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Pseudostellaria fangiana (Caryophyllaceae), a new species from Chongqing, China

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ABSTRACT: *Pseudostellaria fangiana*, a new species from the Wulipo National Nature Reserve in Wushan County, northeastern Chongqing, China, is described and illustrated. Morphologically, *Pseudostellaria fangiana* resembles *Pseudostellaria heterantha*. However, the new species can be distinguished by presence of stolons, with several root tubers in a row, branched at apex, homomorphic leaves, smaller leaf blades, and seeds minutely spiny.

KEY WORDS: morphology, *Pseudostellaria*, *Pseudostellaria heterantha*, taxonomy, Wulipo National Nature Reserve.

INTRODUCTION

Pseudostellaria was established by Pax in 1934 and has been used ever since (Schischkin and Komarov, 1936; Ohwi, 1937; Mizushima, 1965). Currently, the genus comprises approximately 23 accepted species that are widely distributed around the world, with 21 species in eastern and northern Asia, 1 species in Europe, and 1 species in North America (Lu and Rabeler, 2001; Zeng *et al*., 2016; Zhang *et al*., 2017; Luo *et al*., 2021). This genus can be readily distinguished from other genera in the Caryophyllaceae family by the presence of its fleshy root tubers. In addition, the vast majority of species in the genus have cleistogamous flowers and chasmogamous flowers that have petals with two sections (Zeng *et al*., 2016). Since 2000, China has successively published *P. zhejiangensis* X.F Jin & B.Y Ding (2003), *P. polymorpha* W. Z. Di & Y. Ren (2009), *P. tianmushansis* G. H. Xia & G. Y. Li (2001), and *P. wuyishanensis* X. Luo & Q.Y. Yang (2021) (Jin and Ding, 2003; Lian, 2009; Xia *et al*., 2011; Luo *et al*., 2021). To date, a total of 13 species of *Pseudostellaria* have been recorded in China, of which 6 are endemic.

Between April 2023 and June 2024, during our botanical diversity survey in the Wulipo National Nature Reserve in Wushan County, northeastern Chongqing, we discovered an unidentified species of *Pseudostellaria*. This species resembles *P. heterantha* (Maxim.) Pax, but can be distinguished by its stolons, several root tubers in a row, branched at apex, smaller plants and leaves, ovoid petals, and seeds minutely spiny. These characteristics clearly differentiate it from *P. heterantha*. Therefore, we established it as a new species.

MATERIALS AND METHODS

All general morphological data were obtained through specimen observation during fieldwork and at the AU, SWCTU, IBSC, KUN, and FAFU herbaria. Terminology follows the Flora of China (Lu and Rabeler, 2001) and was further refined using online databases, including the Chinese Field Herbarium and Plant Photo Bank of China (PPBC).

TAXONOMIC TREATMENT

Pseudostellaria fangiana Zhe Zhang & H. P. Deng, ***sp. nov.*** **方氏孩儿参 Figs. 1&2**

Type: CHINA. Chongqing (重庆): Wushan County (巫山县), Dangyang Township(当阳乡), Wulipo National Nature Reserve (五里坡国家级自然保护区), growing at the edge of rock walls at the deciduous forest margin, 2150 m, 3 June 2024, *Zhe Zhang, Guangyu Jiang & Le Wang 20240603* (holotype: SWCTU!; isotypes: BAZI!, FAFU!).

Diagnosis: The new species resembles *P. heterantha*, but differs in having stolons(vs. no stolon in *P. heterantha*), with several root tubers in a row (vs. tuber solitary in *P. heterantha*), branched at apex (vs. branched at base in *P. heterantha*), pedicel 1–1.5cm long (vs. 3–3.5 cm long in *P. heterantha*), 4–7 cm tall (vs. 8–15 cm tall in *P. heterantha*) and homomorphic leaves 0.5 – 1.2×0.3–0.6 cm (vs. heteromorphic leaves 2–2.5 × 0.8–1.2 cm in *P. heterantha*), petals ovate to elliptic (vs. oblong-oblanceolate in *P. heterantha*), and seeds minutely spiny (vs. tuberculate in *P. heterantha*) (Table 1.).

Description: Perennial herbs to 4–7 cm high. Root tubers grey, fusiform, 0.3–0.5 × 0.1–0.2 cm, several in a row. Stem erect, with 2 line of hairs, unbranched at base, apex occasionally branched, stoloniferous. Leaves opposite, entire, 0.5–1.2 × 0.3–0.6 cm, homomorphic, ovate to oblong-ovate, glabrous, bases decurrent with sparsely ciliate, apex acute. Lateral veins 3–4 pairs, visible on the adaxial surface. Chasmogamous flowers terminal, occasionally axillary, solitary; pedicel erect, ca.

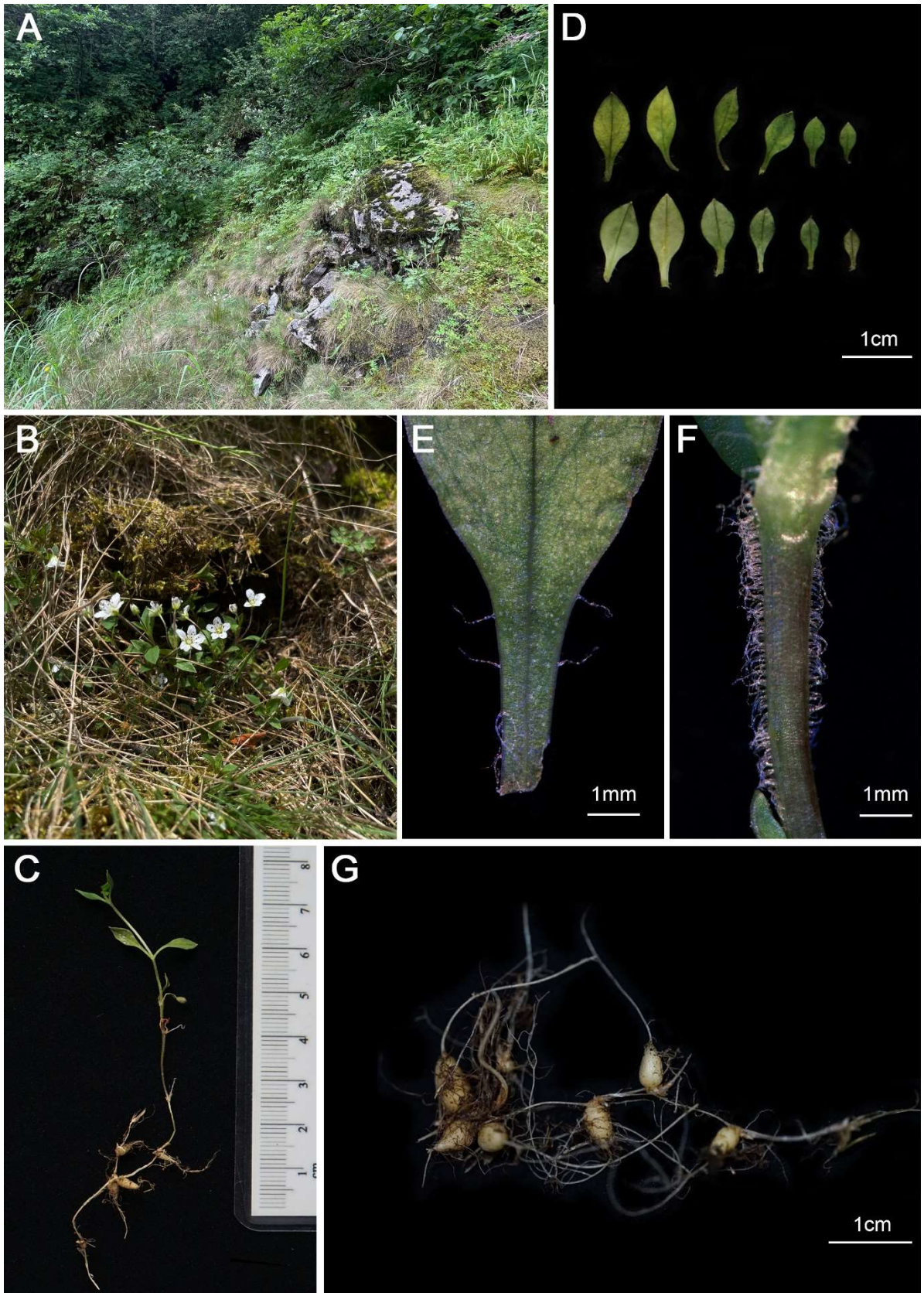

Fig. 1. ***Pseudostellaria fangiana*** Zhe Zhang & H. P. Deng **A** habitat; **B** habit; **C** plant; **D** leaves of plant; **E** leaf base; **F** stem with two lines of hair; **G** tubers.

Table 1. Morphological comparison of ***Pseudostellaria fangiana***, ***P. heterantha***.

Characters	*P. fangiana*	*P. heterantha*
Root tubers	several tubers in a row	tuber solitary
Stem	has stolons, 4–7 cm tall, branched at apex	no stolon, 8–15 cm tall, branched at base
Leaf blade	homomorphic, 0.5–1.2 × 0.3–0.6 cm	heteromorphic, 2–2.5 × 0.8–1.2 cm
Pedicel of chasmogamous flower	1–1.5 cm long	3–3.5 cm long
petal of chasmogamous flower	ovate to elliptic, apically emarginate	oblong-oblanceolate, apically obtuse or acute
Seeds	minutely spiny	tuberculate

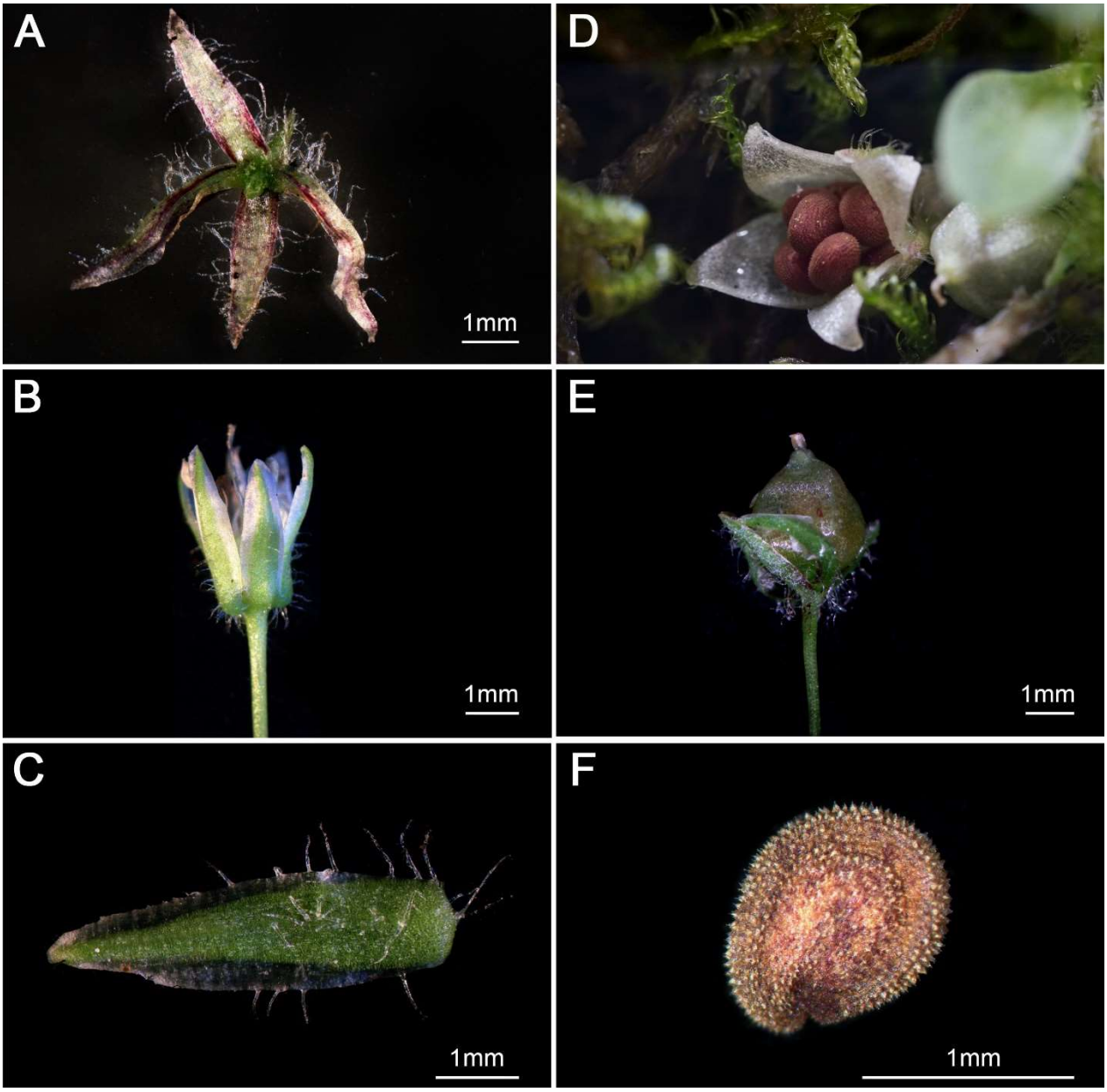

Fig. 2. ***Pseudostellaria fangiana*** Zhe Zhang & H. P. Deng **A** sepals of cleistogamic flower; **B-C** sepals of chasmogamous flower; **D** mature fruit; **E** immature fruit; **F** seed.

1–1.5 cm long, pilose; sepals 5, green, lanceolate, ca. 3 mm long, semi-transparent membranous margins, ciliate below the middle on both sides, abaxial midrib pubescent; petals 5, ovate to elliptic, slightly longer than sepals, ca. 4 mm long, apically emarginate; stamens 10, slightly shorter than petals, approximately ca. 3 mm long; anthers purple, irregularly elliptical; ovary conical, with 2–3 styles at the apex, nearly equal in length to the ovary;

ovules numerous. Cleistogamic flowers axillary on stem; sepals 4, narrowly lanceolate, internally with red longitudinal stripes, abaxially pilose, margin ciliate; petals absent. Capsule ovoid, ca. 3 mm long, slightly longer than sepals, 4-valved. Seeds 4–7, reniform, slightly compressed, minutely spiny.

Distribution and habitat: The new species *P. fangiana* is endemic to the Wulipo National Nature Reserve in Wushan County, northeastern Chongqing Municipality. The plant grows at the edge of rock walls at the deciduous broad-leaved forest margin at 2150 m in elevation. The species of the community include *Polemonium chinense* (Brand) Brand (Polemoniaceae Juss.), *Rhodiola yunnanensis* (Franch.) S. H. Fu (Crassulaceae J. St.-Hil.), *Bistorta suffulta* (Maxim.) H. Gross (Polygonaceae Juss.) & *Carex* L. sp. (Cyperaceae Juss.).

Phenology: Flowering from May to Jun, fruiting from Jul to Sept.

Etymology: To honor the significant contributions of the renowned Chinese botanist Professor Wenpei Fang to plant taxonomy in the Sichuan-Chongqing region, the latin term "*fangiana*" has been chosen as the specific epithet for this new species.

***Discussion*:** In the genus *Pseudostellaria*, the presence or absence of stolons and whether the tuberous roots are arranged in series are important taxonomic characteristics. Among the 13 known species of *Pseudostellaria* distributed in China, only *P. wuyishanensis* X. Luo & Q.Y. Yang, *P. tianmushanensis* G. H. Xia & G. Y. Li, and *P. sylvatica* (Maxim.) Pax exhibit tuberous roots in series. This new species *P. fangiana* is characterized by having stolons and multiple tuberous roots in series, homomorphic leaves, and a smaller overall plant size, which makes it easily distinguishable from other species in the genus.

Ohwi (1937) considered *P. maximowicziana* (Franch. & Sav.) Pax and *P. himalaica* (Franchet) Pax to be synonyms of *P. heterantha* (Maxim.) Pax. This perspective was also supported by Mizushima (1965) and Lu (1998). However, recent research findings do not support this view (Chen *et al*. 2014; Zeng *et al*. 2016; Zhang *et al*. 2017). Zeng *et al*. (2016) proposed that *P. maximowicziana*, *P. himalaica*, and *P. heterantha* should each be recognized as distinct species. In Chongqing, *P. heterophylla* (Miq.) Pax and *P. heterantha* are distributed. These two species have larger plants and lack stolons and serially arranged tuberous roots, making them distinctly different from this new species.

During our specimen research, one specimen, NO. 0149275 (Fig. 3), caught our attention. Currently housed at the South China Botanical Garden, Chinese Academy of Sciences, it is labeled as *P. rupestris* (Turczaninow) Pax. Morphologically, the leaf shape and size, internode length, petal shape, and presence of stolons, along with the suspected feature of serially arranged tuberous roots, were also observed in the specimen. These characteristics differ significantly from *P. rupestris* but are extremely similar to those of this new species. The specimen was collected in 1957 from Mount Emei, Sichuan Province, at an altitude of 1750 m, which is similar to the habitat of *P. fangiana*. Therefore, we speculate that this specimen may indeed be *P. fangiana*, and Mount Emei in Sichuan Province is also a distribution area for this species. So far, there are 14 species of the genus *Pseudostellaria* distributed in China.

Key to Similar Species of *Pseudostellaria fangiana*

1a. Stem no stolon, root tubers solitary; petals of chasmogamic flowers entire 2
1b. Stem has stolons, several root tubers in a row; petals of chasmogamic flower slightly toothed or bi-lobed 3
2a. Stems creeping, decumbent; basal leaves ovate to broadly ovate, distal leaves lanceolate, both sides pilose ..... ***P. zhejiangensis***
2b. Stems erect; basal leaves oblanceolate, distal leaves ovateoblong, margin glabrous ..... ***P. heterantha***
3a. Stems with 1 line of hairs ..... ***P. wuyishanensis***
3b. Stems with 2 line of hairs 4
4a. Root tubers fusiform or ovoid-globose; upper leaves narrow elliptic-lanceolate, 1.0–2.0 ×0.4–0.8 cm; petals obovate, 0.4 × 0.25 cm .... ***P. tianmushanensis***
4b. Root tubers fusiform; homomorphic leaves, 0.5–1.2 × 0.3–0.6 cm ..... ***P. fangiana***

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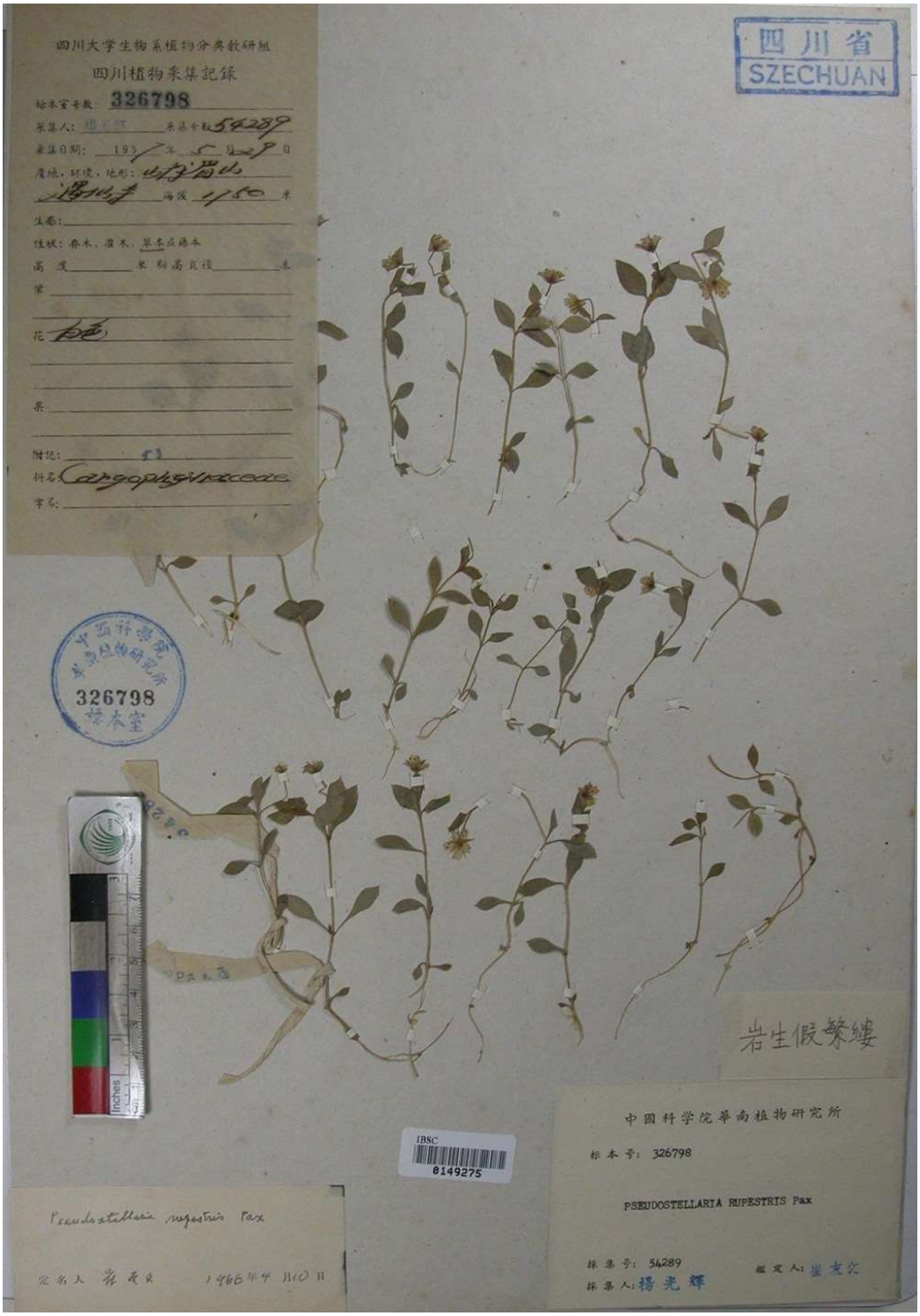

Fig. 3. Suspected specimen of ***Pseudostellaria fangiana*** collected in 1957s.