

中国特有濒危种川东灯台报春（报春花科）的重新发现

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摘要: 2006年6月份和9月份, 作者在对重庆市城口县大巴山地区进行考察时, 采集到了中国特有种川东灯台报春 (*Primula mallophylla*) 的标本, 这是近百年来对该种除模式标本外的再度发现。根据在大巴山观察及采集到的材料, 作者对过去该种的特征描述中存在的一些疑问进行了澄清, 更正和补充了其形态描述; 对历史上混淆的几个种列出了检索表; 报道了该种的染色体数目及核型; 根据国际通用的“红色名录等级及标准”对其濒危等级进行了评估。

关键词: 报春花属; 川东灯台报春; 再发现

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Rediscovery of *Primula mallophylla* (Primulaceae), An Endangered Species Endemic to Dabashan Mountain, China

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Abstract: During our expeditions to Dabashan Mountain in June and September 2006, *Primula mallophylla*, a species endemic to Dabashan Mountain, Northern Chongqing, China, was rediscovered. Based on observations and collections from Dabashan Mountain, the description of *P. mallophylla* is revised and emended. A key to *P. mallophylla* and its related species is provided, and the chromosome numbers and karyotype of this plant are reported. In addition, the current status of *P. mallophylla* is assessed according to the IUCN Red List Categories and Criteria.

Key words: *Primula*; *Primula mallophylla*; Rediscovery

Primula mallophylla Balf. f. was originally described by I. B. Balfour based on a collection of *P. G. Farges* (Farges 1181, Fig. 1), which was made in Eastern Sichuan (Szechuan) Province in the district of Chengkou (Tchen-Keou-tin), which now belongs to Chongqing. Part of Farges 1181 was sent to Edinburgh and to Kew from the Paris Herbarium under the name of *P. japonica* A. Gray. Some additional material of

Farges 1181 in Kew was named *P. angustidens* Pax (Balfour, 1916). Since then, no one has rediscovered the plant, and, thus, this species was assessed as an extinct species (EX) in the China Species Red List (Wang and Xie, 2004).

In June and September 2006, during our expeditions to Dabashan Mountain (Chengkou County), we discovered a purple plant of *Primula* sect. *Proliferae*

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Fig. 1 Photograph of *P. mallophylla* (type, Farges 1181, E)

is shorter (6.5 - 9 mm) and not divided to below the middle, and, thus, they are distinctly different from *P. mallophylla* but similar to *P. bulleyana* or *P. beesiana* Forrest (Chen and Hu, 1990). The distribution of *P. mallophylla* therefore does not extend to southern Sichuan.

Here we re-describe the plant according to our collections and our observations in the field. We also report its chromosome number and karyology, discuss its taxonomic affinities in *Primula* sect. *Proliferae*, and assess its current conservation status.



Fig. 2 Photograph of *P. mallophylla* in the field

Pax (Fig. 2). After checking the original description of *P. mallophylla*, comparing with others in the section, and identifying the materials we collected from Dabashan Mountain, we believe that the plant is *P. mallophylla*.

Although all authors suggested that *P. mallophylla* is a distinct species, parts of the description of the plant, especially the color of the flower and the distribution of the species, were incorrect due to the scarcity of specimens and the briefness of information about the plant in Farges' specimens. Balfour (1916) indicated that the corolla of flower is purple, but Smith *et al.* (1977) and Richards (1993, 2002) described it as orange or deep yellow. According to our field observations in Dabashan Mountain, the description by Balfour of the flower color is early accurate. Smith *et al.* (1977) recorded that C. Schneider collected some *Primula* from southern Sichuan Province in 1914 under the name of *P. bulleyana* Forrest and considered that the collections of Schneider were undoubtedly *P. mallophylla*. However, the calyx of Schneider's specimens

1 Material and methods

Field collections of *P. mallophylla* were undertaken by the authors in June and September of 2006. Vouchers are deposited at the herbarium of Kunming Institute of Botany (KUN, Wu 200610). Related herbarium materials at the Herbarium of Royal Botanic Gardens, Edinburgh (E) were studied. Measurements, colors and other details given in the descriptions are based on living material, herbarium specimens, and data derived from field notes.

Cytological study was carried out using plants cultivated in pots. Actively growing root tips were pretreated in 0.002 mol L 8-hydroxyquinoline at approximately 20 °C for 4 h before fixation in Carnoy I (1 glacial acetic acid: 3 absolute ethanol) at 4 °C for 30 min. Then they were macerated in a 1:1 mixture of mol L HCl and 45% acetic acid at 60 °C for 50 s, stained and squashed in Carbol fuchsin. Karyotype formulae were based on measurements of metaphase chromosomes taken from photographs. The symbols used to describe the karyotypes followed Levan *et al.* (1964).

The conservation status was based on the World Conservation Union (IUCN) Red List Category criteria (IUCN, 2001).

2 Results

Primula mallophylla Balf . f . in Notes Roy . Bot . Gard . Edin . , 9: 181 . 1916, et in J . Roy . Hort . Soc . Lond . , 39: 134, 166, 167 . 1931; W . W . Smith et Forrest in Notes Roy . Bot . Gard . Edin . , 16: 17 . 1928, et in J . Roy . Hort . Soc . Lond . , 54: 43 . 1929; Hand . -Mzt . , ibid . , 54: 52 . 1929; W . W . Smith et Fletcher in Trans . Bot . Soc . Edinb . 33: 158 . 1941; Chen F . H . et Hu C . M . , Primulaceae, in Flora Republicae Popularis Sinicae, 59 (2): 117 . 1990; J . Richards, *Primula* 1st ed . , 196 . 1993 et *Primula* 2nd ed . , 227 . 2002; Hu C . M . et S . Kelso, Primulaceae, in Fl . of China, 15: 143 . 1996 .

A perennial herb, completely farinose and glabrous . Leaves in a basal rosette; petiole 2 - 3.5 cm long, broadly winged; leaf blade oblong to oblong-obovate, 12 - 18 × 4 - 6.5 cm, enlarged to 15 - 25 × 5 - 10 cm in fruit, apex rounded to obtuse, base attenuate, margin irregularly denticulate to erose . Scapes up to 30 cm, slightly puberulous at the apex or not; umbels 2 - 4 whorls, superimposed, 8 - 15-flowered in the umbel; bracts 2 - 3 cm, the outermost ones narrowly elliptic, foliaceous, the inner ones linear to linear-lanceolate . Flower heterostylous . Pedicel 1.2 - 1.6 cm; calyx cup-shaped to tubular, 1 - 1.4 cm, clearly divided to far below the middle, lobes narrowly lanceolate, 7 - 10 mm . Corolla rose-purple, markedly annulate, limb 1.5 - 2 cm in diam . ; lobes obovate, emarginated . Pin flowers: corolla tube 1.3 - 1.5 cm long, slight longer than calyx, style exerted, stamens at middle of corolla tube . Thrum flowers: corolla tube c . 2 times as long as calyx, stamens near annulus; style almost as long as the calyx . Capsule globose, c . 5 mm in diam . , shorter than calyx . Flowering June to July, fruit-bearing September .

Habitat: Streamsides, wet meadows or shaded wet areas in forests; alt . 2100 - 2450 m; growing in association with *Prunella* sp . , *Actaea* sp . , *Ainsliaea* sp . , *Swertia* sp . , *Anaphalis* sp . , *Nothosmygium* sp . ,

and *Anemone* sp .

Distribution: Restricted to Dabashan Mountain areas, Chengkou County, northern Chongqing, China .

Chromosome numbers and karyotype: The chromosomes were counted as $2n = 2x = 22$ (Fig.3), and, thus, the basic chromosome number is $x = 11$; the karyotype was formulated as $2n = 18m + 4sm$ (Fig.3, 4), and the chromosomes show high conformity in size, shape and main arrangement of the constrictions . The basic chromosome number and the karyotype are consistent with other members in the sect . *Proliferae* (Brunn, 1932; Zhu *et al.*, 2001) .

Conservation assessment: The appearance of the plant in the wild seems to indicate that it is a desirable species for gardens, but the current situation of *P. mallophylla* in Dabashan Mountain is serious . During our expeditions to Dabashan Mountain, we just discovered two populations of *P. mallophylla* in this region . One population is in a meadow, with 200 - 300 individuals, all plants concentrated in a small area of about 0.1 hectare . Although this site is in the Dabashan National Nature Reserve, it is also being developed as for tourism



Fig . 3 Metaphase chromosomes in *P. mallophylla* ($2n = 22$)



Fig . 4 Karyogram of *P. mallophylla* ($2n = 18m + 4sm$) .

by the local government . The meadow where *P. mallophylla* is growing is in the heartland of the tourist site, and many tourism projects are being built there now . If action is not taken to protect this meadow, it will be damaged in the next few years, and *P. mallophylla* will also lose its habitat . At the same time, reproductive barriers appear to be strong for *P. mallophylla* in fertilization and or embryo development processes in this population . When we visited this site in June 2006, the flowers were blooming very well . However, when we returned in September of the same year, we only found a few mature fruits, most of infructescences had withered before the fruits reaching maturity . The other population is in an *Abies* and bamboo forest; there are just a few individuals, and the growth of *P. mallophylla* is not very good there .

Considering these factors, according to the assessment of the IUCN Red List Categories and Criteria (version 3.1) (IUCN, 2001), we assign *P. mallophylla* a provisional status of Endangered (EN A1d +

3cd + 4cd; B1b (ii, iii, iv, v) c (iii, iv); D; E) . Therefore, an integrating conservation strategy should urgently be carried out to protect this endangered and little-known species effectively . For example, by enforcing scientific researches on ecology, molecular biology, population genetics, reproductive biology, *in situ* and *ex situ* conservation and sustainable development .

Taxonomic affinities: In morphology, the plant is similar to other members of the sect . *Proliferae* with venulose leaves, superimposed umbels, etc . In the past, it was confused with *P. japonica*, *P. bulleyana* and *P. stenodonta* Balf . f . ex W . W . Smith et Fletcher . Perhaps its closest ally is *P. stenodonta* (Balfour, 1916; Smith *et al.*, 1977), but in fact it is a distinct and easily recognized species . The broader leaves, the long and deeply divided calyx, the long and leaf-like bracts are the main characteristics separating it from other members of the sect . *Proliferae* . The following key may be used to distinguish *P. mallophylla* and its related species .

- 1 . Corolla rose to purple .
 - 2 . Calyx 10 - 14 mm; leaf blade oblong to obovate-oblong, erose-denticulate *P. mallophylla*
 - 2 . Calyx 5 - 6 mm; leaf blade oblanceolate to obovate-elliptic, ± regularly denticulate *P. stenodonta*
- 1 . Corolla yellow or orange .
 - 3 . Scapes and inflorescences efarinose, calyx parted at least to middle *P. aurantiaca*
 - 3 . Scapes and inflorescences farinose or at least inside of calyx farinose, calyx parted scarcely to middle .
 - 4 . Flowers heterostylous, scapes and inflorescences farinose *P. bulleyana*
 - 4 . Flowers homostylous, only inside of calyx farinose *P. japonica*

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