

Sinosenecio jishouensis (Compositae), a new species from north-west Hunan, China

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ABSTRACT. *Sinosenecio jishouensis* D. G. Zhang, Y. Liu & Q. E. Yang, a new species from north-west Hunan, China, is described and illustrated. This new species is easily distinguishable from all its congeners by having leafy stems, broadly elliptic-lanceolate and pinnately-veined leaves, and achenes without a pappus. Its somatic chromosomes were counted as $2n = 48$ and 96 . A color plate, line drawings, light microscope (LM) photomicrographs of floral microcharacters, and a distribution map are given for the new species.

Keywords: Chromosome number; Endemism; Floral microcharacter; Senecioneae; *Sinosenecio jishouensis*; Tephroseridinae.

INTRODUCTION

During field work in April 2007 for the second author's Ph.D. project on systematics and evolution of the genus *Sinosenecio* B. Nord. (Senecioneae-Compositae), an unusual population was found in a valley in the Dehang Geological Park, Jishou City, in northwestern Hunan Province, China. Because of its broadly elliptic-lanceolate and pinnately-veined leaves, at first glance the plant appeared to be a member of the genus *Senecio* L. Upon closer investigation, which included chromosome counts and floral micromorphological observations, the population was determined to represent a hitherto undescribed species in the genus *Sinosenecio*. The site was re-visited in November 2007 for the collection of cytological material. Searches for more sites resulted in the discovery of two additional populations in the park.

NEW SPECIES

Sinosenecio jishouensis D. G. Zhang, Y. Liu & Q. E. Yang, sp. nov.—Type: CHINA. Hunan, Jishou City, Dehang Geological Park, moist soil on limestone rocks in valley, ca. 250 m, 2 Apr 2007, *Qin-er Yang, Qiong Yuan & Ying Liu 544* (holotype, PE). 吉首蒲兒根

Figures 1, 2

Haec species caule foliato, foliis ambitu late elliptico-

lanceolatis, pinnatinerviis, acheniis pappo destitutis a congeneribus diversa.

Rhizomatous herb with leafy stems, stolons absent. Stems solitary or several, erect, up to 40 cm tall, ca. 5-10 mm in diameter at the base, simple, 3-6-angulate, pubescent, sometimes more densely so along the angles. Radical leaves long-petiolate; lamina elliptic-lanceolate, 4-14 cm long, 2-5 cm wide, pinnately 3-5-veined, papyraceous or thinly papyraceous, green, sparsely pubescent on both surfaces, more densely so along the veins on abaxial surface, apex acuminate or acute, base rounded or broadly cuneate, margin irregularly sinuate-dentate; petioles 4-16 cm long, sparsely pubescent, slightly winged, base expanded. Upper stem leaves smaller, with shorter petioles. Capitula $5-\infty$ in apical corymbs; peduncles 1-2 cm long, pubescent, distally dilated. Involucres campanulate, ecalyculate, 5-7 mm long, 6-8 mm wide. Phyllaries ca. 13, uniseriate, oblong-lanceolate, 6-7 mm long, 1.5-2 mm wide, apex acuminate or acutish, pubescent, herbaceous, green. Ray florets ca. 13; corolla tube 2 mm long, glabrous; rays yellow, oblong-elliptic, 8-10 mm long, 3-4 mm wide, apically 3-denticulate, 4-veined. Disc florets ∞ ; corolla 4 mm long; tube 2 mm long; limb campanulate; lobes ovate-lanceolate. Anthers 1.5 mm long, base obtuse; appendages ovate-oblong. Style arms ca. 1 mm long, apex truncate. Achenes cylindrical, 1.5 mm long, glabrous. Pappus absent.

Additional specimens examined. CHINA. Hunan, Jishou City, Dehang Geological Park, stream side, 1 May 1990, *Zhong-cun Gu 0208* (JIU); same locality, 2 Apr 2007, *Dai-gui Zhang 070402001* (JIU).

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Figure 1. *Sinosenecio jishouensis* D. G. Zhang, Y. Liu & Q. E. Yang. A, Habit; B, Inflorescence; C, Phyllary; D, Ray floret; E, Disc floret; F, Stamen; G, Style-arms (All from *Qin-er Yang et al.* 544, PE).

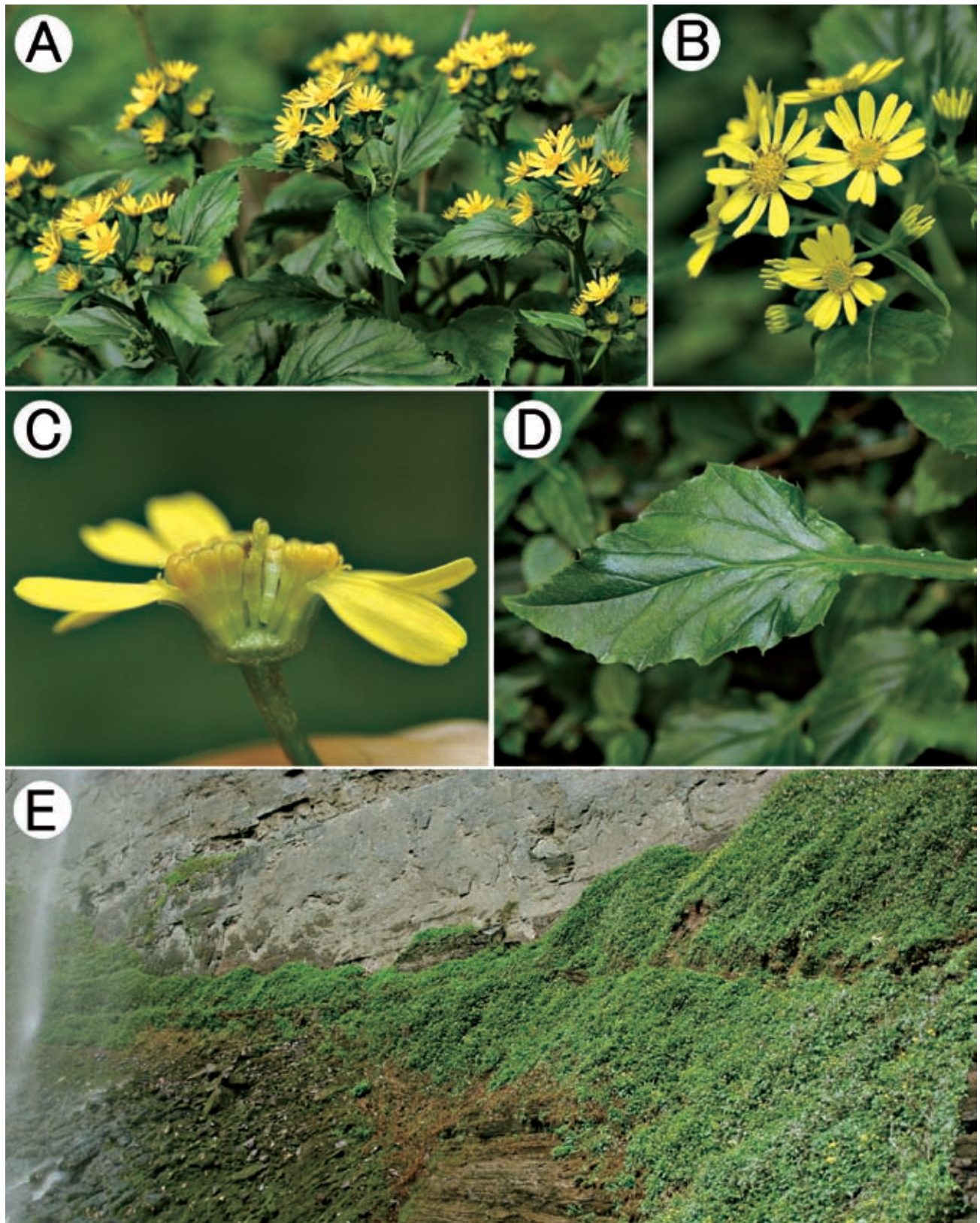


Figure 2. *Sinosenecio jishouensis* D. G. Zhang, Y. Liu & Q. E. Yang. A, Posture; B, Capitula; C, Florets; D, Leaf; E, Habitat. (All from Qin-er Yang et al. 544, PE).

Etymology. The specific epithet 'jishouensis' is derived from the type locality, Jishou City, Hunan Province, China.

Phenology. Flowering March to April; fruiting May.

Distribution, habitat and status. *Sinosenecio jishouensis* is only known from three small populations occurring in three adjacent valleys in Jishou City, Hunan, China (Figure 3), growing in moist soil on limestone rocks along streams or under waterfalls at an altitude of about 250 m. According to the IUCN red list categories and criteria, Version 3.1 (IUCN, 2001), this species should be categorized as a critically endangered species (CR). The most serious problem with the survival of the species is that all its populations thus far known are situated within a geological park which aims not to conserve biodiversity but mainly to attract tourists, and hence the sites of the populations are very easily accessible. In particular, a beautiful waterfall in the park, under which the biggest population of *S. jishouensis* was discovered, is the most frequent destination of tourists visiting the park.

Floral microcharacters. Floral micromorphological characters of *Sinosenecio jishouensis* and *Senecio scandens* Buch.-Ham. ex D. Don were comparatively investigated. It should be noted that *S. scandens* does not belong in *Senecio* s. str. as circumscribed by Pelsner et al. (2007). However, it remains a typical member of the subtribe Senecioninae, so the comparison is still justified. For observation of their anther endothetical cell thickenings and filament collar, heads from specimens were boiled and then fixed with Carnoy's solution. Mature disc florets removed from the fixed heads were transferred to 70% ethanol for 30 min and then to 99% ethanol for 1 h before they were immersed in 5% NaOH for 24 h. 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 \times (filament collar) and 400 \times (endothetical cell thickenings) by light microscopy and photographed.

Although a few cells near the connective tissue exhibited a somewhat radial pattern, the anther

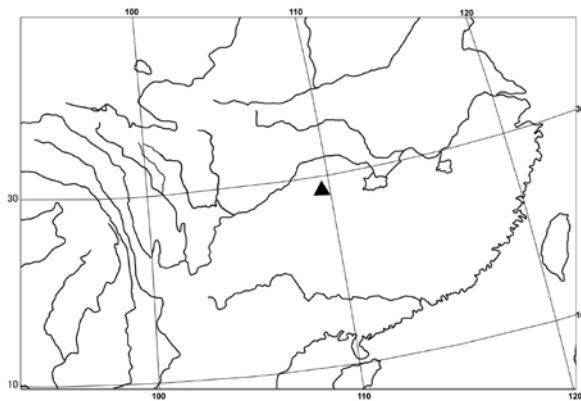


Figure 3. Distribution of *Sinosenecio jishouensis* (▲) in Hunan Province, China.

endothetical cell thickenings of *Sinosenecio jishouensis* were predominantly polar (Figure 4A), conforming to previous reports that endothetical cell thickenings are strictly polar, polar and radial or radial in other species of the genus (Jeffrey and Chen, 1984). The cell thickenings of *Senecio scandens*, like those of other *Senecio* species reported by Nordenstam (1978) and Jeffrey and Chen (1984), were radial (Figure 4C). Cells of the filament collar of *S. jishouensis* were of uniform size (Figure 4B), an important diagnostic feature of *Sinosenecio*, while the filament collar of *Senecio scandens* was dilated towards the base, with the basal lateral cells enlarged (Figure 4D), one of the distinguishing features of *Senecio* (Nordenstam, 1978; Jeffrey and Chen, 1984).

Chromosome cytology. For chromosome counts, root tips were pretreated with 0.1% colchicine for 3 h before they were fixed in Carnoy I, then macerated in a 1:1 mixture of 45% acetic and 1 N HCl at 60°C for 4 min, stained and squashed in Carbol fuchsin.

Thirteen individuals of *Sinosenecio jishouensis* were studied, nine from one population (Qin-er Yang, Qiong Yuan & Ying Liu 544) and four from a second (Qin-er Yang, Qiong Yuan & Ying Liu 1500). 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, D). The prophase chromosomes displayed a distinctly continuous condensation pattern (Figure 5B, E). The metaphase chromosomes were counted to be $2n = 48$ (Figure 5C) in twelve individuals, but $2n = 96$ (Figure 5F) in one individual from the first population.

Discussion. *Sinosenecio* was segregated as an independent genus from the quite heterogeneous *Senecio* L. by Nordenstam (1978), on the basis of its petiolate leaves with the lamina distinct from the petiole, ecalyculate involucre, campanulate limb of the disc florets, polarized or radial pattern of anther endothetical cell thickenings and uniformly sized cells of the filament collar. Jeffrey and Chen (1984), and Chen (1999) accepted Nordenstam's concept of the genus *Sinosenecio*. Thirty-seven species have been recognized in the genus heretofore (Janovec and Barkley, 1996; Chen, 1999; Liu, 2000). All are restricted to China, Korea, and Indo-China (Nordenstam, 1978; Jeffrey and Chen, 1984; Chen, 1999) except one, *S. newcombei* (Greene) J. P. Janovec & T. M. Barkley, a species endemic to the Queen Charlotte Islands, British Columbia, Canada (Janovec and Barkley, 1996). As such, *Sinosenecio* is an East Asian-North American disjunctive genus, with its center of species diversity in central and south China. Jeffrey and Chen (1984) pointed out that because of the narrow endemism of many of its species, the discovery of further new species was to be expected as the botanical exploration of China proceeded.

Molecular sequence data from the ITS region of nuclear ribosomal DNA and micromorphological data from anther endothetical cells indicate that *S. newcombei* is closely related to North American species of the genus

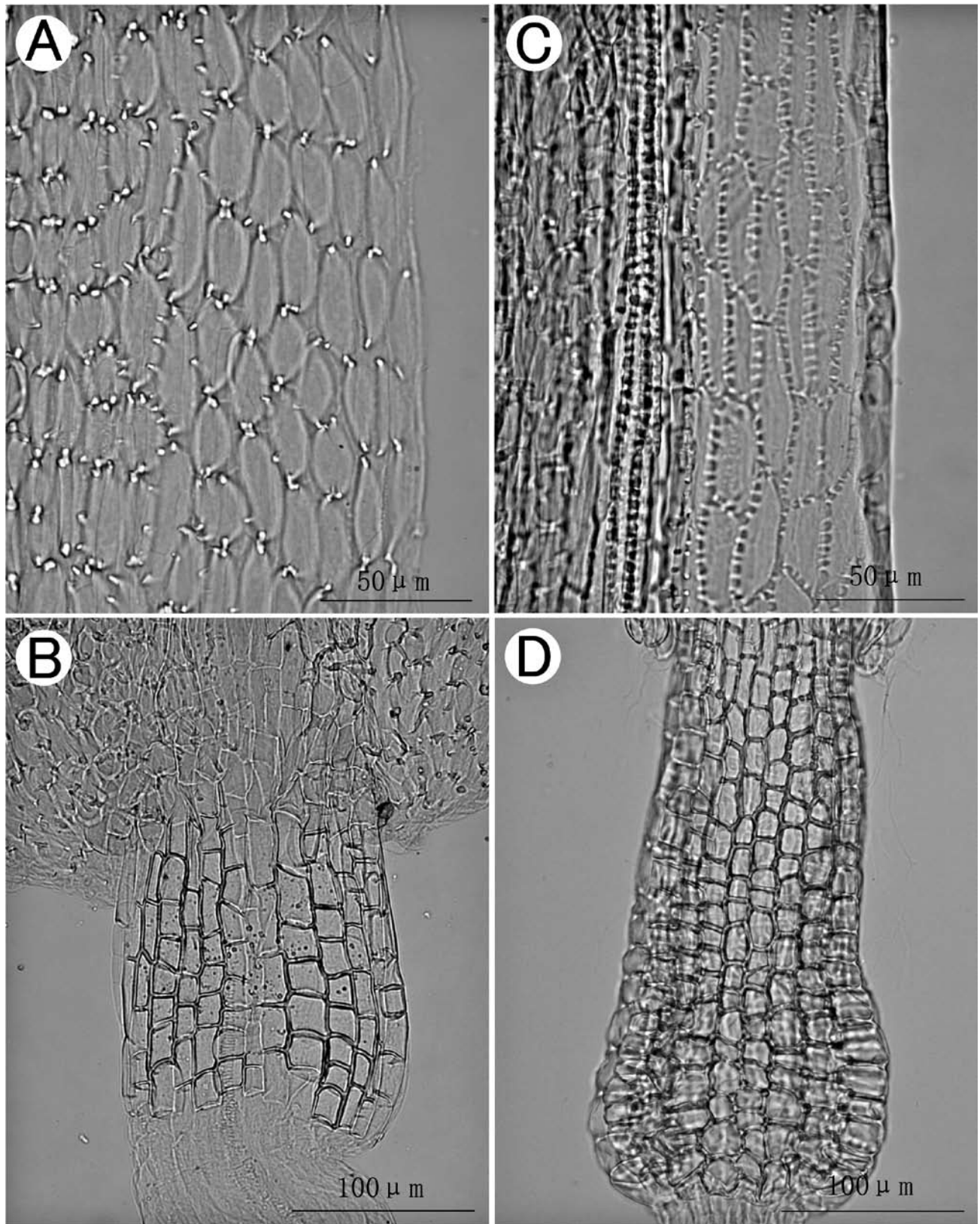


Figure 4. Endothetical cell thickenings (A, C) and filament collars (B, D) of *Sinosenecio* and *Senecio*. A, *Sinosenecio jishouensis* with predominantly polarized thickenings; B, *Sinosenecio jishouensis* with uniformly sized cells; C, *Senecio scandens* with radial thickenings; D, *Senecio scandens* with enlarged basal lateral cells. (A, B from *Qin-er Yang et al.* 544; C, D from *Qin-er Yang et al.* 633. All vouchers at PE).

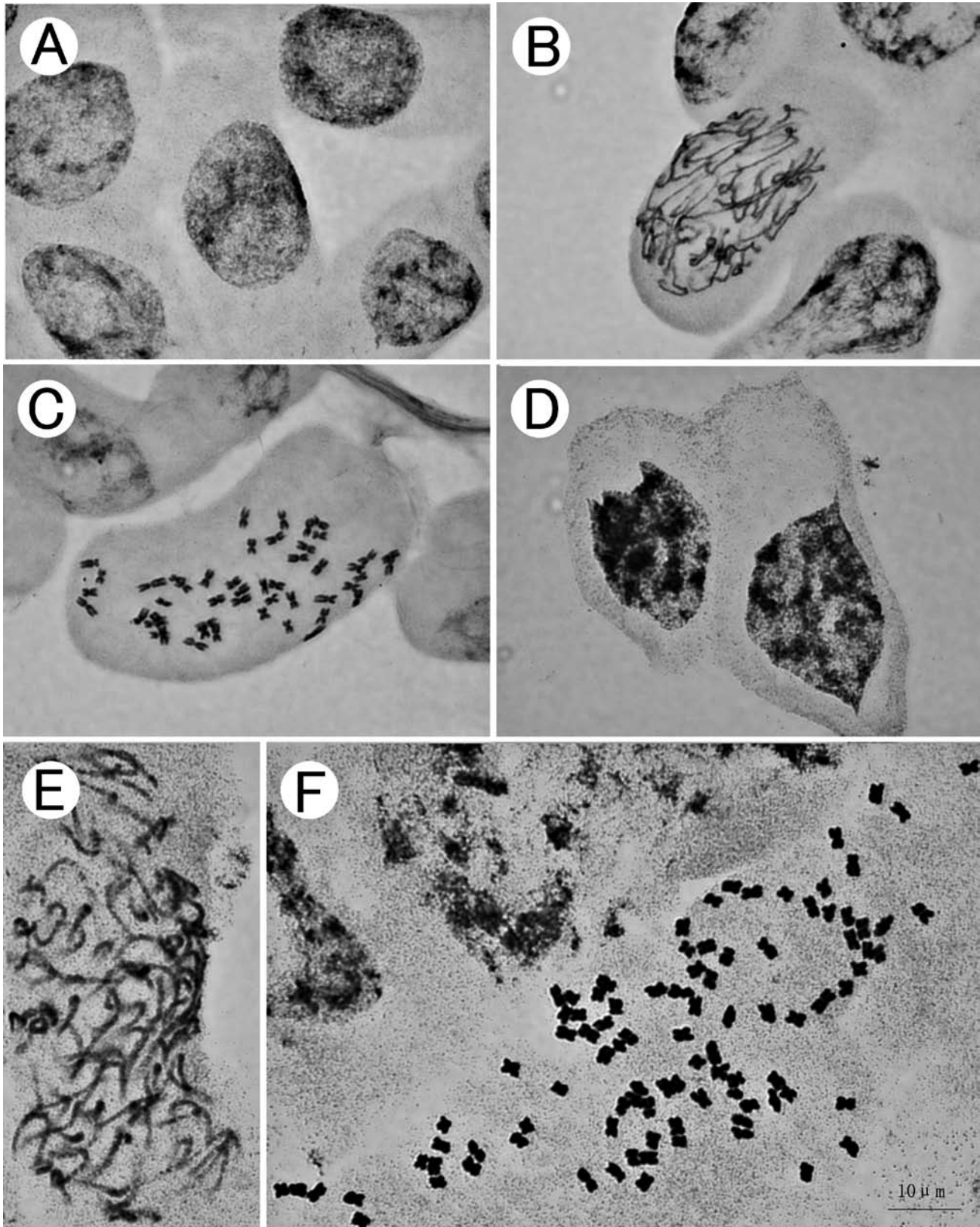


Figure 5. Interphase nuclei (A, D), mitotic prophase (B, E) and metaphase (C, $2n = 48$, F, $2n = 96$) chromosomes of *Sinosenecio jishouensis*. (All from Qin-er Yang et al. 544, PE).

Tephroseris (Golden et al., 2001; Pelser et al., 2007). This genus, together with *Sinosenecio* and *Nemosenecio*, constitutes the subtribe Tephroseridinae C. Jeffrey & Y. L. Chen within tribe Senecioneae Cass. (Jeffrey and Chen, 1984), which was recently found to nest within the subtribe Tussilaginatae (Pelser et al., 2007). These three very closely related genera are more or less distinguishable on the basis of morphological characters. *Nemosenecio* has pinnately divided leaves, *Tephroseris* is often arachnoid-tomentose and has pinnately-veined subentire or dentate leaves with the lamina sometimes not distinct from the petiole, and achenes with a pappus, *Sinosenecio* has usually palmately-veined, sinuate-dentate, sinuate-denticulate or lobulate leaves with the lamina distinct from the petiole, and achenes sometimes without a pappus (Jeffrey and Chen, 1984).

As shown in Figure 2, *Sinosenecio jishouensis* has ecalyculate involucre, campanulate limb of the disc florets, leaves with distinct lamina and petiole, achenes without a pappus, and is only pubescent on leaves and stem but never arachnoid-tomentose. Its anther endothelial cell thickenings are predominantly polar (Figure 4A) and the filament collar cells are uniform in size (Figure 4B), which are two important diagnostic characters of *Sinosenecio* (Nordenstam, 1978; Jeffrey and Chen, 1984). Both external morphological characters and floral micromorphological characters, therefore, justify our treatment of the new species as a member of *Sinosenecio*.

Sinosenecio is very poorly known cytologically. Liu (1999) checked the chromosomes of six taxa in the genus and reported the chromosome numbers of $2n = 24$ in *S. homogynophyllus* (Cumm.) B. Nord. and *S. oldhamianus* (Maxim.) B. Nord., 48 in *S. bodinieri* (Vant.) B. Nord. and *S. septilobus* (Chang) B. Nord., 60 in *S. subcoriaceus* C. Jeffrey & Y. L. Chen, and 72 in *S. globigerus* (Chang) B. Nord. var. *adenophyllus* C. Jeffrey & Y. L. Chen, indicating a remarkable variation in the chromosome number of this genus. The lowest basic number thus far known in the genus, $n = 12$, has also been reported in *Nemosenecio* and *Tephroseris* (Koyama, 1965; Patrik, 2006), two genera very closely related to *Sinosenecio* as mentioned above, whereas the basic chromosome number of *Senecio s. str.* is $x = 10$ (Jeffrey, 1992; Robinson et al., 1997). This study has shown that *Sinosenecio jishouensis* has the chromosome numbers $2n = 48$ and 96 (Figure 5), a tetraploid or octoploid based on $x = 12$. The chromosome number of *Senecio scandens* was reported as $2n = 2x = 20$ (Li, 2004). Having broadly elliptic-lanceolate and pinnately-veined leaves, *S. jishouensis* is reminiscent of some *Senecio* members. Cytological data indicate that the similarity of this new species with some *Senecio* species in leaf shape and venation is totally superficial, and lend strong support to its placement in the genus *Sinosenecio*.

Sinosenecio jishouensis is easily distinguished from all its congeners by having leafy stems, broadly elliptic-lanceolate and pinnately-veined leaves, and achenes without a pappus. Prior to the discovery of our new

species, *S. hainanensis* (Chang & Tseng) C. Jeffrey & Y. L. Chen was the sole species in the genus with pinnately-veined leaves; all other *Sinosenecio* species typically have rounded or reniform to ovate or deltoid and palmately-veined leaves (Jeffrey and Chen, 1984; Chen, 1999). *Sinosenecio jishouensis* is the second species with pinnately-veined leaves in this genus, but it is distinct from *S. hainanensis* in habit and leaf shape. Unlike *S. jishouensis* in which the leaves are both radical and cauline, broadly elliptic-lanceolate in outline, the leaves of *S. hainanensis* are only radical and rosulate, and ovate-oblong or obovate in outline (Jeffrey and Chen, 1984). These two species also differ in habitat preference and geographical distribution, with *S. hainanensis* occurring in tropical forests at altitudes from 900 to 1,200 m on Hainan Island, southern China, whereas *S. jishouensis* occurs in a very open habitat at an altitude of about 250 m in central China's northwestern Hunan.

Although in general facies *Sinosenecio jishouensis* is rather distinctive within the genus, it seems somewhat related to *S. globigerus* (Chang) B. Nord. and its allied species in habit (the presence of both radical and cauline leaves), flower structure (achenes without a pappus) as well as chromosome number ($2n = 48$) (this study and unpublished data), and thus may be referred to series *Elati* C. Jeffrey & Y. L. Chen, subsection *Phalacrocarpa*, section *Sinosenecio*. More work is needed to determine the systematic position of *S. jishouensis* in the genus.

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湖南產蒲兒根屬一新種：吉首蒲兒根

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本文描述了中國湖南西北部產蒲兒根屬一新種：吉首蒲兒根（*Sinosenecio jishouensis* D. G. Zhang, Y. Liu & Q. E. Yang）。本新種以具莖生葉，葉橢圓狀披針形，葉脈羽狀，瘦果無冠毛而與同屬其他種類明顯有別。其體細胞染色體數目為 $2n = 48$ 和 96 。本文提供了吉首華千里光的彩色圖版、線繪圖、花部微觀性狀的光鏡照片以及地理分佈圖。

關鍵詞：染色體數目；特有現象；花部微觀性狀；千里光族；吉首蒲兒根；狗舌草亞族。