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Athyrium puncticaule (Blume) T. Moore (Woodsiaceae), New to Taiwan

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ABSTRACT: *Athyrium puncticaule* is recorded for the first time from Taiwan. Most specimens of this species deposited in Taiwanese herbaria have been misidentified as *Athyrium anisopterum*. It can be distinguishable by densely covered unicellular hairs on the fronds and morphology of pinnae. The authors present a description, illustration, photographs and notes about this new addition to the Taiwanese fern flora and its distinction from other species.

KEY WORDS: ***Athyrium puncticaule*, *Woodsiaceae*, New record, Taiwan.**

INTRODUCTION

During study of Taiwanese *Athyrium* taxonomy, the first author found an unidentified species resembling *Athyrium ansiopterum* Christ but differing that in certain important features and overall aspect. It was recognized by him from both Taiwan and N. Borneo. On sending an account of it as a potential new taxon to the second author, who has studied Himalayan *Athyrium*, the latter replied that he suspected from the description that it must be *Athyrium puncticaule* (Blume) T. Moore. On studying photographs of it he confirmed it to be that species, mentioning its range as known so far, and the first named author agreed with his determination after studying material of *A. puncticaule* in PE herbarium.

The presence of this species has hitherto been undetected in Taiwan, where it had been confused with a related species from the same section, *A. anisopterum*. This species is known from N.E. India, S. India, Sri Lanka, S. China (Yunnan), Thailand, Vietnam, Malaya, Sumatra, Java, N. Borneo and the Philippines (Fraser-Jenkins in press), but has never been reported from Taiwan previously.

The present study is mainly based on the first author's field observations. In addition he has examined the material of *Athyrium* deposited in the following herbaria: TAI: Herbarium of Taiwan University, Taipei. TAIF: Herbarium of Taiwan Forest Research Institute, Taipei. HAST: Herbarium, Research Center for Biodiversity, Academia Sinica, Taipei. SYSU: Herbarium, Department of Biological. Sciences, National Sun Yat-Sen University, Kaohsiung. TNM: Herbarium, National Museum of Natural Science, Taichung. PE: Institute of Botany, Chinese Academy of Sciences, Beijing.

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Key to the species of *Athyrium* Sect. *Polystichoides* in Taiwan

1. Adaxial surface of rachis glabrous ..... *A. anisopterum* Christ
1. Rachis pubescent on both surfaces 2
2. Fronds pinnate, pinna-margin crenate ..... *A. nakanoi* Makino
2. Fronds bipinatifid, pinna-margin serrate ..... *A. puncticaule* (Blume) T. Moore

Sect. *Polystichoides* Ching & Y. T. Hsieh consists of species with asymetrical ultimate segments, more developed on their acroscopic side, bearing no setae above the midribs of the ultimate segments, and with curved sori and perisporiate spores. Although the Taiwanese species are relatively easy to distinguish from each other, there is a common species present in the W. and E. Himalayan region, S. India, Myanmar, S. E. Tibet and S. W. China (Yunnan), *A. foliolosum* T. Moore *ex* R. Sim (syn.: *A. austroyunnanense* Ching, *A. submacrocarpum* Ching & S. K. Wu), which is very closely similar to *A. puncticaule* and which has for many years been confused with it in India and widely misreported there under that name. Apart from the distribution mentioned above, *A. puncticaule* is confined in India to the far N. E., from where it has only been recognized by Fraser-Jenkins (1997).

The two species have approximately the same degree of dissection, though *A. foliolosum* becomes

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bipinnate, and have similar segments, though those of *A. puncticaule* are often more rounded and those of *A. foliolosum* are usually smaller. But the laminar texture of *A. puncticaule* is more succulent and brittle; in addition *A. foliolosum* has no glandular hairs on the rachis. The spores of *A. foliolosum* are smaller and paler in colour, with a wider, clearer, seamed and box-like perispore and the two are cytologically different, *A. foliolosum* being a diploid sexual species and *A. puncticaule* being tetraploid sexual (see Fraser-Jenkins in press). The name *A. foliolosum* has long been misapplied in the Indo-Himalayan region to *A. fimbriatum* in error, following Hope (1902).

TAXONOMIC TREATMENT

Athyrium puncticaule (Blume) T. Moore *Index Filicum* 186. 1860. Figs. 1-3

Aspidium puncticaule Blume, *Enum. Plant. Javae* 2: 159: 1828.
Athyrium lanceum (Kunze) T. Moore, *Index Filicum* 185. 1860.
Athyrium fallax (Mett.) Milde, *Fil. Eur. Atlant.* 49. 1867.
Athyrium halconense Christ, *Philipp. J. Sci., Bot.* 3: 273. 1908.
Athyrium hochreutinieri Christ, *Ann. Cons. Jard. Bot. Genève* 15-16: 197. 1912.

Rhizome erect, 5-30 cm long, the apex clothed with thin brown entire scales c. 5 mm long and 2 mm wide. Stipes tufted, 10-15 cm long, bearing scattered scales (similar to those of the rhizome) almost throughout. Lamina lanceolate, 20-40 cm long, 8-10 cm wide, bipinnatifid or the basal acroscopic lobes of lower pinnae free; pinnae 18 pairs below the narrowly deltate, deeply lobed apex of the frond, short stalked, spreading or somewhat ascending except the lowest which are deflexed and usually somewhat reduced, strongly auriculate at the base on the acroscopic side; largest pinnae about 5 cm long and 0.9 cm wide above the base (the auricle at the base up to 0.9 cm long), the lower base narrowly cuneate, the margins above the auricle lobed about half-way to the costa, the lobes oblique, rounded, entire or somewhat toothed, the apex of the pinna acuminate; veins in the basal auricles and larger lobes pinnate, in the smaller lobes forked once or twice; rachis beneath bearing a few scales and also scattered erect short unicellular hairs; costae, costules and veins beneath bearing scattered multicellular glandular hairs; upper surfaces pubescent; texture herbaceous. Sori medial on the veins, the basal ones in the lower lobes round with reniform indusia, the more distal ones often hooked or broadly linear with indusia of corresponding shape; indusia serrated at their edge, broad (1.8 mm diameter in reniform sori), arched over the sporangia, also bearing glandular hairs. Spores large, mid- to darkish brown, perispore of retate type.

Specimens examined: TAIWAN: Taitung Co. Hsiaokueihu 23° 06' N, 120° 48' E, 1600 m., *Chen, J. F.* 135 (TAIF); *Wang, B. J.* 16633 (TAIF); *Leong, W. C.* 2687 (HAST). Pingtung Co. Payuchih 22° 44' N, 120° 53' E, 1600 m. *Chiou, W. L.* 10470 (TAIF); Chinshuiyin 22° 25'N, 120° 44' E. 1600 m., *Liu, Y. C.* 2216, 2222 , 3209 (SYSU); 1500-1700 m., *Lu, P. F.* 7676 (TAIF); *Tzeng, Y. H.* 940 (TAIF); *Wang, B. J.* 17724 (TAIF); *Wang, B. J.* 17286, 18076, 17417 (HAST); *Leong, W. C.* 1464 (HAST); Hsu, C. C. et Kuoh s.n. (TAI).

Notes: *Athyrium anisopterum* was first recorded from Taiwan by Hayata (1914) as *Dryopteris thysanocarpa* Hayata (*Athyrium thysanocarpum* (Hayata) Hayata), *comb. in syn.*), which was validly synonymised into *A. anisopterum* by Tagawa (1935).

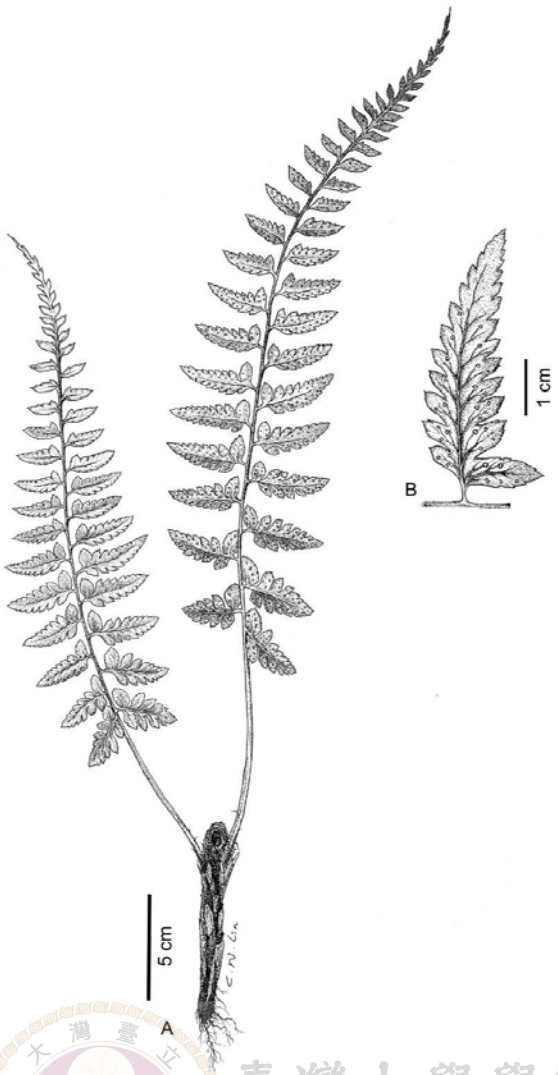


Fig. 1. *Athyrium puncticaule* (Bl.) Moore. A: Habit of plant. B: A pinna showing position of sori.

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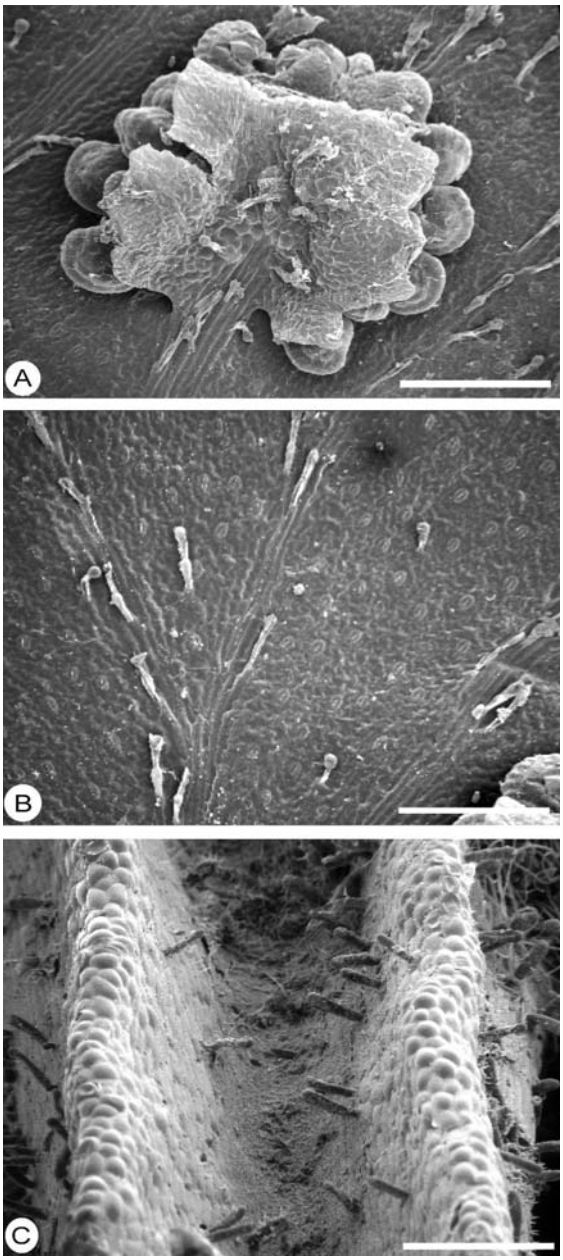


Fig. 2. A: An indusium showing glandular hairs. B: Glandular hairs on the lamina. C: Unicellular hairs in grooves of the rachis. Bar = 500 μm.

Following this, Taiwanese botanists have recognised this species with no difficulty, but they are unfamiliar with *A. puncticaule* in Taiwan (e.g. DeVol and Kuo, 1975; Kuo, 1985; Shieh et al., 1994; Kuo, 1997). Liu et al. (2000) made the first observations on *A. puncticaule* when recording its spore ornamentation by SEM study. But as they observed no difference in spore-morphology between the two species they identified it as *A. anisopterum* Christ. The same misidentification was also made by other botanists in Taiwan. Even though there are several specimens of *A. puncticaule* in various herbaria in Taiwan all of them have been misidentified as *A. anisopterum*.

Though closely related, several important diagnostic differences in morphology exist between *A. puncticaule* and *A. anisopterum*. The type specimen of *A. anisopterum* (Yunnan, *A. Henry*, photo PE!) and various descriptions (Christ, 1898; Wang, 1999; Tagawa and Iwatsuki, 1988), as well as the author's own study of specimens show that *A. anisopterum* has obtuse pinna- and lobe-apices, whereas *A. puncticaule* has more acuminate apices. Another important difference between both species concerns the microscopic appendages borne on the lamina. Christ (1898) did not describe these in his protologue, but the specimens from the same locality (PE!), and the description by Wang (1999) show that *A. anisopterum* has a glabrous lamina, rachis and costa, apart from the scattered, brown linear-lanceolate scales on the abaxial surface of the rachis and costae, which are common to both species. By contrast, *A. puncticaule* is densely covered with minute unicellular hairs on the rachis and costae, interspersed with scattered multicellular glandular hairs on the rachis, costae, lamina and indusia (Fig. 2). These appendages are the most diagnostic characteristic for identification of *A. puncticaule* and to distinguish it from *A. ansiopterum.*

Specimens of *A. anisopterum* examined: Holotype: A. Henry 10109 (P, photograph in PE!) Isotype: *A. Henry* 10109 (MO, photograph from website). CHINA: Yunnan, *Chu, W. M.* 8600, 8670 (PE). TAIWAN: Hsinchu Co., *Simozawa, I. s. n.* July 13, 1938. (TAI); *Lu, P. F.* 4419 (TAIF); Miaoli Co., *Lu, P. F.* 4600, 4601, 4602 (TAIF); Taichung Co. *Wang, J. C.* 12037 (HAST); *Liu, C. H.* 152 (HAST); Nantou Co., *Liu, Y. C.* 3621 (SYSU); *Kuo, C. M.* 11991 (TAI); Chiayi Co., *Wang, C. M.* et al. 5146, 5866 (TNM); *Wang, B. J.* 18613 (TAIF); Pingtung Co., *Liu, Y. C.* 3635 (SYSU); *Hsu, J. W.* 3953, 3954 (HAST).

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Fig. 3. Wild plant of *Athyrium puncticaule* in Taiwan (*Liu, Y. C.* 3209). The erect rhizome is up to c. 20 cm long.

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摘　　要

本文報告臺灣產蹄蓋蕨科新紀錄種：密腺蹄蓋蕨。本種過去多被錯誤鑑定為宿蹄蓋蕨，其植株密被單細胞腺毛為其主要區別特徵，其羽片型態亦異於宿蹄蓋蕨。本文提供密腺蹄蓋蕨之型態描述、手繪圖、毛被物以及生態照片，並於文中描述該種與其他相近種之型態差異。

關鍵詞：密腺蹄蓋蕨、蹄蓋蕨科、新紀錄、臺灣。

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