

# *Adiantum capillus-junonis* Rupr.: An additional species of *Adiantum* L. (Pteridaceae) for Thailand

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Received 5 Jul 2011  
Accepted 18 Oct 2011

**ABSTRACT:** An addition to the pteridophyte flora of Thailand, *Adiantum capillus-junonis* Rupr., is reported for the first time. This new record is based on collections made in Phetchabun and Loei provinces. The species is described and illustrated.

**KEYWORDS:** Adiantaceae, fern, pteridophyte

## INTRODUCTION

*Adiantum* is a genus of about 150 species of ferns in the family Pteridaceae<sup>1–3</sup> (1), but some authors put it in its own family, Adiantaceae<sup>4</sup>. The species in this genus are distinctive in appearance, with dark, often black stipes and rachises, and bright green pinnae. The sori are borne submarginally, and on the reflexed flaps of leaf margin which function like indusia. Also, this modified margin has venation. Many species are particularly known for growing on limestone rocks or cliffs, nearby waterfalls, and other water seepage areas. The highest species diversity is in the tropical south America<sup>5</sup>. Comparatively, high diversity also occurs in eastern Asia, with nearly 40 species in China<sup>6</sup>.

Previously, 10 species of *Adiantum* were recognized in Flora of Thailand since 1985<sup>7</sup>. Then, the eleventh species, *Adiantum thongthamii* Suksathan, was found in Koh Chang, an Island in Trat province, eastern Thailand in 2004<sup>8</sup>. Later, the 12th species, *Adiantum phanomensis* S. Linds. & D. J. Middleton was found in a limestone hill at Khao Phanom, Surat Thani province, peninsular Thailand<sup>9</sup>. Boonkerd et al<sup>10</sup> reported the presence of a tropical American species, *Adiantum latifolium* Lam. which tends to escape from cultivation and becomes naturalized in the peninsular provinces of Thailand: Narathiwat, Yala, and Nakhon Si Thammarat. The 14th species was *Adiantum fragiliforme* C. Chr., an overlooked species in the Flora of Thailand account<sup>11</sup>. The type specimen of this maiden's hair fern was collected from Koh Chang, where additional specimens were collected by the first author of this paper. The 15th species,

*Adiantum membranifolium* S. Linds. & Suksathan was found on limestone cliffs in Chiang Mai, Chiang Rai, and Kanchaburi provinces<sup>12</sup>. In this most up-to-date paper, the authors also noted another overlooked species in the Flora of Thailand and the 16th species of Thai *Adiantum*, *A. gomphophyllum* Baker.

During a field trip in Nong Hin District, Loei province, a patch of *Adiantum* sp. was found on a limestone cliff. The specimens also matched with the previous two collections from Nam Nao District, Phetchabun province. Those specimens did not correspond with any known Thai *Adiantum* and were later found to belong to *A. capillus-junonis* Rupr. This species was previously known from China, Taiwan, and Japan. It was first described by Ruprecht in 1845 and has a wide distribution in China at altitudes ranging from 300–2500 m<sup>6</sup>.

## MATERIALS AND METHODS

This study is based on specimens collected from Phetchabun and Loei provinces. For comparison, we also examined herbarium material deposited in BM, C, P, K, L, and S (Herbarium acronyms are according to Ref. 13). Determinations were made with the help of keys to the species of *Adiantum* from China and Taiwan<sup>4,6</sup>.

## RESULTS

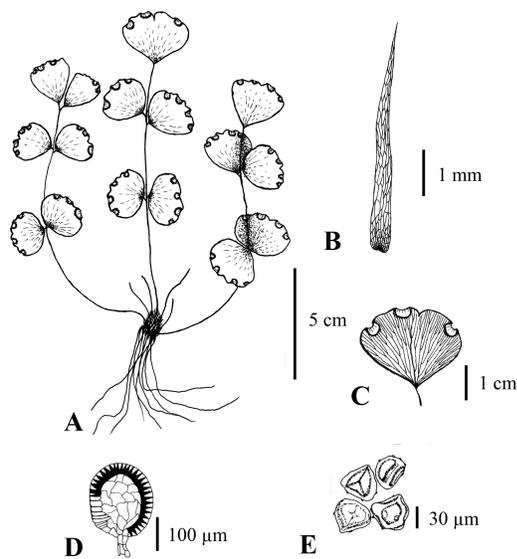
The morphological characters of the Thai specimens are consistent with the descriptions in Refs. 4, 6. They are also extremely similar to those of the type specimen of *Adiantum cantoniense* Hance in the Swedish Museum of Natural History Department of Phanerogamic Botany (S), which is now recognized as

*Adiantum capillus-junonis* Rupr., and to those of other specimens identified as *Adiantum capillus-junonis* at C and BM. Accordingly, *A. capillus-junonis* is a new record for Thailand. The description below is based on the Thai material.

## DESCRIPTION

*Adiantum capillus-junonis* Rupr. Dist. Crypt. Vasc. Ross. 49. 1845.—*Adiantum cantoniense* Hance, Ann. Sci. Nat., Bot., sér. 5, 15(229). 1861. Fig. 1.

*Plant* epipetric. *Rhizomes* short erect; covered with brown lanceolate scales, the scales 4–5.4 mm long, margin glabrous. *Stipes* 3.4–8.7 cm long, 0.12–0.54 mm in diam., deep-castaneous and polished, scales like those on rhizome, smooth upwards. *Laminae* simply pinnate, oblong-lanceolate, 3.5–13 cm × 3.5–5.5 cm; pinnae stipitate, 1–3 pairs, lateral pinnae opposite or subopposite; stalks 0.1–0.5 cm, articulated to pinnae at base of pinnae, persistent; lower pairs of pinnae 1.2–2.1 cm × 1.5–2.5 cm; pinnae circular to obtriangular, base broad cuneate to rounded, basal edges entire, upper margins rounded; fertile pinnae with 2–5 shallow sinuses, slightly denticulate to entire on sterile parts; sterile pinnae slightly denticulate to entire on upper margins; upper pin-



**Fig. 1** *Adiantum capillus-junonis*. A: Whole plant with 1-pinnate fronds; B: Rhizome scale; C: Pinna showing sori; D: A sporangium; E: Spores. Drawn by Sahanat Petchsri and Rossarin Pollawatn from *T. Boonkerd & S. Yannawat 002* (BCU).

**Table 1** Identification key from Ref. 7 amended to include *A. capillus-junonis*.

2. Pinnae with distinct stalk	
5. Pinnae hairy	7. <i>A. siamense</i>
5. Pinnae glabrous	
6. Pinnae crescent-shape, more than 2 cm long	
7. Rachis and stipe with distinct wings	4. <i>A. soboliferum</i>
7. Rachis and stipe without wings	5. <i>A. philippense</i>
6. Pinnae fan-shaped or obtriangular	
8. Upper margin of sterile pinnae crenate; sori up to 10 for each fertile pinnae	6. <i>A. erylliae</i>
8. Upper margin of sterile pinnae entire to slight denticulate; sori 2–5 for each fertile pinnae	15. <i>A. capillus-junonis</i>

nae and terminal pinnae similar; softly herbaceous or membranous, glabrous on both surfaces; veins dichotomous, prominent on both sides. *Sori* 2–5, at margin of pinnae, reflexed soral flaps oblong to reniform, about 1.2 mm broad, up to 3 mm long. *Sporangia* on short stalk, 1/3 as long as the capsule; capsule ca. 350 μm × 275 μm, with 28–30 indurated annulus cells. *Spores* trilete, mostly 56–62 μm diam.

*Specimens examined*.—*T. Boonkerd et al 2011–224*, *T. Boonkerd & S. Yannawat 002*, *P. Chantarnothai et al s.n.* (BCU); *Kittima & Narumon 670* (KKU).

*Thailand*. — Northeastern: Phetchabun (Nam Nao); Loei (Nong Hin).

*Distribution*. — Japan, China, and Taiwan.

*Ecology*. — On wet limestone rock walls in semi-shade, 600–900 m.

*Identification*. — *A. capillus-junonis* can be identified using key in Table 1.

## DISCUSSION

It can be seen from Table 1 and the Flora of Thailand<sup>7</sup> that *A. erylliae* and *A. capillus-junonis* are rather similar. They can be distinguished by habitat and a number of characteristics. *A. capillus-junonis*' habitat is restricted on wet limestone rocks, while *A. erylliae* is terrestrial or epipetric, and has been found growing on small rocks in dry dipterocarp forest and mixed deciduous forest. They also differ in rhizome scales. *A. erylliae* has bicoloured scales, while *A. capillus-junonis* has concolourous scales. Stipes and pinnae stalk of *A. erylliae* are usually black and polished, while *A. capillus-junonis* has deep castaneous and polished. Pinnae of *A. erylliae* is usually obtriangular in shape, whereas that of *A. capillus-junonis* is circular or obtriangular. *A. erylliae* has up to 10 sori per pinna, each sorus arising in close proximity. *A. capillus-junonis*, on the other hand, has, on each pinna, 1–5

sori, scattered irregularly with some distance between each other.

The description of *Adiantum capillus-junonis* given here is based on the Thai specimens. It is important to note that Chinese plants have a character of walking fern, i.e., when the frond tips touch moist ground, a new fern can grow. The lack of such a character in Thai plants is probably due in part to their particular habitat on rock walls and cliffs, which makes it unlikely for the frond tips to touch the moist ground below.

Moreover, Thai plants are rather smaller in sizes of fronds and pinnae and have smaller number of lateral pinnae than Chinese plants. *A. capillus-junonis* grows naturally in China, Taiwan, and Japan. Our finding is the first report of this maidenhair fern outside eastern Asia region. So far, there is no record of this species in Laos, Cambodia, Vietnam, or Malaysia<sup>14–16</sup>. Geographically speaking, Nam Nao District in Phetchabun province is likely to be the southernmost station of *A. capillus-junonis*. It is also worth mentioning that *A. capillus-junonis* has an altitudinal range of 600–900 m in Thailand, while it is found on wet or muddy rocks in semi-open places at 300–2500 m in China<sup>6</sup>.

**Acknowledgements:** This work was supported by the National Research University Project of CHE and the Ratchadaphiseksomphot Endowment Fund (CC270A). We are also indebted to Chulalongkorn University for funding our visit to the main herbaria in Europe, through the Plants of Thailand Research Unit. The first author wishes to express his sincere thanks to the curators and staff of the following herbaria: BM, K, L, P, and S for kindly granting him permission to study their herbarium specimens. We also thank Pranom Chantaranothai and his staff at Applied Taxonomic Research Centre, Khon Kaen University for providing information for the collecting site at Nam Nao District and Sahanat Petchsri for assistance in drawing Fig. 1.

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