

## An expansion of the genus *Deinostigma* (Gesneriaceae)

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**ABSTRACT.** Based on molecular, morphological and cytological studies the previously monotypic genus *Deinostigma* W.T.Wang & Z.Y.Li has been expanded to include several species previously ascribed to *Primulina* Hance. *Deinostigma* now comprises seven species, including one previously placed in synonymy. The new combinations *Deinostigma cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller, *Deinostigma cynostyla* (B.L.Burt) D.J.Middleton & H.J.Atkins, *Deinostigma cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins, *Deinostigma eberhardtii* (Pellegr.) D.J.Middleton & H.J.Atkins, *Deinostigma minutihamata* (D.Wood) D.J.Middleton & H.J.Atkins and *Deinostigma tamiana* (B.L.Burt) D.J.Middleton & H.J.Atkins are made. *Deinostigma eberhardtii* is lectotypified. The genus is defined by a combination of an alternate leaf arrangement, hooked hairs on many plant parts, flowers with the pedicel inserted at an angle and off-centre on the receptacle, and, where known, a somatic chromosome number (2n) of < 36. This new circumscription of the genus expands its distribution from Vietnam into South China.

**Keywords.** Molecular phylogeny, ovary morphology, *Primulina*, taxonomy

### Introduction

The genus *Deinostigma* W.T.Wang & Z.Y.Li in the Gesneriaceae currently has only one species, *D. poilanei* (Pellegr.) W.T.Wang & Z.Y.Li from the southern Annamite range of Vietnam. It was erected as a genus to accommodate the species first described as *Hemiboea poilanei* Pellegr. This species was placed in *Hemiboea* C.B.Clarke due to its bilocular ovary and the perception that one of the locules was sterile, a trait of the species in *Hemiboea*. Wang & Li (1992) argued that it did not belong in *Hemiboea* due to having alternate leaves, free bracts, inside of corolla glabrous, filaments broader

in the upper half, anthers hairy, anther locules divaricate with apices confluent, disc absent, and stigma bifid. In further arguments they noted how it differed from other Asian genera and concluded that a new genus was necessary to accommodate it. Since then, the status and relationships of *Deinostigma poilanei* have remained obscure due to being known from only very few specimens and because relatively little research has been done on the Gesneriaceae of Vietnam.

During work at the Muséum National d'Histoire Naturelle in Paris for an as-yet-unpublished checklist of the Gesneriaceae of Cambodia, Laos and Vietnam by DJM, it became clear that *Deinostigma poilanei* was similar to a number of species from Vietnam and China that were moved into *Primulina* Hance from *Chirita* Buch.-Ham. ex D.Don by Weber et al. (2011), namely *P. cynostyla* (B.L.Burtt) Mich.Möller & A.Weber, *P. cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & A.Weber, *P. eberhardtii* (Pellegr.) Mich.Möller & A.Weber, *P. minutihamata* (D.Wood) Mich.Möller & A.Weber and *P. tamiana* (B.L.Burtt) Mich.Möller & A.Weber. None of these *Deinostigma*-like species were included in the molecular phylogenetic analyses by Weber et al. (2011) but were moved into *Primulina* based on their previous inclusion in *Chirita* sect. *Gibbosaccus* C.B.Clarke by Wood (1974). All species of the hitherto *Chirita* sect. *Gibbosaccus* that were included in the molecular analyses formed a single highly supported clade with *Primulina tabacum* Hance, the type of *Primulina* (Weber et al., 2011).

*Deinostigma poilanei* and the species of *Primulina* similar to it share a number of morphological traits that are not found in other species of *Primulina*. These are alternate leaf arrangement (opposite or verticillate in the remaining *Primulina* species), hooked hairs on many plant parts but particularly on the pedicels, and flowers with the pedicel inserted at an angle and off-centre on the receptacle. In several species the fruit is strongly curved. The alternate leaf arrangement is not particularly clear in the species with a congested rosette of basal leaves but is nevertheless observable by only a single leaf emerging from the apical meristem at a time. Differences also exist in the basic chromosome numbers, with *Primulina* having exclusively  $x = 18$  ( $> 100$  species counted out of  $> 150$  described) (Möller & Pullan, 2015 onwards) while one *Deinostigma*-like species, *P. tamiana*, has been counted with  $x = 16$  (Christie et al., 2012). In other features the plants are indeed similar to *Primulina*. It should also be noted that these *Deinostigma*-like *Primulina* species occur on a variety of substrates but not on limestone and that the majority of the remaining *Primulina* species occur on limestone substrates.

In Wang et al. (1998) *Chirita cicatricosa* W.T.Wang is placed in synonymy of *C. minutihamata* D.Wood (= *Primulina minutihamata*), typified by material from China and Vietnam respectively. We found that the material from China has longer, more slender and more falcate fruits and somewhat larger flowers than material from Vietnam. Coupled with their large disjunct distribution, and pending a revision of the species, we suspect that they may represent distinct species and treat them thus here (see also below).

The aim of this study was to investigate the relationship between *Deinostigma* and *Primulina* and clarify the status of the *Deinostigma*-like *Primulina* species.

## Materials and Methods

### *Plant materials*

Herbarium specimens and living collections of *Deinostigma poilanei* and the *Deinostigma*-like *Primulina* species were studied in the Royal Botanic Garden Edinburgh and the Muséum National d'Histoire Naturelle in Paris.

Materials for morphological and phylogenetic analyses were collected in Vietnam (*Deinostigma poilanei*, *Primulina tamiana*) and China (*Primulina cyrtocarpa*, *Chirita cicatricosa*) (Table 1). Data for the phylogenetic analyses were downloaded from GenBank (including one additional sample of *Primulina minutihamata* from China which we are treating here as *Chirita cicatricosa*). These basically represented a reduced matrix of Old World Gesneriaceae as presented in Middleton et al. (2015). Altogether 132 samples (129 species) were included, covering all 32 genera currently recognised in the subtribe Didymocarpaceae of tribe Trichosporeae (Möller et al., 2009, 2011, 2014; Weber et al., 2013; Middleton et al., 2014a, 2015). The sampling included 20 samples of 19 species of *Primulina*, including the type, *P. tabacum* (Table 1). The phylogenetic trees were rooted on samples of *Microchirita* (C.B. Clarke) Yin Z. Wang (Möller et al., 2009, 2011).

### *DNA extraction, PCR and phylogenetic analysis*

Sequences of the nuclear ribosomal internal transcribed spacers (ITS) and the plastid *trnL-F* intron-spacer (*trnL-F*) for four samples, *Chirita cicatricosa*, *Deinostigma poilanei*, *Primulina cyrtocarpa*, and *P. tamiana*, were obtained. The extraction of genomic DNA was carried out using a CTAB procedure (Doyle & Doyle, 1987, 1990).

The PCR amplification of ITS and *trnL-F* were performed using primers '5P' (5'-GGA AGG AGA AGT CGT AAC AAG G-3') and '8P' (5'-CAC GCT TCT CCA GAC TAC A-3') (Möller & Cronk, 1997) and 'c' (5'-CGA AAT CGG TAG ACG CTA CG-3') and 'f' (5'-ATT TGA ACT GGT GAC ACG AG-3') (Taberlet et al., 1991), respectively, run on a Biorad T100™ Thermal Cycler (Hemel Hempstead, UK). The 10 µL reactions contained 1 µL 10× NH<sub>4</sub> reaction buffer (Bioline, UK), 1 µL dNTPs (2 mM), 0.3 µL MgCl<sub>2</sub> (50 mM), 0.4 µL of each primer (10 µM), 5.6 µL ddH<sub>2</sub>O, 0.1 µL Biotaq polymerase (5U/µL) (Bioline, UK) and 1.2 µL DNA template. The PCR thermocycle profile for ITS started with an initial denaturation for 3 min at 94°C, followed by 30 cycles of 1 min at 94°C, 1 min at 55°C and 1.5 min at 72°C, finished with a final extension step for 5 min at 72°C. For *trnL-F* it was: initial denaturation for 4 min at 94°C, followed by 30 cycles of 45 s at 94°C, 45 s at 55°C and 3 min at 72°C, with a final extension step for 10 min at 72°C. PCR products were run on 1% agarose gels to check for amplification success and quality. PCR amplified fragments were purified using ExoSAP-IT (Affymetrix, UK) following the manufacturer's protocol, and sequenced using the dideoxy chain-termination method. Sequencing samples were prepared using the BigDye Terminator v3.1 Cycle Sequencing Kit (Thermo Fisher Scientific, UK) following the manufacturer's recommendations, and sequencing was carried out by the Edinburgh Genomics sequencing service (University of Edinburgh,

UK). Editing and assemblage of sequencing results were performed using the programs Sequencher 4.5 (Gene Codes Corp, Ann Arbor, USA). The newly acquired sequences were added to the reduced matrix of Middleton et al. (2015) and the matrices realigned manually. They were subsequently submitted to GenBank (Table 1).

Since the combinability of the ITS and *trnL*-F matrices, tested with the ILD test (Farris, 1995a, 1995b), implemented as PHT in PAUP\* 4.0a146 (Swofford, 2002), did not indicate incongruent phylogenetic signals ( $P = 0.58$ ), the two matrices were analysed together. The reconstruction of phylogenetic trees by maximum parsimony (MP) and Bayesian inference (BI), including the calculation of bootstrap (BS) and posterior probability (PP) branch support values, were carried out as previously described (Möller et al., 2009, 2011; Weber et al., 2011; Middleton et al., 2015): the MP analysis on the combined data was carried out in PAUP\* v.4.0b10 (Swofford, 2002), on unweighted and unordered characters. Alignment gaps were treated as missing data. Starting trees were found by parsimony ratchet (Nixon, 1999), in PAUPRat (Sikes & Lewis, 2001) and PAUP\*, and the saved trees further optimised in PAUP\*, with both TBR and Multrees on. Statistical branch support was obtained from 10,000 heuristic bootstrap replicates each starting with a random addition tree, optimized with TBR on and Multrees off in PAUP\* (Möller & al., 2009, 2011).

The BI analyses were run in MrBayes v.3.1.2 (Huelsenbeck & Ronquist, 2001; Huelsenbeck et al., 2007). Models and parameter prior settings were obtained independently for the *trnL*-F, the ITS spacers and 5.8S sequences using MrModeltest v.2.3 (Nylander, 2004), and were GTR + I + G for *trnL*-F and the ITS spacers, and SYM + I + G for the 5.8S gene, respectively, as suggested by the Akaike Information Criterion (AIC; Akaike, 1974). Five million generations were run in two independent analyses each with four Markov chain Monte Carlo (MCMC) chains. One tree was sampled every 1000<sup>th</sup> generation (= 5000 trees), and the first 250 trees (5%) discarded as burn-in, determined after plotting the generations against the Log(n) likelihoods and a majority rule consensus tree construct with the 'sumt' command and posterior probabilities (PP) obtained in MrBayes.

### Cytology

The chromosome numbers for *Deinostigma poilanei* (R. Rybková HB 222) and *Primulina cyrtocarpa* (M.Möller & Y.G.Wei MMO 06-908) (Table 1), were determined from root tips as previously described (Jong & Möller, 2000; Christie et al., 2012). For *Chirita cicatricosa* (Zulin 131585, China, Guangxi, Shangsi), leaf cuttings were cultivated in pots at the South China Botanical Garden, Chinese Academy of Sciences. Actively growing root tips were harvested and pretreated in the dark with 0.1% colchicine and 0.1% 8-Hydroxyquinoline (1:1) at room temperature for 3 hours and then fixed in 3 : 1 absolute ethanol : glacial acetic acid at 4°C for 2 hours. They were macerated in a mixture of 1 : 1 1M HCl and 45% acetic acid at 37°C in a water bath for 45 min, and stained and squashed in 1% aceto-orcein.

## Results and Discussion

### Phylogeny

The MP analysis resulted in 204 most parsimonious trees with a length of 4123 steps, CI of 0.3772 and RI of 0.6797. For the BI runs, the average standard deviation of split frequencies was 0.003949 indicating a strong convergence of the two runs. Furthermore, a close correlation of the PP values between the two runs was observed, confirming the reproducibility of the runs.

In both the MP (Fig. 1) and BI (Fig. 2) phylogenetic trees, *Primulina* s.s. (excluding *Chirita cicatricosa*, *P. cyrtocarpa*, and *P. tamiana*) forms a highly supported clade (BS = 100%; PP = 1), and, most importantly, is the sister clade to *Petrocodon* with maximum branch support (BS = 100%; PP = 1). *Deinostigma poilanei*, together with *Chirita cicatricosa*, *Primulina cyrtocarpa* and *P. tamiana*, forms a separate clade (BS = 73%; PP = 0.88), which is sister to the monotypic *Metapetrocosmea* W.T.Wang with maximum branch support (BS = 100%; PP = 1). Although most of the genera are in highly supported clades, as in previous studies (Möller et al., 2009, 2011), the backbone of the phylogenetic tree is not resolved. However, since both *Primulina* s.s. and the *Deinostigma* clade form strongly supported sister relationships to other genera respectively, it is unlikely that the two genera are closely related. Consequently, we transfer the *Deinostigma*-like *Primulina* species to *Deinostigma* and refer to them thus hereafter.

### Morphology

All species are herbs. They are all probably perennial and, judging from the numerous leaf scars on the stems of some species, they are likely to be deciduous in the dry season. In particular, *Deinostigma cynostyla* has a thick stem with numerous congested leaf scars. The other species have a relatively thin stem and species such as *Deinostigma minutihamata* are mostly procumbent.

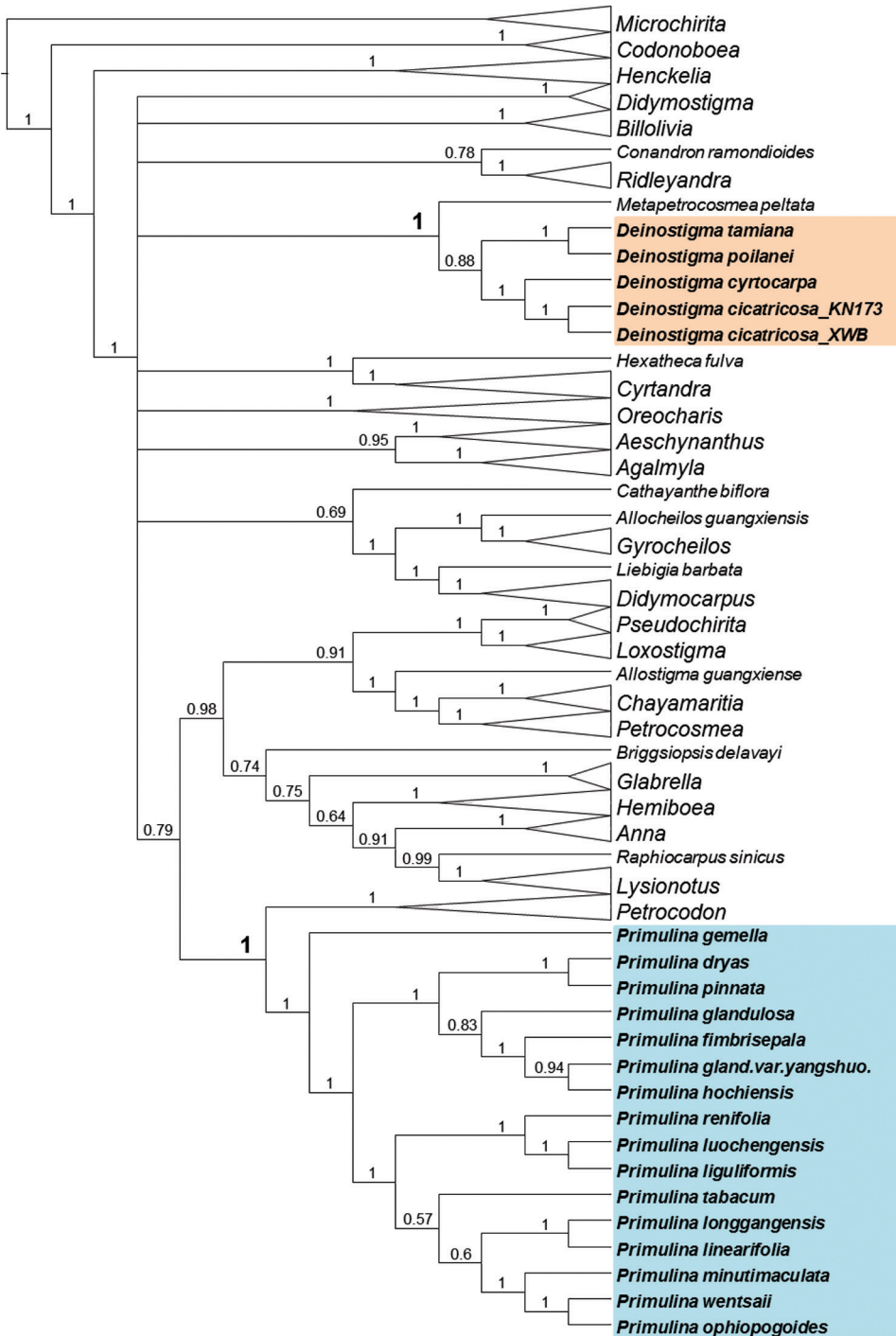
All species have an alternate leaf arrangement although this is not so obvious in *Deinostigma cynostyla* where the leaves are very congested. The alternate leaf arrangement is in contrast to *Primulina* s.s. where the leaves are opposite or in whorls, usually of three. The leaf blade is ovate to elliptic with a weakly (*Deinostigma tamiana*) to strongly (*D. cyrtocarpa*) crenate or dentate margin. In all species the length of the petiole is very variable within an individual, but compared to most other Asian genera, it is generally long in proportion to the length of the leaf blade, and often longer than the blade.

The inflorescences arise from the axils of the upper leaves, are borne on long peduncles, and are dichasia with the typical paired-flower arrangement of the Gesneriaceae. They are few-flowered in most species to many-flowered in *Deinostigma eberhardtii*. In most species the inflorescence is fairly lax but is rather congested in the terminal branches in *Deinostigma cynostyla*. There are hooked hairs on the pedicels, which are not found in *Primulina* s.s.

The corolla is white, blue or variations on purple (or combinations of these), infundibuliform, with the lower lip 3-lobed and the upper lip 2-lobed. From the colour and morphology bee pollination is likely.



**Fig. 1.** Maximum parsimony strict consensus tree based on combined ITS and *trnL-F* sequence data. Clades representing entire genera are collapsed. Numbers along the branches are bootstrap values. Asterisks denote branches receiving < 50% support.



**Fig. 2.** Bayesian inference majority rule consensus tree based on combined ITS and *trnL-F* sequence data. Clades representing entire genera are collapsed. Numbers along the branches are posterior probability values. Asterisks denote branches with < 0.5 posterior probability.

There are two fertile stamens and three staminodes (the central one sometimes obscure). The filaments are geniculate around the middle and glandular or hairy distally. The anthers are hairy or glandular in all species.

The ovary of *Deinostigma poilanei* is small, c. 5 mm long, at an oblique or sometimes almost a right angle to the pedicel and slightly curved upwards, similar to *D. cynostyla* (c. 2.4 mm long), *D. eberhardtii* (c. 4.5 mm long), *D. tamiana* (c. 5.5 mm long) and *D. cyrtocarpa* (7–9 mm long). At maturity, the capsules in *Deinostigma poilanei*, *D. tamiana* and *D. cyrtocarpa* are 1.5–2 cm long and in *D. eberhardtii* 2.5–2.9 cm long. In these species, the capsules are falcate and inserted at an angle to the pedicel to be carried  $\pm$  horizontally (not known in *Deinostigma cynostyla*).

In *Deinostigma cicatricosa* and *D. minutihamata*, the ovary is much larger, c. 12–18 mm long, and only at a slight angle in relation to the pedicel. In *Deinostigma cicatricosa*, the mature capsule is 4.5–5 cm long, has a slight curve and is slender, while in *D. minutihamata*, the capsule remains straight, 2.3–3.5 cm long, and is broader. In all *Deinostigma* species where it is known the capsule dehiscence is loculicidal.

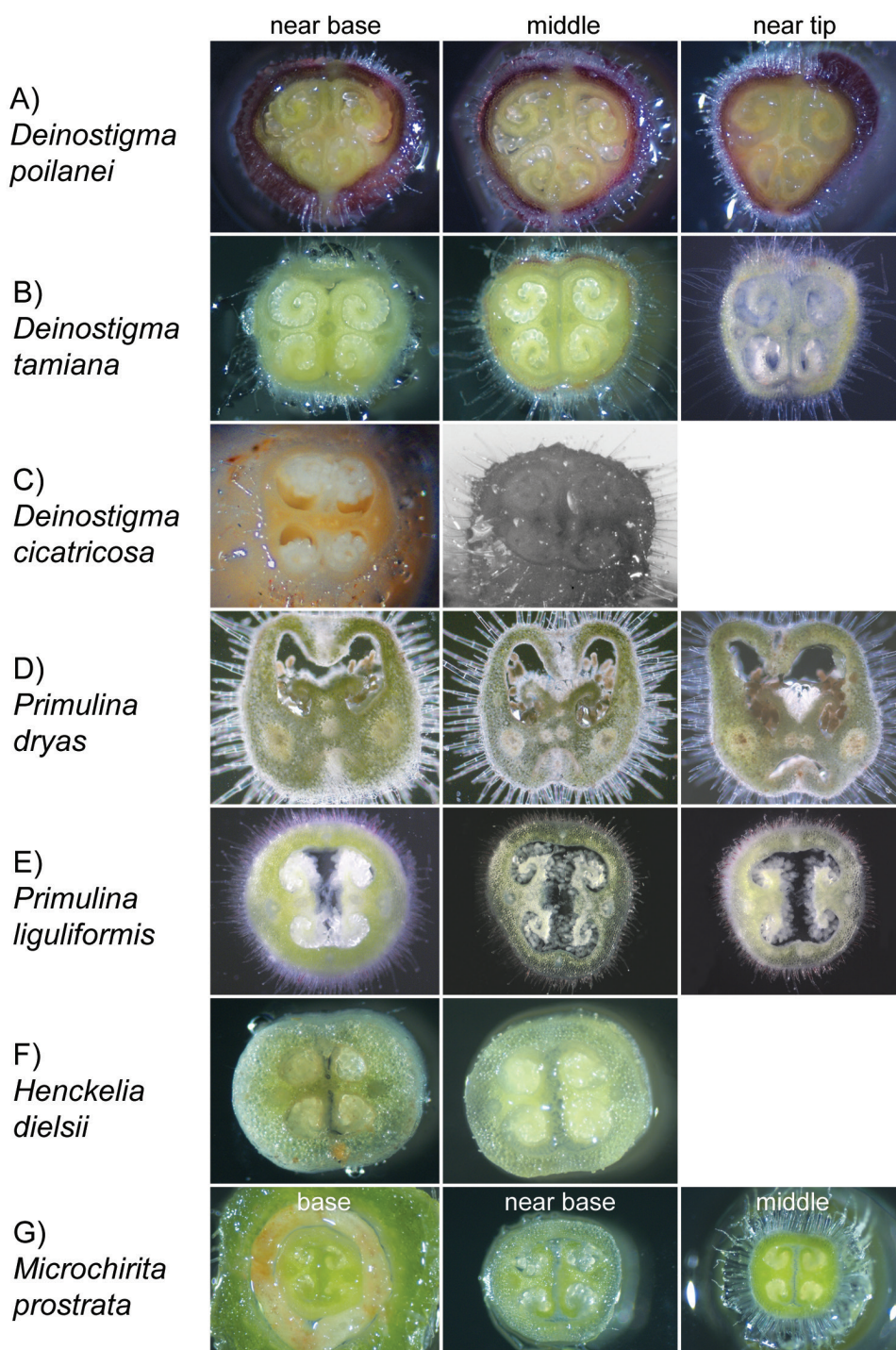
The internal structure of the ovaries could not be studied in all species. In the species studied the internal structure varies considerably. In *Deinostigma poilanei* it is bilocular for its entire length, with axile recurved bifid placentation (Fig. 3A). In *Deinostigma tamiana* and *D. cicatricosa* only the basal part is bilocular while in the middle and distal parts the carpels are not fused and the ovary is unilocular (Fig. 3B, C). We surveyed other species previously within the circumscription of *Chirita*, and now included in other genera (i.e., *Henckelia dielsii* (Borza) D.J.Middleton & Mich. Möller, *Microchirita prostrata* J.M.Li & Z.Xia, *Primulina hochiensis* (C.C.Huang & X.X.Chen) Mich.Möller & A.Weber and *Primulina liguliformis* (W.T.Wang) Mich. Möller & A.Weber), and found them to possess a unilocular ovary for their entire length (Fig. 3E–G). The exception was *Primulina dryas* (Dunn) Mich.Möller & A.Weber, the ovary of which is bilocular throughout but with the abaxial locule being sterile (Fig. 3D).

### Chromosome numbers

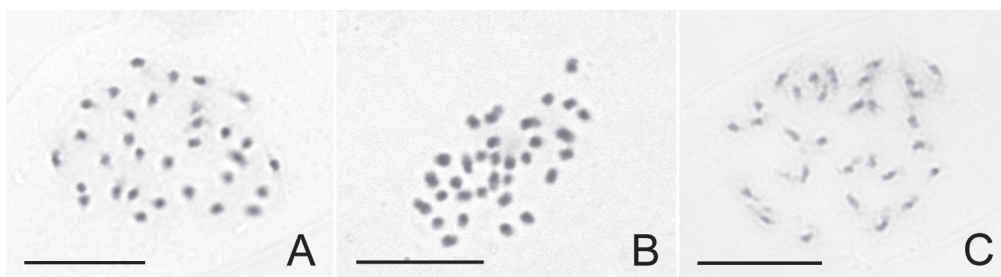
The chromosome number of *Deinostigma poilanei* and *D. cicatricosa* was determined as  $2n = 32$ , that of *D. cyrtocarpa* as  $2n = c. 30$  (Fig. 4). For all species, the chromosomes within each complement did not differ significantly in size and were c. 0.8–1.2  $\mu\text{m}$  in length. *Deinostigma tamiana* was counted previously as  $2n = 32$  (Christie et al., 2012).

The counts for all other *Primulina* species to date (139 counts for 118 species and 4 varieties, Möller & Pullan, 2015 onwards) were uniformly  $2n = 36$ , except for a tetraploid count of  $2n = 72$  for one accession of *P. longgangensis* (W.T.Wang) Y.Liu & Y.Z.Wang (Christie et al., 2012) and one count of  $2n = 28$  for the same species (Cao et al., 2003), the latter likely erroneous since two other counts of *P. longgangensis* showed  $2n = 32$  (Liu et al., 2012; Kang et al., 2014). Overall, the chromosome size of species of *Primulina* s.s. is slightly larger than those with  $2n = c. 30$  and  $32$  chromosomes, being mostly up to 1.6  $\mu\text{m}$  long, with the exception of *P. aff. balansae* (Drake) Mich. Möller & A.Weber with chromosomes up to 2.0  $\mu\text{m}$  long. Overall, the chromosome numbers are in full congruence with the phylogeny, separating *Primulina* s.s. with  $2n = 36$  from those with  $2n = c. 30$  and  $2n = 32$  chromosomes.





**Fig. 3.** Photographic sections taken near the base, the middle and the tip of ovaries of diverse species belonging to *Deinostigma* W.T.Wang & Z.Y.Li (A–C), species previously included in *Chirita* Buch.-Ham. (D–F) and *Microchirita prostrata* J.M.Li & Z.Xia (G). (Photos: M. Möller)



**Fig. 4.** Chromosome spread preparations of three *Deinostigma* W.T.Wang & Z.Y.Li species. **A.** *Deinostigma poilanei* (Pellegr.) W.T.Wang & Z.Y.Li prometaphase with  $2n=32$  chromosomes. **B.** *Deinostigma cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller metaphase with  $2n = 32$  chromosomes. **C.** *Deinostigma cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins prometaphase with  $2n = c. 30$  chromosomes. Scale bar:  $10\mu\text{m}$ . (Photos: A, C: M. Möller; B: Hui-Min Li)

### Geography

The Annamite range of mountains that straddles the border between Vietnam and Laos, and extends into NE Cambodia and further south in Vietnam to just north of Ho Chi Minh City, is known to be an area of high biodiversity and home to many endemic species of plants and animals (Averyanov et al., 2003; WWF, 2015). The Annamites are particularly interesting for Gesneriaceae as the genus *Billolivia* D.J.Middleton, now with seven species (all of which were also described as new), was recently described from the southern end of this range (Middleton et al., 2014a, 2014b; Vu et al., 2015). *Deinostigma*, however, occurs across almost the full length of the mountain range and into southern China, a distribution pattern not otherwise observed in other Gesneriaceae genera except for those which are generally much more widespread (e.g. *Aeschynanthus* Jack, *Didymocarpus* Wall., *Rhynchotechum* Blume).

### Conclusion

In summary, phylogeny, cytology and morphology support a separation of *Chirita cicatricosa* (previously included in synonymy of *Primulina minutihamata*), *Primulina cyrtocarpa* and *P. tamiana* from *Primulina* and their integration into an expanded genus *Deinostigma* with a distribution range covering Southern China and Vietnam. *Primulina cynostyla*, *P. eberhardtii* and *P. minutihamata* must also be moved into *Deinostigma* based on their close morphological similarities to species which have been included in the phylogeny. The genus includes species with leaves in alternate arrangement with distinct nodes (except congested in *D. cynostyla*), bilocular ovaries, at least at the base, and a chromosome number smaller than  $2n = 36$ , these characters distinguishing *Deinostigma* from *Primulina* s.s. *Metapetrocosmea*, though monotypic and sister to *Deinostigma* in the phylogeny, is excluded from *Deinostigma* due to its many differences, such as the unilocular ovary, epipetry, free anthers, capitate stigma, and the capsule globose and straight in relation to the pedicel.

## Taxonomy

We do not attempt a revision here of the species now included in *Deinostigma* but note that a revision is needed. The only major change to the existing taxonomy that we make is to resurrect *Chirita cicatricosa* from synonymy of *Primulina minutihamata* and make combinations in *Deinostigma* for both (see below). All type material cited below has been seen by the authors.

***Deinostigma*** W.T.Wang & Z.Y.Li, Acta Phytotax. Sin. 30(4): 356 (1992). – TYPE: *Deinostigma poilanei* (Pellegr.) W.T.Wang & Z.Y.Li

*Chirita* subsect. *Cicatricosae* W.T.Wang, Bull. Bot. Res., Harbin 1(4): 69 (1981). – TYPE: *Chirita cicatricosa* W.T.Wang

Perennial herbs, caulescent with distinct or short stem. **Leaves** simple, alternate, sometimes congested into a rosette, petiolate; blade slightly peltate or not, margin crenate or dentate, secondary veins pinnate. **Inflorescences** axillary, cymose; pedicels with hooked hairs. **Flowers** with the pedicel inserted at an angle and off-centre on the receptacle. **Calyx** lobes divided to base, elliptic, those on ventral side slightly longer and wider. **Corolla** white, purple, blue or combinations thereof, infundibuliform, lower lip 3-lobed, upper lip 2-lobed, lobe apices rounded. **Fertile stamens** 2, filaments slightly curved, anthers adnate face to face, hairy or with glands, staminodes 3 but with central staminode sometimes obscure. **Nectary** 5-crenate or apparently lacking. **Ovary** fusiform, bilocular throughout or at least near base, then unilocular from middle to apex; stigma of only lower lip developing, broad, flat and weakly 2-lobed. **Fruit** straight to strongly falcate, oblique in relation to the pedicel, dehiscing loculicidally; many-seeded, seeds unappendaged.

**Distribution.** Seven species in southern China and Vietnam. Some of the Vietnamese material was collected close to the border with Laos and it may also occur in that country.

***Deinostigma cicatricosa*** (W.T.Wang) D.J.Middleton & Mich.Möller, **comb. nov.** – *Chirita cicatricosa* W.T.Wang, Bull. Bot. Res., Harbin 1(4): 69 (1981). – TYPE: China, Guangxi, Dongxing, Banba Commune, Renbei, 3 October 1976, Fang, D. *et al.* 1525 (holotype GXMI [GXMI050619]). (Fig. 5A–D)

**Distribution.** China (Guangxi).

**Notes.** Wood (1974) included a specimen from Southern Guangxi (although he cited it as being from ‘Kwangtung’ (Guangdong)) in his new species *Chirita minutihamata*, along with material, including the type, from Vietnam. Wang (1981) later described *Chirita cicatricosa* from Guangxi without explicitly including the Chinese material

of *C. minutihamata* or referring to that species. Wang (1985), Wang et al. (1990) and Wang et al. (1998) placed *Chirita cicatricosa* in synonymy of *C. minutihamata* and cited localities corresponding to the type locality of *C. cicatricosa* and the material cited by Wood (1974). We acknowledge that the material from China and the material from Vietnam are indeed very similar but the differences between them, particularly in the longer, slender, more falcate fruits and the somewhat larger flowers of the Chinese material, along with the widely disjunct distribution, lead us to suspect that they may be recognised as distinct species when the group is revised. We therefore provide the combination in anticipation of this.

***Deinostigma cycnostyla*** (B.L.Burtt) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita cycnostyla* B.L.Burtt, Notes Roy. Bot. Gard. Edinburgh 23: 96 (1960). – *Primulina cycnostyla* (B.L.Burtt) Mich.Möller & A.Weber, Taxon 60: 781 (2011). – TYPE: Vietnam, Da Nang, Ba Na, 1000–1500 m, 27 February 1939, *Poilane, E. 29123* (holotype P [P00602510]).

*Distribution.* Only known from the Ba Na Hills of central Vietnam.

*Notes.* This species has not been included in molecular phylogenetic analyses but has been transferred to *Deinostigma* based on its morphological similarity to *Deinostigma poilanei*.

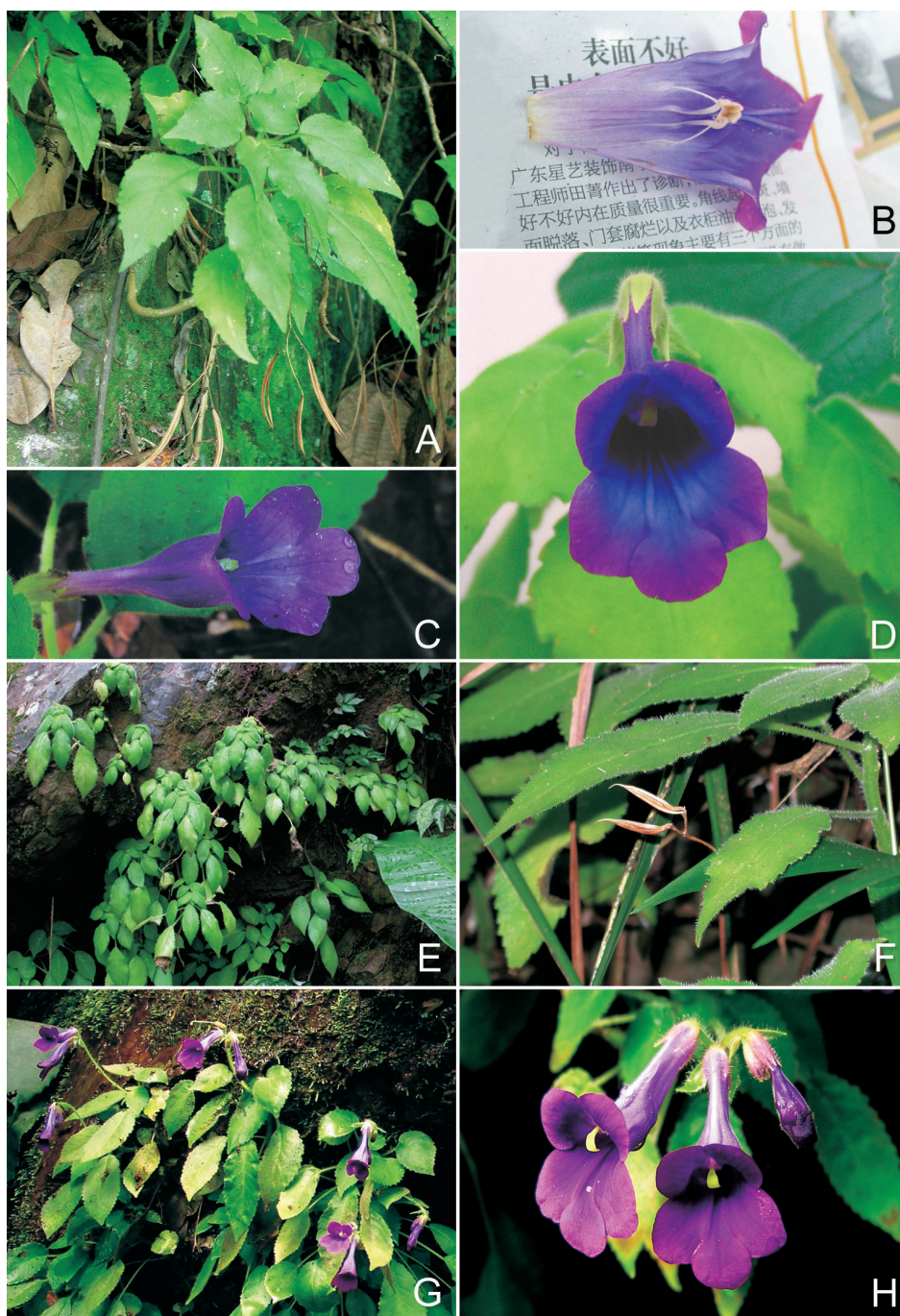
***Deinostigma cyrtocarpa*** (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins, **comb. nov.** – *Chirita cyrtocarpa* D.Fang & L.Zeng, Acta Phytotax. Sin. 31(5): 468 (1993). – *Primulina cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & A.Weber, Taxon 60: 781 (2011). – TYPE: China, Guangxi, Hezhou City, 130–140 m, 16 June 1991, *Zhou L.S. & Zeng L. 1263* (holotype GXMI [GXMI050608]). (Fig. 5E–H)

*Distribution.* NE Guangxi (Hezhou).

***Deinostigma eberhardtii*** (Pellegr.) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita eberhardtii* Pellegr., Bull. Soc. Bot. France 73: 418 (1926). – *Primulina eberhardtii* (Pellegr.) Mich.Möller & A.Weber, Taxon 60: 782 (2011). – TYPE: Vietnam, Thua Thien-Hue, Baika, *Eberhardt 2466* (lectotype P [P00602512], designated here; isolectotype VNM).

*Distribution.* Vietnam (Thua Thien-Hue and Da Nang).

*Notes.* This species has not been included in molecular phylogenetic analyses but has been transferred to *Deinostigma* based on its morphological similarity to *Deinostigma poilanei*.



**Fig. 5.** *Deinostigma cicatricosa* (W.T.Wang) D.J.Middleton & Mich.Möller (A–D) and *D. cyrtocarpa* (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins (E–H). **A.** Habit and mature fruits. **B.** Flower cut open. **C.** Flower top view. **D.** Flower front view. **E.** Habit. **F.** Mature fruits. **G.** Flowering branch. **H.** Flowers front view. (Photos: A, B, E, F: M. Möller; C, D, G, H: Yi-Gang Wei)

***Deinostigma minutihamata*** (D.Wood) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita minutihamata* D.Wood, Notes Roy. Bot. Gard. Edinburgh 31: 370 (1972). – *Primulina minutihamata* (D.Wood) Mich.Möller & A.Weber, Taxon 60: 783 (2011). – TYPE: Vietnam, Kon Tum, Ngok Pa Not, 2300 m, 12 December 1946, *Poilane, E. 35803* (holotype P [P00602518]; isotype P [P00602519]).

*Distribution.* Vietnam (Kon Tum).

*Notes.* See notes under *Deinostigma cicatricosa*. This species has not been included in molecular phylogenetic analyses but has been transferred to *Deinostigma* based on its morphological similarity to *D. cicatricosa* and *D. poilanei*.

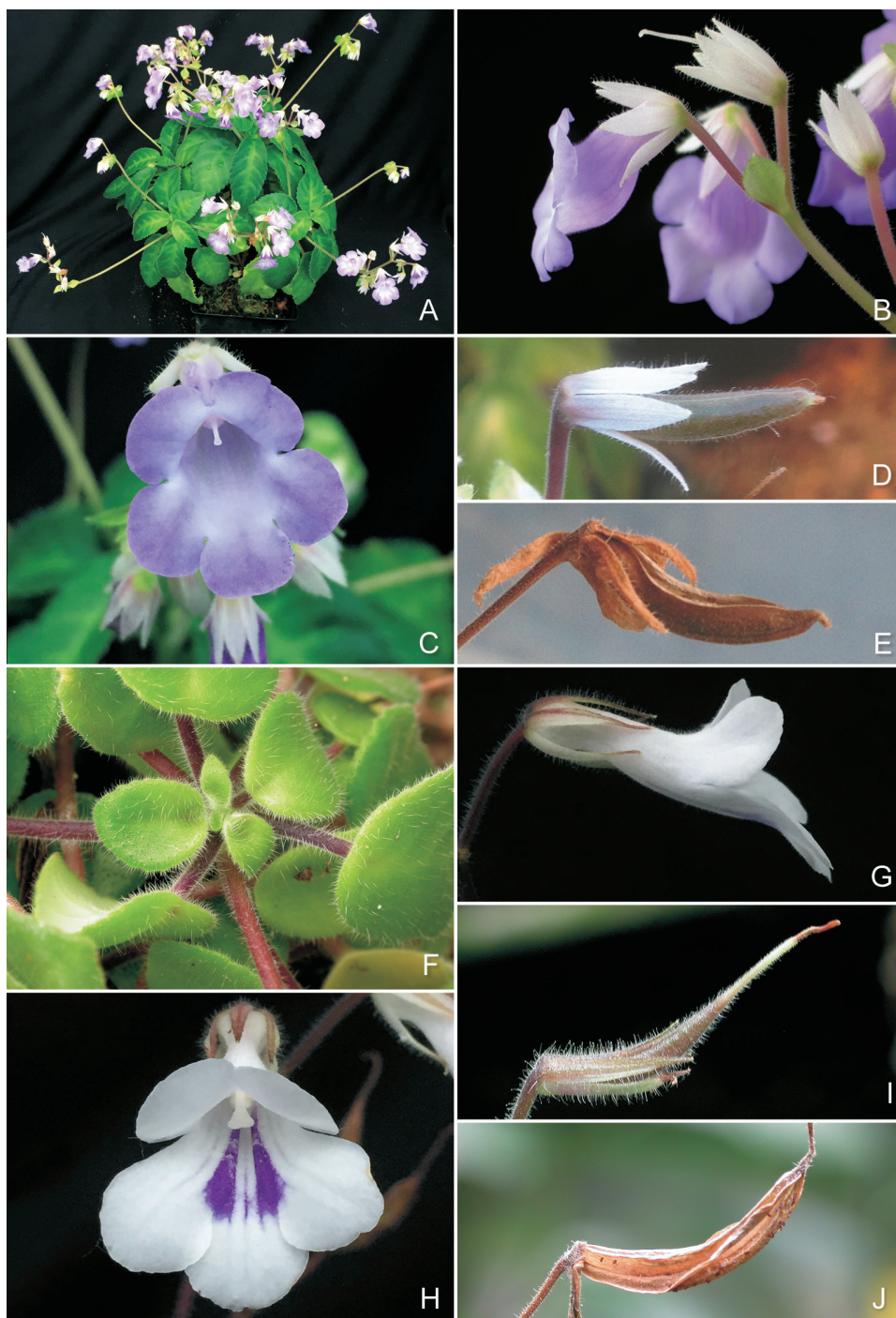
***Deinostigma poilanei*** (Pellegr.) W.T.Wang & Z.Y.Li, Acta Phytotax. Sin. 30(4): 357 (1992). – *Hemiboea poilanei* Pellegr., Bull. Soc. Bot. France 73: 421 (1926). – TYPE: Vietnam, Khanh Hoa, Nha Trang, 300 m, 29 May 1922, *Poilane, E. 3846* (holotype P [P00606338]; isotype P [P00634330]). (Fig. 6A–E)

*Distribution.* Vietnam (Khanh Hoa, Thua Thien-Hue and Da Nang).

***Deinostigma tamiana*** (B.L.Burt) D.J.Middleton & H.J.Atkins, **comb. nov.** – *Chirita tamiana* B.L.Burt, Gloxinian 49(4): 20 (1999). – *Primulina tamiana* (B.L.Burt) Mich.Möller & A.Weber, Taxon 60: 785 (2011). – TYPE: Originally collected as Soviet-Vietnam Expedition 0/114 from Vietnam, Vinh Phuc, Tam Dao National Park, cultivated in RBGE under accession number 19981743\*A, vouchered for the herbarium as *CULTE 15738* (holotype E [E00269898]). (Fig. 6F–J)

*Distribution.* Vietnam (Vinh Phuc, Tam Dao NP).

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**Fig. 6.** *Deinostigma poilanei* (Pellegr.) W.T.Wang & Z.Y.Li (A–E) and *D. tamiana* (B.L.Burtt) D.J.Middleton & H.J.Atkins (F–J). **A.** Habit. **B.** Flower side view. **C.** Flower front view. **D.** Immature fruit. **E.** Mature fruit. **F.** Habit. **G.** Flower side view. **H.** Flower front view. **I.** Immature fruit. **J.** Mature fruit. (Photos: A, B, C, F–J: M.Möller; D, E: Sadie Barber)

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**Table 1.** List of the 132 Gesneriaceae samples of tribe Trichosporeae included in the phylogenetic analysis, including voucher number, deposition, origin and GenBank accession numbers for *trnL-F* and ITS respectively.

Taxon	Voucher number	Deposited in	Origin	<i>trnL-F</i>	ITS or ITS1 / ITS2
<i>Aeschynanthus bracteatus</i> Wall. ex A.DC.	Wang, Y.Z. 991113	PE	China, Yunnan, Xichou county	FJ501501	-
<i>Aeschynanthus bracteatus</i> Wall. ex A.DC.	Cherry, R. 123 [Cult. RBGE 19970165]	E	Vietnam, Lao Cai	-	AF349203 / AF349284
<i>Aeschynanthus lancilimbus</i> W.T.Wang	Wang, Y.Z. S-10868	PE	China, unknown locality	FJ501499	HQ632992
<i>Aeschynanthus micranthus</i> C.B.Clarke	Möller, M. & Qi, Y.D. MMO 01-79	E, PE, WU	China, Yunnan, Hekou county	FJ501500	-
<i>Aeschynanthus micranthus</i> C.B.Clarke	Reid, A. & Fernie, J. 004 [Cult. RBGE 19951561]	E	China, Yunnan, Xishuangbanna Dai Aut. Pref.	-	AF349218 / AF349299
<i>Aeschynanthus rhododendron</i> Ridl.	Woods, P. 600 [Cult. RBGE 19680624]	E	Malaysia, Genting Highlands	HQ632895	FJ501333
<i>Aeschynanthus roseoflorus</i> Mendum	Argent, G. 87/14	E	Indonesia, Seram	HQ632896	HQ632993
<i>Agalmyla biflora</i> (Elmer) Hilliard & B.L.Burtt	RBGE-PNH/1998 25435 [Cult. RBGE 19980287],	E	Philippines, Palawan, Near summit of Cleopatra Needle	FJ501541	-
<i>Agalmyla biflora</i> (Elmer) Hilliard & B.L.Burtt	RBGE-PNH/1998-25517 [Cult. RBGE 19980292]	E	Philippines, Palawan, near Thumb Peak	-	FJ501361
<i>Agalmyla bilirana</i> Hilliard & B.L.Burtt	RBGE-PNHE 1999 12	E	Philippines, Leyte Island	HQ632891	HQ632988
<i>Agalmyla clarkei</i> (Elmer) B.L.Burtt	RBGE-PNH/1999(P99) 13 [Cult. RBGE 19991911]	E	Philippines, Leyte Island, Mt. Lobi	FJ501540	-
<i>Agalmyla clarkei</i> (Elmer) B.L.Burtt	RBGE-PNH/1997 IS26 [Cult. RBGE 19972530A]	E	Philippines, Luzon, Barangay Penicuason	-	FJ501360

<i>Agalmylia glabra</i> (Merr.) Hilliard & B.L.Burt	RBGE-PNHE 1999 28	E	Philippines, Camiguin Island	HQ632892	HQ632989
<i>Agalmylia paucipilosa</i> Hilliard & B.L.Burt	Smith & Galloway 261	E	Indonesia, Sulawesi, Mt. Rantemario	HQ632893	HQ632990
<i>Agalmylia sojoliana</i> Hilliard & B.L.Burt	Smith & Galloway 321	E	Indonesia, Sulawesi, Mt. Sojol	HQ632894	HQ632991
<i>Allocheilos guangxiensis</i> H.Q.Wen, Y.G. Wei & S.H.Zhong	Wei, Y.G. 06-02	IBK	China, Guangxi, Yongfu county	HQ632897	HQ632994
<i>Allostigma guangxiense</i> W.T.Wang	Möller, M. & Wei, Y.G. MMO 05-755	E, IBK	China, Guangxi, Longzhou county	HQ632880	HQ632977
<i>Anna mollifolia</i> (W.T.Wang) W.T.Wang & K.Y.Pan	Möller, M. & Qi, Y.D. MMO 01-146	E, PE, WU	China, Guangxi, Napo county	FJ501543	AF055050 / AF055051
<i>Anna ophiorrhizoides</i> (Hemsl.) B.L.Burt & R.A.Davidson	Möller, M. & Wei, Y.G. MMO 08-1280	E, IBK	China, Sichuan, Emei Shan	HQ632937	HQ633034
<i>Anna submontana</i> Pellegr.	Möller, M. & Qi, Y.D. MMO 01-85	E, PE, WU	China, Yunnan, Maguan county	FJ501542	FJ501362
<i>Billolivia longipetiolata</i> D.J.Middleton & Luu	Luu Hong Truong & Pham Huu Nhan BD624	E	Vietnam, Lam Dong Province, Bidoup – Nui Ba National Park	KU985108	KU985112
<i>Billolivia minutiflora</i> D.J.Middleton & H.Atkins	Ly Ngoc Sam LY498	E	Vietnam, Lam Dong Province, Da Hoai District	KU985109	KU985113
<i>Billolivia vietnamensis</i> D.J.Middleton & Luu	Luu Hong Truong & Nguyen Quoc Dat BGM1601	E	Vietnam, Binh Phuoc, Bu Gia Map National Park	KU985110	KU985114
<i>Billolivia violacea</i> D.J.Middleton & H.Atkins	Middleton, D.J. 4210	E	Vietnam, Lam Dong, Duc Trong District	KU985111	KU985115
<i>Briggsiopsis delavayi</i> (Franch.) K.Y.Pan	Fang, W. 1	IBK	China, Chongqing, Nanchuan county	HQ632879	HQ632976
<i>Cathayanthe biflora</i> Chun	Möller, M. & Wei, Y.G. MMO 08-1327	E, IBK	China, Hainan, Tongshi county	HQ632899	HQ632996

<i>Chayamartitia banksiae</i> D.J.Middleton	<i>Middleton, D.J. 5220 (= Newman, M. et al. LAO1428)</i>	E	Laos, Khammouan, Nakai Nam Theun	KP325433	KP325426
<i>Chayamartitia smitinandii</i> (B.L.Burt) D.J.Middleton & Mich.Möller	<i>Middleton, D.J. et al. 5632</i>	E	Thailand, Nakhon Nayok, Khao Yai NP	KP325431	KP325424
<i>Chayamartitia smitinandii</i> (B.L.Burt) D.J.Middleton & Mich.Möller	<i>Middleton, D.J. et al. 5652</i>	E	Thailand, Nakhon Nayok, Khao Yai NP	KP325432	KP325425
<i>Codonoboea albomarginata</i> (Hemsl.) Kiew	<i>Weber, A. 840805-1/12</i>	WU	Malaysia, Perak, Maxwell's Hill	AJ492297	HQ632961
<i>Codonoboea codonion</i> (Kiew) C.L.Lim	<i>Lim, C.L. FRI 65040</i>	KEP	Malaysia, Terengganu, Jerangau F.R.	JF912538	JF912565
<i>Codonoboea corrugata</i> (Mendum) D.J.Middleton	<i>RBGE-PNHE 1998 s.n.</i>	E	Philippines, Palawan	FJ501484	HQ632962
<i>Codonoboea floribunda</i> (M.R.Hend.) C.L.Lim	<i>Lim, C.L. FRI 64971</i>	KEP	Malaysia, Terengganu, Sg. Nipah F.R.	JF912539	JF912566
<i>Codonoboea malayana</i> (Hook.f.) Kiew	<i>Kiew, R. &amp; Middleton. D.J. FRI 57513</i>	KEP	Malaysia, Pahang, Fraser's Hill	JF912541	JF912568
<i>Codonoboea venusta</i> (Ridl.) Kiew	<i>Kiew, R. RK 5430</i>	KEP	Malaysia, Pahang, Fraser's Hill	JF912545	JF912572
<i>Conandron ramondiooides</i> Siebold & Zucc.	<i>Takeda Herbal Garden Kyoto [Cult. RBGE 19691267]</i>	E	Japan, unknown locality	FJ501515	FJ501340
<i>Cyrtandra cumingii</i> C.B.Clarke	<i>Kokubugata, G. 11134</i>	TNS	Japan, Ruykyus, Iriomote Island	HQ632905	HQ633002
<i>Cyrtandra cupulata</i> Ridl.	<i>Weber, A. 840806-2/4</i>	WU	Malaysia, Perak, Maxwell's Hill	FJ501532	AY818826 / AY818861
<i>Cyrtandra glabra</i> Banks ex C.F.Gaertn.	<i>Cronk, Q.C.B. &amp; Percy, D. T91</i>	E	French Polynesia, Society Is., Tahiti, Mt. Tearoa Col	AY423136	FJ501353

<i>Cyrtandra kusaimontana</i> Hosok.	NTBG 960873	PTBG	Federated States of Micronesia, Caroline Islands	HQ632907	-
<i>Cyrtandra kusaimontana</i> Hosok.	Flynn 5995	PTBG	Federated States of Micronesia, Caroline Islands	-	EU9119945
<i>Cyrtandra longifolia</i> (Wawra) Hillebr. ex C.B.Clarke	Kiehn, M. 920825-2/1 [Cult. HBV]	WU	USA, Hawaii, Kauai	FJ501531	EU9119939
<i>Cyrtandra pendula</i> Blume	Weber, A. & <i>Anthomyrsamy</i> 860730-1/2 [Cult. HBV]	WU	Malaysia, Negeri Sembilan, Kuala Pilah distr., Jeram Toi	FJ501530	FJ501354
<i>Deinostigma cicatricosa</i> (W.T.Wang) D.J.Middleton & Mich.Möller	Möller, M. & Wei, Y.G. MMO 07-1148 [KN173]	E, IBK	China, Guangxi, Fang Cheng	KU990886	KU990890
<i>Deinostigma cicatricosa</i> (W.T.Wang) D.J.Middleton & Mich.Möller	Xu, W.-B. s.n. [XWB]	IBK	China, unknown locality	JX506817	JX506925
<i>Deinostigma cyrtocarpa</i> (D.Fang & L.Zeng) Mich.Möller & H.J.Atkins	Möller, M. & Wei, Y.G. MMO 06-908	E, IBK	China, Guangxi, He Zhou city	KU990885	KU990889
<i>Deinostigma poilanei</i> (Pellegr.) W.T.Wang & Z.Y.Li	Rybková, R. HB 222	E	Vietnam, Hon Ba	KU990888	KU990892
<i>Deinostigma tamiana</i> (B.L.Burtt) D.J.Middleton & H.J.Atkins	Soviet-Vietnam Expedition (Liberec B.G., Czech Republic & St. Petersburg B.G) 01/114 [Cult. RBGE 19973431/19981743]	E	Vietnam, Vinh Phu	KU990887	KU990891
<i>Didymocarpus antirrhinoides</i> A.Weber	Jong, K. 9009 [Cult. RBGE 19650167]	E	Malaysia, Perak, Bujong Melaka, Ipoh.	FJ501513	DQ912671
<i>Didymocarpus citrinus</i> Ridl.	Davis, P. 69437 [Cult. RBGE 19830510]	E	Malaysia, Perlis, Kedah Peak	AJ492293	DQ912669

<i>Didymocarpus cordatus</i> Wall. ex A.DC.	Weber, A. 860816-2/1	WU	Malaysia, Perak, Maxwell's Hill	AJ492294	DQ912673
<i>Didymocarpus podocarpus</i> C.B.Clarke	Noltie, H., Pradhan, Sherrub & Wangdi 193	E	Bhutan, Deothang District	FJ501514	DQ912688
<i>Didymocarpus stenanthos</i> C.B.Clarke	Möller, M. & Qi, Y.D. MMO 01-156	E, PE, WU	China, Yunnan, Binchuan county	FJ501512	DQ912687
<i>Didymocarpus villosus</i> D.Don	Adhikari, B. SB 9	E	Nepal, Sundarjal	HQ632904	HQ633001
<i>Didymostigma obtusum</i> (C.B.Clarke) W.T.Wang	Möller, M. & Wei, Y.G. MMO 08-1310	E, IBK	China, Guangdong, Fengkai county	HQ632875	HQ632971
<i>Didymostigma trichanthera</i> C.X.Ye & X.G.Shi	Möller, M. & Wei, Y.G. MMO 08-1335	E, IBK	China, Guangdong, Longmen county	HQ632876	HQ632972
<i>Glabrella longipes</i> (Hemsl. ex Oliv.) Mich.Möller & W.H.Chen	Möller, M. & Qi, Y.D. MMO 01-122	E, PE, WU	China, Yunnan, Xichou county	FJ501545	AF055052 / AF055053
<i>Glabrella mihieri</i> (Franch.) Mich. Möller & W.H.Chen	Wang, Y.Z. 11315B	PE	China, Chongqing, Nanchuan county	FJ501544	FJ501363
<i>Gyrocheilos chorisepalus</i> W.T.Wang var. <i>synsepalus</i> W.T.Wang	Wei, Y.G. 07-708	IBK	China, Guangdong, Xinyi county	HQ632900	HQ632997
<i>Gyrocheilos lasiocalyx</i> W.T.Wang	Möller, M. & Wei, Y.G. MMO 06-881	E	China, Guangxi, Guiping county	HQ632901	HQ632998
<i>Gyrocheilos retrotrichus</i> W.T.Wang	Möller, M. & Wei, Y.G. MMO 07-1136	E, IBK	China, Guangxi, Wuming county	HQ632902	HQ632999
<i>Gyrocheilos retrotrichus</i> W.T.Wang var. <i>oligolobus</i> W.T.Wang	Wei, Y.G. 06-208	IBK	China, Guangxi, Rongshui county, Sirong town	HQ632903	HQ633000
<i>Hemiboea bicornuta</i> (Hayata) Ohwi	Voucher from Cult. RBGE 19951207	E	unknown origin	FJ501534	FJ501356
<i>Hemiboea cavaleriei</i> H.Lév.	Z.J.Gu, Z.J. G3	KUN	China, unknown locality	FJ501533	FJ501355
<i>Hemiboea omeiensis</i> W.T.Wang	Möller, M. MMO 08-1271	E, IBK	China, Sichuan, Emei Shan	HQ632886	HQ632983

<i>Hemiboea ovalifolia</i> (W.T.Wang) A. Weber & Mich. Möller	<i>B.M.Nong, B.M. 06-1</i>	IBK	China, Guangxi, Napo county, Nonghua	HQ632883	HQ632980
<i>Hemiboea purpureotincta</i> (W.T.Wang) A. Weber & Mich. Möller	<i>Möller, M. &amp; Wei, Y.G. MMO 06-813</i>	E, IBK	China, Guangxi, Tian Ling county	HQ632884	HQ632981
<i>Hemiboea subcapitata</i> C.B. Clarke	<i>Wang, Y.Z. 11306</i>	PE	China, Chongqing, Chengkou county	FJ501535	FJ501357
<i>Henckelia anachoreta</i> (Hance) D.J. Middleton & Mich. Möller	<i>Middleton, D.J. et al. 4480</i>	E	Thailand, Chiang Mai, Doi Suthep	HQ632870	HQ632966
<i>Henckelia bifolia</i> (D. Don) A. Dietr.	<i>Bhaskar Adhikari L2B6</i>	E	Nepal, Chyalding, near Sybrubesi	JF912522	JF912549
<i>Henckelia dielsii</i> (Borza) D.J. Middleton & Mich. Möller	<i>Möller, M. et al. MMO 08- 1211</i>	E, KUN	China, Yunnan, Jingdong county	HQ632871	HQ632967
<i>Henckelia floccosa</i> (Thwaites) A. Weber & B.L. Burt	<i>Jang, C.G. s.n. [G 157]</i>	WU	Sri Lanka, unknown locality	FJ501486	HQ632964
<i>Henckelia grandifolia</i> A. Dietr.	<i>Möller, M. et al. MMO 08- 1222</i>	E, KUN	China, Yunnan, Jingdong county	JF912527	JF912554
<i>Henckelia incana</i> (Vahl) Spreng.	<i>Vogel, S. SVG s.n.</i>	E	India, Nilghiri mts	HQ632869	HQ632965
<i>Henckelia pumila</i> (D. Don) A. Dietr.	<i>Gaoligong Shan Expedition 1996 7938 [Cult. RBGE 19962271]</i>	E	China, Yunnan, Nuijiang Lisu Aut. Pref., Fugong county	FJ501491	FJ501327
<i>Henckelia urticifolia</i> (D. Don) A. Dietr.	<i>EMAK 109 H (Edinburgh- Makalu Expedition 1991)</i>	E	Nepal, Sankhuwasabha dist., Arun valley	FJ501492	FJ501328
<i>Hexatheca fulva</i> C.B. Clarke	<i>Sang, J. &amp; Geri, C. S99358</i>	E	Malaysia, Sarawak, Bau, Fairy Cave	HQ632873	HQ632969
<i>Liebigia barbata</i> (Jack) D.J. Middleton	<i>Woods, P. 1071 (C6570)</i>	E	Indonesia, Java, forest above Cibodas Garden	FJ501538	JF501359
<i>Loxostigma fimbrispalum</i> K. Y. Pan	<i>Wang, Y.Z. 991005</i>	PE	China, Yunnan, Jinping county	FJ501507	KU985104

<i>Loxostigma glabrifolium</i> D.Fang & K.Y.Pan	Wei, Y.G. 709	IBK	China, Guangxi, Napo county	HQ632910	HQ633006
<i>Loxostigma griffithii</i> (Wight) C.B. Clarke	Kew/Edinburgh Kanchenjunga Expedition (1989) 940 [Cult. RBGE 19892473A]	E	Nepal, Yamphudin	FJ501508	FJ501338
<i>Loxostigma</i> sp.	Gaoligong Shan Expedition 1996 7668	E	China, Yunnan	AY423137	HQ633005
<i>Lysionotus chingii</i> Chun ex W.T. Wang	Wang, Y.Z. S-10669	PE	China, unknown locality	FJ501498	FJ501332
<i>Lysionotus forrestii</i> W.W.Sm.	Gaoligong Shan Expedition 1996 7925 [Cult. RBGE 19962269A]	E	China, Yunnan, Nujiang Lisu Aut. Pref.,	FJ501495	AF349152 / AF349233
<i>Lysionotus pauciflorus</i> Maxim.	Möller; M. & Qi, Y.D. MMO 01-101	E, PE, WU	China, Yunnan, Xichou county, Cheng Jia Po	FJ501497	FJ501331
<i>Lysionotus petelotii</i> Pellegr.	Möller; M. & Qi, Y.D. MMO 01-100/4	E, PE	China, Yunnan, road to Xichou	FJ501496	HQ632974
<i>Metapetrocosmea peltata</i> (Merr. & Chun) W.T. Wang	Wei, Y.G. 07-702	IBK	China, Hainan, Wuzhi Shan	HQ632872	HQ632968
<i>Microchirita caliginosa</i> (C.B. Clarke) Yin Z. Wang	ex HB München-Nymphenburg; M.Kiehn & M.Pfossen 2000-1 [Cult. HBV GS-96-02]	WU	Malaysia, unknown locality	FJ501488	FJ501325
<i>Microchirita</i> aff. <i>hamosa</i> (R.Br.) Yin Z. Wang	Möller; M. & Wei, Y.G. MMO 05-753	E, IBK	China, Guangxi, Longzhou county	JF912524	JF912551
<i>Microchirita lavandulacea</i> (Stapf) Yin Z. Wang	Voucher from Cult. RBGE 20000897	E	China, unknown locality	FJ501487	FJ501324
<i>Microchirita sericea</i> (Ridl.) A. Weber & Rafidah	Rafidah, A.R. FRI 64328	KEP	Malaysia, Kelantan, Gunung Reng	JF912548	JF912521



<i>Microchirita tubulosa</i> (Craib) A. Weber & D.J.Middleton	Middleton, D.J. et al. 4809	E	Thailand, Nakhon Sawan, Wat Thep Satha Phon	JF912531	JF912558
<i>Microchirita viola</i> (Ridl.) A. Weber & Rafidah	Rafidah, A.R. FRI 64388	KEP	Malaysia, Kedah, P. Langkawi	JF912533	JF912560
<i>Oreocharis argyreia</i> Chun ex K. Y.Pan	Möller, M. & Wei, Y.G. MMO 07-1131	E, IBK	China, Guangxi, Wuming county	HQ632919	HQ633015
<i>Oreocharis begoniifolia</i> (H.W.Li) Mich.Möller & A. Weber	Möller, M. et al. MMO 08- 1221	E, KUN	China, Yunnan, Jing Dong county	HQ632929	HQ633025
<i>Oreocharis benthamii</i> C.B.Clarke	Möller, M. et al. MMO 08- 1317	E, KUN	China, Guangdong, Zhao Qin county	JF697584	JF697572
<i>Oreocharis cotinifolia</i> (W.T.Wang) Mich.Möller & A. Weber	Chuan, Q.M. 01	IBK	China, Guangxi, Dayaoshan, Jinxiu county	HQ632914	HQ633010
<i>Oreocharis craibii</i> Mich.Möller & A. Weber	Möller, M. & Gao, L.M. MMO 07-1072	E, KUN	China, Sichuan, Pan Zhi Hua county	HQ632921	HQ633017
<i>Oreocharis dasyantha</i> Chun var. <i>ferruginosa</i> K. Y.Pan	Wei, Y.G. 07-700	E	China, Hainan, Delong	HQ632918	HQ633014
<i>Oreocharis longifolia</i> (Craib) Mich.Möller & A. Weber	Möller, M. et al. MMO 08- 1239	E, KUN	China, Yunnan, Jingdong county	HQ632934	HQ633030
<i>Oreocharis mileensis</i> (W.T.Wang) Mich.Möller & A. Weber	Shui, Y.M. 65214	KUN	China, Yunnan, Shilin county	HQ632928	HQ633024
<i>Oreocharis ronganensis</i> (K.Y.Pan) Mich.Möller & A. Weber	Möller, M. & Wei, Y.G. MMO 06-776	E, IBK	China, Guangxi, Rong An county	HQ632927	HQ633023
<i>Oreocharis stewardii</i> (Chun) Mich.Möller & A. Weber	Möller, M. & Wei, Y.G. MMO 06-917	E, IBK	China, Guangxi, Shanjiang county	HQ632926	HQ633022
<i>Petrocodon coriaceifolius</i> (Y.G.Wei) Y.G.Wei & Mich. Möller	Möller, M. & Wei, Y.G. MMO 06-913	E, IBK	China, Guangxi, Yangshuo county	HQ632943	HQ633040
<i>Petrocodon dealbatus</i> Hance	Xie, Q.J. J-042 (US 422841)	US	China, Guangdong, Lianxian county	FJ501537	FJ501358

<i>Petrocodon ferrugineus</i> Y.G. Wei	Möller; M. & Wei, Y.G. MMO 06-784	E, IBK	China, Guangxi, Xincheng county	HQ632946	HQ633043
<i>Petrocodon hancei</i> (Hemsl.) A. Weber & Mich. Möller	Möller; M. & Wei, Y.G. MMO 08-1342	E, IBK	China, Guangxi, He Zhou city	HQ632944	HQ633041
<i>Petrocodon hechiensis</i> (Y.G. Wei, Yan Liu & F. Wen) Y.G. Wei & Mich. Möller	Möller; M. & Wei, Y.G. MMO 07-1077	E, IBK	China, Guangxi, Hechi city	HQ632942	HQ633039
<i>Petrocodon integrifolius</i> (D. Fang & L. Zeng) A. Weber & Mich. Möller	Möller; M. & Wei, Y.G. MMO 06-865	E, IBK	China, Guangxi, Longzhou county	HQ632940	HQ633037
<i>Petrocodon scopulorum</i> (Chun) Yin Z. Wang	Fang, W. 2010-02	IBK	China, Guizhou, Xiuwen county, Maochong village	HQ632947	HQ633044
<i>Petrocodon viridescens</i> W.H. Chen, Mich. Möller & Y.M. Shui	Shui, Y.M. et al. 82661	E	China, Yunnan, Maguan county	HQ632939	HQ633036
<i>Petrocosmea kerrii</i> Craib	Voucher from Cult. RBGE 19715592	E	unknown origin	FJ501502	FJ501334
<i>Petrocosmea minor</i> Hemsl.	Sino-Amer. Bot. Expedition, no. 1574 (US 56119)	US	China, Yunnan, Lunan Xian	FJ501504	KU985106
<i>Petrocosmea nervosa</i> Craib	Smithsonian Institute 78-057 [Cult. RBGE 19933232]	E, US	China, N Yunnan	AJ492299	FJ501335
<i>Petrocosmea sericea</i> C.Y. Wu ex H.W. Li	Gu, Z.J. 99-1104	KUN	China, unknown locality	FJ501503	KU985105
<i>Primulina dryas</i> (Dunn) Mich. Möller & A. Weber	Godfrey, T.C. 369 [Cult. RBGE 19791050]	E	China, Hong Kong	FJ501524	FJ501348
<i>Primulina fimbrisepala</i> (Hand.-Mazz.) Yin Z. Wang	B. Pan, B. s.n.	IBK	China, Guangxi	JX506785	JX506893
<i>Primulina gemella</i> (D. Wood) Yin Z. Wang	L. Averyanov, L. 1987 [Cult. RBGE 19941913]	E	Vietnam, Hong Quang Special Region, Cat Hai	FJ501523	FJ501345

<i>Primulina glandulosa</i> (D.Fang et al.) Yin Z. Wang	J.M.Li, J.M. 054291	PE	China, Guangxi	DQ872804	DQ872841
<i>Primulina glandulosa</i> (D.Fang et al.) Yin Z.Wang var. <i>yangshuoensis</i> (F. Wen, Q.X.Zhang & Yue Wang) Mich.Möller & A. Weber	Möller, M. & Wei, Y.G. MMO 06-912	E, IBK	China, Guangxi, Yang Shuo county	HQ632948	HQ633045
<i>Primulina hochiensis</i> (C.C.Huang & X.X.Chen) Mich.Möller & A. Weber	Pan, B. s.n.	IBK	China, Guangxi	JX506795	JX506903
<i>Primulina liguliformis</i> (W.T.Wang) Mich.Möller & A. Weber	Pan, B. s.n.	IBK	China, Guangxi	JX506804	JX506912
<i>Primulina linearifolia</i> (W.T.Wang) Yin Z. Wang	Li, J.M. 11121	PE	China, Guangxi	DQ872810	DQ872834
<i>Primulina longgangensis</i> (W.T.Wang) Yin Z. Wang	A. Takhtajan, A. & Aruzytov, N. 1975 [Cult. RBGE 19941915]	E	Vietnam, unknown locality	AJ492290	FJ501347
<i>Primulina luochengensis</i> (Yan Liu & W.B.Xu) Mich.Möller & A. Weber	Wei, Y.G. MMO 07-1163	IBK	China, Guangxi, Luocheng county, Xiaochangan town	HQ632949	HQ633046
<i>Primulina minutimaculata</i> (D.Fang et W.T. Wang) Yin Z. Wang	Li, J.M. 067134	PE	China, Guangxi	DQ872815	DQ872828
<i>Primulina ophiopogoides</i> (D.Fang et W.T. Wang) Yin Z. Wang	Wang, Y.Z. 067134	PE	China, Guangxi	DQ872814	DQ872829
<i>Primulina pinnata</i> (W.T. Wang) Yin Z. Wang	Expedition Beijing 896526 (US 294374)	US	China, Guangxi, Rongshui Xian	FJ501526	FJ501349
<i>Primulina renifolia</i> (D.Fang & D.H.Qin) Yin Z. Wang	Möller, M. & Wei, Y.G. MMO 06-791	E, IBK	China, Guangxi, Duan county	KU985103	KU985107

<i>Primulina tabacum</i> Hance	Xie, Q.J. & Ye, C.X. s.n. [Cult. RBGE 19951540]	E	China, Guangdong, Lian River	AJ492300	FJ501352
<i>Primulina wentsaii</i> (D.Fang, et L.Zeng) Yin Z. Wang	Li, J.M. 11630	PE	China, Guangxi	DQ872812	DQ872831
<i>Pseudochirita guangxiensis</i> (S.Z.Huang) W.T.Wang	Möller, M. & Wei, Y.G. MMO 06-798	E, IBK	China, Guangxi, Mashan county	HQ632908	HQ633003
<i>Pseudochirita guangxiensis</i> (S.Z.Huang) W.T.Wang var. <i>glauca</i> Y.G.Wei & Yan Liu	Möller, M. & Wei, Y.G. MMO 05-751	E, IBK	China, Guangxi, Jingxi county	HQ632909	HQ633004
<i>Raphiocarpus sinicus</i> Chun	Möller, M. & Wei, Y.G. MMO 07-1141	E, IBK	China, Guangxi, Shangsi county	HQ632877	HQ632973
<i>Ridleyandra petiolata</i> (Ridl.) A. Weber	Mohd.Hairul, M.A. FRI 60092	KEP	Malaysia, Kedah, Gunung Inas	HQ632935	HQ633032
<i>Ridleyandra porphyrantha</i> (A. Weber & Kiew) A. Weber	Weber, A. 870420-2/4	WU	Malaysia, Pahang, side ridge of Gunung Bunga Buah	FJ501520	HQ633031
<i>Ridleyandra quercifolia</i> (Ridl.) A. Weber	Yao, T.L. FRI 65405	KEP	Malaysia, Perak, Maxwell's Hill	HQ632936	HQ633033