

# *Sinosenecio sichuanicus* (Asteraceae), a new species from Sichuan, China

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**ABSTRACT.** *Sinosenecio sichuanicus* Y. Liu & Q. E. Yang, a new species from Sichuan, China, is described and illustrated. The new species is similar to *S. chienii* (Hand.-Mazz.) B. Nord. in the leaf shape and the mature achenes usually epappose, but differs by having 2-3 cauline leaves, the leaf-lamina pubescent on both surfaces, the petioles pubescent, and the rays larger, 18-20 × 4-5 mm. Its somatic chromosome number ( $2n = 60$ ) is reported here. Photographs of both *S. sichuanicus* and *S. chienii*, line drawings, distribution map, and light microscope (LM) microphotographs of floral characters of *S. sichuanicus* are provided.

**Keywords:** Asteraceae; Chromosome number; Senecioneae; *Sinosenecio sichuanicus*.

## INTRODUCTION

In the course of making a comprehensive survey of the specimens of the genus *Sinosenecio* B. Nord. (Senecioneae-Asteraceae) deposited in Chinese herbaria for the first author's Ph.D. project on the systematics and evolution of this genus, a flowering collection, *Wei-kai Bao et al.* 2496 (CDBI) from Hongya County, Sichuan Province, China, caught our attention. The specimens in the collection had been previously identified as *S. chienii* (Hand.-Mazz.) B. Nord., possibly owing to similarities in the leaf shape and the mature achenes usually epappose, but they differed markedly from the latter in having 2-3 cauline leaves. In *S. chienii*, the leaves are always radical. Flowering and fruiting specimens of this plant were successfully collected during our field studies carried out in Hongya County in June 2007 and May 2009. Upon careful comparison, we found that the plant in question is different from *S. chienii* in a series of characters and thus represents a hitherto undescribed species. Further herbarium work led to the discovery of more specimens of this new species.

## NEW SPECIES

*Sinosenecio sichuanicus* Y. Liu & Q. E. Yang, sp. nov.—

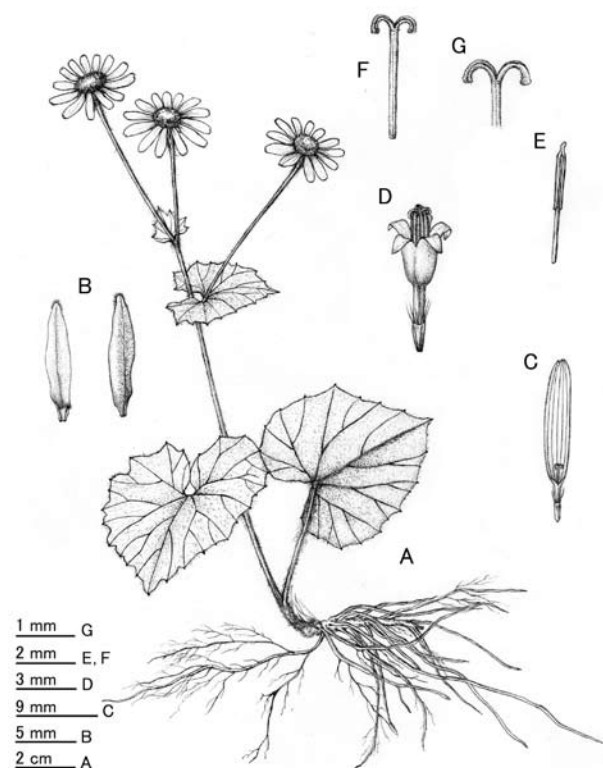
TYPE: CHINA. Sichuan, Hongya County, Gao-miao, Qi-li-ping, Hua-jiao-gou, alt. 2,000 m, on rocks along streamside in deciduous broad-leaved forests, 20 May

2009, *Ying Liu & Tao Deng 2009074* (holotype, IBSC; isotypes, HAST, PE). 四川蒲兒根 Figures 1, 2

*Haec species similis Sinosenecioni chienii* (Hand.-Mazz.) B. Nord. *foliorum laminis cordatis vel late cordatis et acheniis maturis plerumque pappo destitutis, sed caule 2-3-foliato, foliorum laminis utrinque pubescentibus, petiolis pubescentibus, ligulis majoribus 18-20 × 4-5 mm facile distinguitur.*

**Description.** Herb with leafy stem, stolons absent. Rhizomes 6-7 mm in diameter. Stems solitary or several, erect, 20-30 cm tall, simple, fulvous-sericeous, sparsely so in the upper part, densely so at the base. Leaves several, radical, and cauline. Radical leaves 1-2, long-petiolate; lamina broadly cordate to reniform in outline, 5-9 × 5-10 cm, palmately veined, submembranous, green above, pale-green beneath, pubescent on both surfaces, margin repand or sinuate-dentate with mucronulate teeth, apex acuminate or acute, apiculate, base deeply cordate to cordate; petioles 6-14 cm long, pubescent, densely sericeous at the base. Cauline leaves 2-3, smaller, with shorter petioles. Capitula solitary or several; peduncles 4-8 cm long, sparsely fulvous-sericeous in the lower part, fulvous-sericeous in the upper part. Involucres obconic-campanulate, ecalyculate, 5-8 × 8-12 mm. Phyllaries 13, uniseriate, oblong or oblong-lanceolate, 8 × 2-3 mm, apex acuminate or acute, fulvous-sericeous, apex fimbriate-ciliate, herbaceous, green. Ray florets 12-13; corolla tube ca. 2 mm long, glabrous; rays yellow, oblong-elliptic, 18-20 × 4-5 mm, apically 3-denticulate, 4-7 (-9)-veined. Disc florets many; corolla ca. 4 mm long, tube ca. 3 mm long, limb campanulate; lobes ovate-lanceolate. Anthers ca. 2 mm long,

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**Figure 1.** *Sinosenecio sichuanicus* Y. Liu & Q. E. Yang. A, Habit; B, Phyllary (right: abaxial side; left: adaxial side); C, Ray floret; D, Disc floret; E, Stamen; F, Style; G, Style-arms (All from Ying Liu & Tao Deng 2009074, HAST, IBSC, PE).

base obtuse, appendages ovate-oblong. Style arms ca. 1 mm long, apex truncate. Achenes obovoid-cylindrical, 1.5 mm long, smooth, glabrous. Pappus sometimes (in ca. 1/3 florets of a capitulum) of several 1.5-2 mm long hairs at anthesis, but often deciduous, and thus usually absent in mature achenes.

**Additional specimens examined.** CHINA. Sichuan, Hongya County, Hua-jiao-gou, alt. ca. 1,950 m, along stream, in woods, 27 Jun 1994, *Wei-kai Bao et al.* 2496 (CDBI); Hongya County, the same locality, 24 June 2007, *Qin-er Yang, Qiong Yuan & Ying Liu* 923 (IBSC); Hongya County, Luo-han-shan, Da-zhong-gang, alt. 2,400 m, 8 June 1994, *Wei-kai Bao et al.* 1981 (CDBI); Emei County, Mt. Emei, San-dao-he, alt. 1,800 m, 19 May 1956, *Shi-zhen Yu* 49355 (SZ); Emei County, Mt. Emei, Hei-qiao, streamside, alt. 1,300 m, 17 May 1995, *Hong-gui Xu* 01830169 (PE).

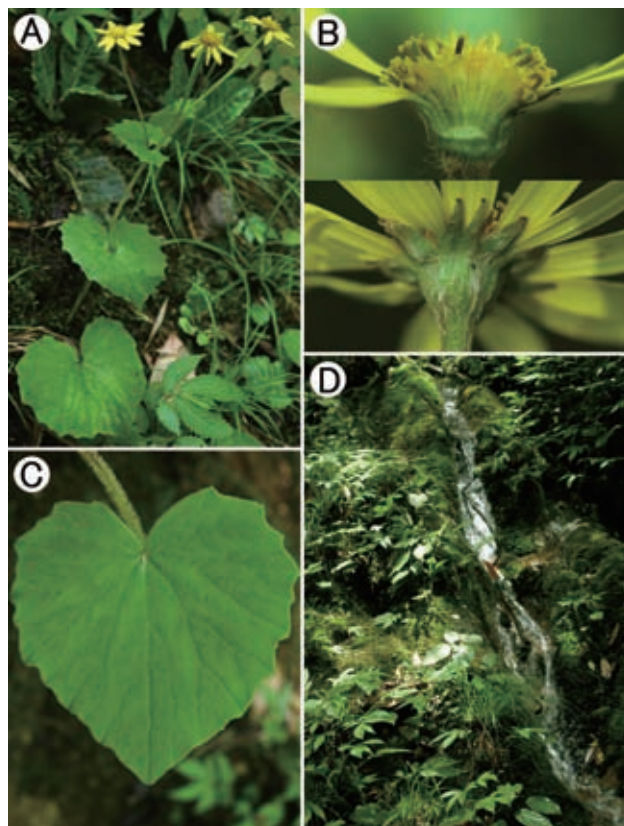
**Etymology.** The specific epithet 'sichuanicus' is derived from Sichuan, a province in western China.

**Phenology.** Flowering May; fruiting June.

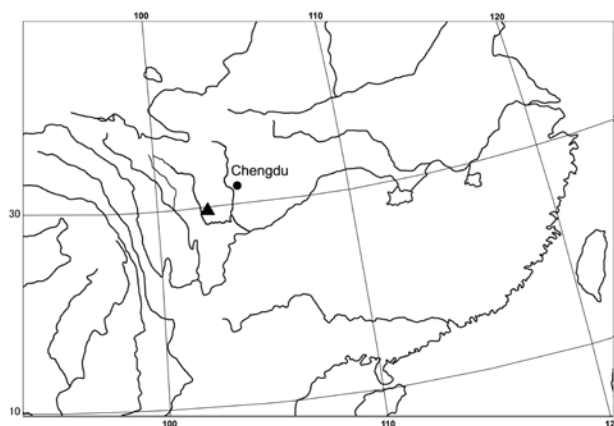
**Distribution, habitat, and status.** *Sinosenecio sichuanicus* is currently known from four populations in Hongya County and Emei County, Sichuan Province, China (Figure 3), growing in grasses or on rocks along streamside in deciduous broad-leaved forests at altitudes of 1,300-2,400 m above the sea level. At least one popula-

tion has suffered from habitat destruction due to intensive human activities such as medicinal plant cultivation.

**Floral micromorphological characters.** For observation of the anther endothelial cell wall thickenings and filament collar of *Sinosenecio sichuanicus*, heads were boiled in distilled water for 3 min, and then fixed with Carnoy I (glacial acetic acid: absolute ethanol = 1 : 3). Mature disc florets removed from the fixed heads were dehydrated in 70% ethanol for 30 min and then in 99% ethanol for 1 h



**Figure 2.** *Sinosenecio sichuanicus* Y. Liu & Q. E. Yang. A, Habit; B, Florets (above) and capitulum (below); C, Leaf; D, Habitat (All from type locality and vouched by Ying Liu & Tao Deng 2009074, HAST, IBSC, PE).



**Figure 3.** Distribution of *Sinosenecio sichuanicus* (▲).

before they were treated with 5% NaOH overnight. The anther tissue was isolated from the florets on the slide, flooded with 50% glycerol, and a cover slip was applied. Samples were then examined at 200× (filament collar) and 400× (endothelial cell wall thickenings) magnification by light microscopy and photographed.

The anther endothelial cell wall thickenings in *Sinosenecio sichuanicus* were strictly polar (Figure 4A), a character claimed by Jeffrey and Chen (1984) to occur in all the species of *Sinosenecio* sect. *Sinosenecio*. The thickenings of its putative close relative, *S. chienii*, were also strictly polar (the results not shown here). In the members of *Sinosenecio* sect. *Phyllocaulon* C. Jeffrey & Y. L. Chen, the endothelial cell wall thickenings are radial or radial and polar (Jeffrey and Chen, 1984; Zhang et al., 2008; Liu et al., 2009; Liu et al., 2010). As indicated in Figure 4B, its filament collar consisted of uniformly sized cells, conforming to one of the diagnostic characters of this genus (Nordenstam, 1978; Jeffrey and Chen, 1984; Chen, 1999).

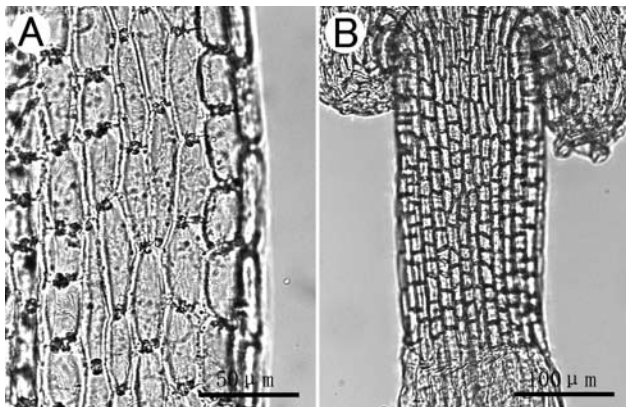
**Chromosome cytology.** As we failed to harvest actively growing roots both in field and greenhouse for chromosomal observation, leaf buds were used. They were pre-treated with 0.1% colchicine for 1.5-2 h before being fixed in Carnoy I (glacial acetic acid: absolute ethanol = 1 : 3).

They were then macerated in a 1:1 mixture of 45% acetic acid and 1 M HCl at 60°C for 3 min, stained, and squashed in Carbol fuchsin.

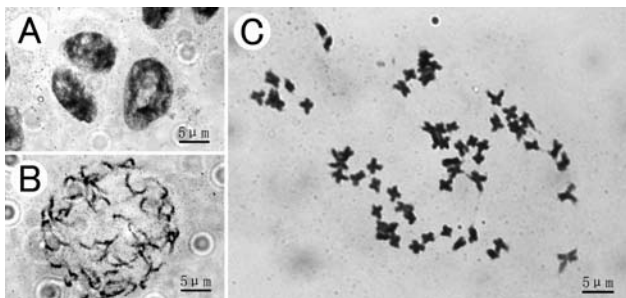
In the interphase nuclei, a few darkly stained condensed bodies were observed, but their boundaries were not clear, because the other part was also stained fairly well but unevenly (Figure 5A). The prophase chromosomes displayed a distinctly continuous condensation pattern (Figure 5B). Its metaphase chromosomes were counted to be  $2n = 60$  (Figure 5C). *Sinosenecio chienii*, the putative close relative of *S. sichuanicus*, has also the same chromosome number (Ying Liu & Qin-er Yang, unpublished data).

**Notes.** *Sinosenecio sichuanicus* is similar to *S. chienii* (Figure 6) in the leaf shape and the mature achenes usually epappose, but differs by having radical and 2-3 cauline leaves (vs. radical), the leaf-lamina pubescent on both surfaces (vs. sparsely fulvous-pilose or subglabrescent above, sparsely villous or glabrescent beneath), the petioles pubescent (vs. fulvous-villous, more or less glabrescent), and the rays larger, 18-20 × 4-5 mm (vs. 8-10 × 2.5-3.5 mm) (also see Table 1).

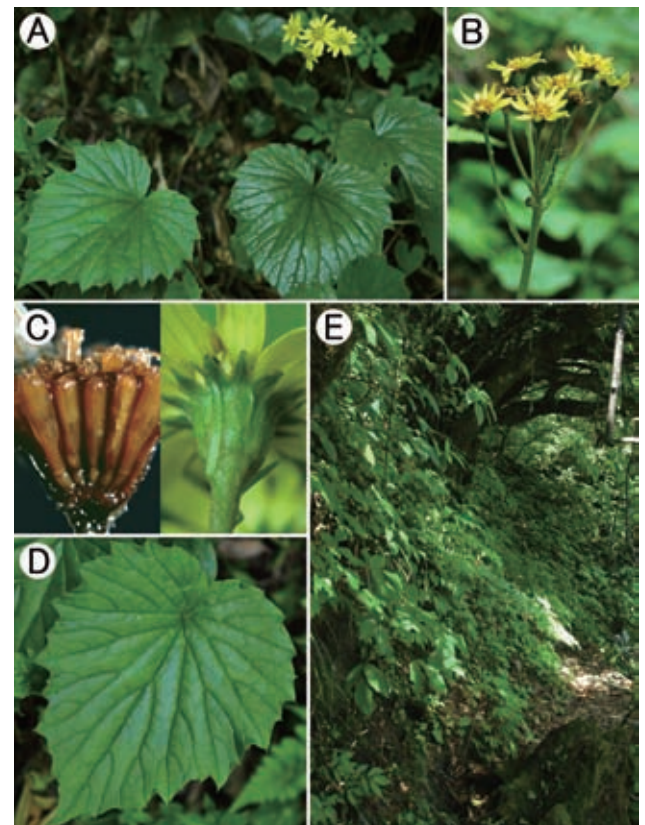
Although *Sinosenecio sichuanicus* and *S. chienii* are overlapping in their geographical distribution and occupy basically the same altitudinal range (Table 1), they have



**Figure 4.** Anther endothelial cell wall thickenings (A) and filament collar (B) of *Sinosenecio sichuanicus*. A, Strictly polar thickenings; B, Uniformly sized cells (All from Ying Liu & Tao Deng 2009074, HAST, IBSC, PE).



**Figure 5.** Interphase nuclei (A), mitotic prophase (B), metaphase (C,  $2n = 60$ ) chromosomes of *Sinosenecio sichuanicus* (All from Ying Liu & Tao Deng 2009074, IBSC, PE).



**Figure 6.** *Sinosenecio chienii* (Hand.-Mazz.) B. Nord. A, Habit; B, Inflorescence; C, Florets (left) and capitulum (right); D, Leaf; E, Habitat (All from Wawushan, Hongya County, Sichuan Province, China and vouched by Ying Liu & Tao Deng 2009078, IBSC, PE).

**Table 1.** Comparison of *Sinosenecio sichuanicus* and *S. chienii*.

	<i>S. sichuanicus</i>	<i>S. chienii</i>
Height (cm)	20-30	20-30
Posture	Herb with radical and 2-3 cauline leaves	Herb with radical leaves
Leaf shape	Lamina broadly cordate to reniform in outline, repand or sinuate-dentate	Lamina cordate to broadly cordate in outline, repand or sinuate-dentate
Leaf size (cm)	7-9 × 7.5-10	4-9 × 4.5-9.5
Petiole	Pubescent	Fulvous-villous, more or less glabrescent
Leaf-lamina pubescence	Pubescent on both surfaces	Sparsely fulvous-pilose or glabrescent above, sparsely villous or glabrescent beneath
Anther endothelial cell wall thickenings	Strictly polar	Strictly polar
Ray-floret number	12-13	10-12
Ray size (mm)	18-20 × 4-5	8-10 × 2.5-3.5
Veining of rays	4-7 (-9)-veined	4-veined
Epidermis of achene	Smooth, glabrous	Smooth, glabrous
Pappus	Absent usually in mature achenes or of several hairs at anthesis	Absent usually in mature achenes or of several hairs at anthesis
Florescence	May	Late March-April
Chromosome number (2n)	60	60
Habitat	On rocks in forests along streamside, 1,300-2,400 m a.s.l	Moist shady places in forests, 950-2,200 m a.s.l
Geographical distribution	Restricted to Hongya and Emei counties, W Sichuan	Widely distributed in W Sichuan

not as yet been found to co-occur in a same community. The two species have different flowering periods and habitat preferences. According to our field observations, *S. sichuanicus* prefers to grow in moist places on rocks or in grasses along streamside in woods, and flowers in May while *S. chienii* often grows in drier places in the woods or on hillsides and flowers from late March to April. In view of these facts, the two closely related species seem to be well isolated from each other reproductively, and it is thus not surprising that we did not observe any putative hybrids in the field.

*Sinosenecio sichuanicus* can be readily referred to subsection *Phalacrocarpa* C. Jeffrey & Y. L. Chen, section *Sinosenecio*, based on its strictly polar anther endothelial cell wall thickenings and mature achenes usually epappose. Jeffrey and Chen (1984), in their infrageneric division of the genus *Sinosenecio*, used the presence or absence of cauline leaves as the only character to distinguish series *Elati* C. Jeffrey & Y. L. Chen from series *Scaposi* C. Jeffrey & Y. L. Chen under subsection *Phalacrocarpa*, with the former series regarded as being characterized by the presence of cauline leaves and the latter by the absence of cauline leaves. We have pointed out that the discovery of *S. yilingii*, a species also from Sichuan, results in the collapse of this character at the series level (Liu et al., 2010). This view is further corroborated by discovery of the present new species. These two species, albeit with cauline leaves, seem to be much more closely related to *S. chienii* and *S. homogynephyllus* (Cumm.) B. Nord. within

series *Scaposi* than to the members within series *Elati*. The chromosome number  $2n = 60$  and the strictly polar pattern of anther endothelial cell wall thickenings of the four species also lend strong support to their placement in the former series (Liu & Yang, 2010; Ying Liu & Qin-er Yang, unpublished data).

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## 中國四川產蒲兒根屬一新種：四川蒲兒根

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本文描述了中國四川產蒲兒根屬一新種：四川蒲兒根（*Sinosenecio sichuanicus* Y. Liu & Q. E. Yang）。本新種在葉片形狀，成熟瘦果通常無冠毛方面與雨農蒲兒根（*Sinosenecio chienii* (Hand.-Mazz.) B. Nord.）相似，但以具 2-3 莖生葉，葉片兩面及葉柄被柔毛，舌片較大（18-20 × 4-5 mm）而與後者相區別。其體細胞染色體數目為  $2n = 60$ 。本文提供了四川蒲兒根以及雨農蒲兒根的彩色圖版、四川蒲兒根的線繪圖、花部微觀性狀的光鏡照片以及地理分佈圖。

**關鍵詞**：菊科；染色體數目；千里光族；四川蒲兒根。