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A taxonomic revision of *Polystichum* Roth sect. *Sorolepidium* (Christ) Tagawa

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Summary. *Polystichum* (Dryopteridaceae) is one of the largest fern genera with long-standing taxonomy difficulties. Among them, *P*. sect. *Sorolepidium* has garnered considerable attention and particularly remained issues in species delimitation. In this study, a taxonomic revision of the *P*. sect. *Sorolepidium* was made based on comprehensive morphological studies that encompassed protologues and numerous specimens. We measured and recorded 26 morphological characters from 134 specimens (including 17 type specimens), and identified eight characters that played significant roles in species complex delimitation. Combining with previous molecular phylogeny studies, we redefined the range of *P*. sect. *Sorolepidium*, recognizing that this section consists of nine species belonging to two complexes. *Polystichum glaciale* complex includes *P. glaciale*, *P. duthiei* and *P. integrilobum*. *P. moupinense* complex includes *P. castaneum*, *P. lachenense*, *P. moupinense*, *P. prescottianum*, *P. salwinense* and *P. shensiense*. *P. duthiei* var. *subbipinnatum* was treated as a synonym of *P. integrilobum*, *P. qamdoense* var. *elongatum* and *P. melanostipes* as the synonyms of *P. shensiense*. *P. qamdoense*, *P. paramoupinense*, *P. habaense*, *P. taizhongense* were treated as synonyms of *P. moupinense*. *P. yadongense*, *P. bomiense*, *P. tibeticum*, *P. pseudocastaneum* were treated as synonyms of *P. prescottianum*. We finally provided key to the species and a list of examined specimens for each species.

Таксономическая ревизия *Polystichum* Roth sect. *Sorolepidium* (Christ) Tagawa

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Ключевые слова: морфология, группа родства, таксономическая ревизия, *Polystichum*, sect. *Sorolepidium*.

Аннотация. *Polystichum* (Dryopteridaceae) – один из крупнейших родов папоротников, в систематике которого существуют давние сложности. В частности, секция *Sorolepidium* характеризуется проблемами в определении границ видов. В данном исследовании представлены результаты таксономической ревизии данной секции, проведенной на основе комплексных морфологических исследований, включающих анализ протологов и многочисленных образцов. Мы измерили и установили 26 морфологических признаков у 134 образцов (включая 17 типовых образцов) и выделили восемь признаков, которые сыграли важную роль в определении видового комплекса. Используя предыдущие молекулярно-филогенетические исследования, мы уточнили объем *P*. sect. *Sorolepidium*, установив, что эта секция состоит из девяти видов, которые можно отнести к двум группам ближайшего родства. Первая группа (*Polystichum glaciale* и его родство) включает *P. glaciale*, *P. duthiei* и *P. integrilobum*, вторая (*P. moupinense* и его родство) – *P. castaneum*, *P. lachenense*, *P. moupinense*, *P. prescottianum*, *P. salwinense* и *P. shensiense*. *Polystichum duthiei* var. *subbipinnatum* принят нами в ранге вида – как *P. integrilobum*; *P. qamdoense* var. *elongatum* и *P. melanostipes* отнесены к синонимам *P. shensiense*; *P. qamdoense*, *P. paramoupinense*, *P. habaense* и *P. taizhongense* синонимизированы с *P. moupinense*; *P. yadongense*, *P. bomiense*, *P. tibeticum* и *P. pseudocastaneum* рассматриваются нами как синонимы *P. prescottianum*. Также мы приводим ключ для определения видов и список исследованных образцов для каждого вида.

Introduction

Polystichum Roth is the largest genus (ca. 500 species worldwide) in the Dryopteridaceae (PPG I, 2016), with seriously complicated difficulties in taxonomy. *Polystichum* sect. *Sorolepidium* (Christ) Tagawa is a group of summer-green small to medium-sized ferns that grows on temperate mountains of Asia (Kung, 1989; Kung, Zhang, 1998). They are commonly found in high-altitude forest margins, meadows, and narrow rock strips that cross the Himalaya-Hengduan Mountains, the Qinghai-Tibet Plateau, the Qinling Mountains, the Tianshan Mountains, and Altai Mountains. While, due to similar habitats, species in this section show morphological convergence, making it difficult to identify different species. So far, these species are the most challenging group to classify in the genus *Polystichum*, with many misidentified specimens.

Polystichum sect. *Sorolepidium* has undergone a series of taxonomic changes (see details in Table S1. All Tables are in the Supplement at https://turczaninowia.asu.ru/). The genus *Sorolepidium* Christ emend. Ching was originally defined by Christ (1911). Later, in 1940, Tagawa treated it as a section within the genus *Polystichum*, including only one species and its variety: *P. duthiei* (Hope) C. Chr. and *P. duthiei* var. *subbipinnatum* Tagawa (Tagawa, 1940). In 1972, while recognized *P*. sect. *Sorolepidium*, Daigobo established a new section named *P*. sect. *Lasiopolystichum* Daigobo, including *P. lachenense* (Hook.) Bedd., *P. prescottianum* (Wall. ex Mett.) T. Moore and *P. wilsonii* Christ (Daigobo, 1972). Kung and Zhang (1998) recognized the validity of the *P*. sect. *Lasiopolystichum* in their publishing titled "Study on the Fern Genus *Polystichum* Roth sect. *Lasiopolystichum* Daigobo from China". They expanded the species range, proposing that there were 30 species and two varieties found in China, and they further divided the section into two series: Ser. *Moupinensia* H. S. Kung et Li Bing Zhang and Ser. *Sinensia* H. S. Kung et Li Bing Zhang, based on the morphology of the scales on the abaxial surface of the pinnae (Kung, Zhang, 1998). Afterwards, in "Flora Reipublicae Popularis Sinicae" (FRPS), *P. lichiangense* (Wright) Ching ex H. S. Kung and *P. obtusipinnum* Ching et H. S. Kung were treated as synonyms of *P. shensiense* Christ, *P. inaense* (Tagawa) Tagawa was

removed from *P*. sect. *Lasiopolystichum*, and finally 27 species and two varieties were accepted (Kung et al., 2001). Liu et al. (2007) then suggested that *P. glaciale* Christ also belongs to *P.* sect. *Lasiopolystichum* based on chloroplast gene. In the following decade, the *P.* sect. *Lasiopolystichum* did not undergo any significant changes. Until "Flora of China" (FOC) (Zhang, Barrington, 2013) reduced the numbers to 13 species, and they officially restored the name "*P*. sect. *Sorolepidium*" instead of "*P*. sect. *Lasiopolystichum*". As their works, they transferred Ser. *Sinensia* to *P*. sect. *Hypopeltis* (Michx.) T. Moore, so that in FOC, *P*. sect. *Sorolepidium* is no longer divided into series. This viewpoint was later confirmed by molecular systematic studies (Le Péchon et al., 2016a, b). Referring to the latest revision, Liang (2018) indicated that *P*. sect. *Sorolepidium* (he used the uncorrected name "sect. *Lasiopolystichum*" in his study) should consist of 24 species based on morphology. He treated *P. saxicola* Ching ex H. S. Kung et Li Bing Zhang and *P. frigidicola* as synonyms of *P. nigrum* Ching et H. S. Kung, *P. yadongense* Ching et S. K. Wu as a synonym of *P. prescottianum*, *P. habaense* Ching et H. S. Kung as a synonym of *P. moupinense* (Franch.) Bedd., and restored *P. lichiangense* from its previous status as a synonym of *P. shensiense*.

Although the scope of *Polystichum* sect. *Sorolepidium* has been redefined in the past, most studies primarily followed the species delimitation outlined in FRPS. Additionally, while Liang (2018) conducted new revisions of the species within *P*. sect. *Lasiopolystichum*, he did not provide an overview of the *P*. sect. *Lasiopolystichum* in conjunction with published molecular systematic studies (Liang, 2018). Therefore, this study aims to revise the taxonomy of *P*. sect. *Sorolepidium*, combining existing molecular systematic studies and morphological evidence to clarify the boundaries of *P*. sect. *Sorolepidium* and propose a new scheme of two species complexes with taxonomic treatment of nine species.

Material and Methods

All specimens used for morphological studies are deposited in the Herbarium of the Institute of Botany, Chinese Academy of Sciences (PE), and detailed information was recorded in Supplement Table S2.

In this study, we comprehensively and thoroughly investigated the protologues and type specimens of *Polystichum* sect. *Sorolepidium* and consulted a large number of specimens in PE, digital specimen photos of "Chinese Virtual Herbarium" (CVH. URL: https://www.cvh.ac.cn/), the "Global Biodiversity Information Facility" (GBIF. URL: https://www.gbif.org/), "Global Plants on JSTOR" (URL: https://plants.jstor.org/), National Herbarium and Plant Laboratories (KATH. URL: http://plantdatabase.kath.gov.np/plants/search) and "Plants of TAIWAN" (URL: https://tai2.ntu.edu.tw/search/2). To further analyze the morphology, in this study we photographed and measured 26 morphological characters of 134 specimens (including 17 type specimens), including 18 qualitative characters and eight quantitative characters (all characters listed in Table S3). Quantitative characters were measured using three replicates for each specimen, and the average values were recorded. The pinnae and scales were measured and photographed by Nikon SMZ 1000 and Leica S9D stereo microscope.

Results

Laminae

For *Polystichum* sect. *Sorolepidium*, the shape of the laminae is generally linear, with the exception of *P. prescottianum*, *P. salwinense* Ching et H. S. Kung and *P. castaneum* (C. B. Clarke) B. K. Nayar et S. Kaur, which are narrowly lanceolate (Table S2). Based on our observation, the laminae texture displays three types in this section: leathery, papery or herbaceous (Table S3). Generally, *P. glaciale*, *P. duthiei* and *P. integrilobum* (Ching ex Y. T. Hsieh) W. M. Chu ex H. S. Kung et Li Bing Zhang are leathery, and others are papery or herbaceous (Table S2). The lamina length of sect. *Sorolepidium* varies greatly, range from 5.3 to 46.1 cm (Table S3). Among them, the leaves of *P. glaciale*, *P. duthiei*, *P. integrilobum*, *P. lachenense*, *P. moupinense*, and *P. paramoupinense* Ching are typically shorter leaves, measuring less than 17.8 cm, while others generally have longer leaves, exceeding 18 cm (Table S2). The width at half of lamina (width HL) is usually 1.2–3.7 cm (Table S3). *P. glaciale*, *P. duthiei*, *P. lachenense*, *P. moupinense*, and *P. paramoupinense* are generally slightly narrower than other species, but the difference is not significant (Table S2).

Pinnae

We found that the apex of pinnae and lobes have two types: aristate and non-aristate (Fig. 1A–B). The aristate of *Polystichum yadongense*, *P. bomiense* Ching et S. K. Wu, *P. tibeticum* Ching, *P. prescottianum*, and *P. pseudocastaneum* Ching et S. K. Wu is about 1 mm in length, this characteristic is not found in other species (Table S2). The pinna insertion angles in this group can be categorized into

three types: ascending, nearly spreading and deflexed (Fig. 1C–E). Most species predominantly display either nearly spreading or ascending (Table S2).

The pinnae shape of the *Polystichum* sect. *Sorolepidium* are deltoid to ovate or broadly lanceolate (Table S3). Among them, *P. integrilobum*, *P. prescottianum*, and *P. shensiense* are usually lanceolate; those of *P. lachenense*, *P. duthiei*, and *P. glaciale* are ovate; *P. salwinense* and *P. castaneum* are ovate to broadly lanceolate; and *P. moupinense* is deltoid (Table S2). The pinnae apex shape can be divided into two categories: obtuse and acuta; *P. duthiei* and *P. glaciale* are obtuse, while the other species are usually acuta (Table S2). Based on the presence of the auricles at the base of the pinnae, *P.* sect. *Sorolepidium* can be divided into three categories: no auricles, acroscopic base indistinctly auriculate and both sides base indistinctly auriculate (Fig. 1F–H). Except for *P. castaneum*, which is slight auricles on the upper side of the pinnae or no auricles, and *P. moupinense* and *P. shensiense* sometimes are slight auricles on both sides of the pinnae, the other species are usually without auricles (Table S2). Additionally, in *P. integrilobum*, *P. shensiense*, and *P. prescottianum*, the ratio of pinnae length at half of lamina to pinnae length at base of lamina is usually less than or equal to two, in other species it is usually greater than two (Table S2). The density of pinnae arrangement on the rachis varies somewhat between species. *P. moupinense* and *P. integrilobum* have

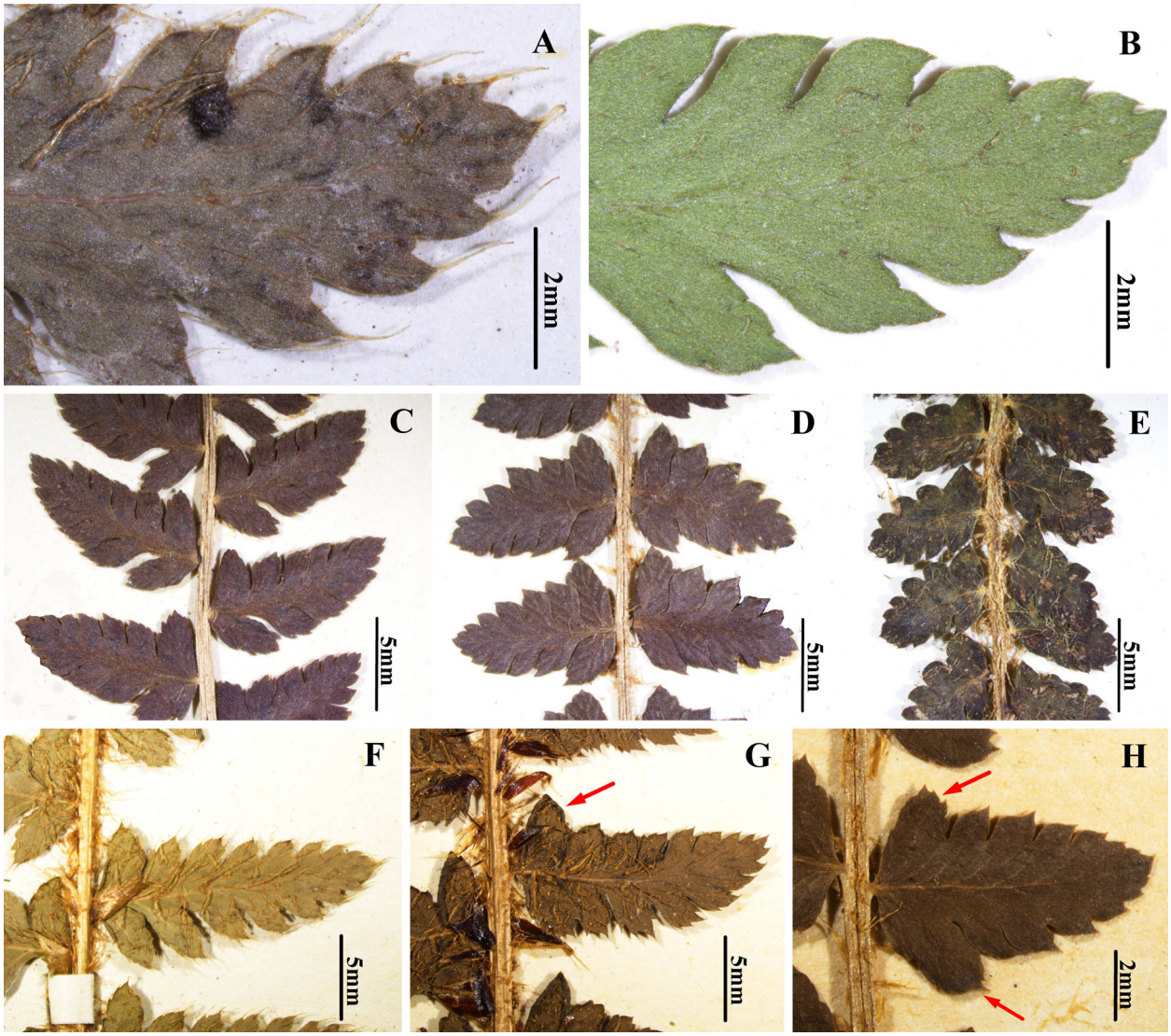

Fig. 1. Morphology of sect. *Sorolepidium*: **A** – Aristate (*P. prescottianum*, Qinghai-Xizang Complex Exp. 5919, PE); **B** – Non-aristate (*P. shensiense*, S. B. Zhang 12932, PE); **C–E** – Pinnae insertion angles; **C** – Ascending (*P. moupinense*, C. W. Wang 70202, PE); **D** – Nearly spreading (*P. moupinense*, C. W. Wang 64687, PE); **E** – Deflexed (*P. moupinense*, Qinghai-Xizang Complex Exp. 10246, PE); **F–H** – Auricles; **F** – No auricles (*P. prescottianum*, Qinghai-Xizang Complex Exp. 5919, PE); **G** – Acroscopic base indistinctly auriculate, red arrow (*P. castaneum*, T. T. Yu 22313, PE); **H** – Both sides base indistinctly auriculate, red arrow (*P. moupinense*, T. T. Yu 8810, PE).

relatively close pinnae arrangement, and the other species have loose arrangement (Table S2).

The number of pinna pairs of species in *Polystichum* sect. *Sorolepidium* is usually between 21 and 35 pairs (Table S3). The number of pinna pairs of *P. glaciale*, *P. duthiei*, and *P. lachenense* is obviously less than that of other species, usually less than 26 pairs (Table S2). Moreover, pinnae of *P. glaciale*, *P. duthiei*, and *P. lachenense* are generally lack deeply divided lobes, whereas other species in this section are usually two to five pairs with deeply divided lobes (Table S2). The pinnae length at half of lamina (pinnae length HL) shows significant differences among the species. For *P. glaciale*, *P. duthiei*, *P. moupinense* and *P. lachenense*, it is usually less than 1 cm but longer in *P. integrilobum*, *P. yadongense*, *P. bomiense*, *P. tibeticum*, *P. pseudocastaneum*, and *P. prescottianum*, which ranges from 1.3 to 3.8 cm (Table S2). The pinnae width at half of lamina (pinnae width HL) also varies among these plants. *P. glaciale*, *P. duthiei*, and *P. lachenense* are narrower, usually between 0.4 and 0.6 cm, and the remaining species generally exceed 0.6 cm in width (Table S2).

Stipes

According to our morphological studies, within this section, all species are dark stipes at the very base, but the range of color variation is relatively variable and unstable. For *Polystichum shensiense*, *P. melanostipes* Ching et H. S. Kung, *P. habaense*, *P. moupinense*, and *P. prescottianum*, it ranges from only the very base of the stipe to darkening of the entire stipe (Fig. 2A–C).

The stipe length in this section can be divided into two categories: short stipes (4.0–7.9 cm) and long stipes (7.2–13.7 cm). Specifically, *Polystichum glaciale*, *P. duthiei*, *P. lachenense*, and *P. moupinense* is short stipes, while the remaining species are long stipes (Table S2). The stipe top diameter typically falls between 0.7 and 1.4 mm (Table S3), with *P. prescottianum* and *P. salwinense* with a thicker top diameter of the stipes, usually between 1.0 and 1.8 mm (Table S2).

Rachis color

The rachis color can be categorized into 3 main types: stramineous, brown and purplish brown (Fig. 2D–F). In most species, the rachis color is stramineous, but a few species, such as *Polystichum prescottianum*, exhibit a continuous variation in rachis color, ranging from stramineous to purplish brown (Fig. 2D–F). Additionally, in *P. shensiense*, there are individuals that display both stramineous and purplish brown rachises.

Scales

For the scales on abaxial surface of the rachis, there are two types of the colors: light brown and blackish brown (Fig. 2G–I). Among them, *Polystichum glaciale*, *P. duthiei*, *P. integrilobum*, and *P. lachenense* are blackish brown scales, while the remaining species are light brown or mixed with blackish brown scales (Table S2). Besides, there are three types of scales margins: laciniate, spinose and nearly entire (Fig. 3AC). *P. glaciale*, *P. duthiei*, and *P. integrilobum* are laciniate or spinose, while other species are nearly entire (Table S2). Generally, the shape of the larger scales at the base of the stipes of *P.* sect. *Sorolepidium* are narrow lanceolate to ovate (Fig. 3D–F). *P. lachenense*, *P. duthiei*, and *P. integrilobum* are narrow lanceolate to narrow ovate; the rest of the species are usually ovate (Table S2). Scales on the adaxial surface of pinnae vary in density; *P. glaciale* is usually densely covered with small scales, whereas other species are sparse (Fig. 3G–H). In addition, the density of scales on the stipes and rachises of this section also varies. Except for *P. lachenense*, whose stipes and rachises are sparsely scaled or nearly glabrous, the other species are usually densely scaled (Table S2).

Indusium

Based on our observation, only *Polystichum glaciale* in this section displays no indusia (Fig. 4A–B; Table S2).

Spore abortion situation

By counting the number of spores in a single sporangium, we find that *Polystichum glaciale*, *P. duthiei*, and *P. integrilobum* are stable at 32; while other species contain 64 or showed varying degrees of abortion (Fig. 4C–E; Table S2).

Discussion

Redefinition of the range of species of the sect. *Sorolepidium*

Plants belonging to the *Polystichum* sect. *Sorolepidium* are found in forest margins and meadows at mid-high altitudes (2500–4700 m) in the Pan-Himalayan region. A few species, such as *P. shensiense*, can also be located in the Qinling Mountains, central China and Taiwan Island, only *P. lachenense* is found in high-altitude areas of Japan (Figs. 5–6). Our morphological evidences state that species within the *P.* sect. *Sorolepidium* are laminae length between 5.3 and 46.1 cm, width HL ranging from 0.9 to 7.4 cm, 1-pinnate, and pinnae usually with 0–4 pairs of deeply divided lobes (Table S3).

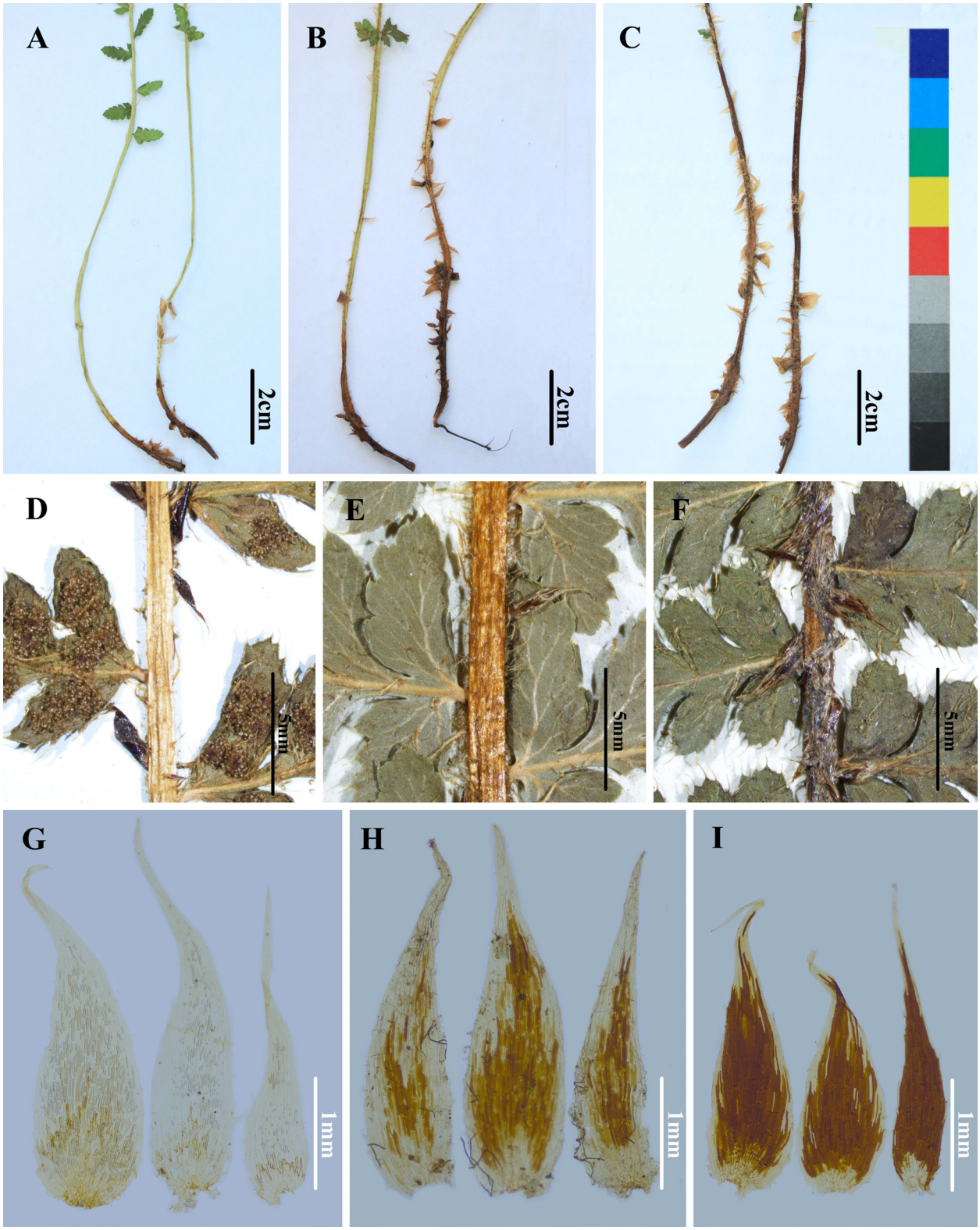

Fig. 2. Morphology of sect. *Sorolepidium*: **A–C** – The range of color variation of the stipes; **A** – Dark color only at the base of the stipes (*P. shensiense*, S. B. Zhang 12932, PE); **B** – Dark color from base of the stipes to middle of the stipes (*P. shensiense*, S. B. Zhang 12976, PE); **C** – Dark color throughout the stipes (*P. shensiense*, S. B. Zhang 12296, PE); **D–F** – Rachises color; **D** – Stramineous (*P. prescottianum*, J. D. A. Stainton 1138, PE); **E** – Brown (*P. prescottianum*, T. S. Ying et D. Y. Hong 650974, PE); **F** – Purplish brown (*P. prescottianum*, B. S. Li et S. Z. Cheng 00730, PE); **G-I** – The color of scales on rachises abaxial surface; **G** – Light brown (*P. prescottianum*, Qinghai-Xizang Complex Exp. 911, PE); **H–I** – Blackish brown (*P. prescottianum*, **H** – B. S. Li et S. Z. Cheng 00730, PE; **J** – J. D. A. Stainton 1138, PE).

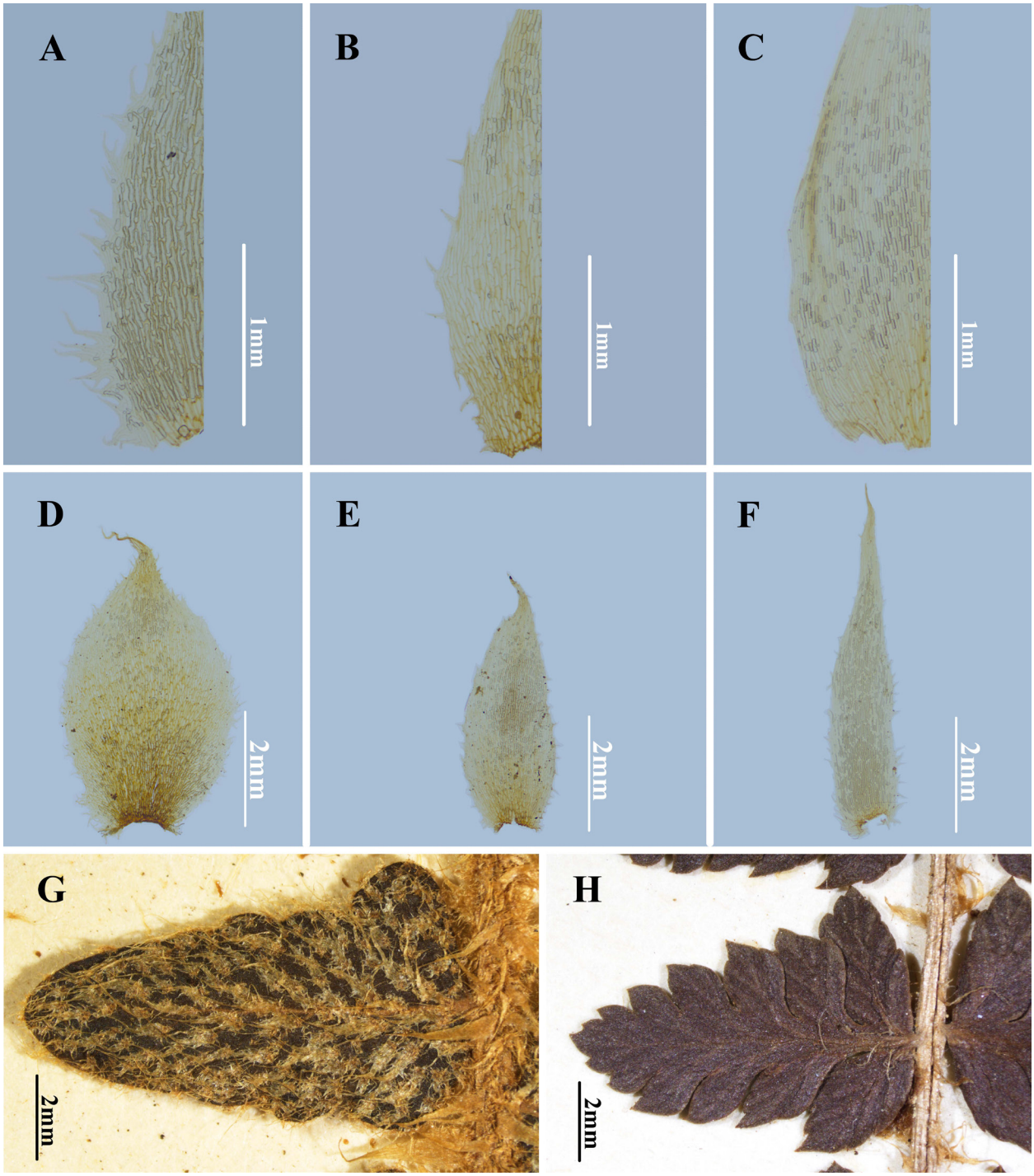

Fig. 3. Morphology of the sect. *Sorolepidium*: **A–C** – Scales margin on rachis of abaxial surface; **A** – Laciniate (*P. glaciale*, Y. Z. Zhao 20973, PE); **B** – Spinose (*P. duthiei*, Qinghai-Xizang Complex Exp. 5695, PE); **C** – Nearly entire (*P. prescottianum*, Qinghai-Xizang Complex Exp. 5919, PE); **D–F** – Larger scales on stipes base; **D** – Ovate (*P. glaciale*, Y. Z. Zhao 20973, PE); **E** – Narrowly ovate (*P. duthiei*, Qinghai-Xizang Complex Exp. 5695, PE); **F** – Lanceolate (*P. integrilobum*, W. M. Zhu et Y. M. Feng 810(2), PE); **G** – Adaxial surface of pinna covered with dense scales (*P. glaciale*, Y. Z. Zhao 20973, PE); **H** – adaxial surface of pinna covered with sparse scales (*P. moupinense*, C. W. Wang 64687, PE).

On the other hand, since *P.* sect. *Sorolepidium* was published in 1940, prior to *P.* sect. *Lasiopolystichum*, which was published in 1972, the Latin name of this group has been revised in the FOC (Tagawa, 1940; Daigobo, 1972; Zhang, Barrington, 2013). Here we also suggest the Chinese name "Yù lóng jué zǔ (玉龙蕨组)" as the vernacular name.

Additionally, *Polystichum qamdoense* Ching et S. K. Wu, we observed several morphological evidences that suggest it should be treated in

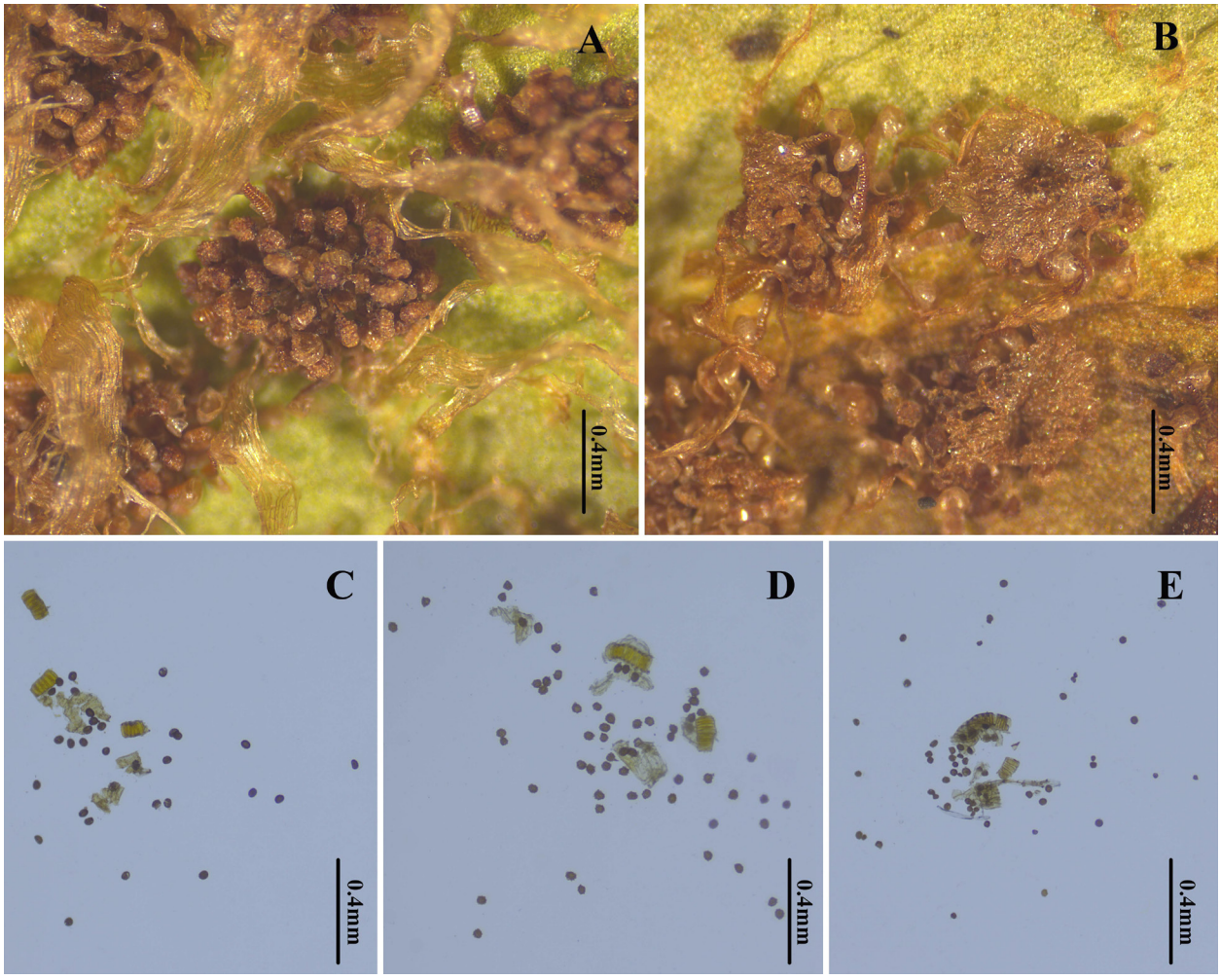

Fig. 4. Morphology of the sect. *Sorolepidium*. **A** – Exindusiate (*P. glaciale*, X. C. Zhang 14283, PE); **B** – Indusiate (*P. duthiei*, X. C. Zhang 14284, PE); **C–E** – Spore abortion situation; **C** – Fertile, 32 spores per sporangium (*P. glaciale*, W. B. Xu et al. QTP709, PE); **D** – Fertile, 64 spores per sporangium (*P. moupinense*, D. E. Boufford et al. 32258, PE); **E** – Partly abortive (*P. castaneum*, R. Wei WR0722, PE).

P. sect. *Sorolepidium*. According to FOC (Zhang, Barrington, 2013), it is classified under *P.* sect. *Hypopeltis*; however, upon comparing its holotype, protologue and the description in FRPS and FOC, we found that there are conflicts in the understanding of the morphology of the scales on abaxial surface of pinnae (Ching, Wu, 1983; Kung et al., 2001; Zhang, Barrington, 2013). The protologue of *P. qamdoense* did not mention the presence of brown linear scales on the abaxial surface of pinnae and the type specimen did not show this, while FRPS and FOC both described the existence of this character. Specifically, in *P. qamdoense*, the size of the pinnae at half of the laminae is about 1.4 cm long and 0.8 cm wide, and the pinnae is with about three pairs of deeply divided lobes, and the scales on the abaxial surface of the rachis are nearly entire (Table S2). These characteristics are closely related to those of *P. moupinense*. Therefore, this section should include *P. qamdoense*. Moreover, it was previously considered that *P. prescottianum*, *P. yadongense*, *P. bomiense*, *P. tibeticum*, and *P. pseudocastaneum* also exhibit similarities with *P. moupinense* related species. These similarities include the number of pinnae pairs (ca. 35 pairs), the number of deeply divided lobes (ca. 5 pairs) and the number of spores in a single sporangium (64, with varying degrees of abortion) as indicated in Table S2. In addition, *P. prescottianum* was clustered with the *P. moupinense* clade in previous molecular studies (Le Péchon et al., 2016b). Consequently, this study suggests that sect. *Sorolepidium* should encompass these five additional species as well.

Two species complexes' revision

Based on morphological studies, we found significant differences in eight key characters within *Polystichum* sect. *Sorolepidium*, which are

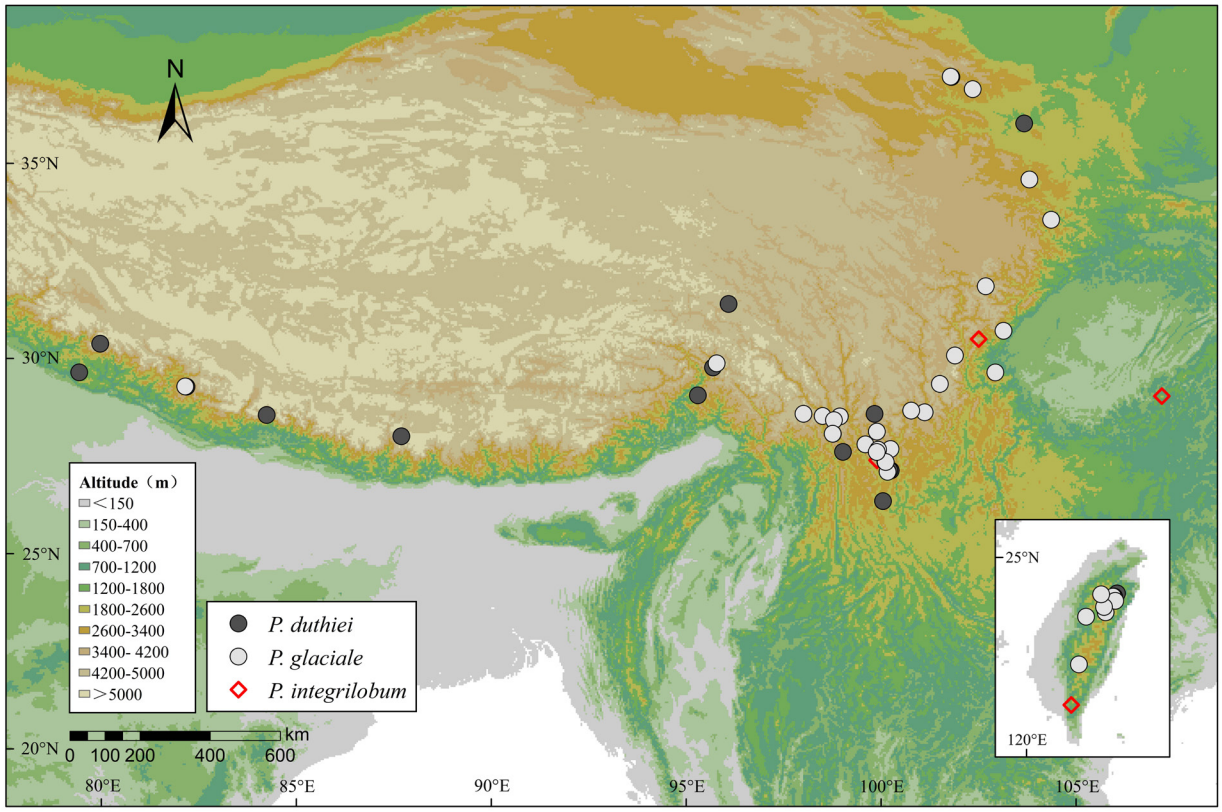

Fig. 5. Distributions of *Polystichum glaciale* complex.

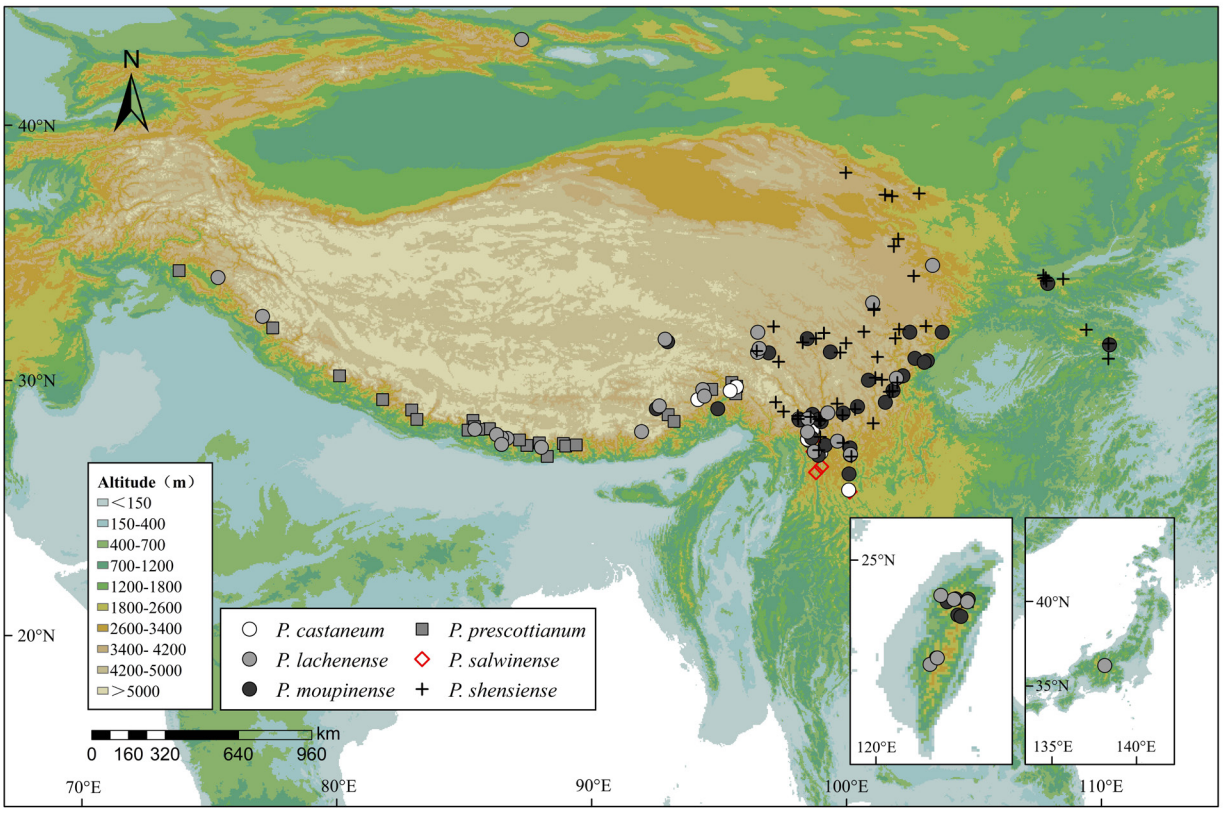

Fig. 6. Distributions of *Polystichum moupinense* complex.

important for distinguishing species complexes, including lamina texture, scales margins on rachis abaxial surface, spore abortion situation, lamina length, width HL, number of deeply divided lobe pairs, pinna length HL and stipe length (Table S4). It can be divided into two species complexes represented by *P. glaciale* and *P. moupinense* (i. e., *P. glaciale* complex and *P. moupinense* complex, see next paragraphs for species in the complex). Existing molecular studies also support that species within *P*. sect. *Sorolepidium* can be divided into two clades, represented by *P. glaciale* and *P. moupinense* (Le Péchon et al., 2016a, b). The lamina length, width HL, pinna length HL, and stipe length of the *P. glaciale* complex are shorter compared to those of the *P. moupinense* complex (Table S4). Moreover, the pinnae of the *P. glaciale* complex lack deeply divided lobes, while the *P. moupinense* complex typically has 1–4 pairs of deeply divided lobes (Table S4). *P. glaciale* complex has 32 spores per sporangium and generally has leathery laminae. The scales margins on the abaxial surface of the rachis are laciniate or spinose (Table S4). In contrast, the *P. moupinense* complex contains 64 spores per sporangium, with some variations showing degrees of abortion (Table S4). Its leaves are usually papery or herbaceous and the scales margins on the abaxial surface of the rachis are nearly entire (Table S4).

Species delimitation in the *Polystichum glaciale* complex

This species complex is primarily distributed in Xizang, Yunnan, Sichuan, and Taiwan in China, with some occurrences in northern India and Nepal (Fig. 5). Three related species are recorded in FOC (2013): *Polystichum glaciale*, *P. duthiei*, and *P. integrilobum*. Traditionally, these three species are distinguished by lobes and indusia. Pinnae of *P. glaciale* and *P. duthiei* have no deeply divided lobes, while those of *P. integrilobum* have 3–5 pairs of deeply divided lobes (Table S2). In terms of indusia, *P. integrilobum* and *P. duthiei* appear, whereas *P. glaciale* does not (Fig. 4A–B). We also observed differences in the scales at the base of the stipes: *P. glaciale* has ovate scales, and the scales of *P. duthiei* and *P. integrilobum* are narrowly lanceolate to ovate (Fig. 3D–F). Regarding the margins of the scales on the adaxial surface of the rachis, *P. glaciale* and *P. integrilobum* typically have laciniate margins, whereas *P. duthiei* is spinose (Fig. 3A–C).

Additionally, in 1940, Tagawa published *Polystichum duthiei* var. *subbipinnatum* referring to a specimen collected from Taiwan and pointed out that the difference between this variety and *P. duthiei* is that the laminae are bipinnate, the pinnae at the middle of the laminae have about 4 pairs of lobes, and the base of the pinnae has at least one pair of deeply divided lobes. FOC treated this variety as a synonym of the *P. duthiei* (Tagawa, 1940; Zhang, Barrington, 2013). However, based on our observations, we believe that the pinnae of *P. duthiei* do not have lobes that are deeply divided to the costa, and it is inappropriate to treat *P. duthiei* var. *subbipinnatum* as a synonym of *P. duthiei*. In addition, by comparing the type specimen with the protologues description, we believe that *P. duthiei* var. *subbipinnatum* and *P. integrilobum* should be the same species. The pinnae of both species are deeply lobed to the costa, and the laminae are about 15 cm in length. Therefore, in this study, *P. duthiei* var. *subbipinnatum* was treated as a synonym of *P. integrilobum*.

In shorts, this study suggested that the *Polystichum glaciale* complex includes three species: *P. glaciale*, *P. duthiei*, and *P. integrilobum*.

Species delimitation in the *Polystichum moupinense* complex

The species in this complex are mainly distributed along the Himalayas and Hengduan Mountains, with a few species distributed in the Qinling Mountains, Central China, Xinjiang, and Taiwan; they are also distributed in Japan and northern Myanmar (Fig. 6). We believe that this complex can be divided into six species.

Polystichum moupinense

Since the publication of *Polystichum moupinense*, several species with little morphological difference have been published continuously, including *P. taizhongense* H. S. Kung, *P. paramoupinense*, and *P. habaense*. Previously, the distinguishing characters between them and *P. moupinense* are "whether the pinnae are deflexed", the number of deeply divided lobes, the color of the stipes and the presence or absence of blackish brown scales on the abaxial surface of the rachis (Table S5) (Ching, Wu, 1983; Kung, 1989, 1997). Among them, "whether the pinnae are deflexed" is the key to distinguishing *P. taizhongense* from *P. moupinense*. However, we observed both ascending and nearly spreading pinnae from type specimens of *P. moupinense* (P00636463, P). At the same time, *P. taizhongense* collected from the type locality also had nearly spreading pinnae. Consequently, we conclude that the feature of "deflexed pinnae" is not reliable for distinguishing between *P. moupinense* and *P. taizhongense*.

The number of deeply divided lobes of the pinnae is also an issue. The quantity of that in *P. taizhongense*, *P. paramoupinense*, and *P. habaense* is just filled in the range of the type specimen of *Polystichum moupinense*, which ranges from 0–5 pairs (Ching, Wu, 1983; Kung, 1989, 1997). Therefore, it may also be inappropriate to use the number of deeply divided lobes to distinguish *P. moupinense* from *P. taizhongense*, *P. paramoupinense* and *P. habaense*. Additionally, according to the descriptions of the protologues, the stipes of *P. paramoupinense* are dark brown, *P. habaense* is purplish-brown, *P. moupinense* and *P. taizhongense* are stramineous with only brown base (Table S5) (Ching, Wu, 1983; Kung, 1989, 1997). However, by observing these four species, we found that the range of color darkening varies continuously, from dark brown at the base to completely dark brown or purplish brown throughout the stipes. In particular, the type locality individuals of *P. taizhongense* are with both stramineous and purplish brown stipes; so we indicated that the color of the stipes is not a stable character to identify the four species mentioned above. Another notable character is the scales on the abaxial surface of the rachis that are mixed with blackish ones. According to the protologues of *P. paramoupinense* and *P. habaense*, these are mixed with blackish scales (Ching, Wu, 1983; Kung, 1989), but we found that this phenomenon also occurs in *P. moupinense*. We believe that whether the abaxial surface of the rachis is mixed with blackish scales cannot be used as a discriminating feature to distinguish the above species. Therefore, this study recommends *P. taizhongense*, *P. paramoupinense* and *P. habaense* to be treated as new synonyms of *P. moupinense*. On the other hand, the color of the stipes (purplish brown), the size of the pinnae at half of the laminae (ca. 1.4 cm long and ca. 0.8 cm wide) and the number of deeply divided lobes (3 pairs) of the type specimen of *P. qamdoense* (00044646, PE) are all within the range of variation of *P. moupinense* (Table S2). The size of *P. qamdoense* is also closer to *P. moupinense* than to *P. prescottianum* as indicated in the protologues. We also suggest *P. qamdoense* to be treated as a new synonym of *P. moupinense*.

Polystichum shensiense

Polystichum lichiangense was treated as a synonym of *P. shensiense* in FRPS and FOC (Kung et al., 2001; Zhang, Barrington, 2013). *P. melanostipes* is quite similar to *P. lichiangense*, but the difference is that the stipes of *P. melanostipes* are purplish brown, the ovate and lanceolate scales on the stipes are blackish brown, and the abaxial surface of the rachis is mixed with blackish brown lanceolate scales (Kung, 1989). With studying of *P. shensiense* and *P. melanostipes* specimens, it was found that in *P. shensiense*, the stipes base in most specimens are purplish brown, but the range of purplish brown was very variable (Fig. 2A–C). For the *P. shensiense* specimens collected from Taibai Mountain (Shanxi Province) and Derge County (Sichuan Province), there were purplish brown stipes but no blackish scales on rachis abaxial surface; while in Banma County (Qinghai Province), there are individuals with purplish brown stipes with blackish scales on the rachis abaxial surface, and some individuals with stramineous stipes and no blackish scales on the rachis abaxial surface. Thus, we conclude that the color of the stipes and the color of the scales on the rachis abaxial surface are unstable in *P. shensiense* and *P. melanostipes*, which recommends treating *P. melanostipes* as a synonym of *P. shensiense*.

Moreover, while Ching and Wu (1983) published *Polystichum qamdoense* in "Flora Xizangica", they also described its variety, *P. qamdoense* var. *elongatum* Ching et S. K. Wu. They noted that the primary difference between the two is that *P. qamdoense* var. *elongatum* is larger, reaching heights of up to 40 cm and with lamina widths of up to 5 cm. Later, this variety was classified as a synonym of *P. qamdoense* in both the FRPS and FOC (Ching, Wu, 1983; Kung et al., 2001; Zhang, Barrington, 2013). Based on our study of the type specimen of *P. qamdoense* var. *elongatum* (specimen number 00044648, PE), we find that it is more closely related to *P. shensiense*. This conclusion is supported by several measurements: the lamina length is 28.4 cm, the pinnae length (HL) is 1.66 cm, it has four pairs of deeply divided lobes, 34 pairs of pinnae, and stramineous stipes (see Table S2). Therefore, we recommend using this name as a synonym for *P. shensiense*.

Polystichum prescottianum

Polystichum tibeticum, *P. bomiense*, *P. yadongense*, *P. pseudocastaneum*, and *P. prescottianum* are another group of morphologically similar species. According to previous studies, the above mentioned five species were mainly distinguished by the color of the stipes and rachis, and the presence or absence of blackish scales on the rachis abaxial surface (Ching, Wu, 1983). Their differences are summarized in Table S6.

The protologues of *Polystichum tibeticum*, *P. bomiense*, and *P. pseudocastaneum* indicated that the rachis of abaxial surface of these three species is mixed with blackish scales (Ching, Wu, 1983). The

protologue of *P. prescottianum* does not mention the color of the rachis scales, but FRPS and FOC describe the color of the scales on the abaxial surface of the rachis as light brown (Kung et al., 2001; Zhang, Barrington, 2013). We found that in the type specimen of *P. prescottianum* (L0052008, L), there are two types of mixed situation of scales on abaxial surface, including with blackish scales on and without blackish scales. In addition, the phenomenon of mixed with blackish brown scales is more common in *P. prescottianum* collected from Nepal. Therefore, we suggest that it is inaccurate to use the color of the rachis scales as a differential feature to distinguish *P. tibeticum*, *P. bomiense*, *P. pseudocastaneum*, and *P. prescottianum*.

On the other hand, regarding to the color of the stipe, the stipe shown in the type specimen of *Polystichum prescottianum* is stramineous; the protologue of *P. pseudocastaneum* indicates that the stipe color of this species is green, and *P. bomiense* and *P. tibeticum* are maroon, reddish brown to purplish brown, respectively (Ching, Wu, 1983).

Due to the limited number of specimens for these five species, it is challenging to observe the variations of the stipe color within every single species; but overall, the stipe color across the species exhibits a continuous range, varying from straw-colored to purplish brown. In addition, the protologue of *P. bomiense* described that the color of the lower part of the rachis is maroon. Based on the observation of the type specimens of this species (00044610, 00044609, 00044611, 00044612, PE), we found that the range of maroon color of the rachis of this species varies from ⅓ to ⅔ of the lower part of the rachis, which indicates that the rachis color is also unstable in this group of species. In general, there is a continuous variation in the color of the stipes and rachis of above five species. Besides, the tips of the pinnae and lobes of these five species have aristates of about 1 mm. Therefore, this study recommends that *P. tibeticum*, *P. bomiense*, *P. yadongense*, and *P. pseudocastaneum* should be treated as new synonyms of *P. prescottianum*.

The pinnae of *Polystichum castaneum* are nearly spreading or slightly ascending, with the pinnae width HL range from 0.6 to 0.8 cm, usually with 1 to 3 pairs of deeply divided lobes, and mixed with blackish brown scales on the abaxial surface of the rachis. The pinnae of *P. salwinense* are ascending, with the pinnae width HL about 1cm and about 3 pairs of deeply divided lobes, and mixed with blackish brown scales on the abaxial surface of the rachis. *P. lachenense* has fewer pairs of pinnae, usually less than 21 pairs, and the pinnae have no deeply divided lobes. The stipes, rachises and pinnae adaxial surface are sparsely scaled, sometimes almost bald, which can easily distinguish it from other species in this complex.

In summary, this study suggests that the *Polystichum moupinense* complex should include *P. castaneum*, *P. lachenense*, *P. moupinense*, *P. prescottianum*, *P. salwinense*, and *P. shensiense*.

Taxonomic treatment

1. Laminae leathery; margins of rachis abaxial surface scales laciniate or spinose; rachis with light brown scales, without mixed with blackish brown scales; 32 spores per sporangi 2

+ Laminae papery or herbaceous; margins of rachis abaxial surface scales nearly entire; rachis with light brown scales, sometimes mixed with blackish brown scales; 64 spores pre sporangium, abortive or partly abortive 4

2. Laminae lanceolate; pinnae width at half of lamina (1.3–)1.4–2.1(–2.2) cm; pinnae with 3–5 pairs deeply divided lobes; the ratio of pinnae length at half of lamina to pinnae length at base of lamina is usually less than or equal to 2 ..... ***P. integrilobum***

+ Laminae linnear; pinnae width at half of lamina (0.4–)0.5–0.8(–1.1) cm; pinnae without deeply divided lobes; the ratio of pinnae length at half of lamina to pinnae length at base of lamina is usually greater than 2 3

3. Stipes's base larger scales ovate; sori exindusiate ..... ***P. glaciale***

+ Stipes's base larger scales lanceolate to narrow ovate; sori indusiate..... ***P. duthiei***

4. Laminae length (5.7–)7.5–14.2(–17.0) cm, width (1.0–)1.1–1.9(–2.5) cm; pinnae without deeply divided lobes; pinna (16–)17–21(–23) pairs; stipes and rachis with sparse scales or nearly glabrous .... ***P. lachenense***

+ Laminae length (9.3–)14.3–31.5(–46.1) cm, width (1.1–)1.6–4.2(–7.4) cm; pinnae base at least with one pair of deeply divided lobes; pinna (16–)25–35(–44) pairs; stipes and rachis with density scales 5

5. Pinnae and lobes arista ca. 1 mm .... ***P. prescottianum***

+ Pinnae and lobes without arista 6

6. Pinnae deltoid to lanceolate or ovate, both sides indistinctly auriculate or no auricle; scales on abaxial surface of the rachis light brown, occasionally mixed with blackish brown scales 7

+ Pinnae usually ovate to broadly lanceolate, acroscopic base indistinctly auriculate or no auricle; abaxial surface of the rachis mixed with blackish brown scales 8

7. Laminae length (9.3–)11.1–18.5(–23.8) cm, width (1.1–)1.5–2.2(–2.6) cm; pinnae deltoid to ovate, closely arranged, with 1–3(–4) pairs of deeply divided lobes ..... ***P. moupinense***

+ Laminae length (16.0–)18.6–26.6(–30.3) cm, width (1.9–)2.3–3.4(–3.8) cm; pinnae deltoid to lanceolate, loosely arranged, with (2–)3–5(–6) pairs of deeply divided lobes ..... ***P. shensiense***

8. Pinnae nearly spreading or slightly ascending; pinnae width at half of lamina 0.6–0.8 cm, with (0–)1–3(–4) pairs of deeply divided lobes; acroscopic base indistinctly auriculate ..... ***P. castaneum***

+ Pinnae obviously ascending; pinnae width at half of lamina 0.9–1 cm, with 3 pairs of deeply divided lobes; acroscopic base without auriculate .... ***P. salwinense***

1. *Polystichum integrilobum* (Ching ex Y. T. Hsieh) W. M. Chu ex H. S. Kung et Li Bing Zhang, 1998, Acta Phytotax. Sin. 36 (3): 244.

≡ *Sorolepidium integrilobum* Ching ex Y. T. Hsieh, 1989, Bull. Bot. Res. 9(3): 48.

Type: China: "Yunnan, Lijiang. 22 VIII 1957. W. M. Chu 810(2)" (PE 01175445!).

= *Polystichum duthiei* var. *subbipinnatum* Tagawa, 1940, Acta Phytotax. Geobot. 9(3): 131. **Type:** China: "Taiwan, Taidung. 24 VII 1938. S. Okamoto s. n." (KYO T01795, digital image!).

Distribution: China: Chongqing, Sichuan, Yunnan.

Altitude: 2200–3600 m.

Specimens examined: CHINA. Chongqing: "Nanchuan, 2200 m. 1 VI 1990. X. C. Zhang et al. 301" (PE); **Sichuan:** "Baoxing, 2900 m. 10 VIII 1936. G. L. Qu 3512" (BM, PE); **Yunnan:** "Lijiang, 2900 m. 18 VIII 1942. K. M. Feng 9097" (PE); "Shangri-La, 3000 m. 1 VIII 2001. X. C. Zhang et al. 2177" (PE).

2. *Polystichum glaciale* Christ, 1905, Bull. Soc. Bot. France 52 (Mém. 1): 28.

≡ *Sorolepidium glaciale* Christ, 1911, Bot. Gaz. 51: 350.

Type: China: "Yunnan, Lijiang. 9 VII 1884. Delavay 45" (P: P02141602, digital image!; iso – P: P02141603, digital image!).

= *Sorolepidium ovale* Y. T. Hsieh, 1991, Bull. Bot. Res. 11 (2): 17.

Type: China: "Yunnan, Lijiang. VII 1921. G. Forrest 19679" (PE 01726632!).

Distribution: China: Gansu, Qinghai, Sichuan, Taiwan, Xizang, Yunnan; Nepal.

Altitude: 2500–4700 m.

Specimens examined: CHINA. Gansu: "Diebu, 2500 m. 4 VI 1999. Bailongjiang Exp. 1876" (PE); "Zhouqu, 2800 m. 26 V 1999. Bailongjiang Exp. 1393 (PE); **Qinghai:** "Datong, 3744 m. 18 VII 2021. S. B. Zhang et al. 12316" (PE); "Datong, 3726 m. 18 VII 2022. S. B. Zhang et al. 13031" (PE); "Datong, 3647 m. 18 VII 2022 S. B. Zhang et al. 13037" (PE); "Datong, 3800 m. 9 VIII 2020. X. C. Zhang et al. 11039" (PE); "Huzhu, 2520 m. 9 VIII 2020. X. C. Zhang et al. 11019" (PE); **Sichuan:** "Barkam, 4260–4400 m. 16 VIII 2007. D. E. Boufford et al. 39834" (PE); "Daocheng, 4400 m. 31 VIII 1981. Qinghai-Xizang Complex Exp. 5872" (PE); "Dayi, 2100–2700 m. 13 VIII 2011. T. C. Hsu 4483" (TAIF); "Dayi, 2100–2700 m. 13 VIII 2011. T. C. Hsu 4484" (TAIF); "Ganzi, 4105–4350 m. 4 VIII 2005. D. E. Boufford et al. 34207" (PE); "Hongya, 2600 m. 8 VI 1994. Wakao Exp. 2010" (CDBI); "Jiulong, 4481 m. 20 VIII 2018. Q. Yu et al. CIBYQ024" (KUN); "Kangding, 4673 m. 6 VIII 2017. W. B. Ju, C. C. Zheng THP-KD-5444" (CDBI); "Lixian, 15 VII 1958. Z. Wu 33011" (PE); "Lixian, 15 VII 1958. Z. L. Wu 33053" (PE); "Muli, 10 IX 1983. Qinghai-Xizang Complex Exp. 13872" (PE); "Pingwu, 2350–3450 m. 27 VI 2024. X. C. Zhang 14283" (PE); **Taiwan:** "Heping, 3500 m. 12 VIII 1991. S. J. Moore 12734" (TAIF); "Heping, 3760 m. 23 IX 2022. T. C. Hsu 14640" (TAIF); "Hualien, 24 VII 2009. C. W. Chen Wade906" (TAIF); "Hualien, 3300 m. 6 VII 2005. T. C. Hsu 216" (TAIF); "Hualien, 3250 m. 15 X 2017. T. C. Hsu 9563" (TAIF); "Hualien, 3400 m. 16 X 2017. T. C. Hsu 9575" (TAIF); "Hualien, 3400–3500 m. 28 VII 2018. Z. X. Chang ZXC001215" (TAIF); "Nantou, 2600–3100 m. 5 X 2002. P. H. Lee et C. M. Chen 2088" (TAIF); "Nantou, 2800–3300 m. 12 IX 2015. P. F. Lu 28684" (TAIF); "Nantou, 2900 m. X 2017. P. F. Lu 30591" (TAIF); "Nantou, 3200 m. 8 X 2016. T. C. Hsu 8605" (TAIF); "Nantou, 3200–3300 m. 3 VI 2021. Z. X. Chang ZXC002463" (TAIF); "Nantou, 3250 m 7 X 2002. s. coll. 12" (TAIF); "Taoyuan, 3300 m. 25 IX 2004. P. F. Lu 8707" (TAIF); "Yilan, 3615 m. 7 IV 2000. C. K. Liou 1317" (TAIF); "Yilan, 3500–3650 m. 6 VII 2005. P. F. Lu 10067. (TAIF); "Yilan, 3200–3300 m 7 VII 2005. S. W. Chung 7898" (TAIF); Xizang: "Bome, 3600 m. 12 VIII 1965. T. S. Ying et D. Y. Hong 650918" (PE); "Zayu, 10 VIII 2013. X. H. Jin et al. ST2847" (PE); "Zayu, 3400 m. 9 X 2004. Qinghai-Xizang Complex Exp. 7633" (PE); "Zayu, 3200 m. VIII 1935. C. W.

Wang 65724" (PE); "Zayu, 3600 m. 12 VIII 1965. T. S. Ying, D. Y. Hong 650918" (PE); "Zayu, 4500 m. 17 VII 2010. South Tibet Expedition Team STET0652" (PE); Yunnan: "Deqin, 4150–4400 m. 24 VIII 1981. PE Hengduanshan Exp. 3667" (PE); "Deqin, 3800–3900 m. 18 X 1940. K. M. Feng 6744" (PE); "Deqin, 4050 m. 11 IX 2023. R. Wei et al. WR0805" (PE); "Deqin, 3806 m. 6 VIII 2020. W. B. Xu et al. QTP709" (PE); "Gongshan, 3864 m. 22 IX 2018. H. Li, H. B. Bai 533324180922991LY" (SABG); "Lijiang, 4500 m. 10 IX 2008. X. P. Qi Q026" (PE); "Lijiang, – 4600 m. 11 VIII 2001. X. C. Zhang 2886" (PE); "Lijiang, 3 VII 1939. Y. Z. Zhao 20973 (PE); "Lijiang, 22 X 1939. Y. Z. Zhao 21966 (PE); "Lijiang, 4300 m. IX 1957. W. M. Chu et Y. M. Feng 761" (PE); "Shangri-La, 3614 m. 26 VII 2019. Z. L. Dao et al. KIBDZL209B11" (KUN); "Shangri-La, 4700 m. 4 X 2004. Z. D. Fang 041002" (PE); "Shangri-La, 28 IX 2004. Z. D. Fang 041008" (PE); "Shangri-La, 3500 m. 4 VIII 1981. Y. F. Han et al. 81 1452" (PE); "Shangri-La, 3800 m. 5 IX 2010. Kangzang Pl. Exp. 10-3309" (PE); "Shangri-La, 3800 m. 5 IX 2010. Kangzang Pl. Exp. 10-3334" (PE); "Shangri-La, 3640 m. 26 X 2004. H. M. Liu YN285" (PE); "Shangri-La, 3700–3850 m. 24 VII 2003. J. M. Lu 90" (KUN); "Shangri-La, 3700 m. 15 VI 1981. Qinghai-Xizang Complex Exp. 1093" (PE); "Shangri-La, 3950 m. 15 VI 1981. Qinghai-Xizang Complex Exp. 1545" (PE); "Shangri-La, 20 VII 2009. S. D. Zhang et K. X. Song 090612" (PE); "Shangri-La, 3748 m. 13 VIII 2011. T. Zhang et al. 11CS3072" (PE); "Shangri-La. 2 VIII 2003. X. C. Zhang et Z. D. Fang 2772" (PE); "Shangri-La, 3500 m. 14 VIII 2001. X. C. Zhang 2907" (PE); "Shangri-La, 3950 m. 31 VIII 1962. Zhongdian Exp. 1778" (PE); **NEPAL. Jumla:** "North side oftop of Danphe lagna Pass, 3900 m. 4 VI 2014. C. R. Fraser-Jenkins 35372" (KATH); "North side oftop of Danphe lagna Pass, 3900 m. 4 VI 2014. C. R. Fraser-Jenkins 35373" (KATH).

3. *Polystichum duthiei* (C. Hope) C. Chr., 1905, Index Filic. 72.

≡ *Aspidium duthiei* C. Hope, 1899, J. Bombay Nat. Hist. Soc. 12: 532.

≡ *Sorolepidium duthiei* (C. Hope) Ching, 1940, Bull. Fan Mem. Inst. Biol. Bot. 10: 10.

Lectotype (designated here): India: "Kumaon, Lebung Pan. 2 VIII 1886. J. F. Duthie 6234" (K: K001040150, digital image!).

= *Polystichum tsuchuense* Ching, 1974, Fl. Tsinling. 2: 222.

Type: China: "Gansu, Zhouqu. 22 VII 1951. T. P. Wang 14539" (PE 00044659!; iso – WUK 0066582, digital image!).

Distribution: China: Sichuan, Taiwan, Xizang, Yunnan; India; Nepal.

Altitude: 3000–4800 m.

Specimens examined: CHINA. Sichuan: "Pingwu, 2350–3450 m. 27 VI 2024. X. C. Zhang 14284" (PE); Taiwan: "Yilan, 3400 m. 7 IV 2000. C. K. Liou 1316" (TAI); **Xizang:** "Bome, 17 IX 2016. Y. H. Yan et al. ZXL07444" (CSH); "Bome, 3871 m. 16 IX 2016. Y. H. Yan et al. ZXL07445" (CSH); "Bome, 3600 m. 21 VIII 1965. T. S. Ying et D. Y. Hong 650918" (PE); "Dingjie, 4700 m. 11 VI 1975. Qinghai-Xizang Complex Exp. 5695" (PE); "Dingjie, 4600 m. 11 VI 1975. Qinghai-Xizang Complex Exp. 3889" (PE); "Dingjie, 4683 m. 26 VI 2020. X. X. Zhu et al. ZXX20692" (KUN); **Yunnan:** "Deqin, 4050 m. 11 IX 2023. R. Wei et al. WR0806-2" (PE); "Eryuan, 3600–3750 m. 25 VII 1963. Dianxibei Jinshajiang Exp. 6142" (PE); "Lijiang, 15 VII 1959. M. L. Lu 00145" (PE); "Lijiang, G. Forrest 5934" (PE); "Lijiang, 4200 m. s. coll. 17103" (HGAS); "Shangri-La, 4200 m. 28 VI 1963. Dianxibei Jinshajiang Exp. 4507" (PE); "ShangriLa, 4300 m. 11 VIII 1986. W. M. Chu et al. 20535" (PE); "Weixi, 3500 m. VII 1935. C. W. Wang 64650" (PE); **INDIA. Uttarakhand:** "Tihri-Garhwal, 4267 m. 9 VIII 1883. J. F. Duthie 396" (BM); "Kumaon, 3962 m. 13 IX 1884. J. F. Duthie 3708" (K); **NEPAL. Jumla:** "3800 m. 4 VI 2014. C. R. Fraser-Jenkins 35371" (KATH); **Manang:** "Thrungse Phedi, 4050 m. 24 VII 1983. K. R. Rajbhandari 8257" (KATH); "Manang Valley, 4100 m. 2 VIII 1983. K. R. Rajbhandari 8759" (KATH); "Nampa Gadh, 3962 m. 27 VII 1886. J. F. Duthie 6233" (K).

4. *Polystichum lachenense* (Hook.) Bedd., 1865, Ferns Brit. India 1: t. 32.

≡ *Aspidium lachenense* Hook., 1862, Sp. Fil. [W. J. Hooker] 4: 8.

Lectotype (designated here): India: "Sikkim, Pungu. J. D. Hooker 207" (K: K001040041, digital image!).

= *Polystichum sinkiangense* Ching ex Chang Y. Yang, 1988, Bull. Bot. Res. 8(2): 55.

Lectotype (designated here): China: "Xinjiang, Urumqi. 25 VII 1970. C. Y. Yang 70.0027" (PE 01150994!; isolecto – XJA-IAC: XJA00000340, digital image!).

Distribution: China: Gansu, Qinghai, Sichuan, Taiwan, Xinjiang, Xizang, Yunnan; India, Japan, Nepal.

Altitude: 2500–4700 m.

Specimens examined: CHINA. Gansu: "Zhuoni, Ching 979" (PE); **Qinghai:** "Jiuzhi,

4021 m. 11 VII 2022. S. B. Zhang et al. 12983" (PE); "Nangqian, 3790 m. 8 IX 1996. T. N. Ho 3008" (PE, HNWP); **Sichuan:** "Derong, 3700 m. 7 VIII 1981. Qinghai-Xizang Complex Exp. 3458" (PE); "Kangding, 4400 m. 10 VII 1983. Q. S. Li 009" (IMC); "Kangding, 3768–4150 m. 16 VII 2017. Y. L. Peng et al. THP-KD-3437" (CDBI); **Taiwn:** "Chiayi, 30 X 1985. C. M. Guo 14496" (TAI); "Hualien, 3300–3700 m, 6 VII 2005. S. W. Chung 7879" (PE); "Miaoli, 3200–3884 m. 12 VI 1987. J. C. Wang et S. F. Huang 4434" (TAI); "Miaoli, 19 VII 1932. S. n." (TAI); "Nantou, 3900 m. 19 VIII 2022. T. C. Hsu 14426" (TAI); "Nantou, 3600 m. 10 VII 1937. S. Suzuki 18122" (PE); "Taitung, 3100–3580 m. 10 IX 1984. H. Ohashi et al. 18757" (PE); "Taoyuan, 3400 m. 13 VIII 1992. S. J. Moore 15069" (TAIF); "Yilan, 17 VII 1937. S. Suzuki s. n." (TAI); **Xinjiang:**"Urumqi, C. Y. Yang 70.0025" (PE); "Urumqi, 2800–3000 m. 25 VII 1970. C. Y. Yang 70.0029" (XJA-IAC); "Urumqi, 2800–3000 m. 25 VII 1970. C. Y. Yang 70.0032" (XJA-IAC); **Xizang:** "Bayi, 4360 m. 2 VIII 1975. Qinghai-Xizang Complex Exp. 751136" (PE, HNWP); "Bayi, 4200 m. 19 IX 2007. X. C. Zhang et L. Wang 4654" (PE); "Biru, 3900 m. 12 IX 1976. D. D. Tao 11367" (PE); "Cuona, 4500 m. 18 VII 1975. C. Y. Wu et al. 75-999" (PE, HNWP); "Gyaca, 4500 m. 21 IX 1975. Qinghai-Xizang Complex Exp. 7925" (PE); "Gyaca, 4000 m. 19 VIII 1972. Xizang Herb. Med. Exp. 4280" (PE); "Riwoche, 4645 m. 7 VIII 2010. Kangzang Pl. Exp. 10-1468" (PE); "Riwoche, 3900 m. 22 VII 1976. Qinghai-Xizang Complex Exp. 9277" (PE); "Zayu, 3600 m. VIII 1935. C. W. Wang 66087" (PE); **Yunnan:** "Fugong, 3456 m. 8 IX 2023. R. Wei et al. WR0741" (PE); "Gongshan, 3800 m. 10 IX 2023. R. Wei et al. WR0772" (PE); "Lijiang, 3700–3900 m. 20 VIII 1957. W. M. Chu et Y. M. Feng 722" (PE); "Shangri-La, 3600 m. 14 VIII 2001. X. C. Zhang 2915" (PE); **INDIA. Himachal Pradesh:** "3658 m. 27 VII 1930. W. N. Koelz 741" (MICH); "4267 m. 22 VIII 1930. W. N. Koelz 1160" (MICH); **Jammu and Kashimir:** "Upper Lidder Valley, IX 1931. R. R. Stewart 12476" (US); "3962 m. 10 VIII 1939. R. R. Stewart et I. Stewart 18202" (US); **Punjab Pradesh:** "3658 m. 30 VI 1933. W. N. Koelz 5032" (MICH); **JAPAN. Honshu:** "Nagano, 2500 m. 26 VII 1959. M. Togashi 371" (PE); "Yamanashi, 2900–3000 m. 31 VII 1979. M. Furuse 13769" (PE); "Yamanashi, 2900–3000 m. 1 VIII 1979. M. Furuse 13800" (PE); "Yamanashi, 3000 m. 31 VIII 1979. M. Furuse 13982" (PE); "Yamanashi, 2900–3000 m. 19 VIII 1956. M. Furuse 31430" (PE); "Yamanashi, 24 VIII 1957. M. Furuse 32912" (PE); "Yamanashi, 2600 m. 24 VIII 1957. M. Furuse 32923" (PE); "Yamanashi, 2500–2800 m. 2 IX 1961. M. Furuse 39137" (PE); "Yamanashi, 2800–3190 m. 22 VII 1967. M. Furuse 45515" (PE); "Yamanashi, 3000 m. 3 VIII 1968. M. Furuse 46745" (PE); **NEPAL. Dolakha:** "4150 m. 24 VII 1977. K. R. Rajbhandari et R. Roy 1850" (KATH); "4267 m. 15 VII 1975. P. R. Shakya et al. 3059" (KATH); **Panchthar:** "3962 m. 8 X 1978. R. L. Fleming 2692" (KATH); **Ramechhap:** "4750 m. 28 VII 1985. H. Ohba et al. 60836" (KATH); "4350 m. 14 VIII 1974. J. H. de Haas 2257" (Z); "4200 m. 9 VIII 1999. M. Tateno 9955102" (KATH); **Solukhumbu:** "3000 m. 3 VIII 1995. C. M. Joshi J-1585962" (KATH); "4000 m. 3 VIII 1995. C. M. Joshi J-1585972" (KATH); **Taplejung:** "Saju pokhari, 16 VII 1972. H. Kanai et al. 725204" (KATH).

5. *Polystichum prescottianum* (Wall. ex Mett.) T. Moore, 1858, Index Fil. (T.Moore) 5: 101.

≡ *Aspidium prescottianum* Wall. ex Mett., 1858, Abh. Senckenberg. Naturf. Ges. 2: 332.

Lectotype (Fraser-Jenkins, 2018, in Annot. Checkl. Ind. Pterid. Part 2: 335.): India: "Uttar Pradesh, Kumaon. 1827. R. Blinkworth 363" (K: K001109888, the middle and right-hand fronds on the sheet, digital image!; isolecto – K: K001040099, K001040100, digital image!).

= *Polystichum tibeticum* Ching, 1983, Fl. Xizang. 1: 219, **syn. nov.**

Type: China: "Xizang, Bomi. 21 VIII 1965. T. S. Ying et D. Y. Hong 650956" (PE 00044657!; iso – PE 00044656!; PE 00044658!).

= *Polystichum yadongense* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 220, **syn. nov.**

Lectotype (designated here): China: "Xizang, Yadong. 9 VIII 1975. Qinghai-Xizang Complex Exp. 911" (PE 01175332!; iso – PE 01175331!; PE 01175333!).

= *Polystichum erinaceum* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 221.

Lectotype (designated here): China: "Xizang, Cona. 15 IX 1975. W. H. Li 1944" (PE 01451699!; iso – PE 01451700!).

= *Polystichum pseudocastaneum* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 222, **syn. nov.**

Type: China: "Xizang, Nyalam. 30 VI 1975. Qinghai-Xizang Complex Exp. 6116" (PE 00044645!; iso – KUN 1216688, digital image!).

= *Polystichum bomiense* Ching et S. K. Wu, 1983 Fl. Xizang. 1: 223, **syn. nov.**

Type: China: "Xizang, Bomi. 22 VIII 1965. T. S. Ying et D. Y. Hong 650974" (PE 00044610!; iso – PE 00044609!; PE 00044611!; PE 00044612!).

= *Polystichum brunneum* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 224.

Type: China: "Xizang, Gyirong. 2 VII 1975. Qinghai-Xizang Complex Exp. 75-446" (PE 00044613!).

Distribution: China: Taiwan, Xizang; Bhutan, India, Nepal, Pakistan.

Altitude: 2400–4500 m.

Specimens examined: CHINA. Taiwan: "Heping, 3600 m. 6 VII 2005. S. W. Chung 7877" (TAIF); "Heping, 3600 m. 7 VII 2005. S. W. Chung 7878" (TAIF); "Heping, 3510 m. 23 VII 2016. R. Knapp 4266" (P); "Heping, 3470 m. 23 VII 2016. R. Knapp 4269" (P); "Taoyuan, 3300 m. 13 VIII 1992. S. J. Moore 15052" (TAIF); "Yilan, 6 VII 2005. P. F. Lu 10000" (TAIF); **Xizang:** "Bayi, 3600–4000 m. 8 VIII 1983. B. S. Li et al. 06230" (PE); "Bayi, 3945 m. 10 IX 2016. Y. H. Yan et al. JSL4368" (CSH); "Bome, 3810 m. 16 IX 2016. Y. H. Yan et al. JSL4556" (CSH); "Bome, 3700 m. 3 VIII 2021. C. Zhang et al. 11227" (PE); "Gyirong, 3600 m. 16 VII 1975. Qinghai-Xizang Complex Exp. 5380" (PE); "Gyirong. 5 VII 1975. s. coll. 542" (PE); "Longzi, 3401 m. 3 IX 2017. PE-Xizang Exp. PE5839" (PE); "Longzi, 3401 m. 3 IX 2017. PE Xizang Exp. PE5843" (PE); "Longzi,4398 m. 7 IX 2017. PE-Xizang Exp. 6095" (PE); "Medog, 3650 m. 7 IX 1982. B. S. Li et al. 00730" (PE); "Nyalam, 3400 m. 26 VI 1975. Qinghai-Xizang Complex Exp. 5919" (PE, HNWP); "Yadong, 2850 m. 11 VIII 2012. Dalu Taiwan Exp. CMTTE1144" (SZG); **BHUTAN. Paro:** "12 X 2005. C. R. Fraser-Jenkins 31616" (TAIF); **INDIA. Himachal Pradesh:** "3048 m. 30 VI 1930. W. N. Koelz 275" (MICH); "3658 m. 30 VI 1933. W. N. Koelz 5014" (MICH); **Jammu and Kashimir:** "3962 m. 28 VIII 1955. Jon Mobed 51" (BRIT); **Punjab:** "2438 m. 2 VII 1917. R. R. Stewart 2575" (MO); **West Bengal:** "Darjeeling, 3200–3600 m. 2 VIII 1972. H. Kanai et al. 725677" (KATH); **Uttarakhand:** "Kumaon, Wallich 363" (K); **NEPAL. Baglung:** "3900 m. 25 VII 1984. P. R. Shakya et al. 8166" (KATH); **Dhankuta:** "3505 m. 21 VII 1971. T. B. Shrestha et D. P. Joshi 211" (KATH); **Dolakha:** "3900 m. 12 IX 1983. K. R. Rajbhandari 10145" (KATH); **Dolpa:** "4044 m. 1 VIII 2014. C. A. Pendry et al. BRD(A)187" (KATH); **Rasuwa:** "4236 m. 27 VIII 1969. S. B. Malla 16236" (KATH); **Sankhuwasabha:** "3846 m. 1 VII 2013. H. Ikeda et al. 1314075" (KATH); "3800 m. 26 VI 1972. H. Kanai et al. 725274" (KATH); **Sindhupalchok:** "4350 m. 14 VIII 1974. J. H. de Haas 2256" (Z); "4100 m. 14 IX 1974. J. H. de Haas 2744" (Z); "3970–4127 m. 11 VIII 1990. M. Minaki et al. 20827" (KATH); **Solukhumbu:** "Thangna, 4050 m. 23 VII 1995. C. M. Joshi J-1586279" (KATH); **Taplejung:** "4500 m. 16 IX 1989. C. Grey-Wilson et al. 709" (KATH); "3600 m. 18 VI 1972. H. Kanai et al. 725215" (KATH); "3200 m. 28 VI 1972. H. Kanai et al. 725286" (KATH); "3962 m. 27 VII 1956. J. D. A. Stainton 1138" (PE); **PAKISTAN.** "2850 m. 13 IX 1923. F. E. W. Venning 159" (KUN).

6. *Polystichum moupinense* (Franch.) Bedd., 1892, Suppl. Ferns Brit. Ind. 42.

≡ *Aspidium moupinense* Franch., 1887, Nouv. Arch. Mus. II (10): 115.

≡ *Polystichum prescottianum* var. *moupinense* (Franch.) C. Chr., 1924, Acta Horti Gothob. 1: 70.

Lectotype (Fraser-Jenkins, 2018, in Annot. Checkl. Ind. Pterid. Part 2: 337): China: "Sichuan, Baoxing. 1870. David s. n." (P: P00636463, digital image!).

= *Polystichum macrochlaenum* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 227.

Type: China: "Xizang, Zayu. 27 VI 1973. Qinghai-Xizang Complex Exp. 73-443" (PE 00044629!; iso – PE 00044630!).

= *Polystichum woodsioides* Christ, 1911, Bot. Gaz. 51: 354.

Type: China: "Sichuan, Baoxing. VIII 1908. E. H. Wilson 2615" (K: K001080988, digital image!).

= *Polystichum qamdoense* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 227, **syn. nov.**

Type: China: "Xizang, Qamdo. 9 VIII 1976. Qinghai-Xizang Complex Exp. 12711" (PE 00044646!).

= *Polystichum taizhongense* H. S. Kung, 1997, Acta Phytotax. Sin. 35 (5): 461, **syn. nov.**

Type: China: "Taiwan, Taizhong. 12 VIII 1991. S. J. Moore 12815" (PYU 01053550, digital image!; iso – S. J. Moore Herbarium, 436258, digital image!).

= *Polystichum paramoupinense* Ching, 1983, Fl. Xizang. 1: 226, **syn. nov.**

Type: China: "Xizang, Bomi. 2 VIII 1965. T. S. Ying et D. Y. Hong 650849" (PE 00044642!; iso – PE 00044641!; PE 00044643!).

= *Polystichum habaense* Ching et H. S. Kung, 1989, Bull. Bot. Res. 9(3): 4, **syn. nov.**

Type: China: "Yunnan, Shangri-La. 31 VIII 1962. Zhongdian Exp. 1766" (PE 01150552!; iso – KUN 0818956, digital image!).

Distribution: China: Hubei, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan.

Altitude: 2800–4700 m.

Specimens examined: CHINA. Hubei: "Shennongjia Forestry District, 2940 m. 9 VII 1976. Shennongjia Pl. Exp. 10736" (PE); "Shennongjia

Forestry District, 2800 m. VIII 2004. X. C. Zhang 3417" (PE); Shaanxi: "Meixian, 3300 m. 7 VIII 1956. Qinling Pl. Exp. 5738" (WUK); "Taibai, 3300 m. 9 VIII 1957. K. T. Fu 10320" (PE); "Taibai, P. C. Tsoong 2739" (PE); **Sichuan:** "Baiyu, 3925 m. 20 VIII 2006. D. E. Boufford et al. 36891" (PE); "Baoxing, 4073 m. 2 VIII 2019. S. X. Yu et al. WS678" (PE); "Barkam, 3990 m. 1 VIII 1960. Sichuan Med. Pl. Exp. 22655" (NAS); "Barkam, 28 VI 1958. Z. L. Wu 32449" (PE); "Chongzhou, 2925 m. 16 VI 2016. W. B. Ju et al. AZH01272" (CDBI); "Chongzhou, 2925 m. 16 VI 2016. W. B. Ju et al. AZH01275" (CDBI); "Daocheng, 4600 m. 29 VIII 1981. Hengduanshan Exp. 5582" (PE); "Kangding, 4427 m. 9 VIII 2017. X. F. Gao et al. THP-KD-5829" (CDBI); "Kangding, 4200 m. 19 VIII 1981. H. S. Kung 6047" (PE); "Kangding, 4200 m. 19 VIII 1981. H. S. Kung 6048" (PE); "Kangding, 15 VIII 2017. Q. Yu et al. THP-KD-5030" (CDBI); "Lushan, 3600 m. 3 VII 1958. L. Liu, H. S. Kung 247" (PE); "Lushan, 3700 m. 6 VII 1958. L. Liu et H. S. Kung 1" (PE); "Maoxian, 3860 m. 5 VIII 2002. X. F. Gao et al. 3173" (CDBI); "Xiangcheng, 4300–4400 m. 12 VIII 1981. Qinghai-Xizang Complex Exp. 4056" (PE); "Yajiang, 4300–4400 m. 7 VIII 2006. D. E. Boufford et al. 36021" (PE); **Taiwan:** "Heping, 11 VII 2006. P. F. Lu 12087" (TAIF); "Hualien, 24 VII 2009. C. W. Chen Wade928" (TAIF); "Miaoli, 3300–3492 m. 22 VII 2012. T. C. Hsu 6053" (TAIF); "Nantou, 30 X 1985. C. M. Guo 14496" (TAI); "Nantou, 2800–3300 m. 12 IX 2015. P. F. Lu 28685" (TAIF); "Nantou, 2900–3300 m. 26 X 2010. T. C. Hsu 3267" (TAIF); "Nantou, 2900–3300 m. 26 X 2010. T. C. Hsu 3268" (TAIF); "Nantou, VIII 1936. S. Sasaki s. n." (TAI); "Taoyuan, 3300 m. 25 IX 2004. P. F. Lu 8693" (TAIF); "Taoyuan, 3300 m. 25 IX 2004. P. F. Lu 8693" (TAIF); "Taoyuan, 3300 m. 25 IX 2004. P. F. Lu 8695" (TAIF); "Yilan, 11 VII 2010. F. W. Li FWL1059" (TAIF); "Yilan, 3500–3650 m. 6 VII 2005. P. F. Lu 10007" (TAIF); "Yilan, 3500–3650 m. 6 VII 2005. P. F. Lu 10010" (TAIF); "Yilan, 3300–3500 m. 5 VII 2005. T. C. Hsu 197" (TAIF); **Xizang:** "Bayi, 4600 m. 4 VIII 1983. B. S. Li et al. 06072" (PE); "Biru, 3800–4000 m. 12 IX 1976. D. D. Tao 11338" (PE); "Gyaca, 4500 m. 21 IX 1975. Qinghai-Xizang Complex Exp. 7925" (PE); "Jomda, 31 VII 2004. D. E. Boufford et al. 31424" (PE); "Milin, 4300 m. 27 VII 1983. B. S. Li et al. 05928" (PE); "Qamdo, 7 VIII 2004, D. E. Boufford et al. 31763" (PE); "Riwoche. 13 VIII 2004. D. E. Boufford et al. 32258" (PE); "Zayu, 4200 m. 9 IX 1982. Qinghai-Xizang Complex Exp. 10245" (PE); "Zayu, 4200 m. 9 IX 1982. Qinghai-Xizang Complex Exp. 10246" (PE); "Zayu, 4200 m. 26 IX 1982. Qinghai-Xizang Complex Exp. 10670" (PE); "Zayu, VIII 1935. C. W. Wang 65323" (PE); **Yunnan:** "Deqin, 3800–4100 m. 1 VIII 1940. K. M. Feng 6240" (PE); "Deqin, 4600 m. 13 VII 1981, Qinghai-Xizang Complex Exp. 2384" (PE, CDBI); "Deqin, 4400 m. 1 VII 1981. Qinghai-Xizang Complex Exp. 2681" (CDBI); "Deqin, 4700 m. 1 VII 1981. Qinghai-Xizang Complex Exp. 2739" (CDBI); "Deqin, 4300 m. 14 VII 1981. Qinghai-Xizang Complex Exp. 3007" (PE); "Deqin, 3700 m. VIII 1935. C. W. Wang 68947" (PE); "Deqin, 3500 m. IX 1935. C. W. Wang 69484" (PE); "Deqin, 3300 m. IX 1935. C. W. Wang 69614" (PE); "Deqin, 3000 m. IX 1935. C. W. Wang 69652" (PE); "Deqin, IX 1935. C. W. Wang 69755" (PE); "Eryuan, 3600–3750 m. 25 VII 1963, Dianxibei Jinshajiang Exp. 6142" (PE); "Gongshan, 3500 m. 26 VII 1982, Qinghai-Xizang Complex Exp. 8767" (PE); "Gongshan, 3600 m. 7 X 1938. T. T. Yu 23268" (PE); "Lijiang, 3900–4500 m. 28 VII 1981. PE Hengduanshan Exp. 02080" (PE); "Lijiang, 3800–4200 m. 28 VII 1984. PE Hengduanshan Exp. 02147" (PE); "Lijiang, 2 VIII 1957, W. M. Chu et Y. M. Feng 938" (PE); "Shangri-La, 3700 m. 27 VI 1963. Dianxibei Jinshajiang Exp. 4475" (PE); "Shangri-La, 3500 m. 30 VI 1963. Dianxibei Jinshajiang Exp. 4521" (PE); "Shangri-La, 3800 m. 25 VIII 1962. Zhongdian Exp. 1321" (PE); "Shangri-La, 4300 m. 7 IX 1962. Zhongdian Exp. 1891" (PE); "Weixi, VII 1935. C. W. Wang 64687" (PE); "Weixi, 3900 m. 10 VII 1937. T. T. Yu 8810" (PE).

7. *Polystichum shensiense* Christ, 1906, Bull. Acad. Int. Géogr. Bot. 16: 113.

≡ *Polystichum prescottianum* var. *shensiense* (Christ) C. Chr., 1924, Acta Hort. Gothob. 1: 71.

Type: China: "Shaanxi, Huxian. 1894. Giraldi 13" (not seen).

= *Nephrodium lichiangense* C. H. Wright, 1909, Kew Bull. 1909 (6): 267.

≡ *Dryopteris lichiangensis* (C. H. Wright) C. Chr., 1913, Ind. Fil. Suppl. 1: 34.

≡ *Polystichum lichiangense* (C. H. Wright) Ching ex H. S. Kung, 1989, Bull. Bot. Res. 9(3): 6.

Lectotype (designated here): China: "Yunnan, Lijiang. VI 1906. G. Forrest 2300 (K: K001040071, digital image!; iso – P: P00635496, digital image!).

= *Polystichum qamdoense* var. *elongatum* Ching et S. K. Wu, 1983, Fl. Xizang. 1: 228.

Type: China: "Xizang, Zayu. 1 VII 1973. Qinghai-Xizang Complex Exp. 73-536" (PE 00044648!).

= *Polystichum obtusipinnum* Ching et H. S. Kung, 1989, Bull. Bot. Res. 9 (3): 6.

Type: China: "Yunnan, Deqin. 1 VIII 1940. K. M. Feng 6242" (PE 01174369!).

= *Polystichum melanostipes* Ching et H. S. Kung, 1989, Bull. Bot. Res. 9 (3): 10, **syn. nov.**

Type: China: "Yunnan, Deqin. VIII 1935. C. W. Wang 68820" (PE 1151458!).

Distribution: China: Gansu, Hubei, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan; Nepal.

Altitude: 2350–4400 m.

Specimens examined: CHINA. Gansu: "Luqu, 3700 m. 3 IX 1937. Z. B. Wang 7641" (PE, WUK); "Tianzhu, 3000 m. 15 VII 1959. Y. Q. He 4899" (PE, WUK); **Hubei:** "Badong, 24 IX 1958. R. H. Huang 211" (WUK); "Shennongjia Forestry District, 2870 m. 11 IX 2021. Q. P. Xiang et al. 12391" (PE); "Shennongjia Forestry District, 2850 m. 14 IX 2021. Q. P. Xiang et al. 12460" (PE); "Shennongjia Forestry District, 25 V 2011. D. G. Zhang ly120523053" (JIU); **Qinghai:** "Banma, 3540 m. 10 VII 2021. S. B. Zhang et al. 12252" (PE); "Banma, 3780 m. 10 VII 2021. S. B. Zhang et al. 12255" (PE); "Banma, 3560 m. 10 VII 2021. S. B. Zhang et al. 12256" (PE); "Datong, 3122 m. 20 VII 2022. S. B. Zhang et al. 13050" (PE); "Datong, 3800 m. 9 VIII 2020. X. C. Zhang et al. 11041" (PE); "Qilian, 3118 m. 6 VII 2022. S. B. Zhang et al. 12932" (PE); "Qilian, 3118 m. 6 VII 2022. S. B. Zhang et al. 12935" (PE); "Qilian, 3250 m. 7 VIII 2020. X. C. Zhang et al. 10924" (PE); "Yushu, 3600 m. 14 VII 2021. S. B. Zhang et al. 12296" (PE); "Yushu, 3786 m. 15 VII 2021. S. B. Zhang et al. 12305" (PE); "Zeku, 9 VII 2022. S. B. Zhang et al. 12967" (PE); "Zeku, 3238 m. 10 VII 2022. S. B. Zhang et al. 12976" (PE); "Zeku, 13 VIII 1982. P. C. Kuo 26052" (HNWP); **Shaanxi:** "Huyi, 2950 m. 8 IX 1962. K. J. Fu 14263" (WUK); "Meixian, 2900 m. 27 VI 2013. BNU Qinling Exp. TB398" (BNU); "Meixian, 2500 m. Qinling Pl. Exp. 494" (PE); "Meixian, 2820 m. 4 IX 1960. Y. P. Hsu 548" (WUK); "Meixian, 2780 m. 7 IX 1960. Y. P. Hsu 561" (WUK); "Pingli, 2900 m. 26 VIII 1990. G. Y. Xu et X. S. Guo 5868" (WUK); "Taibai, 2350 m. 17 IX 1932. K. S. Hao 4258" (PE); "Taibai, 3300 m. 21 VIII 1957. Q. Huang 2151" (PE); "Taibai, 3200 m. 3 X 1955. F. T. Wang et al. 184" (PE); "Taibai, 3200 m. 3 X 1955. F. T. Wang et al. 186" (PE); "Taibai, 3000 m. 10 VII 1960. Y. P. Hsu 570" (PE, WUK); **Sichuan:** "Baiyu, 4197 m. 27 VII 2010. Kangzang Pl. Exp. 10-0801" (PE); "Daofu, 3530 m. 20 IV 1960. C. T. Kuan 120367" (PE); "Barkam, 3900 m. 7 VIII 1958. P. X. Li 10543" (WUK); "Barkam, 3300 m. 3 IX 1957. X. Li 74477" (PE); "Daocheng, 4400 m. 29 VIII 1981. Qinghai-Xizang Complex Exp. 5486" (PE, CDBI); "Dege, 3800 m. 7 VII 1974. Sichuan Veget. Pl. Exp. 7331" (CDBI); "Dege 4025 m. 17 VIII 2006. D. E. Boufford et al. 36662" (PE); "Ganzi, 4200 m. 3 VIII 2005. D. E. Boufford et al. 34023" (PE); "Hongyuan, 13 VII 1958. Z. L. Wu 32821" (PE); "Kangding, 4150 m. 10 VIII 2017. X. F. Gao et al. THP-KD-5898" (CDBI); "Kangding, 4012 m. 5 VIII 2017. W. B. Ju, C. C. Zheng THP-KD-5317" (CDBI); "Kangding, 3800 m. 17 VIII 1981. H. S. Kung 6006" (PE); "Kangding, 3600 m. 19 VIII 1981. H. S. Kung 6046" (PE); "Kangding, 3820 m. 18 VII 2008. Y. L. Peng et al. Gaoxf0278" (CDBI); "Muli, 4000 m. 8 IX 1983. Qinghai-Xizang Complex Exp. 13674" (PE); "Seda, 3800 m. 1 VII 1974. Z. S. Yu 06581" (CDBI); "Xiangcheng, 3900 m. 12 VIII 1981. Qinghai-Xizang Complex Exp. 4771" (PE, CDBI); "Yajiang, 3630 m. 7 VIII 1960. C. T. Kuan 480462" (PE); **Xizang:** "Chaya, 3800 m. 7 VII 1976. Qinghai-Xizang Complex Exp. 12258" (PE); "Jomda, 3900 m. 4 VIII 2009.E. Boufford et al. 41935" (PE); "Riwoche, 18 VIII 1976. Qinghai-Xizang Complex Exp. 12875" (PE); "Zayu, 3400 m. 8 VIII 2013. X. H. Jin et al. ST2518" (PE); "Zayu, 3400 m. X. H. Jin et al. ST2751" (PE); "Zayu, 3600 m. 27 IX 1982. Qinghai-Xizang Complex Exp. 10802" (PE); "Zayu, 3700 m. 27 IX 1982. Qinghai-Xizang Complex Exp. 10821" (PE); "Zayu, 4133 m. 27 2020. W. B. Xu et al. QTP262" (PE); "Zuogong, 3900 m. 8 X 1982. Qinghai-Xizang Complex Exp. 11027" (PE); **Yunnan:** "Deqin, 3700–3900 m. 13 VII 1940. K. M. Feng 5404" (PE); "Deqin, 4100 m. 9 VII 1981. Qinghai-Xizang Complex Exp. 2536" (CDBI); "Deqin, 4100 m. 9 VII 1981. Qinghai-Xizang Complex Exp. 2539" (CDBI); "Deqin, 3500 m. VII–VIII 1935. C. W. Wang 64771" (PE); "Deqin, 4000 m. 12 VIII 1938. T. T. Yu 22313" (PE); "Lijiang, 25 VII 1939. Q. G. Zhao 30447" (PE); "Shangri-La, 3700–3900 m. 10 VIII 1981. PE Hengduanshan Exp. 2830" (PE); "Shangri-La, 3400 m. 17 VII 1937. T. T. Yu 12185" (PE); "Shangri-La, 4100 m. 3 IX 1983. W. M. Chu et al. 17063" (PE); "Weixi, 3500 m. VII 1935. C. W. Wang 64631" (PE); **NEPAL. Gorkha:** "3920 m. 7 VIII 2008. H. Ikeda et al. 20818119" (KATH); **Humla:** "Chungsa valley, 3537 m. 18 VIII 2019. S. R. Zhang et al. H0970" (PE); "Chungsa valley, 3413 m. 18 VIII 2019. S. R. Zhang et al. H1004" (PE); **Ramechhap:** "Neju-Pasinge Kharka, 3700 m. 1 VIII 1985. H. Ohba et al. 61030" (KATH); **Rasuwa:** "Kyangching, 3900 m. 2 X 1977. V. L. Gurung 77/1133" (KATH).

8. *Polystichum castaneum* (C. B. Clarke) B. K. Nayar et S. Kaur, 1974, Companion Handb. Ferns Brit. India 50.

≡ *Aspidium prescottianum* var. *castaneum* C. B. Clarke, 1880, Trans. Linn. Soc. London, Bot. ser. 2, 1(8): 510.

≡ *Polystichum prescottianum* var. *castaneum* (C. B. Clarke) Bedd., 1883. Handb. Ferns Brit. India 210.

Type: India: "Sikkim, J. D. Hooker et W. S. Atkinson s. n." (not seen).

Distribution: China: Xizang, Yunnan.

Altitude: 3200–4200 m.

Specimens examined: CHINA. Xizang: "Bome, 3750 m. 23 VIII 1983. S. Z. Cheng et B. S. Li 07022" (PE); "Bome, 3750 m. 23 VIII 1983. S. Z. Cheng et B. S. Li 07044 (PE)"; "Medog, 3500–3700 m. 20 VIII 1982. S. Z. Cheng, B. S. Li 00320" (PE); "Medog, 3700 m. 20 VIII 1982. S. Z. Cheng, B. S. Li 00347" (PE); "Medog, 3250 m. 31 VII 1974. Qinghai-Xizang Complex Exp. 3821" (PE); "Medog, 3300 m. 31 VII 1974. Qinghai-Xizang Complex Exp. 3839" (PE); "Medog, 3900 m. 1 VIII 1974. Qinghai-Xizang Complex Exp. 3882" (PE); "Medog, 3600 m. 25 VI 1980. Shengtaishi Gaoyuan Team 10378" (PE); "Milin, 3600–4000 m. 24 VI 1980. Shengtaishi Gaoyuan Team 10309" (PE); "Zayu, 3700–4200 m. 8 IX 1982. Qinghai-Xizang Complex Exp. 10143" (PE); "Zayu, 4000 m. 9 IX 1982. Qinghai-Xizang Complex Exp. 10247" (PE); "Dali, 3900 m. 11–12 VII 1984. Sino-Amer. Bot. Exp. 1036" (US); "Gongshan, 3600–3900 m. 15 IX 1940. K. M. Feng 7796" (PE); "Gongshan. 11 X 1940. K. M. Feng 8378" (PE); "Gongshan, 3600 m. 24 VII 1982. Qinghai-Xizang Complex Exp. 8500" (PE); "Gongshan, 3600 m. 26 VII 1982. Qinghai-Xizang Complex Exp. 8756" (PE); "Gongshan, 36007 VIII 1938. T. T. Yu 19729" (PE); "Gongshan, 21 VIII 1938. T. T. Yu 19929" (PE); "Gongshan, 3200 m. 17 IX 1938. T. T. Yu 20356" (PE); "Lijiang, C. Y. Wu 8159 (PE); Weixi, 4000 m. 12 VIII 1938. T. T. Yu 22313" (PE).

9. *Polystichum salwinense* Ching et H. S. Kung, 1989, Bull. Bot. Res., Harbin 9(3): 7.

Lectotype (designated here): China: "Yunnan, Gongshan. 3 IX 1938. T. T. Yu 22670" (PE 01174257!; iso – PE 01174258!; KUN 1216678, digital image!).

Distribution: China: Yunnan; Myanmar.

Altitude: 3500–4200 m.

Specimens examined: CHINA. Yunnan: "Dali, B. S. Sun s. n." (PE); "Dali, VIII 1941. H. C. Wang 1264" (PE); "Deqin, 3500 m. IX 1935. C. W. Wang 69506" (PE); "Fugong, 4000 m. 26 VIII 1934. H. T. Tsai 58191" (PE); "Fugong, 3621 m. 8 IX 2023. R. Wei et al. WR0722" (PE); "Gongshan, 3700–4200 m. 3 VIII 2013. X. H. Jin et al. ST1938" (PE); **MYANMAR.** "3658 m. VII 1925. G. Forrest 27004" (E, MO).

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