Polystichum normale (Dryopteridaceae), a New Species in Section Crucifilix from Guizhou, China

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ABSTRACT. A new fern species, Polystichum normale Ching ex P. S. Wang & Li Bing Zhang (Dryopteridaceae), is described from Guizhou and illustrated for section Crucifilix Tagawa. Distributed in southern Chongqing, northeastern and southeastern Guizhou, and northwestern Hunan, China, the new species is morphologically similar to P. tripterone (Kunze) C. Presl and P. hancockii (Hance) Diels. Polystichum normale has toothed and oblong or almost rectangular pinnae with an acute apex. In contrast, P. tripterone has coarsely serrate and falcate-lanceolate pinnae with an acuminate apex. While P. normale has sori close to the pinna margins, indusia 0.6–0.8 mm in diameter, and a perispore with an irregularly perforate sculpture, P. hancockii has sori closer to the costa, indusia 0.3–0.4 mm in diameter, and a perispore with reticulate sculpture. It is considered Vulnerable (VU), based on IUCN Red List criteria.

Key words: China, Dryopteridaceae, Guizhou, IUCN Red List, Polystichum.

While in San Francisco in April 2009, the first author (L.-B.Z.) examined the collections of Polystichum Roth (Dryopteridaceae) and allies at the CAS herbarium. A specimen from the collection Sino-Amer. Exp. 388 of Polystichum, collected on 27 August 1986 from northeastern Guizhou, China, had reflexed pinnae and almost upright, obtuse teeth on pinna margins. Its reflexed pinnae resemble those of P. deflexum Ching & W. M. Chu, but the tooth shape of the pinnae was very different. The reflexed pinnae and teeth, as well as the sori spread across the entire pinnae, distinguished the specimen from P. submarginale (Baker) Ching ex P. S. Wang. After returning to St. Louis, L.-B.Z. sent images of this specimen to the second author (P.-S.W.), who in fact had collected many specimens of this undescribed taxon since October 1985, initially from Mt. Leigong in Guizhou, and had long recognized this as a distinct species. Subsequent herbarium examinations in CDBI, HGAS, KUN, PE, PYU, and Herbarium Pei-Shan Wang, as well as molecular (Zhang, unpublished) and palynological work, confirm that this species is new to science. We now validly publish the previously ined. name P. normale used by Ching based on material collected by P.-S.W.


Species (sectionis Cruciflicis Tagawa) Polysticho tripteronti (Kunze) C. Presl et P. hancockii (Hance) Diels affinis, sed a P. tripteronte pinnis dentatis oblongis vel fere rectangularibus apice acutis, a P. hancockii soris prope margines pinnarum dispositis, indusiis 0.6–0.8 mm diam. atque perisporarum sculptura irregulariter perforata differt.

Plants perennial, evergreen, (11–)16–33 cm tall; rhizome short, 0.5–2 cm, ascending or erect; scales narrowly ovate, chartaceous, light brown to brown, 3–4 mm; roots dark brown to brown when dry, to 7 cm, 0.2–0.3 mm diam., sparsely covered with hairlike scales. Leaves caespitose; 4 to 7 per rhizome; petiole (4–)8–17 cm, (0.4–)0.7–2.6 mm, median diam., adaxially canaliculate, green, stramineous when dry; basal petiole scales (Fig. 1C) narrowly ovate to lanceolate, 5–7 × 1.2–1.5 mm, thinly chartaceous and brown at mid-portion, membranous and light brown marginally, the margin almost entire, apex acuminate or caudate, matte; distal petiole scales similar but narrower and shorter toward rachis apex, lanceolate or less often narrowly ovate, membranous, light brown, margin ciliate, apex caudate, matte; leaf
lamina lanceolate, slightly contracted toward base, 1-pinnate, (6–)9–27 × 1.9–3.3 cm wide at mid-portion, apex acuminate; rachis 0.7–1.3 mm in median diam., without proliferous buds, adaxially sulcate; rachis scales 1.5–3 × 0.3–0.7 mm, variable in size, membranous, light brown, margin ciliate, apex caudate, matte (Fig. 1D); pinnae in 14 to 28 pairs, not overlapping, pointing upward, basalmost pairs

simple, pinnatifid or 1-pinnate, 8–35 × 3.5–12 mm, the basal 2 pairs 0.7–1.4 cm apart, alternate, green, oblong to nearly rectangular, middle pinnae 9–17 × 3.5–7.2 mm, shortly petiolulate, with petiolules ca. 1.2 mm, chartaceous, acroscopic bases auriculate, basiscopic bases truncate and often forming a (90°–) 100°–110° angle with rachis, apex acute, round but mucronate, acroscopic margins of pinnae repand and serrate, abaxially scaly, adaxially glabrous; micro-scales on abaxial surface subulate without dilated base (narrow-type microscales; cf. Fig. 1E), 0.1–0.23 mm, 0.05–0.1 mm wide at base; pinnae with the venation pinnate; midrib abaxially slightly raised, adaxially flat and invisible; lateral veins free, in 4 to 7 pairs from midrib per pinna, each lateral vein further dichotomous, indistinct on both surfaces. Sori terminal on veins of pinnae, (1 to)4 to 8 per fertile pinna (Fig. 1B), located between midrib and pinna margin, 0.7–2.2 mm distant from pinna margin; all pinnae on fertile laminae, (1 to)4 to 8 per fertile completely green or nonvariegated coloration of the fronds. (Fig. 1F).

Polystichum normale is restricted to southern Chongqing, northeastern and southeastern Guizhou, as well as northwestern Hunan provinces in China. Polystichum normale grows in thick, acidic soils derived from sandstone. Populations were observed under forest cover or in shaded areas in valleys. Elevations of collected populations ranged from 600 to 1850 m.

IUCN Red List category. There seem to be no serious concerns about the conservation status of Polystichum normale. The taxon has been found in many populations in a relatively wide range across three provinces in China. The core distribution areas, Mt. Fanjing (the type locality) and Mt. Leigong, are now well-protected national parks in Guizhou Province. The most recent collection dates back to 2007 from Mt. Fanjing (the type), although the population size was small, estimated at no more than 100 individuals scattered in a river valley. However, the geographical range of P. normale appears to be severely fragmented. The current status of the population collected in 1992 from Sandu County, Guizhou Province, of the population collected in 1979 from Chongqing Municipality, and finally of the population not re-collected since 1958 in Sangzhi County, Hunan, is currently unknown and its reduction in population size may be suspected. These populations should be under increasing threat of extinction as a result of known deforestation and human disturbance (Zhang & Wang, pers. obs.). Therefore, the status of P. normale is best classified as Vulnerable or VU, according to IUCN (2008) criteria.

Etymology. The epithet of the new species is taken from the Latin “normale,” which refers to the completely green or nonvariegated coloration of the fronds.

Discussion. Our unpublished phylogenetic analysis based on chloroplast trnL-F sequences resolved Polystichum normale as sister to P. tripteran, with 97% jackknife support. In another independent phylogenetic analysis based on the chloroplast rbcL gene sequences, P. tripteran was resolved as sister to P. hancockii with 100% bootstrap support (Liu et al., 2007). These two independent studies suggest that P. hancockii, P. normale, and P. tripteran form a supported monophyletic clade. This clade corresponds to Polystichum sect. Crucifilix and is characterized by 1-pinnate lamina with a pair of 1-pinnate or pinnatifid (or simple) basal pinnae.

Morphologically, Polystichum normale is distinguished from P. tripteran by having toothed and oblong or almost rectangular pinnae with an acute apex and by having basal pinnae that are simple (Figs. 1, 2C, D), pinnatifid (Fig. 2B), or 1-pinnate (Fig. 2A). The basalmost pinnae are almost as long as (Fig. 1) to twice as long as the median pinnae (Fig. 2A). In contrast, P. tripteran has coarsely serrate and falcate-lanceolate pinnae with an acuminate apex and basal pinnae ca. six times as long as the median pinnae. Polystichum tripteran is widely distributed in China, Japan, the Korean Peninsula, and the Russian Far East.

Morphological differences between Polystichum normale and P. hancockii lie in that P. normale has the sori positioned closer to pinna margins and the indusia are larger, 0.6–0.8 mm in diameter, whereas P. hancockii has the sori slightly closer to the midrib, with the indusia only 0.3–0.4 mm. In addition, the basal pinnae of P. normale can be simple or pinnatifid or 1-pinnate, while those of P. hancockii are consistently 1-pinnate (at least some laminae on
any given plant of *P. hancockii* have 1-pinnate basal pinnae. *Polystichum hancockii* is distributed in southern, eastern, and central China, Japan, and the Korean Peninsula (Kung et al., 2001).

These three species of *Polystichum* sect. *Crucifilix* are known to grow in acidic soils. In fact, across the broader taxonomic concept of *Polystichum* sect. *Haplopolystichum* Tagawa (1940) s.l., within which

P. hancockii, P. normale, and P. tripteris affine, can nine species (Zhang & He, 2009a) are known to edaphically prefer acidic soils. Acidophiles in section Haplopolyctichum s.l. include P. balansae Christ, P. falciforme Ching ex W. M. Chu & Z. R. He, P. formosanum Rosenst., P. hookeriatorum (C. Presl) C. Chr., P. uniseriale (Ching ex K. H. Shing) Li Bing Zhang, and P. yuanense Liang Zhang & Li Bing Zhang, in addition to the three species discussed herein for section Crucifilix. Additionally, P. acutidens Christ and P. deltodoron (Baker) Diels are sometimes noted as tolerant of acidic soils. This contrasts with the 12 species occurring in basic soils and restricted to limestone areas as described in recent years (Wang & Wang, 1994, 1997, 2001; Zhang & He, 2009a, 2009b, 2010, 2012; He & Zhang, 2010, 2011; Zhang et al., 2010).

**Polystichum normale** is one of the morphologically most variable species in section Haplopolyctichum s.l., sensu Zhang and He (2009a). Its pinna shape, marginal teeth, as well as the morphology of the basal pinnae, are quite variable (Fig. 2), but this variation seems continuous among those specimens seen. It could be hypothesized that this variability may correlate with the relatively broad distribution of *P. normale* across three provinces in south-central China as well as with the diverse habitats observed.

**KEY TO SPECIES OF POLYSTICHEM SECT. CRUCIFILIX**

1a. Pinnae coarsely serrate on margins, falcate-lanceolate in shape, apex acuminate — *P. tripteris*

1b. Pinnae toothed on margins, oblong or almost rectangular, apex acute

2a. Basal pinnae commonly 1-pinnae (at least some laminae on a given plant have 1-pinnae basal pinnae); sori slightly closer to midrib; indusia 0.3–0.4 mm diam.; perispores with reticulate sculpture .......................... *P. hancockii*

2b. Basal pinnae rarely 1-pinnae; sori closer to pinna margins; indusia 0.6–0.8 mm diam.; perispores with irregularly perforate sculpture .......................... *P. normale*


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**Literature Cited**


