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Source: Novon: A Journal for Botanical Nomenclature, 18(4):550-554. 2008.
Published By: Missouri Botanical Garden
DOI:
URL: http://www.bioone.org/doi/full/10.3417/2007077

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Abstract. *Paris stigmatosa* Shu-dong Zhang (Melanthiaceae) is described and illustrated from northeastern Yunnan, China. The new species was found growing in wet habitats under bamboo thickets on Yaoshan Mountain of Qiaojia County. The new species is very similar to *P. polyphylla* Smith, from which it differs by having fewer subsessile leaves (four to six), 3-merous flowers, and stigmas 21–34 mm long. A key to the new species and sympatric species is given, and their similarities are discussed.

Key words: China, IUCN Red List, Melanthiaceae, *Paris*, Yunnan.

The genus *Paris* L. (Melanthiaceae) (Angiosperm Phylogeny Group II, 2003) comprises more than 20 species of perennial herbs distributed in Eurasia (Li, 1986; Kato et al., 1995; Liang & Victor, 2000). All species except the European species *P. quadrifolia* L. and the Caucasian species *P. incompleta* M. Bieberstein are endemic to eastern Asia (Osaloo & Kawano, 1999). There are 22 species (12 endemic) in China (Liang & Victor, 2000), which is the center of species diversity and endemism for the genus.

The previous taxonomic circumscription of *Paris* has been problematic (e.g., Tatewaki & Sutô, 1935; Hara, 1969; Takhtajan, 1983; Li, 1984, 1986, 1998; Mitchell, 1987, 1988; Li & Noltie, 1997). Hara (1969) divided the genus into three sections, i.e., sections *Paris*, *Kinugasa* (Tatewaki & Sutô) Hara, and *Euthyra* (Salisbury) Franchet. Takhtajan (1983) suggested that *Paris* comprised three distinct genera: *Paris* s. str., *Kinugasa* Tatewaki & Sutô, and *Daiswa* Rafinesque. Li (1998), following Hara's (1969) treatment, maintained *Paris* s.l., dividing into two subgenera, subgenus *Daiswa* (Rafinesque) H. Li and subgenus *Paris*. In subgenus *Daiswa*, five sections were included, section *Dunniana* H. Li, section *Euthyra* (Salisbury) Franchet, section *Marmorata* H. Li, section *Fargesiana* H. Li, and section *Thibetica* H. Li; in subgenus *Paris*, three sections were included, section *Paris*, section *Kinugasa* (Tatewaki & Sutô) Hara, and section *Axiparis* H. Li. Previous molecular data (Osaloo & Kawano, 1999; Farmer & Schilling, 2002) supported Takhtajan's treatment in part; however, Ji et al. (2006) recently used nuclear ITS and plastid *psbA-trnH* and *trnL-trnF* DNA sequence data on a set of 21 species of *Paris* and confirmed that *Paris* s.l. is monophyletic. In this paper, we follow Li's (1998) treatment because of her comprehensive study for global *Paris* species.

Thirteen species were placed in *Paris* subg. *Daiswa* (Li, 1998) based on morphological characters such as thickened rhizomes, 1-loculed ovaries with parietal placentation, berry-like, irregularly dehisced capsules, and seeds with a succulent aril. There are 12 species of subgenus *Daiswa* in China, with 10 species occurring in Yunnan Province. Southwestern China (including Yunnan) clearly represents the center of diversity for *Paris* subgen. *Daiswa* (Gu & Li, 1988). Rising from the upper reaches of the Yangtze River,

 doi: 10.3417/2007077

Yaoshan Mountain lies along the border between northeastern Yunnan and southern Sichuan provinces. During recent fieldwork on Yaoshan Mountain by the authors, five taxa of *Paris* subgen. *Daiswa* were collected. Of these, *P. stigmatosa* is identified as a new species.

Specimens were collected on Yaoshan Mountain of northeastern Yunnan Province, and voucher specimens were deposited at the herbaria of Kunming Institute of Botany (KUN) and Yunnan University (YUKU). Flowers were observed directly in the field and rehydrated before most measurements and sketches were made. For the morphological descriptions, all materials were studied with the aid of a light microscope (Olympus TGHM, Tokyo, Japan). Pollen grains of the new species were collected in the field and examined by LM and SEM by the authors, because pollen exine sculptures play a key role in determining phylogenetic relationships among species of *Paris* (see Wei, 1988). Measurements were based on 20 pollen grains, the values of P (polar axis length) and E (equatorial diameter) were measured, and the P:E ratio was calculated.

Paris stigmatosa Shu-dong Zhang, sp. nov. TYPE: China. Yunnan: Qiaojia Co., Yaoshan Mtn., 2600–2900 m, 7 July 2004, *Hong Wang*, *Qin Lin*, *Shu-dong Zhang & Na-na Lin 03-1372* (holotype, KUN; isotypes, MO, PE, YUKU). Figure 1.

A *Paris polyphylla* Smith foliis obovatis subsessilibus, sepalis externis plerumque 3 atque stigmatibus 21–34 mm longis differt.

Plants perennial, erect; rhizome thickened to cylindrical, simple to 4 cm; stem green or purple, glabrous, 12–33 cm. Leaves 4 to 6; petioles subsessile; leaf blades obovate, glabrous, 4–9 × 2–3.5 cm, acuminate, cuneate. Fertile peduncles 3.5–11.5 cm, glabrous. Outer tepals typically 3, sometimes 4 or 2, green, ovate, 2–4.6 × 0.6–1 cm, glabrous, acuminate, cuneate, shortly ciliate at margin; inner tepals usually absent or 3, yellow-green, filiform, erect, equal to outer ones; stamens usually 6 or 8; filaments purple, 2–3 mm; anthers 3–5 mm; free portion of connective purple, ca. 0.2 mm, acute; ovary green, subglobose, 3–5.4 × 3–4.1 mm; style ca. 1 mm; stigmatic lobes 2, 3, or 4, purple, 21–34 mm; pollen prolate, monocolpate, rugulate-reticulate, 40.10 ± 2.49 × 21.24 ± 1.00 μm (Fig. 2). Capsule green at maturity, globose, 0.8–1 cm diam.; seeds enveloped by red, succulent aril, 4–5 × ca. 3 mm.

Distribution and habitat. *Paris stigmatosa* is an endemic species and has only been collected at the type locality on Yaoshan Mountain. Two populations with approximately 50 mature individuals each were found under moist bamboo thickets at altitude (2500–) 2600–2900 m.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), this species should be included in the category Critically Endangered (CR).

Phenology. Observed in flower May to July and in fruit in August.

Etymology. The epithet of the new species refers to its distinctive stigmas and is taken from the Latin "stigma" and the suffix "-osus," meaning "well developed." The elongate stigmas of *Paris stigmatosa* are conspicuous and are at least twice as long as stigmas known for other Chinese species.

Comparison to similar and sympatric species. Among the 12 individuals in the nine known specimens, two have three yellow-green, erect, filiform inner tepals. This also occurs in *Paris polyphylla* var. *pseudothibetica* H. Li found in Yunnan, on Yaoshan Mountain. According to Li's (1998) treatments, specimens with inner tepals were treated as *P. polyphylla* f. *pseudothibetica*, while specimens lacking inner tepals were *P. polyphylla* f. *macrosepala* H. Li. Li (1998) observed that both forms always appeared within the same natural population. In addition, Li (1998) also observed that the inner tepals could disappear in *P. polyphylla* f. *pseudothibetica* and grow out in *P. polyphylla* f. *macrosepala* in the greenhouse. The proportion of the two types was close to 1:1 (Li, 1998). There are also individuals with conical inner tepals noted for populations of *P. tetraphylla* A. Gray (Li, 1998) found far to the northeast in coastal Asia. Based on these observations, we consider that the absence of inner tepals should not be treated as a stable or diagnostic taxonomic character in *Paris*.

The long stigmas (up to 34 mm) in the new species *Paris stigmatosa* are unique. We examined stigma length in all species of *Paris* and found that only *P. tetraphylla* has long stigmas, but these are less than 12 mm. This species is distributed from Sakhalin Island, Russia, to Hokkaido, Honshu, and Shikoku, Japan. *Paris tetraphylla* does share some morphological characters with the new species, such as the inner tepals usually lacking and fewer outer tepals and stigmas (both typically four). However, it differs from the new species in having slender rhizomes, axile placentation, green style bases, and the same number of tepals and subtending leaves (typically four).

The new species *Paris stigmatosa* is similar to *P. polyphylla* in characters such as the number of tepals fewer than the leaves (5 to 11), the green calyxes, an inconspicuous free portion of anther connective, and

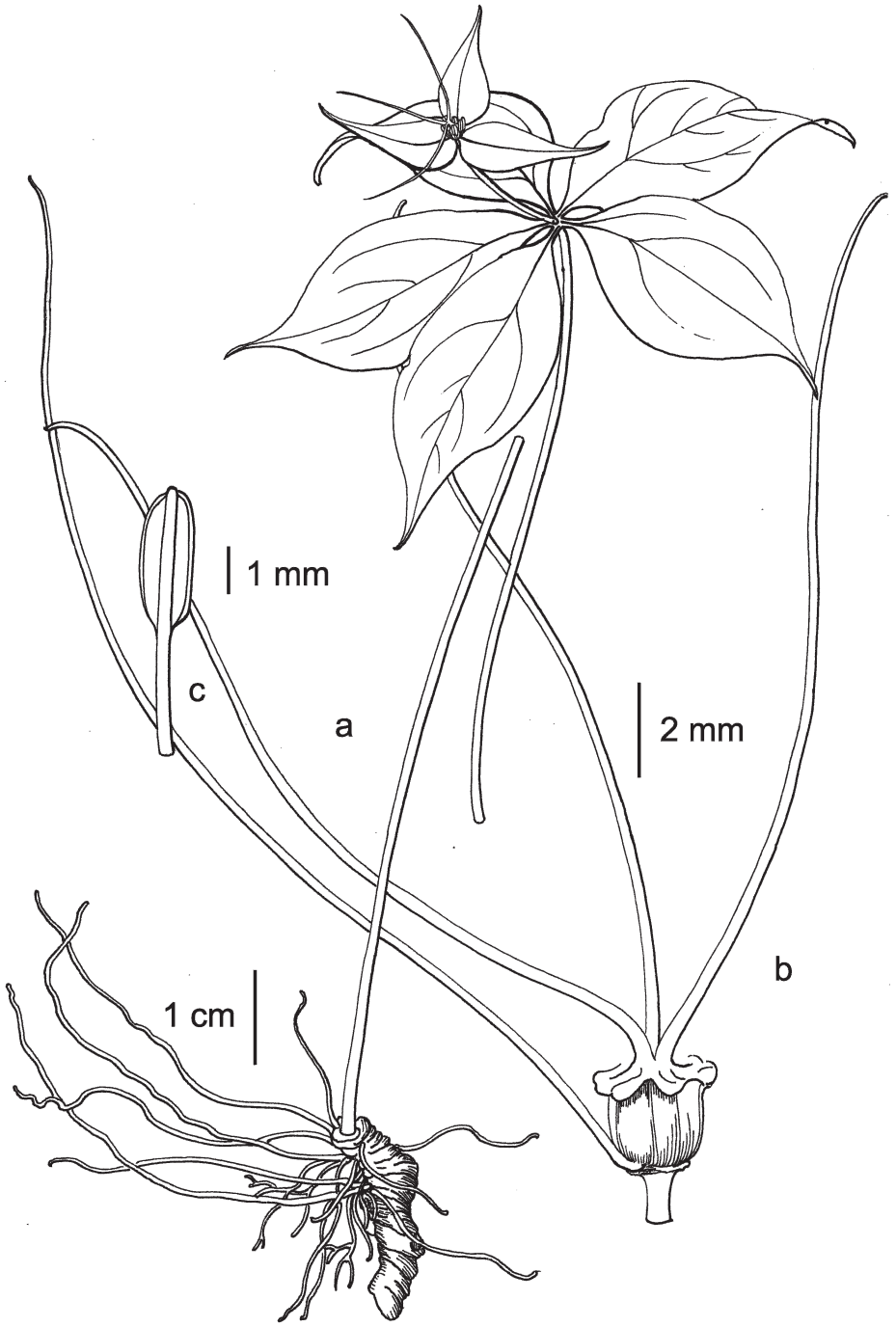

Figure 1. *Paris stigmatosa* Shu-dong Zhang. —a. Habit. —b. Pistil and inner tepal. —c. Anther. Drawn by Wang Ling from the holotype, *Hong Wang*, *Qin Lin*, *Shu-dong Zhang & Na-na Lin 03-1372* (KUN).

stamens twice as many as outer tepals. The new species differs from *P. polyphylla* in having subsessile petioles, obovate leaves, and much longer stigmas. *Paris polyphylla* varies in characters such as the number of leaves (5 to 11), the length of free portion of anther connective (inconspicuous or 0.5–2 mm), and the number of stigmatic lobes (Hara, 1969; Wang & Tang, 1978; Li, 1984, 1986). There are about 10

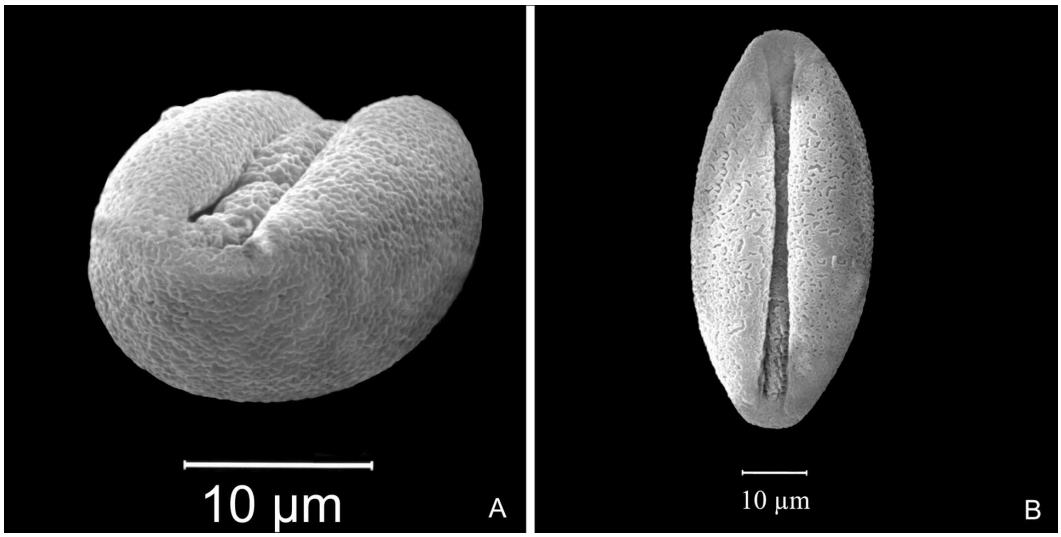

Figure 2. SEM images of pollen grains of *Paris stigmatosa* Shu-dong Zhang. —A. Polar view. —B. Equatorial view. Pollen from the paratype, *Hong Wang*, *Qin Lin*, *Shu-dong Zhang & Na-na Lin 03-1370* (KUN).

varieties recognized from China and nearby regions (Liang & Victor, 2000), and both *P. polyphylla* var. *stenophylla* Franchet and *P. polyphylla* var. *pseudothibetica* are sympatric with the new species. We found that *P. polyphylla* var. *stenophylla* was distinct from other varieties in *P. polyphylla* in having many more (10 to 15) lanceolate to linear-lanceolate leaves, and *P. polyphylla* var. *pseudothibetica* was unique in its conspicuous (3–10 mm) free portion of anther connective and in having a smaller number of apetalous individuals. We observed that *P. polyphylla* var. *pseudothibetica* and the new species grew in the same habitat. However, the new species is readily distinguished by its obovate versus oblong or oblanceolate leaves and subsessile petioles, even when both species were seen only as vegetation.

In addition to the varieties of *Paris polyphylla* mentioned above, *P. mairei* H. Léveillé, *P. marmorata* Stearn, and *P. delavayi* Franchet var. *petiolata* (Baker ex C. H. Wright) H. Li are also sympatric with *P. stigmatosa* on Yaoshan Mountain. *Paris marmorata* is easily distinguished due to the unique white mottling on its leaves. Typical specimens of *P. mairei* can be identified by their papillose pubescence; however, specimens collected from Yaoshan Mountain have little pubescence, but may be recognized by their purple fruits and oblanceolate to obovate-lanceolate leaves, while *P. delavayi* var. *petiolata* is easily identified in the field by its ovate-oblong leaves with a cordate or rounded base and the deflexed tepals equal in number to the leaves.

The new species is distinguished from other sympatric *Paris* species by the key below.

Key to six taxa of *Paris* from Yaoshan Mountain, northeastern Yunnan, China

1a. Leaves dark green, with white mottling . . *P. marmorata*
1b. Leaves green, without mottling 2
2a. Plants papillose-pubescent; fruits purple . . . *P. mairei*
2b. Plants glabrous; fruits green 3
3a. Tepals of the same number as the leaves (6), outer tepals purple . . . . . *P. delavayi* var. *petiolata*
3b. Number of tepals often fewer than leaves, outer tepals green 4
4a. Leaves 4 to 6; stigmas 21–34 mm . . . . . *P. stigmatosa*
4b. Leaves 5 to 14; stigmas less than 10 mm 5
5a. Leaves lanceolate to linear; free portion of anther connective inconspicuous, only to 0.5 mm . . . . . *P. polyphylla* var. *stenophylla*
5b. Leaves lanceolate to oblanceolate; free portion of anther connective conspicuous, 3–10 mm . . . . . *P. polyphylla* var. *pseudothibetica*

Paratypes. CHINA. **Yunnan:** Qiaojia Co., Mt. Yao, 7 July 2004, *Hong Wang*, *Qin Lin*, *Shu-dong Zhang & Na-na Lin 03-1370* (KUN), 25 May 2005, *Shu-dong Zhang & Na-na Lin 03-1681* (KUN), 28 May 2005, *Shu-dong Zhang & Na-na Lin 03-1803* (KUN), 30 May 2005, *Shu-dong Zhang & Na-na Lin 03-1881* (KUN), 7 Aug. 2002, *Cheng-lin Dang 31043* (YUKU).

Acknowledgments. We are grateful to Qin Lin, Jie Cai, and Na-na Lin for their kind help in the fieldwork in northeastern Yunnan, and to the curators Yan Zhang (KUN) and Wei-ming Zhu (YUKU) for making the specimens available. We are indebted to Ling Wang, the botanical artist at KUN, for the drawings. This project was supported by the National Natural Science Foundation of China (30670160) and the Ministry of Science and Technology of China (2005DKA21006).

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