

# Twenty-six additional new combinations in the *Magnolia* (Magnoliaceae) of China and Vietnam

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## Abstract

In accordance with the previous reduction of the remaining genera of subfamily Magnolioideae (Magnoliaceae) into the genus *Magnolia*, twenty-six new nomenclatural combinations are formally made by transferring to *Magnolia* some additional Chinese and Vietnamese taxa from the segregate genera of *Manglietia*, *Michelia* and *Yulania*. The following nine new combinations are created from *Manglietia*, namely *Magnolia admirabilis*, *M. albistaminea*, *M. guangnanica*, *M. jinggangshanensis*, *M. maguanica*, *M. pubipedunculata*, *M. pubipetala*, *M. rufisyncarpa* and *M. sinoconifera*. Also, twelve new combinations are created from *Michelia*, namely *Magnolia caloptila*, *M. caudata*, *M. fallax*, *M. gelida*, *M. hunanensis*, *M. maudiae* var. *rubicunda*, *M. multitepala*, *M. platypetala*, *M. rubriflora*, *M. septipetala*, *M. sonlaensis*, *M. xinningia*. Finally, five new combinations are created from *Yulania*, namely *Magnolia baotaina*, *M. pendula*, *M. pilocarpa* var. *ellipticifolia*, *M. puberula* and *M. urceolata*.

## Keywords

Magnolioideae, *Manglietia*, *Michelia*, morphological features, synonyms, *Yulania*



*Magnolia maguanica* (formerly *Manglietia maguanica* (photo taken by SK Png at South China BG on 21.04.2017)).

## Introduction

Richard B. Figlar (2012), a past president and present scientific advisor of Magnolia Society International, provides a concise but thorough background to the complex generic history of subfamily Magnolioideae of family Magnoliaceae, starting with J.E. Dandy in the early part of the previous century. This pre-eminent British plant taxonomist, specialising in Magnoliaceae, recognised the family as consisting of 2 tribes, the Liriodendreae representing the single distinct genus *Liriodendron*, with the remainder of the family, about which Dandy (1927) acknowledges there had never been uniformity of opinion, forming the Magnolieae, comprising 9 genera, which he subsequently increased by 2.

Revisions were to follow Dandy's death in late 1976, including the classification of the leading Chinese Magnoliaceae researcher, Liu Yu-hu (aka Law Yuh-wu). His proposed Taxonomic System of Magnoliaceae (Law 1984), republished in *Magnolias of China* in the year he died (Liu et al. 2004), basically added a further 4 genera to those of Dandy. Representatives of 10 of the 15 genera included in subfamily Magnolioideae in Liu's classification occur in China.

H.P. Nooteboom, who was to succeed Dandy at the forefront of Magnoliaceae research in Europe, realised that his predecessor had been mistaken in his interpretation of certain morphological characters and thus commenced his reduction of Magnolioideae (Nooteboom 1985), to just 6 genera. Ultimately, with the advent of molecular DNA sequencing data (Azuma et al. 1999, 2000, 2001, Kim et al. 2001, Nie et al. 2008, Wang et al. 2006, Kim and Suh 2013), combined with comparative morphological research (Figlar 2000, Figlar and Nooteboom 2004), showing the remaining genera, including *Manglietia* Blume and *Michelia* Linnaeus, residing among the other sections of *Magnolia*, Figlar and Nooteboom proposed a new classification system in their 2004 paper. Their new system includes *Magnolia* at the head of a now monogeneric Magnolioideae subfamily comprising subgenus *Magnolia* with 8 sections and 7 subsections, subgenus *Yulania* with 2 sections and 6 subsections, and subgenus *Gynopodium* with 2 sections.

This system was not followed in the *Flora of China* treatment of Magnoliaceae (Xia et al. 2008), where previously recognised genera such as *Manglietia* and *Michelia* were retained, two former sections of *Magnolia* were given generic status as *Houpoea* N.H. Xia & C.Y. Wu and *Oyama* (Nakai) N.H. Xia & C.Y. Wu, and former genera, such as *Lirianthe* Spach and *Yulania* Spach of 1839 were reinstated. Since then, authors describing new species from China have followed this classification, a few examples being *Manglietia pubipedunculata* Q.W. Zeng & X.M. Hu (Hu et al. 2019), *Michelia caudata* M.X. Wu, X.H. Wu & G.Y. Li (Wu et al. 2015) and *Yulania dabieshanensis* T.B. Zhao, Z.X. Chen & H.T. Dai (Dai et al. 2012).

However, Figlar and Nooteboom's (2004) classification system is now widely accepted by the scientific community, with many authors following this broad view of *Magnolia*, such as Arroyo et al. (2013), Ninh et al. (2020), Pérez et al. (2016) and Zou et al. (2020).

Figlar (2012) advised against the alternative classification system now operating:

*In a one genus system only Manglietia, Michelia and 3 minor genera require new names in Magnolia. In a 13 genera system, it would be necessary to dismantle the largest and most well-known genus, Magnolia, and rename the constituents into 10 new genera. That would be enormously destructive to the long-established Magnolia-centric nomenclature and literature, causing unnecessary and undesirable consequences to science, conservation and horticulture.*

With this in mind, 26 new combinations are created here, representing nine species of *Manglietia*, eleven species and one variety of *Michelia*, plus four species and one variety of *Yulania*. Most of these taxa were named and described over the past decade, but include some older previously synonymised, now reinstated taxa, that are herein transferred to *Magnolia*, as will be numerous other taxa in a sequel to this paper (Callaghan and Png 2019a, 2020).

## Materials and methods

The new combinations proposed in this paper are made in compliance with the rules and recommendations of the 2018 International Code of Nomenclature for algae, fungi and plants (ICN), known as The Shenzhen Code (Turland et al. 2018), in particular ICN Article 41 and Recommendation 41A in respect of new combinations.

Where available, digital images of type specimens of newly named taxa posted to the internet at the websites of various herbaria have been sighted and these are indicated in the text by ‘online image!’ appearing after the herbarium acronyms whose representative names are listed in the appendix following the references. Additional sighted specimens are indicated by ‘!’ after the herbarium acronym.

Consultation of the relevant literature was made to determine whether a number of taxa previously determined as synonyms of earlier named taxa were, in fact, genuine independent species or varieties as they had been originally described. Differences in numerous morphological features, natural distributions and/or elevations and where appropriate, the incompatible phenology of flowering and/or fruiting periods, are tabulated and referred to in the notes under the relevant taxa to fully substantiate their independent status.

Floras and other literature dealing with the Magnoliaceae of China that have been consulted during this study are cited in the text, with some of the more important sources of information including a number of papers by Dandy (1928 a–c, 1930), The Magnoliaceae of China (Chen and Nooteboom 1993), Magnoliaceae in Flora Reipublicae Popularis Sinicae (Law et al. 1996), Magnolias of China (Liu et al. 2004), Magnoliaceae in Flora of China Vol. 7 (Xia et al. 2008), A Taxonomic Revision of the Magnoliaceae from China (Sima 2011) and the recent Ex Situ Cultivated Flora of China : Magnoliaceae (Yang et al. 2016), which documents the diversity of Magnoliaceae plants in Chinese botanical gardens.

The Biodiversity Heritage Library website (<https://www.biodiversitylibrary.org>) proved indispensable in accessing a number of articles on earlier-named Magnoliaceae dating back to the early nineteenth century and beyond. A good proportion of the numerous relevant scientific and mainstream literature consulted during this research is internet accessible via the links included with the references. The links included in the 2019 unpublished version of this paper were rechecked to confirm their current accessibility.

## Results

In accordance with the previous reduction of the remaining genera of subfamily Magnolioideae (Magnoliaceae) into the genus *Magnolia*, twenty-six new nomenclatural combinations are formally made by transferring to *Magnolia* some additional Chinese and Vietnamese taxa from the segregate genera of *Manglietia*, *Michelia* and *Yulania* that were described during the past decade and occasionally earlier, plus a few formerly synonymised, now reinstated taxa.

The following nine new combinations are created from *Manglietia*, namely *Magnolia admirabilis* (Y.H. Law & R.Z. Zhou ex L. Fu, Q.W. Zeng & X.M. Hu) C.B. Callaghan & S.K. Png, *M. albistaminea* (Y.W. Law, R.Z. Zhou & S.X. Qin) C.B. Callaghan & S.K. Png, *M. guangnanica* (D.X. Li & R.Z. Zhou ex X.M. Hu, Q.W. Zeng & L. Fu) C.B. Callaghan & S.K. Png, *M. jinggangshanensis* (R.L. Liu & Z.X. Zhang) C.B. Callaghan & S.K. Png, *M. maguanica* (H.T. Chang & B.L. Chen) C.B. Callaghan & S.K. Png, *M. pubipedunculata* (Q.W. Zeng & X.M. Hu) C.B. Callaghan & S.K. Png, *M. pubipetala* (Q.W. Zeng) C.B. Callaghan & S.K. Png, *M. rufisyncarpa* (Y.W. Law, R.Z. Zhou & F.G. Wang) C.B. Callaghan & S.K. Png and *M. sinoconifera* (F.N. Wei) C.B. Callaghan & S.K. Png.

Also, twelve new combinations are created from *Michelia*, namely *Magnolia caloptila* (Y.W. Law & Y.F. Wu) C.B. Callaghan & S.K. Png, *M. caudata* (M.X. Wu, X.H. Wu & G.Y. Li) C.B. Callaghan & S.K. Png, *M. fallax* (Dandy) C.B. Callaghan & S.K. Png, *M. gelida* (T.B. Zhao, Z.X. Chen & D.L. Fu) C.B. Callaghan & S.K. Png, *M. hunanensis* (C.L. Peng & L.H. Yan) C.B. Callaghan & S.K. Png, *M. maudiae* var. *rubicunda* (T.P. Yi & J.C. Fan) C.B. Callaghan & S.K. Png, *M. multitepala* (R.Z. Zhou & S.G. Jian) C.B. Callaghan & S.K. Png, *M. platypetala* (Hand-Mazz.) C.B. Callaghan & S.K. Png, *M. rubriflora* (Y.W. Law & R.Z. Zhou ex F.G. Wang, Q.W. Zeng, R.Z. Zhou & F.W. Xing) C.B. Callaghan & S.K. Png, *M. septipetala* (Z.L. Nong) C.B. Callaghan & S.K. Png, *M. sonlaensis* (Q.N. Vu) C.B. Callaghan & S.K. Png and *M. xinningia* (Y.W. Law & R.Z. Zhou ex Q.X. Ma, Q.W. Zeng, R.Z. Zhou & F.W. Xing) C.B. Callaghan & S.K. Png.

Finally, five new combinations are created from *Yulania*, namely *Magnolia baotaina* (D.L. Fu, Q. Zhang & M. Xu) C.B. Callaghan & S.K. Png, *M. pendula* (D.L. Fu) C.B. Callaghan & S.K. Png, *M. pilocarpa* var. *ellipticifolia* (Z.Z. Zhao & Z.W. Xie) C.B. Callaghan & S.K. Png, *M. puberula* (D.L. Fu) C.B. Callaghan & S.K. Png and *M. urceolata* (D.L. Fu, B.H. Xiong & X. Chen) C.B. Callaghan & S.K. Png.

## Discussion

The transfer of the above twenty-six taxa to *Magnolia* is necessary following the present near universal acceptance by the scientific community and horticultural industry that the Magnolioideae is one of two monogeneric subfamilies within Magnoliaceae and the fact that the majority of resulting new combinations and names arising from the relegation of *Manglietia* and *Michelia* into *Magnolia* have previously been made by various authors such as Figlar (2000) for the majority of the *Michelia* species, with Sima (2001) transferring some additional *Michelia* species, Kumar (2006) transferring the majority of *Manglietia* species, Nooteboom transferring a number of species from both the previous genera plus *Yulania* in Flora of China Vol. 7 (Xia et al. 2008: 49–50) and most recently Callaghan and Png (2013) transferring species from these three genera that were mainly described and named subsequent to the publication of Flora of China.

## Conclusions

To maintain these twenty-six predominantly recently described taxa in limbo in segregate genera will contribute to further instability and inevitable confusion in the scientific and popular literature, as well as within the botanical world and the horticultural industry, which has resulted from having two diverse systems operating simultaneously.

The authors would like to take this opportunity to suggest that to further substantiate their now reaffirmed species or varietal status, comparative DNA barcoding (Caddy-Retalic and Lowe 2012), should be undertaken of these and other taxa, often with small remnant populations and/or disjunct geographic distributions, that have been previously subsumed in synonymy under earlier-named species having much larger populations of widespread occurrence. As a result of becoming virtual non-entities, this can be detrimental to their conservation and ultimate survival in nature. Consequently their potential benefits to mankind, such as the medicinal properties that some Magnoliaceae species are known to possess, including present and prospective production of anti-cancer drugs and treatments (He et al. 2017, Huang et al. 2017, Lu et al. 2017, Ma et al. 2020, Prasad and Katiyar 2018, Zhang et al. 2020), are never assessed or realised.

## Taxonomic section

***Magnolia admirabilis* (Y.H. Law & R.Z. Zhou ex L. Fu, Q.W. Zeng & X.M. Hu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209515-1

**Basionym.** *Manglietia admirabilis* Y.H. Law & R.Z. Zhou ex L. Fu, Q.W. Zeng & X.M. Hu, Novon 23(1): 37, fig. 1 (2014).

**Chinese name.** 奇异木莲 meaning “distinctive *Manglietia*”

**Type.** CHINA. Yunnan Province: Maguan County, Gulinqing, Chuntianping, ca. 1300 m, limestone montane evergreen broad-leaved forests, 12 May 1986, *Zhou Renzhang* 98 (holotype: IBSC n.v.). Guangdong Province: Guangzhou, Magnolia Garden of South China Botanical Garden, ca. 50 m, 3 May 2011, *Lin Fu* 20110503 (paratype: IBSC n.v.)

**Note.** There is no data or images held at IBSC for the holotype (Huang Xiangxu, pers. comm., July 2019).

***Magnolia albistaminea* (Y.W. Law, R.Z. Zhou & X.S. Qin) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209516-1

**Basionym.** *Manglietia albistaminea* Y.W. Law, R.Z. Zhou & X.S. Qin. In: X.S. Qin et al., *Novon* 16: 260, fig. 1 (2006).

**Chinese name.** 白蕊木莲 meaning “white-stamened manglietia”

**Type.** CHINA. Guangdong Province: South China Botanical Garden, Guangzhou (collected from plant introduced in 1982 from Mt. Jianfengling, Ledong County, Hainan), 10 May 2001, *R.Z. Zhou* 130 (holotype: IBSC n.v.; isotype: MO n.v.). Same locality (collected from plant introduced as above) 23 April 1999, *R.Z. Zhou* 9916 and *R.Z. Zhou* 0136 (paratypes: IBSC n.v.).

*Manglietia fordiana* Oliv. var. *hainanensis* (Dandy) N.H. Xia. In: Xia et al. (2008: 58), p.p. quoad syn. *Manglietia albistaminea* Y.W. Law et al.

*Manglietia fordiana* Oliv. In: Sima and Lu (2009: 23) and Sima (2011: 88), both p.p. quoad syn. *Manglietia albistaminea* Y.W. Law et al.

**Note.** There are no data or images held at IBSC for the holotype (Huang Xiangxu, pers. comm., July 2019), nor could the isotype be located at MO (Jim Solomon, pers. comm., July 2019).

***Magnolia baotaina* (D.L. Fu, Q. Zhang & M. Xu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209518-1

**Basionym.** *Yulania baotaina* D.L. Fu, Q. Zhang & M. Xu. In: D.L. Fu et al., *Amer. J. Agric. and Forest.* 7(5): 231–232, fig. 1 (2019c).

**Chinese name.** 宝台山玉兰 meaning “Mount Baotai yulania”

**Type.** CHINA. Yunnan Province: Yongping County, Mount Baotai, 2600 m, 12 March 2017, *D.L. Fu* 2017031201 (holotype: CAF n.v.). Same locality, 9 September 2017, *D.L. Fu* 2017093001 (paratype: CAF n.v.).

**Note.** The type specimens of *Yulania baotaina* cannot be located at the Beijing herbarium of CAF (Wang Hongbin, pers. comm., March 2020).

***Magnolia caloptila* (Y.W. Law & Y.F. Wu) C.B. Callaghan & S.K. Png, comb. nov.**  
urn:lsid:ipni.org:names:77209519-1

**Basionym.** *Michelia caloptila* Y.W. Law & Y.F. Wu. In: Bull. Bot. Res., Harbin 4(2): 152, 154: fig. *s.n.* (1984).

**Chinese name.** 美毛含笑 meaning “beautiful-haired michelia”

**Type.** CHINA. Jiangxi Province: Zixi County, Nangang, Matoushan, 450 m, in woods, 17 September 1980, *Jiangxi gong-da linxue-xi (JXAU) 80069* (holotype: IBSC! + online image!; isotypes: LBG online images!).

Digital images of type specimens below accessed 19 March 2019:  
holotype [IBSC: 0003281]: <http://www.docin.com/p-1050989203.html> (Sima 2011: 316, photo 2-58).

isotype [LBG: 00004082]: <http://www.cvh.ac.cn/spm/LBG/00004082>

isotype [LBG: 00004123]: <http://www.cvh.ac.cn/spm/LBG/00004123>

*Michelia fujianensis* Q.F. Zheng. In: Xia and Deng (2002: 130) and Xia et al. (2008: 83), both p.p. quoad syn. *Michelia caloptila* Y.W. Law & Y.F. Wu.

*Michelia caloptila* Y.W. Law & Y.F. Wu. In: Sima (2011: 234), p.p. excl. syns. *Michelia concinna* H. Jiang & E.D. Liu and *Michelia septipetala* Z.L. Nong.

**Note 1.** *Michelia caloptila* Y.W. Law & Y.F. Wu was listed as a dubious species in Chen and Nooteboom (1993: 1088), in which it was noted that specimens had not been seen. It was subsequently reduced to a synonym of *Michelia fujianensis* as noted above. It is recognised as a genuine species by Law et al. (1996: 189), Liu et al. (2004: 228), Deng and Yang (2015: 167), Yang et al. (2016: 237) and Sima (2011: 234), wherein *M. caloptila* is in *Michelia* subsection *Micheliopsis*, series *Micheliopsis* and *M. fujianensis* is in *Michelia* subsection *Velutinae*. Differences between the abaxial indumentum of the 9–16 cm long leaves of *M. caloptila* and of the 6–11 cm long leaves of *M. fujianensis* are illustrated in Plate 3-2E (*M. caloptila*) and Plate 3-3E (*M. fujianensis*) of Sima (2011: 325; 326). Further substantiation of the specific status of *M. caloptila* is evident from a comparison of its morphological features with those of *M. fujianensis*, as shown in Table 1 on the following page.

**Note 2.** As a consequence of the above substantiation of the species status of *Michelia caloptila*, plus the past reduction to *Magnolia* of the remaining genera of sub-family Magnolioideae, *Michelia caloptila* is here transferred to *Magnolia*.

***Magnolia caudata* (M.X. Wu, X.H. Wu & G.Y. Li) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209521-1

**Basionym.** *Michelia caudata* M.X. Wu, X.H. Wu & G.Y. Li. In: X.H. Wu et al., Acta Bot. Bor-Occid. Sin. 35(5): 1058, fig. 1 (2015).

**Chinese name.** 尾叶含笑 meaning “caudate-lobed michelia”, referring to shape of leaf apex.

**Table 1.** Differentiating features of the species *Michelia caloptila* and *Michelia fujianensis*.

Plant feature	<i>Michelia caloptila</i> Y.W. Law & Y.F. Wu	<i>Michelia fujianensis</i> Q.F. Zheng
maximum dimensions	to 15 m × 30 cm dbh <sup>†</sup>	to 16 m × 100 cm dbh <sup>‡</sup>
bark colour	grey	greyish-brown (greyish-white <sup>‡</sup> )
indumentum of branchlets	brown tomentose	densely cinnamon tomentose
indumentum of buds	brown tomentose	densely cinnamon tomentose
leaf shape	narrowly elliptic or elliptic	oblong or narrowly obovate-elliptic
leaf dimensions	9–16 × 2.5–5 cm	6–11 × 2.5–4 cm
leaf apex	acuminate or caudate-acuminate	acute
leaf indumentum adaxially	entirely glabrous	densely short-tomentose at midrib
leaf indumentum abaxially	minutely brown tomentose	densely ferruginous or brownish-yellow appressed sericeous
secondary lateral leaf veins	7–12 pairs	8–9 pairs (not 9–15 <sup>§</sup> )
petiole length and indumentum	5–10 mm, brown tomentose	10–15 mm, densely cinnamon tomentose
tepala number	6–9 <sup>‡</sup>	15–16 (12–17 <sup>‡</sup> )
gynophore in fruit	ca. 20 mm long	2–2.5 mm long
fruit aggregate length	4–10 cm	2–3 cm
mature carpels	broadly ovate or suborbicular, 1–1.8 cm long with 1–4 seeds	obovoid, 1.5–2 cm × ca. 1.2 cm with 1 seed
fruiting period	September <sup>†</sup>	October–November <sup>‡</sup>

The differentiating features of *Michelia caloptila* are cited from Law and Wu (1984) to whom the flower was unknown, Liu et al. (2004: 228)<sup>†</sup> and Yang et al. (2016: 237)<sup>‡</sup>, with those of *M. fujianensis* from Zheng (1981), supplemented by Law et al. (1996: 189)<sup>§</sup> and Liu et al. (2004: 260)<sup>‡</sup>.

**Type.** CHINA. Zhejiang Province: Qingyuan County, Songyuan town, Jiaokeng village, Guanmenao Conservation Area, in evergreen broad-leaved forests, ravines, 460 m, 12 April 2010, *Ye Qing-jiao & Wu Xia-hua 1096* (holotype: ZJFC n.v.). Zhejiang Province: Qingyuan County, Songyuan town, Jiaokeng village, 460 m, 26 September 2010, *Ma Dan-dan, Li Gen-you, Wu Ming-xiang QY20100922* (paratype: ZJFC n.v.).

***Magnolia fallax* (Dandy) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209522-1

**Basionym.** *Michelia fallax* Dandy. In: Notes, Roy. Bot. Gard. Edinburgh 16(77): 130 (1928c).

**Chinese names:** 灰绒含笑 meaning “grey-velvet michelia”, referring to the grey indumentum covering branchlets, buds, etc. Also: 大叶含笑 meaning “large-leaved michelia”

**Type.** CHINA. Hunan Province: near Wukang-chow (=Wugang), Yunshan, ca. 950 m, in lofty shady forests, 12 July 1918, *Handel-Mazzetti 12281* p.p. quoad fruiting specimen (holotype: WU online image!; isotypes: A online image!, K online image!).

Digital images of holotype and isotype specimens below accessed 19 March 2019: holotype [WU: 0039581]: <http://herbarium.univie.ac.at/database/detail.php?ID=70940> isotype [A: 00039058]: <https://s3.amazonaws.com/huhwebimages/6C9726D2157D489/type/full/39058.jpg>

isotype [K: K000681458]: <http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000681458>

*Michelia cavaleriei* Finet & Gagnep. In: Chen and Nooteboom (1993: 1058), Frodin and Govaerts (1996: 55), Wu and Chen (2006: 56), Sima and Lu (2009: 50), Sima (2011: 214), Deng and Yang (2015: 148), each p.p. quoad syn. *Michelia fallax* Dandy.

*Michelia cavaleriei* Finet & Gagnep. var. *cavaleriei*. In: Xia et al. (2008: 84), p.p. quoad syn. *Michelia fallax* Dandy.

**Note 1.** James E. Dandy (1928c: 130), provides background information concerning the division of the fruiting and flowering collections made under number 12281 by Handel-Mazzetti on 12 July 1918 and by his servant Wang Te-hui in April 1919 respectively. From his study of these collections, Dandy came to the realisation that they represented two distinct species, retaining Handel-Mazzetti's name *Michelia platypetala* for Wang's flowering material and publishing the name *Michelia fallax* for Handel-Mazzetti's fruiting material.

**Note 2.** An undated identification label in the name of J.E. Dandy, affixed to the Kew Herbarium isotype specimen of *M. fallax*, indicates his subsequent determination of it as *M. cavaleriei* Finet & Gagnep. This specimen and the other above seen type specimens are all ca. 20 cm in length and 6 cm wide, roughly only about two-thirds of Dandy's original description of the leaves of *M. fallax* being "usque ad ca. 30 cm longa et 8.5 cm lata" (up to about 30 cm long and 8.5 cm wide). Dandy's dimensions are not a misprint, since there are a number of *M. fallax* specimens of different provenances (and provinces) posted to the Chinese Virtual Herbarium (CVH) website with leaves approaching this size, which is alluded to in one of this species two Chinese names translating as "large-leaved michelia". The above noted dimensions must be presumed to be those of the other specimen noted in Dandy's description, the undated specimen *Dalziel s.n.*, collected at about 900 m near Thai-yong, 97 km west of Swatow (Shantou) on Guangdong's northeastern coast, sometime between 1895 and 1902 (this specimen was not located for the current research).

**Note 3.** Subsequent to Dandy, *M. fallax* has been listed as a synonym of *M. cavaleriei* and of *M. cavaleriei* var. *cavaleriei* by the authors cited in the section preceding Note 1. However, the present authors consider that while these two species are superficially similar in the shape of their leaves, that the known comparative features recorded in Table 2 below distinguish *Michelia fallax* as an independent species. Also, it does not key out with the original validating descriptions for *Michelia humanensis* or *M. xinningia* with which it shares synonymy under *M. cavaleriei* var. *cavaleriei* in Flora of China. Therefore, consistent with the past reduction to *Magnolia* of the remaining segregate genera of subfamily Magnolioideae, *Michelia fallax* is here transferred to *Magnolia*.

**Table 2.** Differentiating features of the species *Michelia fallax* and *Michelia cavalieri*.

Plant feature	<i>Michelia fallax</i> Dandy	<i>Michelia cavalieri</i> Finet & Gagnep.
indumentum of branchlets	appressed grey tomentose, becoming tawny near apex	silver-grey or rufous appressed pilose <sup>§</sup>
indumentum of buds	appressed shiny grey tomentose	silver-grey or rufous appressed pilose <sup>§</sup>
leaf shape	elliptic-oblong, oblong or narrowly oblong	narrowly oblanceolate-oblong or narrowly oblong <sup>§</sup>
leaf apex	acuminate or subacuminate	acuminate or short-acute <sup>§</sup>
leaf base	obtuse or sub-rounded	cuneate or broadly cuneate <sup>§</sup>
leaf dimensions	up to ca. 30 × 8.5 cm (ca. 29 × 9 cm <sup>†</sup> )	10–20 × 3.5–6.5 cm <sup>§</sup>
leaf indumentum abaxially	short appressed grey pubescent	glaucous, silver-grey or rufous appressed pilose when young <sup>§</sup>
secondary lateral leaf veins	ca. 14–16 pairs	11–15 pairs <sup>‡</sup>
petiole length and indumentum	ca. 2.5 cm, initially appressed grey or yellow-brown tomentose, later glabrescent	2 cm, puberulus (0.7–1.5 cm <sup>#</sup> silver-grey or rufous appressed pilose <sup>§</sup> )
gynoecium indumentum	appressed grey tomentellous	glabrous except for few bristly hairs towards apex of carpels <sup>††</sup>
number of ovules	ca. 10	2
fruiting peduncle indumentum	appressed glossy grey or yellowish-brown tomentose	silver-grey or rufous appressed pilose <sup>§</sup>
fruit aggregate length	10–12 cm	5–10 cm <sup>§</sup>
mature carpels length	up to ca. 2.5 cm	1.5–2 cm <sup>‡</sup>
fruiting period	July	September–October <sup>‡,§</sup>

The differentiating features of *Michelia fallax*, whose flower is unknown, are cited from Dandy (1928c) and CVH (2017)<sup>†</sup>; those of *M. cavalieri* from Finet & Gagnepain (1906), Law et al. (1996: 184)<sup>‡</sup>, Liu et al. (2004: 229)<sup>§</sup> and Yang et al. (2016: 239)<sup>#</sup>, plus Dandy (1928c: 130)<sup>††</sup>.

***Magnolia gelida* (T.B. Zhao, Z.X. Chen & D.L. Fu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209524-1

**Basionym.** *Michelia gelida* T.B. Zhao, Z.X. Chen & D.L. Fu. In: Y.F. Hu et al., *Advances Orn. Hort. China* 2013: 39–40, fig. 1 (2013).

**Chinese name.** 耐冬含笑 meaning “winter resisting michelia”

**Type.** CHINA. Henan Province: Jinling County, Changge city, cultivated (native to Zhejiang Province: Fuyang County), 24 March 2010, *Zhao Tian-bang, Fu Da-li et al.* 201003245 (holotype: HEAC, fol, fl. n.v.)

***Magnolia guangnanica* (D.X. Li & R.Z. Zhou ex X.M. Hu, Q.W. Zeng & L. Fu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209525-1

**Basionym.** *Manglietia guangnanica* D.X. Li & R.Z. Zhou ex X.M. Hu, Q.W. Zeng & L. Fu, *Novon* 23(2): 172, figs. 1, 2 (2014).

**Chinese name.** 广南木莲 meaning “Guangnan manglietia”

**Type.** CHINA. Yunnan Province: Guangnan County, Heizhiguo town and village, Mt. Gulu, in limestone montane evergreen broad-leaved forest, 1710 m, 17 October 1993, *Zhou Ren-zhang* & *Zeng Qing-wen* 93049 (holotype and isotype: IBSC n.v.). Same locality, 12 May 1992, *D.X. Li* & *Z.Q. Ouyang* 920512 (paratype: MO n.v.). Same locality 16 April 2003, *R.Z. Zhou* 03046 (paratype: IBSC n.v.). Yunnan Province: Guangnan County, Mount Houshan, near Zhujie village of Zhujie town, 1600 m, 4 October 1993, *R.Z. Zhou* 9304 (paratype: IBSC!). Yunnan Province: Kunming Botanical Garden, cultivated, 1 May 2010, *X.M. Hu* & *Q.W. Zeng* 00166 (paratype: IBSC n.v.).

**Note.** The holotype and isotype specimens of *Manglietia guangnanica* could not be found by herbarium staff at IBSC, nor could the paratype specimen at MO be located (Jim Solomon, pers. comm., July 2019). However, the paratype that was received from IBSC, *R.Z. Zhou* (*Zhou Ren-zhang*) 9304 collected at 1600 m, inexplicably has the locality and collection date as for the holotype / isotype above and not Mount Houshan on the 4 October 1993 as is noted in the 2014 paper for this paratype.

***Magnolia hunanensis* (C.L. Peng & L.H. Yan) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209526-1

**Basionym.** *Michelia hunanensis* C.L. Peng & L.H. Yan. In: C.L. Peng et al., J. Hunan Forest. Tech. Coll. 1995(1): 15 (1995).

**Chinese name.** 湖南含笑 meaning “Hunan michelia”

**Type.** CHINA. Hunan Province: Xinning County, without elevation or collection date, *L.H. Yan* & *C.L. Peng* 93018 (holotype: HFBG n.v.; isotype: HFTC n.v.).

*Magnolia maudiae* (Dunn) Figlar var. *hunanensis* (C.L. Peng & L.H. Yan) Sima (2001: 33).

*Michelia cavaleriei* Finet & Gagnep. In: Xia & Deng (2002: 132) and Sima (2011: 214), both p.p. quoad syn. *Michelia hunanensis* C.L. Peng & L.H. Yan—Sima & Lu (2009: 50), p.p. quoad syns. *Michelia hunanensis* C.L. Peng & L.H. Yan and *Magnolia maudiae* (Dunn) Figlar var. *hunanensis* (C.L. Peng & L.H. Yan) Sima.

*Michelia cavaleriei* Finet & Gagnep. var. *cavaleriei*. In: Xia et al. (2008: 84), p.p. quoad syn. *Michelia hunanensis* C.L. Peng & L.H. Yan.

**Note 1.** The holotype specimen was irretrievably damaged during repeated relocations of the HFBG herbarium (Yan Lihong, pers. comm.). Photographs were sent in its place.

**Note 2.** The numerous known differentiating features compiled in Table 3 below confirm *Michelia hunanensis* as an independent species and not a variety of *Magnolia maudiae*, nor a synonym of *Michelia cavaleriei* var. *cavaleriei* as noted above.

**Table 3.** Differentiating features of *Michelia hunanensis*, *M. maudiae* and *M. cavaleriei*.

Plant feature	<i>Michelia hunanensis</i> C.L. Peng & L.H. Yan	<i>Michelia maudiae</i> Dunn	<i>Michelia cavaleriei</i> Finet & Gagnep.
maximum height	20 m	31 m <sup>§</sup>	10 m <sup>**</sup>
indumentum of buds	greyish-pilose	glabrous (covered with white powder <sup>††</sup> )	silver-grey or rufous appressed pilose <sup>**</sup>
leaf shape	oblong or broadly oblong	oblong-elliptic or occasionally ovate-elliptic <sup>††</sup>	narrowly oblanceolate-oblong or narrowly oblong <sup>**</sup>
leaf dimensions	13–33 × 6–9 cm	7–18 × 3.5–8.5 cm <sup>††</sup>	10–20 × 3.5–6.5 cm <sup>**</sup>
leaf apex	cuspidate	obtuse acuminate (occasionally long-acuminate <sup>†</sup> )	acuminate or short-acute <sup>**</sup>
leaf base	rounded or obtuse	acute or cuneate	cuneate or broadly cuneate <sup>**</sup>
undersides of leaves	greyish pubescent	glabrous, as is the entire plant <sup>††</sup> , except for the silky grey pubescent stamens <sup>†</sup>	glaucous and silver-grey or rufous appressed pilose when young <sup>**</sup> )
lateral leaf veins	8–14 pairs	8–12 pairs	11–15 pairs <sup>§§</sup>
petiole length and indumentum	2–3.5 cm, pilose	2.5–3 cm, glabrous (1–3 cm <sup>††</sup> )	2 cm, puberulus (0.7–1.5 cm) <sup>**</sup> , silver-grey or rufous appressed pilose <sup>**</sup>
tepal number	9	9–11 <sup>††</sup>	10–12 <sup>**</sup>
tepal shape and size (outer 3)	obovate, 6–7 cm long (width not specified)	obovate, 5–7 × 3.5–4 cm <sup>††</sup>	obovate-elliptic (2.5–4 cm long <sup>**</sup> )
tepal shape and size (inner 3)	obovate-lanceolate, 4–4.8 × 1.2–1.4 cm	obovate, elliptic to broadly spathulate, 4.5–5 × 1.8–2.5 cm <sup>†</sup>	obovate-elliptic, 2.5 × 1.5 cm
length of stamens	ca. 1 cm	1.5–2.2 cm <sup>†</sup>	1.2–1.4 cm <sup>§§</sup>
gynoecium length, shape and indumentum	1 cm, cylindric, pubescent	1.5–1.8 cm (1.0–1.3 cm, subcylindric <sup>†</sup> ), glabrous	1 cm, narrowly ovate, with a few hairs only near the carpel apex
gynophore length	5–8 mm	ca. 10 mm	ca. 4 mm <sup>§§</sup>
fruit aggregate length	8–17 cm	10–12(–14) cm <sup>†</sup>	5–10 cm <sup>**</sup>
flowering period	March–April	January–March <sup>††</sup>	March <sup>§§, **</sup>
fruiting period	August–September	October–November <sup>††</sup>	September–October <sup>§§, **</sup>

The distinguishing features of *Michelia hunanensis* are cited from Peng et al. (1995). Those of *M. maudiae* are cited from Dunn (1908), supplemented by Chen and Nootboom (1993:1072)<sup>†</sup>, Deng and Yang (2015: 157)<sup>§</sup>, Law et al. (1996: 179)<sup>†</sup>, Lee (1935: 487)<sup>#</sup>, Liu et al. (2004: 290)<sup>††</sup> and Yang et al. (2016: 295)<sup>\*\*</sup>, with those of *M. cavaleriei* from Finet and Gagnepain (1906), supplemented by Law et al. (1996: 184)<sup>§§</sup>, Liu et al. (2004: 229)<sup>\*\*</sup> and Yang et al. (2016: 239)<sup>\*\*</sup>.

***Magnolia jinggangshanensis* (R.L. Liu & Z.X. Zhang) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209527-1

**Basionym.** *Manglietia jinggangshanensis* R.L. Liu & Z.X. Zhang. In: Fedd. Repert. 130(3): 289, 290 fig. 1, 291 fig. 2 (2019)

**Chinese name.** 井冈山木莲 meaning “Jinggangshan manglietia”

**Type.** CHINA. Jiangxi Province: Jinggangshan, in evergreen forest, 980 m, 8 May 2001 (fl.), R.L. Liu 20010012 (holotype: BJFCI; isotypes: PE n.v., K n.v.)

**Note.** The isotypes at PE and K could not be located (Xiaohua Jin, PE, Beijing, pers. comm., July 2019 and Clare Drinkell, assistant curator, Kew, pers. comm., July 2019).

***Magnolia maguanica* (Chang & B.L. Chen) C.B. Callaghan & S.K. Png, comb. nov.**  
urn:lsid:ipni.org:names:77209528-1

**Basionym.** *Manglietia maguanica* Chang & B.L. Chen. In: B.L. Chen, Acta Sci. Nat. Univ. Sunyatseni 1988(1): 109 (1988).

**Chinese name.** 马关木莲 meaning “Maguan manglietia”

**Type.** CHINA. Yunnan Province: Maguan County, Bazhai, near Xiaoshan, in woods, ca. 1800 m, 7 October 1986, *B.L. Chen & Y.H. Su 86s-053* (holotype: SYS! + online image!; isotype: L online image!).

Digital image of specimens below accessed 19 March 2019:

holotype (SYS): <http://www.docin.com/p-1050989203.html> (Sima 2011: 312, photo 2-42).

isotype [L: L0204985]: [http://medialib.naturalis.nl/file/id/L0204985\\_MLN/format/large?fpi=1](http://medialib.naturalis.nl/file/id/L0204985_MLN/format/large?fpi=1)

*Manglietia insignis* (Wall.) Blume. In: Chen and Nootboom (1993: 1044), Frodin and Govaerts (1996: 52), J. Li (1997: 132), Wu and Chen (2006: 10), and Xia et al. (2008: 56), each p.p. quoad syn. *Manglietia maguanica* Chang & B.L. Chen.

*Magnolia insignis* Wall. In: Khurajam and Goel (2015: 109), p.p. quoad syn. *Manglietia maguanica* Chang & B.L. Chen.

**Note.** *Manglietia maguanica* is listed as a synonym of *M. insignis* in Chen & Nootboom (1993) and subsequently by the authors noted above. However, both are recognised as independent species in the majority of the more recent Chinese publications, including Liu et al. (2004: 164, 156), Xing et al. (2009: 198, 196), Sima and Lu (2009), Sima (2011: 98, 102), Deng and Yang (2015: 48, 54) and Yang et al. (2016: 192, 181).

***Magnolia maudiae* Dunn (Figlar) var. *rubicunda* (T.P. Yi & J.C. Fan) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209530-1

**Basionym.** *Michelia maudiae* Dunn var. *rubicunda* T.P. Yi & J.C. Fan. In: J.C. Fan et al., J. Sichuan Forest. Sci. Tech. 30(4): 68, plate 1 (2009).

**Chinese name.** 红花深山含笑 meaning “red-flowered deep mountains michelia”

**Type.** CHINA. Sichuan Province: Dujiangyan, cultivated at the Arboretum of Sichuan Agricultural University, 22 February 2009, *T.P. Yi 09001* (holotype: SAUT=SIFS, fl. n.v.). Other specimens recorded: same locality, 13 September 2008, *T.P. Yi 08005* (SAUT=SIFS, fr. n.v.). Sichuan Province: Dujiangyan Juyuan Nursery, 20 August 2008, *T.P. Yi 08004* (SAUT=SIFS, fr. n.v.). [Introduced from Tongdao County, Hunan Province].

***Magnolia multitepala* (R.Z. Zhou & S.G. Jian) C.B. Callaghan & S.K. Png, comb. nov.**  
urn:lsid:ipni.org:names:77209531-1

**Basionym.** *Michelia multitepala* R.Z. Zhou & S.G. Jian. In: S.G. Jian et al., *Ann. Bot. Fenn.* 44: 65, fig. 1 (2007).

**Chinese name.** 多瓣含笑 meaning “multi-tepalled michelia”

**Type.** CHINA. Yunnan Province: Xichou County, Fadou Mountain, in moist evergreen broad-leaved forest, 1300–1500 m, March 2003, *R.Z. Zhou 0401* (holotype: IBSC n.v.). Same locality, July 2004, *R.Z. Zhou & S.G. Jian 20040701* (paratype: IBSC n.v.).

*Michelia macclurei* Dandy. In: Xia et al. (2008: 85), p.p. quoad syn. *Michelia multitepala* R.Z. Zhou & S.G. Jian.

*Michelia doltsopa* Buch.-Ham. ex DC. In: Sima and Lu (2009: 53) and Sima (2011: 196), both p.p. quoad syn. *Michelia multitepala* R.Z. Zhou & S.G. Jian.

**Note 1.** There is no data or images held at IBSC for the holotype (Huang Xiangxu, pers. comm., July 2019).

**Note 2.** The authors of *Michelia multitepala* noted that it closely resembles *M. ingrata* B.L. Chen & S.C. Yang and *M. macclurei* Dandy, but recorded in their comparative diagnosis sufficient morphological differences with these species to substantiate and name *Michelia multitepala* as a distinct new species. *M. multitepala* is recorded as a synonym of *M. doltsopa* Buch.-Ham. ex DC. by the above noted authors. However, in Liu’s classification system of Magnoliaceae (Liu et al. 2004: 381), both *M. macclurei* and *M. ingrata* are placed in *Michelia* section *Anisochlamys* Dandy while *M. doltsopa* is placed in *Michelia* section *Michelia*.

**Note 3.** *Michelia multitepala* is sufficiently distinct from *M. doltsopa* (Candolle 1818), to justify its species status, as shown by their known differentiating features compiled in Table 4 below. Additionally, *M. multitepala* is known only to occur at 1300–1500 m on Fadou Mountain in the southeast of Yunnan Province, whereas *M. doltsopa* occurs between 1500–2300 m throughout its widely dispersed geographical area from Yunnan to N Myanmar, NE India, Bhutan and SE Xiyang (Liu et al. 2004: 242), or 2100–2500 m from central Nepal and Burma (Myanmar) to Sichuan and Yunnan (Polunin and Stainton 1999: 19). As a consequence of the substantiation of its specific status, *Michelia multitepala* is here transferred to *Magnolia* in accordance with the past reduction of the remaining genera of subfamily Magnolioideae to the genus *Magnolia*.

***Magnolia pendula* (D.L. Fu) C.B. Callaghan & S.K. Png, comb. nov.**  
urn:lsid:ipni.org:names:77209533-1

**Basionym.** *Yulania pendula* D.L. Fu. In: D.L. Fu et al., *Amer. J. Agric. and Forest.* 7(5): 220–221, figs. 5 & 6 (2019c).

**Type.** CHINA. Sichuan Province: Beichuan County, Guixi town, Linfeng village, Yaowang Valley, secondary forest, 1200 m, 2 April 2012, *D. L. Fu 2012040201* (holo-

**Table 4.** Differentiating features of the species *Michelia multitepala* and *M. doltsopa*.

Plant feature	<i>Michelia multitepala</i> R.Z. Zhou & S.G. Jian	<i>Michelia doltsopa</i> Buch.-Ham. ex DC
tree dimensions	15 m tall, 30 cm diameter	30 m tall <sup>§</sup> , 1 m diameter
indumentum of leaf buds	rufous appressed-tomentellous	rufous or greyish-white appressed pubescent <sup>§</sup> , orange-rusty hairs on pale green scales <sup>†</sup>
leaf texture	leathery	thinly leathery <sup>§</sup>
leaf shape and dimensions	elliptic, 14–18 × 5–6.5 cm	elliptic-oblong, 10–22 × 5–7 cm <sup>§</sup> (10–18(–22) × 3.5–8 cm <sup>††</sup> )
leaf apex	acuminate or short acuminate	short acute or long acute <sup>§</sup>
leaf base	broadly cuneate	obtuse or broadly cuneate <sup>§</sup>
leaf beneath	pale green	pale green and somewhat glaucous beneath <sup>‡</sup> , glaucous with orange pubescent veins <sup>†</sup>
lateral leaf veins	13–15 pairs	10–14 pairs <sup>†</sup>
petiole length and indumentum	1.5–3 cm, rufous appressed tomentellous	1–2 cm <sup>‡‡</sup> , slightly silky grey pubescent <sup>‡</sup> , later glabrescent
stipular scars	none	to ca. 1/5 of petiole length <sup>§</sup>
peduncle indumentum	rufous appressed-tomentellous	densely appressed-villose <sup>§</sup>
tepala number, shape and size	11–12, oblong-lanceolate, 4–6.5 × 0.8–1.7 cm	(8–)12–16, narrowly obovate spoon-shaped 3.6–7.5 × 1.4–3 cm <sup>††</sup>
stamen length	14–16 mm	8–15 mm <sup>††</sup>
gynoecium length	2–2.5 cm	1.5–2 cm <sup>†</sup>
fruit aggregate length	8–15 cm	4–7 cm <sup>§</sup> (6–10 cm <sup>‡‡</sup> )
shape of carpels	ellipsoid	globose <sup>‡</sup>
flowering period	February–March	March–April <sup>§</sup>

The differentiating features of *Michelia multitepala* are from Jian et al. (2007); those of *Michelia doltsopa* are from Candolle (1818), supplemented by Law et al. (1996: 159)<sup>†</sup>, Lee (1935: 483)<sup>‡</sup>, Liu et al. (2004: 242)<sup>§</sup>, Mitchell and Coombes (1998: 181)<sup>†</sup>, Polunin and Stainton (1999)<sup>‡</sup>, Spongberg (1998: 135)<sup>††</sup> and Yang et al. (2016: 257)<sup>‡‡</sup>.

type: CAF n.v.). Same locality, 13 September 2012, *D. L. Fu 2012091308* (paratype, CAF n.v.).

**Chinese name.** 垂枝玉兰 meaning “weeping yulan”

**Note.** The type specimens of *Yulania pendula* cannot be located at the Beijing herbarium of CAF (Wang Hongbin, pers. comm., March 2020).

***Magnolia pilocarpa* Z.Z. Zhao & Z.W. Xie var. *ellipticifolia* (D.L. Fu, T.B. Zhao & J. Zhao) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209534-1

**Basionym.** *Yulania pilocarpa* (Z.Z. Zhao & Z.W. Xie) D.L. Fu var. *ellipticifolia* D.L. Fu, T.B. Zhao & J. Zhao. In: D.L. Fu et al., Bull. Bot. Res., Harbin 27(5): 526; figs. 1C–D (2007).

**Chinese name.** 椭圆叶罗田玉兰 meaning “elliptical-leaved Luotian yulan”

**Type.** CHINA. Henan Province: Xinzheng City, 23 March 2002, *T.B. Zhao et al. 200203231* (holotype: HEAC, flos. n.v.). Same locality, 21 September 2002, *T.B. Zhao et al. 200209211* (paratype: HEAC, folia, ramulus et peruli-alabastrum; n.v.).

*Yulania pilocarpa* (Z.Z. Zhao & Z.W. Xie) D.L. Fu. In: Xia et al. (2008: 76), p.p. quoad syn. *Yulania pilocarpa* var. *ellipticifolia* D.L. Fu et al.

*Yulania denudata* var. *pilocarpa* (Z.Z. Zhou & Z.W. Xie) Sima & S.G. Lu. In: Sima (2011: 163), p.p. quoad syn. *Yulania pilocarpa* var. *ellipticifolia* D.L. Fu et al.

**Note 1.** The genus *Yulania* Spach (Spach 1839) was resurrected in Flora of China (Xia et al. 2008), but there has not been universal acceptance of this in China, with *Yulania* again recognised as a subgenus under *Magnolia* (Ying et al. 2009, Yang et al. 2016).

**Note 2.** *Yulania pilocarpa* var. *ellipticifolia* is sufficiently distinguished from *Y. pilocarpa* to maintain its varietal status by the following features: indumentum of the branchlets (densely pubescent, later glabrous vs. glabrous [Law et al. 2004: 93]); the leaf shape (elliptical, rarely inverted-triangular vs. obovate to broadly obovate [Law et al. 2004]) and the shape and size of the inner 6 tepals (petaloid, 5–7 × 2–3.2 cm vs. nearly spatulate, 7–10 × 3–5 cm [Law et al. 2004]). Additionally, the two taxa are geographically isolated (central Henan Province vs. SE Hubei Province). The illustration of the leaves accompanying the original description of *Yulania pilocarpa* var. *ellipticifolia* (Fu et al. 2007: fig.1D) shows them to be in stark contrast to the leaves of *Magnolia pilocarpa* illustrated in Liu et al. (2004: 93).

***Magnolia platypetala* (Hand.-Mazz.) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209535-1

**Basionym.** *Michelia platypetala* Hand.-Mazz. In: Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 58(12): 89 (1921).

**Chinese name.** 阔瓣含笑 meaning “broad-petalled (tepalled) michelia”

**Type.** CHINA. Hunan Province: Yunshan, near Wukang-chow (= Wugang), ca. 950 m, lofty shady forests, April 1919, *Wang Te-Hui* (*De-Hui Wang*) 12281 (p.p. quoad flowering material only, in Handel-Mazzetti, 1921) (holotype: W (possibly destroyed in WWII); isotypes: A online image!, K online image!, SYS!, WU online image!).

Digital images of isotype specimens below accessed 19 March 2019:

isotype [A: 00039059]: <http://kiki.huh.harvard.edu/databases/image.php?id=304833>

isotype [K: K000681459]: <http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000681459>

isotype [WU: 0039591]: <http://herbarium.univie.ac.at/database/detail.php?ID=71255>

*Michelia cavaleriei* Finet & Gagnep. In: Chen and Nooteboom (1993: 1058), Frodin and Govaerts (1996: 55), Wu and Chen (2006: 56), each p.p. quoad syn. *Michelia platypetala* Hand.-Mazz.

*Magnolia maudiae* var. *platypetala* (Hand.-Mazz.) Sima (2001: 33).

*Magnolia cavaleriei* var. *platypetala* (Hand.-Mazz.) Noot. In: Xia et al. (2008: 49).

*Michelia cavaleriei* var. *platypetala* (Hand.-Mazz.) N. H. Xia. In: Xia et al. (2008: 85).

**Note 1.** Dandy (1928c: 130) provides relevant background information concerning the type collections of *Michelia platypetala* and *M. fallax* from the same general locality in Hunan Province in consecutive years and how they were both initially confused as the former species.

**Note 2.** As recorded in the synonymy section preceding Note 1, *Michelia platypetala* is noted as a synonym of *M. cavaleriei* and has been made a variety of both *Magnolia maudiae* and *Michelia cavaleriei*, the 2001 and 2008 publications with a noted elevational range of 1200–1500 m despite Handel-Mazzetti's type collection being made at ca. 950 metres. However, *M. platypetala* retains its species status in Law et al. (1996: 177), Liu et al. (2004: 306), Sima (2011: 219), Deng and Yang (2015: 144) and Yang et al. (2016: 306).

**Note 3.** Grimshaw and Bayton (2009: 500) record a personal communication received from Richard Figlar in 2007 advising that “this taxon (*Magnolia maudiae* var. *platypetala*) probably ought to be recognised at the specific level, as *Magnolia platypetala*, as it differs considerably from *M. maudiae* both in its hairiness and its later bud-break”. Sima (2011: 327), illustrates the contrasting difference between the indumentum of the undersurfaces of the leaves of *M. platypetala* (Plate 3-4H) and that of the leaves of *M. maudiae* (Plate 3-4C). Additionally, in a study by Zhang and Xia (2007) on leaf architecture and its taxonomic significance in respect of subtribe Micheliinae of Magnoliaceae, the pronounced contrast in the leaves of *Michelia platypetala* and *M. cavaleriei* as revealed by stereoscopic magnified imaging (shown at figs. 36 and 37 in their paper), resulted in these authors concluding that these two taxa should be recognised as independent species”. It is apparent that there is now an almost unanimous consensus of the species status of *Michelia platypetala*, which is confirmed by the comparison of its morphological features with those of *M. cavaleriei* compiled in Table 5 below. In view of its distinctive characteristics and accepting the majority recognition by the above-mentioned Chinese authors of *Michelia platypetala* as a genuine species, it is here transferred to *Magnolia* as a consequence of the past reduction of the remaining genera of subfamily Magnolioideae to the genus *Magnolia*.

***Magnolia puberula* (D.L. Fu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209537-1

**Basionym.** *Yulania puberula* D.L. Fu. In: D.L. Fu et al., Amer. J. Agric. and Forest. 7(5): 208–209, fig. 3 (2019a).

**Chinese name.** 短毛玉兰 meaning “short-haired yulan”

**Type.** CHINA. Hubei Province, Wudang Mountain, ca. 970 m, 26 March 2018, *D.L. Fu 2018032601* (holotype: CAF, fl. n.v.). Same locality, 8 October 2017, *D.L. Fu 2017100801* (paratype: CAF, fr. n.v.).

**Note.** The type specimens of *Yulania puberula* cannot be located at the Beijing herbarium of CAF (Wang Hongbin, pers. comm., March 2020).

**Table 5.** Differentiating features of the species *Michelia platypetala* and *M. cavaleriei*.

Plant feature	<i>Michelia platypetala</i> Hand-Mazz.	<i>Michelia cavaleriei</i> Finet & Gagnep.
life form	medium-sized tree to 20 m	small-sized tree 7–10 metres
indumentum of branchlets	rufous sericeous	silver-grey or rufous appressed pilose <sup>†</sup>
indumentum of buds	rufous sericeous	silver-grey or rufous appressed pilose <sup>†</sup>
leaf shape	oblong or elliptic-oblong	narrowly oblong or narrowly oblanceolate-oblong <sup>†</sup>
leaf dimensions	11–18(–20) × 4–6(–7) cm (12–17 × 4.5–6.5 cm <sup>†</sup> )	10–20 × 3.5–6.5 cm <sup>†</sup> (8–21 × 2.5–5 cm <sup>†</sup> )
leaf apex	acuminate or abruptly narrowed short-acuminate	acuminate or short-acute <sup>†</sup>
leaf base	broadly cuneate or obtuse	cuneate or broadly cuneate <sup>†</sup>
leaf indumentum abaxially	greyish-white appressed puberulent or rufous appressed hairs	silver-grey or rufous pilose, appressed when young <sup>†</sup>
lateral leaf veins	8–14 pairs	11–15 pairs <sup>§</sup>
petiole length	2–3 cm <sup>†</sup>	2 cm (0.7–1.5 cm <sup>†</sup> )
pedicel (peduncle) length	0.5–2 cm	1.5–2.5 cm <sup>§</sup>
bract scar number	2	2–3
tepal number and shape	9 (9–11 <sup>†</sup> ), obovate-elliptic or elliptic	ca. 12 (10–12 <sup>†</sup> ): obovate-elliptic <sup>†</sup>
tepal length (outer 3)	5–7 cm	2.5 cm (2.5–4 cm <sup>†</sup> )
stamen / anther length	ca. 1 cm / ca. 6 mm	1.2–1.4 cm / ca. 8 mm <sup>§</sup>
gynoecium shape, length and indumentum	cylindric, 6–8 mm, grey or golden puberulent	narrowly ovoid, ca. 10 mm, glabrous except for few bristly hairs towards apex of the carpels <sup>†</sup>
gynophore length	ca. 5 mm	ca. 4 mm <sup>§</sup>
number of ovules	ca. 8 in each immature carpel	2 in each immature carpel
fruit aggregate length	5–15 cm	5–10 cm <sup>†</sup>
mature carpels shape and size	ellipsoid, rarely globose or ovoid, 1.5–2(–2.5) × 1–1.5 cm	obovoid or ellipsoid, 1.5–2 cm long <sup>§</sup>
flowering period	March–April	March <sup>§</sup>

The distinguishing features of *Michelia platypetala* are mainly cited from Law et al. (1996: 177), Liu et al. (2004: 306) and Yang et al. (2016: 306)<sup>†</sup>, because the description of *M. platypetala* Hand.-Mazz. (1921) includes the composite description of 2 species, including for the fruit of the subsequently named *M. fallax*. The features of *M. cavaleriei* are from Finet and Gagnepain (1906), supplemented by Dandy (1928c: 130)<sup>‡</sup>, Law et al. (1996: 184)<sup>§</sup>, Liu et al. (2004: 229)<sup>†</sup> and Yang et al. (2016: 239)<sup>†</sup>.

***Magnolia pubipedunculata* (Q.W. Zeng & X.M. Hu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209538-1

**Basionym.** *Manglietia pubipedunculata* Q.W. Zeng & X.M. Hu. In: X.M. Hu et al., *PLoS ONE* 14 (3): 4–5, fig. 1 (e0210254: 2019). [13 March 2019 – e-published]

**Chinese name.** 柔毛花梗木莲 meaning “pubescent-peduncled manglietia”

**Type.** CHINA. Yunnan Province: Wenshan Prefecture, Maguan County, Miechang Town, Daxinzhai Village, Donggualin, Huashikeng, evergreen broad-leaved forests,

1453 m, 104°05'21"E; 22°54'50"N, 14 May 2004, *Q.W. Zeng 89* (holotype: IBSC n.v.). Same locality, 9 September 2003, *Q.W. Zeng 80* (paratype: IBSC n.v.).

**Note.** There are no data or images held at IBSC for the holotype (Huang Xiangxu, pers. comm., July 2019).

***Magnolia pubipetala* (Q.W. Zeng) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209539-1

**Basionym.** *Manglietia pubipetala* Q.W. Zeng. In: Q.W. Zeng et al., *Pakistan J. Bot.* (6): 1917, 1919 + 1918, fig. 1 (2007).

**Chinese name.** 毛瓣木莲 meaning “hairy-tepals manglietia” (this Chinese name is often erroneously applied to *Manglietia rufibarbata* which has glabrous tepals)

**Type.** CHINA. Yunnan Province: Maguan County, Bazhai, evergreen broad-leaved forests, ca. 1500 m, 14 May 2002, *Ren-zhang Zhou 0256* (holotype: IBSC online image!). Yunnan Province: Xichou County, Fadu, Hemawan, evergreen broad-leaved forests, ca. 1600 m, 2 May 1979, *Gao Ting-xiang & Zhu Dai-qing 05* (paratype: IBSC n.v.). Yunnan Province: Kunming Botanical Garden, introduced 1987 from Yunnan Province’s Malipo County, Jingchang, evergreen broad-leaved forests, 1400 m, 3 May 2003, *Zheng Qing-wen 67* (paratype: IBSC!).

holotype (IBSC): <http://www.docin.com/p-1050989203.html> (Sima 2011: 313, photo 2-48).

*Manglietia rufibarbata* Dandy. In: Xia et al. (2008: 60), Sima and Lu (2009: 30) and Sima (2011: 68), each p.p. quoad syn. *Manglietia pubipetala* Q.W. Zeng.

**Note.** *Manglietia pubipetala* Q.W. Zeng is considered as conspecific with *M. rufibarbata* Dandy by the above authors. However, *M. pubipetala* can be sufficiently differentiated from *M. rufibarbata* Dandy to justify its species status, as shown by the comparative morphological features included in Table 6 on the following page (adapted from Table 1, Zeng et al. 2007). *M. pubipetala* is therefore transferred to *Magnolia* consistent with the past reduction of the remaining genera of subfamily Magnolioideae to the genus *Magnolia*.

***Magnolia rubriflora* (Y.W. Law & R.Z. Zhou ex F.G. Wang, Q.W. Zeng, R.Z. Zhou & F.W. Xing) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209540-1

**Basionym.** *Michelia rubriflora* Y.W. Law & R.Z. Zhou ex F.G. Wang et al., *Pakistan J. Bot.* 37(3): 559, fig. 1 (2005).

**Chinese name.** 红花含笑 meaning “red-flowered michelia”

**Type.** CHINA. Hainan: Mount Jianfengling, 500–600 m, 31 October 2001, *Zhou Ren-zhang 0265* (holotype: IBSC n.v.). Guangdong Province: Guangzhou, *Magnolia*

**Table 6.** Differentiating features of species *Manglietia pubipetala* and *M. rufibarbata*.

Plant feature	<i>Manglietia pubipetala</i> Q.W. Zeng	<i>Manglietia rufibarbata</i> Dandy
indumentum of branchlets	brown villose	densely rufous villose
leaf shape	narrowly obovate-elliptic	oblanccolate or oblanccolate-oblong or obovate-oblong
leaf apex	caudate-acuminate	acuminate or subacuminate
leaf base	cuneate	cuneate or obtuse or occasionally rounded
leaf dimensions	13–17.5 × 4.5–6 cm	10–25 × 4–9 cm <sup>†</sup>
leaf indumentum abaxially	glaucous, densely brown villose	rufous pubescent, especially near midrib
leaf texture	papery	thinly leathery
secondary lateral leaf veins	ca. 10–12 pairs	ca. 12–18 pairs
petiole length / indumentum	1.2–1.5 cm, brown villose	up to 3 cm, rufous villose or tomentose
stipules	brown villose, adnate to petiole	stipules externally densely rufous villose, adnate to petiole only lower 1/3
tepal number	9	11 (9–12 <sup>†</sup> )
tepal size (outer 3) and indumentum	3.8–4.0 × 2.5–2.7 cm, pale brown pubescent	ca. 3 × 2 cm <sup>†</sup> , glabrous <sup>‡</sup>
stamen scars length	6–7 mm	ca. 10–12 mm
gynoecium shape	narrowly obovoid-ellipsoid	ovoid-oblong

The differentiating features of *Manglietia pubipetala* are from Zeng et al. (2007) and those of *M. rufibarbata* are from Dandy (1928), supplemented by Liu et al. (2004: 190)<sup>†</sup>, Zeng et al. (2007)<sup>‡</sup>.

Garden of Guangdong Forest Research Institute, 8 October 2001, *Zhou Ren-zhang 0265b* (paratypes: IBSC!; P online image!).

Digital image of paratype specimen below accessed 19 March 2019:

paratype [P: P00852399]: <http://mediaphoto.mnhn.fr/media/1445779250360OrFutLDauT0PI7UU>

*Michelia mediocris* Dandy. In: Xia et al. (2008: 85), p.p. quoad syn. *Michelia rubriflora* Y.W. Law & R.Z. Zhou.

**Note.** While *Michelia rubriflora* is noted as a synonym of *M. mediocris* in Flora of China (Xia et al. 2008), the present authors agree with Wang and co-authors that *Michelia rubriflora* can be more than sufficiently differentiated from *M. mediocris* by the diagnostic features of these two species included in Table 1 of their paper (Wang et al. 2005), to substantiate its species status. A more comprehensive analysis of their differentiating features is compiled in Table 7 below. *Michelia rubriflora* also does not key out with the original validating description for *M. subulifera* (Dandy 1930:212), with which it shares synonymy under *M. mediocris* in Flora of China. Evidently an independent species, *Michelia rubriflora* is transferred in the present paper to the genus *Magnolia* by reason of the past reduction of the remaining genera of subfamily Magnolioideae to that genus.

**Table 7.** Differentiating features of the species *Michelia rubriflora* and *M. mediocris*.

Plant feature	<i>Michelia rubriflora</i> Y.W. Law & R.Z. Zhou	<i>Michelia mediocris</i> Dandy
tree dimensions	to 15 m × 25 cm dbh	35 m × 90 cm dbh <sup>†</sup> (30 m × 190 cm dbh) <sup>‡</sup>
indumentum of buds	greyish-white or pale brown appressed pilose	rufous appressed puberulent <sup>‡</sup>
indumentum of branchlets	greyish-white or pale brown appressed pilose	appressed grey or yellowish-brown tomentose
leaf shape	ovate-elliptic	elliptic or elliptic-oblong
leaf dimensions	5–9 × 2.5–3.5 cm	6–13 × 3–5 cm <sup>§</sup>
leaf indumentum abaxially	greyish-white or pale brown appressed pilose	initially appressed greyish pubescent (greyish-white appressed puberulent) <sup>‡</sup>
leaf texture	leathery	thinly leathery <sup>‡</sup>
lateral leaf veins	9–11 either side of midrib	12–15 either side of midrib
stipular scars	1–2 mm long	none <sup>‡</sup>
petiole length and indumentum	1–2.5 cm, greyish-white or pale brown appressed pilose	1.5–3 cm <sup>§</sup> , initially appressed grey tomentellous, then glabrescent
tepal number /colour	9, red	9–10 <sup>‡</sup> , white <sup>‡</sup>
tepal size and shape	2.5–3.5 × 1.0–1.2 cm, lanceolate	1.8–2.2 × 0.5–0.8 cm, spatulate <sup>§</sup>
stamen length /colour	1.5–1.7 cm, red	1.0–1.5 cm <sup>§</sup> , yellowish-green
gynophore	not exerted above androecium	extended well above androecium (illustration) <sup>‡</sup>
flowering period	October–November	December–January <sup>‡</sup> [China] February–March <sup>‡</sup> [Vietnam]
fruiting period	October–November of the next year	August–September <sup>‡</sup> [China] September–October <sup>‡</sup> [Vietnam] of the same year

The differentiating features of *Michelia rubriflora* are from F.G. Wang et al. (2005) and those of *M. mediocris* are from Dandy (1928a), supplemented by Chen and Nooteboom (1993: 1073)<sup>‡</sup>, Deng and Yang (2015: 142)<sup>‡</sup>, Law et al. (1996: 180)<sup>§</sup>, Liu et al. (2004: 292)<sup>‡</sup>, Sam et al. (2004)<sup>‡</sup>.

***Magnolia rufisyncarpa* (Y.W. Law, R.Z. Zhou & F.G. Wang) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209541-1

**Basionym.** *Manglietia rufisyncarpa* Y.W. Law, R.Z. Zhou & F.G. Wang. In: F.G. Wang et al., *Nordic J. Bot.* 24(5): 519, fig. 1 (2004).

**Chinese name.** 红雌蕊木莲 meaning “red gynoecium manglietia”

**Type.** CHINA. Yunnan Province: Wenshan, Mount Laojun, 1600 m, 12 May 2001, *Zhou Ren-zhang 008* (holotype IBSC!; isotype: IBSC n.v.). Same locality, 1800 m, 26 April 2001, *Zhou Ren-zhang 0134* (paratype: IBSC n.v.). Guangdong Province: South China Botanical Garden, 30 April 1997, *Zhou Ren-zhang 134* (paratypes: IBSC n.v.; P online image!). Digital image of paratype specimen below accessed 15 March 2020:

paratype [P: P00634914]: <http://mediaphoto.mnhn.fr/media/1443127138308WwtO3rNrsfBvSzZP>

*Manglietia insignis* (Wall.) Blume. In: Xia et al. (2008: 56), Sima and Lu (2009: 26) and Sima (2011: 102), each p.p. quoad syn. *Manglietia rufisyncarpa* Y.W. Law et al.

*Magnolia insignis* Wall. In: Khuraijam and Goel (2015: 109), p.p. quoad syn. *Manglietia rufisyncarpa* Y.W. Law, R.Z. Zhou & F.G. Wang.

**Note.** *Manglietia rufisyncarpa* is listed as a synonym of *M. insignis* in Flora of China (Xia et al. 2008), by Sima and Lu (2009) and by Sima (2011). However, the present authors agree with Wang and co-authors that *M. rufisyncarpa* can be more than sufficiently differentiated from *M. insignis* (Wall.) Bl. by the diagnostic characters of these two species compiled by Wang et al. (2004: Table 1), to substantiate its independent species status. Additionally, *M. rufisyncarpa* flowers from April–May whereas *M. insignis* flowers from May–June (Liu et al. 2004: 156). Also, among the many *Manglietia* photos in Magnolias of China, the bright red gynoecium of this species, alluded to in its Chinese name, is particularly noticeable as one of only a few exhibiting this colour, with *M. insignis* displaying a green gynoecium. *Manglietia rufisyncarpa* also does not key out with the original validating descriptions for *M. maguanica* Chang & B.L. Chen, *M. yunnanensis* Hu or *Magnolia shangpaensis* Hu, with which it shares synonymy under *Manglietia insignis* in Flora of China. In view of the above, *M. rufisyncarpa* is transferred in the present paper to *Magnolia*, consistent with the past reduction of the remaining genera of subfamily Magnolioideae to the genus *Magnolia*.

***Magnolia septipetala* (Z.L. Nong) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209542-1

**Basionym.** *Michelia septipetala* Z.L. Nong. In: *Guihaia* 13(3): 220–221, fig. 1 (1993).

**Chinese name.** 七瓣含笑 meaning “seven-petals (tepals) michelia” (the tepals in fact are recorded as 7–9)

**Type.** CHINA. Jiangxi Province: Xinfeng County, Jinpen Shan, in woods, 21 May 1986, *Nong Zhi-lin* 086067 (holotype: IBK, fl. white n.v.). Other specimens recorded: Same locality? *Nong Z.L.* 086167. Jiangxi Province: Shangyou County, Wuzhifeng, Guangu Shan, 670 m, 23 November 1976, *Nong Z.L.* 760347 (JXAU online images!). Digital images of specimen 760347 with collector noted as Shi Xinghua, accessed 19 March 2019:

[JXAU: 0001182]: <http://www.cvh.ac.cn/spm/JXAU/JXAU0001182>

[JXAU: 0001183]: <http://www.cvh.ac.cn/spm/JXAU/JXAU0001183>

[JXAU: 0001184]: <http://www.cvh.ac.cn/spm/JXAU/JXAU0001184>

*Michelia fujianensis* Q.F. Zheng. In: Xia and Deng (2002: 130) and Xia et al. (2008: 83), both p.p. quoad syn. *Michelia septipetala* Z.L. Nong.

*Michelia caloptila* Y.W. Law & Y.F. Wu. In: Sima (2011: 234), p.p. quoad syn. *Michelia septipetala* Z.L. Nong.

**Note.** The holotype specimen of *Michelia septipetala* cannot be found at IBK (Xu Wei-bin, pers. comm., July 2019). However, *M. septipetala* can be easily differentiated from both *M. fujianensis* and *M. caloptila*, the 2 species under which it is noted in synonymy above, by the comparison of their morphological and phenological characteristics summarised in Table 8 below.

**Table 8.** Differentiating features of *Michelia septipetala*, *M. fujianensis* and *M. caloptila*.

Plant feature	<i>Michelia septipetala</i> Z.L. Nong	<i>Michelia fujianensis</i> Q.F. Zheng	<i>Michelia caloptila</i> Y.W. Law & Y.F. Wu
maximum height	28 m (30 m <sup>†</sup> )	to 16 m <sup>§</sup>	ca. 15 m <sup>‡</sup>
bark colour	greyish-white	greyish-brown	grey
indumentum of buds	densely ferrugineous-tomentose	densely cinnamon-coloured tomentose	brown tomentose
indumentum of branchlets	densely ferrugineous-tomentose	densely cinnamon-coloured tomentose	brown tomentose
leaf shape	oblong-elliptic	oblong or narrowly obovate-elliptic	narrowly elliptic or elliptic
leaf dimensions	8–16 × 2.8–5.5 cm	6–11 × 2.5–4 cm	9–16 × 2.5–5 cm
leaf apex / base	short acuminate / broadly cuneate	acute / rounded	acuminate or caudate-acuminate / cuneate
leaf indumentum adaxially	almost glabrous	densely short-tomentose at midrib	glabrous
leaf indumentum abaxially	ferrugineous-pubescent, denser at midrib	densely ferrugineous or brownish-yellow appressed sericeous	minutely brown tomentose
lateral leaf veins	11–13 pairs	8–9 pairs	7–12 pairs
petiole length / indumentum	5–7 mm, densely ferrugineous pubescent	10–15 mm, densely cinnamon tomentose	5–10 mm, brown tomentose
peduncle indumentum	densely ferrugineous-tomentose	densely cinnamon-coloured tomentose	not known
tepals number and shape	7–9: external 3 tepals obovate, internal tepals narrowly obovate	15–16: spatulate-oblong (12–17, outer 3 tepals narrowly obovate, inner tepals obovate, or narrowly ovate <sup>§</sup> )	6–9: obovate-oblong <sup>#</sup>
stamen number and length	ca. 20, 10–15 mm	number not known, 4–5.5 mm	ca. 35 (photo <sup>‡</sup> ), length not known
filament length	4–5 mm	1–1.5 mm	not known
gynoecium length	narrowly cylindric, ca. 20 mm	cylindric, ca. 5 mm	not known
gynophore length	ca. 8 mm	ca. 1 mm	not known
immature carpels	ca. 20, densely yellow-brown sericeous, with 2–3 ovules each carpel	pubescent, most aborted	not known
gynophore in fruit	yellow-brown tomentose, 18–25 mm long	pilose, 2–2.5 mm long	ca. 20 mm long
fruit aggregates	7–13 cm long	2–3 cm	4–10 cm long
mature carpels	sessile, oblong or rounded, 1–1.8 × 0.9–1.3 cm with 1–3 seeds	obovoid, 1.5–2 cm × ca. 1.2 cm with 1 seed	broadly ovate or suborbicular, 1–1.8 cm long with 1–4 seeds.
flowering period	May (–June?)	January–February <sup>‡</sup> December–January <sup>§</sup>	not known
fruiting period	November	October–November <sup>§</sup>	September <sup>‡</sup>

The differentiating features of *Michelia septipetala* are cited from Nong (1993) and Liao and Guo (2010)<sup>†</sup>; those of *Michelia fujianensis* from Zheng (1981)<sup>‡</sup>, supplemented by Liu et al. (2004: 260)<sup>§</sup>, with those of *Michelia caloptila* from Law and Wu (1984) and Liu et al. (2004: 228)<sup>‡</sup>, who each note the flowers as then unknown, plus Yang et al. (2016: 237)<sup>#</sup>.

***Magnolia sinoconifera* (F.N. Wei) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209543-1

**Basionym.** *Manglietia sinoconifera* F.N. Wei. In: *Guihaia* 13(1): 5, fig. *s.n.* (1993).**Chinese name.** 那坡木莲 meaning “Napo manglietia”**Type.** CHINA. Guangxi Zhuang Autonomous Region: Guilin Botanical Garden (cultivated; introduced from Napo County, W Guangxi), 3 June 1991, *Wei Fa-nan 1910* (holotype: IBK n.v.).*Manglietia dandyi* (Gagnep.) Dandy. In: Xia et al. (2008: 54), p.p. quoad syn. ?*Manglietia sinoconifera* F.N. Wei.**Note 1.** The holotype specimen of *Manglietia sinoconifera* cannot be found at IBK (Xu Wei-bin, pers. comm., July 2019).**Note 2.** Some of the features distinguishing *Manglietia sinoconifera* from *M. dandyi*, under which it is questionably placed as conspecific in Flora of China due to uncertainty over its status (because the holotype could not be sighted), are listed in Table 9 below. *M. sinoconifera* (to 10 m) also does not key out with the description for the large-leaved *M. megaphylla* Hu & W.C. Cheng (1951), a tree to 40m (Liu et al 2004), with which it shares synonymy under *M. dandyi* in Flora of China. *Manglietia sinoconifera* is recognised as a genuine species in Yang et al. (2016: 213–214), wherein its introduction to Guilin Botanical Garden from Napo County is recorded as 1973 (18 years earlier than stated in the protologue).**Table 9.** Differentiating features of the species *Manglietia sinoconifera* and *M. dandyi*.

Plant feature	<i>Manglietia sinoconifera</i> F.N. Wei	<i>Manglietia dandyi</i> (Gagnep.) Dandy
life form	ca. 10 m	to 15 m <sup>†</sup>
indumentum of branchlets	densely light reddish-brown	initially soft red pilose, finally ash-grey and almost glabrous
leaf shape	oblanceolate	ovate or broadly lanceolate
leaf dimensions	15–24 × 5.5–8 cm	16–17 × 7–8 cm (16–24 × 5–8.5 cm <sup>‡</sup> )
leaf apex	cuspidate	short acuminate
leaf base	cuneate	obtuse
leaf indumentum abaxially	appressed brown pubescent	red pilose
petiole length and indumentum	2.2–3 cm, appressed brown pubescent	3 cm (1.2–2.3 cm <sup>‡</sup> ), red pilose
lateral leaf vein pairs	14–19	8–13 <sup>‡</sup>
tepala number and shape	11: outer 3 oblong, inner 8 generally obovate and spatulate	9–11: outer 3 obovate-oblong <sup>‡</sup> , intermediate obovate, innermost oblanceolate
tepala dimensions and indumentum (outer 3)	6.5 × 3.5 cm, glabrous	2–2.2 × 1.5–1.7 cm, pubescent externally at base <sup>‡</sup>
stamen length	10–13 mm	5.5–7 mm <sup>‡</sup>
gynoecium length	ca. 25 mm	10–13 mm <sup>‡</sup>
ovules in each carpel	12	2–10 <sup>‡</sup>
flowering period	May <sup>†</sup>	April <sup>‡</sup>

The distinguishing features of *Manglietia sinoconifera* are cited from Wei (1993) supplemented by Yang et al. (2016: 214)<sup>†</sup> and those of *M. dandyi* from Gagnepain (1939 as *Magnolia dandyi*) supplemented by Chen and Nooteboom (1993: 1037)<sup>‡</sup>.

***Magnolia sonlaensis* (Q.N. Vu) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209544-1

**Basionym.** *Michelia sonlaensis* Q.N. Vu. In: Q.N. Vu et al., *Nordic J. Bot.* 37(9): 2–3, figs. 1,2 (2019).

**Vietnamese name:** Giỏi sơn la, meaning “Son La michelia”

**Type.** VIETNAM. Son La Province: Yen Chau District, Muong Lum Municipality, Lum village, degraded secondary vegetation, 2270 m, 104°28'44.25"E, 21°00'56.53"N, 1 May 2018, *Nam 152018.2* (holotype: VNF!). Same locality, 2275 m, 104°29'30"E, 21°00'47"N, 2 March 2001, *D.K. Harder et al. 7092* (paratypes: HN!, MO n.v.). Same locality, 2270 m, 104°28'44"E, 21°00'56"N, 19 May 2017, *Nam 1952017* (paratype: VNF n.v.). Same locality, 2272 m, 104°28'44.30"E, 21°00'60"N, 13 April 2019, *Nam 1342019* (paratype: VNF n.v.). Same region, 915 m, 104°28'?"E, 21°00'59"N, 29 December 2010, *Nam 291210.5*; *Nam 291210.6*; *Nam 291210.7* (paratypes: VNF n.v.).

***Magnolia urceolata* (D.L. Fu, B.H. Xiong & X. Chen) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209546-1

**Basionym.** *Yulania urceolata* D.L. Fu, B.H. Xiong & X. Chen. In: D.L. Fu et al., *Amer. J. Agric. and Forest.* 7(5): 219–220, fig. 4 (2019b).

**Chinese name.** 宽瓣玉兰 meaning “wide-capsuled yulan”

**Type.** CHINA. Lectotype: Liu Yuhu in Zheng W.J. (Ed) *Flora of Trees of China* 1: 459; fig. 139 (1983). Guizhou Province: Weining County, 2300 m, 30 September 2017, *D.L. Fu 2017093001* (paratype: CAF, fr. n.v.). *D.L. Fu 2009052401* (paratype: CAF, young fr.). Henan Province: Zhengzhou City (cultivated), *D.L. Fu 2012032001* (paratype: CAF, fl. n.v.).

**Note.** The type specimens of *Yulania urceolata* cannot be located at the Beijing herbarium of CAF (Wang Hongbin, pers. comm., March 2020).

***Magnolia xinningia* (Y.W. Law & R.Z. Zhou ex Q.X. Ma, Q.W. Zeng, R.Z. Zhou & F.W. Xing) C.B. Callaghan & S.K. Png, comb. nov.**

urn:lsid:ipni.org:names:77209547-1

**Basionym.** *Michelia xinningia* Y.W. Law & R.Z. Zhou ex Q.X. Ma et al., *Pakistan J. Bot.* 37(1): 37, fig. 1 (2005).

**Chinese name.** 新宁含笑 meaning “Xinning michelia”

**Type.** CHINA. Hunan Province: Xinning County, Ziyunshan, in evergreen broad-leaved forests, 1500 m, 20 September 1992, *R.Z. Zhou 197* (holotype: IBSC n.v.; isotype: IBSC n.v.).

*Michelia cavalieriei* Finet & Gagnep. var. *cavalieriei*. In: Xia et al. (2008: 84), p.p. quoad syn. *Michelia xinningia* Y.W. Law & R.Z. Zhou.

*Michelia foveolata* Merr. ex Dandy. In: Sima & Lu (2009: 55) and Sima (2011: 216), both p.p. quoad syn. *Michelia xinningia* Y.W. Law & R.Z. Zhou.

**Note 1.** Digital images of *R.Z. Zhou* 197 and 0197 were received from IBSC in 2019, but with the collection dates in April 1988 and April 1996 (Ziyunshan, 800 m) respectively, so probably represent paratypes not mentioned in the 2005 protologue.

**Note 2.** In Flora of China (Xia et al. 2008), the 9-tepalled *Michelia xinningia* from Hunan, with a published height by the naming authors of 20 m, appears incongruously as a synonym of the ca. 12-tepalled *M. cavalieriei* var. *cavalieriei* with a height to 10 m (Liu et al. 2004: 229; Xia et al. 2008: 8; Deng and Yang 2015: 148). This would indicate that this remains about the maximum height of *M. cavalieriei* since being described as a small tree of 4–7 metres more than a century earlier (Finet and Gagnepain 1906: 573), based on a collection from Guizhou ca. 400 km distance from the type locality of *Michelia xinningia* in Hunan. This discrepancy in their heights indicates that *M. xinningia* was evidently meant to appear in Flora of China as a synonym of the

**Table 10.** Differentiating features of the species *Michelia xinningia* and *M. foveolata*.

Plant feature	<i>Michelia xinningia</i> Y.W. Law & R.Z. Zhou	<i>Michelia foveolata</i> Merr. ex Dandy
maximum height	20 m	30+ m
bark colour	greyish-brown	pale grey or dark grey <sup>#</sup>
indumentum of buds	golden villose	densely rufous tomentellous <sup>#</sup>
indumentum of branchlets	golden villose	densely rufous tomentellous <sup>#</sup>
leaf shape	narrowly elliptic	oblong-elliptic, elliptic ovate or broadly lanceolate <sup>#</sup>
leaf dimensions	12–18 × 4.5–5.5 cm	17–23 × 6–11 cm <sup>#</sup>
leaf texture	Leathery	thickly leathery <sup>#</sup>
lateral leaf veins	8–9 pairs	16–20 pairs (16–26 pairs <sup>§</sup> )
leaf abaxially	golden villose with brown pilose midrib	densely coppery-red tomentellous <sup>#</sup>
petiole length and indumentum	1–1.5 cm (1.5–2 cm <sup>†</sup> ), golden villose	1.5–4 cm <sup>††</sup> , silky brown pubescent <sup>‡</sup>
tepala number, colour, with shape and size of outer 3	9, white, obovate, 4–5 × ca. 2 cm (7–9 tepals in photo Xing et al. 2009: 213)	9–12, pale yellow with purplish base, broadly ovate, 6–7 cm long <sup>#</sup>
staminal complex length	ca. 15 mm	ca. 22–25 mm <sup>‡</sup>
stamen number	30–35	ca. 50 <sup>§</sup>
filament colour	Red	dark purple <sup>#</sup>
anther length	ca. 0.8 cm	1.5–2 cm <sup>§</sup>
gynoecium length	ca. 1.6 cm	2–3 cm <sup>§</sup>
gynophore length	15–20 mm	12–15 mm <sup>‡</sup>
flowering period	April–May	March–May <sup>#</sup>
elevation and distribution	900–1500 m, Xinning, Hunan <sup>#</sup>	500–1800 m, Guangdong, S Guangxi, SE Guizhou, W Hubei, S Hunan, Jiangxi, SE Yunnan <sup>#</sup>

Footnote: The distinguishing features of *Michelia xinningia* are cited from Ma et al. (2005) and Yang et al. (2016)<sup>†</sup>, with those of *M. foveolata* from Dandy (1928b), supplemented by Chen and Nooteboom (1993: 1066)<sup>‡</sup>, Law et al. (1996: 181)<sup>§</sup>, Lee (1935: 485)<sup>‡</sup>, Liu et al. (2004: 256)<sup>#</sup> and Yang et al. (2016: 272)<sup>††</sup>.

then new combination *M. cavaleriei* var. *platypetala* (Hand.-Mazz.) N.H. Xia of the same height. However, the present authors agree with the abstract and Latin diagnosis of the authors of *M. xinningia* which indicate it to be sufficiently distinguished from *M. cavaleriei* var. *platypetala* (Ma et al. 2005: Table 1), to warrant species status, as has been recognised in Xing et al. (2009: 212) and Yang et al. (2016: 331). Also, *Michelia xinningia* can easily be differentiated from *M. foveolata*, under which it is made a synonym by Sima and Lu (2009) and included as such in Sima (2011: 216), by the comparative features compiled in Table 10.

**Note 3.** Bearing in mind the above discussion and comparative features, *Michelia xinningia* is an obviously distinct species. Therefore it is here transferred to *Magnolia* due to the past reduction of the previous segregate genera of subfamily Magnolioideae to the genus *Magnolia*.

**Note 4.** A search of the literature has found that *Michelia xinningia* is in cultivation at 4 Chinese botanical gardens, each in which *M. platypetala* and *M. foveolata* are also cultivated (Callaghan and Png 2019b).

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## Appendix I

List of the acronyms of institutional herbaria appearing in this paper.

- A** Arnold Arboretum Herbarium (of Harvard University Herbaria), Cambridge, Massachusetts, USA
- BJFC** Forestry Herbarium, Beijing Forestry University, Xiaozhuang, Beijing, China
- CAF** Dendrological Herbarium, Chinese Academy of Forestry, Haidian, Beijing, China
- HEAC** Henan Agricultural University Herbarium, Zhengzhou, Henan, China
- HFBG** Herbarium, Forestry Botanical Garden of Heilongjiang, Dongliqu, Harbin, Heilongjiang, China
- HFTC** Herbarium, Hunan Forestry Technical College, Hengyang, Hunan, China
- HN** Herbarium, Vietnam Academy of Science and Technology, Hanoi, Vietnam
- IBK** Herbarium, Guangxi Institute of Botany, Yanshan, Guilin, Guangxi, China
- IBSC** Department of Taxonomy Herbarium, South China Institute of Botany, (SCBI) Chinese Academy of Sciences, Wushan, Guangzhou, Guangdong, China
- JXAU** Dendrological Herbarium, Department of Forestry, Jiangxi Agricultural University, Meiling, Nanchang, Jiangxi, China
- K** Royal Botanic Gardens Herbarium, Kew, Surrey, London, UK

<b>L</b>	Leiden University Branch (Rijksherbarium), National Herbarium of the Netherlands, Leiden, the Netherlands
<b>LBG</b>	Herbarium, Lushan Botanical Garden, Lushan, Jiangxi, China
<b>MO</b>	Herbarium, Missouri Botanical Garden, St. Louis, Missouri, USA
<b>P</b>	Herbarium National de Paris, Muséum National d'Histoire Naturelle, Paris, France
<b>PE</b>	Laboratory of Systematic and Evolutionary Botany Herbarium, Institute of Botany, Chinese Academy of Sciences, Xiang Shan, Beijing, China
<b>SIF</b>	Dendrological Herbarium, Forestry School of Sichuan, Dujiangyan, Sichuan, China
<b>SYS</b>	Biology Department, Botanical Division Herbarium, Zhongshan University (Sun Yat-sen University), Guangzhou, Guangdong, China
<b>VNF</b>	Vietnam Forestry Herbarium, Hanoi, Vietnam
<b>W</b>	Herbarium, Natural History Museum, Wien, Austria
<b>WU</b>	Herbarium, Institute of Botany, University of Vienna, Austria
<b>ZJFC</b>	Dendrological Herbarium, Department of Forestry, Zhejiang Forestry University, Linan, Zhejiang, China

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# A new species and a new record of *Liparis* sect. *Decumbentes* (Malaxidinae, Orchidaceae) from Peru

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## Abstract

A new species of *Liparis* sect. *Decumbentes*, *Liparis sessilis* Damián, Salazar & Rimarachín, **sp. nov.** is described and illustrated from Amazonas (Perú), including color photographs, a detailed comparison and an identification key to all the species of *Liparis* sect. *Decumbentes*. In addition, we report *Liparis brachystalix* Rchb.f. for the first time for the orchid flora of Peru, and select a lectotype for its synonym, *L. commelinoides* Schltr.

## Resumen

Una nueva especie de *Liparis* sect. *Decumbentes*, *Liparis sessilis* Damián, Salazar & Rimarachín, **sp. nov.** se describe e ilustra de Amazonas (Perú), incluyendo fotografías a color, una comparación detallada y una clave de identificación de todas las especies de *Liparis* sect. *Decumbentes*. Además, reportamos *Liparis brachystalix* Rchb.f. por primera vez para la orquíflora del Perú, y seleccionamos un lectotipo para uno de sus sinónimos, *L. commelinoides* Schltr.

## Keywords

Andes, Amazonas, *Liparis brachystalix*, *Liparis sessilis*, neotropics

## Palabras clave

Andes, Amazonas, *Liparis brachystalix*, *Liparis sessilis*, neotropico

## Introduction

The genus *Liparis* Rich., in the traditional sense, is cosmopolitan and includes over 300 species (Cribb 2005). Although most authors have followed this broad concept (e.g. Ridley 1886; Schlechter 1921, Schweinfurth 1959; Bennett and Christenson 1993, 1995; Brako and Zarucchi 1993; Garay and Romero-González 1999; Ormerod 2012, 2016; Damián and Ormerod 2016), a molecular phylogenetic study by Cameron (2005) showed that thus delimited *Liparis* is grossly polyphyletic, and both its generic and infrageneric classification are pending revision.

The most recent proposal of a sectional classification of *Liparis* by Garay and Romero-González (1999) recognized 19 sections, but their monophyly has not been assessed. One of the sections proposed by Garay and Romero-González (1999), sect. *Decumbentes*, consisted of 4 South American species and was typified with *Liparis brachystalix*. This species was originally described from a plant collected in the surroundings of Quito (Reichenbach 1876) and was illustrated by a painting from a Colombian plant by Manuel Antonio Cortes (Mutis 1969: pl. 575; Fernandez 1992) executed during the Royal Botanical Expedition to the New Kingdom of Granada led by Jose Celestino Mutis. Cortes painted the plant more than 40 years before W. Jameson collected it in Ecuador but the results of the expedition remained unpublished until the 20<sup>th</sup> century. Members of sect. *Decumbentes* are characterized by their decumbent or prorept stems provided with secund or alternate leaves, and according to Garay and Romero González (1999) have an elongated column typical for the genus. However, most of the representatives included in this group (Table 1) have a short, straight column similar to that seen in *Crossoglossa* Dressler & Dodson (this last genus was treated by Garay and Romero-González as *Liparis* sect. *Tipuloidea*). *Liparis crispifolia* Rchb. f. is an exception, having a slender, arcuate column.

In Peru, sect. *Decumbentes* is represented by 3 species: *Liparis brachystalix*, *L. laticuneata* C. Schweinf. and a new species, in the following referred to as *L. sessilis* Damián, Salazar & Rimarachín. These are mostly restricted to the eastern slopes of the Andean Cordillera in the departments of Amazonas, Cusco, Pasco and Huancavelica where they grow as terrestrial (rarely epiphytic) plants between 2000–3000 m a.s.l. *Liparis crispifolia* has been cited for Peru by several authors, all of them following the dubious record of Schlechter (1921), who indicated “Cajamarca (?)” [sic]. Schweinfurth (1959) explicitly stated “*fide* Schlechter” in attributing this species to Peru, and subsequent works appear to have simply followed him (Brako and Zarucchi 1993; Zelenko and Bermúdez 2009; Goicochea et al. 2019). However, this taxon is endemic to the surroundings of Quito (Ecuador), where the type came from according to Reichenbach’s protologue, and recently re-collected in the same region (Dodson 1989; Dodson 2002; both reports misidentified as *L. nigrescens*).

During a field exploration conducted in the Private Conservation Area of the Berlin Forest (PCA BF), a protected area located in the northeast part of Peru, we collected

**Table 1.** Features distinguishing the species of *Liparis* sect. *Decumbentes*.

Character	<i>L. brachystalix</i>	<i>L. crispifolia</i>	<i>L. laticuneata</i>	<i>L. sessilis</i>
Leaf size (cm)	1.6–3.7×0.9–2.2	5–6×3.7–4	2–5.5×2–3	2.5–3.5×1–1.5
Leaf veins	5–11	up to 11	up to 11	3–7
Petiole length (cm)	1.3–2.5	1.8–3	2–2.5	petiole absent
Flower color	Green with darker band along the center of the labellum	Greenish sepals and petals, labellum reddish purple	Green with darker band along the center of the labellum	Green with darker band along the center of the labellum
Sepal size (mm)	6–8×2	6–14×2	6×2	6–8×1–2
Petal size (mm)	6–9×1	5–14×6	6–7×2	5–7×1
Labellum size (mm)	7–8×3–7	16–40×10–36	7–8×10–13	10–12×4–5
Labellum shape	Obovate-oblong to pandurate	Oval to rhombic	Flabellate-cuneate	Ovate-elliptic
Labellum base	Strongly cordate to sagittate	Truncate	Shortly cuneate-truncate	Truncate,
Labellum callus	2–3 thickened veins	Base contracted to form a callus-like	V-shaped with an elliptic fovea	Squarish fovea above the base
Column length (mm)	2	4	1	2
Column shape	Straight or essentially so, stout	Arcuate, slender	Straight, stout	Straight, stout

a long epiphyte individual of *Liparis* sharing the distinctive vegetative features of sect. *Decumbentes*. After an extensive review of literature and herbaria we concluded that this specimen did not match any *Liparis* species described to date, and here we propose it as new. In the following, we provide a detailed description, a line illustration, color photographs and brief notes about the ecology of this specimen, and we compare it with other members of sect. *Decumbentes*.

## Materials and methods

A live flowering plant of the new species was collected on March 9, 2016 while conducting a floristic study in Bosque Berlin (Amazonas). The species was photographed *in situ* and also from ethanol preserved floral material using a Nikon D810 camera with Nikkor 60 mm lens. Herbarium specimen were prepared to be used as type material, and deposited at UFV and HUT (Acronyms following Thiers 2019). Descriptions and measurements were carried out under an Euromex SB-1903 and an AmScope SM-3TZ-54S-10M stereomicroscopes. The line illustration of the new species was prepared from alcohol-preserved material and digital photos. A total of 31 exsiccates of other members of *Liparis* sect. *Decumbentes* were compared for this work from the following herbaria: USM, MOL, HOXA, AMAZ, HUPCH, HSP, F, MO, HNOP, MEXU, QCE, QCNE and NY. We conducted a careful comparison of the new species with the protologues and type material of all species belonging to *Liparis* sect. *decumbentes*, as well as regional floras and checklists such as Schweinfurth (1959), Brako and Zarucchi (1993) and Ulloa Ulloa et al. (2004, 2017).

## Taxonomic treatment

### *Liparis sessilis* Damián, Salazar & Rimarachín, sp. nov.

urn:lsid:ipni.org:names:77209563-1

Figs 1A, E, 2

**Type.** PERU. Amazonas; Bagua Grande, Bosque Berlín–“plot Higueron”, UTM 17 M 0786059, 9346365, 2300 m a.s.l. March 9, 2016, *L. Rimarachín LR 517* (holotype: UFV, isotype: HUT).

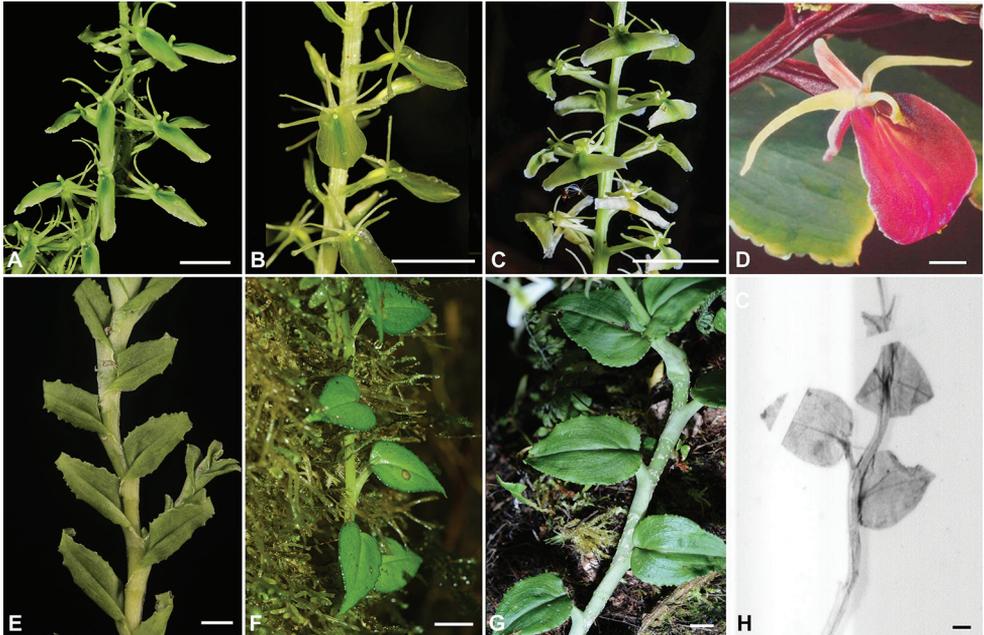
Similar to *Liparis brachystalix* Rchb.f. but differing in having sessile leaves (vs. distinctly petiolate) and ovate-elliptic labellum with truncate base (vs. obovate-oblong to pandurate labellum with cordate to sagittate base).

**Description.** Terrestrial or epiphyte, long-creeping herb. **Stem** elongate, decumbent, laterally compressed, green, 2 mm in diameter, up to 35 cm. **Leaves** distichous, sessile, ovate, acute, with a narrow base clasping the stem, the margins undulate, 3-veined, 2.5–3.5 cm long and 1–1.5 cm wide. **Inflorescence** terminal, erect, racemose, producing many (up to 20) flowers in succession, peduncle terete in cross-section, provided with conspicuous glandular trichomes up to 6 mm long. **Floral bracts** pale greenish, narrowly triangular, margins undulate, 7–8 mm long and 2 mm wide. Ovary terete, with longitudinal keels, pale greenish, to 8 mm long including the pedicel. **Flowers** resupinate, widely spreading, sepals, petals and column pale greenish, labellum green, darker towards the center on the basal one-third. **Dorsal sepal** lanceolate, apex convex, broadly triangular, obtuse, margins revolute, 1-veined, 6–7.5 mm long and 1–1.5 mm wide. **Lateral sepals** lanceolate, slightly oblique, broadly rounded, margins revolute, 1-veined, 8 mm long, 2 mm wide. **Petals** linear, truncate with a rounded mucro, margins irregular, revolute, 1-veined, 7.5 mm long, 1 mm wide. **Labellum** ovate-elliptic, apex obtuse, upper lateral margins irregularly erose, 11-veined, 10–12 mm long, 4–5 mm wide, ecallose, with a squarish fovea above the base, medially with two low ridges converging up to three-quarters of the lamina. **Column** short, stout, 1.7 mm long; **anther** cucullate, 2-celled. **Pollinia** 2, obovate. **Fruit** unknown.

**Etymology.** The specific epithet refers to the distinctive sessile leaves of the species.

**Distribution and ecology.** This species inhabits the cloud forests around the river Utcubamba in the province of the same name in the district of Bagua Grande. This area is known as “El Higuero” and is legally administered by the Rafael Cotrina family. This family, together with that of the third author, are conducting research and conservation programs about the yellow-tailed woolly monkey *Lagothrix flavicauda* Humboldt and its habitat in the PCA BF. Flowers have been recorded in March and April.

*Liparis sessilis* inhabits the understory rich in mosses, rocks and old stems of *Anthurium* Schott and *Psychotria* L. species. Also, this species has been using *Palicourea* shrubs as its phorophyte and can reach up to 2 m above ground. The roots of *Liparis sessilis* are poorly developed and the stems turn white or brownish as the younger parts of the plant grow. According to recent observations (Rimarachín pers. obs.), the population of this species is small. Indeed, it has only been found in a degraded area and in



**Figure 1.** Flowers (A–D) and portions of stem with leaves (E–H) of the species of *Liparis* sect. *Decumbentes* **A, E** *Liparis sessilis* **B, F** *Liparis brachystalix* **C, G** *Liparis laticuneata* **D, H** *Liparis crispifolia*. Photographs: **A** L. Rimarachín, **B** L. Egoavil, **C, E, G** A. Damián, **D** A. Hirtz, **F, G** Salazar. **H** E. Santiago. Scale bar: 1 cm.

two other zones of primary forest. The species has been propagated from cuttings and is currently being grown in the PCA BF.

**Comments.** Among the four species belonging to *Liparis* sect. *Decumbentes*, *L. sessilis* is most similar to *L. brachystalix*, which differs in having petiolate leaves and different labellum morphology. *Liparis sessilis* is easily distinguished from other members of its section by the features indicated in the key and in Table 1.

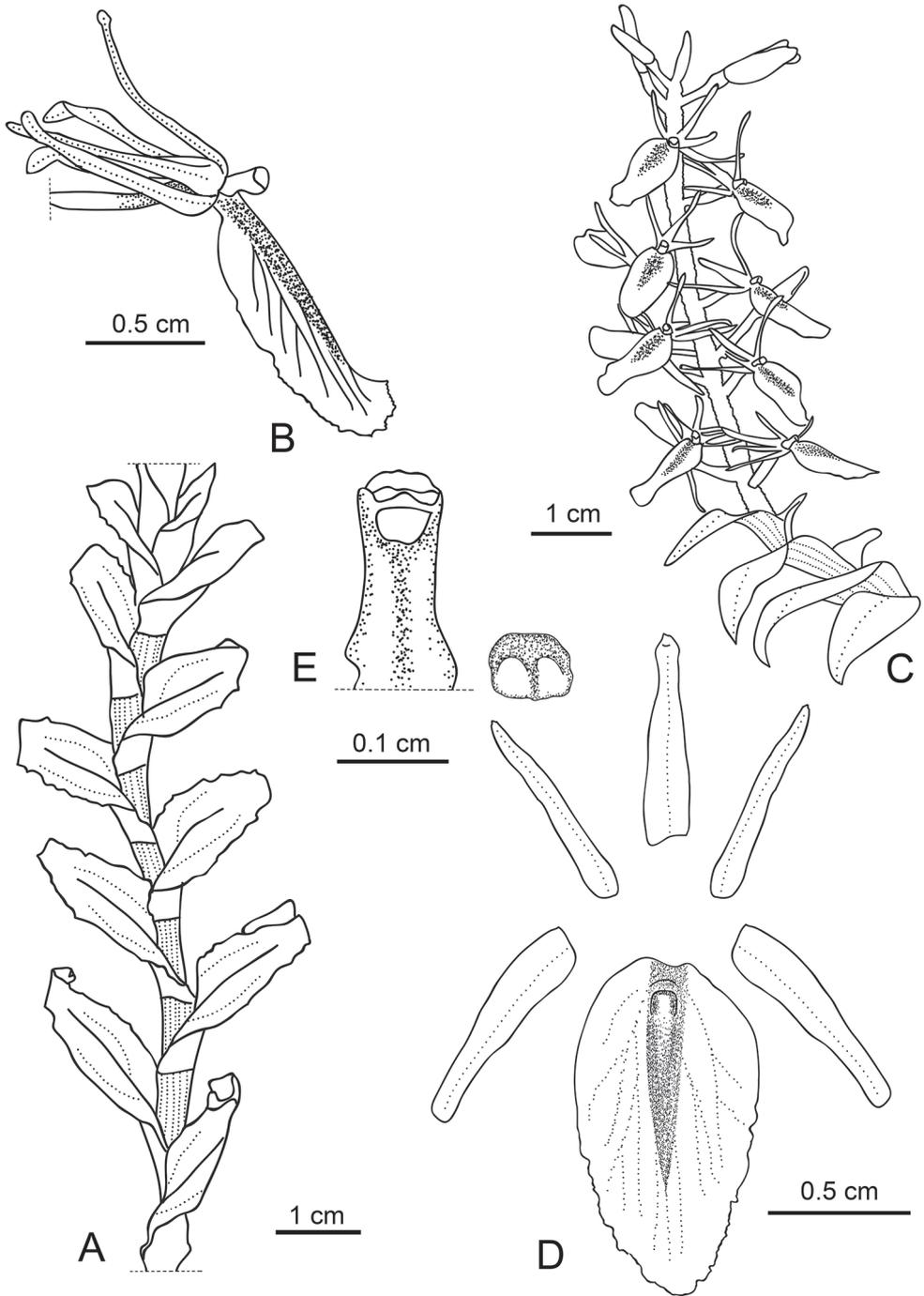
### *Liparis brachystalix* Rchb.f., *Linnaea*

*Liparis brachystalix* Rchb.f., *Linnaea* 41: 43 (1876). Type: Ecuador, Pichincha, *Jameson*, *W. s.n.* (holotype US [drawing AMES!], isotypes AMES, GH, P (as *Jameson* 448).

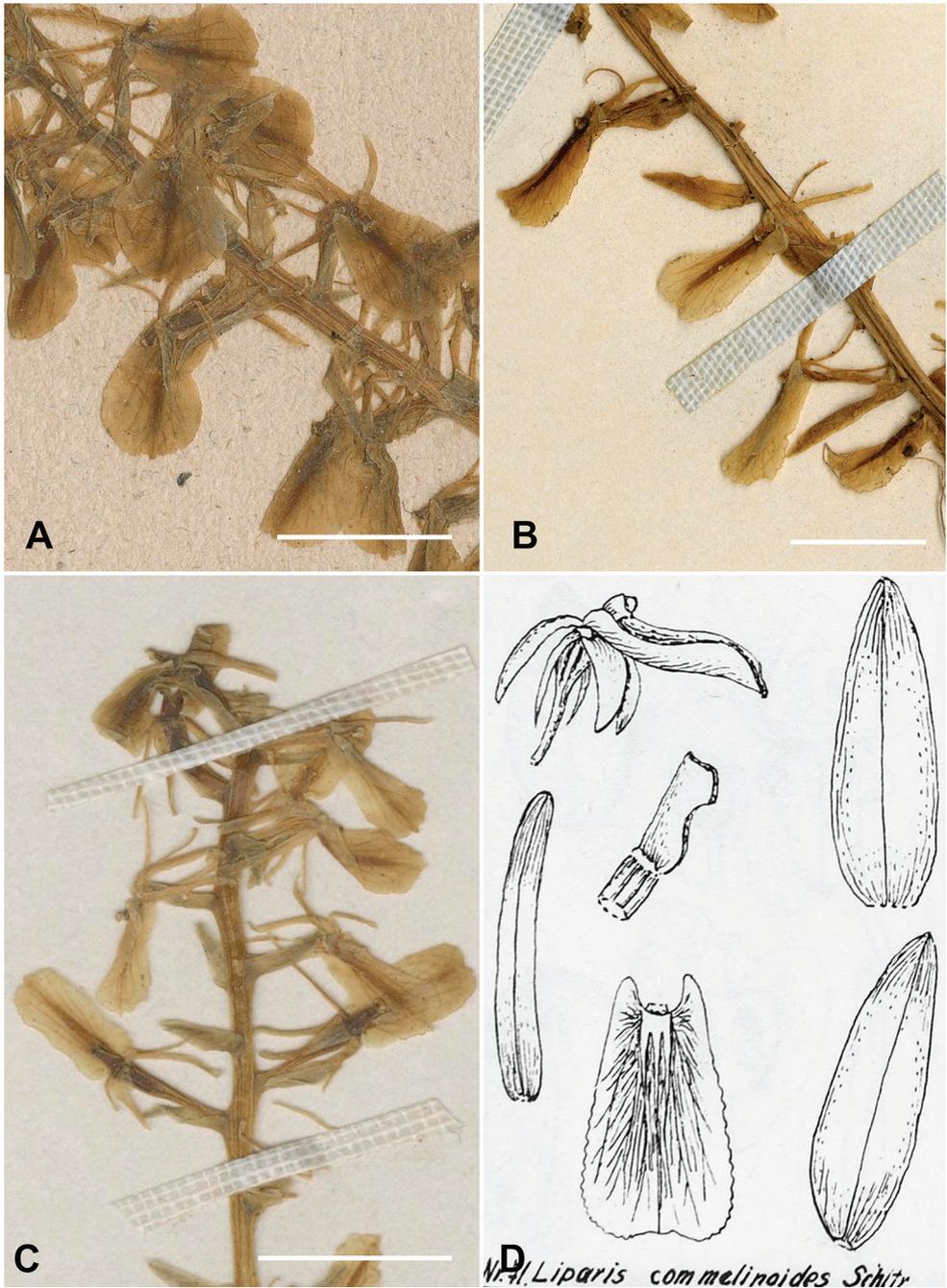
*Leptorkis brachystalix* (Rchb.f.) Kuntze, *Revis. Gen. Pl.* 2: 671 (1891).

*Liparis pothoides* F.Lehm. & Kraenzl., *Bot. Jahrb. Syst.* 26: 478 (1899). Type: Colombia, Paramo de Guanacas, Central Andes of Popayan, *F. C. Lehmann* 8094 (holotype K-photo, isotype AMES-photo).

*Liparis commelinoides* Schltr., *Repert. Spec. Nov. Regni Veg.* 14: 119 (1915). Type: Ecuador, Pichincha, *L. Sodiro* 137 (holotype B, destroyed; Lectotype selected here: drawing of the holotype published by Mansfeld, 1930: no. 71. Fig. 3D).



**Figure 2.** *Liparis sessilis* Damián, Salazar & Rimarachín **A** habit **B** lateral view of flower **C** inflorescence, **D** dissected perianth **E** column in ventral view with anther. Drawn by Alexander Damián from the type *L. Rimarachin* LR517.



**Figure 3.** **A** holotype of *Liparis brachystalix* (W. Jameson 448, P) **B** holotype of *Liparis pothoides* (F. C. Hellmann 8094, AMES) **C** holotype of *Liparis fendleri* (Fendler 1422, PH) **D** Schlechter's sketch of a flower from the holotype of *Liparis commelinoides*, published by Mansfeld (1930). Scale bar: 1 cm.

*Liparis fendleri* Schltr. Repert. Spec. Nov. Regni Veg. Beih. 6: 32 (1919). Type: Venezuela, Prope Colonia Tovar, *A. Fendler 1422* (holotype AMES-photo!, isotypes GOET-photo!, AMES-photo!).

**Remarks.** *Liparis brachystalix* is quite constant morphologically, having ovate, petiolate leaves with undulate margins, and labellum with a cordate base, apiculate apex, and a simple callus formed by thickened veins. Labellum shape varies slightly, being somewhat panduriform in the type of *L. pothoides* (Fig. 3B) to obovate-oblong in those of *L. fendleri*, *L. commelinoides* and *L. brachystalix* (Fig. 3A, C, D).

In Peru, *Liparis brachystalix* was collected in the 1960s in the cloud forests of Amazonas, but it was overlooked (Brako and Zarucchi 2993; Ulloa Ulloa et al. 2004, 2017). In a recent update of the checklist of Peruvian orchids of Zelenko and Bermudez (2009) published by Goicochea et al. (2019), *L. brachystalix* was recorded for the first time in Peru. However, the record by Goicochea et al. (2019) did not indicate any vouchers supporting it. Therefore, herein we provide the first vouchered citation of *L. brachystalix* for this country. *Liparis brachystalix* is widespread along the eastern slope of the Peruvian Andes, inhabiting the cloud forest of Amazonas, Pasco, and Huancavelica at an altitude of 2000–2900 m.

**Specimens examined.** AMAZONAS, Prov. Bongara, Dtto. Yambrasbamba, 1860–2000 m, 2–26 March 1967, *S. S. Tillet 673-304* (USM!); PASCO, Prov. Oxapampa, Dtto. Huancabamba, 10.25.45S 75.26.35W, 2870 m, 28 February 2009, *R. Vasquez, L. Valenzuela, J. Mateo & R. Rivera 35414* (USM!, HOXA!, HUT!, MOL!); Prov. Oxapampa, Dtto. Huancabamba, 10°26'35"S, 075°26'16"W, 2200.2500 m, 12 March 2006, *R. Vasquez et al. 31065* (HOXA!). HUANCAVELICA, Prov. Tayacaja, Dtto. Tintay Puncu, Lihuapampa, Bosque nublado Usnopata-sector Vacayupana, 2900 m, 18 February 2015, *L. Egoavil s.n.* (photo!).

### Key to the species of *Liparis* sect. *Decumbentes*

- 1 Leaves sessile; labellum convex towards the apex ..... *L. sessilis*
- Leaves conspicuous petioles > 1 cm long; labellum concave or flat ..... 2
- 2 Flowers green with a red-purple labellum; sepals and petals > 1 cm long; labellum ovate-rhombic, ecallose; column slender and arcuate ..... *L. crispifolia*
- Flowers entirely green with a darker green longitudinal band on the labellum; sepals and petals < 1 cm long; labellum obovate-oblong or flabellate-cuneate, with a distinct callus; column stout and straight or essentially so ..... 3
- 3 Labellum broader than long, shortly cuneate at the base and abruptly expanded above, recurved; column straight ..... *L. laticuneata*
- Labellum longer than broad, cordate at base and not abruptly expanded above, flat; column curved or straight ..... *L. brachystalix*

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# Lectotypification of the name *Melastoma candidum* f. *albiflorum* and its taxonomic status

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## Abstract

A nomenclatural and taxonomic treatment of the name *Melastoma candidum* f. *albiflorum* (Melastomataceae) is presented. A lectotype is designated for this name, with an updated morphological description based on fresh material. The name *Melastoma candidum* f. *albiflorum* is proposed as a heterotypic synonym of *Melastoma candidum*.

## Keywords

flora of China, *Melastoma*, synonym, taxonomy

## Introduction

*Melastoma* L. comprises species mainly distributed in the Southeast Asia and extends to India, South China, Japan, northern Australia, and Oceania (Meyer 2001). *Melastoma* is taxonomically difficult, and the recognized number of species in this genus remains controversial due to rapid adaptive radiation and extensive natural hybridization (Renner and Meyer 2001; Liu et al. 2014; Zhou et al. 2017). It was claimed that this genus comprises about 100 species (Chen 1984), but only 22 species were recognized in the

recent taxonomic revision (Meyer 2001; Chen and Renner 2007). However, it was estimated that this genus might include 80–90 species based on a scientific investigation of the island of Borneo (Wong 2016).

In China, nine *Melastoma* species were recorded in the south of the Yangtze River by Chen (1984), yet only five of them were recognized in more recent publications (Meyer 2001; Chen and Renner 2007). This revised treatment has incorporated *M. affine*, *M. normale* and *M. candidum* into *M. malabathricum*, but this has not been accepted by several plant taxonomists (Huang et al. 2018).

In this study, we are in agreement with the recognition of *M. candidum* as a distinct species (Liu et al. 2014; Ng et al. 2017). *Melastoma candidum* is a relatively common species with purple flowers that occurs in southern China and northern Vietnam (Chen 1984). *Melastoma candidum* f. *albiflorum* J. C. Ou, a form of *M. candidum*, was first described from Taiwan Island (Ou 1976). However, this name was not validly published under Art. 40 of ICN (McNeill 2014; Turland et al. 2018) because Ou (1976) cited two gatherings but failed to designate a type, and no Latin description or diagnosis was provided. This taxon can be easily distinguished from *M. candidum* f. *candidum* by its white flowers.

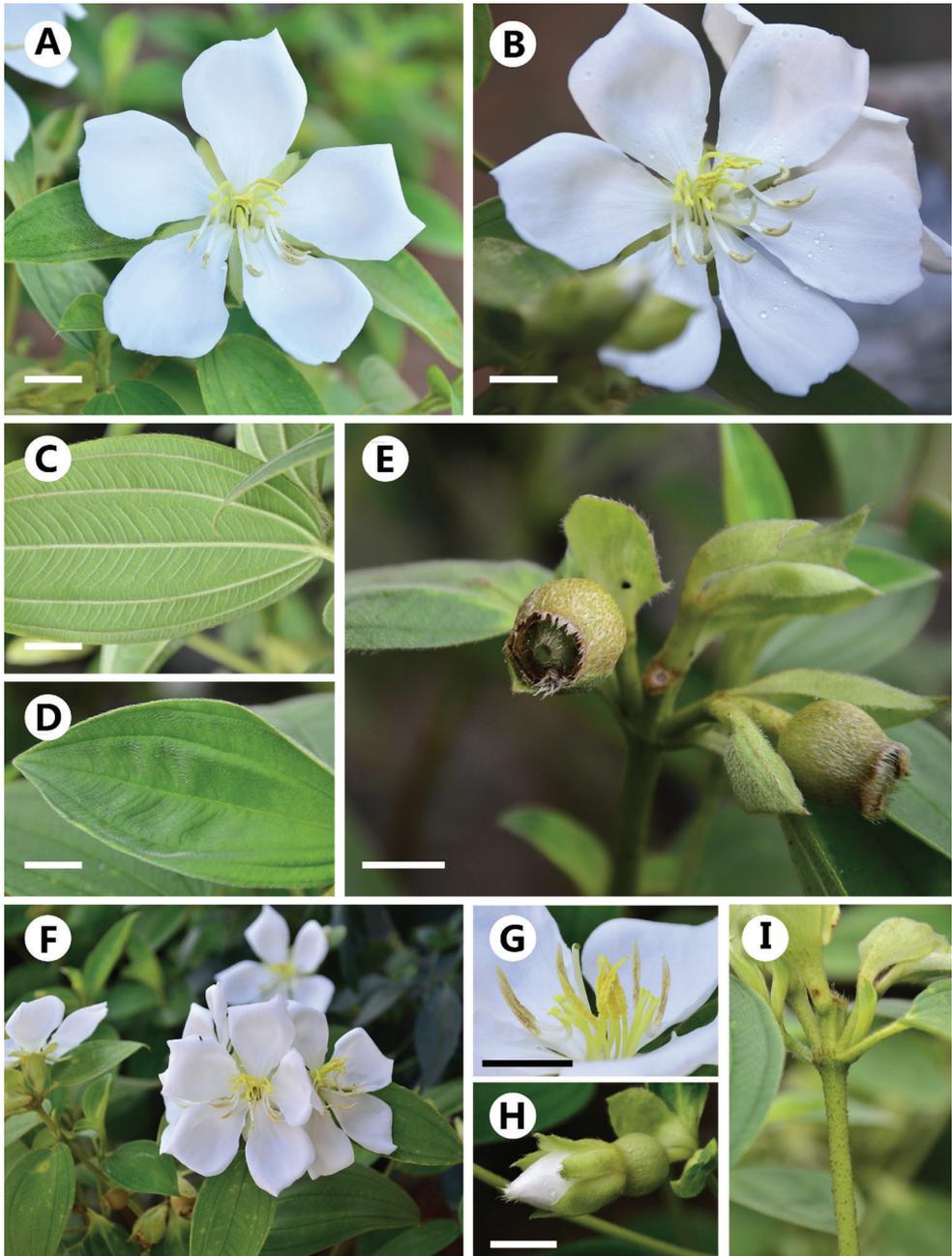
During a recent field survey, we collected an unidentified specimen of *Melastoma* in Fujian province, China, which we believed has not been recorded in mainland China. It closely resembles *M. candidum* in morphology, but has white flowers. After a comprehensive morphological comparison, we propose that this specimen be conspecific with *M. candidum* f. *albiflorum*. Here we designate a lectotype for this taxon name and discuss its taxonomic status.

## Materials and methods

Morphological data for identification and description of this taxon were based on observations of specimens in the field (ten individuals) and the herbarium. The voucher specimens are deposited in the Herbarium of Sun Yat-sen University (SYS), Guangzhou, China. Lectotypification and taxonomic treatment of this taxon is presented according to the "International Code of Botanical Nomenclature" (McNeill 2014; Turland et al. 2018), and a full description is provided.

## Results

Detailed morphological examination revealed that morphological characters of this unidentified taxon of *Melastoma*, such as erect habit, ovate leaves, twigs with compressed scales, hypanthia with compressed strigose scales, and fruits with densely appressed strigose scales (Fig. 1), are most similar to *M. candidum*. The two taxa differ only in petal color, with white petals in this taxon and purple petals in *M. candidum*. Considering that this taxon is sympatric with *M. candidum* in Fujian and Taiwan, we propose that *M. candidum* f. *albiflorum* is conspecific with and should be synonymized under *M. candidum*.



**Figure 1.** The white form of *Melastoma candidum*. **A** flower 5-merous **B** flower 6-merous **C** abaxial surface of leaf blade **D** adaxial surface of leaf blade **E** capsule **F** inflorescences **G** apex of flower showing heteranthery **H** close-up of bud showing margin ciliate of sepals and petals **I** twig of plant with pedicels Scale bars: 1 cm (**A–E, G, H**).

## Taxonomic treatment

### *Melastoma candidum* D. Don

**Synonym.** *Melastoma candidum* D. Don f. *albiflorum* J. C. Ou.

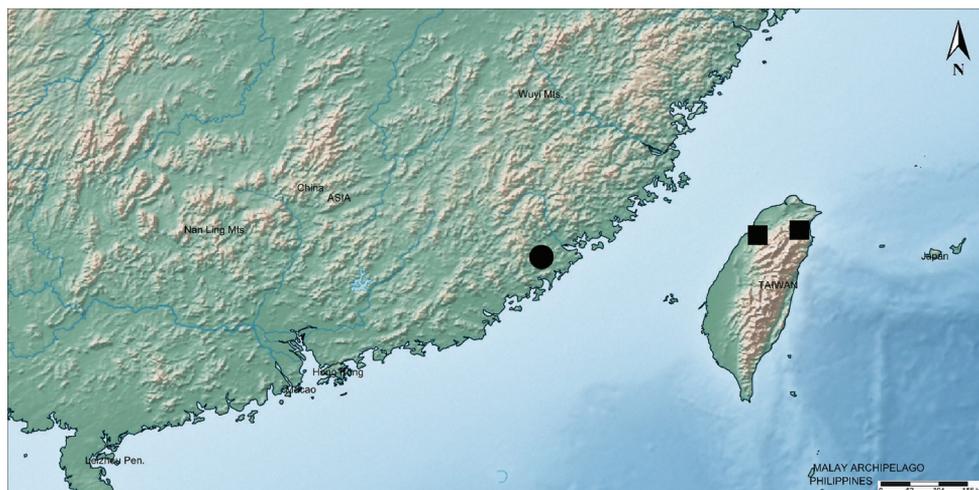
**Lectotype** (designated here): – CHINA. Taiwan. Ilan, Yuensanhsiang, leg. *Jun-Chih Ou* 64, July 6, 1976, Herbarium of National Research Institute of Chinese Medicine (HNRICM!).

**Description.** Perennial shrubs, 0.3–1.5 m tall. Twigs nearly 4-angled to subterete in the younger parts and terete in the old parts, densely covered with appressed to suberect strigose with scales. Leaf blades ovate to elliptic, papery, 3.3–4.8×6–9.5 cm, base broadly cuneate to rounded or subcordate, apex acuminate, margin entire, palmately 7-nerved (the marginal nerves often inconspicuous), adaxially densely strigose, abaxially densely puberulous, strigose along veins; petioles 1.4–2.0 cm, densely strigose with scales. Inflorescences subcapitate corymbose, terminal, 3–5-flowered, with 2 leaf-like bracts at base. Pedicels 8–12 mm, densely strigose with scales; bracteoles 2, opposite, elliptic-lanceolate to elliptic, 6–13 mm, abaxially densely strigose, margin ciliate. Hypanthia 7–12 mm, densely appressed-strigose with scales, margin fimbriate. Sepals lanceolate to ovate-lanceolate, apex acuminate, densely strigose and pubescent on both sides and along the margin. Petals 5, occasionally 6, white, obovate, ca. 27×18 mm, apex rounded. Stamens 10, dimorphic, longer stamens with anthers linear, curved, ca. 9 mm, filaments ca. 10 mm, joined by a connective ca. 9 mm, curved, spur bifid ca. 2 mm, shorter stamens with anthers ca. 8 mm, 2-tuberculate at base, filaments ca. 7 mm, without prolonged connective. Ovary half-inferior, campanulate, with a ring of bristles at apex. Capsule dry, urceolate, apically dehiscent, 9–16×7–10 mm, densely squamose strigose. Seeds numerous, minute, cochleate. Fl. May–Aug, fr. Aug–Oct.

**Distribution and habitat.** The white-flowered form of *M. candidum* was first reported only from Hsinchu Hsien and Ilan Hsien (Taiwan). This form has also been reported to occur in the Ryukyu Island (Hatusima and Amano 1994), but without exact specimen information. The individuals in Fujian, China represent the first known occurrence of this form outside of Taiwan Island (Fig. 2). It occurs only in lowland evergreen forest margins at an elevation of approximately 150–300 in Pinghe County, Fujian. They occur in evergreen forests dominated by *Blechnum orientale*, *Dicranopteris pedata*, *Miscanthus floridulus* and *Rhodomyrtus tomentosa*.

**Notes.** The key character of the white form of *M. candidum* is its white-colored flowers, which can be easily distinguished from the purple form of *M. candidum*. Whereas the purple form has a relatively wide range of distribution in northern Vietnam and southern China (Liu et al. 2014), the white-flowered individuals have been found across a narrow region. Individuals in Taiwan and mainland China may represent independent origins of white petals from local populations of *M. candidum*, since breakdown of the anthocyanin synthesis pathway in plants is relatively common (Smith et al. 2012; Zheng et al. 2019).

The flowers of the white form of *M. candidum* have been used in folk-medicine for the treatment of hypertension, dysentery, diarrhea and antibacterial (Chou and Liao



**Figure 2.** Distribution map of the white form of *Melastoma candidum*. Square (■) represents previously reported localities, solid circle (●) represents newly recorded locality. Map was created using SimpleMappr, <http://www.simplemappr.net> (Shorthouse 2010).

1982). During our survey, we also learned that the white form has been cultivated as a medicinal herb by the local people in Pinghe County, Fujian. They believe that it is highly effective for the treatment of nephritis, and has led to the exploitation of natural populations, threatening its survival in the wild. Due to its narrow geographical range and small population size, effective conservation effort is required.

**Paratype.** – CHINA. Fujian Province, Pinghe County, in lowland evergreen forest margins, 24°02.66'N, 117°04.75'E, Elev. 276 m. 28 July 2019, X. J. Zhang, ZXJ-1901 (SYS)

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# A new species of *Rhododendron* (Ericaceae) from Guizhou, China

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## Abstract

A new species of the *Rhododendron* (Ericaceae) in subgen. *Tsutsusi* sect. *Tsutsusi* from Puding county of Guizhou, China, is described and illustrated. The new species, *R. pudingense* X.Y. Dai, C.H. Yang & Y.P. Ma, is similar to *R. myrsinifolium* Ching ex Fang et M. Y. He and *R. minutiflorum* Hu, but it can be easily distinguished by its length and being pubescent on inner surface of corolla tube, sparse hairs below the middle of filament and the glabrous style.

## Keywords

China, Ericaceae, Guizhou, *Rhododendron*, *R. pudingense*, *Tsutsusi*

## Introduction

*Rhododendron* Linn., the largest genus of woody plants in the Ericaceae (Chamberlain et al. 1996, Ma et al. 2010), consists of more than 1000 species (Wu et al. 2005). China is recognized as one of the main distribution and diversity centers for the genus *Rhododendron* (Geng 2014). There have been a number of new species reported from China in recent years (Liao et al. 2015, Ma et al. 2015, Cai et al. 2016), and there are now more than 600 *Rhododendron* species known from the country (Tian et al. 2019).

Sleumer (1949, 1980) classified *Rhododendron* subgenus *Tsutsusi* Pojarkova into three sections. Based on molecular evidence from the analysis of ITS, combined with features of leaf anatomic structure and vessels, Liu (2007) divided *Rhododendron* subgenus *Tsutsusi* into 74 species and two subspecies as well as 13 varieties and one form. More recently, Geng (2014) revised *Rhododendron* subgenus *Tsutsusi* into two sections (*Tsutsusi* and *Brachycalyx*) recognizing in the process 58 species (figures include both variety and form), which accounts for 72.5% all over the world.

The Yunnan-Kweichow Plateau is famous for its plant diversity in China (Huang et al. 2018). However, unlike Yunnan where there have been many explorations for plants, large areas of Guizhou remain to be investigated (Huang et al. 2018). During May 2018 fieldwork in the Puding County of the Guizhou Province discovered an unknown *Rhododendron* species. The following year, during April 2019 the same *Rhododendron* was also discovered again in the Wangmo County of the same province. Examination of *Rhododendron* specimens and relevant literature for the genus from all over the world revealed that the morphological characters of the potentially new species do not fit any known species of *Rhododendron* (Liu 2007, Geng 2014, Liao et al. 2015, Ma et al. 2015, Cai et al. 2016, Tian et al. 2019). Hence, we concluded that the Puding and Wangmo County, Guizhou Province *Rhododendron* specimens represent a species new to science, which we formally described here.

## Materials and methods

Information on living plants and habitats was obtained from field investigations in 2018 and in 2019. Species descriptions and measurements were obtained from field notes and dried herbarium specimens. Then, the specimens were identified by a thorough literature examination (Wu et al. 2005, Geng 2014) and compared with type specimen images available online (JSTOR Global Plants, <http://plants.jstor.org/>). We also examined herbarium specimens from KUN, GF and from the online tools CVH (<http://www.cvh.ac.cn/>).

## Results

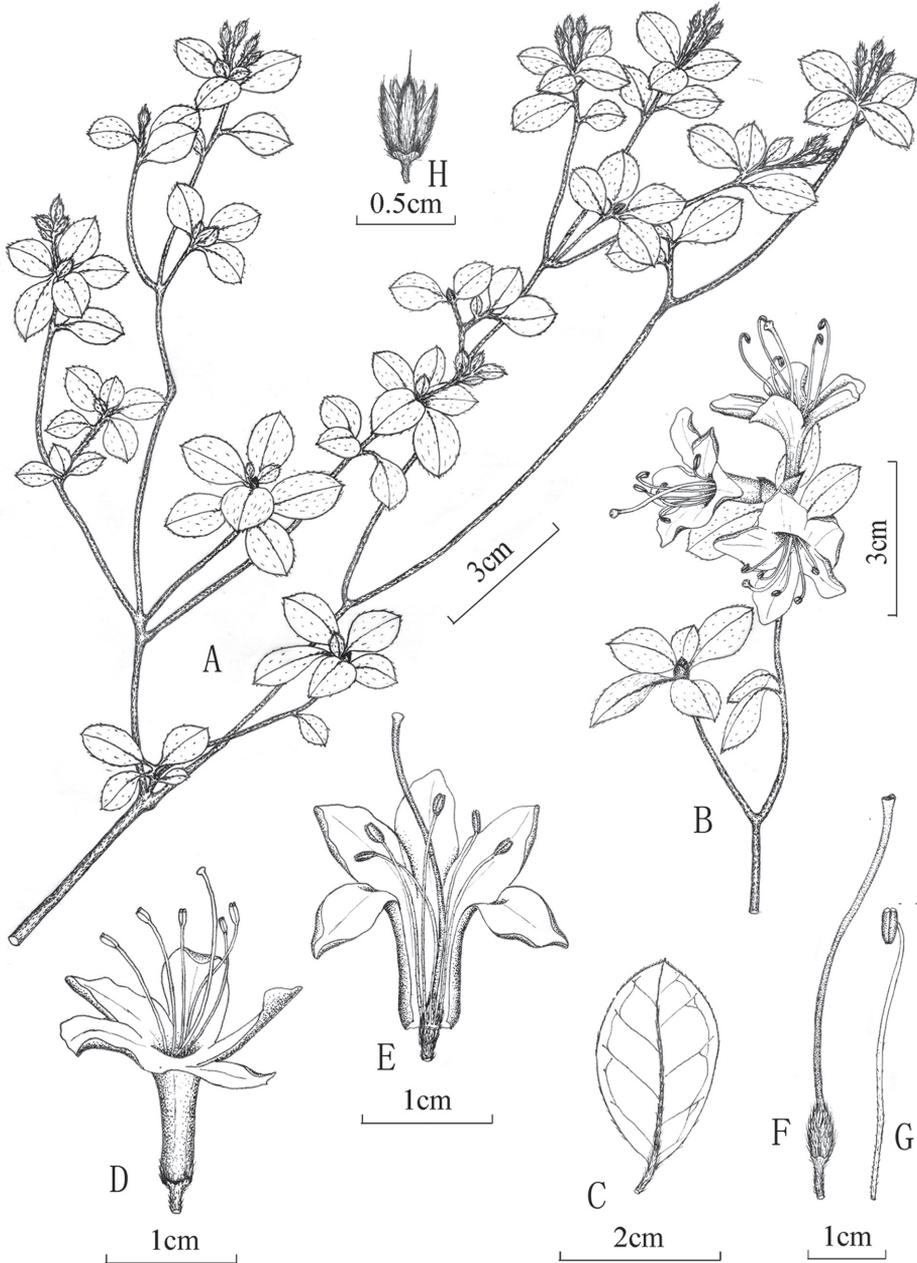
### Taxonomic treatment

***Rhododendron pudingense* X.Y. Dai, C.H. Yang & Y.P. Ma., sp. nov.**

urn:lsid:ipni.org:names:77209564-1

Figs 1, 2

**Type.** China. Guizhou: Puding County, Machang town, Longjinshan, 26°17'34.08"N, 105°35'20.04"E, altitude 1400 m alt., 7 May 2018, *XiaoyongDai* 180507112 (fl., Holotype GF!, isotypes KUN!, PE!).



**Figure 1.** *Rhododendron pudingense* X.Y. Dai & C.H. Yang, sp. nov. **A** fruiting branch **B** flowering branch **C** leaf abaxial **D** flowers **E** side view of flower **F** stigma and ovary **G** stamen **H** capsule.

**Description.** *Shrubs* evergreen. *Branches* subverticillate, young shoots with coarsely strigose, hairs flat. *Leaves* hard leathery, crowded at branch top, obovate to obovate-elliptic, 8–20 × 5–10 mm; apex obtuse, obtusely pointed or mucronate, base cuneate,

margin slightly revolute; abaxial surface sparsely with coarsely brown strigose except for midvein; adaxial surface green, margin sparsely with coarsely strigose at first, and then fall off gradually except for midvein; adaxial abaxial surface greyish white, while yellow-white when dry; midrib and lateral veins concaved on abaxial surface and projecting on abaxial surface, lateral veins inconspicuous visible on both sides, anastomosing margin. *Petioles* 2–4 mm at length, densely with coarsely dark brown strigose. *Floral bud* ovoid, paleta ovoid, 7–10 × 4–6 mm, outer surface ridge coarsely strigose, margin villous. *Inflorescence* terminal, 4–6-flowered. *Pedice*l 4–10 mm at length, densely coarsely strigose. *Calyx* slightly 5-lobed, delta, sinuate, 1 × 1.5 mm, outer side coarsely strigose, margin densely. *Corolla* funnel, bilaterally symmetric, 15–20 mm at length; tube cylindric, inner surface slightly puberulent, 8–11 × 2–3 mm; lobes 5, apex obtusely pointed or mucronate, equal, 6–9 × 4 mm. *Stamens* 5, subequal, exerted, 15–28 mm at length; filaments pink, slightly puberulent; anthers purple; ovary ovoid, 3.5 mm at length, densely coarsely strigose. *Style* ca. 20–28 mm at length, longer than parts of stamens, purplish red at middle and lower part, glabrous; stigmas capitate, pink. *Capsule* oblong, 5 mm at length, coarsely strigose.

**Etymology.** The specific epithet is named after the type locality Puding County, in which this plant was first discovered.

**Vernacular name.** Chinese mandarin: pǔ dìng dù juān (普定杜鹃)

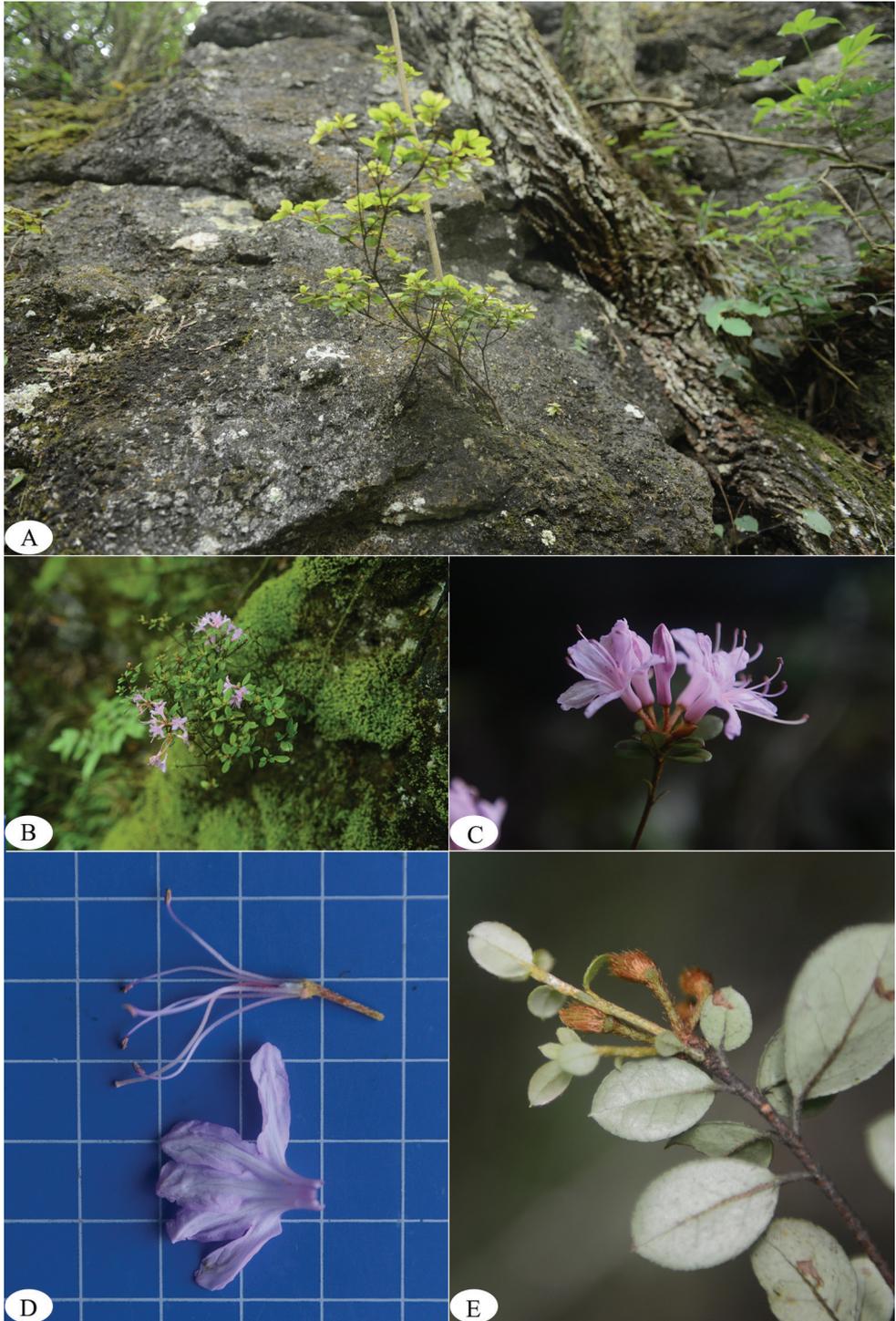
**Phenology.** This new species has been observed in flowering from mid-April to early May and fruiting from early May to October.

**Distribution and habitat.** So far, this species is only known from the type locality (Puding County) and from the Wangmo County, Guizhou Province, southwest China. At these locations *Rhododendron pudingense* grows in evergreen and deciduous broad leaved mixed open forests within the rock cracks of limestone hills, at an elevation of 1300 m to 1400 m.

**Conservation status.** *Rhododendron pudingense* is currently known only from two locations, Puding County and Wangmo County (Guizhou Province, China) with a combined population estimated at 100 individuals, and an area of occupancy (AOO) of <500 kilometers. Within this species known range the populations are severely fragmented and occupy a vegetation association in decline; we therefore propose to treat it as [EN B2ab(iii); D] in accordance to the IUCN Red List Categories and Criteria version 13 (IUCN Standards and Petitions Subcommittee 2017).

**Additional specimens examined.** China. **Guizhou:** Puding County, Machang Town, Longjinshan, altitude Longjinshan, 26°17'34.08"N, 105°35'20.04"E, 1400 m alt., 20 August 2018, *Xiaoyong Dai* 18082201 (fr., paratype GF!); China. **Guizhou:** Wangmo County, Mashan Town, Heidong, 25°14'21.05"N, 106°22'13.73"E, 1300 m alt., 10 April 2019, *Xiaoyong Dai & Jianghua HUANG* 19041002 (fl., paratype GF!).

**Relationships.** The new species is morphologically similar to *R. myrsinifolium* and *R. minutiflorum* (Table 1), however, *R. pudingense* can be easily distinguished from these species by examination of the corolla tube, stamens and styles. Notably, *R. pudingense* has a longer corolla tube (8–11 mm long) than *R. myrsinifolium* and *R. minutiflorum*, whose corolla tube lengths are both < 4 mm (Table 1). In addition, *R. pudingense* has glabrous styles



**Figure 2.** *Rhododendron pudingense* X.Y. Dai & C.H. Yang, sp. nov. **A** habitat **B** one flowering plant **C** inflorescence **D** flower viewed from different angles as well as stigma and filaments **E** fruit branch.

**Table 1.** Diagnostic characters for *Rhododendron pudingense* and closely related species.

Characters	<i>R. myrsinifolium</i>	<i>R. pudingense</i>	<i>R. minutiflorum</i>
Leaf shape	elliptic, rarely obovate	obovate to obovate-elliptic	oblong to obovate or broadly ovate
Leaf length	6–8 × 3–5 mm	8–20 × 5–10 mm	8–15 × 3–5 mm
Leaf margin	red-brown punctate glands	no glands	no glands
Corolla tube length	4 mm long	8–11 mm long	3 mm long
Corolla tube surface	glabrous in both sides	outer surface glabrous whereas inner surface puberulent	outer surface reddish glandular-hairy and inner surface puberulent
Stamen length	12–14 mm	15–28 mm	7 mm long
Filament	glabrous	slightly puberulent below the middle of filament	puberulent at the lower part
Style length	12–15 mm	20–28 mm	8 mm long
Style covers	coarsely appressed setose at the lower part	glabrous	Sparsely shortly glandular-hairy below

whereas the lower part of style in *R. myrsinifolium* and *R. minutiflorum*, is furnished with coarsely appressed setose hairs or sparsely shortly glandular-hairy (Table 1). Furthermore, the stamens of *R. pudingense* are 15–28 mm long and slightly puberulent below the middle of filament, where those of *R. myrsinifolium*, are 12–14 mm long and glabrous, and the stamens of *R. minutiflorum* are 7 mm long and puberulent in their lower portion (Table 1).

## Acknowledgments

Research for this paper was supported by the Study on Ericaceae Plant in Guizhou of Guizhou Academy of Forestry and the Benefit Monitoring of Natural Forest Protection Project in Guizhou (2011–2020), and also supported by the Biodiversity Survey and Assessment Project of the Ministry of Ecology and Environment, China (2019HJ2096001006) and the Strategic Biological Resources Service Network Program of Chinese Academy of Sciences (KFJ-BRP-017-02). The authors are grateful to the curators of the herbaria GF, GFS, HGAS, GZAC, IBSC, KUN, SZ, and PE for allowing them access to *Rhododendron* collections. They also thank Prof. Yuying Geng for assistance with specimen determinations. The authors also appreciate the assistance rendered by Shenhu Tang and Jianghua Huang during fieldwork.

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# A new species of *Eriobotrya* (Rosaceae) from Yunnan Province, China

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## Abstract

*Eriobotrya laoshanica*, a new species of Rosaceae from Yunnan, China, is described and illustrated. The new species is easily distinguished from the most similar species *E. malipoensis* K. C. Kuan by its longer petioles (2–5 vs. 0.5–1 cm); indumentum on the lower leaf surfaces (densely tomentose vs. glabrous); much fewer flowers (15- to 30-flowered vs. 50- to 100-flowered) on the panicle; larger flowers (2.5–3 vs. 1.5–2 cm in diameter); and non-angulated (vs. angulated) young fruits.

## Keywords

chloroplast genome sequences, morphology, phylogeny, subtribe Malinae

## Introduction

The genus *Eriobotrya* Lindley, a small genus of subtribe Malinae (tribe Maleae, subfamily Amygdaloideae, Rosaceae) consisting of approximately 30 species, is distributed in Himalaya, eastern Asia and western Malesia (Vidal 1965; Gu and Spongberg 2003;

Mabberley 2017). This genus is considered close to *Rhaphiolepis* based on the shared characters of larger seeds and thinner endocarp (Robertson et al. 1991). Recent studies based on molecular evidence strongly supported the *Eriobotrya-Rhaphiolepis* clade (Lo and Donoghue 2012; Xiang et al. 2016). *Eriobotrya japonica* (Thunberg) Lindley, commonly known as loquat, is an important fruit tree cultivated throughout south-eastern Asia and southern Europe (Gu and Spongberg 2003).

There are about 16 *Eriobotrya* species (five endemic) recorded in China (Gu and Spongberg 2003; Yang and Lin 2007; Li et al. 2012). Among them, there are only four species and one natural hybrid species flowering in autumn and winter, namely, *E. × daduheensis* H. Z. Zhang ex W. B. Liao, Q. Fan et M. Y. Ding, *E. japonica*, *E. malipoensis* K. C. Kuan, *E. prinoides* Rehder et E. H. Wilson, and *E. serrata* J. E. Vidal (Gu and Spongberg 2003; Ding et al. 2015). In our investigations into *Eriobotrya* species in Yunnan province of China, a distinct *Eriobotrya* species flowering in autumn was collected in 2015. After four years' field observations and comprehensive literature studies, we confirmed it was a new species and it is described and illustrated here.

## Materials and methods

Morphological observations of the putative new species and its close relatives were carried out based on living plants in the field as well as dried specimens. All morphological characters were measured using a stereomicroscope with ocular micrometer (Leica S8APO, Leica Microsystems Inc., Germany). The voucher specimens were deposited in the herbarium of Sun Yat-sen University (SYS) and the herbarium of South China Botanical Institute (IBSC).

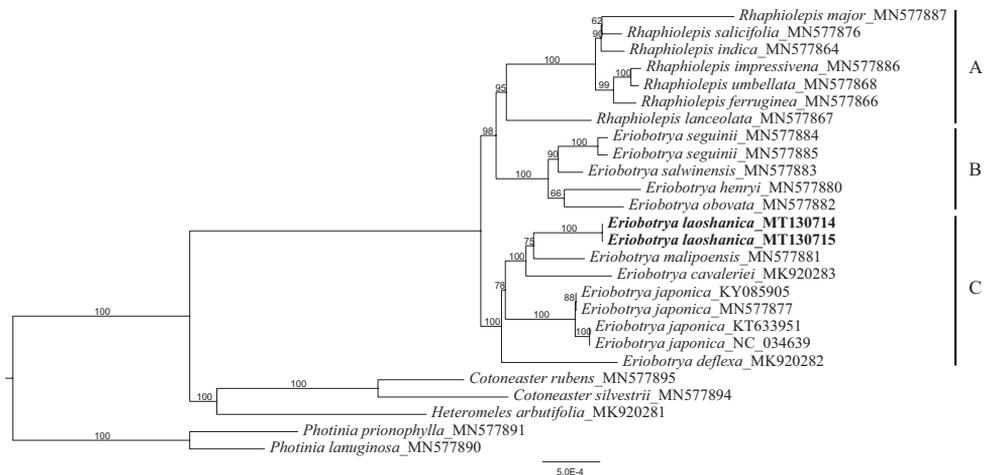
Leaf samples for the putative new species were collected and stored in silica gel. The total DNA was extracted with the TIANamp Genomic DNA Kit [TIANGEN Biotech (Beijing) CO. Ltd] according to the protocol procedure, and then sent to Novogene Bioinformatics Technology (Beijing, China) Co. Ltd for quality inspection and low-coverage genome sequencing using Illumina 2000 platform following the standard Illumina sequencing procedure. Approximately 6 GB cleaned raw data was produced and assembled into circled chloroplast genomes with the perl script NOVO-Plasty2.7.2 (Dierckxsens et al. 2017; accession numbers: MT130714, MT130715), using the chloroplast genome and the *rbcL* gene of *E. japonica* (downloaded from NCBI website, accession number: NC\_034639.1) as reference and seed, respectively. Then the two assembled sequences were annotated on online GeSeq (Tillich et al. 2017) with the same reference of *E. japonica* (accession number: NC\_034639.1). Further, complete chloroplast genome sequences for *Eriobotrya*, and other close genus such as *Rhaphiolepis*, *Heteromeles*, *Cotoneaster*, and *Photinia* were downloaded from the NCBI nucleotide database (Zhang et al. 2017). Together with the putative new species, all the chloroplast genomes were aligned with MAFFT version 7 (Rozewicki et al. 2019) and then manually checked and revised with MEGA version 6.0 (Tamura et al.

2013). The phylogenetic tree was then constructed with IQ-Tree 1.6.10 (Nguyen et al. 2015) based on the maximum likelihood method, in which the best-fit model of DNA substitution was auto-determined by calculating the Bayesian Information Criterion (BIC) using the 88 available nucleotide substitution models, ultrafast bootstrap was set as 2000, and *Photinia* species were set as outgroup.

## Results

### Molecular analyses

The alignment length of these twenty-five chloroplast genomes was 166,363bp in total, with the statistics of 1,307 parsimony-informative sites. No variable sites were detected between the two accessions of the new species but 139 variable sites were detected between the new species and *E. malipoensis*. This low diversity within the species was also observed in *E. japonica* (KT633951 was also identical to NC\_034639, KY085905 identical to MN577877). The best-fit nucleotide substitution model was detected as TVM+F+R2 based on Bayesian Information Criterion (BIC). The ML phylogenetic tree (Fig. 1) showed that all the *Rhaphiolepis* species formed a well-supported clade (clade A) that is sister to a clade of *Eriobotrya* species (clade B) and the sister group relationship of these two clades is well supported; *E. henryi*, *E. obovata*, *E. salwinensis* and *E. seguinii* clustered together forming the clade B; the clade A and B formed a sister relationship; the putative new species, *E. laoshanica* is placed into a well-supported clade with *E. malipoensis* and *E. calaleriei*, and then clustered with *E. japonica* and *E. deflexa* forming the clade C.



**Figure 1.** Maximum likelihood consensus tree of the new species and related species. Numbers above branches are ML bootstraps, the new species is shown in bold.

## Taxonomic treatment

### *Eriobotrya laoshanica* W.B. Liao, Q. Fan & S.F. Chen, sp. nov.

urn:lsid:ipni.org:names:77209566-1

老山枇杷

**Type.** CHINA. Yunnan Province, Malipo County, Mount Laoshan, in thin forests on the slopes of limestone hills, 22°59.08'N, 104°50.48'E, 1160 m a.s.l., 14 October 2019, Q. Fan 17570 (holotype: SYS; isotypes: IBSC, SYS). (Figs 2, 3)

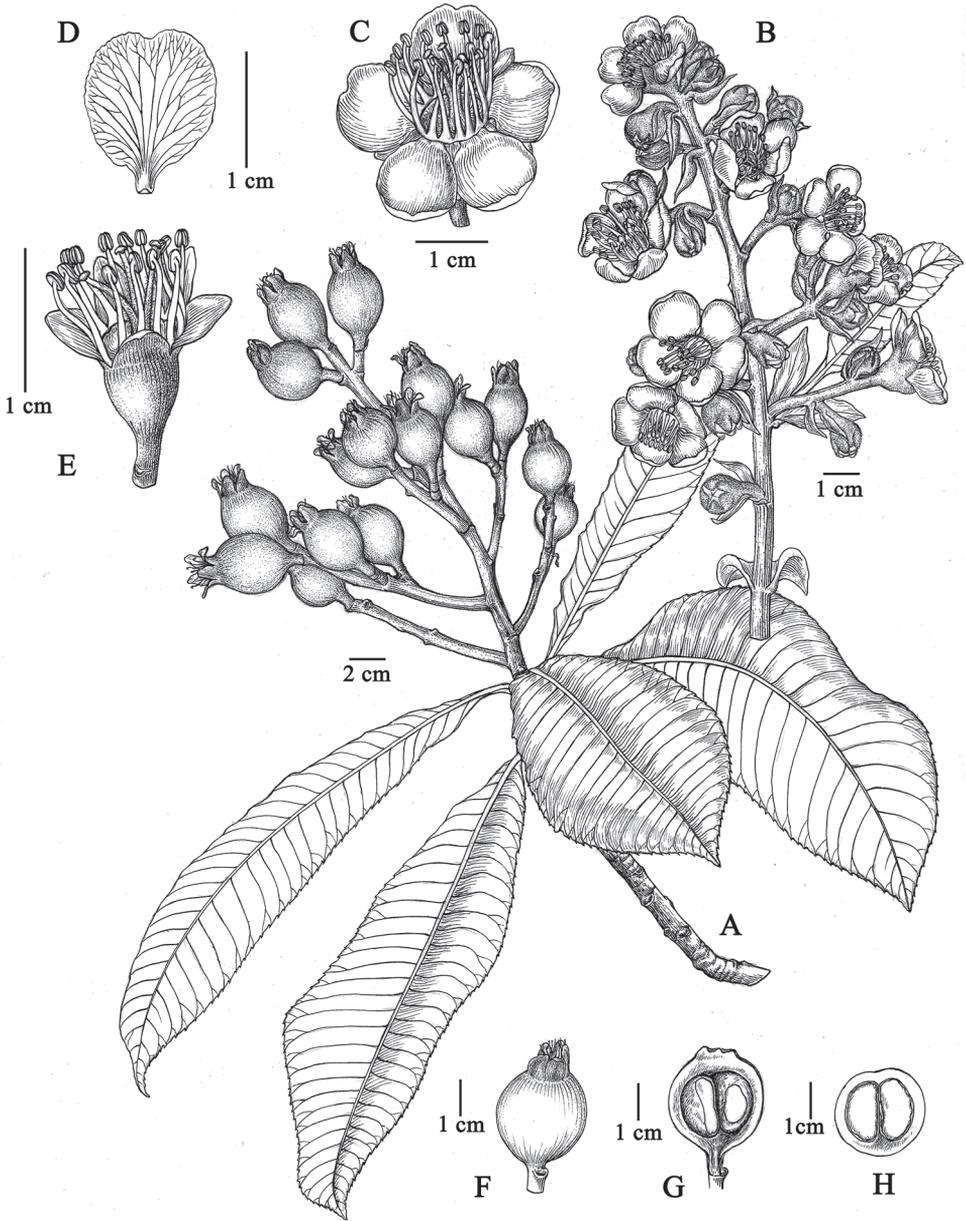
**Diagnosis.** This species is similar to *E. malipoensis* and *E. serrata*, but differs from them in its leaf shape, indumentum on the lower leaf surfaces, longer petioles, much fewer flowers on the panicle, larger flowers, and other traits.

**Description.** Evergreen small tree, 4–10 m tall, much branched; stems 8–25 cm in diameter; branchlets grey-white, terete, glabrous, 6–10 mm in diameter. Leaves spirally inserted on branches and often crowded at tips of branchlets; petioles 2–5 cm long, glabrous; stipules elliptic or ovate-lanceolate, 1–3 × 0.5–1 cm, glabrous, caducous; leaf blades oblong or broad elliptic, 20–40 × 7–12 cm, thickly coriaceous, glabrous, midrib elevated on both surfaces, secondary veins 21–30 pairs, arching slightly and often dichotomous before reaching the margin, elevated on both surfaces margin serrate, apex acute or cuspidate, base cuneate, gradually tapering to the petiole. Inflorescence in terminal panicles, 15- to 30-flowered, 8–15 cm long, 6–10 cm in diameter, with 6–10 lateral racemes, the lowermost laterals in the axils of reduced leaves (often almost entirely consisting of the stipules only), upper ones in axils of bracts, lateral racemes sometimes branched in the lower part of the inflorescence; peduncle and pedicels densely yellow-brown tomentose; bracts ovate-triangular, 1–1.5 cm long, abaxially tomentose, adaxially glabrous or sparsely pubescent; bracteoles subulate or triangular, 3–8 mm long, abaxially densely tomentose, adaxially pubescent. Flowers 2.5–3 cm in diameter. Hypanthium obconical, 4–6 × 5–7 mm, abaxially densely yellow-brown tomentose, 5-lobed, the calyx lobes ovate, 3–5 × 2–4 mm, abaxially densely tomentose, adaxially glabrous; petals white, obovate or round, 6–9 × 5–10 mm, shortly clawed, glabrous, margin crisped or irregularly crenulate, apex retuse; stamens 20; filaments 3–6 mm long, glabrous; anthers 1–2 mm long; ovary semi-inferior, the free apex densely villous, ovoid, 2–3 mm across, 3–5-loculed, with 2 ovules per locule; styles 3–5, densely villous, 5–7 mm long, connate at base or fused from base to middle; ovules ovoid or ellipsoid, c. 1 mm across. Pome yellow at maturity, subglobose, 2.5–3.5 cm in diameter, glabrescent, crowned by the persistent calyx lobes forming an apical beak; pericarpium fleshy, ca. 3 mm thick. Seeds (1-) 2 per fruit.

**Phenology.** Flowering from September to October, fruiting from November to December.

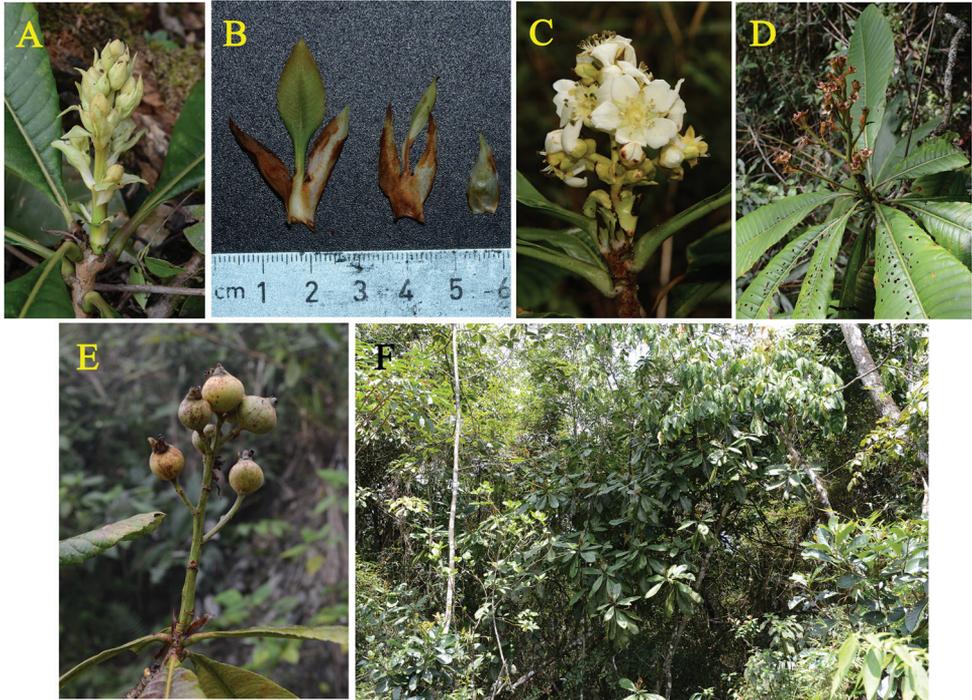
**Etymology.** The specific epithet refers to Laoshan Mountain, the locality of the type collection.

**Distribution and habitat.** *Eriobotrya laoshanica* is currently known only from two localities in Laoshan Natural Reserve, Malipo County, southeastern Yunnan, China. Here, the species is distributed in thin forests on the slopes of limestone hills at al-



**Figure 2.** *Eriobotrya laoshanica* sp. nov. **A** fruiting branch **B** inflorescence **C** flower, front view **D** petal, adaxial view **E** flower without corolla showing hypanthium and calyx lobes **F** fruit **G** fruit, in longitudinal section **H** fruit, in transverse section. **A** and **F–H** from *Q. Fan 13900* **B–E** from *Q. Fan 17570*. Drawn by Yun-Xiao Liu.

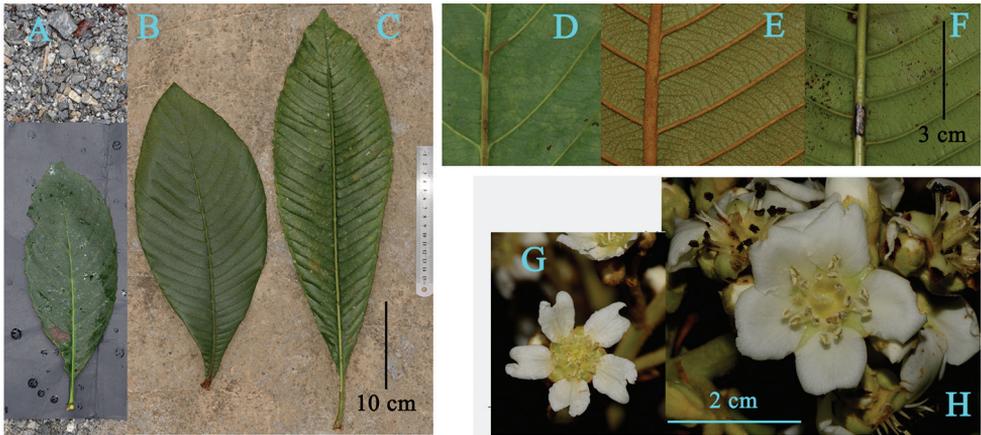
titudes of 1100–1358 m a.s.l. The common associated tree species include *Aucuba chinensis*, *Caryodaphnopsis tonkinensis*, *Ficus semicordata*, *Firmiana* sp., *Garcinia paucineris*, *Machilus* sp. and *Syzygium claviflorum*.



**Figure 3.** *Eriobotrya laoshanica* sp. nov. **A** young flowering branch **B** reduced leaves and bract **C** flowering branch **D** young fruiting branch **E** fruits **F** habitat.

**Conservation status.** Only two populations were found with no more than 50 mature individuals in a total area of about 5 km<sup>2</sup>. It's about 6.5 km away between the two populations. The wood of this species is very suitable for firewood. During the expedition in 2019, we found that at least two big trees about 15 cm in diameter were felled by the local villagers. Thus the species could be considered as CR (Critically Endangered) status according to IUCN Red List criteria (B2ab(v); IUCN 2019).

**Note.** The closest relative of *Eriobotrya laoshanica* on morphological grounds could be *E. malipoensis* Kuan, which usually coexists with the new species. They shared several characteristics, e.g., the long thick-coriaceous leaves that are up to 40 cm long; styles 3–5; and the subglobose fruits. The new species can be distinguished from *E. malipoensis*, however, by its longer petioles (2–5 vs. 0.5–1 cm); indumentum on the lower leaf surfaces (densely tomentose vs. glabrous); much fewer flowers (15- to 30-flowered vs. 50- to 100-flowered) on the panicle; larger flowers (2.5–3 vs. 1.5–2 cm in diameter); and non-angulated (vs. angulated) young fruits. *E. laoshanica* also has some resemblance to *E. serrata* Vidal but differs in its thicker leaves; leaf shape (oblong to broad elliptic vs. obovate to oblanceolate); more lateral veins (21–30 vs. 10–16 pairs); and larger fruits (2.5–3.5 vs. 1.5–1.8 cm in diameter) (Table 1 and Fig. 4).



**Figure 4.** Morphological comparisons amongst *Eriobotrya laoshanica*, *E. malipoensis* and *E. serrata*. **A–C** leaves of *E. serrata* (**A**), *E. malipoensis* (**B**) and *E. laoshanica* (**C**) **D–F** abaxial leaf surface of *E. serrata* (**D**), *E. malipoensis* (**E**) and *E. laoshanica* (**F**) **G, H** flowers of *E. malipoensis* (**G**) and *E. laoshanica* (**H**). Photos taken by Qiang Fan.

**Table 1.** Morphological comparisons amongst *Eriobotrya laoshanica*, *E. malipoensis* and *E. serrata*.

Characters	<i>E. laoshanica</i>	<i>E. malipoensis</i>	<i>E. serrata</i>
Leaf shape and size	oblong or broad elliptic, 20–40 × 7–12 cm	oblong or oblong-obovate, 30–40 × 10–15 cm	obovate or oblanceolate, 9–23 × 3.5–13 cm
Texture of leaves	thickly coriaceous	thickly coriaceous	thinly coriaceous
Indumentum on the lower leaf surfaces	glabrous	densely rusty tomentose	tomentose when young, glabrescent
Petiole length	2–5 cm	0.5–1 cm	1.5–3 cm
Lateral veins	21–30 pairs	20–25 pairs	10–16 pairs
Inflorescences	with reduced leaves, 15- to 30-flowered	without reduced leaves, 50- to 100-flowered	without reduced leaves, 30- to 60-flowered
Flower size (diameter)	2.5–3 cm	1.5–2 cm	1–2 cm
Fruit shape and size (diameter)	subglobose, 2.5–3.5 cm	pyriform, 2–3.5 cm	ovoid or pyriform, 1.5–1.8 cm

To distinguish these species of *Eriobotrya* flowering in autumn and winter (from September to February) in China, an identification key is provided (based on Zhang et al. 1990; Gu and Spongberg 2003; Ding et al. 2015).

**Additional specimens examined (paratypes).** China. Yunnan: Malipo, Laoshan natural reserve, 22°58.66'N, 104°50.80'E, 1135 m a.s.l., 16 September 2015 (young fl.), *Q. Fan 13700* (SYS); the same locality, 16 September 2015 (young fl.), *Q. Fan 13701* (SYS); the same locality, 22°59.10'N, 104°50.64'E, 1140 m a.s.l., 30 November 2015 (young fr.), *Q. Fan 13887* (SYS); the same locality, 1140 m a.s.l., 30 November 2015 (fr.), *Q. Fan 13900* (SYS); the same locality, 1140 m a.s.l., 30 November 2015 (fr.), *Q. Fan 13901* (SYS); the same locality, 1160 m a.s.l., 26 September 2019 (young fl.), *Q. Fan 17540* (SYS); the same locality, 1358 m a.s.l., 26 September 2019 (no fl. and no fr.), *Q. Fan 17543* (SYS).

Key to *Eriobotrya* species flowering in autumn and winter in China

- 1 Leaves abaxially glabrous or glabrescent ..... **2**  
 – Leaves abaxially rusty or gray persistent tomentose ..... **3**  
 2 Leaves abaxially glabrous..... *E. laoshanica*  
 – Leaves abaxially brownish yellow tomentose when young, glabrescent .....  
 ..... *E. serrata*  
 3 Leaves abaxially rusty tomentose; leaf blade 30–40 cm long; lateral veins 22–  
 25 pairs..... *E. malipoensis*  
 – Leaves abaxially gray tomentose; leaf blade 7–30 cm long; lateral veins 9–16  
 pairs..... **4**  
 4 Leaf blade adaxially rugose; styles 5..... *E. japonica*  
 – Leaf blade adaxially not rugose; styles 2–4, rarely 5 ..... **5**  
 5 Stipule subulate; inflorescences 8–12 cm long; pome 1.5–3 cm in diam .....  
 ..... *E. × daduheensis*  
 – Stipule ovate; inflorescences 6–10 cm long; pome 0.6–1 cm in diam .....  
 ..... *E. prinoides*

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# *Gymnosiphon syceorosensis* (Burmanniaceae), the second new species for the Philippines

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## Abstract

A new holomycoheterotrophic member of Burmanniaceae, *Gymnosiphon syceorosensis*, is described from Mt. Hamiguitan located on the island of Mindanao, Philippines. This species differs from the recently named *G. philippinensis* from Cebu in a number of quantitative and qualitative characters. Phenetic (neighbor-joining) and phylogenetic (maximum parsimony) analyses of characters from Asian and Australian *Gymnosiphon* species were conducted and diagnostic taxonomic features were discussed. This new species appears to be most closely related to *G. affinis* J.J. Sm. from New Guinea but differs in a number of floral features including inner perianth lobe shape, stamen position in floral tube, and anther connective shape.

## Keywords

Dioscoreales, Mindanao, monocot, Mt. Hamiguitan, mycoheterotroph

## Introduction

Mycoheterotrophs are plants that obtain nutrients from mycorrhizal fungi that are attached to the roots of vascular plants as well as from saprophytic fungi (Leake 1994). This trophic form occurs in ten angiosperm families, some of which are green and photosynthetic and are called partial mycoheterotrophs whereas others have little or no photosynthetic activity and are called full mycoheterotrophs (Merckx et al. 2013). These conditions are analagous to hemi- and holoparasitic angiosperms. Because both life forms can be found in various genera of Burmanniaceae (Dioscoreales) and even

among different species of *Burmannia*, this family provide an opportunity to study the evolutionary origins of these trophic modes. Among the eight genera in the family (Merckx et al. 2013; Burmanniaceae s. str., i.e. without five genera now placed in Thismiaceae), *Campylosiphon* Benth., *Burmannia* L. and *Gymnosiphon* Blume have both Neo- and Paleotropical members. The holomycoheterotrophic genus *Gymnosiphon* was listed by Merckx et al. (2013) as containing 16 Neotropical, 8 African + Madagascan, and 9 Asian species. Since that publication, two species have been added: *G. philippinensis* Pelser, Salares & Barcelona (Philippines) and *G. queenslandicus* Gray, Mahyuni & Low (Australia) bringing the total number of species to 35 (Gray et al. 2019; Pelser et al. 2019). As pointed out by Pelser et al. (2019), most Asian species are rarely collected, reflecting either true rarity or the fact that these plants are often overlooked.

Field work on the Philippine island of Mindanao was conducted during June 2019 as part of a project funded by the National Science Foundation entitled “Plant Discovery in the Southern Philippines”. One excursion included the Mount Hamiguitan Range Wildlife Sanctuary, a UNESCO World Heritage site that contains many Philippine endemic and endangered plant species such as *Nepenthes copelandii* Merr. ex Macfarl., *Paphiopedilum adductum* Asher, *Rhododendron kochii* Stein, and *Shorea polysperma* Merr. (Amoroso and Aspiras 2011). During the course of general collecting, specimens initially identified as *Burmannia* were obtained. Part of this collection was later determined to be *Gymnosiphon* by the presence of an unwinged ovary with prominent locular glands, parietal placentation, and a deciduous perianth limb. Merrill (1924, p. 251) excluded *G. aphyllus* from the Philippines and no other species were listed for the archipelago. The recently named *G. philippinensis* Pelser, Salares & Barcelona (Pelser et al. 2019), collected on limestone substrate in southern Cebu, is apparently the first documentation of this genus in the Philippines (Pelser et al. 2011 onwards). Those authors concluded that this taxon represented a new species based on a manual comparison to the morphologies of other Asian *Gymnosiphon* species. A similar method was used in Gray et al. (2019) for *G. queenslandicus* Gray, Mahyuni & Low.

The present study presents results from cladistic and phenetic analyses that were used to assist the process of determining the distinctiveness of the Hamiguitan taxon as compared to previously described species. Moreover, these data also provided information about species boundaries in *Gymnosiphon* section *Gymnosiphon* Urb. This was deemed necessary given the different taxonomic concepts for Asian and Australian *Gymnosiphon* species as published by different authors over the past century (Fig. 1). The matrices constructed included continuous (quantitative) and categorical (qualitative) characters and these were analyzed separately and in a concatenated matrix. The separate analyses were conducted to determine if similar relationships emerged no matter what the partition or method of analysis. Ideally, these morphological data should be examined in the context of a molecular phylogeny of the species, but the only published studies of this type (Merckx et al. 2006, 2008) sampled just one Asian species (*G. aphyllus* Blume) among the 11 accessions included.

Blume 1827	Beccari 1878	Smith 1909	Schlechter 1913	Jonker 1938	Tuyama 1940	Pelser et al. 2019	Gray et al. 2019
<i>G. aphyllum</i>	<i>G. borneense</i>		<i>G. pedicellatum</i>	<i>G. aphyllum</i>	<i>G. nana</i>		
	<i>G. papuanus</i>		<i>G. celebicum</i>	<i>G. papuanus</i>			
		<i>G. affine</i>	<i>G. torricellense</i>	<i>G. affinis</i>			
			<i>G. minahassae</i>	<i>G. minahassae</i>			
			<i>G. oliganthum</i>	<i>G. oliganthum</i>			
			<i>G. pauciflorum</i>	<i>G. pauciflorus</i>			
				<i>G. neglectus</i>			
					<i>G. okamotoi</i>		
						<i>G. philippinensis</i>	
							<i>G. queenslandicus</i>

**Figure 1.** Species concepts over time in Asian and Australian *Gymnosiphon*. Names shaded with the same color represent synonyms of the same species according to Jonker (1938). The two taxa named by Tuyama (1940) were not included in this study. The synonymy of *G. nana* (*nanus*) is based upon World Plants Online (2020).

## Materials and methods

### Field work

Flowering individuals of the Mt. Hamiguitan *Gymnosiphon* taxon were photographed *in situ*. Collections were dried and pressed as herbarium vouchers (no. 1314) and tissue was dried in silica gel for later DNA extraction and sequencing. A few individuals were also placed in bottles containing 70% ethanol for later examination. Dissection and photography of the fixed tissues was accomplished with an Olympus SZH-10 stereomicroscope fitted with a Leica MC190HD digital camera.

### Character scoring

For comparisons with other Asian and Australian *Gymnosiphon* species, descriptions and illustrations from the primary literature were examined. The taxa *G. nanus* (Fukuy. & T.Suzuki) Tuyama from Orchid Island and *G. okamotoi* Tuyama from Republic of Palau were not included because their protologues were obtained after manuscript submission. From these a list of characters that appeared taxonomically useful was compiled. The original observations for this study as well as information from the literature were compiled in an Excel spreadsheet (Suppl. material 1: Table S1). These were mainly from (Jonker 1938, 1948) and Schlechter (1913) as well as the descriptions of *G. aphyllum* by Beccari (1878) and Smith (1922). Three species (*G. minahassae* Schltr., *G. oliganthus* Schltr., and *G. pauciflorus* Schltr.) were only collected once thus the taxon descriptions of Schlechter and Jonker (who examined the same specimens) were consolidated. For *G. affinis* J.J.Sm., *G. aphyllum* Blume and *G. papuanus* Becc., the descriptions and taxonomic views differed among Blume, Schlechter and Jonker, thus, they were considered separately (see Fig. 1).

Twelve continuous (i.e. quantitative) and 12 categorical (i.e. qualitative, discrete) characters were used (Tables 1, 2, respectively). Schlechter (1913) provided both quantitative and qualitative characters in his descriptions, albeit not consistently for all structures and species. Photographs of the six types used by Schlechter are available for examination at BGBM (Berlin). These images have sufficient resolution to allow some characters to be scored, e.g. lengths of scale leaves, flowers, and fruits. Some data were obtained for quantitative characters not explicitly mentioned in the literature by extrapolating from drawings. This was justified because the sizes of some structures (e.g. flower length) mentioned in the articles could be confirmed from the herbarium specimen image. From the type photos, measurements were taken from as many structures as possible and the mean values recorded. The use of original author descriptions to generate the categorical characters posed some difficulties because each employed different terminology. The following is a brief listing of the continuous (0–11) and categorical (12–23) characters used in this study. For additional discussion of these characters, see Suppl. material 2: File S2.

**Table 1.** Continuous characters 0–11 for *Gymnosiphon* taxa used in this study. Top line is currently accepted name, bottom line is source of descriptive data and in some cases synonyms. The top number represents the ln-transformed standardized range (0 to 10), the bottom number the observed range. Missing data are shown as “?”.

Taxa/Characters	0	1	2	3	4	5	6	7	8	9	10	11
<i>G. affinis</i> J.J. Sm.	5.170	2.369	4.531	7.112	3.479	5.532	0.000	0.000	?	0.000	3.856	2.609
(Jonker 1938)	2.398	0.916	1.099	1.253	1.946	1.253	0.916	0.470	?	0.916	1.447	1.099
<i>G. affinis</i> J.J. Sm.	5.170	6.915	1.123	3.673	3.479	4.950	8.480	4.563	0.988	5.305	10.000	0.000
( <i>G. torricellensis</i> Schlechter 1913)	2.398	1.118	0.693	0.693	1.946	1.194	1.504	0.924	0.668	1.131	1.668	0.956
<i>G. aphyllus</i> Blume	5.530	?	5.827	7.112	6.280	4.008	8.797	5.621	?	2.795	6.058	4.890
( <i>G. borneensis</i> Becc.)	2.442	?	1.253	1.253	2.140	1.099	1.526	1.030	?	1.030	1.526	1.224
<i>G. aphyllus</i> Blume	6.520	1.915	4.531	9.304	7.105	5.532	8.797	4.239	2.835	3.660	0.150	8.568
( <i>G. pedicellatum</i> Schlechter 1913)	2.565	0.896	1.099	1.609	2.197	1.253	1.526	0.892	0.756	1.065	1.314	1.426
<i>G. aphyllus</i> Blume	5.873	?	5.332	10.000	7.578	5.245	7.655	3.861	0.773	9.669	0.000	10.000
(Smith 1909)	2.485	?	1.194	1.723	2.230	1.224	1.447	0.854	0.658	1.308	1.308	1.504
<i>G. aphyllus</i> Blume	7.119	4.513	?	7.933	7.885	5.532	8.480	4.073	?	4.497	2.169	6.676
(Jonker 1938)	2.639	1.012	?	1.386	2.251	1.253	1.504	0.875	?	1.099	1.386	1.322
<i>G. minabassae</i> Schlechter	4.795	4.676	3.951	6.165	4.475	2.594	7.824	6.513	3.225	2.795	2.992	1.864
(Schlechter 1913)	2.351	1.019	1.030	1.099	2.015	0.956	1.459	1.118	0.775	1.030	1.416	1.058
<i>G. neglectus</i> Jonker	4.600	4.513	10.000	0.000	3.479	4.008	2.630	2.241	10.000	4.497	?	2.609
(Jonker 1938)	2.327	1.012	1.749	0.095	1.946	1.099	1.099	0.693	1.099	1.099	?	1.099
<b><i>G. sycerosensis</i> Nickrent</b>	4.401	5.316	4.390	2.853	3.479	4.008	0.000	0.900	4.351	5.305	2.169	4.346
( <i>G. sp.</i> 1314, this ms.)	2.303	1.047	1.082	0.560	1.946	1.099	0.916	0.560	0.829	1.131	1.386	1.194
<i>G. oliganthus</i> Schlechter	2.341	5.551	2.998	6.165	0.000	0.000	4.854	7.862	0.445	0.000	2.169	1.022
(Schlechter 1913)	2.048	1.058	0.916	1.099	1.705	0.693	1.253	1.253	0.642	0.916	1.386	1.012
<i>G. papuanus</i> Becc.	4.401	4.513	5.204	0.000	4.475	2.206	10.000	7.862	?	0.000	6.951	4.068
(Jonker 1938)	2.303	1.012	1.179	0.095	2.015	0.916	1.609	1.253	?	0.916	1.558	1.179
<i>G. papuanus</i> Becc.	6.203	10.000	3.800	0.000	3.479	0.761	6.415	5.657	2.238	0.967	2.652	0.755
( <i>G. celebicum</i> Schlechter 1913)	2.526	1.256	1.012	0.095	1.946	0.770	1.361	1.033	0.728	0.956	1.404	0.997
<i>G. pauciflorus</i> Schlechter	1.519	0.000	5.827	0.000	5.406	1.164	10.000	10.000	0.224	4.497	3.856	2.116
(Schlechter 1913)	1.946	0.811	1.253	0.095	2.079	0.811	1.609	1.466	0.631	1.099	1.447	1.072
<i>G. philippinensis</i> Pelsler et al.	0.000	9.284	6.844	2.853	5.406	4.950	7.485	4.031	5.332	8.298	8.379	1.991
(Pelsler et al. 2019)	1.758	1.224	1.374	0.560	2.079	1.194	1.435	0.871	0.875	1.253	1.609	1.065
<i>G. queenslandicus</i> Gray et al.	2.598	6.469	1.533	1.906	4.475	3.326	7.991	5.799	0.000	4.497	2.169	2.609
(Gray et al. 2019)	2.079	1.099	0.742	0.405	2.015	1.030	1.470	1.047	0.621	1.099	1.386	1.099
<i>G. suaveolens</i> (H.Karst) Urb.	10.000	6.469	0.000	9.304	10.000	10.000	5.850	0.187	1.202	10.000	9.736	7.853
(Maas-van de Kamer 1998)	2.996	1.099	0.560	1.609	2.398	1.705	1.322	0.489	0.678	1.322	1.658	1.386

**Table 2.** Categorical characters 12–23 for *Gymnosiphon* taxa used in this study. Top line is currently accepted name, bottom line is source of descriptive data and in some cases synonyms. Missing data are shown as “?”.

Taxa/Characters	12	13	14	15	16	17	18	19	20	21	22	23
<i>G. affinis</i> J.J. Sm. (Jonker 1938)	0,1	?	0	?	1	0	3	1	1	0	1	0
<i>G. affinis</i> J.J. Sm. ( <i>G. torricellensis</i> Schlechter 1913)	0	0	2	0	1	0	3	2,3	0	1	1	0
<i>G. aphyllus</i> Blume ( <i>G. borneensis</i> Becc.)	1	?	2	?	1	?	0,1	0,1	0	?	0	0
<i>G. aphyllus</i> Blume ( <i>G. pedicellatum</i> Schlechter 1913)	1	3	0	1	1	1	2	1	0	3	0	0
<i>G. aphyllus</i> Blume (Smith 1909)	0,1	3,4	0	1	1	?	1	1	0	3	0	0
<i>G. aphyllus</i> Blume (Jonker 1938)	0,1	?	0	?	1	1	0,1	0	0	1	0	0
<i>G. minahassae</i> Schlechter (Schlechter 1913)	0	3	2	1	0	1	1	1	0	?	0	0
<i>G. neglectus</i> Jonker (Jonker 1938)	2	3	2	0	1	0	0	0	1	3	0	0
<b><i>G. syceosensis</i> Nickrent</b> ( <i>G. sp.</i> 1314, this ms.)	1	1	0	0	1	1	4	2	0	3	0	0
<i>G. oliganthus</i> Schlechter (Schlechter 1913)	0	0	2	1	1	1	4	1,2	0	1	0	0
<i>G. papuanus</i> Becc. (Jonker 1938)	0,1	?	0,2	?	0	1	0	?	1	1,2	1	0
<i>G. papuanus</i> Becc. ( <i>G. celebicum</i> Schlechter 1913)	1	0	0,2	0	0	1	0	1	1	2	1	0
<i>G. pauciflorus</i> Schlechter (Schlechter 1913)	0	1	2	0	0	1	0	1	1	2	0	0
<i>G. philippinensis</i> Pelsner et al. (Pelsner et al. 2019)	1	2	1	1	0	0	0	0	1	0	1	0
<i>G. queenslandicus</i> Gray et al. (Gray et al. 2019)	1	0	0	0	1	1	3	3	1	0	0	0
<i>G. suaveolens</i> (H.Karst) Urb (Maas-van de Kamer 1998)	1	4	0	0	0	1	4	1	1	2	0	1

- 0 Plant height (cm);  
1 Leaf length (mm);  
2 Floral bract length (mm);  
3 Pedicel length (mm);  
4 Flower length (mm);  
5 Outer perianth lobe length (mm);  
6 Floral tube length (mm);  
7 Ratio floral tube to outer perianth lobe length;  
8 Ratio outer perianth lobe length to width;  
9 Ovary length (mm);  
10 Fruit length (mm);  
11 Persistent floral tube length (mm);  
12 Inflorescence type: (0) simple cyme, (1) bifid cyme, (2) capitate;  
13 Outer perianth lobe outline including marginal lobes: (0) orbicular, (1) broadly ovate, (2) ovate, (3) rectangular, (4) broadly obtrulate;

- 14 Outer perianth lobe outline without lateral lobes: (0) ovate, (1) narrowly ovate, (2) triangular;
- 15 Outer perianth lobe margin to apex: (0) below apex, (1) equal apex;
- 16 Outer perianth lobe margin: (0) entire, (1) crenate;
- 17 Outer perianth lobe color: (0) white, (1) violet;
- 18 Inner perianth lobe shape: (0) linear, (1) lanceolate, (2) ovate, (3) obovate, (4) cuneate;
- 19 Inner perianth lobe apex: (0) acute, (1) obtuse, (2) truncate, (3) 3-lobed;
- 20 Position of stamens in floral tube: (0) just below inner perianth lobe, (1) between inner perianth lobe and ovary;
- 21 Connective shape: (0) quadrangular, (1) triangular, (2) forked, (3) elliptic;
- 22 Connective apiculate: (0) no, (1) yes;
- 23 Stigma appendages: (0) no, (1) yes.

## Analyses

Sizes reported in the literature as ranges were converted to median values. Means were calculated from original observations from the Hamiguitan samples as well as measurements taken from the BGBM photographs. Data matrices containing the untransformed data were constructed in Mesquite (Maddison and Maddison 2018) and exported as Nexus and TNT (Tree Analysis using New Technology) files for downstream analyses (Goloboff et al. 2008; Suppl. material 3: File S3). The categorical characters were used “as is” in later analyses whereas the continuous character mean values were natural log-transformed  $[\ln(x+1)]$  and range-standardized  $[x_s = (x - \min/\max - \min) \times 10]$  as outlined in Thiele (1993) with Microsoft Excel. All characters were treated as unordered.

Uncorrected distances for the transformed continuous character matrices were generated using Mesquite. Neighbor-joining (NJ) was performed separately on this matrix and the “as is” categorical character matrix using PAUP\* (Swofford 2002). Maximum parsimony (MP) analyses of the categorical data were conducted with PAUP\*. The neotropical species *Gymnosiphon suaveolens* was chosen as the outgroup for all analyses because ancestral area analyses suggests the genus originated in the New World and took a boreotropical migration route to the Old World (Merckx et al. 2008). MP analyses of the continuous and concatenated (continuous plus categorical) data matrices were conducted with TNT. The log-transformed standardized continuous characters were optimized as additive with Farris (1970) optimization. The search routine as implemented in “aquickie.run” finds optimal scores 20 times independently by using defaults of “xmult” plus 10 cycles of tree-drifting (Goloboff 1999). For strict consensus calculation, TBR (tree bisection reconnection) collapsing was used (Goloboff and Farris 2001). The direction and magnitude of change for the continuous characters was determined by using the TNT command *blength* for each of the 11 characters. Bremer (1994) support values (decay indices) were calculated which represent the difference (number of steps) between the score of the most parsimonious tree and the next most parsimonious tree where the node in question is lost.

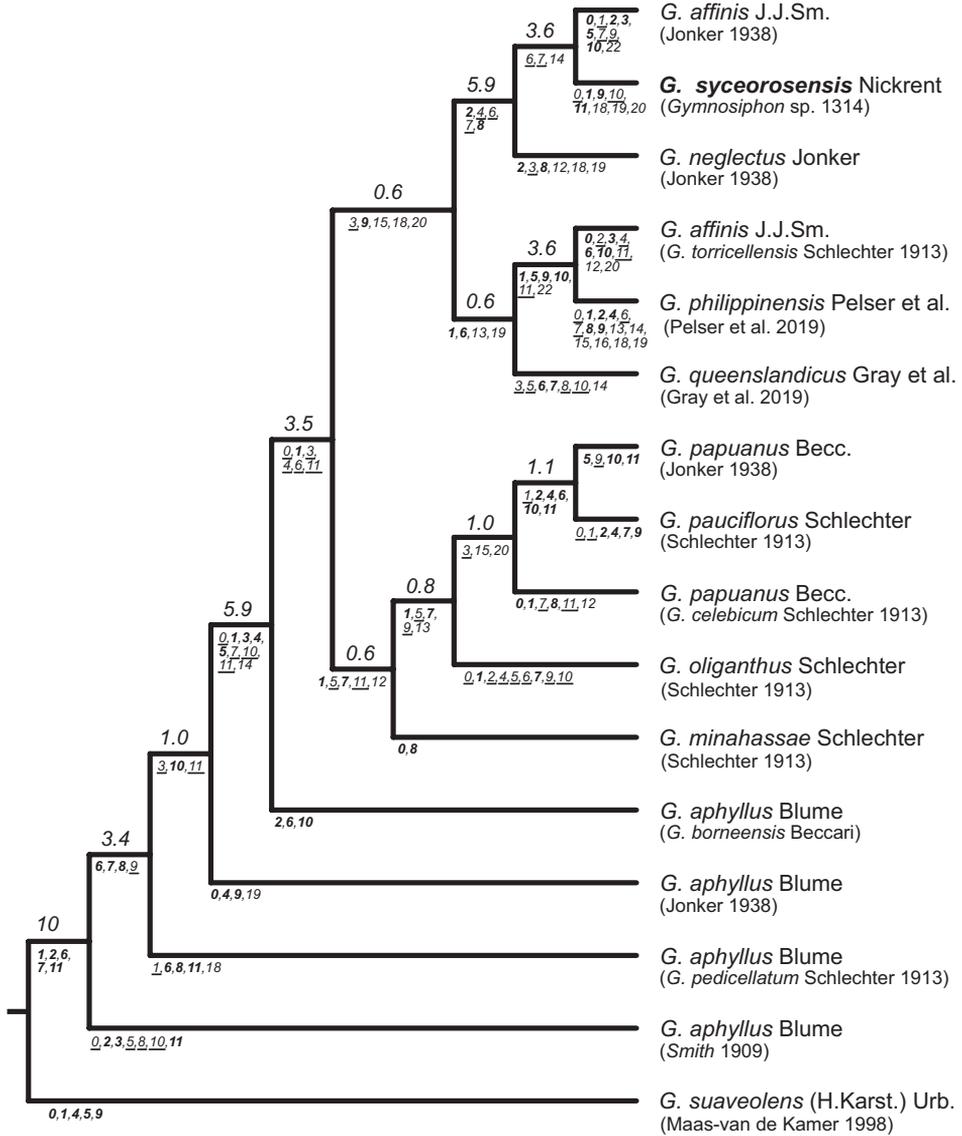
## Results and discussion

The MP strict consensus tree from the concatenated continuous and categorical data matrices analyzed with TNT (Fig. 2) contains clades with varying degrees of support as measured by Bremer decay index values. The four *Gymnosiphon aphyllus* terminals are present as a grade at the base of the tree. A well-supported clade (Bremer decay index > 5 steps) is composed of *G. aphyllus* (*G. borneensis* Beccari) and all remaining species. A clade composed of *G. minabassae*, *G. oliganthus*, *G. pauciflorus* and the two *G. papuanus* terminals is present, but with a Bremer index of < 1 step. Bremer support was higher (> 3 steps) for the sister relationship between *G. affinis* (*G. torricellensis* Schlechter) and *G. philippinensis*. This clade was then sister to *G. queenslandicus*, but with lower Bremer support. Finally, a well-supported clade (> 5 steps) was recovered containing *G. neglectus*, *G. affinis* Jonker and *Gymnosiphon* sp. 1314.

The above results can be compared to those obtained when the continuous and categorical characters are analyzed separately using phenetic and MP methods (Suppl. material 4: File S4). A number of relationships shown in Fig. 2 are recovered as clusters (Suppl. material 4: File S4A) or clades (Suppl. material 4: File S4B) when the continuous characters are analyzed separately. These include the grade of *G. aphyllus*, the clade of *G. papuanus* Becc. and *G. pauciflorus*, the clade *G. affinis* (*G. torricellensis*) and *G. philippinensis*, and the clade of the new taxon *Gymnosiphon* sp. 1314 with *G. affinis* J.J. Sm. and *G. neglectus*. The taxa *G. minabassae*, *G. oliganthus*, and *G. papuanus* (*G. celebicum* Schlechter) emerged as a grade in the TNT analysis (Fig. 2) but as a cluster or clade (Suppl. material 4: File S4A, B, respectively) when continuous characters were analyzed alone. Analysis of the categorical characters separately (Suppl. material 4: File S4C, D) resulted in topologies that differed substantially from the TNT results (Fig. 2).

Overall, it appears that a greater contribution to the tree shown in Fig. 2 came from the continuous, not categorical characters. Both NJ and MP analyses of this data partition recovered similar groupings as compared with the concatenated dataset analyzed with MP in TNT. When apomorphies are plotted on the strict consensus tree, the majority (60%) are autapomorphic (confined to the terminals). Of the 66 synapomorphies, only 11 are categorical characters. This study demonstrates that greater resolution can be obtained by including continuous characters, which has been shown in empirical studies (e.g. Hardy et al. 2008) as well as simulations (Parins-Fukuchi 2017).

The type species for the genus, *Gymnosiphon aphyllus*, may be the earliest diverging member among the Asian species. The variation in descriptive data (Suppl. material 1: Table S1) probably results from different taxonomic terminology and interpretation of the morphology as well as real polymorphism that exists among populations of this widespread taxon. The first explanation can be demonstrated by comparing the descriptions of Schlechter and Jonker who both examined the same specimens. The four *G. aphyllus* terminals did not form a clade with MP or a cluster with NJ in any of the analyses. Jonker (1938) lumped *G. borneensis* Beccari and *G. pedicellatus* Schlechter into *G. aphyllus* Blume (Fig. 1). Because of their weak association, further study



**Figure 2.** Maximum parsimony cladogram derived from the concatenated continuous and categorical data matrices. Below the currently accepted taxon names are the sources of descriptive data and in some cases synonyms (see Suppl. material 1: Table S1). Numbers above branches are Bremer support values. Numbers below the nodal branches are unambiguous synapomorphies that occurred on every tree. Characters 0–11 are continuous, 12–23 categorical. For the continuous characters, increases are shown in bold, decreases as underlined fonts. Taxon names follow Jonker (1938, 1948) plus two recently named taxa (*G. philippinensis* and *G. queenslandicus*).

of original material from all of these taxa is required to justify any decision regarding lumping or splitting. Because species boundaries cannot easily be determined from morphology alone, a molecular phylogenetic study of all these taxa is required.

The clade composed of *G. minhassae*, *G. oliganthus*, *G. papuanus* and *G. pauciflorus* (Fig. 2) has nearly the same composition as the group formed from NJ of continuous characters (Suppl. material 4: File S4A), with the exception that the latter contains *G. queenslandicus*. *Gymnosiphon pauciflorus* is sister to *G. papuanus* and that clade sister to *G. papuanus* Becc. that was considered *G. celebicum* by Schlechter (Fig. 2). To avoid a paraphyletic *G. papuanus*, one could lump *G. pauciflorus* into *G. papuanus* or recognize three species. *Gymnosiphon pauciflorus* shares several features with *G. papuanus* (Suppl. material 1: Table S1), including characters states such as entire outer perianth lobe margins, linear inner perianth lobes, the position of stamens in the floral tube and forked connectives. Differences that were used in the key by Jonker include the number of flowers in the inflorescence, a meristic character not used here because of extreme variation and overlap. For these two taxa, Jonker (1938) indicates “3-many” for *G. papuanus* and “1–3” for *G. pauciflorus*. Because the latter was collected only once (Schlechter 16653), this taxon could represent a few-flowered variant of *G. papuanus*. Interestingly, the species nearest to *G. pauciflorus* in the Jonker key was *G. neglectus* that occurs in a distant clade in Fig. 2.

Jonker (1938) combined *G. torricellensis* with *G. affinis*, describing the type of the former as “incomplete material but very probably belonging to this species.” With reference to *G. torricellensis*, Schlechter (1913) wrote (translated from German): “Of all the species hitherto known from the monsoon area, the present one is well differentiated by the broad, slightly three-lobed petals, and by the anthers.” The description in that work was complete (Suppl. material 1: Table S1) and analysis of this taxon with the description of *G. affinis* from Jonker (1938) results in the two being present in two different clades (Fig. 2). This result was consistent across all partitions and analytical methods. The two taxa differ in several taxonomic characters including outer perianth lobe margin, inner perianth lobe shape and apex, position of stamen in floral tube, connective shape, and ratio of floral tube to outer perianth lobe length. For this reason, it seems prudent to maintain these two taxa as different species. The taxon *Gymnosiphon okamotoi* Tuyama was not included in these analyses; however, after examining its description and illustration (Tuyama 1940), it is clear this species has strong affinity with *G. affinis* and may even be conspecific with it.

The results of the present study agree with the assessment by Gray et al. (2019) that *Gymnosiphon queenslandicus* is closely related to *G. affinis* s. lat., which is reflected with the categorical but not the continuous characters. Although *G. torricellensis* occurs together with *G. philippinensis* and *G. queenslandicus*, Bremer support for that clade is relative low. Gray et al. (2019), who examined one of the type collections of *G. affinis* (Versteeg 1425) noted that the position of the stamens was illustrated incorrectly in Smith (1909) and that they actually occur below the middle of the floral tube. This character state also occurs in *G. neglectus* and *G. philippinensis* but not *G. torricellensis* and *Gymnosiphon* sp. 1314. Whether this feature changes through floral developmental (bud through anthesis) should be investigated, although for *G. affinis*, Jonker (1938 p. 31) says that even in very young buds there is still “lowly” insertion of the stamens.

*Gymnosiphon* sp. 1314 is clearly not conspecific with *G. philippinensis* because it differs in many character states such as outer perianth lobe margin, flower color, inner perianth lobe shape, position of the stamens in the floral tube, and length of the floral

tube relative to the outer perianth lobe. NJ and MP of the continuous characters and the combined data analyses place it as sister to *G. affinis* with good Bremer support, but this relationship was not seen with analyses of the categorical characters. The unique combination of character states justifies describing the Hamiguitan taxon as a new species.

## Taxonomy

### *Gymnosiphon syceorosensis* Nickrent, sp. nov.

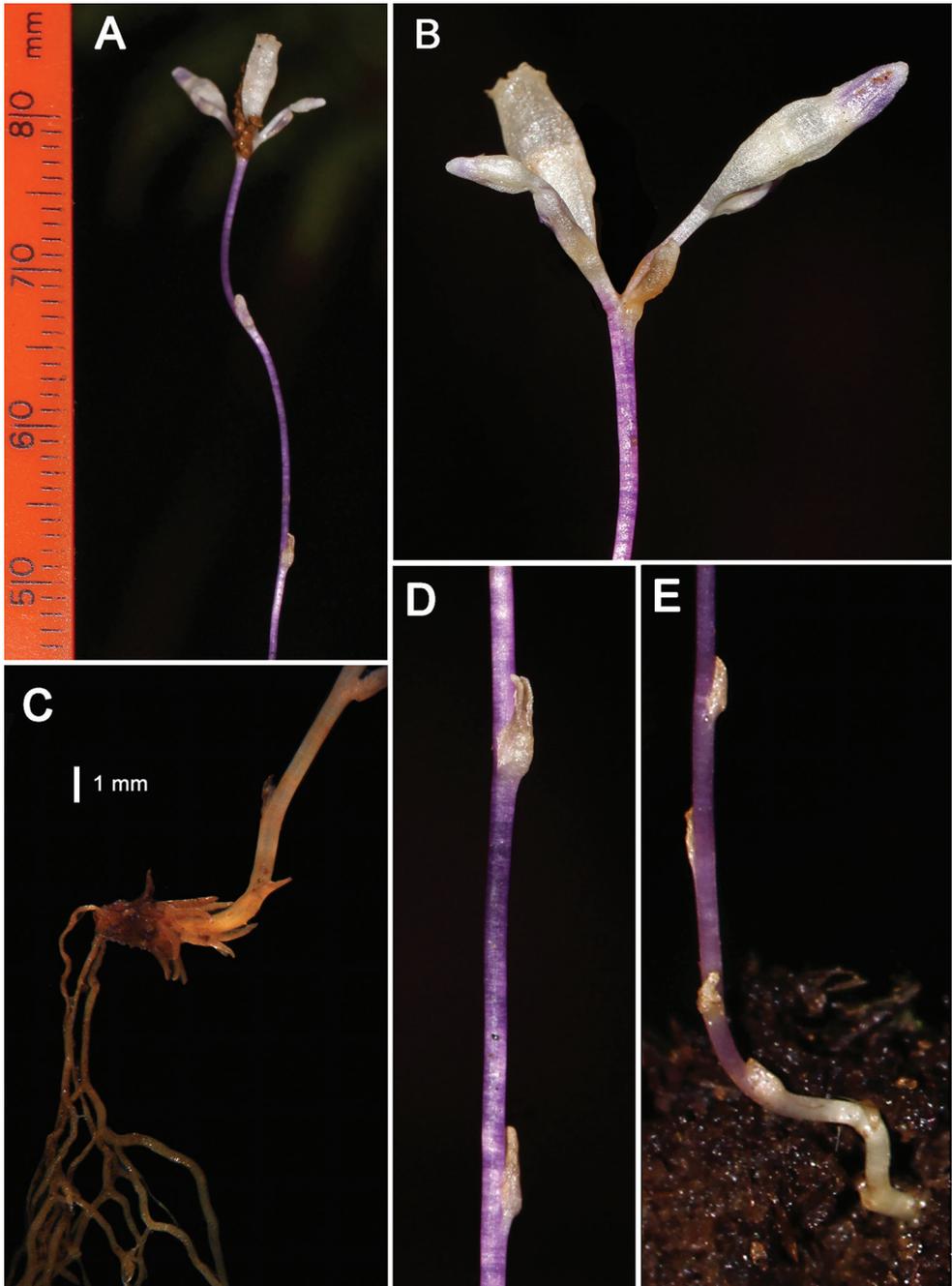
urn:lsid:ipni.org:names:77209567-1

Figs 3, 4

**Type.** PHILIPPINES. Davao Region, Davao Oriental Province, Municipio San Isidro, Barangay La Union, Mt. Hamiguitan Range Wildlife Sanctuary, 6°43.819'N, 126°10.757'E, elev. 1184 m, 18 June 2019, *Plants & Lichens of the Southern Philippines Survey* no. 1314 (holotype: BRIT, isotypes: CMUH, SIU).

**Diagnosis.** Similar to *G. affinis* J.J. Sm. s. str. but differing in the outer perianth lobe color (white and violet vs. pure white), inner perianth lobe shape (cuneate vs. obovate), stamen position in floral tube (just below inner lobe vs. below middle of perianth), connective shape (elliptical vs. quadrangular), and connective apex (not apiculate vs. apiculate).

**Description.** Erect holomycoheterotrophic herb 5–10 cm tall, glabrous, achlorophyllous. Rhizome below ground, horizontal, cylindrical, 2–6 mm long, ca. 1.0 mm wide, with few short branches, covered in numerous patent, subulate scale leaves, 1–2 × 0.2–0.3 mm. Roots highly branched, contorted, 0.05–0.2 mm in diameter, lacking root hairs. Stems solitary or with a few basal branches, erect, purple, terete, 0.5 mm wide, internodes 0.3–1.5 cm long. Scale leaves sparse, spiral on stem, sessile, appressed, light tan, narrowly ovate, 1.5–2.2 mm long, base clasping ca. half the stem circumference, apex acute. Inflorescence terminal, bicinnate (biparous cymose), terminal prophyll with two branches, each branch (peduncle) ca. 2.5 mm long, two-flowered, monochasial. Flowers erect, actinomorphic, mature buds ca. 6.0 mm long. Pedicel up to 1.0 mm long, floral bracts broadly ovate, 1.8–2.1 mm long, entire, apex obtuse. Outer perianth lobes (limbs) 3, valvate, light purple, ca. 2.0 mm long, outline (including central and lateral lobes) broadly ovate, central lobes narrowly ovate, apex acute, cucullate, lateral lobes induplicate in bud, not reaching apex of central lobe, margins somewhat crenate, wavy, undulate; floral tube white, 1.5 mm long, 1.5 mm wide, slightly constricted at junction with limbs; limbs circumscissile, caducous, separating from the top of the floral tube which persists on the fruit. Inner perianth lobes 3, inserted just below limb sinuses, cuneate, slightly folded lengthwise, ca. 0.3 mm long, apex truncate, mucronate. Anthers essentially sessile, inserted ca. 0.2 mm below insertion of inner perianth lobes, bilocular, tetrasporangiate, quadrangular in outline, ca. 0.7 mm wide; connectives narrowly elliptical in face view, projecting slightly above apex of thecae. Style cylindrical, ca. 1.8 mm long (including stigma), apical portion 3-lobed,



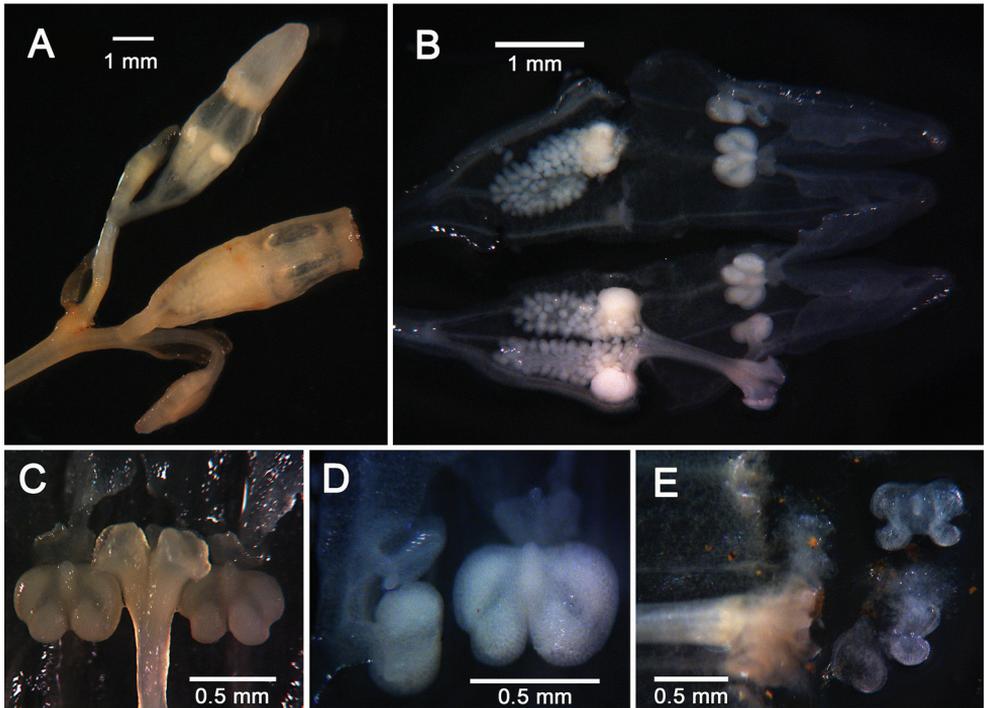
**Figure 3.** *Gymnosiphon syceorosensis* sp. nov. **A** upper portion of the plant with a young fruit in the central position of the bifid cyme. The entire plant was ca. 10 cm high **B** closer view of the flower buds and young fruit **C** underground portion of the plant (fixed in alcohol) showing short rhizome with scale leaves, exogenous roots, and basal part of aerial stem **D** closer view of stem scale leaves **E** base of aerial stem where it emerges from the soil. Photos **A, B, D, E** by Michael Galindon. Photo **C** by DLN.

ca. 0.7 mm wide, style branches ca. 0.3 mm long; stigma lobes hollow, funnellform, narrowly cordate (compressed laterally), ca. 0.2 mm wide, edge thickened, covered in minute papillae, apex lacking appendages. Ovary infundibuliform, ca. 2.1 mm long, 1.5 mm wide at apex, unilocular with three parietal placentae each bearing at their apices a prominent, spherical, 0.4 mm-wide gland. Fruit (immature) ca. 3.0 mm long (ovary portion), persistent floral tube cylindrical, ca. 2.3 mm long, bearing the remains of the stigmas and anthers.

**Distribution, habitat, and conservation.** *Gymnosiphon syceorosensis* is only known from the type collected in the tropical upper montane rainforest of Mt. Hamiguitan, Mindanao. The plant was found along the trail at 1184 m elevation, ca. 1 air km south of the summit of Mt. Hamiguitan. The substrate was predominantly ultramafic. This forest has the highest number of endemic and threatened plant species among the five vegetation types surveyed by Amoroso and Aspiras (2011). The habitat where this plant was found also contained other mycoheterotrophs such as *Burmannia lutescens* (a new record for this species for the Philippines) and *Sciaphila* sp. (Triuridaceae). Association of different mycoheterotrophs in one local area was mentioned by Schlechter (1913) and Pelsner et al. (2019). This phenomenon may reflect the ecological requirements of the fungi or the association of different plant species with one fungus (Maas-van de Kamer 1998). The latter seems to be supported for Burmanniaceae where that family as well as Gentianaceae and Triuridaceae have been found associated with Glomerales and Diversisporales (Hynson and Bruns 2010). Because only one population of *G. syceorosensis* was discovered, no estimation of its abundance or overall distribution can be made. It, like most *Gymnosiphon* species, is likely rare in nature, but because it is inconspicuous, it is likely undercollected. Until further work can be undertaken to determine how many populations of *G. syceorosensis* exist, the conservation status of this species should at this time be considered Data Deficient (DD) according to the IUCN (2019). Note that the DD category does not imply that the taxon is not threatened.

**Etymology.** The specific epithet commemorates the Mt. Hamiguitan Range Wildlife Sanctuary. The word “hagimit” is Cebuano for “a small tree of primary forest with rough leaves: *Ficus* sp.” (Wolff 1972). Apparently the “g” and “m” consonants were switched (a common occurrence in Cebuano), thereby producing “hamigit”. Adding the suffix “-an” which mean “a place of” gives hamiguitan, i.e. “a fig tree place” or “a place with a fig tree”. When constructing the specific epithet for *Gymnosiphon*, the goal was to express “from fig-mountain”. Fig-tree is translated to Latin as “syce” (συκη, feminine) and mountain as “oros” (ὄρος, masculine), thus giving “syceoros” (Stearn 1992). Using one of the recommended adjectival endings for geographic epithets with a masculine termination yields “syceorosensis”.

It should be pointed that generic names derived from Greek that end in “-on” are often interpreted as neuter, however, according to ICN Art. 62.2, compound generic names take the gender of the last word in the nominative case in the compound. In this example, the Greek word element -siphon (σιφών) is masculine, thus the gender for all specific epithets of *Gymnosiphon* should be masculine. The type species was originally



**Figure 4.** *Gymnosiphon syceorosensis* sp. nov. **A** bifid cyme (bicinnate) showing older flower bud at top and young fruit below **B** fixed flower bud, sectioned longitudinally **C** closer view of the stigma flanked by two anthers **D** anther in longitudinal section (left) and in face view (right) showing position relative to inner perianth lobes **E** terminal portion of floral tube that is persistent on the fruit. Note the disintegrating stigma and anthers among the debris. All photos by DLN.

published by Blume (1827) as *G. aphyllum* (neuter), but this should be corrected to *G. aphyllus* (masculine).

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## Supplementary material 1

### Original morphological data derived from the literature and, for *Gymnosiphon syceorosensis*, from original observations

Author: Daniel L. Nickrent

Data type: statistical data

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Link: <https://doi.org/10.3897/phytokeys.146.48321.suppl1>

## Supplementary material 2

### List of continuous and categorical characters used for the *Gymnosiphon* taxa, with discussion

Author: Daniel L. Nickrent

Data type: statistical data

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Link: <https://doi.org/10.3897/phytokeys.146.48321.suppl2>

### Supplementary material 3

#### **TNT matrix used in this study with 12 continuous and 12 categorical characters**

Author: Daniel L. Nickrent

Data type: statistical data

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### Supplementary material 4

#### **Trees resulting from continuous and categorical characters analyzed separately using neighbor-joining (NJ) and maximum parsimony (MP) methods**

Author: Daniel L. Nickrent

Data type: statistical data

Explanation note: **File S4A.** NJ tree of continuous characters. **File S4B.** MP cladogram of continuous characters. **File S4C.** NJ tree of categorical characters. **File S4D.** MP cladogram of categorical characters.

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Link: <https://doi.org/10.3897/phytokeys.146.48321.suppl4>



# *Michaelmoelleria* (Gesneriaceae), a new lithophilous dwelling genus and species with zigzag corolla tube from southern Vietnam

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## Abstract

*Michaelmoelleria*, a new genus from southern Vietnam is described with a single species, *M. vietnamensis*. The new genus is morphologically most similar to *Deinostigma* and *Tribounia* but it differs from the latter two by having four fertile stamens. Nuclear ribosomal internal transcribed spacer (ITS) region and plastid *trnL-F* intron spacer (*trnL-F*) DNA sequence data from the new genus and eighty-seven species representing 42 genera within tribe Didymocarpeae are used to resolve its generic placement. The molecular evidence reveals that it is most closely related to *Cathayanthe* rather than *Deinostigma* and *Tribounia*. The chromosome number is counted as  $2n = 36$  that further clarified its distinction comparing to the related genera within tribe Didymocarpeae. A global conservation assessment is also performed and classifies *Michaelmoelleria vietnamensis* as Critically Endangered (CR).

\* These authors contributed equally to this work as first authors.

**Keywords**

*Cathayanthe*, cliff-dwelling, *Deinostigma*, Didymocarpoideae, flora of Vietnam, IUCN, phylogeny, *Tribounia*

**Introduction**

The generic delimitations in Asian Gesneriaceae are often ambiguous due to significant overlap in characters between genera (Burt 1977), which has led to many revisions including synonymization of small and monotypic genera (Möller et al. 2011a, b; Puglisi et al. 2011; Weber et al. 2011a, b; Möller et al. 2016) and establishment or resurrection of new or previously synonymized genera in recent years (Wei et al. 2010; Weber et al. 2011c; Middleton and Triboun 2012; Middleton and Möller 2012; Middleton et al. 2014, 2015, 2018). The combined phylogenetic-morphological approach was therefore performed as it takes both molecular and morphological evidence into account (Wei et al. 2010).

Vietnam comprises 331,000 km<sup>2</sup> situated on the eastern Indochinese Peninsula. The flora of Vietnam contains ca. 12,000 vascular plant species (Averyanov et al. 2003). Despite the high species diversity, it is still under-sampled, with only 43 collections per 100 km<sup>2</sup> (Middleton et al. 2019). Due to the status of uneven collection among the countries within Southeast Asia, Thailand, for example, has an estimate of 75 collections per 100 km<sup>2</sup> (Middleton et al. 2019) resulting in species richness and endemics of Gesneriaceae being much higher than those in Vietnam. Recently discovered new genera such as *Somrania* D.J.Middleton (Middleton and Triboun 2012), *Tribounia* D.J.Middleton (Middleton and Möller 2012), *Chayamaritia* D.J.Middleton & Mich. Möller (Middleton et al. 2015) and *Rachunia* D.J.Middleton & C.Puglisi (Middleton et al. 2018) further clarified this status. Besides, the uneven collection also seems to occur within Vietnam. Fu et al. (2019) reported no record of *Elatostema* from Vietnam's southernmost provinces and partially ascribed this pattern to unequal sampling effort across the country. Therefore, they proposed a more significant sampling effort in southern Vietnam.

As part of ongoing research into the diversity of Gesneriaceae in Vietnam, a group of botanists from the Vietnam National Museum of Nature (VNMN) and the Gesneriad Conservation Center of China (GCCC) undertook an extensive fieldtrip in southern Vietnam in 2018. A plant belonging to Gesneriaceae was collected in La stream, Tay Giang community, Tay Son district, Binh Dinh province, close to the belt of An Khe city, Gia Lai province, southern Vietnam (Fig. 1). Surprisingly, this unknown species was unable to be placed in any genus based on morphological characters. Superficially, it shares some similarities to *Deinostigma* and *Tribounia*, but would be easily distinguished from the former by its distinct characters of the long and zigzag corolla tube and rounded corolla lobes and from the latter by its four stamens and a 2-lobed stigma. To confirm the generic placement of this species,



**Figure 1.** Photos of the new genus, *Michaelmoelleria*, the population in natural habitat. *M. vietnamensis* F.Wen, Z.B.Xin & T.V.Do **A** habitat along the La stream **B** habit **C** plants in flower **D** frontal view of flower in natural habitat **E** lateral view of flower in natural habitat. Photos by Fang Wen, arranged by Wen-Hua Xu.

molecular and cytological experiments were also performed. After consulting the relevant literature (Wang et al. 1998; Ho 2000; Li and Wang 2005; Phuong 2005; Wei et al. 2010; Wen et al. 2019) along with the molecular and cytological evidence, we concluded that this new species was assignable to a new genus, *Michaelmoelleria* gen. nov. This new genus will be an addition to the ongoing project of ‘Flora of Vietnam’ and ‘Flora of Cambodia, Laos and Vietnam’.

## Materials and methods

### Ethics statement

The locations where this new species was collected were not in any protected area. No specific permissions were required to enter these areas. Our field studies did not involve any endangered or protected species. Special permits to conduct this research were not required.

## Material collection

This new species/genus has been monitored in the field by staff from the VNMN and grown by the authors at the nursery of the VNMN and the GCCC since the plants were collected. We also collected leaf materials of this proposed new species, using silica gel to dry them in the field for DNA extraction.

## Morphological observations and specimens examined

A study of the new genus *Michaelmoelleria* and the only currently known species, *M. vietnamensis*, from southern Vietnam, was undertaken. All available specimens of *Michaelmoelleria* are stored in the following herbaria in China and Vietnam: IBK and VNMN (herbarium acronyms according to Index Herbariorum; Thiers 2016, 2019). All morphological characters were studied using a dissecting microscope (SZX16, Olympus, Tokyo, Japan). Characteristics were described using the applicable terminology presented by Wang et al. (1998). The morphological comparison with other species was based on the study of living plants in the field, in cultivation in the VNMN and the GCCC, and herbarium specimens.

## Genomic DNA extraction, PCR amplification, and Sequencing

To confirm the placement of this new plant, we performed phylogenetic inference of DNA sequence data obtained from the nuclear ribosomal internal transcribed spacer (ITS) region and the plastid *trnL-F* intron spacer (*trnL-F*). Eighty-seven species representing 42 genera as in-group and two species representing one genus as an out-group, including nearly all genera within tribe Didymocarpeae, were sampled. DNA extraction, PCR amplification, and sequencing were performed, following Wei et al. (2013). Sequences obtained from this study and GenBank are listed in the Appendix I.

## Phylogenetic analysis

Sequence data were edited and assembled using Lasergene Navigator 7.1 (DNASTar, Madison, Wisconsin, USA). Cleaned sequences were aligned with Geneious R11 (Kearse et al. 2012). Regions of ambiguous alignment and sites with more than 80% missing data were excluded during analyses (Sun et al. 2018). Phylogenetic analyses were conducted using Bayesian inference (BI) and maximum likelihood (ML) methods. ITS and *trnL-F* datasets were used to construct the ML tree independently to evaluate the congruence between two makers. As there were no hard incongruences (Nishii et al. 2015), we performed the following analysis using a combined dataset.

Best-fit DNA substitution models were selected using the Akaike Information Criterion (AIC) in Modeltest v 2.7 (Posada and Crandall 1998). Modeltest determined the best models GTR + G + 1 for the combined dataset. BI analyses were based on a Markov chain algorithm implemented in MRBAYES 3.2.6 (Huelsenbeck and Ronquist 2001). Four chains of the Markov chain Monte Carlo (MCMC) simulation were performed for 4,000,000 generations, each with trees sampled every 100 generations. After discarding the first 25% of the trees, the retained ones were used to calculate the node probability (posterior probability). ML analyses with 1000 bootstrap resampling were conducted using an online version of RAxML-HPC2 v8.2.10 (Stamatakis et al. 2008), available at (<http://www.phylo.org/index.php/portal/>) (Miller et al. 2010) with the gamma model of rate heterogeneity.

### Chromosome preparations

Leaf cuttings yielded new root tips when grown hydroponically for 2–3 weeks. The new root tips were then pretreated with a solution of 0.002 mol·L<sup>-1</sup> 8-hydroxyquinoline at 13 °C for 4–5 h. After fixation for 24 h by Carnoy solution (3:1 ethanol: acetic acid) at 4 °C, dissociate, stain, and squash methods followed (Jong and Möller 2000, Christie et al. 2012). The chromosome numbers were determined in at least 20 cells from 10 different root tips with well-spread chromosomes in metaphase and captured using a light microscope (Leica DM 2500, camera Leica DFC420).

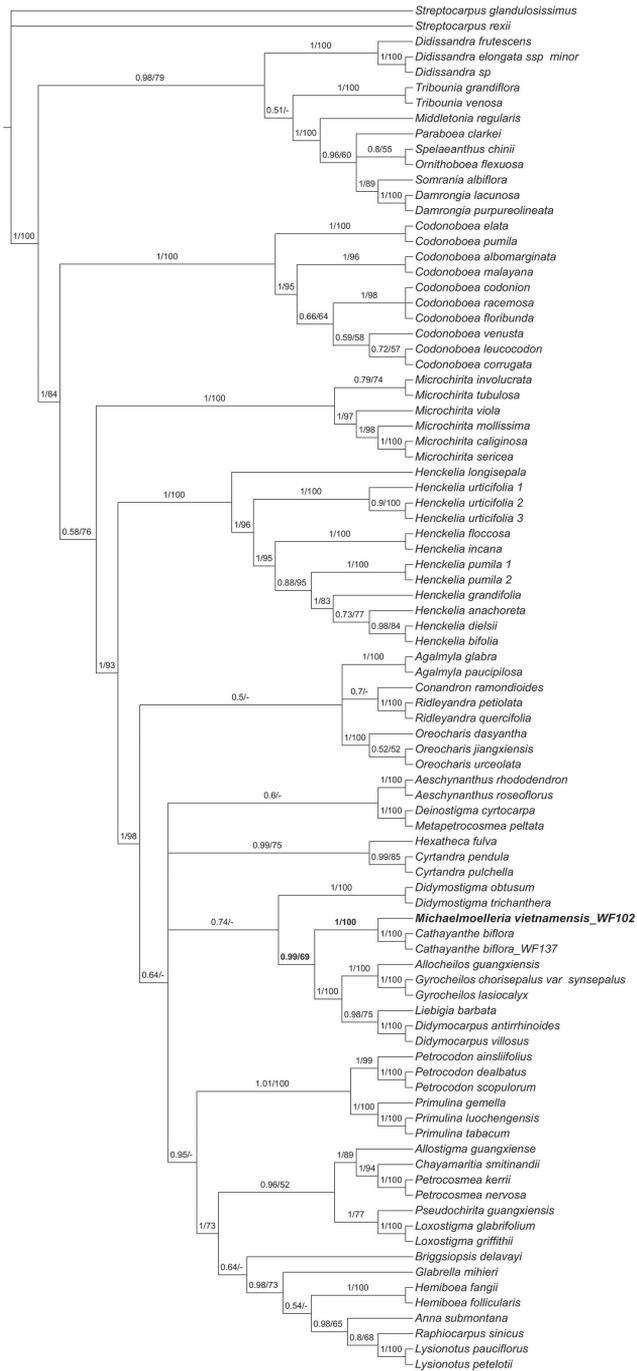
## Results

### Molecular phylogenetic studies

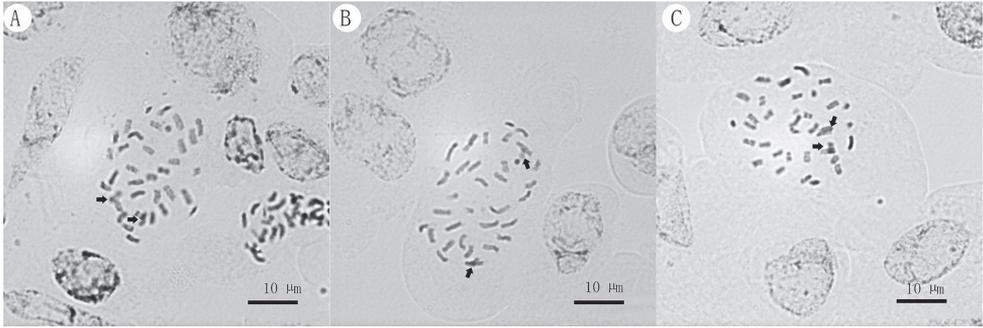
The aligned matrix of the combined data (80% missing data were excluded) was 1441 characters, 819 for *trnL-F*, and 622 for ITS. Of the 778 (54.0%) variable characters, 565 (39.2%) were parsimony-informative including indels. BI analysis of the combined dataset resulted in a consensus tree with a well-resolved backbone but included a large polytomy. The BI tree was largely compatible with the best ML tree (Fig. 2).

### Chromosome characteristics

We illustrated the somatic chromosomes of *Michaelmoelleria vietnamensis* at metaphase in Fig. 3. It possesses small chromosomes, falling in the range from 1.51 to 4.15 µm, and we identified the number of the somatic chromosomes as  $2n = 36$  (Fig. 3), with two relatively small satellites. The chromosomes are small, and the position of centromere could not be determined so that it would not be allowed a detailed karyotype analysis.



**Figure 2.** The Bayesian Inference 50% majority rule consensus tree from the combined dataset of *trnL-trnF* and ITS. Numbers on the branches indicate the posterior probability ( $\geq 0.5$ ) of Bayesian inference analysis and bootstrap values ( $\geq 50\%$ ) of the maximum likelihood. **BOLDFACE** indicates the new species/new genus. Created by Long-Fei Fu.



**Figure 3.** Somatic chromosomes at metaphase of *Michaelmoelleria vietnamensis* F. Wen, Z.B. Xin & T.V. Do,  $2n = 36$  **A–C** are from different cells, solid arrow and, satellites. Photos and arrangements by Lan-Ying Su.

## Ecology

Plants of the new taxon were mostly inaccessible, growing on vertical sandstone cliffs and the slope of sandstone hills under tropical evergreen broad-leaved forest. Voucher specimens were made in the usual way (Bridson and Forman 1998) from some accessible plants that could be reached from the base of the cliffs. The conservation assessment was prepared following IUCN (2019).

## Taxonomic treatment

### *Michaelmoelleria* F. Wen, Y.G. Wei & T.V. Do, gen. nov.

urn:lsid:ipni.org:names:77209568-1

**Diagnosis.** *Michaelmoelleria* resembles monotype genus *Cathayanthus*, but differs from the latter by leaf blade glabrous (vs. sericeous to pubescent in *Cathayanthus*, same as order followings); calyx actinomorphic (vs. zygomorphic); fertile stamens 4 (vs. 2), stigma 2, both developed ligulate (vs. 1, subcapitate, divided on 1 side); capsule long linear (vs. fleshy, narrowly ellipsoid). The new genus is also morphologically similar to *Deinostigma* and *Tribounia*, but is easily distinguished from both by having corolla tube narrowly curving to zigzag infundibuliform-tubular, and bent at about 90° angle in the middle of corolla tube (vs. infundibuliform in *Deinostigma*; of a narrow lower tube which widens into an infundibuliform & upper tube which has a prominent boss on the dorsal surface in *Tribounia*, same as order followings), fertile stamens number 4 (vs. 2; 2) and stigma 2-lobed, lobes often gathering together (vs. upper lip usually vestigial and only lower lip developing, broad, flat and weakly 2-lobed; capitate).

**Type and only known species.** *Michaelmoelleria vietnamensis* F. Wen, Z.B. Xin & T.V. Do, sp. nov.

**Description.** Herbs, perennial, epipetric, obvious flesh stem, rosette when young and elongated when aging. Leaves basal or clustered at the top of the stem when young but alternate on elongated aerial stem after years of growth; leaf blade ovate to elliptic, glabrous, base cordate to broadly cuneate, apex obtuse. Inflorescences lax, axillary, 1- or 2-flowered cymes; bracts 2. Calyx actinomorphic, 5-parted to the base. Corolla bluish purple to purple, zygomorphic, inside glabrous; tube obviously curved at the middle, dramatically enlarged to be trumpet-shaped from the middle of corolla tube toward limb, much longer than limb; limb 2-lipped; adaxial lip 2-lobed and abaxial lip 3-lobed, lobes rounded to oblate, apex rounded. Stamens 4, included; anthers basifixed, coherent in pairs, thecae divaricate, confluent at apex, dehiscent longitudinally; staminode 1. Disc annular. Ovary narrowly ellipsoid, 1-loculed; placentas 2, parietal, projecting inward and divaricate. Stigma 2, both developed and appressed, lobes ligulate. Capsule straight in relation to pedicel, linear, dehiscent loculicidally to base, splitting along one suture, straight, not twisted.

**Etymology.** *Michaelmoelleria* was named in honor of Prof./Dr. Michael Möller from the Royal Botanic Garden Edinburgh. He is a well-known botanist studying Old World Gesneriaceae, especially in Africa (Madagascar) and Asia (China), and mentor of the senior author from the 1990s to the present. “*Michaelmoeller-*” (means “Michael Möller”) stands for his full name. “*moeller*” is the English modification of the German family name, “Möller”. Initially, we planned to use “*Moelleria*” as the genus name. However, this name was used in different places three times. They are *Moelleria* Cleve (Bacillariophyta, incertae sedis) [non *Moelleria* Scop. (Spermatophyta, Flacourtiaceae) ( $\equiv$  *Iroucana* Aubl.)]; [nec *Moelleria* Bres. (Fungi, Clavicipitaceae) ( $\equiv$  *Moelleriella* Bres.)] [nec *Moelleria* (Freng.) Freng. (Bacillariophyta, Naviculaceae)] (Blanco and Wetzel 2016). Thus, to prevent confusion with those mentioned above, three existing and existed “*Moelleria*”, we consider that using the variant of Dr. Michael Möller’s full name, “*Michaelmoeller*”, to name this new genus to be most appropriate.

**Distribution and habitat.** Endemic to southern Vietnam, under broadleaved forests in a montane granite area at 140–200 m altitude.

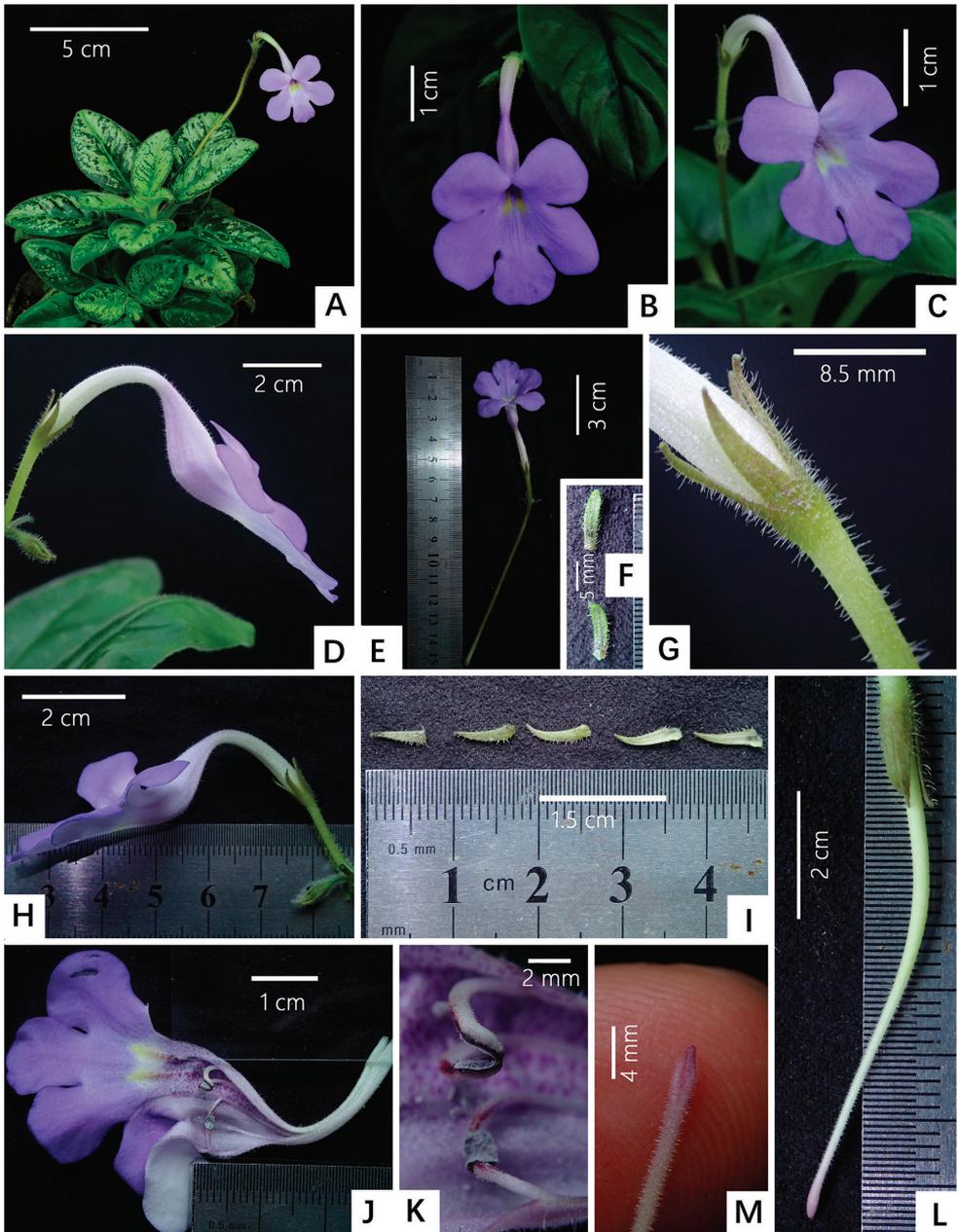
***Michaelmoelleria vietnamensis* F. Wen, Z.B. Xin & T.V. Do, sp. nov.**

urn:lsid:ipni.org:names:77209569-1

Figs 1, 4

**Type.** VIETNAM. Binh Dinh province, Tay Son district, Tay Giang community, La stream. 13°55'59"N, 108°45'43"E, ca. 148 m, WYG180329-01 (holotype: VNMN!, isotypes IBK!).

**Description.** Herbs perennial, rosette when young and stem obviously elongated after years of growth. Stem fleshy, cylindrical, 6–30 cm long, 4–6 mm in diameter, densely white pubescent when young, but glabrescent to glabrous when aging. Leaves alternate on elongated aerial stem, 12–20 cm or more, nearly clustered near the top of the stem and look opposite. Petiole 4–8.5 cm long, 3–3.5 mm in diameter, densely white pubescent. Leaf-blade slightly fleshy to thickly chartaceous, when dried flimsily



**Figure 4.** Photos of new genus, *Michaelmoelleria* F. Wen, Y.G. Wei & T.V. Do. *M. vietnamensis* F. Wen, Z.B. Xin & T.V. Do **A** flowering potted plant in GCCC's greenhouse **B** frontal view of the corolla and the corolla tube **C** different angles of a lateral view of corolla and corolla tube (I) **D** different angles of lateral view of the corolla and the corolla tube (II) **E** cyme **F** bracts (above: adaxial surface; below: abaxial surface) **G** calyx lobes **H** lateral view of flower and bud **I** calyx lobes (the left three: adaxial calyx lobes surfaces; the right two: abaxial calyx lobes surfaces) **J** opened corolla showing stamens and staminode **K** our fertile anthers **L** pistil and calyx **M** stigma. Photos by Fang Wen, arranged by Wen-Hua Xu.

chartaceous, ovate to elliptic, glabrous, green to dark green, usually with irregular silvery or argenteous spots on the adaxial surface, but silvery-brown to slight yellowish-brown in dry season, 4.5–7 × 2.5–4 cm, base marginally oblique, often slightly cordate, cordate to broadly cuneate, apex obtuse, margin entire, sinuate or with inconspicuously undulate teeth, adaxially and abaxially erectly puberulent; venation alternate along main vein, lateral veins 5–7 on each side of midrib. Cymes axillary near stem apex, fasciculate, 6–10 flowered per plant; peduncle slender, 8–15 cm long, 1–1.5 mm in diameter, brownish-green, densely erectly puberulent; bracts 2, ovate, both usually deflected to same side, 9.8–10.5 × 2.5–2.7 mm, adaxially sparsely puberulent, abaxially sparsely puberulent; 1-flowered and 2-flowered per cyme but one of both often abortive; pedicel 1.5–3 cm long, 1–1.2 mm in diameter, green to lime, sparsely extremely white puberulent. Calyx actinomorphic, 5-parted to the base, segments lanceolate to narrowly lanceolate, 8–8.5 mm long, 2–2.3 cm in diameter at the base, apex acute but top usually formed hammer-shape, margin entire, outside sparsely white puberulent, inside glabrous. Corolla obviously curving to zigzag funnellform, zygomorphic, 8–8.5 cm long, outside bluish-purple to purple, densely glandular and glandular-puberulent, inside purple, nearly glabrous, the color of the throat same as the corolla with two brownish-yellow stripes and sparse dark yellow glands on the surfaces of the two stripes. Corolla tube narrowly curving or zigzag infundibuliform-tubular, bent at about 90° angle in the middle of corolla tube, and gradually slightly swollen from the middle to the base of the tube, 3.5–3.9 mm in diameter at middle/corner and 4.8–5.4 mm at the base of tube; dramatically enlarged to be trumpet-shaped from the middle of corolla tube toward limb, 1.9–2.3 cm wide at the orifice of the corolla limb. Corolla limb 2-lipped, adaxial lip 2-lobed, lobes semi-rounded to slightly obliquely oblong-rounded, 1.3–1.5 × 1–1.2 cm; abaxial lip 1.5–1.9 cm long, 3-lobed, middle lobe rounded to oblate and narrowed at the base of middle lobe, 1–1.1 × 0.9–1 cm, lateral lobes orbicular to slightly obliquely oblong-rounded to oblate, 0.9–0.95 × 1.1–1.2 cm. Stamens 4, bigger pair adnate to corolla tube ca. 2.8 cm from the base and smaller pair adnate to corolla tube ca. 2.5 cm from the base, coherent; anthers glabrous; filaments glabrous to very sparsely glandular-puberulent, but near the top of filaments and the part close to anther densely glandular-puberulent, longer pair 8–9 mm long and shorter pair 7–7.5 mm; anthers glabrous, 2.2–2.5 mm long, margin of locule dark purple to purplish-brown; pollen gray; staminode 1, punctate, adnate to corolla tube 2–2.1 cm from base, ca. 1 mm long. Disc annular, ca. 1 mm high, margin entire. Pistil 8–8.5 cm long; ovary cylindrical-linear, glabrous, 3.5–4 cm long, pale green; style linear, densely erect glandular and glandular-puberulent, ca. 4.5 cm long; stigmas 2-lobed, often gathering together but slightly opened at the end of flower, lobes ligulate, pink, sparsely glandular-puberulent at the base of stigma lobes but glabrous from the middle to the top of stigma lobes, 3.6–3.7 mm long. Capsule straight in relation to pedicel, linear, glabrous, 7.5–10 cm long, 2–2.5 mm in diameter, straight, dehiscing loculicidally to base, splitting along one suture, straight, not twisted.

**Phenology.** Flowering occurs from March to April and fruiting from March to June.

**Etymology.** The genus is named for the famous botanist, Dr. / Prof. Michael Möller, from the Royal Botanic Garden Edinburgh, and the species is named for Vietnam, which holds the first discovered and only known location for the species.

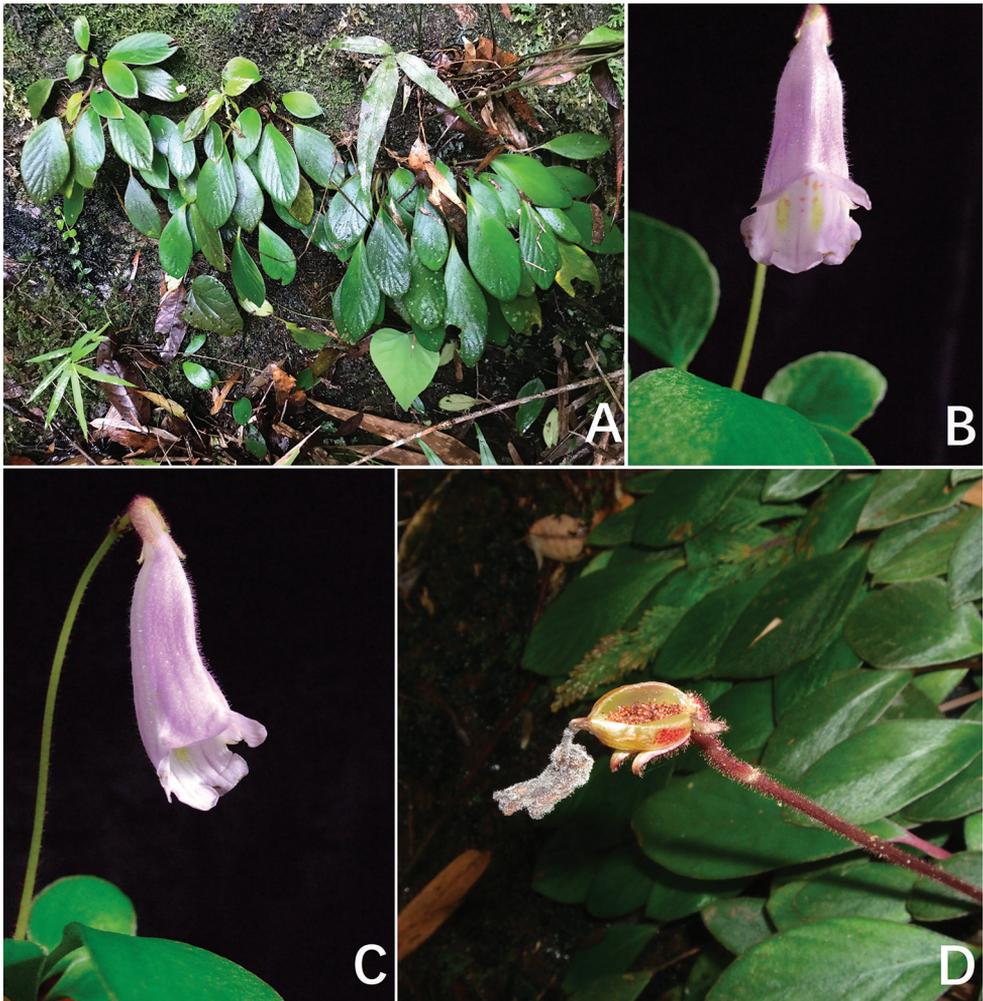
### Preliminary conservation status

Based on the result of our joint field surveys in the type locality and adjacent regions, the EOO and AOO of *Michaelmoelleria vietnamensis* are about 2.65 km<sup>2</sup> and 0.02 km<sup>2</sup>, respectively. So far, only one population of this species has been recorded along the local stream on the sandstone hills of Binh Dinh province, southern Vietnam, but we believe that more *M. vietnamensis* populations will be found in the hills and mountains of southern Vietnam. If that is the case, the Extent of Occurrence (EOO) and Area of Occupancy (AOO) of this species will increase. The beautiful flowers and variegated leaves have led to its over-harvesting by local people who have sold it as an ornamental plant. For example, some local people are selling them on the digital networking platform, Facebook. This activity has caused a decline in the quantity of *M. vietnamensis*. Moreover, our field surveys showed that *M. vietnamensis* only occurred in the sandstone hills of Tay Giang community, Tay Son district, Binh Dinh province. Man-made *Eucalyptus* forests have severely fragmented the natural habitat. According to the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN 2019), we assess this taxon as a Critically Endangered species (CR B1+B2ab (iii, v)).

### Discussion

In March 2018, a plant having bluish-purple flowers of Gesneriaceae was collected in southern Vietnam. Neither the collectors nor the researchers on the family were able to allocate it to any known genus at that time. Collectors once thought that it might be a member of *Deinostigma* because this genus is distributed from South China to Central Vietnam (Möller et al. 2016), and shows superficial similarities to *Deinostigma* in general appearance. For example, the caulescent habit (*D. cicatricosa*, *D. cyrtocarpa*, *D. minutibamata* (D. Wood) D.J. Middleton & H.J. Atkins), usually more and less fleshy leaves (in most *Deinostigma* species except three species as mentioned above) and fleshy stems, but differs in long and zigzag narrowly infundibuliform corolla tube, four fertile stamens and two lingulate stigmas. The other morphological similar genus is *Tribounia*, a genus endemic to Thailand (Middleton and Möller 2012). The two genera share the characters of zigzag corolla tube and rounded corolla lobes but can be distinguished by the number of fertile stamens. Based on those morphological characters above, we confirmed that it does not belong to *Deinostigma* or *Tribounia*. Furthermore, after consulting the related literature (Burt 1954, 1963; Wang et al. 1990, 1998; Li and Wang 2005; Weber et al. 2011c, 2013), we also could not find any genus in which to place this unknown species.

The phylogenetic relationship was largely congruent with previous studies (Möller et al. 2009, 2011a, 2016; Middleton et al. 2015, 2018). *Michaelmoelleria vietnamensis* and its morphologically similar genus *Deinostigma* is recovered within a polytomy but the phylogenetic relationship of them is distant. It also shows a more distant relationship between *Michaelmoelleria vietnamensis* and the other similar genus *Tribounia*. However, our analyses of DNA sequence data suggest that *Michaelmoelleria vietnamensis* is closely related to the genus *Cathayanthe* with strong support (PP = 1, BS = 100) and both of them sister



**Figure 5.** Photos of *Cathayanthe biflora* Chun, the related genus/species of *Michaelmoelleria vietnamensis* F. Wen, Z.B. Xin & T.V. Do **A** habitat **B** cyme and frontal view of flower **C** cyme and lateral view of flower **D** fruit. Photos by Fang Wen, arranged by Wen-Hua Xu.

to the clade comprised of the genera of *Allocheilos*, *Gyrocheilos*, *Liebigia*, and *Didymocarpus* with strong support of BI analysis (PP = 0.99) but weak support of ML analysis (BS = 69). Morphologically, *Michaelmoelleria vietnamensis*, which represents this new genus endemic to Vietnam, can be easily distinguished from the genera of *Cathayanthe*, *Allocheilos*, *Gyrocheilos*, *Liebigia*, and *Didymocarpus* by these distinct characters: fleshy stem and leaves alternate on elongated aerial stem. In addition, only two genera's chromosome numbers among above-mentioned genera were reported (*Liebigia speciosa* (Blume) DC. in *Liebigia*:  $2n = 28$  or  $32$ ; *Didymocarpus* ssp.:  $2n = 20, 22, 24, 28, 32, 36, 44, 54$ ) (Möller and Pullan 2015 onwards; Yang et al. 2019). Furthermore, the chromosome numbers of *Allocheilos* W.T. Wang (two species, both endemic to China) and *Gyrocheilos* W.T. Wang (six species and two varieties, distributed from South China to North Vietnam), which are the relative



**Figure 6.** Photos of *Deinostigma* W.T.Wang & Z.Y.Li (**A–E**) and *Tribounia* D.J.Middleton (**F–I**), the morphologically similar genera and species of *Michaelmoelleria* F.Wen, Y.G.Wei & T.V.Do (*M. vietnamensis* F.Wen, Z.B.Xin & T.V.Do) **A** *Deinostigma eberhardtii* (Pellegr.) D.J.Middleton & H.J.Atkins **B** *D. tamiana* (B.L.Burtt) D.J.Middleton & H.J.Atkins **C** *D. cynostyla* (B.L.Burtt) D.J.Middleton & H.J.Atkins **D** *D. cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller **E** *D. cyrtocarpa* (D.Fang & L.Zeng) Mich. Möller & H.J.Atkins **F–G** *Tribounia venosa* (Barnett) D.J.Middleton **H–I** *T. grandiflora* D.J.Middleton. **A–E** photos by Fang Wen **F–I** photos by David Middleton, arranged by Wen-Hua Xu.

genera of *Michaelmoelleria*, had never been reported before (Li and Wang 2005; Middleton 2015). The cytological evidence showed  $2n = 36$ , which is the difference from above genera, except *Didymocarpus pedicellatus* R.Br. (Mehra and Vasudevan 1972; Vasudevan 1976). Building on these, we treat *Michaelmoelleria vietnamensis* as a distinct genus of tribe Didymocarpeae. All distinguishing characters for identification of *Michaelmoelleria*, *Cathayanth* (Fig. 5), *Deinostigma* (Fig. 6A–E) and *Tribounia* (Fig. 6F–I) are listed in Table 1.

**Table 1.** Comparison of morphological characters *Michaelmoelleria*, *Cathayanthe*, *Deinostigma* and *Tribounia*.

Characters	<i>Michaelmoelleria</i>	<i>Cathayanthe</i>	<i>Deinostigma</i>	<i>Tribounia</i>
Life form	perennial	perennial	perennial	probably annual
Stem	glabrescent to glabrous when ageing	rhizomatous, stemless	multifarious, from short and constrictive to procumbent; from glabrous to pubescent and puberulent	with hairs and often hooked at the tip
Leaves	alternate on elongate aerial stem, 12–20 or more	few, 4–8, basal	alternate, numerous	opposite, numerous
Leaf-blade	ovate to elliptic, both surfaces glabrous	oblanceolate to obovate or elliptic, adaxially whitish to brownish sericeous, abaxially appressed pubescent	multifarious, slightly peltate or not, glabrous or eglandular pubescent on both surfaces	ovate, densely pubescent adaxially and abaxially mostly with eglandular pubescents (occasional glandular pubescent present in <i>Tribounia grandiflora</i> )
Calyx	Actinomorphic, 5-parted to the base	zygomorphic, 2-lipped	divided to base, elliptic, those on ventral side slightly longer and wider	equally 5-partite almost to base
Corolla	tube narrowly curving to zigzag infundibuliform-tubular, and bent at about 90° angle in the middle of corolla tube, and gradually slightly swollen from the middle to the base of the tube; dramatically enlarged to be trumpet-shaped from the middle of the corolla tube toward the limb	tube tubular, nearly straight to slightly bent, slightly gibbous abaxially toward limb, much longer than limb	tube infundibuliform, lower lip 3-lobed, upper lip 2-lobed, lobe apices rounded	zygomorphic, of a narrow lower tube which widens into an infundibuliform upper tube which has a prominent boss on the dorsal surface
Fertile stamens number	4	2	2	2
Ovary	cylindric-linear, glabrous, 3.5–4 cm long	narrowly ellipsoid, ca. 6 mm long	fusiform, long or short, with different indumentum, from glabrous to glandular- and eglandular-puberulent	cylindrical, densely glandular pubescent, ca. 6 mm long in <i>T. venosa</i> , 7.5–11.0 mm long in <i>T. grandiflora</i>
Stigma	2-lobed, often gathering together	subcapitate, lower part developing	ligulate, upper lip usually vestigial and only lower lip developing, broad, flat and weakly 2-lobed	capitate

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## Appendix I

The following is a list of used samples that are ordered alphabetically by taxon with their GenBank accession number of *trnL-trnF* and ITS sequences respectively. The new taxa whose sequences are newly published are listed with the complete voucher information.

*Aeschynanthus rhododendron* HQ632895, HQ632993; *Aeschynanthus roseoflorus* HQ632896, FJ501333; *Agalmyla glabra* HQ632892, HQ632989; *Agalmyla paucipilosa* HQ632893, HQ632990; *Allocheilos guangxiensis* HQ632897, HQ632994; *Allostigma guangxiense* HQ632880, HQ632977; *Anna submontana* FJ501542, FJ501362; *Briggsiopsis delavayi* HQ632879, HQ632976; *Cathayanthe biflora* HQ632899, HQ632996; *Cathayanthe biflora* China: Hainan province, Shuiman Town, near Wuzhishan Mountain, WYG180606-01, 6 Jun., 2018, IBK!, MN787055, MN759631; *Chayamaritia smitinandii* KP325432, KP325425; *Codonoboea albomarginata* AJ492297, HQ632961; *Codonoboea codonion* JF912538, JF912565; *Codonoboea corrugata* FJ501484, HQ632962; *Codonoboea elata* JF912523, JF912550; *Codonoboea floribunda* JF912539, JF912566; *Codonoboea leucocodon* JF912540, JF912567; *Codonoboea malayana* JF912541, JF912568; *Codonoboea pumila* JF912543, JF912570; *Codonoboea racemosa* JF912544, JF912571; *Codonoboea venusta* JF912545, JF912572; *Conandron ramondioides* FJ501515, FJ501340; *Cyrtandra pendula* FJ501530, FJ501354; *Cyrtandra pulchella* HQ632906, EU919941; *Damrongia lacunosa* KU203896, KU203801; *Damrongia purpureolineata* KU203893, KU203798; *Deinostigma cyrtocarpa* JX506777, JX506885; *Didissandra elongata* ssp. *minor* KP325427, KP325420; *Didissandra frutescens* FJ501522, JN934793; *Didissandra* sp. KP325429, KP325422;

*Didymocarpus antirrhinoides* FJ501513, DQ912671; *Didymocarpus villosus* HQ63290, HQ633001; *Didymostigma obtusum* HQ632875, HQ632971; *Didymostigma trichanthera* HQ632876, HQ632972; *Glabrella mihieri* FJ501544, FJ501363; *Gyrocheilos chorisepalus* var. *synsepalus* HQ632900, HQ632997; *Gyrocheilos lasiocalyx* HQ632901, HQ632998; *Hemiboea fangii* HQ632882, HQ632979; *Hemiboea follicularis* HQ632885, HQ632982; *Henckelia anachoreta* 1 HQ632870, HQ632966; *Henckelia bifolia* JF912522, JF912549; *Henckelia dielsii* HQ632871, HQ632967; *Henckelia floccosa* FJ501486, HQ632964; *Henckelia grandifolia* JF912527, JF912554; *Henckelia incana* HQ632869, HQ632965; *Henckelia longisepala* HQ632868, HQ632963; *Henckelia pumila* 1 JF912529, JF912556; *Henckelia pumila* 2 FJ501491, FJ501327; *Henckelia urticifolia* 1 DQ872821, DQ872835; *Henckelia urticifolia* 2 JF912532, JF912559; *Henckelia urticifolia* 3 FJ501492, FJ501328; *Hexatheca fulva* HQ632873, HQ632969; *Liebigia barbata* FJ501538, DQ912668; *Loxostigma glabrifolium* HQ632910, HQ633006; *Loxostigma griffithii* FJ501508, FJ501338; *Lysionotus pauciflorus* FJ501497, FJ501331; *Lysionotus petelotii* FJ501496, HQ632974; *Metapetrocosmea peltata* HQ632872, HQ632968; *Microchirita caliginosa* FJ501488, FJ501325; *Microchirita involucrata* 2 JF912526, JF912553; *Microchirita mollissima* JF912528, JF912555; *Microchirita sericea* JF912521, JF912548; *Microchirita tubulosa* JF912531, JF912558; *Microchirita viola* JF912533, JF912560; *Middletonia regularis* KU203884, KU203789; *Oreocharis dasyantha* HQ632918, HQ633014; *Oreocharis jiangxiensis* HQ632933, HQ633029; *Michaelmoelleria vietnamensis* VIETNAM. Binh Dinh province, Tay Son district, Tay Giang community, La stream. 13°55'59"N, 108°45'43"E, ca. 148 m, 29 Mar., 2018, WYG180329-01, IBK!, MN787054, MN783373; *Oreocharis urceolata* HQ632922, HQ633018; *Ornithoboea flexuosa* KU203931, KU203836; *Paraboea clarkei* JN934715, JN934757; *Petrocodon ainsliifolius* HQ632941, HQ633038; *Petrocodon dealbatus* FJ501537, FJ501358; *Petrocodon scopulorum* HQ632947, HQ633044; *Petrocosmea kerrii* FJ501502, FJ501334; *Petrocosmea nervosa* AJ492299, FJ501335; *Primulina gemella* FJ501523, FJ501345; *Primulina luochengensis* HQ632949, HQ633046; *Primulina tabacum* AJ492300, FJ501352; *Pseudochirita guangxiensis* HQ632908, HQ633003; *Raphiocarpus sinicus* HQ632877, HQ632973; *Ridleyandra petiolata* HQ632935, HQ633032; *Ridleyandra quercifolia* HQ632936, HQ633033; *Somrancia albiflora* KU203887, KU203792; *Spelaeanthus chinii* FJ501457, FJ501307; *Streptocarpus glandulosissimus* KR703972, AF316918; *Streptocarpus rexii* AJ492305, AF316979; *Tribounia grandiflora* JX839281, JX839280; *Tribounia venosa* JX839282, JX839283.



# *Jasminum parceflorum* (Oleaceae), a new species from southern Yunnan, China

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## Abstract

*Jasminum parceflorum* (Oleaceae), a new species from tropical limestone habitats in Yunnan, China, is described and illustrated here. The new species is similar to *J. pierreanum* and *J. rarum*, but can be distinguished by its linear calyx lobes, dry calyces without ridges, terminal 1 (or 3)-flowered cymes and axillary solitary flowers.

## Keywords

*Jasminum*, limestone forest, Xishuangbanna

## Introduction

*Jasminum* L. (Linnaeus 1753), with about 200 species of woody climbers and erect shrubs (Green 2004), is the largest genus of the olive family. The genus is distributed throughout the Old World tropics and warm temperate regions (Green 1969, 2004), with the specific diversity center suited in tropical Asia. Within *Jasminum*, De Candolle (1844) divided the genus into four sections based on leaf arrangement and leaf organization, i.e., sect. *Unifoliolata* DC., sect. *Trifoliolata* DC., sect. *Alternifolia* DC., and sect. *Jasminum* (sect. *Pinnatifolia* DC.). Green (2001) followed De Candolle's infrageneric classification and further added another section, i.e., sect. *Primulina* P. S. Green, which is characterized by the combination of opposite leaves and yellow

flowers. In China, more than 40 species of *Jasminum* have been recorded (Chang et al. 1996, Zhang et al. 2019), of which at least 26 species can be found in limestone forests.

During a botanical expedition to Yinchang Mountain, Jinghong City, Yunnan Province, China in February 2018, we encountered an unusual species lacking flower and fruit, which possesses the most typical character states of the genus *Jasminum* such as opposite leaves, entire leaf margin, articulated petiole, abaxial vein axils with tufted hairs and abaxial leaf surface with glandular dots. However, based on some other vegetative characters such as laminar size, shape and vein characters, etc., the species was distinctly different from any described jasmine species in China and neighboring countries. In order to know more about its habitat and characters of its flowering and fruiting, we revisited Yinchang Mountain and adjacent areas in July 2018, July and November 2019, and collected more specimens. Subsequent detailed morphological comparisons with the similar species revealed that it represents an undescribed *Jasminum* species, belonging to *J.* sect. *Unifoliolata* DC. (De Candolle 1844) by having simple, opposite leaves and white flowers.

## Materials and methods

Observations and measurements of morphological characters of the new species were carried out in the field and at the herbarium, based on living individuals and specimens. Glandular dots, hairs and other tiny morphological characters were observed by using a stereomicroscope (LEICA EZ4W). Morphological comparisons with related species based on the specimens from the JSTOR Global Plants (<http://plants.jstor.org/>), IBK, IBSC, KUN and SYS herbaria.

## Taxonomy

### *Jasminum parceflorum* Kai Zhang & D.X. Zhang, sp. nov.

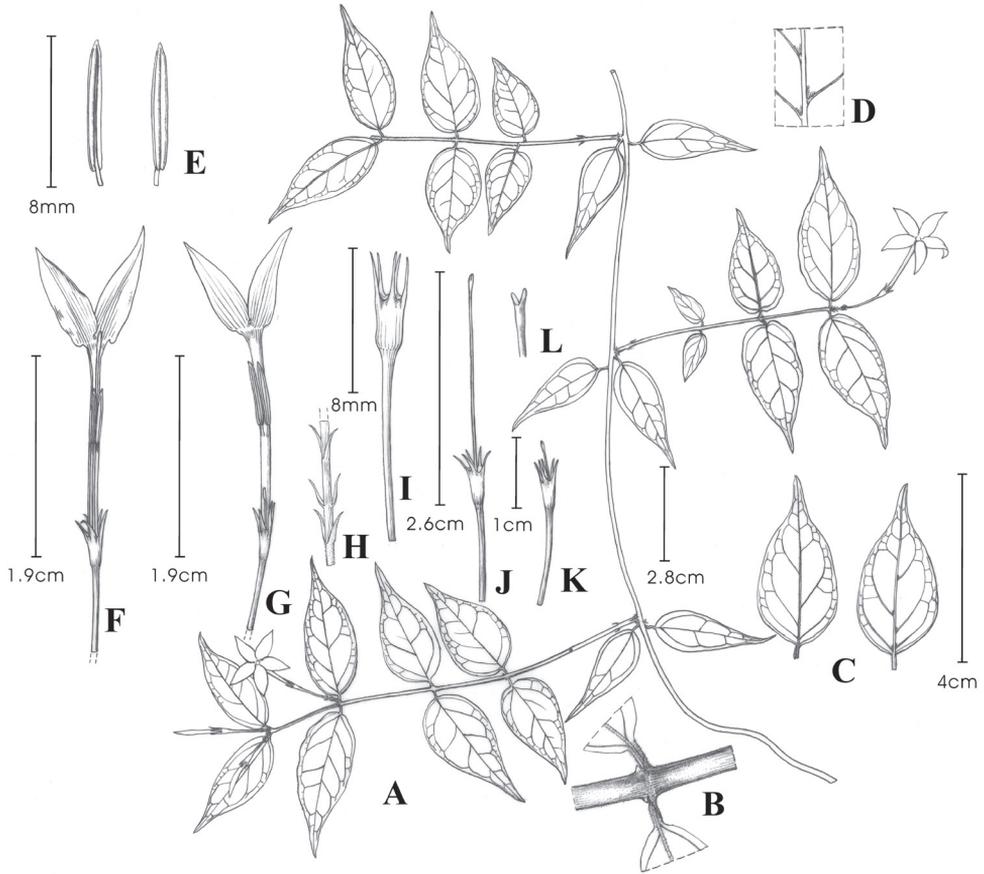
urn:lsid:ipni.org:names:77209570-1

Figs 1, 2

**Diagnosis.** *Jasminum parceflorum* is morphologically similar to *J. pierreanum* Gagnep. and *J. rarum* Kerr, but can be distinguished by its linear calyx lobes, dry calyces without ridges, terminal 1 (or 3)-flowered cymes and axillary solitary flowers.

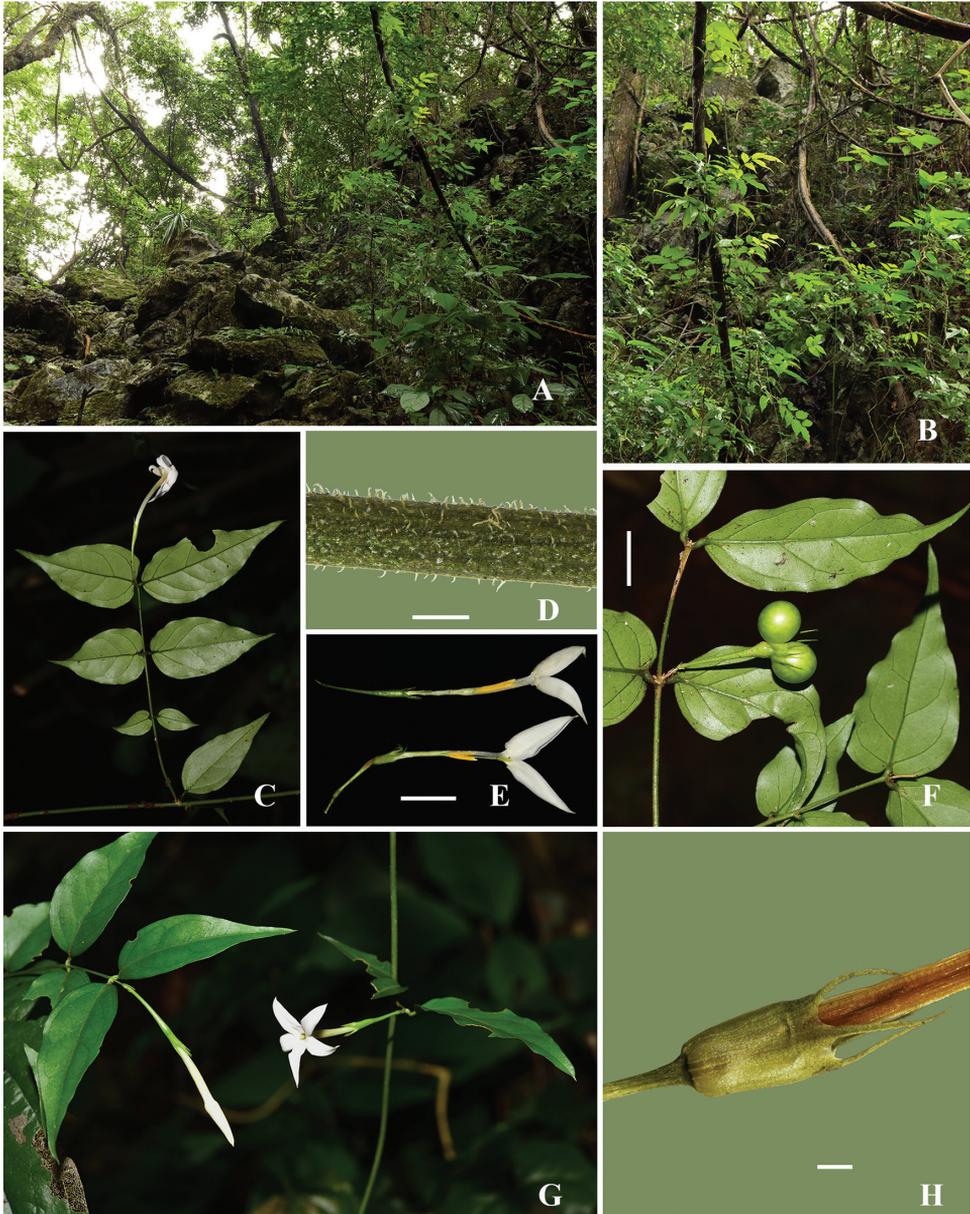
**Type.** CHINA. Yunnan Province: Xishuangbanna Prefecture, Jinghong City, Yinchang Mountain, 21°59'6.48"N, 101°14'4.22"E, 1218 m a.s.l., 18 July 2018, *Kai Zhang & Mingsong Wu 00581* (holotype: IBSC!; isotypes: IBSC!, HITBC!).

**Description.** Shrubs, scandent, evergreen, 1–5 m tall. Branches grayish yellow, terete; branchlets green, slender, pubescent, slightly compressed and inconspicuously grooved when young. Leaves opposite, simple; petiole 1–3 mm long, slightly twisted, articulate near middle, sulcate adaxially, pubescent; leaf blade ovate or lanceolate, sometimes broadly ovate, 2.8–6.3 cm long, 0.9–2.5 cm wide, papery, with entire margin, slightly revolute, base broadly cuneate, rounded or subtruncate, sometimes cuneate or subcordate, slightly



**Figure 1.** *Jasminum parceflorum*. **A** flowering branch **B** branchlet **C** leaves (adaxial view and abaxial view) **D** vein axils with hair tufts (abaxial view) **E** stamens **F** pin flower **G** thrum flower **H** peduncle with bracts **I** calyx **J** pistil of pin flower **K** pistil of thrum flower **L** stigma. Drawn by Yunxiao Liu.

oblique, apex acuminate to caudate-acuminate, adaxially pubescent along midvein, and sparsely pubescent near apex when young, abaxially yellow glandular dotted and vein axils with hair tufts; midvein slightly impressed adaxially, elevated abaxially, lateral veins 3–6 pairs, slightly elevated on both surfaces, arcuate-ascendant, anastomosing near margin. Flowers 1 (or 3) in terminal cymes, solitary in leaf axils, dimorphic. Peduncle 1–9 mm long, slightly pubescent. Bracts subulate-filiform, 2–3 mm long, glabrous. Pedicel 1.1–1.6 cm long, glabrous. Calyx campanulate, glabrous; tube 3–4 mm long; lobes 5, linear, (2–) 2.5–4 (–4.5) mm long. Corolla white, salverform; tube 1.3–2.3 cm long, ca. 1.5 mm in diam; lobes 5, lanceolate, 8–11 mm long, 2–3 mm wide, apex argute. Thrum flowers: stamens 2; filaments ca. 1 mm long, glabrous; anthers 12.7–13.6 mm above base of corolla tube, 6.1–7 mm long; stigma 1.5–2.4 mm long, 2-lobed; style filiform, 3.9–5 mm long, glabrous; ovary 0.9–1 mm long, glabrous. Pin flowers: stamens 2; filaments ca. 1 mm long, glabrous; anthers 10.8–11.7 mm above base of corolla tube, 5.4–5.6 mm



**Figure 2.** *Jasminum parceflorum*. **A** habitat **B** habit **C** branch with a thrum flower **D** branchlet **E** dissected corolla tubes, thrum flower (upper) and pin flower (lower) **F** fruiting branch **G** branches with pin flowers **H** calyx. Scale bars: 0.5mm (**D**), 1 cm (**E**, **F**), 1 mm (**H**). Photos by Kai Zhang.

long; stigma 1.9–2.9 mm long, 2-lobed; style filiform, 13.4–19 mm long, glabrous; ovary 0.9–1 mm long, glabrous. Fruits globose or subglobose, 8–9 mm in diam.

**Phenology.** Flowering from July to August, fruiting from September to November.



**Figure 3.** **A** Distribution of *Jasminum parceflorum* in Yunnan Province, China **B** view of Yinchang Mountain.

**Distribution and habitat.** *Jasminum parceflorum* is currently found in Mengla County and Jinghong City, Xishuangbanna Prefecture, Yunnan Province, China (Fig. 3). It grows in tropical evergreen forests on slopes of limestone mountains, never occurring in open areas such as mountain ridges and forest edges.

**Conservation status.** Only two populations of the new species were found in Xishuangbanna Prefecture, Yunnan Province, although it may be distributed in adjacent limestone areas. Each population has no more than 200 mature individuals which only occur in limestone forests. According to the IUCN Red List Categories and Criteria (IUCN 2019), *Jasminum parceflorum* is assigned a status of Vulnerable (VU D1).

**Etymology.** The specific epithet is derived from the fact that its mature individual has fewer flowers in comparison with most other jasmine species.

**Additional specimens examined.** CHINA. Yunnan Province: Xishuangbanna Prefecture, Jinghong City, Yinchang Mountain, 15 July 2018, *Kai Zhang & Mingsong Wu* 00532, 00533 (IBSC!); same locality, 18 July 2018, *Kai Zhang & Mingsong Wu* 00582 (IBSC!); same locality, 12 July 2019, *Kai Zhang & Lianxuan Zhou* 01177, 01178 (IBSC!); same locality, 13 November 2019, *Kai Zhang* 01216 (IBSC!). Mengla County, Lvshilin, 21°54'36.80"N, 101°17'3.83"E, 614 m a.s.l., 13 November 2019, *Kai Zhang* 01215 (IBSC!).

## Discussion

Some reproductive characters, such as shape of bracts and calyx lobes, inflorescence type and position are the key taxonomic characters in distinguishing infrageneric taxa of *Jasminum*. The basic inflorescence type of *Jasminum* species is a cyme, which could form a panicle, raceme, corymb, umbel, or head. Most jasmine species have both axillary and terminal cymes, while some species only have terminal cymes, e.g., *J. sambac* (L.) Ait., some species usually only have axillary solitary flowers, e.g., *J. nudiflorum* Lindl., and other species have both axillary solitary flowers and terminal cymes, e.g., *J. rehderianum* Kobuski, although the terminal cymes usually reduce into solitary flowers in this new

**Table 1.** Comparison of morphological characters among *Jasminum parceflorum*, *J. rarum* and *J. pierreanum*.

Character	<i>J. parceflorum</i>	<i>J. rarum</i>	<i>J. pierreanum</i>
Leaf blade base	usually broadly cuneate, rounded or subtruncate, sometimes cuneate or subcordate	broadly cuneate, rounded, sometimes cuneate	more or less subcordate
Calyx lobe	linear, (2–) 2.5–4 (–4.5) mm long	subulate, to somewhat triangular, 0.75 mm long	subulate, to somewhat triangular, 0.25–1 mm long
Dry calyx	ridges absent	ridges present	ridges present
Corolla lobe number	5	6	5 or 6
Inflorescence	terminal 1 (or 3)-flowered cymes and axillary solitary flowers	cymes terminal or axillary, 1–5-flowered	cymes terminal or axillary, (1–) 3–5- or more-flowered

species. By having terminal 1 (or 3)-flowered cymes and axillary solitary flowers, *J. parceflorum* can be easily distinguished from most jasmine species. It seems to be similar to *J. rarum* in leaf aspect, which was treated as synonym of *J. pierreanum* (Green 2000). Since *J. rarum* differs from *J. pierreanum* in the shape of the leaf base (cuneate to rounded vs. more or less subcordate), and is currently known only from the type collected from Baw Re, Kanchanaburi, Thailand, further studies, particularly observations on living individuals and more specimens of *J. rarum* from the type locality, are needed to reconsider its taxonomic status. Here *J. pierreanum* and *J. rarum* were considered as putative closest allies, and a detailed morphological comparison between them is given in Table 1.

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# Corrigendum: Revision of *Fothergilla* (Hamamelidaceae), including resurrection of *F. parvifolia* and a new species, *F. milleri*

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In our recent work (Haynes et al. 2020), we overlooked a pertinent paper (Turner 2016), which affects the nomenclature and typification of *Fothergilla major*. We provide a correction below:

***Fothergilla major* (Sims) Sweet, Hort. Suburb. Lond.: 124. 1818.**

*Fothergilla alnifolia* var. *major* Sims in Bot. Mag. 33: sub t. 1341, t. 1342. 1810

**Type.** Illustration in Bot. Mag. 33: t. 1342. 1810 (Lectotype designated by Turner 2016)

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