Dryopteris liboensis (Dryopteridaceae), a New Species in *Dryopteris* sect. *Erythrovariae* from Guizhou, China

*Li-Bing Zhang**

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A., and Chengdu Institute of Biology, Chinese Academy of Sciences, P.O. Box 416, Chengdu, Sichuan 610041, People's Republic of China

Pei-Shan Wang and Xiao-Ying Wang

Guizhou Academy of Sciences, Guiyang, Guizhou 550001, People's Republic of China
pswang36@yahoo.com.cn
*Author for correspondence: libing.zhang@mobot.org

ABSTRACT. *Dryopteris liboensis* P. S. Wang, X. Y. Wang & Li Bing Zhang, a new species of *Dryopteris* Adans. (Dryopteridaceae) from southern Guizhou, China, is described and illustrated. *Dryopteris liboensis* is assigned to *Dryopteris* subg. *Erythrovariae* (H. Ito) Fraser-Jenk. on the basis of its stiff and narrow petiole and rachis scales, but the new species is noteworthy within the section because these scales are not bullate. *Dryopteris liboensis* has stiff, narrowly lanceolate and filiform scales on the petiole and rachis and is therefore considered a member of the *D. erythrosora* (D. C. Eaton) Kuntze group of *Dryopteris* sect. *Erythrosoriae* H. Ito. It is unique among Chinese taxa of *Dryopteris* sect. *Erythrovariae* in having leaves 1- or 2-pinnate basally, with zero to three free lobes, and 1-pinnatifid at the blade apex.

Key words: China, Dryopteridaceae, *Dryopteris*, Guizhou, IUCN Red List.

Dryopteris Adans. (Dryopteridaceae) is one of the largest fern genera, with about 300 or more species worldwide (Lu, 1993). *Dryopteris* has been classified into four subgenera as *Dryopteris* subg. *Dryopteris*, *Dryopteris* subg. *Erythrovariae* (H. Ito) Fraser-Jenk., *Dryopteris* subg. *Nephrocystis* (H. Ito) Fraser-Jenk., and *Dryopteris* subg. *Pycnopteris* (Moore) Ching (Fraser-Jenkins, 1986), or three subgenera as *Dryopteris* subg. *Dryopteris*, *Dryopteris* subg. *Erythrovariae*, and *Dryopteris* subg. *Pycnopteris* (Wu & Lu, 2000). Of these, *Dryopteris* subg. *Erythrovariae* is one of the three subgenera recognized in both classifications. The circumscription of *Dryopteris* subg. *Erythrovariae* by Wu and Lu (2000), however, differs slightly from that of Fraser-Jenkins (1986). Fraser-Jenkins (1986) used overall morphological similarities to characterize *Dryopteris* subg. *Erythrovariae* and did include a few species without bullate scales. In contrast, Wu and Lu (2000) strictly used the presence of bullate scales to define *Dryopteris* subg. *Erythrovariae*. As a result of the differing circumscriptions, the taxonomic placement of a few species, e.g., *D. polita* Rosenst., has been controversial. A recent molecular analysis demonstrated that Fraser-Jenkins's (1986) definition of *Dryopteris* subg. *Erythrovariae* is more natural (Zhang et al., 2012).

In the summer of 2005, one of the authors (P.-S.W.) collected specimens of an unidentified species of *Dryopteris*. Additional material was collected in 2009 and 2010 from the same locality. This species is similar to members of *Dryopteris* subg. *Erythrovariae* in the shape of the petiole and rachis scales, but the scales are not bullate. The discovery of this species offered an opportunity to test the differing views of Fraser-Jenkins (1986) and Wu and Lu (2000).

Dryopteris liboensis P. S. Wang, X. Y. Wang & Li Bing Zhang, sp. nov. TYPE: China. Guizhou: Libo Co., Lihua, Wujia River, 25°21′1.71″N, 108°7′32.26″E, 520 m, on rock wall by river, 3 Aug. 2005, *P.-S. Wang 20052* (holotype, PYU; isotypes, CDBI, MO, Herbarium Pei-Shan Wang [Guizhou Institute of Biology]). Figure 1.

Diagnosis. *Dryopteris liboensis* P. S. Wang, X. Y. Wang & Li Bing Zhang is most similar to species of the *D. erythrosora* (D. C. Eaton) Kuntze group of *Dryopteris* sect. *Erythrosoriae* H. Ito in having narrowly lanceolate and filiform scales on the petiole base and rachis, but it differs from any species of this series in China by its leaves that are 1- or 2-pinnate basally, the lower pinnae with up to three pairs of free lobes only, rather than either 1-pinnate leaves or if 2-pinnate, then the leaves with more than 10 pairs of pinnules.

Terrestrial, evergreen, 13–26 cm tall; rhizomes 5–7 mm, erect or slightly ascending, together with petiole bases densely scaled, the scales brown, narrowly

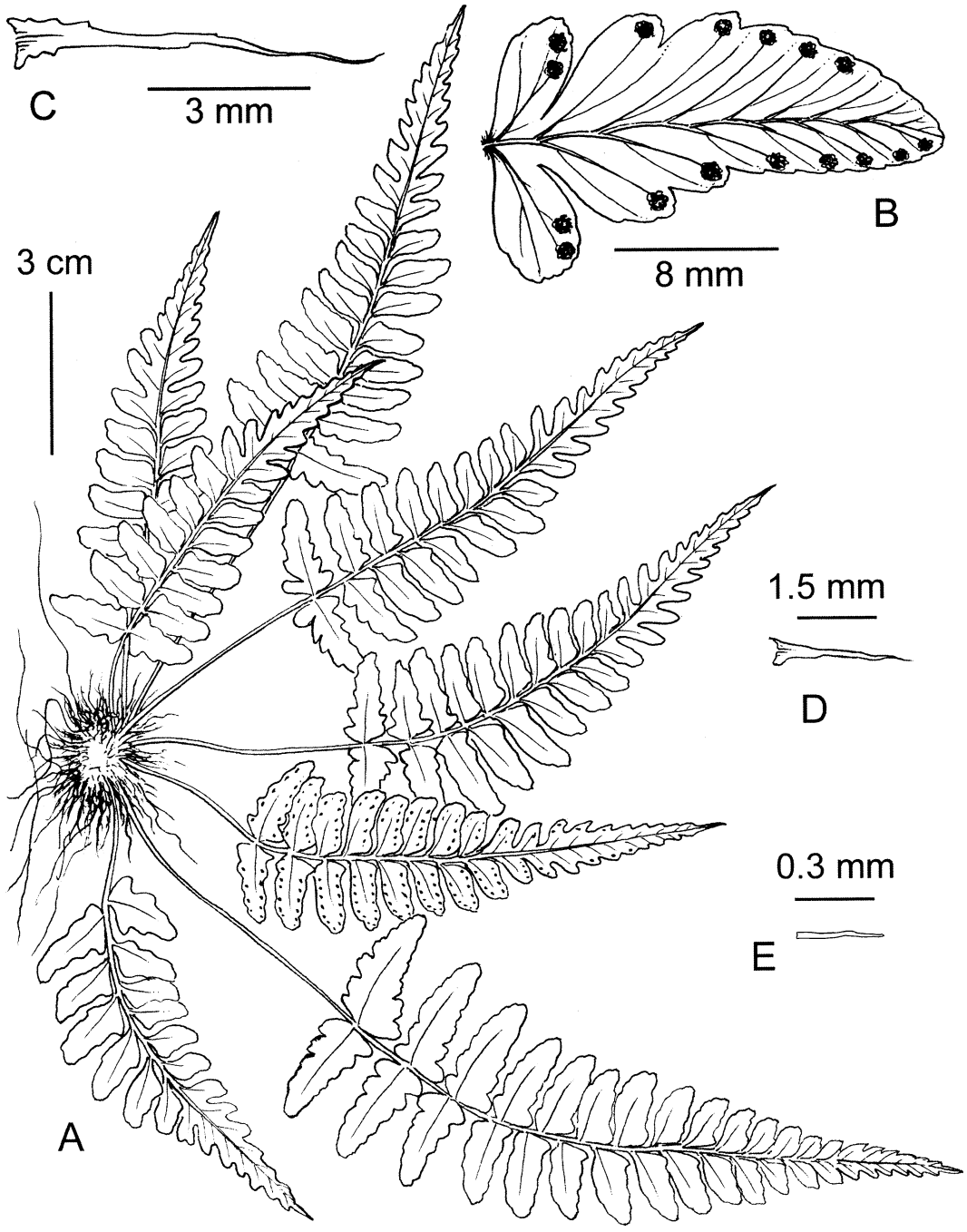

Figure 1. *Dryopteris liboensis* P. S. Wang, X. Y. Wang & Li Bing Zhang. —A. Habit. —B. Pinna. —C. Petiole scale. —D. Rachis scale. —E. Scale from lower leaf surface. Based on the isotype, *P.-S. Wang 20052* (CDBI).

lanceolate, 6–12 mm, 0.5–1.2 mm at base, stiff, not bullate, entire on margin, the scale apex filiform. Leaves caespitose; petiole brown at base and stramineous upward, thin but tough, adaxially sulcate, 4–14 cm, 0.5–1.5 mm diam., glabrate acropetally, with a tuft of stiff, narrowly lanceolate and filiform scales at base, these basal scales similar to those on rhizomes; leaf lamina narrowly deltate to narrowly ovate or lanceolate, 7–14 × 3–7 cm, cordate at base, acuminate at apex, 1- or 2-pinnate at frond base, 1-pinnatifid at apex; rachis

sulcate adaxially, 0.3–0.5 mm diam., sparsely scaled abaxially, the scales pale brown, narrowly lanceolate and filiform; pinnae chartaceous, in 5 to 12 pairs, short-stalked or sessile, alternate or opposite, often spreading, deltate to narrowly ovate, ± falcate, rounded or slightly cordate at base, obtuse at apex; largest pinnae near base, 1.4–3.5 × 0.8–1.8 cm, pinnatifid or with the basal pinnules sessile, the free lobes in 0 to 3 pairs; adaxially glabrous, abaxially glabrate, with a few narrowly lanceolate to linear microscales; pinna rachis 0.5–0.8 mm diam., slightly scaled abaxially; pinna lobes oblong, obtuse at apex, the margin incise-serrate; veins in lobes pinnately branched, the lateral veinlets often furcate. Sori round, 1 to 9 on each side of midrib of fertile pinnae, dorsal or nearly terminal on veinlets, close to pinna or blade margins; indusia peltate, brown, ca. 0.7 mm diam., persistent, lacerate on margin.

Distribution and habitat. *Dryopteris liboensis* was found only in Libo County in southern Guizhou, bordering northern Guangxi, China. It is possible that this species may also occur in adjacent areas in southern Guizhou and northern Guangxi. *Dryopteris liboensis* was collected from shady sandstone walls under a forest canopy by a river at an altitude of 520 m. The soil is acidic, which is the typical preference for most species of *Dryopteris*.

IUCN Red List category. Only one population at one locality with ca. 30 individuals was collected, although *Dryopteris liboensis* may be found elsewhere nearby. Based on the evidence available, *D. liboensis* should be classified as Critically Endangered (CR), according to the International Union for Conservation of Nature and Natural Resources guidelines (IUCN, 2008). Although the habitat of *D. liboensis* in Libo County is inside the Maolan Nature Reserve and thus is relatively well protected, further investigation of the species' population dynamics is needed to best assess its vulnerability.

Etymology. The epithet of the new species is taken from the Chinese pinyin, "libo," the name of the county in southern Guizhou, China, and the Latin suffix, "-ensis," meaning "of origin or place," referring to the type locality and known distribution of the species.

Discussion. It appears equivocal in which subgenus *Dryopteris liboensis* should be classified. Although the new species has no bullate scales, which is similar to species of *Dryopteris* subg. *Dryopteris*, *D. liboensis* is not taxonomically placed within *Dryopteris* subg. *Dryopteris*. The new species has a chartaceous leaf blade and a tuft of stiff, narrowly lanceolate and filiform scales at the petiole base, while the remainder of the petiole is glabrate. These features are reminiscent of members of *Dryopteris* subg. *Erythrovariae*. There are a few species in *Dryopteris* subg. *Erythrovariae* that are notable for the absence of bullate scales: *D. cyclopeltidiformis* C. Chr., *D. integriloba* C. Chr., *D. polita*, and *D. yenpingensis* C. Chr. & Ching ex Ching (Fraser-Jenkins, 1986). A preliminary molecular analysis based on chloroplast DNA sequences from *rbcL* and *trnL-F* loci does support *D. liboensis* as a member of *Dryopteris* subg. *Erythrovariae* and *Dryopteris* sect. *Erythrovariae* (Zhang et al., unpublished data). Accordingly, *D. liboensis* is the fifth member of *Dryopteris* subg. *Erythrovariae* known to lack bullate scales. *Dryopteris assamensis* (C. Hope) C. Chr. & Ching was reported as having no bullate scales (Fraser-Jenkins, 1986), but in fact, it does have bullate-based scales at the base of the pinna rachis and along the midribs of pinnules (Wu & Lu, 2000).

Among the species of *Dryopteris* sect. *Erythrovariae* in China, *D. liboensis* is unique in having leaves that vary from 1-pinnate or 2-pinnate on basal pinnae, to 1-pinnatifid at the frond apex. The lower pinnae have at most 3 pairs of free lobes or pinnules. There are five additional species in the *D. erythrosora* group in China, characterized by having narrowly lanceolate or linear, stiff, and entire petiole and rachis scales: *D. decipiens* (Hook.) Kuntze, *D. erythrosora* (Eaton) Kuntze, *D. fuscipes* C. Chr., *D. hondoensis* Koidz., and *D. ryo-itoana* Sa. Kurata. The six Chinese species of the *D. erythrosora* group can be distinguished from one another by the following key (modified from Wu & Lu, 2000).

Key to Species of the *Dryopteris erythrosora* Group from China

1a. Leaves consistently 1-pinnate; pinnae serrate or deeply lobed on margin but lobes sessile ..... *D. decipiens*
1b. Leaves 1- or 2-pinnate at frond base; pinnules short-stalked or sessile.
  2a. Leaves shorter than 28 cm; the lower pinnae with 0 to 3 pairs of free lobes or pinnules ..... *D. liboensis*
  2b. Leaves exceeding 30(50) cm; lower pinnae with more than 10 pinnule pairs.
    3a. Pinnules deltate or ovate, serrate or shallowly pinnatifid; pinnule apex obtuse.
      4a. Pinnules serrate; sori close to pinna midrib ..... *D. fuscipes*
      4b. Pinnules shallowly pinnatifid; sori close to pinnule margins ... *D. ryo-itoana*
    3b. Pinnules lanceolate, pinnatifid; pinnule apex acuminate.
      5a. Pinnules shallowly pinnatifid; pinna rachis and pinnule rachis densely set with bullate scales; indusia darkish red in center .... *D. erythrosora*

5b. Pinnules deeply pinnatifid; pinna rachis and pinnule rachis sparsely set with bullate scales; indusia light red in center ..... *D. hondoensis*

Paratypes. CHINA. **Guizhou:** Libo Co., Lihua, Wujia River, 25°21′1.71″N, 108°7′32.26″E, 520 m, 8 Aug. 2009, *J.-H. Zhao & N.-W. Zhao 404* (CDBI, GZTM), summer 2010, *J.-H. Zhao & N.-W. Zhao s.n.* (GZTM).

Acknowledgments. We express our appreciation to Jun-Hua Zhao and Neng-Wu Zhao for their help with part of the fieldwork. We thank Faqiang Lü for the line drawing in Figure 1. Helpful comments were received from J. P. Roux, an anonymous reviewer, and Victoria Hollowell. We thank the curators of the herbaria CDBI, GZTM, MO, and PYU for providing access to the material in their care.

Literature Cited

Fraser-Jenkins, C. R. 1986. A classification of the genus *Dryopteris* (Pteridophyta: Dryopteridaceae). Bull. Brit. Mus. (Nat. Hist.), Bot. 14: 183–218.

IUCN. 2008. IUCN Red List Categories and Criteria, Version 7. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.

Lu, S.-G. 1993. A classification synopsis of the genus *Dryopteris* from Yunnan. Acta Phytotax. Sin. 31: 385–391.

Wu, S.-G. & S.-G. Lu. 2000. *Dryopteris* Adans. Pp. 102–220 *in* C.-Y. Wu (editor), Flora Reipublicae Popularis Sinicae, Vol. 5(1). Science Press, Beijing.

Zhang, L.-B., L. Zhang, S.-Y. Dong, E. B. Sessa, X.-F. Gao & A. Ebihara. 2012. Molecular circumscription and major evolutionary lineages of the fern genus *Dryopteris* (Dryopteridaceae). Evol. Biol. 12: 180.