**Tectaria danangensis** (Tectariaceae), a new fern species from Vietnam

Van The Pham\(^1,2\), Shu-Han Li\(^3,4\), Shi-Yong Dong\(^3,5\)

\(^1\) Laboratory of Ecology and Environmental Management, Science and Technology Advanced Institute, Van Lang University, Ho Chi Minh City, Vietnam \(^2\) Faculty of Technology, Van Lang University, Ho Chi Minh City, Vietnam \(^3\) Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China \(^4\) University of Chinese Academy of Sciences, Beijing 100049, China \(^5\) Center of Conservation Biology, Core Botanical Gardens, Chinese Academy of Sciences, Guangzhou 510650, China

**Corresponding author:** Shi-Yong Dong (dongshiyong@scib.ac.cn)

**Academic editor:** Blanca León  |  Received 6 January 2022  |  Accepted 17 February 2022  |  Published 11 April 2022

**Citation:** Pham VT, Li S-H, Dong S-Y (2022) *Tectaria danangensis* (Tectariaceae), a new fern species from Vietnam. PhytoKeys 194: 1–13. https://doi.org/10.3897/phytokeys.194.80129

**Abstract**

A new fern species, *Tectaria danangensis* (Tectariaceae) from Vietnam, which had long been misreported as *T. crenata*, is described and illustrated. The new species resembles *T. poilanei*, a species long neglected in the fern flora of Indochina, in the frond shape and sori arrangement, but differs by its irregularly 2-rowed sori (versus regularly 2-rowed, distantly and evenly arranged) between lateral veins of pinnae, fronds being more or less dimorphic (versus monomorphic) and basal pinnae each with a base-joined (versus free) lobe. Phylogenetic analyses of five plastid regions (*atpB*, *ndhF* + *ndhF-trnN*, *rbcL*, *rps16-matK* + *matK* and *trnL-F*) suggested *T. danangensis* has a close affinity to *T. harlandii*. *Tectaria danangensis* appears to be an intermediate species between *T. harlandii* and *T. poilanei*.

**Keywords**

Indochina, morphology, molecular phylogeny, taxonomy, *Tectaria crenata*

**Introduction**

The fern species *Tectaria crenata* Cav. represents a morphologically distinctive group in the genus *Tectaria* Cav. (Tectariaceae). It was originally described on the basis of plants from the Mariana Islands and is characterised by the 1-pinnate fronds and indusiate sori in regular rows parallel to lateral veins of pinnae (Copeland 1907). Tardieu-Blot
Van The Pham et al. / PhytoKeys 194: 1–13 (2022)

and Christensen (1941) recorded *T. crenata* in the flora of Indochina and cited five collections from Vietnam. However, *T. crenata* was reported by Holttum (1991) only from western Malesia, Philippines and southern Pacific Islands, but not in Indochina (including Cambodia, Laos, southern Myanmar, Thailand and Vietnam). The distribution of *T. crenata* in Vietnam remains uncertain (Hassler 2004–2021).

During recent years, we examined herbarium specimens of *Tectaria* from Asia in many herbaria and did not find any specimens of *T. crenata* from Indochina (excluding Peninsular Thailand) with typical morphology of this species as those in Malesia and Pacific Islands. The specimens from Vietnam, cited as *T. crenata* by Tardieu-Blot and Christensen (1941), turned out to represent an undescribed species which is reported here as *T. danangensis*. To test the relationships of *T. danangensis* with other species, we also conducted phylogenetic analyses of sequences of five plastid regions (*atpB, ndhF + ndhF-trnN, rbcL, rps16-matK + matK* and *trnL-F*).

**Methods**

For morphological comparisons, we studied herbarium specimens from Indochina in Herbaria BM, BO, CDBI, E, HN, HNU, IBSC, K, KUN, L, P, PE, SING and TAIF. We also conducted field observations of *Tectaria* species in Vietnam focusing on the variations of frond dimorphism, the shape and number of lateral pinnae, venation, sori arrangement and the presence or absence of indusia.

To infer the phylogenetic position of *T. danangensis*, we assembled a sequence matrix containing five plastid regions (*atpB, ndhF + ndhF-trnN, rbcL, rps16-matK + matK* and *trnL-F*) of 61 specimens (Appendix 1). The sampling was based on previous phylogenetic studies of *Tectaria* by Ding et al. (2014), Zhang et al. (2017) and Dong et al. (2018). *Tectaria crenata* was revealed to be a non-monophyletic species, but its sampled specimens from western Malesia to the Solomon Islands were resolved in a strongly supported clade with *T. decurrens* (C. Presl) Copel. and *T. sulitii* Copel. (Dong et al., in press). One of the analysed specimens, Chen et al. SITW11094 (BSIP, IBSC, TNM), was used here to represent *T. crenata*. Except for one specimen of *T. danangensis* (i.e. *Dong 4909*) which was newly sequenced and analysed in this study, other specimens were analysed in previous studies and their corresponding sequences are available in GenBank. The methods to obtain and align the five cpDNA sequences for *Dong 4909* have been as described in Ding et al. (2014).

We analysed the matrix using Bayesian Inference (BI), Maximum Likelihood (ML) and Maximum Parsimony (MP). The MP analysis was conducted in PAUP* version 4.0d100 (Swofford 2002), with all characters weighted equally and gaps treated as missing data. One thousand heuristic replicated searches were carried out using random stepwise addition with branch swapping by tree bisection-reconnection (TBR), saving 100 trees per replicate. Bootstrap values (BS) were calculated with 1000 heuristic bootstrap replicates, one random sequence addition and TBR swapping. For BI and ML analyses, we used the software jModelTest (Posada 2008) to determine the best-
fitting substitution models for the concatenated sequences and the results suggested GTR+G+I as the best-fitting model. The BI analysis was conducted with MrBayes 3.2.6 (Ronquist et al. 2012), using 10 million generations with one tree sampled every 1,000 generations; four runs with four chains were performed in parallel. The first 25% trees were discarded as burn-in. The ML analysis was conducted using raxmlGUI 2.0 (Edler et al. 2020). A thorough tree search for the best ML tree was performed. The ML bootstrap analysis was performed with 1000 replications. The analysed sequence matrix and resulting trees are available in Dryad Digital Repository (https://doi.org/10.5061/dryad.51c59zw9t).

Results

Morphological comparisons showed that the specimens recorded as T. crenata by Tardieu-Blot and Christensen (1941) represent an undescribed species which is recognised as T. danangensis. This new species superficially resembles T. crenata in the 1-pinnate fronds and entire pinnae, but distinctly differs in sori features, such as being borne on anastomosing veins (versus terminal on free veins included in areoles) and in irregular two rows (versus regularly 2-rowed, distantly and evenly arranged) between lateral veins of pinnae/segments (Fig. 1A and B). Based on herbarium specimens and recent collections, we found that T. danangensis is quite variable in the frond dimorphism, with fertile fronds contracted to different extents compared with sterile ones and its sori are in irregular two rows between lateral veins, close or distant to each other. A few specimens of T. danangensis with less contracted fertile fronds are similar to those of T. poilanei Tardieu, but differ mainly in their irregular 2-rowed sori (versus regularly 2-rowed) between lateral veins, upper pinnae mostly being adnate (versus pointed) to rachis and basal pinnae each having a basiscopic base-joined (versus free) lobe (Figs 1 and 2). We detected a total of 25 herbarium collections of T. danangensis containing fertile fronds, of which seven collections bore evidently abortive sporangia.

Our phylogenetic analyses of cpDNA sequences with all three methods (BI, ML or MP) consistently resolved T. danangensis in Clade IV-8 of Tectaria (Fig. 3). Based on the current sampling, two specimens of T. danangensis and an unidentified specimen (Zhang et al. 8817, for which we had no chance to examine the morphology) formed a strongly support sister relationship with T. harlandii clade including T. × hongkongensis S.Y. Dong and a T. harlandii-like specimen (PP = 1.0, MLBS = 94% and MPBL = 90%). In contrast, T. crenata and allied species were resolved in a different clade (IV-9, Fig. 3). Though T. danangensis was suggested as having a close affinity to T. harlandii (Hook.) C.M. Kuo, these two species are morphologically strikingly different in sori features. Specifically, T. danangensis has discrete sori, whereas T. harlandii has nearly acrostichoid sori. A comparison of morphological characters amongst T. danangensis, T. poilanei and T. harlandii is listed in Table 1.
Figure 1. Morphological comparison between *Tectaria danangensis* (A, B) and *T. poilanei* (C, D). A, C habit. B, D detail of a pinna showing venation and sori arrangement. Drawn by Shu-Han Li, with A and B based on Dong 4909 (holotype, IBSC) and C and D on Poilane 24074 (holotype, P).
A new fern species from Vietnam

Discussion

Tardieu-Blot and Christensen (1941) overlooked the sori differences between *T. danangensis* and *T. crenata* and misidentified the former as the latter in Vietnam. Though having similar shape and dissection of fronds to *T. danangensis*, *T. crenata* and its allied species in Clade IV-9 (Fig. 3) (including *T. decurrens*, *T. pleiosora* (Alderw.) C. Chr. and *T. repanda* (Willd.) Holttum) differ from *T. danangensis* in their characteristic sori which are large and regularly 2-rowed between lateral veins, with each sorus being terminal on a single veinlet in an areole (Tagawa and Iwatsuki 1988: 372; Holttum 1991: 80). Such sori features are stable in these species and can be considered as a synapomorphy for Clade IV-9. In contrast, for species in Clade IV-8, the sori are never in regular two rows between lateral veins nor terminal on free veinlets included in areoles. Instead, their sori are relatively small, scattered between lateral veins and mostly borne on anastomosing veins in most species clustered in Clade IV-8, except for *T. danangensis*, *T. harlandii* and *T. × hongkongensis*. *Tectaria danangensis* has a unique arrangement of sori which are in irregular two rows between lateral veins (Fig. 1A and B); while in *T. harlandii* and *T. × hongkongensis*, the sori are nearly acrostichoid, with sporangia running along veinlets between lateral veins, as shown in Zhao and Dong (2016: Fig. 2C).

By examining specimens of all *Tectaria* species with 1-pinnate, pinnae-entire fronds recorded in Indochina and nearby regions (Tardieu-Blot and Christensen 1941; Tagawa and Iwatsuki 1988; Xing et al. 2013; Fraser-Jenkins et al. 2018), we found that some specimens of *T. danangensis* look very like those of *T. fissa* (Kunze) Holttum, a species frequently occurring in western Malesia but not in Indochina (Holttum 1991; Lindsay and Middleton 2012 onwards). A detailed comparison (Table 1) showed that

| Frond dimorphism | *T. harlandii* | *T. danangensis* | *T. poilanei* | *T. fissa* |
|------------------|---------------|-----------------|--------------|-----------|
| Number of lateral pinnae/segments | 1–3 pairs | 2–5(6) pairs | 3–4 pairs | 1–5 pairs |
| Upper pinnae/segments | Adnate to rachis, mostly connate with terminal segment at base | Adnate to rachis, connate with terminal segment or not | Free, shortly petiolulate or sessile | Adnate to rachis, connate with terminal segment or not |
| Lobes on basal pinnae | Absent | Present; their bases connate to basal pinnae | Present; their bases cuneate, sessile or shortly petiolulate | Mostly present; their bases cuneate or connate |
| Wingless petioles of basal pinnae | Absent | Almost absent, 0–0.5 cm long | 1.2–2 cm long | 0–1.5 cm long |
| Transverse veins between lateral veins of pinnae | Distinct on sterile fronds, absent on fertile fronds | Variable, mostly indistinct | Absent | Distinct |
| Sori | Nearly acrostichoid, with sporangia running along veins between lateral veins | Round; irregularly in 2 rows between lateral veins, close or distant | Round; regularly in 2 rows between lateral veins, uniformly distant | Round; irregularly in 4–6 rows between lateral veins, close to each other |
| Indusia | Absent | Present | Present | Present |
Van The Pham et al. / PhytoKeys 194: 1–13 (2022)

*T. danangensis* differs from *T. fissa* and other species having 1-pinnate fronds by its ve-
nation lacking distinct transverse veins between lateral veins and its sori being generally
in only two rows (versus 4–6 rows) between lateral veins.

*Tectaria danangensis* appears to be an intermediate species between *T. harlandii*
and *T. poilanei*; the latter (*T. poilanei*) has long been neglected in literature account-
ing the fern flora of Indochina (e.g. Tardieu-Blot and Christensen 1941; Tagawa
and Iwatsuki 1988; Phan 2010; Lindsay and Middleton 2012 onwards). According to
herbarium specimens examined, *T. danangensis* is not rare in Vietnam; it has been col-
lected from 1837 to 2014 across nearly all the country and, morphologically, is quite
variable in the frond dimorphism and sori distribution between lateral veins. As shown
in Table 1, some characters in *T. danangensis*, such as frond dimorphism, attachment
pattern of pinnae to rachis, venation and sori distribution, exhibit intermediate states
of those between *T. harlandii* and *T. poilanei*. Notably, *T. poilanei* is quite stable in pin-
nae features (i.e. the broad-lanceolate shape, lower pinnae consistently being petiolu-
late and basal pinnae each bearing a free basiscopic lobe), venation lacking transverse
veins between lateral veins and regularly 2-rowed well-spaced sori (Fig. 1C and D); this
species is currently represented, so far as we know, by its type specimen from southern
Vietnam (Tardieu-Blot 1940) and a few collections from Thailand extend its distribu-
tion (e.g. *Beusekom & Smitinand 2193* (L) from Chantaburi, *Hansen & Smitinand
12644* (K, L) from Mae Hong Son and *Maxwell 04-156* (L) and *Hansen et al. 10886*
(K, L) from Chiang Mai). Based on its variable morphology and frequently abortive
sporangia, we hypothesised that *T. danangensis* possibly involved hybridisation with
other species. Further studies, especially chromosome number and reproductive mode,
are needed to better determine the origin of *T. danangensis* and its relationships with
other *Tectaria* species.

**Taxonomic treatment**

*Tectaria danangensis* S.Y. Dong, sp. nov.
urn:lsid:ipni.org:names:77296979-1
Figs 1A, B, 2

**Type.** Vietnam. On the border between Da Nang and Thua Thien Hue Prov.: Bach
Ma National Park, 107°51'37"E, 16°17'59"N, 680 m elev., 02 Dec 2017, S.Y. Dong
4909 (holotype: IBSC!, designated here; isotypes: HNU!, IBSC!).

**Diagnosis.** *Tectaria danangensis* is similar to *T. poilanei* Tardieu, but differs in its
irregularly 2-rowed sori (versus regularly 2-rowed, well-spaced and evenly arranged)
between lateral veins, fronds more or less being dimorphic (versus monomorphic) and
basal pinnae each having a base-joined (versus free) lobe.

**Description.** Rhizome short, erect or decumbent. Fronds more or less dimor-
phic, with fertile fronds slightly contracted; stipe reddish-brown, 3–4 mm in diameter,
30–50 cm long, bearing scales only at base; scales lanceolate, ca. 8–10 × 1–1.5 mm,
Figure 2. Herbarium specimens of *Tectaria danangensis*, showing contracted fertile fronds (A, C) as compared with sterile fronds (B, D) A, B Dong 4909 (type, IBSC) C, D Cadiere 165 (P).
Van The Pham et al. / PhytoKeys 194: 1–13 (2022)

reddish-brown; lamina nearly round or oblong, 35–55 × 25–35 cm, imparipinnate or terminated by tri-lobed segments, having 2–4(6) pairs of lateral pinnae, pinnae and segments entire at margin, herbaceous in texture, hairless; basal pinnae forked, 14–27(33) × 1.7–5 cm, petiolules 0–5 mm long, acroscopic base cuneate, basiscopic base round, apex caudate-acuminate, having a basiscopic lobe, the basiscopic lobes 7–24 × 1–3.5 cm; suprabasal pinnae linear, 14–30 × 1–4.5 cm, sessile, base cuneate, apex acuminate or caudate; upper pinnae similar to suprabasal pinnae in size and

Figure 3. Bayesian consensus tree of Tectaria, based on combined plastid regions of atpB, ndhF + ndhF-trnN, rbcL, rps16-matK + matK and trnL-F. The position of the new species, T. danangensis, is indicated by an arrow.
shape, but mostly adnate to rachis. Veins fully anastomosing, with most areoles having included free or forked veinlets, transverse veins between lateral veins mostly indistinct. Sori round, borne on anastomosing veins, generally in two rows between lateral veins of pinnae (more or less with additional sori present beyond two rows), 8–11 each row in broad pinnae or 4–6 in obviously contracted fertile pinnae, well-spaced or adjacent. Indusia round-reniform, mostly curled and almost covered by sporangia when mature.

**Distribution and habitat.** Vietnam (Da Nang, Lam Dong, Quang Binh, Quang Nam, Quang Tri, Thanh Hoa, and Thua Thien Hue); terrestrial in broadleaved evergreen forest, occurring in slopes of valley or along mountain ridge, elev. 200–1400 m, locally common.

**Additional specimens examined (paratypes).** Vietnam. Da Nang: Ba Na Mountain, Hoa Vang District, Sallet s.n. (P); without locality, Gaudichaud s.n. (P). Lam Dong: Da Lat, Wu et al. WP1447 (HN). Quang Binh: Phong Nha – Ke Bang National Park, Nguyen NT39, NT69 & NT102 (HNU); without locality, Phan s.n. (HNU). Quang Nam: without locality, Poilane 29484 & 31661 (P). Quang Tri: Huong Hoa District, Averyanov et al. CPC2906 & CPC2907 (HNU); Dakrong District, Phan et al. HLF6122 (HNU); Dakrong Nature Reserve, Lu 19232 (TAIF); “Mai-lanh”, Poilane 1189 (P, PE, SING). Thanh Hoa: Phu luc, Lecomte & Finet 1338 (P). Thua Thien Hue: A Luoi District, Averyanov et al. HAL7289, HAL7342, HAL7423, HAL7622, HAL7738 (HNU); Nam Dong District, Averyanov et al. HAL6940 (HNU); “Tua Luu”, Cadiere 165 (P). Southern Vietnam (Annam, with localities’ names unreadable): Eberhardt 373 (P).

**Acknowledgements**

We thank the curators of BM, BO, CDBI, E, HN, HNU, IBSC, K, KUN, L, P, PE, SING and TAIF for allowing access to their specimens, the Management Board and staff of Bach Ma National Park for specimens collecting permission and Nguyen Xuan Nghia and Le Tuan Anh for their help in fieldwork. Liang Zhang kindly provided photos of the collection Zhang et al. 7214 which led to its identification as *Tectaria danangensis*. This study was supported by National Natural Science Foundation of China (grant no. 31670203).

**References**

Copeland EB (1907) A revision of *Tectaria* with special regard to the Philippine species. Philippine Journal of Science 2: 409–418.

Ding HH, Chao YS, Callado JR, Dong SY (2014) Phylogeny and character evolution of the fern genus *Tectaria* (Tectariaceae) in the Old World inferred from chloroplast DNA sequences. Molecular Phylogenetics and Evolution 80: 66–78. https://doi.org/10.1016/j.ympev.2014.06.004
Dong SY, Chen CW, Tan SS, Zhao HG, Zuo ZY, Chao YS, Chang YH (2018) New insights on the phylogeny of *Tectaria* (Tectariaceae), with special reference to *Polydictyum* as a distinct lineage. Journal of Systematics and Evolution 56(2): 139–147. https://doi.org/10.1111/jse.12292

Dong SY, Chen CW, Tan SS, Huang L, Li SH (in press) An expanded plastid phylogeny of *Tectaria* (Tectariaceae), with description of four new species from the Solomon Islands. Systematic Botany.

Edler D, Klein J, Antonelli A, Silvestro D (2020) raxmlGUI 2.0: A graphical interface and toolkit for phylogenetic analyses using RAxML. Methods in Ecology and Evolution 12(2): 373–377. https://doi.org/10.1111/2041-210X.13512

Fraser-Jenkins CR, Gandhi KN, Kholia BS (2018) An annotated checklist of Indian pteridophytes, part-2. Bishen Singh Mahendra Pal Singh, Dehra Dun, 573 pp.

Hassler M (2004–2021) World Plants, synonymic checklist and distribution of ferns and lycophytes of the World. Version 12.8. http://worldplants.de

Holtttum RE (1991) Flora Malesiana, series 2, Pteridophyta, vol. 2, part 1, *Tectaria* group. Rijksherbarium/Hortus Botanicus, Leiden, 132 pp.

Lindsay S, Middleton DJ (2012 onwards) Ferns of Thailand, Laos and Cambodia. http://rbg-web2.rbge.org.uk/thaiferns/

Phan KL (2010) The updated checklist of the fern flora of Vietnam following the classification scheme of A. Smith et al. (2006). Journal of Fairylake Botanical Garden 9(3): 1–13.

Posada D (2008) jModelTest: Phylogenetic model averaging. Molecular Biology and Evolution 25(7): 1253–1256. https://doi.org/10.1093/molbev/msn083

Ronquist F, Teslenko M, Van Der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP (2012) MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. Systematic Biology 61(3): 539–542. https://doi.org/10.1093/sysbio/sys029

Swofford DL (2002) PAUP: Phylogenetic analysis using parsimony (and other methods), version 4.0b10. Sinauer Associates, Sunderland.

Tagawa M, Iwatsuki K (1988) Dryopteridaceae. In: Smitinand T, Larsen K (Eds) Flora of Thailand 3(3). Royal Forest Department, Bangkok, 327–392.

Tardieu-Blot M (1940) Sur quelques fougères nouvelles ou récoltées pour la première fois en Indochine. Bulletin de la Société Botanique de France 87(2): 366–372. https://doi.org/10.1080/00378941.1940.10836440

Tardieu-Blot M, Christensen C (1941) *Tectaria*. Flore Générale de l’Indo-Chine 7(2): 402–423.

Xing FW, Yan YH, Christenhusz MJM (2013) *Tectaria*. In: Wu CY, Raven P, Hong DR (Eds) Flora of China, vols. 2–3. Missouri Botanical Garden Press, St. Louis; Science Press, Beijing, 733–746. http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=10291

Zhang L, Zhou XM, Chen DK, Schuettpelz E, Knapp R, Lu NT, Luong TT, Dang MT, Duan YF, He H, Gao XF, Zhang LB (2017) A global phylogeny of the fern genus *Tectaria* (Tectariaceae: Polypodiales) based on plastid and nuclear markers identifies major evolutionary lineages and suggests repeated evolution of free venation from anastomosing venation. Molecular Phylogenetics and Evolution 114: 295–333. https://doi.org/10.1016/j.ympev.2017.05.020

Zhao HG, Dong SY (2016) A new hybrid of *Tectaria* (Tectariaceae) from southern China. Phytotaxa 266(3): 213–218. https://doi.org/10.11646/phytotaxa.266.3.5
Appendix 1

Accessions used for phylogenetic analyses in this study. Information are arranged in this order: species name, voucher specimen (collector, number, and herbarium), place of origin, and GenBank numbers for rbcL, atpB, rps16-matK + matK, ndhF + ndhF-trnN, and trnL-F spacer (NA indicates data absent).

*Polydictyum menyanthidis* (C.Presl) Copel., *Dong 3921* (IBSC, LAE), Papua New Guinea (Lae), MF623752/MF623680/MF623704/MF623728/MF623776.

*Pteridrys australis* Ching, *Dong 3560* (IBSC), China (Yunnan), KJ196892/KJ196486/KJ196796/KJ196678/KJ196522.

*Tectaria angulata* (Willd.) Copel., *Dong 3497* (IBSC, LAE), Papua New Guinea (Kimbe), MF623756/MF623756/MF623708/MF623732/MF623779.

*Tectaria barberi* (Hook.) Copel., *Dong 3942* (IBSC, LAE), Papua New Guinea (Kimbe), MF623756/MF623756/MF623708/MF623732/MF623779.

*Tectaria beccariana* (Ces.) C.Chr., *Dong 4944* (IBSC), Indonesia (Java), OK104174/OK480073/OK480115/OK480153/OK480194.

*Tectaria cf. harlandii* (C.M.Kuo, Zhang et al. 7194 (CDBI), Vietnam (Ha Tinh), NA/NA/KY937237/N/NA/NA.

*Tectaria christovalensis* (C.Chr.) Alston, *Dong 3973* (IBSC), Papua New Guinea (Kimbe), OK104179/OK480081/OK480121/OK480161/OK480202.

*Tectaria cicutaria* (L.) Copel., *Sundue 2095* (VT), Puerto Rico, KJ196905/KJ196408/KJ196870/KJ196471/KJ196480.

*Tectaria coadunata* (J.Sm.) C.Chr., *Dong 1836* (IBSC), China (Yunnan), KJ196878/KJ196471/KJ196531/KJ196779/KJ196661.

*Tectaria crenata* Cav., *Chen et al. SITW11094* (BSIP, IBSC, TNM), Solomon Islands (Temotu), OK104204/OK480084/OK480124/OK480164/OK480205.

*Tectaria danangensis* S.Y.Dong, *Dong 3559* (IBSC), China (Yunnan), KJ196870/KJ196471/KJ196535/KJ196741/KJ196674.

*Tectaria deusta* (Kunze) Copel., *Dong 3570* (IBSC), China (Yunnan), KJ196883/KJ196545/KJ19678/KJ196668/KJ196605.

*Tectaria dubia* (C.B.Clarke & Baker) Ching, *Dong 4344* (IBSC), China (Yunnan), MF623762/MF623690/MF623714/MF62378/MF623783.

*Tectaria durvillei* (Bory) Holttum, *Dong 3920* (IBSC, LAE), Papua New Guinea (Lae), MF623763/MF623691/MF623715/MF623739/MF623784.

*Tectaria fauriei* Tagawa, *Dong 3553* (IBSC), China (Yunnan), KJ196870/KJ196535/KJ196741/KJ196674.

*Tectaria fissa* (Kunze) Holttum, *Dong 4261* (IBSC), Malaysia (Selangor), MF623766/MF623694/MF623718/MF623742/MF623787.

*Tectaria fusipes* (Bedd.) C.Chr., *Dong 3856* (IBSC), China (Hainan), MF623767/MF623695/MF623719/MF623743/MF623788.

*Tectaria gaudichaudii* Maxon, *Selling 3605* (H), USA (Hawaii), KF887176/NA/NA/NA/NA.

*Tectaria griffithii* (Baker) C.Chr., *Dong 3632* (IBSC), China (Guangxi), KJ196872/KJ196473/KJ196758/KJ196775/KJ196651; Zhang et al. 6765 (CDBI), Vietnam (Bac Kan), KY937337/NA/KY937229/NA/KY937501.

*Tectaria gymnocarpa* Copel., *Dong 3967* (IBSC), Papua New Guinea
Tectaria harlandii (Hook.) C.M.Kuo, Chen et al. 4846 (IBSC), China (Guangdong), KJ196839/KJ196432/KJ196612/KJ196758/KJ196718. Tectaria hekouensis Ching & Chu H.Wang, Dong 3608 (IBSC), China (Yunnan), KJ196894/KJ196487/KJ196520/KJ196799/NA; Zhang et al. 6502 (CDBI), Vietnam (Hanoi), KY937340/NA/KY937238/NA/KY937514. Tectaria heracleifolia (Willd.) Underw., Sundue 2094 (VT), Puerto Rico, KJ196904/KJ196407/KJ196597/KJ196728/KJ196695. Tectaria heterocarpa Bedd., Dong 5189 (IBSC), Bangladesh (Sylhet), MW795598/MW795606/MW795612/MW795620/MW795628. Tectaria × hongkongensis S.Y.Dong, Dong 3631 (IBSC), China (Hong Kong), KJ196886/KJ196484/KJ196568/KJ196783/KJ196666. Tectaria impressa (Fée) Holttum, Dong 3615 (IBSC), China (Yunnan), KJ196841/KJ196420/KJ196572/KJ196626. Tectaria labrusca (Hook.) Copel., Chao 1981 (TAIF), Malaysia (Sarawak), KJ196818/KJ196499/KJ196600/KJ196745/KJ196692. Tectaria latifolia (G.Forst.) Copel., Chen et al. SITW11095 (BSIP, IBSC, TAIF, TNM), Solomon Islands (Temotu), OK104190/OK480096/OK480135/OK480174/OK480217. Tectaria melanocaulos (Blume) Copel., Chen Wade1865 (TAIF), Indonesia (Java), KJ196832/KJ196422/KJ196562/KJ196735/KJ196709. Tectaria morsei (Baker) S.Y.Dong, Dong GZE219 (IBSC), China (Guizhou), KJ196893/KJ196418/KJ196521/KJ196798/KF561675; Zhang et al. 7312 (CDBI), Vietnam (Quang Binh), KU605205/NA/KU605139/NA/KU605117. Tectaria multiflora (C.B.Clarke) Ching, Chen Wade1382 (TAIF), Vietnam (Bu Gia Map National Park), KJ196834/KJ196425/KJ196558/KJ196756/KJ196713. Tectaria psomiocarpa S.Y.Dong, Chen s.n. (TAIF), Philippines (Luzon), J196889/KJ196777/KJ196524/KJ196794/KJ196657. Tectaria remotipinna S.Y.Dong, Chao 1977 (TAIF), Philippines (Palawan), OK104195/OK480104/OK480144/OK480183/OK480228. Tectaria sagenioides (Mett.) Christenh., Dong 1599 (IBSC), China (Hainan), KJ196896/KJ196436/KJ196550/KJ196760/KJ196625. Tectaria semipinnata (Roxb.) C.V.Morton, Chao 1977 (TAIF), Malaysia, KJ196817/KJ196498/KJ196601/KJ196744/KJ196691; Dong 5237 (IBSC),
Indonesia (Sumatra), NA/OK480106/OK480146/OK480185/OK480230. **Tectaria simonsii** (Baker) Ching, *Dong 3639* (IBSC), China (Guangxi), KJ196837/KJ196430/KJ196555/KJ196730/KJ196717. **Tectaria simulans** Ching, *Dong 4306* (IBSC), China (Yunnan), OK104197/OK480108/OK480148/OK480187/OK480231. **Tectaria singaporiana** (Hook. & Grev.) Copel., *Dong 4260* (IBSC), Singapore, MF623771/MF623699/MF623723/MF623747/MF623791. **Tectaria sp.** Zhang et al. 8817 (CDBI), Vietnam (Khanh Hoa), NA/NA/KY937269/NA/KY937557. **Tectaria tricuspis** (Bedd.) Copel., *Chao 1978* (TAIF), Malaysia (Kuala Lumpur), KJ196820/KJ196501/KJ196598/KJ196847/KJ196694. **Tectaria trifoliata** (L.) Cav., *Sundue 2062* (VT), Puerto Rico, KJ196901/KJ196409/KJ196565/KJ196848/NA. **Tectaria vanikoroensis** S.Y.Dong & C.W.Chen (ined.), *Chen et al. SITW11129* (BSIP, IBSC, TNM), Solomon Islands (Temotu), OK104200/OK480111/NA/OK480190/OK480234. **Tectaria vasta** (Blume) Copel., *Dong 5218* (IBSC), Indonesia (Sumatra), NA/OK480112/OK480151/OK480191/NA. **Tectaria wightii** (C.B.Clarke) Ching, *Fraser-Jenkins s.n.* (TAIF), India (Kerala), KJ196906/KJ196416/KJ196561/KJ196732/KJ196710. **Tectaria zeilanica** (Houtt.) Sledge, *Dong 3634* (IBSC), China (Yunnan), KJ196862/KJ196442/KJ196540/KJ196768/KJ196637.