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A New Species of *Gentiana*, *Gentiana ciliolata* and It's Two Subspecies of subsp. *ciliolata* and subsp. *longiloba* of Yunnan & Sichuan Provinces

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Abstract

A new species of *Gentiana* (*Gentianaceae*), *Gentiana ciliolata* is described and illustrated; it has a spectacular characteristics of calyx lobe ciliolate, distributed in Yunnan and Sichuan Provinces on the two sides of Jinsha River, and then two subspecies have been further re-classified as *Gentiana ciliolata* subsp. *ciliolata* and *Gentiana ciliolata* subsp. *longiloba* respectively. The subsp. *ciliolata* idistributes on the right side of Jinsha River in Yiliang County, Yunnan Province and the subsp. *longiloba* distributes itself on the southwest and west part of Sichuan Province, such as Leibo County, Wenchuan County and Mabian Yi Autonomous Prefacture, in the grassland under forests and moist rock slopes at an altitude of 1300 - 3200 m.

Keywords

New Species, *Gentiana ciliolate*, subsp. *ciliolate*, subsp. *longiloba*, Yiliang County, Leibo County, Jinsha River, Yunnan Province, Sichuan Province

1. Introduction

Gentiana (*Gentianaceae*) is one of the most complicated genera containing more than 360 species in the world, 248 species of 10 Sects. in China [1] [2] [3] [4], and new species have been identified continually [5] [6] [7] [8]. A very interesting new species *Gentiana ciliolata* with calyx lobe being densely ciliolate, the

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margins of stem leaves ciliolate, stem leave petiole margin ciliolate, and even the margins of corolla sparsely ciliolate has been identified by Shaoyong Yang and Fan Du as early as 2007, belonging to Sect. *Chondrophyllae* Bunge of Ser. *Orbiculatae* Marq. By the specimens collected in Xiaocaoba Houhe and Chaotianma Doukouzi in Yiliang County, Zhaotong city, Yunnan Province in 2006, the plant is much bigger than the most species of this Sect., however we had not got the ecological photos of the living plant. Since 2018, Haifeng Cao discovered some historical specimens collected in 1972 near the public road of Chaotianma Forest in Yiliang County, Yunnan Province in KUN and they had just been named as a new species *of Gentiana iliangensis* by Yuquan Ma in 1975; and then he found some other older specimens collected in Jinping Mountain, Leibo County, Sichuan Province in 1960 in Zhongshan Botanical Garden, Nanjing, Jiangsu Institute of Botany, Chinese Academy of Sciences and they had been identified as *Gentiana rubicundis* first and then named as another new species of *Gentiana dalengshanensis* by Ting-nung Ho in 1979; and then more specimens collected in Yinchang Gou in Leibo County, Sichuan Province in 1983 have been discovered in the Herbarium, Sichuan University and they had been identified as *Gentiana rubicundis* by Ting-nung Ho in 1997; and the oldest specimens collected in 1934 in Guandou Mountain, Dazhubao Xiang, Mabian Yi Autonomous Prefacture, Leshan city, Sichuan Province have been discovered in PE (Herbarium of Institute of Botany, Chinese Academy of Sciences) and HIMU (Herbarium, Innermongolia University) respectively, which had been named as a new species of *Gentiana mabienensis* by Yuquan Ma in 1962. According to the combined investigations, we found that there are six (6) spots of all the above specimens: 2 spots in Yunnan Province, viz., Xiaocaoba Houhe and Chaotianma Doukouzi in Yiliang County, Zhaotong city in Wumeng Moutain Series; and four (4) spots in Sichuan Province, viz., Yinchang Gou of Leibo County, Wolong Mountain of Wenchuan County, Dazhubao Xiang of Mabian County and Balang Mountain of Liangshan Yi Autonomous Prefacture in Hengduan Mountain Series. The shortest distance between Xiaocaoba Houhe of Yiliang county, Yunnan Province to Yinchang Gou, Leibo city, Sichuan Province is only 100 km, and the farthest distance between Yinchang Gou of Leibo county to Balang Mountain, Liangshan Yi Autonomous Prefacture, Sichuan Province is 366 km, such that we identified all the above new and old specimens as a new species of *Gentiana ciliolata* for their common spectacular characteristics of calyx ciliolate etc., but two subspecies of *Gentiana ciliolata* subsp*. ciliolata* and *Gentiana ciliolata* subsp*. longiloba* have been further re-classified according to the morphologies of caylx lobe and the geographical segregation by Jinsha River.

The new species of *Gentiana ciliolata*, belongs to Ser. *Orbiculatae* Marq. of Sect. *Chondrophyllae* Bunge. It's corolla tube long and it's calyx lobe conspicuously ciliolate, the middle and upper part of stem leaves bigger, which are quite easily be differentiated from other species of Ser. *Orbiculatae*, but most similar to *Gentiana jamesii* Hemsl., a little bit similar to *Gentiana. rubicundi* of Ser. *Rubicundae* Marq., however the calyx lobe ovate or long elliptic, rarely lan-

ceolate; the margins of stem leaves and calyx lobes conspicuously ciliolate, basal leaves small, the middle or upper part of stem leaves are the biggest; corolla gentian blue or purplish-blue, with yellowish green spots and striates downward corolla limb.

Gentiana ciliolata is a species confused as long as 84 years, and in the taxonomical research history, another successful example is *Bothriospermum lomgistylum* [9].

2. Materials & Methods

Holotypus and isotypus of *Gentiana ciliolata* subsp. *ciliolate*: Du & J. Wang ZT1978 (SWFC); Holotypus and isotypus of *Gentiana ciliolata* subsp. *longiloba*: Zhao & M. He 121722(SZ). All the specimens examined are in the Table 1 and photos are shown in Figure 1.

3. Results & Discussions

Figure 1 shows some typus specimens of *Gentiana ciliolata* S. Yang, H. Cao & F. Du, sp. nov. (Figure 2).

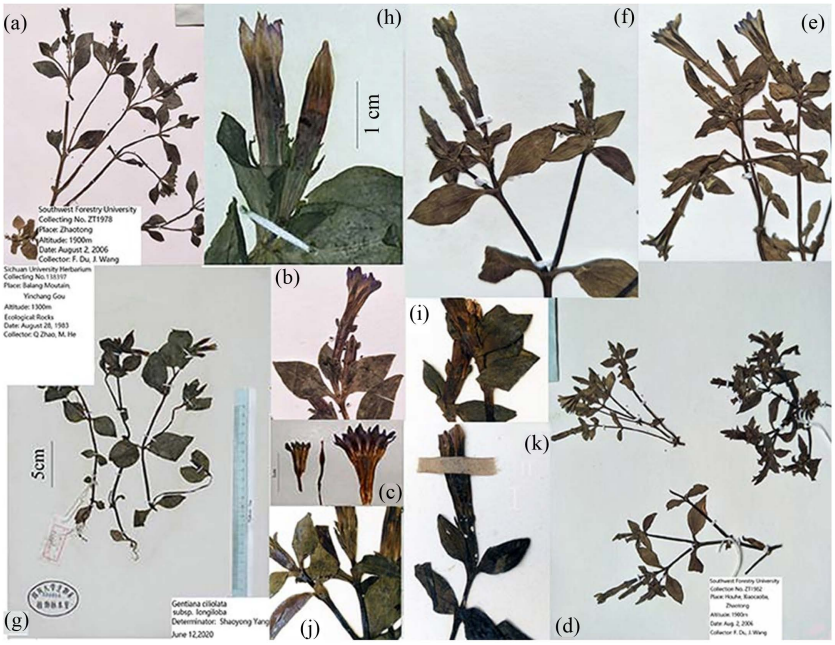


Figure 1. Speciemens of *Gentiana ciliolata* S. Yang, H. Cao et F. Du sp. nov. (a) Holotype specimen of *Gentiana ciliolata* subsp. *ciliolata* (F. Du & J. Wang ZT1978, SWFC). (b) Flower & Calyx of *Gentiana ciliolata* subsp. *ciliolata* (F. Du & J. Wang ZT1978, SWFC); (c) Calyx, Pistil & corolla of *Gentiana ciliolata* subsp. *ciliolata* (F. Du & J. Wang ZT1978, SWFC). (d) Plant of *Gentiana ciliolata* subsp. *ciliolata* (F. Du & J. Wang ZT1982, SWFC); (e) Part of *Gentiana ciliolata* subsp. *ciliolata* (F. Du & J. Wang ZT1982, SWFC); (f) The upper leaves & calyx of *Gentiana ciliolata* subsp. *ciliolata* (F. Du & J. Wang ZT1982, SWFC); (g) Plant of *Gentiana ciliolata* subsp. *longiloba* (M. He, Q. Zhao & Q. Wang 138397, SZ); (h) Caylx & corolla of *Gentiana ciliolata* subsp. *longiloba* (M. He, Q. Zhao & Q. Wang 138397, SZ); (i)-(k) Upper leaves and calyx of *Gentiana ciliolata* subsp. *longiloba* (M. He, Q. Zhao & Q. Wang 138397, SZ).

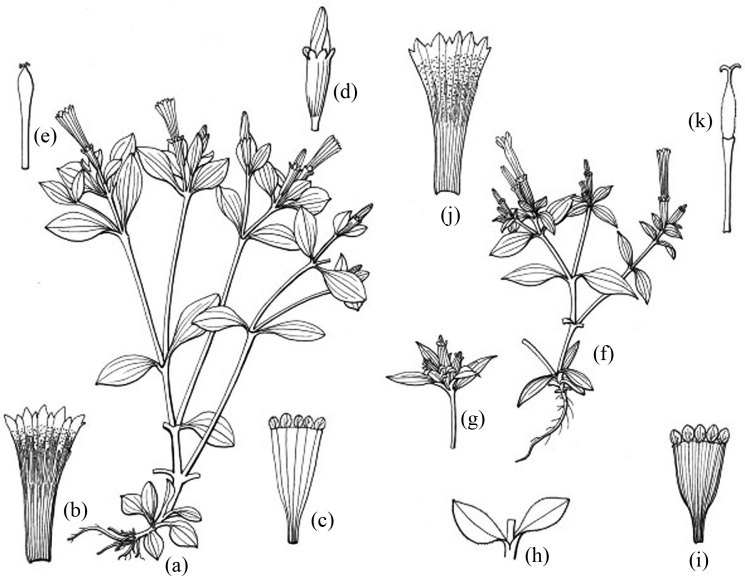


Figure 2. *Gentiana ciliolata* S. Yang, H. C & F. Du sp. nov. Drawn by L.Wang. (a) Plant of *Gentiana ciliolata* subsp. *ciliolata*; (b) Corrola and stamen; (c) Calxy; (d) flower before anthesis, (e) Ovary & Pistil; (f) Plant of *Gentiana ciliolata* subsp. *ciliolata*; (g) Inflorescence; (h) Top Stem leaves; (i) Calxy; (j) Corrola and stamen; (k) Ovary & Pistil.

Table 1. Specimens examined.

Specimens	Collector	Location	Altitude	Ecological condition	Area	Province	Date of collection
F. Du & J. Wang ZT1978 (SWFC)	F. Du & J. Wang	Xiaocaoba Houhe	1900 m	moist rocky slopes and forest margins	Yiliang County, Zhaotong city	Yunnan Province	2 August, 2006
F. Du & J. Wang ZT1982 (SWFC)	F. Du & J. Wang	Chaotianma Forest	1900 m	moist rocky slopes and forest margins	Yiliang County, Zhaotong city	Yunnan Province	2 August, 2006
F. Du & J. Wang ZT1960 (SWFC)	F. Du & J. Wang	Chaotianma Forest	1900 m	moist rocky slopes and forest margins	Yiliang County, Zhaotong city	Yunnan Province	2 August, 2006
KUN: (No. 0833155, No. 0833156)	Dian-Dong-Bei Group 591	Chaotianma Forest	1850 m	rocks of hill slope near streams,	Yiliang County, Zhaotong city	Yunnan Province	13 September, 1972
Collection No. 121722, SZ: (No.334088)	Q. Zhao & M. He	Balang Mountain	1300 m	rock	Yinchang Gou, Leibo County	Sichuan Province	28 August, 1983
Collection No. 138397, SZ: (No: 339314, 339316)	M. He, Q. Zhao & Q. Wang,	Balang Mountain	3200 m	rock	Wolong town, Wenchuan County,	Sichuan Province,	25 July, 2007
Collection No. 28032, NAS: (No. 00077219, No. 00077220)	Yaopu Group of Sichuan	Jinping Mountain	2800 m	holt	Leibo County, Liangshan Prefacture,	Sichuan Province	20 September, 1960
S. L. Sun 5758, PE: (No: 0029364, 00028001, 00094722, 00094721); HIMC: (without No.)	S. L. Sun	Guandou Mountain	1460 m	grassland under forest	Dazhubao Xiang, Mabian Yi Nationality Autonomous Prefacture	Sichuan Province	13 August, 1934

Following is the taxonomical descriptions to the new species:

Plant herbal annual, l5 - 25 cm, stem erect or ascending, glabrous, tinged purple with fine straites, the base or upper middle stem branched, ascending and then branched again dichotomously. Basal leaves 2 - 3 pairs, withered at anthesis, with short petiole, margins ciliolate, leaves long spatulate, ovate or ovate round, blades 15 - 40 × 5 - 15 mm, papyraceus, or thin leathery, glabrous, light yellow or green, margin faintly cartilaginous and ciliolate, apex acuminate or faintly obtuse, mucronulate; base truncate or round obtuse, petiole flat, c. 5 mm. Stem leaves slightly reflexed, base attenuate into petiole, petiole connate into a tube, width 1 - 2 mm, petiole 3 - 10 mm, margin ciliolate, leaves blade elliptic, ovate or ovate round, middle leaves or upper leaves are usually the biggest, leaves blades 4 - 52 × 3 - 35 mm, glabrous, squamiform or faveaolate adaxially and glabrous abaxially sometimes, front green and back purple, veins 3 - 7, mid-vein apparent, lateral veins fine, veins apparent on the back of leaves, margins ciliolate, apex blunted or acute, mucronulate sometimes; margins sparsely ciliated or papilliferous-especially the top pair of stem leaves. The flowers solitary or 1 - 3 flowers clustered. Pedicel purple, 1 - 12 mm, glabrous, within the top pair of leaves of the branchlet. Calyx obconical tubular or funnel, calyx tube 10 - 20 mm, intra-calycular membranous, papilliferous on juvenile calyx tube base, tinged purple, lobes 5, straight or recurved, 2 - 3 mm, ovate round, ovate, long elliptic or lanceolate, green, equal, 2 big and 3 small or 2 small and 3 big, leathery or fleshy, glabrous abaxially and scrobiculate foveate adaxially, apex acute and mucronulate, with a slight caudate, base round obtuse and contracted, margin densely ciliated, resess truncate, 0.5 - 0.8 mm. Corolla infundibuliform or obconical tubular, tube 25 - 45 mm long, gentiana blue, diameter 15 mm, with yellowish green spots and striates downward corolla limb, lobes 5, 2.0 - 4.0 mm, wide triangular ovate, apex round obtuse, plicae 1.5 - 3.0mm, ovate, apex subapiculate or obtuse ovate, acuminate or mucronate, Resess wide ovate, 1.5 - 3 mm, papilliferous adaxially and laniferous abaxially, apex truncate, margin faintly ciliated, margin entire or seldom faintly sinuate. Stamens inserted at the lower part of corolla tube, equal; filament 5 - 8 mm, filiform, anthers 2 - 3 mm, linear oblong. Ovary 10 - 15 mm, narrow ellipsoid, faintly ciliated, style 2 - 8.5 mm, stigma lobes 2, oblong, reflexed, linear. Capsules 15 - 20 mm, obovoid, cylindraceous or obviate cylindraceous, apex round obtuse or obtuse, wide winged, narrow winged on two sides, gynophore 8 - 35 mm, stout. Seeds ellipsoid, 0.8 - 1.3 mm, long elliptic, yellowish brown, slightly net grained. Flowers and fruits Sept.

Gentiana ciliolata S. Yang, H. C & F. Du sp. nov. is so far known not only from the typus locality in Yiliang County, Zhaotong city, Yunnan Province, on moist rocky slopes and forest margins or along streams at elevations of 1850 - 1900 m in Wumeng Mountian Series, but in four (4) areas of Sichuan Provinc on the left side of Jinsha River, alt. 3200 m, in the range of Hengduan Mountain Series, and two subspecies of *G. ciliolata* subsp. *ciliolata* and *G. ciliolata* subsp. *longiloba* have been further re-classified according to the calyx lobe morphologies by the geographical segregation of Jinsha River, the subsp. *ciliolata* of Yi-

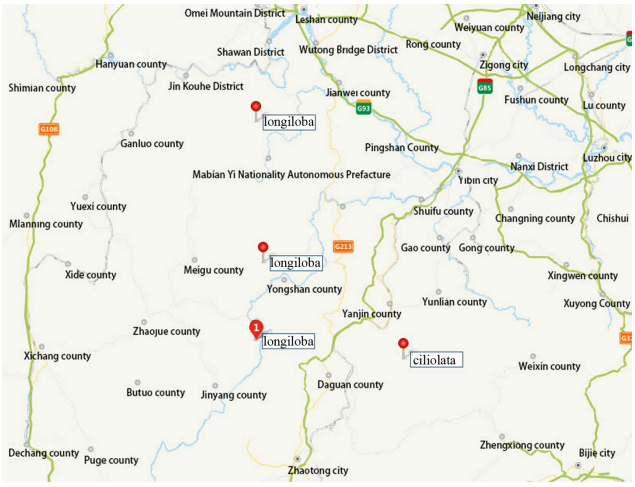
liang county, Yunnan Province with the calx lobe ovate or ovate round, the specimens kept in SWFU and KUN; while as the subsp. *longiloba* of Wolong Mountain of Wenchuan county, Leibo county of Liangshan Prefacture and Dazhubao Xiang of Mabian County, Sichuan Province with the calyx lobe oblong spatula, oblong or lanceolate, apex pungent, these characteristics are stable, the specimens are kept in SZ, CDBI, NAS, PE and HIMU (Figure 3).

Index:

1) Calyx lobe ovate round or ovate, apex round, 2 - 3 mm—subsp. *ciliolata*; distribute in Wumeng mountain areas, east part of Jinsha River, Yunnan Province.

2) Calyx lobe long round spatulate, long round or lancelolate, apex 4 - 7 mm—subsp. *longiloba*; distribute in Hengduan Mountain Series, in the west part of Jinsha River, Sichuan Province.

There are two forms of *Gentiana ciliolata* subsp. *ciliolata*, one plant big, soft, stem twist sometimes, leaves big and green, papyraceous; another plant small and drawf, leaf stiff and purple. The comparison shows at Figure 1(a) & Figure 1(d) and Figure 2(a) & Figure 2(f). This is caused by the different micro-ecological conditions: on moist forest margins, the plant is big, soft and green, but on the



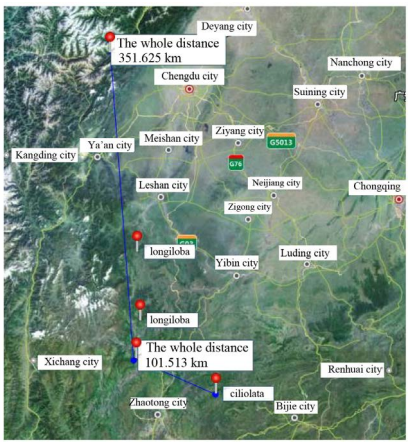


Figure 3. The Geolographical distribution areas of *Gentiana ciliolata* subsp. *ciliolata* & *Gentiana ciliolata* subsp. *longiloba* S. Yang, H. C & F. Du.

rocky and dry climate environment, the plant is small and drawf, stiff, leaves epidermals squamiform or faveolate. Here the phenotypic variation and covariation of quantitative traits have genetic and environmental components.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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