



NOTE

A taxonomic revision of the fern genus *Tectaria* (Tectariaceae) from Bangladesh

Shi-Yong DONG^{1,2,*}, A.K.M. Kamrul HAQUE³, Mohammad Sayedur RAHMAN⁴,
Mohammad Abdur RAHIM⁵, Saleh Ahammad KHAN⁵

1. Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China.

2. Center of Conservation Biology, Core Botanical Gardens, Chinese Academy of Sciences, Guangzhou 510650, China.

3. Department of Botany, Mohammadpur Government College, Dhaka, Bangladesh.

4. Bangladesh National Herbarium, Dhaka-1216, Bangladesh.

5. Department of Botany, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh.

*Corresponding author's email: dongshiyong@scib.ac.cn; Office phone: +86-20-37252716; Fax, +86-20-37252831.

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ABSTRACT: A critical revision of *Tectaria* (Tectariaceae) from Bangladesh is presented here for the first time based on herbarium collections and field surveys. Eleven species are recognized in Bangladesh, including two narrowly distributed species (*T. chattagramica* and *T. heterocarpa*) and nine E & SE Asia-widespread species (*T. decurrens*, *T. fuscipes*, *T. herpetocaulos*, *T. impressa*, *T. ingens*, *T. multicaudata*, *T. polymorpha*, *T. simonsii* and *T. vasta*). The confusions involving species recognition and the application of names in previous literatures are clarified. To facilitate the recognition of species, we provided a key to species and photos for all except *T. simonsii*. In addition, for each species the diagnostic characters, citation of representative specimens from Bangladesh, brief information on local habitat, abundance and geographical distribution, and notes on affinities are provided.

KEY WORDS: Geographical distribution, morphology, nomenclature, species recognition, taxonomy.

INTRODUCTION

The fern genus *Tectaria* Cav. is the major constituent of Tectariaceae in eupolypods I (PPG I, 2016), consisting of about 250 species in tropical and subtropical areas of the world. This is a morphologically very diverse group. The common features for all species in *Tectaria* are the rhizome and stipe covered with lanceolate scales, the adaxially non-grooved frond-axes, and the ctenitoid hairs on adaxial surface of frond-axes. For the majority of *Tectaria*, additional diagnostic characters include the less dissected and herbaceous lamina, anastomosing veins, and round sori (Ching, 1931). *Tectaria* are common components of the herbaceous layer in lowland forest, with most species occurring from the sea level to 1500 m in altitude.

When viewing the *Tectaria* of South Asia, we noticed that this group from Bangladesh is rather poorly documented. The *Tectaria* treatment in *Encyclopedia of Flora and Fauna of Bangladesh*, vol. 5 (Siddiqui *et al.*, 2007) is apparently inaccurate and out-of-date. For example, among the nine species of *Tectaria* recorded by Siddiqui *et al.* (2007), *T. leuzeana* (Gaud.) Copel. should be placed in the genus *Pleocnemia* C. Presl (Holttum, 1991); *T. heterosora* (Baker) Ching is an illegitimate name (Morton, 1973: 270); *T. variolosa* (Wall. ex Hook.) C. Chr. is a synonym of *T. impressa* (Fée) Holttum

(1988); *T. paradoxa* (Fée) Sledge should be excluded from the flora of Bangladesh (Holttum, 1988; Fraser-Jenkins, 2008; Fraser-Jenkins *et al.*, 2018). On the other hand, *T. herpetocaulos* Holttum, once reported from Bangladesh (Holttum, 1991: 89), and *T. multicaudata* (C.B. Clarke) Ching which was originally described based on a collection from Sylhet, Bangladesh (Clarke, 1880), were neglected by Siddiqui *et al.* (2007). Thus, a taxonomic revision of *Tectaria* from Bangladesh is badly needed.

The present account is intended to be an update of *Tectaria* in *Encyclopedia of Flora and Fauna of Bangladesh*, vol. 5 (Siddiqui *et al.*, 2007), aiming to provide accurate and updated knowledge on *Tectaria* from Bangladesh in species diversity, nomenclature, and geographical distribution. To determine the species of *Tectaria* in Bangladesh, the first author (Dong) has checked all specimens of *Tectaria* from Bangladesh in herbaria BFRI, DACB, DUSH, E, JUH, K, P, TAIF, and SING, and made a field survey to Chittagong Division and Sylhet Division in September 2019. Nomenclatural types of all names involved here, as well as the species which are variously allied to *Tectaria* species in Bangladesh but are not distributed in this country, have been carefully studied by the first author via visiting actual and/or virtual herbaria in recent years. For the main characters and their states to distinguish species of *Tectaria*, Ding *et al.* (2014) is referred.



TAXONOMIC TREATMENT

Based on herbarium specimens and our new collections, we recognized 11 species of *Tectaria* in Bangladesh. Among these species, *T. simonsii* (Baker) Ching is the only one which is described here without voucher specimens of Bangladesh. According to Ching (1931), *T. simonsii* had been collected at least twice from Chittagong. Other three species, *T. coadunata* (J. Sm.) C. Chr., *T. griffithii* (Baker) C. Chr., and *T. subconfluens* (Bedd.) Ching, which were previously mentioned with distributions in Bangladesh (Fraser-Jenkins *et al.*, 2018), are excluded in this account, because we did not see any voucher nor are sure the existence of authentic collections of these species from Bangladesh. Of the 11 species recognized here, *T. chattagramica* (C.B. Clarke) Ching and *T. heterocarpa* (Bedd.) C.V. Morton are narrowly distributed, occurring only in Bangladesh and neighbouring area (NE India and N Myanmar). Other nine species are all widespread in E and SE Asia. So in terms of conservation, *T. chattagramica* and *T. heterocarpa*, especially the former which is rare in Bangladesh, should be given more attentions.

Key to species of *Tectaria* in Bangladesh

- 1a. Veins free or anastomosing, if anastomosing, costal and costular areoles present, areoles without veinlets or a few of the areoles rarely with veinlets 2
- 1b. Veins wholly anastomosing, costal and costular areoles lacking, all areoles with included veinlets 6
- 2a. Veins free, or only those beside costae anastomosing, others free ... 3
- 2b. Veins amply anastomosing 4
- 3a. Veins all free, or in many cases forming one row of costal areoles, others free; stipe scales blackish; fronds 1-pinnate-pinnatifid, basal pinnae 10–15 (20) cm long *T. fuscipes*
- 3b. Veins all free; stipe scales brown or light-castaneous, never blackish; fronds 2-pinnate-pinnatifid when fully developed, basal pinnae ca. 40–80 cm long *T. ingens*
- 4a. Lamina pentagonal, not or a little longer than wide; stipe blackish, lustrous *T. chattagramica*
- 4b. Lamina ovate or ovate-triangular, much longer than wide; stipe stramineous, brown or castaneous, matte 5
- 5a. Lamina usually chartaceous in texture; stipe glabrous above the base *T. impressa*
- 5b. Lamina herbaceous; stipe scaly throughout *T. multicaudata*
- 6a. Fronds pinnatifid to rachis-wing; stipe winged except the base 7
- 6b. Fronds 1-pinnate; rachis and stipe wingless 8
- 7a. Sori regularly in two rows between lateral veins of segments *T. decurrens*
- 7b. Sori scattered between lateral veins of segments *T. vasta*
- 8a. Stipe and rachis blackish, lustrous; fronds without terminal pinnae (terminal lamina trilobed) *T. simonsii*
- 8b. Stipe and rachis stramineous or light brown, matte; fronds with a terminal, entire pinna 9
- 9a. Lateral pinnae (6)8–13 pairs, never forked; each lateral pinna bearing a scaly bud at base *T. heterocarpa*
- 9b. Lateral pinnae 2–5 pairs, lowest ones forked or not; scaly buds never present 10
- 10a. Rhizome long-creeping *T. herpetocaulos*
- 10b. Rhizome erect *T. polymorpha*

1. *Tectaria chattagramica* (C.B. Clarke) Ching, *Sinensia* 2: 35, f. 14. 1931; Siddiqui *et al.*, *Encycl. Flora*

Fauna Bangladesh 5: 331. 2007. - *Polypodium chattagramicum* C.B. Clarke, *Trans. Linn. Soc. London, Bot.* 1: 548, t. 81. 1880. **Type:** BANGLADESH. Chittagong: Burkul, 12 Feb 1873, *Clarke 19879A* (lectotype, designated by Holttum in *Kew Bull.* 43: 481. 1988, K-001080708).

Figs. 1A, 1B

Diagnostic characters: Lamina pentagonal, tripartite, consisting of a central lamina and a pair of lateral pinnae or segments, slightly or strongly dimorphic; stipe and rachis blackish, lustrous, with scales on basal stipe; veins anastomosing, forming costal and costular areoles, without veinlets included in areoles, those near segment-margins free; sori large, in two rows on ultimate segments, exindusiate.

Additional specimens examined: Bangladesh. **Chittagong:** Rangamati Distr., Burkul, *Clarke 19879A* (K-001080708) & *19879M* (K-001080711); Cox's Bazar Distr., Kaptai, *Khan 10532* (DACB-30094); Chittagong Distr., Mirsharai, Hinguli, *Pasha 42* (DACB-30.095); Khagrachari Distr., Baghaichari-Kasalong, *Clarke 8257* (K-001080707); District unknown, "Ruttunpoea", *Clarke 19767* (K-001080709).

Habitat and abundance: Terrestrial in lowland forest, rare.

Distribution: Bangladesh, NE India, N Myanmar, and north-central Thailand ("Huey Ya").

Note: *Tectaria chattagramica* is a distinct species characterized by the pentagonal fronds and the veins being anastomosing but lacking veinlets in areoles (Fig. 1B). It is one of a few species restricted to Bangladesh and neighbouring areas. As Ching (1931) has pointed out, the nearest relative to this species is *T. tenerifrons* (Hook.) Ching; both species share the pentagonal fronds and the same pattern of venation. However, *T. tenerifrons* is very different in other features, such as the creeping rhizome, very slim frond-axes, and the lamina being membranaceous in texture. *Tectaria tenerifrons* is restricted to limestone areas in S Myanmar (Moulmein) and N & SW Thailand, without distribution in Bangladesh.

Tectaria subconfluens, which was mentioned by Fraser-Jenkins *et al.* (2018) with distribution in Bangladesh, is very similar to *T. chattagramica* in fronds' size, shape, and division. However, *T. subconfluens* is sharply different by a different pattern of venation (with veinlets present in areoles), central lamina being long-decurrent along rachis, reddish and scaly stipe, and the presence of scaly buds on the base of pinnae.

2. *Tectaria decurrens* (C. Presl) Copel., *Leafl. Philipp. Bot.* 1: 234. 1907; Siddiqui *et al.*, *Encycl. Flora Fauna Bangladesh* 5: 331. 2007. - *Aspidium decurrens* C. Presl, *Reliq. Haenk.* 1: 28. 1825. **Type:** PHILIPPINES. Sorzogon, *Haenke s.n.* (holotype, PRC-450242).

Figs. 2A, 2B

Nephrodium leptophyllum C.H. Wright, *Bull. Misc. Inform. Kew.* 1906: 11. 1906. - *Tectaria leptophylla* (C.H. Wright) Ching, *Sinensia* 2: 22. 1931. **Type:** VIETNAM. Tonkin: Lao Cai, 17 Sep 1900, *Wilson 24* (holotype, K-001084252).



Fig. 1. Collections of *Tectaria* from Bangladesh, part 1. **A–B:** *T. chattagramica* (C.B. Clarke) Ching from Chittagong; **A**, Clarke 19879A (lectotype, K); **B**, drawing of veins based on Khan 10532 (DACB). **C–D:** *T. fuscipes* (Wall. ex Bedd.) C. Chr. from Moulvibazar; **C**, Rahim s.n. (JUH); **D**, drawing of veins based on Kamrul s.n. (JUH). **E:** *T. impressa* (Fée) Holttum from Dhaka (Miza 479 at DACB). **F:** *T. ingens* (Atk. ex C.B. Clarke) Holttum from Sylhet (Clarke 18520 at K). **G:** *T. multicaudata* (C.B. Clarke) Ching from Sylhet (Clarke 18427 at K).

Diagnostic characters: Fronds 1-pinnatifid, with lamina pinnatifid to the rachis-wing, segments entire; stipe winged throughout; veins thoroughly anastomosing, not forming costal or costular areoles, with simple or forked veinlets present in all areoles; sori large, regularly in two rows between lateral veins of segments; indusia large, reniform or nearly so, persistent.

Additional specimens examined: Bangladesh. Chittagong:

Rangamati Distr., Baghaichari, Kasalong, Clarke 8249 (P-01418649); ibid., Barkal, Clarke 19695 (US-01580132); Chittagong Distr., in 1859, Hooker & Thomson s.n. (P-01418622).

Habitat and abundance: Terrestrial in lowland forest, usually growing in shady, moist places in a valley or streamside, rare in Bangladesh.

Distribution: Widespread in tropical and subtropical E Asia, SE Asia, and Pacific Islands.



Fig. 2. Collections of *Tectaria* from Bangladesh, part 2. **A–B:** *T. decurrens* (C. Presl) Copel.; **A**, Thomson s.n. (P) from Chittagong; **B**, a part of lamina, showing sori in two rows between lateral veins (*Haenke s.n.* at PRC, holotype from Philippines). **C–D:** *T. vasta* (Blume) Copel.; **C**, Clarke 19622 (K) from Chittagong; **D**, a part of lamina, showing scattered sori (*Rahim s.n.* at JUH from Moulvibazar). **E:** *T. herpetocaulos* Holttum from Bandarban (*Fraser-Jenkins 30268* at TAIF). **F:** *T. heterocarpa* (Bedd.) C.V. Morton from Chittagong (*Fraser-Jenkins 30197* at TAIF). **G:** *T. polymorpha* (Wall. ex Hook.) Copel. from Moulvibazar (*Rahim s.n.* at JUH).

3. *Tectaria fuscipes* (Wall. ex Bedd.) C. Chr., Contr. U. S. Natl. Herb. 26: 290. 1940. – *Aspidium fuscipes* Wall. ex Bedd., Suppl. Ferns Brit. Ind. 15, pl. 366. 1876. **Type:** INDIA. Assam: Cachar, Clarke 7050 (holotype, K-001080698). **Figs. 1C, 1D**

Polypodium pilosum Roxb., Calcutta J. Nat. Hist. 4: 492. 1844, non Schkuhr (1806). **Type:** BANGLADESH. Chittagong, Roxburgh s.n. (lectotype, BR00000698457, designated by Morton in Contr. U.S. Natl. Herb. 38: 356. 1974).

Tectaria paradoxa auct., non (Fée) Sledge, Siddiqui *et al.*, Encycl. Flora Fauna Bangladesh 5: 333. 2007.

Diagnostic characters: Stipe with considerable

scales on lower to basal parts; scales linear-lanceolate, stiff, blackish in color; fronds slightly or distinctly dimorphic, 1-pinnate-pinnatifid; pinnae pectinate; basal pinnae triangular, with the basal basiscopic pinnules much produced; veins all free in fertile fronds, or occasionally forming one to several costal areoles, those in sterile fronds variable, fully free, or forming only several to a continuous row of areoles along costae and costules; sori regularly in two rows on segments of pinnae; indusia reniform, mostly persistent.



Additional specimens examined: Bangladesh. **Chittagong:** Bandarban Distr., Ruma, *Khandakar* 957 & 1644 (DACB). Chittagong Distr., Brahmanbaria, Azampur, *Mirza* 321, 339 & 340 (DACB); *ibid.*, Chittagong City, *Lu et al.* 16216 (TAIF-296887); *ibid.*, Chittagong University, *Lu et al.* 16179 (TAIF-296870); *ibid.*, Mirsharai, 12 May 1997, *Anonymous* 76 (DACB); Rangamati Distr., Farua, *Mirza* 979, 1026, 1030, 1045 & 1056 (DACB), *Uddin* 3268 (DACB); *ibid.*, Jamuna Chari, *Mirza* 905 & 908 (DACB); *ibid.*, Kaptai, *Khan & Mia* 10625 (DACB), *Uddin* 2651 (DACB); *ibid.*, Udalchhari, *Mirza* 882 (DACB). **Mymensingh:** Sherpur Distr., Gozni, *Sarkar & Chandra* 20 (JUH). **Sylhet:** Moulvibazar Distr., Sreemangal, *Bushra* 239 (DACB), *Dong* 5187 (IBSC), *Mirza* 32, 36, 490, 549, 553 & 554 (DACB), *Kamrul s.n.* (JUH), *Rahim s.n.* (JUH-11347); *ibid.*, Madhabkundu, *Mirza* 571, 572, 573 & 574 (DACB); Sylhet Distr., Sylhet Sadar, *Clarke* 17933 (K), *Khatun* 5877 (DACB), *Dong* 5194 & 5199 (IBSC); *ibid.*, Tamabil, *Mirza* 6, 7, 16 & 39 (DACB).

Habitat and abundance: Terrestrial in forest, alt. 0–100 m, very common.

Distribution: From eastern Himalayas (Bhutan, NE India, Nepal), through Bangladesh and Myanmar to Indochina (Laos, N Thailand, Vietnam), eastwards to Taiwan Island.

Note: *Tectaria fuscipes* appears to be the most common species of *Tectaria* in Bangladesh. It has long been confused with *T. paradoxa* (Fée) Sledge (*e.g.*, Sledge, 1972). As Fraser-Jenkins (2008) has noticed, *T. paradoxa* is characterized by the sori being marginal and restricted to the apices of the pinna-lobes, while in *T. fuscipes* the sori are median and more generally distributed. In addition, the stipe-scales are somewhat different in color between these two species, being distinctively blackish in *T. fuscipes* but castaneous in *T. paradoxa*. Phytogeographically *T. paradoxa* is restricted to Sri Lanka and southern India, not extending north to Bangladesh (Fraser-Jenkins *et al.*, 2018).

The distribution of *T. fuscipes* in eastern Java and southwestern Celebes (Holttum, 1991: 48) is to be confirmed. There are two collections available to us from Java which look very like *T. fuscipes*. However, the separate distribution and the much wider stipe-scales indicate that the collections from Java may be not representatives of real *T. fuscipes*. Further investigations are needed to clarify the true identity of those from Java and Celebes.

4. *Tectaria herpetocaulos* Holttum, Dansk Bot. Ark. 23: 241. 1965. **Type:** MALAYSIA. Perak: Cameron Highlands Road, 600 m, in 1960, *Molesworth-Allen* 4454 (holotype, 5 sheets, K-000236259 to K-000236263).

Fig. 2E

Tectaria simaoensis Ching & Chu H. Wang, Acta Phytotax. Sin. 19: 130. 1981. **Type:** CHINA. Yunnan: Simao, *Ching* 595 (holotype, PE-00044752).

Diagnostic characters: Rhizome long-creeping; fronds monomorphic or nearly so, imparipinnate; lateral pinnae 2–5 pairs, entire, lowest ones rarely forked on the basiscopic side, scaly buds never present; veins thoroughly anastomosing, not forming costal areoles, with veinlets present in all areoles; sori small, scattered between lateral veins; indusia reniform, persistent.

Additional specimens examined: Bangladesh. **Chittagong:** Bandarban Distr., Ruma, *Fraser-Jenkins* 30268 (TAIF-303187). Rangamati Distr., Kaptai, *Uddin* 1417 (DACB); *Fraser-Jenkins* 30164 (TAIF). **Sylhet:** Sylhet Distr., Sylhet Sadar, *Mirza* 871 (DACB).

Habitat and abundance: Terrestrial in montane forest, alt. 400–500 m, rare in Bangladesh.

Distribution: Bangladesh, China (Yunnan), India (northeastern states, Andaman and Nicobar Island), Myanmar (Kengtung); Indochina and Peninsular Malaysia.

Note: Fraser-Jenkins (2008) mistakenly reduced *T. herpetocaulos* to *T. wightii* (C.B. Clarke) Ching, a species restricted to southern India. These two species are clearly distinct in the sori distribution and the presence (or not) of proliferous buds on rachis, although they share the characteristic rhizome (long-creeping) and the frond-dissection (1-pinnate, with broad and entire pinnae). *Tectaria wightii* is different from *T. herpetocaulos* by the two-rowed sori between lateral veins and the presence of scaly buds at the joint of pinnae to rachis. In contrast, in *T. herpetocaulos* the sori are scattered and the buds never occur. Actually *T. herpetocaulos* is most similar to *T. polymorpha* in appearance, both having imparipinnate fronds, 2–5 pairs of lateral pinnae, fully anastomosing veins, and scattered sori. However, the rhizome is consistently long-creeping in *T. herpetocaulos*, but is short-erect in *T. polymorpha*. In addition, the basal pinnae tend to produce a lobe on the basiscopic side in *T. polymorpha* but are mostly simple in *T. herpetocaulos*.

5. *Tectaria heterocarpa* (Bedd.) C.V. Morton, Contr. U.S. Natl. Herb. 38: 270. 1973. - *Sagenia heterocarpa* Bedd., Ferns Brit. Ind. t. 47. 1865. - *Nephrodium heterosorum* Baker, Syn. Fil. 504. 1874, non *N. heterocarpum* (Blume) T. Moore; Siddiqui *et al.*, Encycl. Flora Fauna Bangladesh 5: 332. 2007. - *Aspidium heterocarpum* (Bedd.) Bedd., Ferns Brit. Ind. Suppl. 16. 1876, non *A. heterocarpum* Blume (1828). - *Tectaria heterosora* (Baker) Ching, Sinensia 2: 29, f. 11. 1931. **Type:** INDIA. Meghalaya: Khasi Hills, *Thomson s.n.* (holotype, K).

Fig. 2F

Diagnostic characters: Rhizome short, erect; fronds monomorphic or nearly so, imparipinnate; lateral pinnae (6)8–13 pairs, entire, basal pinnae never forked; one scaly bud frequently present at the base of each lateral pinna; veins thoroughly anastomosing (the same pattern as in *T. herpetocaulos*); sori small, scattered between lateral veins; indusia reniform, persistent or not.

Additional specimens examined: Bangladesh. **Chittagong:** Bandarban Distr., Ruma, *Islam* 1623 (DACB). Chittagong City, *Hooker s.n.* (SING); *Fraser-Jenkins* 30196 & 30197 (TAIF); Cox's Bazar, *Sinclair* 38497 (SING); *Pasha* 86 (DACB); *Dong* 5207 (IBSC); Dhohazari, *Uddin* 948 (DACB). Rangamati Distr., Farua Chara, *Mirza* 987 (DACB); Kaptai, *Uddin* 1000, 1466 & 1673 (DACB). **Sylhet:** Moulvibazar Distr., Rajkandi, *Kamrul s.n.* (JUH-11351, 11352); *Rahim s.n.* (JUH-11353, 11355); *Dong* 5189 (IBSC).



Habitat and abundance: Terrestrial in lowland forest, along banks of streams, alt. 0–50 m, very common.

Distribution: Bangladesh, NE India, N Myanmar (Warzup) and Nepal.

Note: As Morton (1973) has pointed out, *Tectaria heterosora* (Baker) Ching is a superfluous name of *T. heterocarpa*, both based on a single type. It is not correct to apply *T. heterosora* for the plants in Bangladesh (Siddiqui *et al.*, 2007).

Tectaria heterocarpa is apparently a member of *T. polymorpha* group characterized by the imparipinnate fronds and the broad and entire pinnae (Figs. 2E–2G). Besides *T. polymorpha* and *T. heterocarpa*, other closely allied species include *T. herpetocaulos* and *T. wightii*. Phylogenetical analyses of cpDNA sequences supported *T. polymorpha* group to be a distinct lineage within the core *Tectaria* clade (Ding *et al.*, 2014; Dong *et al.*, 2018).

6. *Tectaria impressa* (Fée) Holttum, Kew Bull. 43: 483. 1988. - *Phlebionium impressum* Fée, Mém. Foug. 5: 314, pl. 24A, f. 2. 1852. **Type:** “India Orientale”, Griffith *s.n.* (holotype, RB).

Fig. 1E

Tectaria variolosa (Wall. ex Hook.) C. Chr., Contr. U.S. Natl. Herb. 26: 280. 1931; Siddiqui *et al.*, Encycl. Flora Fauna Bangladesh 5: 335. 2007. - *Aspidium variolosum* Wall. ex Hook., Sp. Fil. 4: 51. 1862. **Type:** MYANMAR. Amherst, Wallich 379, p.p. (lectotype K-001080680, designated by Ching (1931: 22); isoelectotypes: K-001080684, P-01439469, P-01439472, UC-267883, US-00135279).

Diagnostic characters: Stipe stramineous or brown, with scales restricted to the base; lamina ovate-triangular, 2-pinnate, semi-dimorphic, usually chartaceous in texture; veins anastomosing, forming costal and costular areoles in sterile fronds, with veinlets present in some areoles beyond the costal and costular areoles; sori large, regularly in two rows between lateral veins of pinnae; indusia reniform, persistent.

Additional specimens examined: Bangladesh. Chittagong: Burrunchevry, Clarke 19576 (P); Cox’s Bazar, Pasha 56 (DACB). Comilla Distr., Puttun, Clarke 14204 (P). Dhaka: Bakterpur, Clarke 17202 (P); Sherpur Distr., Modhutula, Alaka *s.n.* (JUH-2152); without locality, Clarke 8361, 16753 & 17088 (P); Mirza 479 (DACB). Sylhet: Sylhet Distr., Boraikandi, Khatun 5877 (DACB); Khadimnagar, Kabir *s.n.* (JUH-2146). Habigonj Distr., Rema–Kalenga Sanctuary, Khan & Mia 10402, 10406 & 10422 (DACB); Kalenga, Mirza 505 (DACB); Satchari Forest, Mirza 520 & 525 (DACB). Moulvibazar Distr., Rajkandi, Kamrul *s.n.* (JUH-11354), Dong 5188 (IBSC); Lowachera, Bushra 237 (DACB-34313), Mirza 490 & 568 (DACB).

Habitat and abundance: Terrestrial in forest, alt. 0–100 m, very common.

Distribution: Widespread in NE India and Indochina, eastwards to Taiwan Island and southeast to Indonesia (Sumatra, Java, and Celebes).

7. *Tectaria ingens* (Atk. ex C.B. Clarke) Holttum, Revis. Fl. Malaya 2: 503. 1954. - *Nephrodium ingens* Atk. ex C.B. Clarke, Trans. Linn. Soc. London, Bot. 1: 526, pl. 73. 1880. **Type:** INDIA. Darjeeling, 900 m, 27 Sep 1869, Clarke 9295 (lectotype, K-001080679, designated by

Holttum in *Kew Bull.* 43: 479. 1988).

Fig. 1F

Diagnostic characters: Large herbs, with fronds up to 2 m long; mature fronds 2-pinnate to 3-pinnate at base, ultimate pinnules pectinate; pinnae dimorphic, *i.e.*, in a single frond the fertile pinnae contracted and the sterile pinnae comparatively broad; veins all free; sori large, in two rows on ultimate segments; indusia reniform, persistent.

Additional specimens examined: Bangladesh. Sylhet: Bholagonj, 9 Oct 1872, Clarke 18520 (K).

Habitat and abundance: Terrestrial in lowland forest, very rare.

Distribution: Bhutan, China (W Yunnan), NE India and N Myanmar (Kachin).

Note: *Tectaria ingens* is an inadequately known species due to its rarity. It is morphologically very similar to *T. setulosa* (Baker) Holttum from southern China and northern Vietnam and seems not clearly distinguishable from the latter. The examination of limited specimens of *T. ingens* from its type locality and nearby areas shows that the stipe scales are narrower in *T. ingens* than in *T. setulosa* and the dimorphism of pinnae does not occur in *T. setulosa*.

8. *Tectaria multicaudata* (C.B. Clarke) Ching, Sinensia 2: 20. 1931. - *Nephrodium multicaudatum* C.B. Clarke, Trans. Linn. Soc. London, Bot. 1: 540, t. 77. 1880. **Type:** BANGLADESH. Sylhet, ca. 80 m, 30 Nov 1872, Clarke 18427C [lectotype, K-001080692, designated by Fraser-Jenkins *et al.* (2018: 377)].

Fig. 1G

Tectaria griffithii auct., non (Baker) C. Chr., Holttum in Fl. Malesiana 2(1): 132. 1991, p.p., excluding the type of *T. griffithii*.

Diagnostic characters: Stipe dark brown or castaneous, obviously covered with spreading, linear-lanceolate scales; lamina ovate, 1-pinnate-pinnatifid to nearly 2-pinnate at base, consisting of a pinnatifid terminal lamina and 3–4 pairs of free lateral pinnae, monomorphic or slightly dimorphic, herbaceous in texture; veins anastomosing, forming costal and costular areoles, with veinlets lacking or seldom present in a few areoles; sori in two rows on ultimate segments, terminal on free veins; indusia reniform, persistent.

Additional specimens examined: Bangladesh. Sylhet: Sylhet Distr., Bholagonj, Clarke 17424 (P). Moulvibazar Distr., Lowachera, Bushra 240 (DACB); BTRI to Lawachara, Mirza 488, 547 & 597 (DACB); Rajkandi, Dong 5190 (IBSC); without locality, Clarke 18428 (P).

Habitat and abundance: Terrestrial in montane forest, alt. 0–100 m, common.

Distribution: Widespread in NE India and Indochina, southwards to Borneo and Indonesia (Sumatra).

Note: *Tectaria multicaudata* had long been mistakenly considered as conspecific with *T. griffithii* (Ching, 1931; Holttum, 1991). In fact, they are two distinct species and are readily distinguishable from each other in venation. As shown by Ding *et al.* (2013: 63), in *T. multicaudata* the veins form narrow areoles along



costae and costules, but are much more complicatedly anastomosing and do not form costal and costular areoles in *T. griffithii*. The report of *T. griffithii* in Bangladesh (Fraser-Jenkins *et al.*, 2018) is to be confirmed, which may be a misreport of *T. multicaudata*.

Tectaria coadunata, which was mentioned with distribution in Bangladesh (Fraser-Jenkins *et al.*, 2018), is similar to *T. multicaudata* in the shape and division of fronds and in the pattern of venation. The main difference between them lies in the appearance of stipe and rachis, which are scaly throughout in *T. multicaudata* but are glabrous in *T. coadunata*.

9. *Tectaria polymorpha* (Wall. ex Hook.) Copel., Philipp. J. Sci. 2: 413. 1907; Siddiqui *et al.*, Encycl. Flora Fauna Bangladesh 5: 334. 2007. - *Aspidium polymorphum* Wall. ex Hook., Sp. Fil. 4: 54. 1862. **Type:** NEPAL. Without special locality, 1820, *Wallich 382* [lectotype, K-001044564, designated by Holttum (1991: 87)].

Fig. 2G

Diagnostic characters: Rhizome short, erect; fronds monomorphic, imparipinnate; lateral pinnae 2–4 pairs, entire, basal pinnae mostly forked on the basiscopic side; scaly buds never present; veins thoroughly anastomosing (the same pattern as in *T. herpetocaulos*); sori small, scattered between lateral veins; indusia reniform, persistent or not.

Additional specimens examined: Bangladesh. **Chittagong:** Bandarban Distr., Ruma, *Islam 3513* (DACB). **Sylhet:** Moulvibazar Distr., Rajkandi, *Rahim s.n.* (JUH-11350).

Habitat and abundance: Terrestrial in montane forest, rare.

Distribution: Widespread in Indian subcontinent and Indochina, eastwards to Taiwan Island and the Philippines.

Note: Fraser-Jenkins (2008) mentioned the resemblance of *T. polymorpha* to *T. wightii*, the latter restricted to southern India, but did not notice the main difference between them. Besides the differences in rhizome habit and leaf dimorphism as stated by Fraser-Jenkins (2008: 314–315), *T. wightii* is sharply different from *T. polymorpha* in the 2-rowed sori between lateral veins. The report of *T. polymorpha* in Indonesia (East Java and Celebes) and Lesser Sunda Islands (Holttum 1991: 87) seems doubtful and is to be confirmed.

10. *Tectaria simonsii* (Baker) Ching, Sinensia 2(2): 32, f. 8. 1931. - *Nephrodium simonsii* Baker, Syn. Fil. (Hooker & Baker), ed. 2. 504. 1874. **Type:** INDIA. Assam: Nuku & Naga Hills, *Simons 301* (lectotype, K-001080670, designated by Holttum in *Gard. Bull. Singapore* 34: 144. 1981).

Diagnostic characters: Stipe and rachis blackish, lustrous, with scales restricted to the base of stipe; fronds 1-pinnate, consisting of a terminal lamina and 1–2 pairs of lateral pinnae; terminal part of lamina and basal

pinnae deeply tri-lobed; middle pinnae entire, crenate, or narrowly lobed at base, sessile or shortly petiolate, base round or cordate; veins fully anastomosing, not forming costal areoles, with veinlets present in all areoles; sori small, scattered, exindusiate.

Distribution: Widespread in NE India, northern Indochina, and tropical and subtropical E Asia.

Habitat and abundance: Terrestrial in montane forest, rare.

Note: We did not see any collections of *T. simonsii* from Bangladesh. This species is included here based on the report of Ching (1931: 33) who had checked somewhere, probably at K, two collections from Chittagong which were cited as “*Scott ex Herb. Bedd.*” and “*Capt. Dodgson*”, respectively. The above description is based on the collections from northeastern India. *Tectaria simonsii* is common in tropical and subtropical East Asia but perhaps has been extinct in Bangladesh.

11. *Tectaria vasta* (Blume) Copel., Philipp. J. Sci. 2: 411. 1907; Siddiqui *et al.*, Encycl. Flora Fauna Bangladesh 5: 335. 2007. - *Aspidium vastum* Blume, Enum. Pl. Javae 2: 142. 1828. **Type:** INDONESIA. Java, *Blume s.n.* (lectotype, L-0052210, designated here; isotype, K-0063131).

Figs. 2C, 2D

Aspidium alatum Hook. & Grev., Icon. Filic., pl. 184. 1831. — *Sagenia alata* (Hook. & Grev.) Bedd., Ferns Brit. India, pl. 169. 1866. **Type:** BANGLADESH. Sylhet, *Wallich 378* (holotype, K-001080767).

Diagnostic characters: Fronds 1-pinnatifid, with lamina pinnatifid to the rachis-wing, segments entire; stipe winged except at the base; veins thoroughly anastomosing, not forming costal or costular areoles, with veinlets present in all areoles; sori small, scattered between lateral veins of segments; indusia reniform, persistent or not.

Additional specimens examined: Bangladesh. **Chittagong:** Demagri, *Clarke 19622* (K, US); Dohazari, *Uddin 994* (DACB); Pomkul, *Clarke 19697* (K). Chittagong Hill Tracts, *Gamble 7814* (K). Rangamati Distr., Farua Chara, *Mirza 893 & 962* (DACB). **Sylhet:** Moulvibazar Distr., Rajkandi, *Kamrul s.n.* (JUH-11349) & *Rahim s.n.* (JUH-11348).

Habitat and abundance: Terrestrial in montane forest, common.

Distribution: Bangladesh, China, India, Myanmar; Indochina (Laos, Thailand, Vietnam) and Malesia (Peninsular Malaysia, Indonesia).

Note: *Tectaria vasta* morphologically resembles *T. decurrens*, both having 1-pinnatifid fronds, with rachis and stipe winged throughout. However, the sori are of two different patterns between them, being small and scattered in *T. vasta* (Fig. 2D) but much larger and regularly in two rows between lateral veins in *T. decurrens* (Fig. 2B). Phylogenetically both species are supported to be members of core *Tectaria* (Clade IV) but are rather remotely positioned in the molecular tree (Ding *et al.*, 2014; Dong *et al.*, 2018).



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