila* species. Here, we describe these two new species, providing detailed morphological accounts of both. We also include a key to the species of *Sciaphila* in Borneo.

## Discussion

The taxonomy of the genus *Sciaphila* in Asia has not been fully resolved. In the past decade, Hsieh *et al.* (2003), Chantanaorrapint & Thaithong (2004), Averyanov (2007) and Xu *et al.* (2011) revised the genus *Sciaphila* in Taiwan, Thailand, Vietnam and China (Hainan), respectively. Each of these studies revealed new species or new distributional records for the genus, indicating that more undescribed species are hidden in tropical Asia. Previously, because the greatest number of species (eight) was recognised in Papua New Guinea, including three endemics, this area was recognised as the centre of distribution of *Sciaphila* (van de Meerendonk 1984). However, Tsukaya and Okada (2013a) added two new species endemic to Borneo from surveys in Betung Kerihun National Park; consequently, Borneo harbours at least nine species, with three endemics, and was revealed to have greater richness of *Sciaphila* than Papua New Guinea where has eight species of the genus.

Here, we report two new species from a week-long survey in Lambir Hills National Park, increasing the richness of the *Sciaphila* flora in Borneo. Since two limited surveys in two national parks resulted in the discovery of four new species (Tsukaya and Okada 2013a), further detailed botanical surveys in Borneo should reveal many more new species and provide critical data for conservation.

## Acknowledgements

The authors thank the Forest Department of Sarawak (Malaysia), for support and permission to conduct this research. We also thank Makoto Kato, Takao Itioka, Tomoaki Ichie, Seiki Yamane, Usun Shimizu-kaya and Aogu Yoneyama for helping conduct the botanical surveys during the expedition. The beautiful, very helpful line drawings were prepared by Ms. Mutsuko Nakajima. This work was supported by Grants-in-Aid from the Japan Society for the Promotion of Science to T. H. and the Shikata Memorial Trust for Nature Conservation to K.S. The authors thank Prof. Averyanov and Martin Callmender who provided helpful comments on an earlier draft.

## References

- Averyanov, L.V. (2007) The genus *Sciaphila* Blume (Triuridaceae) in the flora of Vietnam. *Taiwania* 52: 12–19.
- Beccari, O. (1890) *Malesia raccolta di osservazioni botaniche intorno alle piante dell' arcipelago Indo-Malese e Papuano pubblicata da Odoardo Beccari, Volume 3*. Tip. dei fratelli Bencini, Firenze-Roma.  
<http://dx.doi.org/10.5962/bhl.title.79357>
- Bentham, G. (1855) On the South American Triuridaceae and leafless Burmanniaceae from the collection of Mr. Spruce. *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 8–17.
- Blume, C.L. (1827) *Sciaphila*. *Bijdragen tot de flora van Nederlandsch Indië* 10: 514.  
<http://dx.doi.org/10.5962/bhl.title.395>
- Chantanaorrapint, S. & Thaithong, O. (2004) *Sciaphila nana* Blume (Triuridaceae), a new record for Thailand. *Thai Forest Bulletin (Botany)* 32: 12–14.
- Giesen, H. (1938) Triuridaceae. In: Engler, A. (ed.) *Das Pflanzenreich* IV(18). W. Engelmann. Leipzig, 84 pp.
- Hsieh, T.-H., Wu, C.-S. & Yang, K.-C. (2003) Revision of *Sciaphila* (Triuridaceae) in Taiwan. *Taiwania* 48: 239–247.
- Ichie, T., Itioka, T. & Ito, A. (2009) Lambir Hills National Park (Malaysia). *Japanese Journal of Ecology* 59: 227–232.
- Meerendonk, J.P.M. van de (1984) Triuridaceae. In: Steenis, C.G.G.J. van (ed.) *Flora malesiana ser. I*, 10. Martinus Nijhoff, The Hague, Boston, London, pp. 109–121.
- Schlechter, R. (1912) Neue Triuridaceae Papuasiens. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 49: 70–89.
- Tsukaya, H. & Okada, H. (2005) *Thismia mullerensis* (Burmanniaceae), a new species from Muller Range, Central Kalimantan. *Acta Phytotaxonomica et Geobotanica* 56: 129–133.
- Tsukaya, H. & Okada, H. (2012a) A new species of *Thismia* (Thismiaceae) from West Kalimantan, Borneo. *Systematic Botany* 37: 1–5.  
<http://dx.doi.org/10.1600/036364412x616639>
- Tsukaya, H. & Okada, H. (2012b) A new variety of *Didymoplexis cornuta* (Orchidaceae) from West Kalimantan, Borneo. *Acta Phytotaxonomica et Geobotanica* 62: 89–93.

- Tsukaya, H. & Okada, H. (2012c) A color variation of *Epirixanthes* species (Polygalaceae) found in West Kalimantan, Borneo, Indonesia. *Acta Phytotaxonomica et Geobotanica* 62: 95–97.
- Tsukaya, H. & Okada, H. (2013a) A new species of *Sciaphila* Blume (Triuridaceae) from Kalimantan, Borneo, with a new record from Borneo. *Systematic Botany* 38: 600–605.  
<http://dx.doi.org/10.1600/036364413x670476>
- Tsukaya, H. & Okada, H. (2013b) A new species of *Lecanorchis* Blume (subfamily Vanilloideae, Orchidaceae) from Kalimantan, Borneo. *Systematic Botany* 38: 69–74.  
<http://dx.doi.org/10.1600/036364413x662079>
- Tsukaya, H., Nakajima, M. & Okada, H. (2011) *Kalimantanorchis*: a new genus of mycotrophic orchid from West Kalimantan, Borneo. *Systematic Botany* 36: 49–52.  
<http://dx.doi.org/10.1600/036364411x553117>
- Xu, H., Y.-D, Li & Chen, H.-Q. (2011) A new species of *Sciaphila* (Triuridaceae) from Hainan Island, China. *Novon* 21: 154–157.  
<http://dx.doi.org/10.3417/2009016>
- Yamakura, T. (1995) A long-term and large-scale research of the Lambir rain forest in Sarawak: progress and conceptual background of Japanese activities. *Tropics* 4: 259–276.  
<http://dx.doi.org/10.3759/tropics.4.259>