

Two Taxa of Ferns Newly Recorded to Taiwan

臺灣的兩個新紀錄蕨類植物

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Abstract

This paper describes the ferns *Diplazium esculentum* (Retz.) Sw. var. *pubescens* (Link) Tardieu et C. Chr., and *Schellolepis persicifolia* (Desv.) Pic.Serm. as newly recorded taxa to Taiwan. They are very rare possibly due to the fact that Taiwan is the northeastern marginal range of their distribution. According to the IUCN Red List criteria, their rare status in Taiwan was categorized as EN for *D. esculentum* var. *pubescens* and CR for *S. persicifolia*.

摘要

本文報導臺灣新紀錄的兩種蕨類植物—毛軸過溝菜蕨 (*Diplazium esculentum* (Retz.) Sw. var. *pubescens* (Link) Tardieu et C. Chr.) 及稜脈蕨 (*Schellolepis persicifolia* (Desv.) Pic.Serm.)。二者在臺灣的族群相當稀少，推測應係相對於各自的分布範圍而言，它們俱屬邊緣分布之故。根據國際自然保育聯盟 (IUCN) 的評估準則，二者在臺灣的保育等級分別列為瀕臨滅絕及嚴重瀕臨滅絕。

Key words: *Diplazium esculentum* var. *pubescens*, IUCN, new records, *Schellolepis persicifolia*, Taiwan

關鍵詞：毛軸過溝菜蕨、國際自然保育聯盟、新紀錄、稜脈蕨、臺灣

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Introduction

Taiwan is an island situated off the southeastern coast of mainland China at 21°45'N~25°56'N, and 120°E~122°E in the transition zone between the tropical region and the temperate region. It is a hub of plant interchanges among the Japanese archipelago, the Ryukyu Islands, South China, the Philippines, and even Malaya (Kuo 1985). Its geographical location and mountainous topography provide it a rich and diverse vascular flora (Hsieh 2002), harboring about 630~650 (Moore 2000) or even over 700 (Knapp 2011) species and subspecies of ferns and lycophytes. Due to excellent dispersion ability of the spores (Moran 2008; Kessler 2010) and the presence of various air currents, such as

typhoons and monsoons, they have been blown in and out of this island for eons.

Diplazium esculentum (Retz.) Sw. var. *pubescens* (Link) Tardieu et C.Chr. and *Schellolepis persicifolia* (Desv.) Pic.Serm. are, respectively, an Asiatic fern and a Paleotropical fern. They were recently discovered in Taiwan. Based on their distribution patterns, it is postulated that they arrived in Taiwan recently via the southwesterly monsoon current or typhoon. They are very rare with restrict distribution, perhaps due to the fact that Taiwan is the northeastern margin range of their distribution and they are new arrivals.

This paper provides taxonomic treatments of the two taxa and categorizes their rare status in Taiwan according to the IUCN Red List criteria (IUCN 2001, 2003).

Taxonomic Treatment

1. *Diplazium esculentum* (Retz.) Sw. var. *pubescens* (Link) Tardieu et C.Chr. in Lecomte, Fl. Indo-Chine [P.H. Lecomte et al.] suppl. 270. 1940. — *Diplazium pubescens* Link, Hort. Berol. [Link] 2: 72. 1833. — *Callipteris esculenta* (Retz.) J.Sm. ex T.Moore et Houlston var. *pubescens* (Link) Ching, Acta Phytotax. Sin. 9 (4): 350. 1964.

毛軸過溝菜蕨 (毛軸菜蕨) Figs. 1 and 2.



Fig. 1. An overview of habitat and whole plant (young individual without sori) of *Diplazium esculentum* (Retz.) Sw. var. *pubescens* (Link) Tardieu et C.Chr.: at a site in Tonling Village, Wufeng District, Taichung City (photographed by Cheng-Wei Chen, 26 August 2011).



Fig. 2. A portion of lateral pinnae of *Diplazium esculentum* (Retz.) Sw. var. *pubescens* (Link) Tardieu et C.Chr. from Chungcheng Village, Ren-ai District, Nantou Co. (photographed by Tian-Chuan Hsu, 13 December 2011).

Morphology: Terrestrial. Rhizomes erect and stout, densely scaly. Scales brown to dark brown in color, lanceolate in shape, ca. 1 cm long and 1 mm wide, with sparse protruding teeth along the margins. Stipes 30-60 cm long, 3-5 mm wide, blackish at base, and covered with scales similar to those on rhizomes. Laminae 50-120 cm long, 30-60 cm broad, triangular or broadly lanceolate, the form changing with ages: young fronds pinnate with broader pinnae, later fronds bipinnate with narrower pinnules, and adult fronds often tripinnatifid; apex pinnatifid, acuminate. Pinnae 8-16 pairs, broadly lanceolate, lower ones petiolate. Pinnules 6-10 pairs, lanceolate, 4-6 cm long, 6-10 mm wide; apex acuminate, base truncate, subsessile, crenate to shallowly lobed, dentate on margin. Abaxial sides of rachis, pinnae and pinnules densely covered with light yellowish hairs. Venation goniopteroid. Sori linear, borne along the veinlets, indusiate.

Distribution: India, Myanmar, South and Southwest China, and North Vietnam. Taiwan might be its NE margin.

Habitat: Two populations were found in lowlands of the central Taiwan. One had 5 or 6

individuals in an area of about 5 m² somewhat-shaded sandlot beside stream bed at an elevation of about 500 m. The other had over 100 individuals at an area of about 500 m² along ditches with full sun light exposure at an elevation of about 300 m.

Reproductive mode: 64 spores per sporangium were found from the Taiwanese specimens, suggesting that the reproductive mode of *D. esculentum* var. *pubescens* is sexual reproduction (Takamiya *et al.* 2001).

Specimens examined: Taiwan, Taichung City : Wufeng District, Tonlin Village, *P.-F. Lu 21207* (TAIF), *Y.-H. Chang 20101229-009* (TAIF); Nantou County: Ren-ai Township, Chungcheng Village, *Y.-H. Chang 20111213-001 ~ 008* (TAIF).

Conservation category based on IUCN:
EN B2ab(ii,iii),c(ii)

Remarks: The variety *D. esculentum* var. *pubescens* is distinguishable from the typical *D. esculentum* var. *esculentum* by the pubescent lower surfaces of rachis, pinnae, and pinnules for the former but the glabrous surfaces for the latter.

II. *Schellolepis persicifolia* (Desv.) Pic.Serm., *Webbia* 28: 470. 1973. — *Polypodium persicifolium* Desv., *Berl. Mag.* 5: 316. 1811, ('*persicaefolium*'). — *Goniophlebium persicifolium* (Desv.) Bedd., *Suppl. Ferns S. Ind.* 21. 1876, ('*persicaefolium*').

稜脈蕨 Figs. 3, 4 and 5.

Polypodium grandidens Kunze ex Mett., *Bot. Zeit.* (Berlin) 4: 423. 1846. — *Goniophlebium grandidens* (Kunze ex Mett.) Fée, *Mem. Foug.*, 5. Gen. Filic. 255. 1850-1852. — TYPE: *G. H. Mettenius*

s.n. (holo, LZ, destroyed; Iso, MO, photo!), from a cultivated plant in Hortus Botanicus, Leipzig, Germany, 1858.

Goniophlebium rotense Hosok., Trans. Nat. Hist. Soc. Formosa 31: 476. 1941; *ibid.* 32: 286. 1942.

— TYPE: *T. Hosokawa 7622* (holo, TAI!), from Rota Is., Marianas, Micronesia, Jul. 13, 1934.

Goniophlebium cuspidatum auct. non (D. Don) C. Presl (1836): Bedd., Ferns Brit. India 79, pl. 79. 1865.

Morphology: Epiphytic. Rhizomes long-creeping, ca. 5-7 mm wide, densely scaly when young but easily deciduous when old. Scales ovate-lanceolate, acuminate, ca. 3-4 mm long, 1.5 mm wide, dark brown, margin ciliate. Stipes remote, articulate, ca. 30-40 cm long, 3-4 mm wide, stramineous, glabrous except bases. Lamina broadly lanceolate, ca. 70-120 cm long, 12-25 cm wide, imparipinnate. Terminal pinnae almost the same as those of lateral ones. Rachis covered with plentiful linear scales when young, gradually glabrous when maturing. Lateral pinnae ca. 10-25 pairs, lanceolate, petiolate, articulate, apex acuminate, base cuneate, margin serrate, glabrous. Costa prominent, both sides scaly when young, and becoming glabrous when growing. Venation reticulate (goniophlebioid pattern) forming 2-3 rows of costal areolae; each areolae with an included veinlet. Sori sound, often yellowish, exindusiate, borne on the tips of included veinlets, in one row on either side of costa, usually sunken in cavities.

Distribution: From the Himalayas through Malaya to the Pacific islands, including India (Assam), South China (Hainan), Thailand, Vietnam, the Philippines (Luzon and Mindanao), Malaysia, Indonesia (Sumatra, Java, Borneo, Sulawesi,

Moluccas, and New Guinea), Solomon Islands and Micronesia. Taiwan might be its NE margin range.

Habitat: Only 5 or 6 individuals were found on three short and dead trunks of *Sphaeropteris lepifera* (J.Sm. ex Hook.) R.M. Tryon at the Fushan Botanic Garden, Ilan Co., NE Taiwan, at an elevation of about 700 m: the rainforests with wet climate year round.

Reproductive mode: Chinese specimens show sexual mode of reproduction by having 72 diploid somatic chromosomes and 64 spores per sporangium (Kato and Nakato 1999). Taiwanese specimens have 64 spores per sporangium also suggesting the sexual reproduction.

Specimens examined: Taiwan, Ilan County: Yuanshan Township, Fushan Botanical Garden, *Y.-H. Chang 20100607-015, 20100628-001 & 20110809-004* (TAIF); Philippines, Mindanao: Bukidnon Province, Impasug-ong Municipality, Mt. Kitanglad, *V. B. Amoroso et al. 268 & 358* (TAIF); Micronesia, Marianas: Rota Is., *T. Hosokawa 7622* (TAI).

Conservation category based on IUCN: CR D



Fig. 3. An overview of two individuals of *Schellolepis persicifolia* (Desv.) Pic.Serm. growing closely on a short and dead trunk of *Sphaeropteris lepifera* (J.Sm. ex Hook.) R.M.Tryon in Fushan Botanical Garden, Yuanshan Township, Ilan Co. (photographed by Wei-Hsiu Wu, 7 June 2010).



Fig. 4. A basal segment of lateral pinnae of *Schellolepis persicifolia* (Desv.) Pic.Serm. from Fushan Botanical Garden, Yuanshan Township, Ilan Co. (photographed by Wei-Hsiu Wu, 7 June 2010).

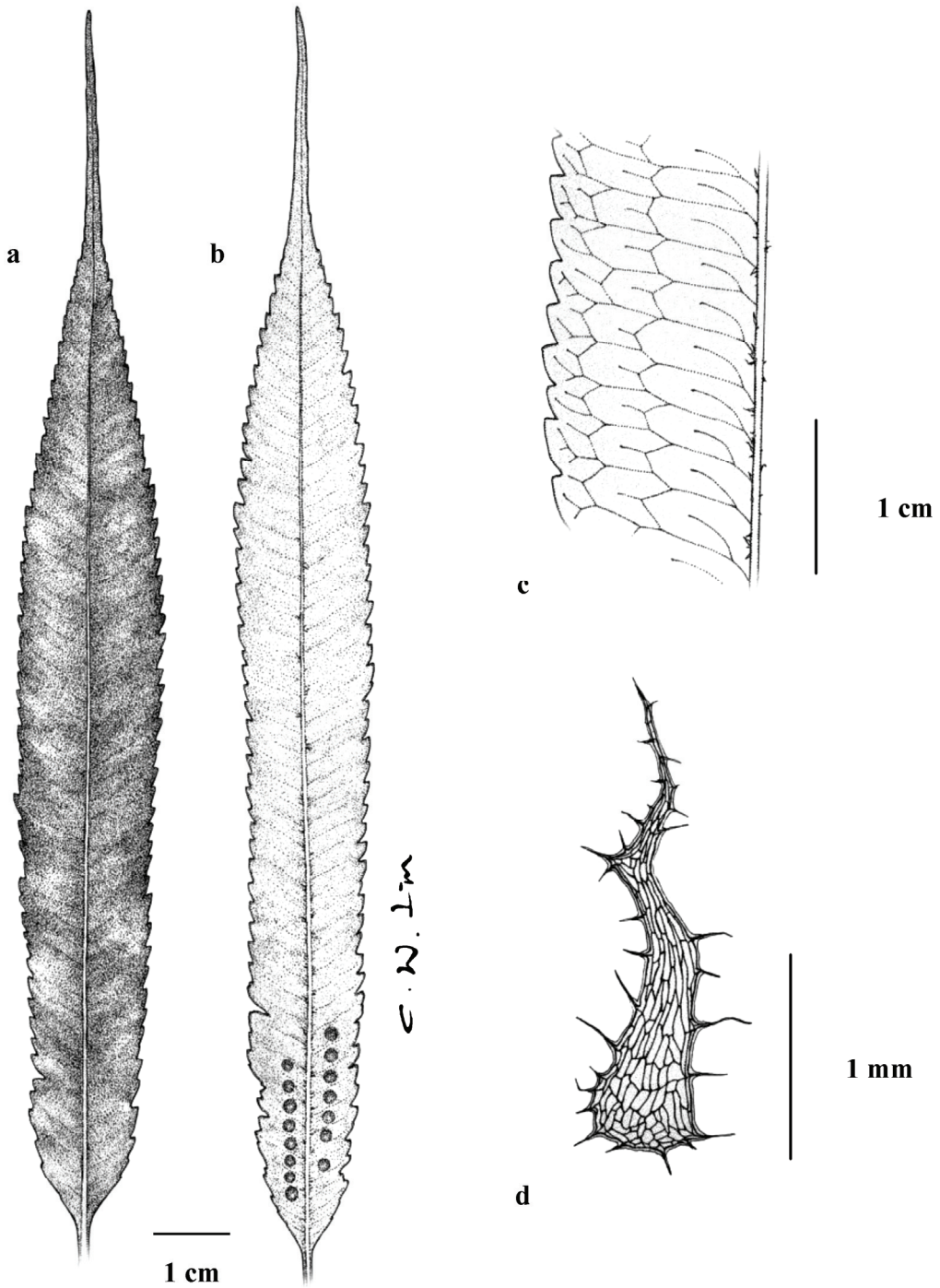


Fig. 5. *Schellolepis persicifolia* (Desv.) Pic.Serm. (a, the upper surface of lateral pinnae; b, the lower surface of lateral pinnae with sori; c, venation; and d, scale on the lower surface of lateral pinnae).

Discussion

The genus *Schellolepis* was established by John Smith (1866), and *S. percussa* (Cav.) Pic.Serm. was lectotypified by Rodl-Linder (1990). A number of the species included in the genus varies from about 9 species (Rodl-Linder 1990: *percussum* group) to about 20 species (Wu and Ching 1991; Lu 2000), depending on which species concept is applied. The circumscription of the genus is mainly from Malaysia through the Philippines and Indonesia to Fiji, but a few of the members expanded the distribution to the subtropical Asia. The key characteristics to separate this genus from the other genera in the family Polypodiaceae are imparipinnate lamina, the terminal pinnae conforming with the lateral ones, all the lateral segments articulate to rachis, sori more or less sunken, and exospore smooth.

Rodl-Linder (1990) and Rodl-Linder *et al.* (1990) emended the definition of the genus *Goniophlebium* to incorporate most of the members of Asiatic *Polypodium sensu lato* which have goniophlebioid venation patterns, including *Metapolypodium* Ching, *Polypodiastrum* Ching, *Polypodiodes* Ching, and *Schellolepis* (J.Sm.) J.Sm. as its synonyms. This scheme was supported by some molecular phylogenetic analyses (Schneider *et al.* 2004 a & b; Kreier *et al.* 2008) as the goniophlebioid lineage was proven to be monophyletic. However, based on cpDNA phylogenetic tree with more intensive sampling, Lu and Li (2006) indicated that the genera *Metapolypodium*, *Polypodiastrum*,

Polypodiodes and *Schellolepis* formed their own monophyletic sub-clades within the *Goniophlebium* clade, and thus, they should be recognized as the separate genera as defined by Ching (1978). We herein follow Lu and Li (2006) and Ching (1978) to use the name *Schellolepis persicifolia* instead of *Goniophlebium persicifolium*.

Schellolepis persicifolia was first discovered in Taiwan by Mr. Wan-Bin Chen, a technician at the Fushan Botanical Garden, in 2010. It is a newly recorded genus to Taiwan. Sori of *S. persicifolia* found in Taiwan occur only on the basal part of the lower pinnae (Figs. 4, 5). This differs from the typical specimens of which the sori occur on the entire part of most of the pinnae. Whether *S. persicifolia* in Taiwan is a marginal resident in its distribution range and has not fully adapted to the new habitat requires a further investigation.

In Taiwan there is another goniophlebioid species *Polypodiastrum mengtzeense* (Christ) Ching similar to *S. persicifolia*. The main difference between the two species is that all of the pinnae are free for the latter, whereas the ones of at least the one-third of the upper frond are adnate to the rachis for the former. *P. mengtzeense* is common in the mountains at the medium elevations in Taiwan, but for a long time it has been misidentified as *Goniophlebium argutum* (DeVol and Kuo 1975) or *Polypodium argutum* (Shieh *et al.* 1994).

S. persicifolia is also easily misidentified from *Phymatosorus cuspidatus* (D.Don) Pic.Serm. However, the pinnae of the upper fronds of the latter are adnate to the rachis and the margins

of the pinnae are entire.

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