



## New taxonomic treatments for three enigmatic scientific names of Taiwan fern flora

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**ABSTRACT:** Based on the collections of U. Faurie from Formosa (i.e. Taiwan), E. Rosenstock published 40 new fern taxa in 1915. However, there are still some scientific names remaining enigmatic to date. Due to the reexaminations of their type specimens as well as the related protologues, three names are here identified and reduced to synonyms under different fern taxa. A fourth name remains ambiguous.

**KEY WORDS:** E. Rosenstock, Flora, Fern, Formosa, Synonymy, Taiwan, Taxonomy, U. Faurie.

### INTRODUCTION

Eduard Rosenstock (24, Mar., 1856–20, Sep., 1938) was a German horticulturist as well as a botanist whose specialized fields were chiefly on taxonomy of pteridophytes and spermatophytes. His major contribution on the fern flora of Taiwan is the publication of an article “Filices Formosanae novae, a Cl. P<sup>e</sup> U. Faurie anno 1914 collectae” (Rosenstock 1915). In this paper, a total of 40 taxa (including 23 species, 16 varieties and 1 form; Table 1) are introduced. Among these 40 names, however, there are still four ambiguous ones, viz., *Asplenium wilfordii* Mett. ex Kuhn var. *densum* Rosenst. (type: *U. Faurie* 142), *Dryopteris adauca* Rosenst. (type: *U. Faurie* 40), *D. splendens* (Hook.) Kuntze var. *formosana* Rosenst. (type: *U. Faurie* 381bis), and *Pteris quadriaurita* Retz. var. *abbreviata* Rosenst. (type: *U. Faurie* 122). *Dryopteris adauca* and *D. splendens* var. *formosana*, are here resolved by reexamination of the type specimens. *Pteris quadriaurita* var. *abbreviata*, which used to be synonymized under *Pteris fauriei* s.l., is also clarified and reclassified after reinspection of relevant type specimens as well as the protologue. The taxonomic treatments of these three taxa are proposed as below.

### TAXONOMIC TREATMENTS

#### 1. *Asplenium wilfordii* Mett. ex Kuhn var. *densum* Rosenst.

A comparison between three morphologically similar *Asplenium* species: *A. austrochinense*, *A. oldhami*, and *A. wilfordii* was made by Kuo (1987). Based on his key, *Asplenium wilfordii* var. *densum*, which is treated under “uncertain taxa” in the latest edition of “Flora of China” (Wu *et al.* 2013) and is

noted to resemble *A. austrochinense*, should be classified into the *A. wilfordii* group. Comparison of the type photos of *A. austrochinense* (C.G. Matthew s.n., 20 Oct. 1907; in K), *A. wilfordii* (C. Wilford 783; in K), and *A. wilfordii* var. *densum* (in NY), shows that the last has obviously broader ultimate segments than the first two specimens. Although *A. wilfordii* can occur both on tree trunks and rocks, and plants on trees often have larger fronds with much thinner texture as well as finer segments than the plants on rocks, the dissimilarities between *A. wilfordii* and *A. wilfordii* var. *densum* are still hard to be ignored. Thus, it is appropriate to keep *A. wilfordii* var. *densum* as a distinct taxon tentatively till more powerful evidence is submitted.

#### 2. *Dryopteris adauca* Rosenst. (Fig. 1)

*Tectaria kusukusensis* (Hayata) Lellinger, Amer. Fern Journ. 58(4): 157. 1968. **Basionym:** *Dryopteris kusukusensis* Hayata, Icon. Pl. Formosan. 4: 157, f. 98. 1914. **Type:** FORMOSA (Taiwan), Prov. Takao, Kusukusu, B. Hayata & S. Sasaki s.n., Jul. 1912 (holotype: TI, photo!); Chinese name: 高士佛三叉蕨

**Synonym:** *Dryopteris adauca* Rosenst., Hedwigia 56(5): 341. 1915. **Type:** FORMOSA (Taiwan), Keelung, *U. Faurie* 40, Mar. 1914 (lectotype: S [S-P-17865], here designated, photo!); *syn. nov.*

*Dryopteris adauca* was based on a collection by U. Faurie (*U. Faurie* 40) from northern Taiwan. This name has been a puzzle to pteridologists and no one knew about this plant more than the content of its protologue (e.g., Yang & Liu 2002; Wu *et al.* 2013). Nevertheless, judging from the protologue and the photo image of the type specimen, *D. adauca* can be determined confidently to be the same as *Dryopteris kusukusensis* Hayata (*Tectaria kusukusensis* (Hayata) Lellinger) (Figs. 2-1 & 2-2), and should be reduced to a synonym under it.

**Table 1.** List of fern taxa which were collected by U. Faurie from Formosa (Taiwan) in 1914 and subsequently published by E. Rosenstock in 1915. The mark “\*” denotes taxa with ambiguous taxonomy.

Formosan fern species published by E. Rosenstock in 1915	Family	Current taxonomic treatments on literature	
			Scientific name
<i>Lycopodium fauriei</i>	Lycopodiaceae		<i>Phlegmariurus fargesii</i> (Herter) Ching [FOC 2013]
<i>Asplenium cataractarum</i>	Aspleniaceae		<i>Hymenasplenium murakami-hatanakae</i> Nakaike [FOC 2013]
<i>Asplenium pseudofalcatum</i> var. <i>subintegrum</i>	Aspleniaceae		<i>Asplenium steerei</i> Harr. [referred from the identification by M.G. Price on the type of <i>Asplenium pseudofalcatum</i> var. <i>subintegrum</i> in MICH]
<i>Asplenium pseudofalcatum</i> var. <i>subintegrum</i> forma <i>obtusatum</i>	Aspleniaceae		<i>Asplenium steerei</i> Harr. [referred from the identification by M.G. Price on the type of <i>Asplenium pseudofalcatum</i> var. <i>subintegrum</i> in MICH]
<b><i>Asplenium wilfordii</i> var. <i>densum</i>*</b>	Aspleniaceae		<i>Asplenium</i> cf. <i>austrochinense</i> Ching [FOC 2013]
<i>Athyrium allanticarpum</i>	Athyriaceae		<i>Diplazium kawakamii</i> Hayata [FOC 2013]
<i>Athyrium obtusifolium</i>	Athyriaceae		<i>Athyrium nakanoi</i> Makino [FOC 2013]
<i>Diplazium crenato-serratum</i> var. <i>hirta</i>	Athyriaceae		<i>Diplazium pullingeri</i> (Baker) J. Sm. [FOC 2013]
<i>Diplazium formosanum</i>	Athyriaceae		<i>Deparia formosana</i> (Rosenst.) R. Sano [FOC 2013]
<i>Diplazium laxifrons</i>	Athyriaceae		<i>Diplazium laxifrons</i> Rosenst. [FOC 2013]
<i>Diplazium maximum</i> var. <i>formosanum</i>	Athyriaceae		<i>Diplazium petrii</i> Tardieu [FOC 2013]
<i>Diplazium uraiense</i>	Athyriaceae		<i>Diplazium dilatatum</i> Blume [FOT 1994]
<i>Dryopteris athyriiformis</i>	Athyriaceae		<i>Diplazium uraiense</i> Rosenst. [FOC 2013]
<i>Woodwardia orientalis</i> var. <i>formosana</i>	Blechnaceae		<i>Cornopteris banajaoensis</i> (C. Chr.) K. Iwats. & M.G. Price [FOC 2013]
<i>Dryopteris atrosetosa</i>	Dryopteridaceae		<i>Woodwardia prolifera</i> Hook. & Arn. [FOC 2013]
<i>Dryopteris aureo-vestita</i>	Dryopteridaceae		<i>Dryopteris squamiseta</i> (Hook.) Kuntze [FOC 2013]
<i>Dryopteris erythrosora</i> var. <i>tenuipes</i>	Dryopteridaceae		<i>Dryopteris maximowicziana</i> (Miq.) C. Chr. [FOC 2013]
<i>Dryopteris subtripinnata</i> var. <i>bunkikiyensis</i>	Dryopteridaceae		<i>Dryopteris tenuipes</i> (Rosenst.) Seriz. [FOT 1994]
<i>Elaphoglossum subellipticum</i>	Dryopteridaceae		<i>Dryopteris sparsa</i> (D. Don) Kuntze [FOC 2013]
<i>Leptochilus cuspidatus</i> var. <i>crenatus</i>	Dryopteridaceae		<i>Elaphoglossum commutatum</i> (Mett. ex Kuhn) Alderw. [Knapp 2011]
<i>Polystichum aculeatum</i> var. <i>durissimum</i>	Dryopteridaceae		<i>Bolbitis angustipinna</i> (Hayata) H. Ito [FOC 2013]
<i>Polystichum arisanicum</i>	Dryopteridaceae		<i>Polystichum biaristatum</i> (Blume) T. Moore [FOC 2013]
<i>Polystichum formosanum</i>	Dryopteridaceae		<i>Arachniodes globisora</i> (Hayata) Ching [FOT 1994]
<i>Polystichum lentum</i> var. <i>gelida</i>	Dryopteridaceae		<i>Polystichum formosanum</i> Rosenst. [FOT 1994, FOC 2013]
<i>Polystichum varium</i> var. <i>eurylepidotum</i>	Dryopteridaceae		<i>Polystichum prionolepis</i> Hayata [FOT 1994, FOC 2013]
<i>Hymenophyllum punctisorum</i>	Hymenophyllaceae		<i>Dryopteris formosana</i> (Christ) C. Chr. [FOC 2013]
<i>Cyclophorus lingua</i> var. <i>attenuata</i>	Polypodiaceae		<i>Hymenophyllum polyanthos</i> (Sw.) Sw. [Knapp 2011]
<i>Polypodium arisanense</i>	Polypodiaceae		<i>Pyrosia lingua</i> (Thunb.) Farw. [FOC 2013]
<i>Polypodium diversum</i>	Polypodiaceae		<i>Lepisorus obscurevenulosus</i> (Hayata) Ching [referred from the identification by C.M. Kuo on the type of <i>Polypodium arisanense</i> in P]
<i>Polypodium loxogramme</i> var. <i>lamprocaulon</i>	Polypodiaceae		<i>Lemmaphyllum diversum</i> (Rosenst.) Tagawa [FOC 2013]
<i>Polypodium pseudocucullatum</i>	Polypodiaceae		<i>Loxogramme grammitoides</i> (Baker) C. Chr. [FOC 2013]
<i>Polypodium raishaense</i>	Polypodiaceae		<i>Micropolypodium okuboi</i> (Yatabe) Hayata [FOC 2013]
<i>Polypodium</i> ( <i>Selliguea</i> ) <i>wrightii</i> var. <i>lobatum</i>	Polypodiaceae		<i>Polypodiodes raishaensis</i> (Rosenst.) S.G. Lu [FOC 2013]
<b><i>Pteris quadriaurita</i> var. <i>abbreviata</i>*</b>	Pteridaceae		<i>Colysis</i> × <i>shintenensis</i> (Hayata) H. Ito [Tagawa 1936; Lellinger 1968]
<i>Aspidium phaeocaulon</i>	Tectariaceae		<i>Pteris fauriei</i> Hieron. var. <i>fauriei</i> [FOC 2013]
<i>Dryopteris arisanensis</i>	Thelypteridaceae		<i>Tectaria phaeocaulis</i> (Rosenst.) C. Chr. [FOT 1994]
<i>Dryopteris subhispidula</i>	Thelypteridaceae		<i>Metathelypteris gracilescens</i> (Blume) Ching [FOC 2013]
<i>Dryopteris uraiensis</i>	Thelypteridaceae		<i>Cyclosorus taiwanensis</i> (C. Chr.) H. Ito [FOT 1975]
<b><i>Dryopteris adaucta</i>*</b>	?		<i>Metathelypteris uraiensis</i> (Rosenst.) Ching [FOT 1975]
<b><i>Dryopteris splendens</i> var. <i>formosana</i>*</b>	?		?

### 3. *Dryopteris splendens* (Hook.) Kuntze var. *formosana* Rosenst. (Figs. 3 & 4)

*Dryopteris* × *holttumii* L.B. Zhang, Fl. China 2–3: 616. 2013. **Basionym:** *Dryopsis* × *fauriei* Holttum & P.J. Edwards, Kew Bull. 41(1): 198. 1986.—*Dryopteris* × *fauriei* (Holttum & P.J. Edwards) L.B. Zhang, Phytotaxa 71: 21. 2012, non Kodama (1914). **Type:** FORMOSA (Taiwan), Mt. Arisan, *U. Faurie 381bis*, May 1914 (holotype: P [P00642759], photo!; isotype: S [S-P-7812], photo!); Chinese name: 霍氏鱗毛蕨

**Synonym:** *Dryopteris splendens* (Hook.) Kuntze var. *formosana*

Rosenst., Hedwigia 56(5): 343. 1915. **Type:** FORMOSA (Taiwan), Mt. Arisan, *U. Faurie 381bis*, May 1914 (lectotype: P [P00642759], here designated, photo!; isolectotype: S [S-P-7812], photo!); *syn. nov.*

The name *Dryopteris splendens* var. *formosana* has remained ambiguous for a long time and was even listed in “excluded taxa” from the genus *Dryopteris* (Wu *et al.* 2013). It is somewhat astonishing because its type, *U. Faurie 381bis* (Figs. 3 & 4), is also cited as type of *Dryopsis* × *fauriei* Holttum & P.J. Edwards.



**Fig. 1.** Lectotype of *Dryopteris adaucta* Rosenst. (FORMOSA, Keelung; *U. Faurie* 40, Mar. 1914; in S [S-P-17865]; the digital photo is courtesy from the holding herbarium S).

There are two duplicates of specimens of *U. Faurie* 381bis (in P and S), and both duplicates are here confirmed to be the same taxon after careful morphological comparison of their photographs. The duplicate in P is holotype of *Dryopsis* × *fauriei*, and another in S is doubtless its isotype. Regarding *Dryopteris splendens* var. *formosana*, its holotype is not designated explicitly in the protologue, and hence lectotypification is necessary.

*Dryopteris splendens* var. *formosana* was published far earlier than *Dryopsis* × *fauriei*. However, when this hybrid taxon is kept at “species” level, not a variety, the lifting of “*Dryopteris splendens* var. *formosana*” to “*Dryopteris formosana*” is blocked by the name by Christensen (1905) and become an illegitimate name. *Dryopteris* × *fauriei* (Holtum & P.J. Edwards) L.B. Zhang published in 2012 is also illegitimate as there is an earlier *D. fauriei* Kodama (Matsumura 1914). For the above reasons, *Dryopteris* × *holtumii* was adopted (Zhang *et al.* in Wu *et al.* 2013) and *D. splendens* var. *formosana* is here synonymized under it.



**Figs. 2-1** (above) & **2-2** (below). Holotype of *Tectaria kusukusensis* (Hayata) Lellinger (FORMOSA, Prov. Takao, Kusukusu; *B. Hayata* & *S. Sasaki* s.n., Jul. 1912; in TI; photographed by Dr. S.J. Moore).





Fig. 3. Isolectotype of *Dryopteris splendens* (Hook.) Kuntze var. *formosana* Rosenst. (FORMOSA, Mt. Arisan; *U. Faurie* 381bis, May 1914; in S [S-P-7812]; the digital photo is courtesy from the holding herbarium S).

4. *Pteris quadriaurita* Retz. var. *abbreviata* Rosenst. (Fig. 5)

*Pteris fauriei* and its variety *minor* (Fig. 6) were both published by Hieronymus (1914), and most of the specimens cited were collected from North Taiwan (*A. Henry* 1427 and *U. Faurie* 628 for the former, and *U. Faurie* 685 for the latter) except *U. Faurie* 4594 (from Japan). Before the mid-20<sup>th</sup> century, this species and its variety *minor* were usually misidentified as *P. quadriaurita* Retz. (e.g., Henry 1896; Yabe 1902; Sasaki 1928; Ohwi 1957), *P. biaurita* L. var. *quadriaurita* (Retz.) Krug (e.g., Matsumura & Hayata 1906; Kawakami 1910; Hayata 1917; Ito 1928), or *P. biaurita* (e.g., Hayata 1917, *pro parte*). *Pteris fauriei* var. *minor* was often neglected and sunk under the type variety *P. fauriei* var. *fauriei* until it was proven to be a sexual diploid ( $2n = 58$ ), usually with coriaceous laminae and growing in warmer, shinier habitats, obviously different from the typical variety which was shown to be an apomictic triploid ( $2n = 87$ ) with herbaceous laminae and preferring cooler and shaded sites (Huang *et al.* 2006,

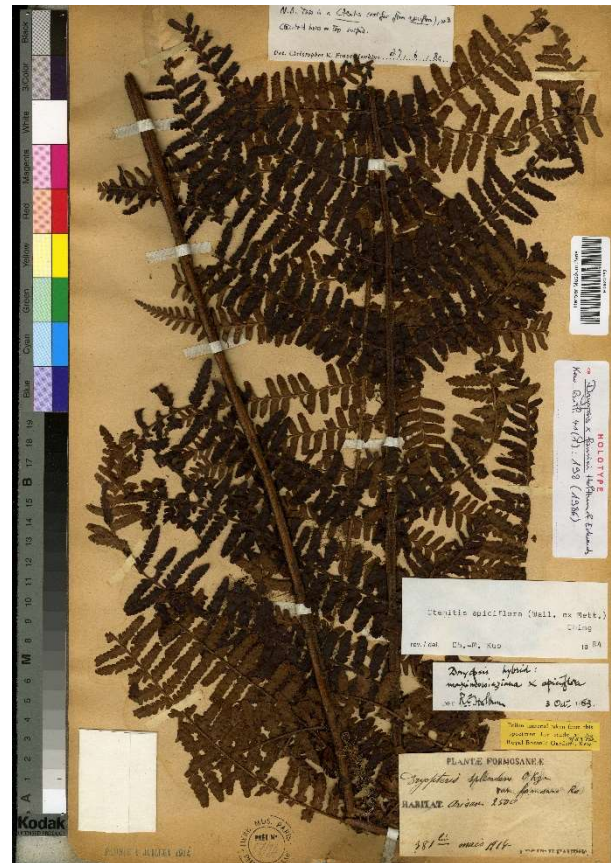


Fig. 4. Holotype of *Dryopteris* × *holtumii* L.B. Zhang (FORMOSA, Mt. Arisan; *U. Faurie* 381bis, May 1914; in P [P00642759]; the digital photo is courtesy from the holding herbarium P (MNHN)).

2007; Chao *et al.* 2017). After Hieronymus, S. Suzuki seems to be the first who recognized *P. fauriei* var. *fauriei* as different from *P. fauriei* var. *minor*. He identified the montane material (*Fukuyama & Suzuki s.n.*, from Aroe, Taitung, Taiwan, deposited in T) as the former name. However, he treated those collected from seacoast or isles in Northeast Taiwan as *P. quadriaurita* rather than *P. fauriei* var. *minor* (Suzuki 1936).

*Pteris quadriaurita* Retz. var. *abbreviata* Rosenst. was first described as a new variety by Rosenstock (1915) based on the specimens of *U. Faurie* 122 collected by *U. Faurie* from Keelung in North Taiwan. However, this variety was also often treated as a synonym of *P. fauriei* (e.g., Nakaike 1975; Li *et al.* 1975; Huang *et al.* 1994; Yang & Liu 2002; Wu *et al.* 2013). Although Tagawa (1937) considered *P. quadriaurita* var. *abbreviata* as nothing but a dwarf form of *P. faurie*, it is noteworthy that he also mentioned *P. quadriaurita* var. *abbreviata* as identical with *P. fauriei* var. *minor*. After reexamining the type photos as well as the descriptions of the protologues, we recognize that the latter viewpoint of Tagawa is correct. Since *P. fauriei* var. *minor* is documented to be different from and is thought to be a separable and differentiable



**Fig. 5.** Isolectotype of *Pteris quadriaurita* Retz. var. *abbreviata* Rosenst. (FORMOSA, in rupibus littoris Kelung; U. Faurie 122; in KYO; photographed by Dr. S.J. Moore).

taxon from the typical variety (Huang *et al.* 2006, 2007; Chao *et al.* 2017), we here treat *P. quadriaurita* var. *abbreviata* as a synonym under *P. fauriei* var. *minor*.

#### The triploid type variety of *Pteris fauriei*:

*Pteris fauriei* Hieron. var. *fauriei*, Hedwigia 55(4): 345. 1914. **Type:** FORMOSA (Taiwan), Tamsui, *A. Henry 1427* (syntypes: B [B\_20\_0128109], photo!; MO); FORMOSA (Taiwan), in silvis Maruyama, *U. Faurie 628* (syntypes: P [P00608404, P00608405 & P00608406], photos!); JAPAN, insula Oshima, *U. Faurie 4594* (syntypes: P [P00608407 & P00608408], photos!); Chinese name: 傅氏鳳尾蕨

#### The diploid variety of *Pteris fauriei*:

*Pteris fauriei* Hieron. var. *minor* Hieron., Hedwigia 55(4): 347. 1914. **Type:** FORMOSA (Taiwan), in rupibus littoris Kelung, *U. Faurie 685* (lectotype: B [B\_20\_0128121], here designated, photo!; isolectotypes: P [P00608401, P00608402 & P00608403], photos!; TI [1 sheet without herbarium number], photo!); Chinese name: 濱海傅氏鳳尾蕨

**Synonym:** *Pteris quadriaurita* Retz. var. *abbreviata* Rosenst., Hedwigia 56(5): 333. 1915. **Type:** FORMOSA (Taiwan), in rupibus littoris Kelung, *U. Faurie 122*, Mar. 1914 (lectotype: TI [1 sheet without herbarium number], here designated, photo!; isolectotypes: KYO [4 sheets without herbarium numbers], photos!), *syn. nov.*



**Fig. 6.** Lectotype of *Pteris fauriei* Hieron. var. *minor* Hieron. (FORMOSA, in rupibus littoris Kelung; U. Faurie 685 [B\_20\_0128121]; in B; the digital photo is courtesy from the holding herbarium B).

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