Taiwania 70(4): 599–605, **2025**
DOI: 10.6165/tai.2025.70.599

Leptopus longipedicellatus, a new species of *Leptopus* (Phyllanthaceae) from Guangxi Province, China

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(Manuscript received 20 December 2024; Accepted 23 July 2025; Online published 14 August 2025)

ABSTRACT: *Leptopus longipedicellatus*, a new species of Phyllanthaceae from Guangxi Province, China, is described. Results from phylogenetic analyses of the nuclear ribosomal intergeneric transcribed spacer (nrITS) and plastid marker *matK* showed that the new species has a close relationship with *L. fangdingianus*, *L. malipoensis* and *L. pachyphyllus*, and it might be the sister of *L. pachyphyllus*, another endemic species to Guangxi Province. Morphologically, the new species could be distinguished from all other species of *Leptopus* by its long pedicels of female flowers and fruits, which are 3.0–4.5 cm in length. Additionally, the new species further differs from *L. pachyphyllus* by its narrower sepals of male flowers (1.2–1.5 mm wide vs. 2.5–3.0 mm wide) that are yellow-white to slightly green in color (vs. reddish), petals of male flowers subequal to the sepals in length (vs. about 1/2 to the sepals in length), filaments of stamens 3.0–4.0 mm long (vs. ca. 1.6 mm long), smaller sepals of female flowers (3.0–4.0 × 1.1–1.6 mm vs. 5–6 mm × ca. 4.0 mm), disc in female flowers shallowly bilobed for ca. 1/5 of length (vs. deeply bilobed for 1/3–1/2 of length).

KEY WORDS: Karst environment, *Leptopus*, *Leptopus pachyphyllus*, Poranthereae, Phyllanthaceae, Taxonomy.

INTRODUCTION

Leptopus Decne., a small genus in the tribe Poranthereae, subfamily Phyllanthoideae of Phyllanthaceae (Zhang *et al*., 2021), was erected by Decaisne (1844) based on *L. cordifolius* Decne. The genus is represented by ten species of herbs and shrubs distributed mainly from the Caucasus to Malesia (Vorontsova and Hoffmann, 2009; Zhang *et al*., 2021), with about seven species recorded in China (Li and Vorontsova, 2008; Zhang *et al*., 2021). The monophyly of the genus was well-supported in recent molecular phylogenetic study (Zhang *et al*., 2021). Morphologically, the genus could be distinguished from other genera in the same tribe by its disc in flowers that is evidently lobed, fruits less than 10 mm in diameter, exocarp adnate to endocarp, and mature seeds with copious endosperm (Li and Vorontsova, 2008; Vorontsova and Hoffmann, 2009).

During the field investigation in Mashan County, Guangxi Province of China, in April 2024, two of the authors (S.J. Zhang and W.B. Xu) found several field populations of a *Leptopus* species. The species is similar to the congeneric species *L. pachyphyllus* X.X. Chen in morphology. After detailed morphological investigation and molecular phylogenetic analyses of the genus *Leptopus*, it was concluded that the species found in Mashan County represents a new species. Therefore, the species is formally described here.

MATERIALS AND METHODS

Specimens of *Leptopus* deposited in the herbaria GXMG, IBK, IBSC, KUN and PE were carefully examined. Herbarium abbreviations cited in the present study follow the Index Herbariorum (http://sweetgum.nybg.org/science/ih/, continuously updated). Extensive field investigations of Chinese *Leptopus* species were conducted during the past five years. All available types or type images of accepted names of *Leptopus* taxa (including their synonyms) recorded in Vorontsova and Hoffmann (2009), in which a most recent taxonomic revision of *Leptopus* was conducted, were examined carefully through the website of JSTOR Global Plants (https://plants.jstor.org/) or our visit of Chinese herbaria. In addition, morphological characters of stems, leaves, flowers, fruits and seeds of relevant species were photographed and measured.

To study the phylogenetic position of the new species within *Leptopus*, a phylogenetic study of the genus was performed, based on two DNA markers, viz. the nuclear ribosomal intergeneric transcribed spacer (nrITS) and plastid marker *matK*, which were used previously in phylogenetic analysis of *Leptopus* (Vorontsova *et al*., 2007; Zhang *et al*., 2021). Total genomic DNA of seven individuals representing four species of *Leptopus* was extracted from silica gel-dried leaves using a Plant Genomic DNA Kit (Biomed, Shenzhen, China). The whole plastome sequences and nrITS sequences of all the individuals mentioned above were obtained through the genome skimming approach, following Zhang *et al*. (2021). The *matK* sequences of these individuals were then extracted from the assembled whole plastid genomes.

Table 1. Sequences information for all samples used in the present study. Sequences newly generated in this study are marked in bold. The taxon names correspond to those marked on the phylogenetic trees.

Taxon	Voucher specimen	nrITS	*matK*
Leptopus australis (Zoll. & Moritzi) Pojark._1		AM745811	AM745812
*Leptopus australis*_2		AM745813	AM745814
*Leptopus australis*_3		AM745815	AM745816
Leptopus chinensis (Bunge) Pojark_1		MN722097	MN722149
*Leptopus chinensis*_2		MH710764	MH659095
*Leptopus chinensis*_3		AM745819	AM745820
*Leptopus chinensis*_4		AM745821	AM745822
Leptopus clarkei (Hook. f.) Pojark._1		AM745938	AM745939
*Leptopus clarkei*_2		AM745940	AM745941
*Leptopus clarkei*_3		AM745834	AM745835
Leptopus cordifolius Decne._1		AM745826	AY552433
*Leptopus cordifolius*_2		AM745827	AM745828
*Leptopus cordifolius*_3		#	NC_058615
Leptopus fangdingianus (P.T. Li) Voronts. & Petra Hoffm.		AM745809	AM745810
*Leptopus fangdingianus*_YG355	*YXZ28* (IBSC)	**PV351181**	**PV402684**
Leptopus malipoensis W.H. Zhang & Gang Yao		MW962203	MZ062211
*Leptopus malipoensis*_YG354	*YXZ12* (IBSC)	**PV351180**	**PV402683**
Leptopus pachyphyllus X. X. Chen_WH113	*ZWH-WH113* (CANT)	**PV351178**	**PV402678**
*Leptopus pachyphyllus*_WH114	*ZWH-WH114* (CANT)	**PV351179**	**PV402679**
*Leptopus longipedicellatus*_YG415	*S.J. Zhang & W.B. Xu 20240425* (HIB)	**PV351182**	**PV402680**
*Leptopus longipedicellatus*_YG419	*S.J. Zhang & B.s. Xia 20163188* (HIB)	**PV351183**	**PV402681**
*Leptopus longipedicellatus*_YG420	*S.J. Zhang & B.s.xia 20163189* (HIB)	**PV351184**	**PV402682**
Actephila albidula Gagnep.		AM745910	AM745911
Actephila collinsiae W. Hunter ex Craib		AM745912	AM745913
Actephila excelsa var. *excelsa* (Dalzell) Müll.Arg.		AM745918	AM745919
Actephila excelsa var. *javanica* (Miq.) Pax & K.Hoffm.		AM745920	AM745921
Actephila latifolia Benth.		AM745922	AM745923
Actephila lindleyi (Steud.) Airy Shaw_1		AM745924	AM745925
*Actephila lindleyi*_2		AM745926	AM745927
Actephila ovalis (Ridl.) Gage		AM745929	AM745930
Actephila subsessilis Gagnep.		AM745914	AM745915
Bridelia ovata Decne.		FJ439908	FJ439946
Bridelia retusa (L.) A.Juss.		FJ439907	FJ439945
Cleistanthus concinnus Croizat		FJ439930	FJ439972
Cleistanthus petelotii Merr. ex Croizat		FJ439931	FJ439973
Cleistanthus sumatranus (Miq.) Müll.Arg.		FJ439933	FJ439975
Cleistanthus tomentosus Hance		FJ439932	FJ439974
Notoleptopus decaisnei (Benth.) Voronts. & Petra Hoffm._1		AM745830	AM745831
*Notoleptopus decaisnei*_2		AM745832	AM745833
Phyllanthopsis arida (Warnock & M.C. Johnst.) Voronts. & Petra Hoffm.		AM745762	AM745763
Phyllanthopsis phyllanthoides (Nutt.) Voronts. & Petra Hoffm.		AM745836	AM745837

Sequences of fourteen individuals representing six species of *Leptopus* were downloaded from NCBI (*www.ncbi.nlm.nih.gov*). In addition, some species in genera *Actephila* Blume, *Bridelia* Willd., *Cleistanthus* Hook. f. ex Planch., *Notoleptopus* Voronts. & Petra Hoffm. and *Phyllanthopsis* (Scheele) Voronts. & Petra Hoffm. were included and used as outgroups in phylogenetic analyses, based on the phylogenetic frameworks in previous studies (Kathriarachchi *et al*., 2005; Vorontsova *et al*., 2007). DNA sequences of relevant species were also obtained from NCBI. Detailed information about the species included in phylogenetic study are provided in Table 1.

Sequences were aligned using MAFFT v. 7.221 (Katoh and Standley, 2013), and then two independent datasets were constructed: the nrITS dataset and the *matK* dataset. The two datasets were not combined here due to the topological conflicts in several nodes obtained from the current phylogenetic analyses of these two datasets. All the two datasets were analyzed using two approaches: Bayesian Inference (BI) and Maximum Likelihood (ML) were conducted using MrBayes v. 3.2.7 (Ronquist and Huelsenbeck, 2003) and RAxML (Stamatakis, 2006). The models of nucleotide substitution of the two DNA datasets used here were selected under the Akaike Information Criterion (AIC) using jModelTest V.3.7

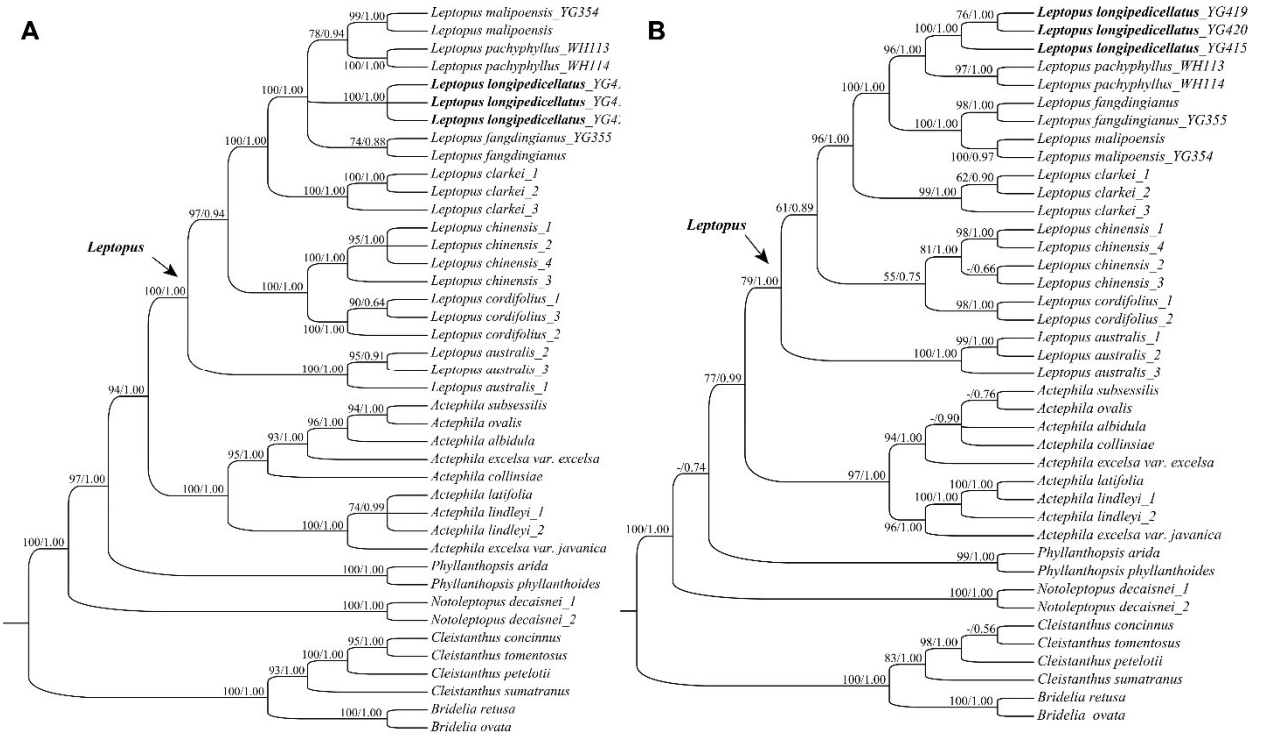

Fig. 1. Bayesian inference (BI) tree of *Leptopus* based on analysis of (A.) *matK* dataset and (B.) nrITS dataset. Bootstrap (BS) value in maximum likelihood (ML) analysis and posterior probability (PP) in BI analysis is indicated on the left and right of slanting bar associated with phylogenetic node, respectively. value ≥ 50% in maximum likelihood (ML) analysis and posterior probability (PP) ≥ 0.50 in BI analysis is indicated on the left and right of slanting bar associated with phylogenetic node, respectively. Dash denotes that the BS value is less than 50% in ML analysis.

(Posada, 2008): GTR+I+Γ for nrITS and TVM+Γ for *matK*. Detailed information about the parameter setting in BI and ML analyses followed our recent study (Zhang *et al*., 2021), except that each of Markov Chian Monte Carlo (MCMC) analysis was run for 20,000,000 generations, sampling every 500 generations. In BI analyses, the average standard deviations (SD) of split frequencies for datasets were all below 0.01 and effective sample sizes (ESS) of all parameters were over 200, indicating that the number of generations set in MCMC analyses were all sufficient. In this study, we defined the high or strong support values as bootstrap (BS) value in ML analysis as BS ≥ 80% or posterior probabilities (PP) in BI analysis ≥ 0.95, moderate support value as 70% ≤ BS < 80% or 0.90 ≤ PP < 0.95, and low or weak support value as BS< 70% or PP < 0.90, following the treatment of Xue *et al*. (2023).

RESULTS AND DISCUSSION

In the latest taxonomic revision of the genus *Leptopus*, nine species were accepted by Vorontsova and Hoffmann (2009). A new species of the genus, viz. *L. malipoensis* W.H. Zhang & Gang Yao, was described recently from Yunnan Province, China (Zhang *et al*., 2021). Seven of the ten accepted species of *Leptopus* were included in the present phylogenetic study (Table 1). In the present study, the *matK* dataset and nrITS datas*et al*ignments contained 1,947 bp and 779 bp, respectively. The monophyly of *Leptopus* and all species sampled in the genus were all strongly supported in all analyses (Fig. 1). In analyses of the nrITS dataset, the new species was recovered as the sister of *L. pachyphyllus* with strong support (BS = 96%, PP = 1.00; Fig. 1B), and then sister to the *L. fangdingianus* (P.T.Li) Voronts. & Petra Hoffm.-*L. malipoensis* clade with strong supports (BS = 100%, PP = 1.00; Fig. 1B). The sister relationship between *L. fangdingianus* and *L. malipoensis* was also highly supported in analyses of the nrITS dataset (BS = 100%, pp = 1.00; Fig. 1B). While in BI analysis of the *matK* dataset, *L. fangdingianus*, the *L. malipoensis*-*L. pachyphyllus* clade and the new species formed a highly supported lineage (BS = 100%, PP = 1.00), but the three clades were recovered as polytomy (Fig. 1). In ML analysis of this dataset, the new species was recovered as the sister of (*L. malipoensis*-*L. pachyphyllus*)-*L. fangdingianus*, a lineage that obtained only with weak support (BS < 50%). It is noteworthy that, the sister relationship between *L. malipoensis* and *L. pachyphyllus* was moderately supported in both BI and ML analyses of the *matK* dataset (BS = 78%, PP = 0.94; Fig. 1). Thus, the isolated position of *L. longipedicellatus* outside all other species sampled here in *Leptopus* were well supported (Fig. 1).

Table 2. Comparison of morphological characters of ***Leptopus longipedicellatus*** and ***L. pachyphyllus***

Characters	*L. longipedicellatus* sp. nov.	*L. pachyphyllus*
Leaf		
laminas	(3)3.5–6.5(7.5) × 1.2–3.5 cm	2.0–5.0 × 1.5–2.5 cm
Petioles	3.0–6.5 mm long	3.0–4.0 mm long
Male flowers		
Pedicels	1.8–3.5 cm long	2.0–2.5 cm long
Sepals	Oblong-ovate, 3.0–3.5 × 1.2–1.5 mm, yellow-white to slightly green	Ovate, 3.0–4.0 × 2.5–3.0 mm, reddish
Petals	Clavate to slightly linear, subequal to the length of sepals	Spathulate, ca. 1/2 to the length of sepals
Filaments	3.0–4.0 mm long	Less than 2.0 mm in length
Female flowers		
Sepals	Ovate-oblong, 3–4 × 1.1–1.6 mm	Ovate, 5.0–6.0 × ca. 4.0 mm
Pedicels	3.0–4.5 cm long	1.5–2.8 cm long
Discs	Shallowly bilobed for ca. 1/5 of length	Bilobed for 1/3–1/2 of length
Fruits		
Pedicels	3.0–4.5 cm in length	2.0–3.3 cm in length

A detailed morphological comparison between the new species and all other ten species accepted currently in *Leptopus* was also conducted. Morphologically, the new species has long pedicels of female flowers and fruits (Fig. 2 B, C, F), which could be up to 4.5 cm in length and much longer than that of all other species accepted currently in the same genus. In habit, the new species is most similar to *L. pachyphyllus* (Fig. S2B), a species endemic to Guangxi Province, China (Chen, 1988). However, the new species differs from the latter in having oblong-ovate sepals of male flowers that are 3.0–3.5 × 1.2–1.5 mm in size and yellow-white to slightly green in colors (Fig. 2C, D), petals of male flowers clavate to slightly linear in shape and subequal to the sepals in length (Fig. 2C, D), filaments of stamens 3.0–4.0 mm long (Fig. 2C), longer pedicels of female flowers and fruits 3.0–4.5 cm in length (Fig. 2B, C, F), and discs in female flowers shallowly bilobed for ca. 1/5 of length (Fig. 2E). In contrast, *L. pachyphyllus* has ovate sepals of male flowers that are 3.0–4.0 × 2.5–3.0 mm in size and reddish in color, petals of male flowers spathulate in shape and ca. 1/2 to the length of sepals, filaments of stamens ca. 1.6 mm long, shorter pedicels of female flowers and fruits that are 1.5–2.8 cm and 2–3.3 cm in length respectively, and discs in female flowers bilobed for 1/3–1/2 of length (Chen, 1988; Li and Vorontsova, 2008). A detailed comparison of morphological characters between the new species and *L. pachyphyllus* also could be referred in Table 2.

In addition, the new species also differs much from the other two phylogenetically close relatives *Leptopus fangdingianus* and *L. malipoensis* in morphology. It could be easily distinguished from *L. fangdingianus* by its smaller leaves that are usually 3.5–6.5 × 1.2–3.5 cm in sizes (vs. usually 6.0–10.0 × 2.5–4.0 cm in sizes), male flowers 1–5 per fascicle (vs. 1–2 per fascicle), pedicels of male flowers 1.8–3.5 cm in length (Fig. 2C) (vs. far less than 1.8 cm in length), disc of male flowers bilobed for 1/5–1/2 of length (Fig. 2D) (vs. deeply bilobed for ca. 4/5 of length), filaments of male flowers 3–4 mm in length (Fig. 2C) (vs. ca. 1 mm in length), pedicels of female flowers 3.0–4.5 cm in length (Fig. 2B, C) (viz. 2.0–2.5 cm in length), disc of female flowers bilobed for ca. 1/5 of length (Fig. 2E) (vs. deeply bilobed for ca. 3/4 of length), 3 styles (Fig. 2E) (vs. 4 or 6 styles), ovary 3-locular (vs. 4 or 6-locular), and longer pedicels of fruits 3.0–4.5 cm in length (Fig. 2F) (viz. 1.7–2.5 cm in length). The new species much differs from *L. malipoensis* by its stems that are usually erect (Fig. 2A) (vs. slender and usually pendulous or procumbent), stems and branchlets subglabrous (Fig. 2B) (vs. hirsute), glabrous leaves usually 3.5–6.5 × 1.2–3.5 cm in sizes (Fig. 2B) (vs. hirsute leaves usually 5.0–13.0 × 3.0–5.5 cm in sizes), pedicels of male flowers 1.8–3.5 cm in length (Fig. 2C) (vs. 1.0–2.5 cm in length), filaments of male flowers 3–4 mm in length (Fig. 2C) (vs. far less than 3 mm in length), glabrous pedicels of female flowers 3.0–4.5 cm in length (Fig. 2B, C) (vs. sparsely hirsute and 1.5–2.8 cm in length), and capsules 6–8 mm in diameter (Fig. 2G) (vs. 4–6 mm in diameter).

For the other three species of *Leptopus* that were not included in the present phylogenetic analyses, viz. *L. emicans* Pojark., *L. hainanensis* (Merr. & Chun) Pojark. and *L. robinsonii* Airy Shaw, they are significantly different from the new species in morphology. *Leptopus emicans*, which is distributed from east Himalaya to Burma, much differs from the new species by its branchlets that are longitudinally ribbed (vs. not ribbed; Fig. 2B), smaller sepals of female flowers 1.0–1.5 × ca. 1.0 mm in sizes (vs. 3–4 × 1.1–1.6 in sizes; Fig. 2E), discs of female flowers deeply bilobed for 3/4 of length (vs. shallowly bilobed for ca. 1/5 of length; Fig. 2E), and fruiting pedicels 1.0–1.5 cm in length (vs. 3.0–4.5 cm in length; Fig. 2F, G). The species *L. hainanensis*, which is endemic to Hainan Province, China, differs from *L. longipedicellatus* by its smaller leaves that are 0.5–4.0 × 0.4–2.0 cm in sizes (vs. 3.5–6.5 × 1.2–3.5 cm in sizes), pedicels of male flowers 1.5–3.0 mm long (vs. 18–35 mm

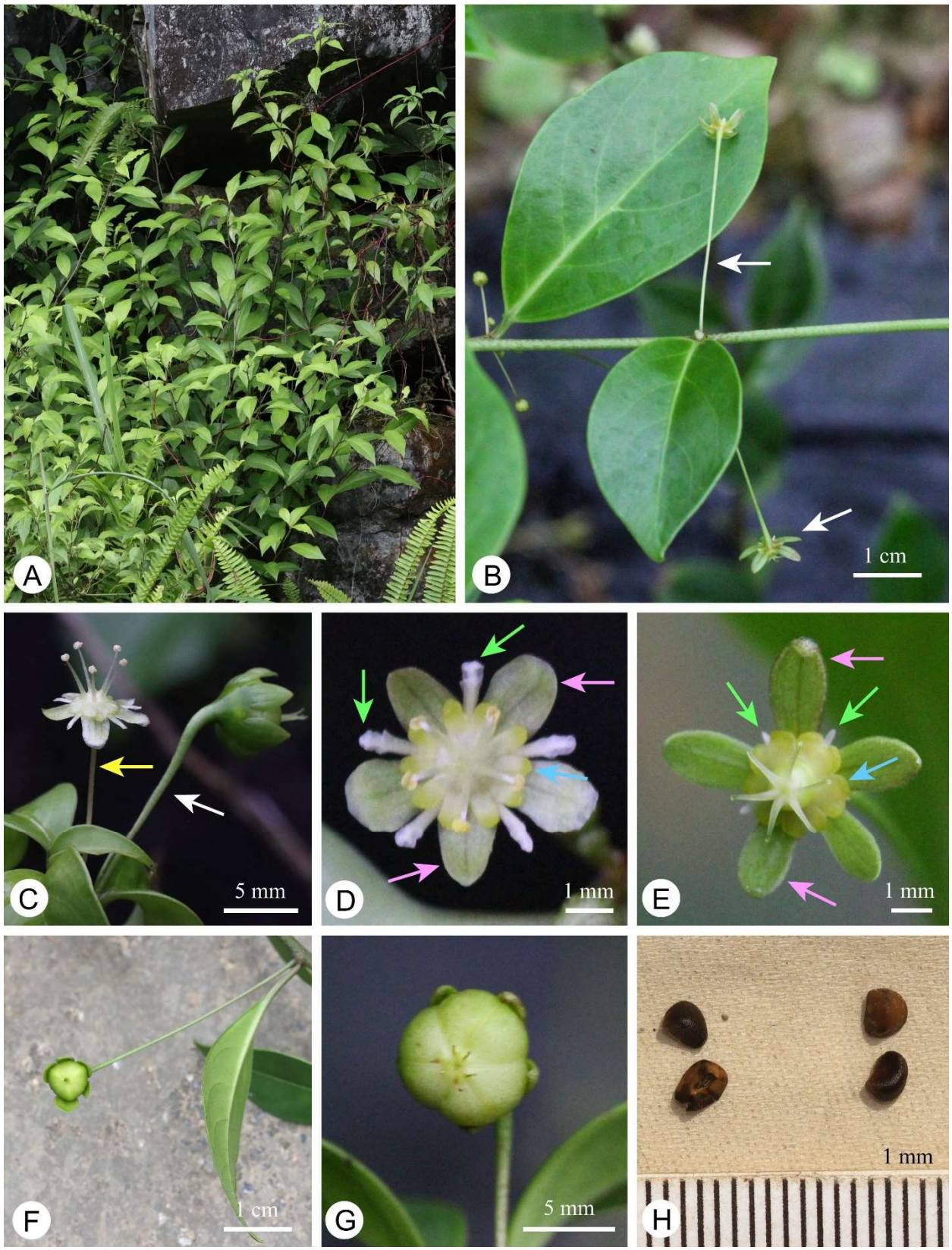

Fig. 2. ***Leptopus longipedicellatus*** Gang Yao, Wen B. Xu & Shou J. Zhang. **A**. Habit. **B**. Branchlet. **C**. Flowers. **D**. Male flower. **E**. Female flower. **F**. Young fruit. **G**. Fruit. **H**. Seeds. White arrowheads indicate female flowers; Yellow arrowhead indicates male flower; Pink arrowheads indicate sepals; Green arrowheads indicate petals; Blue arrowheads indicate discs. Photos by Wen-Bin Xu.

long; Fig. 2C), and pedicels of female flowers 10–12 mm long (vs. 30–45 mm long; Fig. 2B, C). The species *L.robinsonii*, which is endemic to Khanh Hoa Province, Vietnam, differs from the new species by its reddish branchlets that are bilaterally flattened (vs. green branchlets that are terete; Fig. 2B), filaments of stamens and styles of pistil that are hirsute (vs. glabrous; Fig. 2C), pedicels of male flowers 0.5–1.5 mm long (vs. 18–35 mm long; Fig. 2C), discs of male flowers deeply bilobed for 4/5–5/6 of length (vs. bilobed for 1/5–1/2 of length; Fig. 2D), pedicels of female flowers 5–10 mm long (vs. 30–45 mm long; Fig. 2B, C), and discs of female flowers deeply bilobed for 1/2 to 3/4 of length (vs. shallowly bilobed for ca. 1/5 of length; Fig. 2E).

TAXONOMIC TREATMENT

Leptopus longipedicellatus Gang Yao, Wen B.Xu & Shou J.Zhang, ***sp. nov.*** **长梗雀舌木 Figs. 2, S1A**

***Type*: CHINA**. Guangxi Province, Mashan County, Guling Town, Sankatun, N23.65091942°, E108.34608383°, at the elevation of ca. 430 m, 11 April 2024, *S.J. Zhang & W.B. Xu 20240425* (holotype: HIB, Barcode no. 0259009; isotype: IBSC).

***Diagnosis*:** *Leptopus longipedicellatus* is most similar to *L. pachyphyllus* X.X. Chen in morphology, but differs from the latter by its narrow sepals of male flowers that are 1.2–1.5 mm wide and yellow-white to slightly green in color, petals of male flowers subequal to the sepals in length, filament of stamens 3.0–4.0 mm long, long pedicels of both female flowers and fruits 3.0–4.5 cm in length, smaller sepals of female flowers 3.0–4.0 × 1.1–1.6 mm in sizes, and disc in female flowers shallowly bilobed for only ca. 1/5 of length.

***Description*:** Monoecious. **Shrubs** up to 1.5 m tall. **Stems** straight, terete, usually green, subglabrous. **Leaves** alternate, leathery, elliptic to oblong-elliptic, (3)3.5–6.5(7.5) cm long and 1.2–3.5 cm wide, both surface glabrous, margin entire, base cuneate to broadly cuneate, apex acuminate; midvein raised adaxially and abaxially; secondary veins 3–5 pairs, obliquely ascending and extending towards the margins. **Petioles** 3–6.5 mm long, glabrous. **Stipules** very small and usually caducous. **Inflorescences** axillary, solitary or sometime 2–5 fasciculate. **Staminate flowers** 1–5 per fascicle, 5.0–7.0 mm in diameter, yellow-white to slightly green; pedicels 1.8–3.5 cm long, glabrous; sepals 5, 3–3.5 mm long and 1.2–1.5 mm wide, oblong-ovate, apically usually round, adaxially glabrous, abaxially slightly pubescent, obscurely 3-veined; petals 5, white, usually as long as sepals, clavate to slightly linear, alternating with sepals; disc extrastaminal with 5 contiguous regular segments bilobed for 1/5–1/2 of length, apices of lobes rounded; stamens 5, opposite sepals; filaments 5, free, 3–4 mm long; anthers 5, longitudinally dehiscent. **Pistillate flowers** usually 1 per fascicle, 6.0–8.5 mm in diameter; pedicels usually 3.0–4.5 cm long, glabrous, apically slightly dilated; sepals 5, 3–4 mm long and 1.1–1.6 mm wide, ovate-oblong, apically acute to round, glabrous on both surfaces, usually 3-veined abaxially; petals 5, much shorter than sepals, linear, alternating with sepals; disc with 5 contiguous regular segments shallowly bilobed for ca. 1/5 of length, apices of lobes truncate to rounded; ovary 3-locular, ovate, glabrous, ovules 2 per locule; styles 3, free, erect, apex bifid to base. Fruiting pedicels 3.0–4.5 cm long, apically slightly dilated, glabrous; **Fruits** capsular, dehiscent into 3 2-valved cocci when mature, depressed globose, subglabrous, 6–8 mm in diameter, 4.5–6.0 mm high, persistent sepals ovate-triangular. **Seeds** 6, 2 per locule, brown to dark-brown, laterally compressed, 2.5–3.0 mm long and 1.5–2.0 mm wide, endosperm fleshy, lacking appendages.

***Phenology*:** Flowering from March to August and fruiting from May to October.

***Etymology*:** *Leptopus longipedicellatus* is named after its long pedicels of female flowers and fruits that are 3.0–4.5 cm in length, which is an important morphological trait that could be used to distinguish the species easily from other members of *Leptopus*.

***Habitat and distribution*:** The species usually grows in stone crevices in limestone hills at the elevation of 180–450 m.

***Conservation status*:** At present, only a small number of populations and individuals were found in Guling Town and Jinchai Town in Mashan County, Guangxi Province. According to Guidelines for using the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee, 2024), *L. longipedicellatus* is assessed as data deficient (DD).

Additional specimens examined (paratypes). **CHINA**. Guangxi Province, Mashan County, Jinchai Town, 10 September 2016, *S.J. Zhang & B.S. Xia 20163188* (HIB); 10 October 2016, *S.J. Zhang & B.S. Xia 20163189* (HIB).

Key to species of *Leptopus*, modified from Zhang *et al.* (2021)

1a. Pedicels of female flowers 3.0–4.5 cm long; Fruiting pedicels 3.0–4.5 cm long ……..…….…… ***L. longipedicellatus***
1b. Pedicels of female flowers never longer than 3.0 cm; Fruiting pedicels usually less than 3.0 cm long (except 1.4–3.5 cm long in *L. clarkei* and 1.5–3.6 cm long in *L. cordifolius*) ……..… 2
2a. Leaf laminas coriaceous, almost succulent, endemic to Guangxi Province, China …….....***L. pachyphyllus***
2b. Leaf laminas membranaceous to thick chartaceous, never succulent 3
3a. Leaf laminas with 8–10 visible pairs of secondary veins, fruits strongly reticulate; seeds with orange micropylar appendage …… ***L. emicans***
3b. Leaf laminas with 0–6 (7) visible pairs of secondary veins; fruits smooth to faintly reticulate; seeds without appendage ……..….. 4
4a. Ascendant herbs to subshrubs up to 0.5 m high; pedicels of female flowers 2–5 mm long, 5–9 mm in mature fruit …….. ***L. australis***
4b. Erect to procumbent herbs or shrubs 0.5–4 m high; pedicels of female flowers 5–30 mm long, 7–36 mm in mature fruit …… 5
5a. Pedicels of male flowers less than 3 mm long ……..…… 6
5b. Pedicels of male flowers more than 3 mm long, and usually up to 10 mm or longer ……..……7
6a. Branches white to light brown; male flower petals, filaments and

styles mostly glabrous; seeds smooth; endemic to Hainan Province, China ……..…….…… ***L. hainanensis***
6b. Branches reddish; male flower petals, filaments and styles hirsute, seeds transversely to irregularly ridged, sometimes pitted, endemic to Khanh Hoa Province, Vietnam …….. ***L. robinsonii***
7a. Stems flexuous; branches strongly ribbed ……..…… ***L. clarkei***
7b. Stems straight; branches terete to moderately ribbed ……...….8
8a. Petioles of mature leaves at least 1/4 of leaf lamina length; leaf apex rounded ……..…….... ***L. cordifolius***
8b. Petioles of mature leaves 1/10–1/6 of leaf lamina length; leaf apex not rounded, except several specimens of *L. chinensis* …….. 9
9a. Twigs longitudinally ribbed, or sometimes terete, leaf laminas usually 0.8–3 cm long (never longer than 5 cm) and 0.4–1.5 cm wide ……..…. ***L. chinensis***
9b. Twigs never longitudinally ribbed; leaf laminas usually longer than 5 cm and wider than 2.5 cm ……..…… 10
10a. Stems and branchlets usually pendulous or procumbent; ovary 3-locular, styles 3; endemic to Yunnan Province, China … ***L. malipoensis***
10b. Stems and branchlets ascendant or erect, ovary 4–5-locular, styles 4–5; endemic to GuangxiProvince,China …..…… ***L. fangdingianus***

ACKNOWLEDGMENTS

The authors are grateful to the curators and staff of herbaria GXMG, IBK, IBSC, KUN and PE for providing specimen images or hosting our visits. Meanwhile, we are grateful to curators and staff in HIB and HITBC for the production and depositing of the type specimens of *L. longipedicellatus*.

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Fig. S1. ***Leptopus longipedicellatus*** Gang Yao, Wen B. Xu & Shou J. Zhang (**A.** *S.J. Zhang & W.B. Xu 20240425*; holotype: HIB, barcode no. 0259009) and ***L. pachyphyllus*** X.X. Chen (**B.** *Y.S. Tan 4-3-424*; holotype: GXMI, barcode no. 050268).