

Research note

***Diplazium maonense* Ching, a Poorly Known Species of the Athyriaceae (Pteridophyta) in Taiwan**

Shann-Jye Moore,¹⁾ Tsung-Hsin Hsieh,²⁾ Yao-Moan Huang,³⁾
Wen-Liang Chiou^{3,4)}

【 Summary 】

Herein, *Diplazium maonense* Ching is confirmed to grow in Taiwan. The morphological description and a key to related *Diplazium spp.* are provided. The chromosome number of the sporophyte was counted 123 which indicates it is a triploid. The spore number per sporangium is 32. The first young frond is pinnate. All these characteristics indicate that its sporophytes are reproduced through apogamy.

Key words: Athyriaceae, chromosome number, *Diplazium maonense*, fern, Pteridophyta.

Moore SJ, Hsieh TH, Huang YM, Chiou WL. 2002. *Diplazium maonense* Ching, a poorly known species of the Athyriaceae (Pteridophyta) in Taiwan. Taiwan J For Sci 17(1):113-118.

研究簡報

紀台灣一鮮為人知的蹄蓋蕨科植物：馬鞍山雙蓋蕨

牟善傑¹⁾ 謝宗欣²⁾ 黃曜謀³⁾ 邱文良^{3,4)}

摘 要

本文確定馬鞍山雙蓋蕨生長於台灣，文中描述其形態並提供一檢索表。本種孢子體(2n)染色體數為123，顯示為三倍體；每個孢子囊內含32顆孢子；第一片孢子葉為一回羽狀複葉，此等特徵顯示本種孢子體係由無配生殖的方式所產生。

關鍵詞: 蹄蓋蕨科、染色體數、馬鞍山雙蓋蕨、蕨類、蕨類植物門。

牟善傑、謝宗欣、黃曜謀、邱文良。2002。紀台灣一鮮為人知的蹄蓋蕨科植物：馬鞍山雙蓋蕨。台灣林業科學 17(1)：113-118。

¹⁾Department of Biology, National Taiwan Normal University, 88 Sec. 4, Tingchou Rd., Taipei 116, Taiwan. 國立師範大學生物系，台北市 116 汀州路四段 88 號。

²⁾Department of Science Education, National Tainan Teachers College, 33 Sec. 2, Shulin St., Tainan 700, Taiwan. 國立台南師範學院科學教育系，台南市 700 樹林街 2 段 33 號。

³⁾Division of Forest Biology, Taiwan Forestry Research Institute, 53 Nanhai Rd., Taipei 100, Taiwan. 行政院農業委員會林業試驗所森林生物系，台北市 100 南海路 53 號。

⁴⁾Corresponding author 通訊作者 Email: chiou@serv.tfri.gov.tw

*The research program of TFRI 90 Science-08-1. 林試所科技計畫 90 科技-08-1。

Received October 2001, Accepted December 2001. 2001 年 10 月送審 2001 年 12 月通過。

TEXT

Diplazium maonense Ching is distributed over southeastern China, including Fujian, Guangdong, and Hong Kong (Chu 1999). In Taiwan, it was possibly first collected by U. Faurie from a hill in Keelung, northern Taiwan, according to the specimens examined, and Tagawa (1933) published it as *D. bantamense* Blume forma *serratum*. However, he possibly misidentified *D. donianum* as *D. bantamense* because the latter is only distributed in the Malay Archipelago, whereas the former is a Pan-East-Asian species. Tagawa (1941) then mentioned that *D. bantamense* forma *serratum* was possibly only a dwarf individual of *D. crassiusculum* Ching. Based on the morphology of the terminal pinna, Tagawa (1962) thought that it was a synonym of *D. lobatum* and added a question mark before it. He also proposed it possibly belonged to a group of underdeveloped individuals of *D. lobatum*.

Of recent taxonomic studies in Taiwan, except for Shieh (1976) who followed Tagawa (1962), no other documents mention this taxon, e.g., DeVol and Kuo (1975), Kuo (1985), Shieh et al. (1994), and Kuo (1997, 1999). Although one of the pictures in the Manual of Taiwan Vascular Plants (Kuo 1997) looks similar to this taxon, the author listed it as *D. lobatum*. This picture was removed in the 2nd edition of that book (Kuo 1999) without any description of this name.

In this study, we collected the specimens and compared them with the types of related taxa and clearly identified it as *D. maonense* Ching. Thus, a key is provided to distinguish the related species of Taiwan. In addition, the chromosome number, the number of spores per sporangium, and young sporophytes were examined, and its reproductive behavior is discussed.

Diplazium maonense Ching in Hong Kong Nat 7:88. 1936; Edie, Ferns Hong Kong 215, fig. 120. 1977; Flora Fujianica 1: 102. 1982; Flora Reipubl Popul Sin 3(2): 495-6. 1999.----Type: Hong Kong, New Territories, Maonshan, 6, Apr 1906, C. G. Matthew *s.n.* (K!) (Fig. 1A).

--*Diplazium bantamense* Blume forma *serratum* Tagawa in Acta Phytotax Geobot 2:199. 1933; ----Type: Taiwan, in sylvis Kirun (Keelung), anno 1914, U. Faurie no. 165 (KYO!) (Fig. 1B).

--*Asplenium sylveticum* auct. non Hooker: Bentham in Flora Hong Kong 452. 1861, *pro parte*.

--*Diplazium crassiusculum* auct. non Ching: Tagawa in Acta Phytotax Geobot 10:280. 1941.

--*Diplazium lobatum* auct. non (Tagawa) Tagawa: Tagawa in Acta Phytotax Geobot 20:215. 1962, *pro parte*.

Terrestrial. Rhizome short to long-creeping, 3-5 mm thick, dark blackish brown, with leaves close or to 4-5 cm apart, scaly at apex and usually bare on the rest; scales narrowly lanceolate to linear, acuminate at apex, 4-6 mm long, blackish brown, toothed at margin. Stipes 20-45 cm long, stramineous, dark brown and scaly at base, adaxially grooved. Lamina pinnate, ovate to oblong-ovate, 25-50 cm long, 12-20 cm wide, with 4-8 pairs of lateral pinnae, widest at or near base, abruptly contracted and caudately long acuminate at apex. Rachis grooved above, open to costae grooves, papillate on grooved upper surface. Terminal pinna 5-12 cm long, 1.5-2.2 cm wide, with lobes in lower part (sometimes with 1-2 pairs of independent lobes). Lateral pinnae narrowly oblong-lanceolate, firm papyraceous; basal and middle pinnae about equal size, 8-12 cm long,



Fig. 1. Holotypes of 2 *Diplazium*. A: *D. maonense* Ching. B: *D. bantamense* Blume forma *serratum* Tagawa.

1.8-2.5 cm broad, with stalks 3-6 mm long; upper ones slightly smaller than lower ones; base rounded, broadly cuneate, or sometimes truncate, usually slightly asymmetrical; margin crenate, serrate near apex. Costae slightly grooved above, papillate on grooved upper surface near base, prominent beneath. Veins free, visible and plain on both surfaces (sometimes obscure or slightly grooved above), in groups at an angle of about 60° to costa; vein-groups 3-6 mm apart, usually catadromous in upper lateral pinnae, but sometimes changing to anadromous in lowest 1-2 pairs of pinnae, forking to pinnate (sometimes difficult to distinguish); those forking vein-groups forked near costa, acroscopic branch simple, basiscopic branch forked again 2-3

times; those pinnate vein-groups (usually occurring in larger leaves) with about 4 pairs of simple veinlets. Sori linear, usually from near base along 1/2-4/5 length of veinlets, double (the so-called diplazoid sori) on lowest acroscopic branch of vein-group, usually simple (asplenoid sori) on remainder; indusia the same shape as sori, entire or subentire at margin (Fig. 2).

The chromosome number counted from cells of the root tip is $2n = 123$ (Fig. 3). This indicates that it is a triploid plant. There were 32 spores in each sporangium. Spores were bilateral with winglike folds (Fig. 4) as illustrated in Liu et al. (2000) who did not identify their material and mentioned it as *Diplazium* sp. aff. *lobatum*.

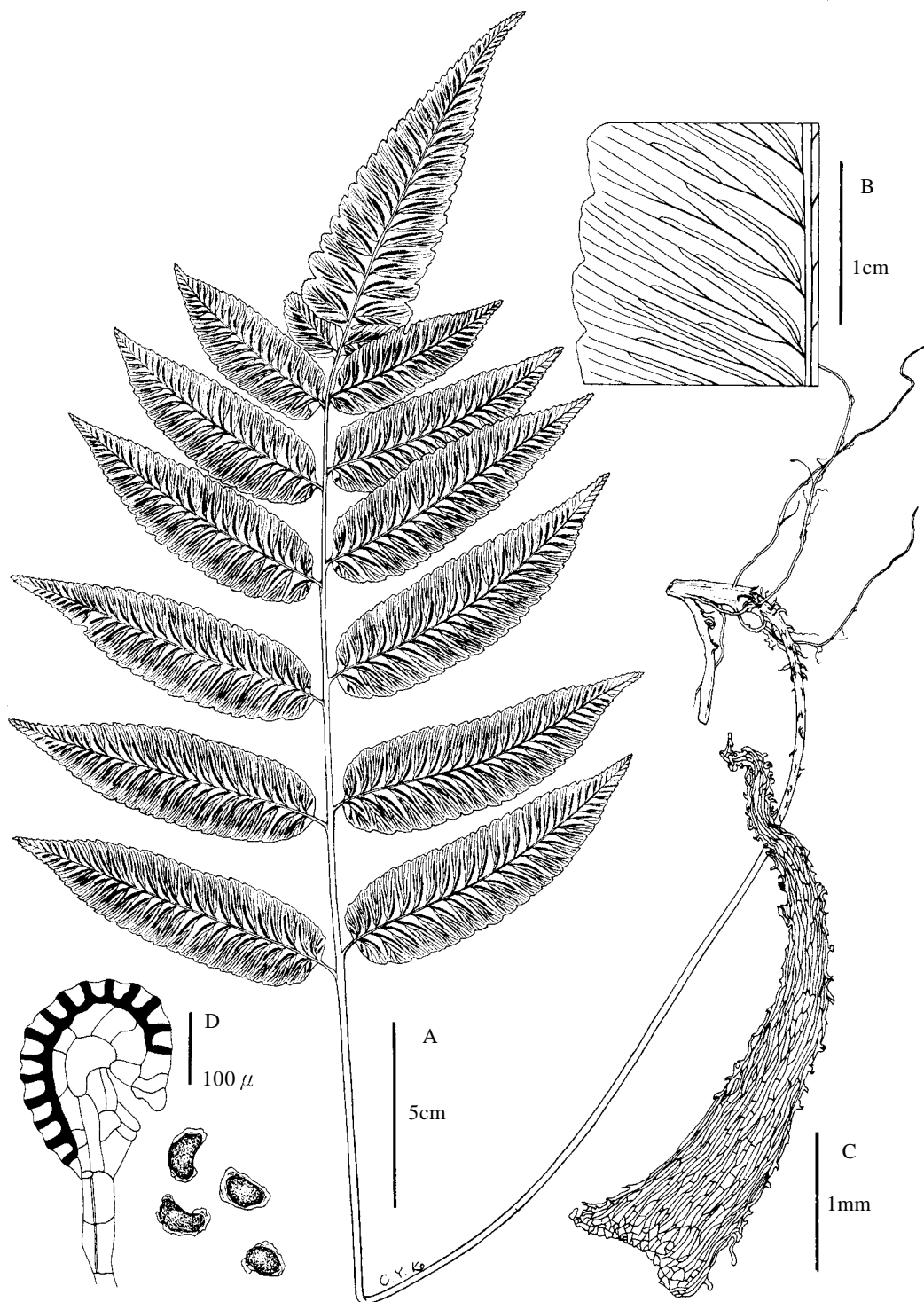


Fig. 2. Morphology of the sporophyte of *Diplazium maonense* (Moore 18580). A: plant. B: veins and sori. C: scale on stipe. D: sporangium and spores.

It grows sparsely in the understory of secondary forests at low elevations (50-400 m) of northern Taiwan. Both mature and young sporophytes appear in nature. The 1st sporophyte frond is pinnate (Fig. 5). The characteristics of the triploid chromosome, the 32 spores in a sporangium, and the pinnate 1st juvenile frond indicate that this species reproduces its sporophytes through apogamy.

Additional specimens examined: **Taiwan**. Taipei City: Hsiangshan, Y. H. Chang 3714, W. L. Chiou 14733, S. J. Moore 18385, 18580 (TAIF). Taipei Co.: Wulai, S. J. Moore 1761, 4027, 4029, 4045, 18695 (TAIF); Shuanghsi S. J. Moore 24939 (TAIF); Hsin-shan-mun-hu, Y. H. Chang 4101, 4102, 4104, S. H. Su 945 (TAIF). **Hong Kong**. Victoria,

Wilford 37 (K, Paratype).

The following key is provided to aid in identifying the taxa morphologically related to *D. maonense* in Taiwan. *Diplazium donianum* var. *aphanoneuron* (Ohwi) Tagawa is included in this key although it is not mentioned in most articles published in Taiwan, e.g., DeVoi and Kuo (1975), Kuo (1985, 1997, 1999), even though it is treated as a synonym of *D. donianum* (Mett.) Tard.-Blot (Shieh 1976). On the other hand, it is reported to grow in Taiwan in other articles published elsewhere (Nakaike 1992, Iwatsuki 1992, Kato 1995; Chu 1999).

Key to taxa morphologically related to *Diplazium maonense* Ching in Taiwan

1. Terminal pinna lobed or with free lobes in



Fig. 3. Chromosomes of a root tip cell of *Diplazium maonense* ($2n = 123$). Bar = 5 μ m.

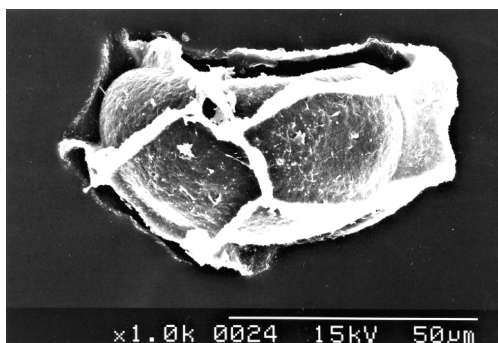


Fig. 4. Morphology of a *Diplazium maonense* spore from a SEM observation.



Fig. 5. First sporophyte frond from a cultured gametophyte of *Diplazium maonense*.

lower part

2. Pinnae crenate at margin and serrate near apex..... *D. maonense*

2. Pinnae entire at margin, or serrulate at upper part *D. lobatum*

1. Terminal pinna not lobed in lower part

2. Lateral veins visible *D. donianum*

2. Lateral veins hidden.....

..... *D. donianum* var. *aphanoneuron*

ACKNOWLEDGMENTS

We thank 2 anonymous reviewers for their useful comments; Dr. N. Murakami (KYO), Dr. R. J. Johns (K), Mr. P. J. Edwards (K), and Dr. Xian-Chun Zhang (PE) for their kind assistance of examining the specimens in their herbaria; and Ms. Chien-Yu Ko for drawing the picture (Fig. 2).

LITERATURE CITED

- Chu WM. 1999.** (ed.) Flora Reipublicae Popularis Sinicae Tomus 3(2). Beijing: Science Press. 566 p.
- DeVol CE, Kuo CM. 1975.** Athyriaceae. In: Li HL, Liu TS, Huang TC, Koyama T, DeVol CE, editors. Flora of Taiwan, Vol. 1. Taipei: Epoch Publishing. p 441-75.
- Iwatsuki K. 1992.** Ferns and fern allies of Japan. Tokyo: Heibonsha. 311 p.
- Kato M. 1995.** Woodsiaceae. In: Iwatsuki K, Yamazaki T, Boufford DE, Ohba H, editors. Flora of Japan. Vol. 1. Pteridophyta and Gymnospermae. Tokyo: Kodansha. p 195-231.
- Kuo CM. 1985.** Taxonomy and phytogeography of Taiwanese pteridophytes. *Taiwania* 30:5-100.
- Kuo CM. 1997.** Manual of Taiwan vascular plants. Vol. 1. 1st ed. Taipei: Council of Agriculture. 256 p.
- Kuo CM. 1999.** Manual of Taiwan vascular plants. Vol. 1. 2nd ed. Taipei: Council of Agriculture. 266 p.
- Liu YC, Kuo CM, Liu HY. 2000.** SEM studies on spores in Taiwanese fern genera. I. Athyrioids. *Taiwania* 45:181-200.
- Nakaike T. 1992.** New flora of Japan Pteridophyta (revised & enlarged). Tokyo: Shibundo. 868 p.
- Shieh WC. 1976.** An enumeration of indigenous pteridophytes in Taiwan 8. *Journ Sci Engin* 13:60.
- Shieh WC, DeVol CE, Kuo CM. 1994.** Athyriaceae. In: Editorial Committee of the Flora of Taiwan, 2nd edition, editors. Flora of Taiwan. Vol. 1. Taipei: Editorial Committee of the Flora of Taiwan, 2nd edition. p 414-48.
- Tagawa M. 1933.** Spicilegium Pteridographiae Asiae Orientalis V. *Acta Phytotax Geobot* 2:189-205.
- Tagawa M. 1941.** Studies on Formosan ferns 5. *Acta Phytotax Geobot* 10:275-89.
- Tagawa M. 1962.** *Diplazium donianum* and its allies of Ryukyu Islands, a preliminary account. *Acta Phytotax Geobot* 20:213-8.