



A new species and new section of *Viola* (Violaceae) from Guangdong, China

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Abstract

Viola hybanthoides W. B. Liao et Q. Fan (Violaceae), a new species from Mount Danxia of Guangdong province in China, is described and illustrated. The most distinctive characters of *Viola hybanthoides* are the subshrub habit, the anterior petal with a long stalk-like claw (up to 3.5 mm, ca. 1/3 of the petal's length), and the very short upper petals (only 2.5–3 mm long, less than 1/2 of the lateral petals' length), all of which are characters shared with some *Hybanthus* species. These characters of this species are distinguishable from all other *Viola* species, which are usually herbs, and have the anterior petal without a long stalk-like claw and much longer upper petals (usually more than 8 mm long). Based on the new species, a new *Viola* section *Danxiaviola* W. B. Liao et Q. Fan is described. To distinguish *Viola* sections in China, an identification key is provided.

Key words: *Viola hybanthoides*, section *Danxiaviola*, Violaceae, new species, new section

Introduction

Mount Danxia is famous for its Danxia landform, a term that refers to various landscapes formed from red-colored sandstones and conglomerates, largely of Cretaceous age (<http://www.worldheritagesite.org/sites/danxia.html>). Because the entire hilly area looks like a red stone sculpture park, Mt. Danxia is also known as Red Stone Park of China (Peng 2001), and has now become a national park and a natural World Heritage Site. Since 2004, we have conducted continuous biological surveys on Mt. Danxia in order to elucidate the biodiversity patterns of Danxia landforms (Peng *et al.* 2011). During the expeditions, a distinct new *Viola* species, *Viola hybanthoides* W. B. Liao et Q. Fan, was collected on Mt. Danxia.

Viola L. is the largest genus of Violaceae, with approximately 525–600 species and an extensive north-temperate distribution (Ballard *et al.* 1999). Becker (1925) recognized 14 sections, 28 subsections, and 7 series based on ultrastructure of the pistil (reviewed in Yoo & Jang 2010). After that, many researchers made taxonomic revisions to Becker's classification. However, the infrageneric classification still remains controversial today (reviewed in Ballard *et al.* 1999, Yoo & Jang 2010; Fig. 1 in Ballard *et al.* 1999). There are 96–111 *Viola* species in China which belong to five sections according to Becker's classification (or five subgenera according to Yuzepchuk and Klokov's (1949) classification), i.e., *Erpetion*, *Melanium*, *Chamaemelanium*, *Dischidium* and *Nomimum*. Among them, *Nomimum* is the largest section, with 78–95 species in China (Wang 1991, Chen *et al.* 2007).

2. Materials and Methods

2.1 Molecular Methods

Leaf materials of the putative new species, *Viola hybanthoides*, were collected from three randomly selected adult individuals on Mt. Danxia in May 2012. All the leaves for DNA extraction were stored with silica gel in zip-lock plastic bags until use. A voucher specimen (*Q. Fan 11605*) is deposited in the Herbarium (SYS) of Sun Yat-sen University.

clade (BS = 81%) with sections *Chamaemelanium* and *Dischidium*. They share the character that the stigmas are not beaked in front. However, it has whitish to pale purple petals, while all species of the two sections mentioned have yellow petals. Furthermore, the chromosome number of *V. hybanthoides* is $2n = 20$, while the two sections possess the chromosome number of $2n = 12$ (Clausen 1929; Yoo and Jang 2010). Therefore, our new species belongs to neither of them. Morphologically, we could separate the new species from section *Nomimum* easily though they have the similar flower color. The styles of section *Nomimum* are beaked at the apex, while that of *V. hybanthoides* is not beaked. In addition, neither of the two phylogenetic trees support that *V. hybanthoides* is grouped in section *Nomimum*.

In conclusion, the morphological differences and the molecular phylogenetic results provide sufficient evidence for treating *V. hybanthoides* as a distinct new species, and we have also described a new section for this species.

5. Acknowledgements

We are deeply grateful to Mrs. Yunxiao Liu for her excellent illustration; Mr. Rongfeng Hou for his assistance in our fieldwork; Prof. Daniel Potter, Dr. Renchao Zhou and Xianggang Shi for their comments on the manuscript. This work was supported by the National Natural Science Foundation of China (31100159, 31170202 and 31061160184) and the Doctoral Foundation of Ministry of Education of China (20090171120034, 20110171110032).

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Appendix: species name and GenBank accessions for phylogenetic analysis

Taxon	ITS	matK	rpl16	atpB-rbcL
<i>V. acuminata</i>	AY928273	DQ842573	GQ262683	DQ834750
<i>V. alba</i>	EU413913			
<i>V. albida</i>	AY928292	DQ842589	GQ262702	DQ834766
<i>V. amamiana</i>	JF830899			
<i>V. ambigua</i>	EU413933			
<i>V. arvensis</i>	DQ055340			
<i>V. atrovioleacea</i>	FJ002878			
<i>V. betonicifolia</i>	JF830902			
<i>V. biflora</i>	AY928309	DQ842607	GQ262678	DQ834784
<i>V. brevistipulata</i>	AY928275	DQ842570	GQ262680	DQ834747
<i>V. caspia</i>	HM486500			
<i>V. chaerophylloides</i>	AY928290	AB038188	GQ262699	DQ834764
<i>V. collina</i>	EU413938	DQ842571	GQ262681	DQ834748
<i>V. dactyloides</i>	JQ950561			
<i>V. davidii</i>	FJ002902			
<i>V. delavayi</i>	FJ002908			
<i>V. diamantiaca</i>	AY928288	DQ842585	GQ262697	DQ834762
<i>V. diffusa</i>	FJ002917			
<i>V. diffusoides</i>	FJ002914			
<i>V. dissecta</i>	DQ787774	DQ842609	GQ262700	DQ834786
<i>V. eizanensis</i>	DQ787773			
<i>V. ganchouenensis</i>	FJ002918			
<i>V. grandisepala</i>	FJ002903			
<i>V. grypoceras</i>	AY928280	DQ842577	GQ262689	DQ834754
<i>V. guestphalica</i>	DQ055378			
<i>V. hancockii</i>	FJ002890			
<i>V. hirta</i>	EU413945			
<i>V. hirtipes</i>	AY928297	DQ842595	GQ262706	DQ834772
<i>V. hondoensis</i>	AY928272	DQ842572	GQ262682	DQ834749

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