

Original Article

## *Tectaria kehdingiana* (Kuhn) M.G. Price (Tectariaceae), a lesser-known species from Peninsular Thailand

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### Abstract

An addition to the known Thai Flora, a species of ferns, *Tectaria kehdingiana* (Kuhn) M.G. Price has been found in Nakhon Si Thammarat Province, peninsular Thailand. This species is described and illustrated.

**Keywords:** *Tectaria kehdingiana*, *Tectaria shahidaniana*, fern, pteridophyte

### 1. Introduction

*Tectaria* was first described as a genus by Cavanilles in 1799 (Cavanilles, 1799). The genus is terrestrial or epipetric and comprises about 150 to 210 species in the tropics (Kramer, 1990; Holttum, 1991). It was previously placed in the family Aspidiaceae (Pichi Sermolli, 1977), in Dryopteridaceae (Kramer, 1990; Moran, 1993; Tagawa and Iwatsuki, 1988) and in Dennstaedtiaceae (Rusea *et al.*, 2004). Currently, the genus is placed in its own family Tectariaceae (Panigrahi, 1986; Smith *et al.*, 2006; Mabberley, 2008; Christenhusz *et al.*, 2011). Twenty five species have been enumerated in the flora of Thailand since 1988 (Tagawa and Iwatsuki, 1988). Later, *T. manilensis* (C. Presl) Holttum was removed from the genus *Ctenitis* and was added to the Thai *Tectaria* account in 1989 (Tagawa and Iwatsuki, 1989). Then, four more species, i.e., *T. brachiata* (Zoll. & Moritzi) C.V. Morton, *T. keckii* (Luer) C. Chr., *T. pilosa* (Fée) R.C. Moran, and *T. siifolia* (Willd.) Copel. (Boonkerd and Pollawatn, 2000), were included in the Thai Flora. However, up to now the presence of these four species in Thailand is still dubious due to disagreement on recognition of species. *T. amplifolia* (Alderw.) C. Chr., for example, was treated by Holttum as a synonym of *T. keckii*,

while both species were recognized as two different species. In addition, this disagreement can also be found in the identification of *T. siifolia* and *T. ternifolia* (Alderw.) C. Chr. (Boonkerd and Pollawatn, 2000; Lindsay *et al.*, 2009; the PlantList, 2013). To date, no conclusion has been drawn as to how these species should be treated. Holotype of *T. pilosa* at Kew Herbarium collected by Beusekom & Phengkklai from Kanchanaburi, Thailand needs further investigation. *Quercifilix zeylanica* (Houtt.) Copel. was removed from the genus *Quercifilix* (Sledge, 1972) and was added to the Thai *Tectaria* account (Lindsay *et al.*, 2009).

Recently, *T. phanomensis* S. Linds. was described as a new species. It occurred in thin soil on a limestone cliff at about 100 m altitude in Khlong Phanom National Park, Surat Thani Province, Peninsular Thailand (Lindsay *et al.*, 2008). *T. shahidaniana* Rusea, was listed and mentioned as provisional new records, and pending further investigation (Lindsay *et al.*, 2009). Moreover, *T. remotipinna* Ching & Chu H. Wang was published as a new record. It grew on stream banks in hill evergreen forest over granitic bedrock at 1,000-1,450 m in Chiang Mai Province, northern Thailand (Lindsay *et al.*, 2013). Recently, Ding *et al.* (2014) constructed a phylogeny for the fern genus *Tectaria*, with emphasis on the Old World species, based on sequences of five chloroplast regions (*atpB*, *ndhF* plus *ndhF-trnL*, *rbcl*, *rps16-matK* plus *matK*, and *trnL-F*). The results strongly supported the monophyly of *Tectaria* in a broad sense, in which *Ctenitopsis*,

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*Hemigramma*, *Heterogonium*, *Psomiocarpa*, *Quercifilix*, *Stenosemia*, and *Tectaridium* should be included. In addition, the variation of venation pattern and the base chromosome number ( $x=40$ ) were considered as two synapomorphic characters for *Tectaria* (Ding et al., 2014). Thus, the inclusion of *Quercifilix* into *Tectaria* is confirmed in their study. Likewise, *Heterogonium* was transferred to *Tectaria* (Christenhusz, 2010; Dong, 2014; Mazumdar, 2014). The reduced basiscopic lobe at basal pinna was noted by Holttum (1988) as the diagnostic feature for *Heterogonium* (Holttum, 1988). However, it is homoplastic in *Tectaria* and is not significant in recognizing the separation of *Heterogonium* from *Tectaria* (Ding et al., 2014). Therefore, four species of *Heterogonium*, i.e. *T. hennipmanii* (Tagawa & K. Iwats.) S.Y. Dong, *T. nayarii* Mazumdar, *T. sagenioides* (Mett.) Christenh., and *T. stenosemioides* (Alderw.) C. Chr. (Christensen, 1934; Christenhusz, 2010; Dong, 2014; Mazumdar, 2014), in Thailand should be included in *Tectaria*. At present, a revision of *Tectaria* Cav. for Thailand is in progress.

*Tectaria kehdingiana* (Kuhn) M.G. Price was first described as *Luerssenia kehdingiana* Kuhn from a specimen collected in Langkat (Lankat) Regency of north Sumatra, Indonesia in 1882 by Christian Luerssen, a German pteridologist (Luerssen, 1882). Then, Christ (1897) moved this species to the genus *Aspidium* Sw. It was, however, later returned to the genus *Luerssenia* Kuhn again (Diels, 1899; Alderwerelt, 1908). Then, Price (1972) transferred this taxon to the genus *Tectaria* and it has long been recognized in the Malesiana region (Holttum, 1991).

## 2. Materials and Methods

During field trips to Khao Luang and Khao Nan National Parks in Nakhon Si Thammarat Province, an unknown fern specimen was collected. It was later identified as *Tectaria kehdingiana* (Kuhn) M.G. Price. So far, *T. kehdingiana* has been collected from two sites in Nakhon Si Thammarat province: on the trail to Krung Ching waterfalls in lower tropical rain forest in Khao Luang National Park and on shady forest floor next to a limestone hill in Khao Nan National Park. This study is based on Thai specimens. For comparison, we also examined herbarium materials of all *Tectaria* species deposited at B, BCU, BK, BKF, BM, CMU, CMUB, E, K, KKU, L, P, PSU, S, SING and UKMB [Herbarium abbreviations according to Thiers (continuously updated)].

## 3. Results

The morphological characters of the Thai specimens [S. Suddee and P. Puudjaj 1359, T. Boonkerd & R. Pollawatn 439, P. Pongkai 70, T. Boonkerd, S. Chantanaorrapint and W. Khwaiphan 415 (BCU); Kyle Williams, Rachun Pooma, Manop Poopath, Voradol Chamchumroon 1406 (BKF), Middleton et al. 5538 (E)] matched well with those of the *Tectaria kehdingiana* (Kuhn) M.G. Price (*F. Kehding* 2991)

type specimens kept at B, K (line drawing), P and SING. *T. kehdingiana* can thus be identified and officially described and illustrated as an additional fern species for Thailand.

## 3.1 Description

*Tectaria kehdingiana* (Kuhn) M.G. Price, Brit. Fern Gaz. 10(5): 262. 1972; Holttum, Fl. Males., Ser. II, Pterid. 2: 99, f. 16e. 1991.—*Luerssenia kehdingiana* Kuhn in Luerss., Bot. Centralbl. 11: 77. 1882; Baker, Ann. Bot. 5(4): 455. 1891; Diels in Engle and Prantl, Nat. Pflanzenfam. 1, 4: 180-181, f. 93A, B. 1899; Alderw., Malayan Ferns: 233. 1908.—*Aspidium kehdingianum* (Kuhn) Christ, Farnkr. Erde: 235. 1897. Type: Sumatra, *F. Kehding* 2991 (holotype **B!** (B 20 0170369), isotype **K!** (K000237165), **P!** (P00636717), **SING!**).—*Tectaria shahidaniana* Rusea, Folia Malaysiana 5: 28, pl. 2, 4, 6, 7, 8. 2004; Lindsay, Middleton, Boonkerd & Suddee, Thai For. Bull. (Bot.) 37: 98. 2009. Type: Malaysia, *RG 702* (holotype **UPM**, isotype **UKMB!**) (Figure 1 and 2).

*Rhizome* short, erect, bearing a tuft of fronds at apex, scaly; *scales* gradually narrowing from base towards apex, up to 3.75 mm long, shining brown with paler margin, the margin hairy. *Fronds* dimorphic, lamina simple. *Sterile fronds*: stipes castaneous, to 6.6 cm long, with short white hairs; lamina 29.0–48.0 x 4.7–6.7 cm, elliptic-oblong, apex acute, base cuneate, margin entire, glabrous on both surfaces except few short hairs on midrib or main veins beneath, texture chartaceous to subcoriaceous, venation reticulate forming many areoles and areolules with free included veinlets, veinlets simple or forked. *Fertile fronds*: stipes to 38 cm long, with short white hairs; lamina 30.0–38.1 x 1.7–2.1 cm, elliptic-oblong, apex acute, base cuneate, margin subentire to undulate, veins forming two rows of areoles with free included veinlets, veinlets simple. *Sori* large, one to each areole, terminal on included veinlets, covered throughout



Figure 1. *Tectaria kehdingiana* (Kuhn) M.G. Price: A. natural habitat near Krung Ching waterfall, Khao Luang National Park, Nakhon Si Thammarat Province B. part of sterile lamina showing pattern of venation, C. part of fertile lamina showing sori and indusia. Photographed by Thaweesakdi Boonkerd.

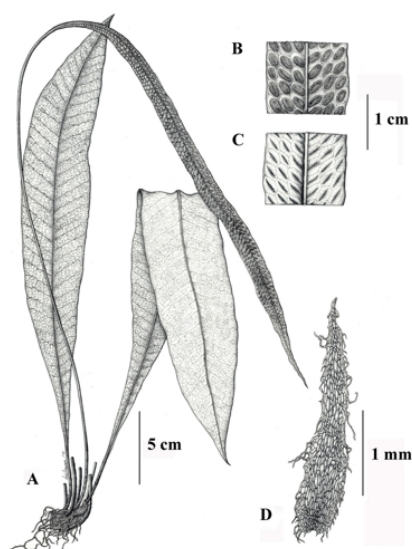


Figure 2. *Tectaria kehdingiana* (Kuhn) M.G. Price: A. whole plant showing two sterile and one fertile fronds, B. part of lower surface of fertile lamina showing sori and indusia, C. same part of fertile lamina from above, D. Rhizome scale. Drawn by Wilaiwan Nuchthongmuang from *T. Boonkerd & R. Pollawatn 439* (BCU).

abaxially, rather deeply impressed on abaxial surface of lamina, indusia peltate, persistent.

**Specimens Examined.**— THAILAND: *K. Williams, R. Pooma, M. Poopath, V. Chamchumroon 1406* (BKF), *Middleton et al. 5538* (E), *P. Pongkai 70* (BCU), *S. Suddee & P. Puudjia 1359* (BKF), *T. Boonkerd & R. Pollawatn 439* (BCU), *T. Boonkerd, S. Chantanaorrapint & W. Khwaiphan 415* (BCU); MALESIA: Malay Peninsula, *RG 702* (UKMB); Sumatra, Langkat Regency, *F. Kehding 2991* [B (line drawing), K (line drawing), P, SING]; Sumatra, Atjeh Gajolanden Bivouac, *C. G.G. J. van Steenis 9299* (K); Mentawai Islands, Sipora Island, *C. Boden-Kloss 14766* (K).

**Thailand.**— PENINSULAR: Nakhon Si Thammarat (trail to Krung Ching waterfalls, Khao Luang National Park; Klong Klai, Khao Nan National Park).

**Distribution.**— India (Nicobar Islands), Malesia [Malay Peninsula, Mentawai Islands, Sumatra (type)].

**Ecology.**— Terrestrial in shaded areas in dense tropical rain forest at 160-300 m alt.

**Vernacular.**— *Kachot Krung Ching*

**Note.**— Monomorphic frond is also observed, but very rare. If it is observed, the fertile portion is usually confined to the acuminate apex.

#### 4. Discussion

The description of *Tectaria kehdingiana* given here is based on the Thai specimens. It is important to note that these specimens have fronds of nearly the same size as the type specimen in the herbarium at P. Apart from Sumatra

Island and the nearby small islands (Luerksen, 1882; Baker, 1891; Holttum, 1991; Chandra et al., 2008; Fraser-Jenkins, 2012), this fern species also occurs in *Wang Kelian Heritage Trails*, Perlis State Park, northern peninsular Malaysia (Rusea, Latiff, and Jaman, 2004) and in lower Peninsular Thailand as is reported here. As of now, Klong Klai Ranger Station, Khao Nan National Park, Nakhon Si Thammarat Province is the northernmost station of this fern species. The present distribution pattern of this *Tectaria* species (Figure 3) may be related to the theory of continental drift. According to this theory, Sumatra Island was formerly unified into peninsular Thailand and Peninsular Malaysia, but it is now the western part of the Indochina subcontinent (Metcalf, 1988). A small population of less than 20 mature individuals was observed at *Wang Kelian Heritage Trails*, northern Peninsular Malaysia (Rusea, Latiff, and Jaman, 2004). *Tectaria kehdingiana* is regarded as a very rare species on Nicobar Islands (Chandra et al., 2008; Fraser-Jenkins, 2012). In Thailand, approximately 50 mature individuals were found in Khao Luang and Khao Nan National Parks, Nakhon Si Thammarat Province. So far, five natural habitats are known; no information about the status of the population on Sumatra and Mentawai Islands



Figure 3. Distribution of *Tectaria kehdingiana* (Kuhn) M.G. Price: 1-4 show the previous distribution, 5 shows the present finding 1. Langkat, north Sumatra 2. Mentawai Islands 3. Wang Kelian, Perlis, northern peninsular Malaysia 4. Nicobar Islands 5. Nakhon Si Thammarat, Peninsular Thailand.

is available (Iwatsuki, 1973). Since less than 250 mature individuals from the presently known natural sites were observed, this species should be listed as an endangered species on a worldwide basis (IUCN, 2015).

*Tectaria kehdingiana* and *T. singaporiana* are the only two species in Thailand which bear simple entire lamina. Their differences in fertile fronds, sori and indusia distinguish the two species. *T. kehdingiana* bears dimorphous fronds while *T. singaporiana* has monomorphic fronds. *T. kehdingiana* has sori on included veinlets, whereas sori of *T. singaporiana* is on junction of anastomosing veins. *T. kehdingiana* also has rather large sori and indusia in comparison with small sori and indusia in *T. singaporiana*. In contrast, sori and indusia of *T. kehdingiana* and *Tectaria decurrens* (C. Presl) Copel. are more or less similar, especially in the fields. However, *T. kehdingiana* has constant simple, entire fronds, while *T. decurrens* always has both simple and deeply lobed fronds, and stipe that is typically winged. However, from the senior author's experience, *T. decurrens* also exhibits simple entire lamina. Holttum noted that *T. decurrens* has unlobed linear fronds of about 30 cm long (Holttum, 1991). In addition, *T. kehdingiana* has sori covering the frond's entire underside, while *T. decurrens* has sori in two rows between adjacent lateral main veins (Table 1).

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Table 1. Morphological comparison of *T. kehdingiana* and *T. decurrens*.

Characters	<i>Tectaria kehdingiana</i>	<i>Tectaria decurrens</i>
<b>Frond</b>	simple, entire	deeply lobed (mostly); simple, entire (rarely)
<b>Stipe</b>	wingless	winged
<b>Sori</b>	covered throughout, abaxially	in 2 rows between adjacent lateral main veins

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