

## FIVE ASIATIC THELYPTERIS SPECIES RE-INTERPRETED

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**ABSTRACT.** The nomenclature of five species of *Thelypteris* Schmidel from Asia is discussed: *Aspidium jaculosum* Christ (1904) is established as distinct from *A. subpubescens* Bl. (1828) and therefore, from *Thelypteris subpubescens* (Bl.) Iwats. (1965); the question of typification of *Nephrodium malabariense* Fée (1865) and of its conspecificity with *Cyclosorus jaculosus* sensu Panigrahi & Manton (1958), non Christ (1904), is dealt with; *Nephrodium biauratum* Bedd. (1892) is shown as conspecific with *N. lebeufii* Baker (1891); *Thelypteris srilankensis* is proposed as a nom. nov. for *Nephrodium zeylanicum* Fée (1865), non *T. zeylanica* Ching; four new combinations at species rank with the genus *Thelypteris* Schmidel are made.

Holtum (1971), in partial agreement with Ching (1963), proposed 23 genera within the thelypteroid ferns and considered (l.c. p. 21) that "the presence of acicular or glandular hairs near the annulus of sporangia is always diagnostic". He, however, stated that such hairs may not occur in every sporangium and recognised (l.c. p. 18) his system as "only tentative" which "will probably raise many new problems". He, further, stated that "nearly all species have names in *Thelypteris*, so that authors who prefer to regard my genera as subgenera or sections of *Thelypteris* can easily do so". Iwatsuki (1963, 1964, 1965) and Smith (1971) from a critical re-appraisal of the taxonomic value of the diagnostic characters utilised for recognising genera amongst the thelypteroid ferns by Ching (1963), Copeland (1947) and Holtum (1954), amongst others, have established the existence of a wide range of variability in the spores, gametophyte, root, rhizome, fronds, venation, reproductive structures, trichomes (including acicular/glandular hairs on the sporangial stalks) and chromosomes; while Iwatsuki (1964) refers the thelypteroid ferns to three genera, Smith (1971), following Morton (1963) refers them all from the New World to the comprehensive genus *Thelypteris*. But both of them maintain that the traditional separation of species with free veins or the lowest veins of adjacent groups just meeting at the sinus as belonging to *Lastrea* Bory or *Thelypteris* and with veins of adjacent groups variously uniting as belonging to *Cyclosorus* Link (cf. Copeland 1947, Holtum 1954) has to be abandoned due to the discovery of gradual intergrades as more and more species of thelypteroid ferns are described.

During a nomenclatural check of the Indian species referred to the genus *Nephrodium* Rich. by Beddome (1883), and while identifying my own collections of Indian ferns, the following note on the identity, nomenclature and 'typification' of the five species—*Aspidium jaculosum* Christ (1904) from Taiwan, *Nephrodium malabariense* Fée (1866) from Malabar (India), *N. lebeufii* Baker (1891) from Cambodia, *N. biauratum* Bedd. (1892) from Assam and *N. zeylanica* Fée from Ceylon—has been prepared. In consideration of the artificial nature of the genera *Thelypteris* Schmidel and *Cyclosorus* Link, as discussed above, I propose to refer the Indian species of *Nephrodium* sensu Beddome (1883) to the genus *Thelypteris* sensu lato, in

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agreement with Morton (1959, 1963), Iwatsuki (1963, 1964, 1965), Schelpe (1965), Reed (1968), Smith (1971) and Fosberg & Sachet (1972).

***Thelypteris jaculosa* (Christ) Panigrahi, comb. nov.**

Syn.: *Aspidium jaculosum* Christ in Bull. Herb. Boiss. Ser. 2, 4:615 (1904). *Cyclosorus jaculosus* (Christ) H. Ito in Bot. Mag. Tokyo 51:725, f. 4 (1937); non Panigrahi & Manton in Journ. Linn. Soc. Bot. 55:729-743 (1958).

*Thelypteris subpubescens* auct.; Iwatsuki in Mem. Coll. Univ. Kyoto Ser. B. 31, 3:173 (1965), quoad descript., excl. typo, non *Aspidium subpubescens* Blume (1828).

Syntypes: Taiwan, habitat in sylvis Kushaku, 8 vi 1903, *Faurie* 646 [P-(4 sheets)! G (2 sheets)!, BM!, KYO, photo-K!]; Taipeh, *Faurie* 840 (KYO); in sylvis Kelung, 13 v 1903, *Faurie* 657 [P-3 sheets!, G!, KYO, photo-K!].

Rhizome wide creeping,  $\pm$  5 mm in diam., scaly, scales linear with long tail, dark brown; stipes not remote (the lectotype with a rhizome 8 cm long bears only one frond with two more arrested young fronds), stramineous with reddish brown tinge, 10-25 cm long, scaly up to 1 cm from base, hirsute throughout; frond 75-105 cm long, lamina 17-30 cm broad, oblong lanceolate, pinnae 10-18 pairs, the lower pinnae narrowing downwards; the lowest 3-4 pairs gradually reduced to almost auricles, remotely placed (to  $\pm$  7 cm) from each other, the largest auricle linear-subtriangular (i.e. almost butterfly-like in shape), 12  $\times$  8 mm broad, sessile, strongly deflexed and overlapping the rachis, lobed  $\frac{1}{3}$  or less, the lobes almost denticulate, veins branched and joined up to form areoles; the largest pinnae 12-14.5  $\times$  1.6-1.8 cm, cut  $\pm$   $\frac{1}{3}$  or less towards costa, apex of pinnules mucronate or moderately acute, pointing forwards; veins 9-10 pairs per pinnule, of which 2-2 $\frac{1}{2}$  pairs anastomose below the callus sinus (the excurrent vein from the first united pair does not always join up with the next uniting veins); apical pinna distinct, acuminate, 6-11  $\times$  3.5-4.5 cm, lobes oblong, subdeltoid and oblique; short scattered hairs variable in density, more prominent on costae; costules and veins and margins of pinnules, the laminar surfaces subglabrous or minutely sparsely hairy eglandular; 5-6 sori on each side of costules, medial on veins, the tip of pinnules free from sori, indusiate, indusia reniform  $\pm$  hairy; spores bilateral, reticulate, or tuberculate, dark brown.

Distribution. Japan, Taiwan, Hong Kong, Thailand and India.

JAPAN: Taipei Wulai, 2 vii 1963, *Tamura, Shimuza & Caho* 20052 (E); Kyushu, 21 vii 1956, *Iwatsuki* 2120 (K). HONG KONG: Shin Cheng Shanten, 12 iv 1914, *Tutcher* 10869 (K). TAIWAN: Tatwa volcano, on a small glen growing on steep bank of a waterfall, 15 i 1882, *Hancock* 59 (BM, K); Kushaku, 8 vi 1903, *Faurie* 646 (P, G, BM); Shinton, 9 i 1914, *Faurie* s.n. (BM); Banki yo, 600 m, v 1914, *Faurie* 392 (BM); Banksing, *Henry* 1509 (K). THAILAND: Wang Djao, 13 x 1904, *Hosseus* 88 (BM); Kanburi, Kwae Noi river, 18 xii 1952, *Molesworth-Allen* 2183 (BM). INDIA: Meghalaya, Mawshumai, 3 xi 1872, *Clarke* 18213 D, E (P).

The syntypes and isosyntypes of *Aspidium jaculosum* Christ from Taiwan are deposited at Paris (P), Geneva (G), Kyoto (KYO) and British Museum (Natural History) (BM), as cited above, *not* in the Christ Herb. at Basle (BAS) as stated by Christ (1904). One of the 4 sheets representing *Faurie*

646 (bis) at Paris bears a label on which calculations of the length and breadth of the frond and pinnae have been shown, presumably by Christ himself; further isosyntypes of this number are available for study in several herbaria; I, therefore, select it as the lectotype.

Iwatsuki (1965:173-174) amplified the short description given by Christ (1904) for *Aspidium jaculosum* Christ, but both he and Reed (1968) seem to have copied Ching (1938) and Holttum (1954) in treating *Cyclosorus jaculosus* (Christ) H. Ito (1937) as a synonym of *Thelypteris subpubescens* (Bl.) Iwats., the latter based through *Aspidium subpubescens* Blume, Enum. Pl. Jav. 149 (1828) on a different type from Java (L—on a double-size sheet *Herb. Lugd. Bat.* no. 910327-113!). The latter is characterised by a suberect caudex with tufted fronds, 2-4 pairs of basal pinnae gradually reduced (but not to butterfly-like auricles), pinnae crenate to less than  $\frac{1}{4}$  way cut and with 2-2½ pairs of veins anastomosing etc. (cf. Holttum in Ghatak, Manton & Holttum 1971:191 and Panigrahi 1975, in press). *T. subpubescens* (Bl.) Iwats. is absent from Japan and Taiwan, and Holttum now considers that *Cyclosorus subpubescens* of his book (1954) is conspecific with *T. dentata* (Forsk.) E. St. John, but not with the plant described by Blume from Java.

***Thelypteris malabariensis* (Fée) Panigrahi, comb. nov.**

Syn.: *Nephrodium malabariense* Fée, 10 Mem. 43 (1865).

*Cyclosorus jaculosus* auct.; Panigrahi & Manton in Journ. Linn. Soc. Bot. 55:729-743, text fig. 1 (right-hand side) (1958), quoad descript. excl. typo, non *Aspidium jaculosum* Christ (1904).

Type: India, Malabar (tropical region), sine coll. in Herb. Hook. fil. & Thomson s.n. (holo.—not traced at Paris, P, nor at Strasbourg); Malabar, *Stocks & Law* s.n. (iso. ? B; photo. K).

Rhizome wide-creeping, fronds to 65 cm long, lanceolate, stipes rather approximate, dark purple due to presence of anthocyanin, rachis greyish brown; 10-20 pairs of pinnae remotely placed on rachis, basal ones opposite-upper alternate, the 2-3 lower pairs gradually reduced but never to butterfly, like auricles, the lowest pair deflexed; the largest pinnae 12 cm × 12 mm; pinnae sessile, truncate, caudate-acuminate, spread at right angles to rachis,  $\pm$  half-way cut towards the costa, 1-1½ pairs of veins anastomosing; fronds glabrescent to sparsely hairy, hairs short (mostly 1/5 mm), moderately coarse and thick in texture, frond apex pinna-like, deeply lobed and shorter in length than the largest pinna, 5-7 sori on each side of costule, dorsal, indusia short-hairy, brownish-grey, reniform and persistent; spores oval with epispore, 39.4  $\mu$ m × 29.1  $\mu$ m; 2n = 144, n = 72 (tetraploid). (see Panigrahi & Manton 1958).

Distribution: China, Hong Kong, Burma, Bangladesh, India, Sikkim, Nepal, Sri Lanka, Java and Borneo.

HONGKONG: *Bodinier* 87 (P), *Fortune* 30 (P), *Philbert* 1818 (P). CHINA: Hainan, Kiungchiao City, 12 viii 1932, *Fung* 20328 (K); Yunnan, *Henry* 11537 (K). BURMA: Rangoon, *Lelland* s.n. (E). BANGLADESH: Mymensingh, Bhawaniganga, 21 vii 1867, *Clarke* 4844 (L). INDIA: Maharashtra, Mahabaleshwar, iv 1836, sine coll. (K) & 1826, *Winterbottom* s.n. (K); Malabar & Concan, *Stocks & Law* s.n. (BM, E, L, P, U) & Malabar, Herb. John Miers, 11-844/14 (BM); Tamil Nadu, Nilgherries, sine coll. (L, P); Pen. Ind. Orient., 1836, *Wight* 120 (U); Canara-Mercara, 900-1200 m, 1887, *Richsed*

s.n. (P) and *Hohenacker* 602 (P); Madhya Pradesh, Pachmarhi, 900 m, *Morris* (P); Bihar, Moongher, *Griffith* 2239/2 (right side) (K); Uttar Pradesh, Ghagher, 22 viii 1849, *Jamieson* 88A (E); Himalayas, banks of Jumna, *Parker* s.n. (E). SIKKIM: Teesta valley, 300 m, 20 viii 1874, C.N. 618 (K); Buddam than, 1300 m, 3 xi 1879, *Levinge* s.n. (G). NEPAL: ii 1848, *Login* s.n. (K). South Andamans, Port Monat Hill Jungle, 15 xii 1891, *Dr King* s.n. (K). SRI LANKA: (Ceylon), *Thwaites* C.P. 714 (P); Badolla Baposella Pass, *Thwaites* C.P. 974 (E, P); xii 1875, *G. Wall* s.n. (K); *Walker* 116 (G); Colombo-Kandy Road, Kadugannawa (62nd mile post) on damp bank in *Heved* plantation, 12 xii 1950, *Ballard* 1091 (K); Hakagala Peak (*Manton* P. 199): i viii 1952, *Alston* 11744 (BM). JAVA: Gedeh, ix 1858, sine coll. (L). BORNEO: *Teijsmann* s.n. (L).

The type specimen of *Nephrodium malabariense* Fée (Herb. Hook. f. & Thomson, sine coll. from Malabar) has not been found at Paris either by Prof. Holttum or myself despite a thorough search. Prof. Holttum and Dr Heine of Paris inform me that practically none of the 'types' of Fée are in European herbaria including that at Strasbourg, where Fée was the Professor, and that Fée's specimens could be at Rio de Janeiro (Brazil) or elsewhere. However, another specimen, from the "Herbarium of Hook. fil. & Thomson" collected by Stocks & Law from Malabar but not cited by Fée (1865), identified earlier as *Nephrodium molle* Desv., bears the determinavit label "*Nephrodium malabariense* Fée", but lacks Fée's usual signature on specimens identified by him. However, Hooker & Thomson did not themselves collect plants in Malabar, but received specimens for their herbarium from various collectors. Fée could have used one of Stocks & Law's plants from Malabar (in Herb. Hook. fil. & Thomson) for describing *Nephrodium malabariense* Fée. Therefore, Stocks & Law's plant from Malabar, deposited at Berlin, is treated as a probable isotype. Seven other specimens of *Stocks & Law* s.n. from Malabar present in *Herb. Hook. fil. & Thomson* and labelled *Nephrodium molle* Desv. have been located at BM, E, L, U and P; these, however, had not been determined as *N. malabariense* Fée.

***Thelypteris lebeufii* (Baker) Panigrahi, comb. nov.**

Syn.: *Polypodium lebeufii* Baker in Ann. Bot. 5:461 (1891).

*Nephrodium biauiritum* Bedd., Handb. Ferns Brit. Ind. Ceylon & Malay Penin., Suppl. : 68 (1892). Type: Assam, Dhubri, on the Churland, subject to inundation, *Gustav Mann* s.n. (holo. K; iso. BM, E, L, G).

*Dryopteris lebeufii* (Baker) C. Chr., Ind. Fil. 254 (1905).

*D. biauiriti* (Bedd.) C. Chr., l.c. 254 (1905).

*Cyclosorus biauiritus* (Bedd.) Ching in Bull. Fan Mem. Inst. Biol. Bot. 8:197 (1938); Tardieu-Blot & Christensen in Lecomte, H., Flore Gen. Indo-Chine 7, 2:385 (1941).

*Thelypteris biauiriti* (Bedd.) Reed in Phytologia 17, 4:263 (1968).

Type. Cambodia, *Cambodge Expedition of Dr Harmandi*, 29 v 1875, *M. Godefroy-Lebeuf* 69 (holo. K; iso. BM).

Rhizome wide-creeping, (not dorsiventral), 2–3 mm in diam., blackish-chocolate coloured, almost naked, growing tip covered with thin brown

deciduous scales; stipes 5 cm apart, glabrous, stramineous, up to 40 cm long with a few lanceolate palea at the base; frond oblong-lanceolate, bipinnatifid, membranous, finely pilose and minutely glandular,  $\pm 40 \times 12-20$  cm at the middle, narrowed gradually to base; 9-12 pairs of subopposite sessile pinnae, rather distant (up to 7 cm) from each other, the lowest pair reduced to almost auricles, the superior lobe of which is pinnatifid and up to 2.25 cm long; the largest pinnae  $10 \times 2.5$  cm and cut more than half-way towards costa; some pinnules up to 8 mm only; the lowest pair of veins anastomosing at a very obtuse angle. Sori medial, indusium small, fugacious.

Distribution: India, Thailand & Cambodia.

INDIA: Uttar Pradesh, Gorakhpur, on the way to Daibhar, growing on sandy alluvial soil of a bund under the shade of *Syzygium* ssp., *Barringtonia acutangula* etc., in between two swamps, 28 xii 1966, Panigrahi 10726 (BSA). THAILAND: Sisawat, Kaniburi, 50 m, 6 i 1926, A. Kerr 10153 (K); Soi York, on clayey soil at the river bank, 160 m, 18 xii 1961, Larsen 8809 (K—rhizome in this specimen thinner—almost wiry).

A critical study of the type specimens of both *Nephrodium lebeufii* Baker (1891) represented by a fertile frond without a rhizome and of *N. biauritus* Bedd. (1892), establishes them as conspecific, a view shared by Christensen (as is evident from his determinavit label on the isotype of *N. biauritus* Bedd. at BM) and by Tardieu-Blot & Christensen (1941:385) in citing Godefroy's specimen from Cambodia under *Cyclosorus biauritus* (Bedd.) Ching and by Professor Holttum (personal discussion).

***Thelypteris srilankensis* Panigrahi, nom. nov.**

Syn.: *Nephrodium zeylanicum* Fée, 10 Mem. 42 (1865) non *Thelypteris zeylanica* Ching (1936).

*Nephrodium extensum* (Bl.) Moore var. *minor* Bedd., Handb. Ferns Brit. Ind. 201, t. 201 (1866). Type: Ceylon, Thwaites s.n. (K).

*N. amboinense* auctt.; Baker in Hook. & Bak., Syn. Fil. 292 (1867) p.p. quoad Plant. Zeyl., Ceylon, Ambagamoia, Thwaites C.P. 3390 (K) non *N. amboinense* (Willd.) Presl (1836).

*N. molle* Desv. var. *amboinense* auctt.; Bedd., Handb. Ferns Brit. Ind. 278 (1883) p.p. quoad Plant. Zeyl., Thwaites C.P. 3390 (with a note on this sheet by Baker quoting Becket to say "should be 3391"—K).

Type: Ceylon, Thwaites C.P. 3391 (holo.—not traced at Paris, P, nor Strasbourg; iso. BM).

A small fern with flexible fronds; rhizome creeping with closely set fronds and covered with brown, uniformly coloured, minutely hairy, thin scales; stipe 4-7 cm long, sulcate and scaly at base only; lamina decrescent at the base, 32-40  $\times$  8-12 cm, bearing 12-14 pairs of lateral pinnae and a very conspicuous terminal one, the latter largest in size, 10-15  $\times$  1.6-1.9 cm with deeply cut ( $\frac{3}{4}$ - $\frac{1}{2}$  towards costa) up-curved lobes; 3-4 pairs of basal pinnae very gradually reduced (the lowest 1  $\times$  0.5 cm), but never to mere auricles; the lateral pinnae sessile,  $\pm$  cuneate at the base, lanceolate with long attenuate apex, slightly crenate or cut  $\frac{1}{4}$ - $\frac{1}{2}$  towards costa, lobes pointing forwards, 4-8.5  $\times$  1-1.3 cm, nearly 3 cm apart from each other; papyraceous-



herbaceous, shining, almost glabrous, the lower surface with minute transparent glands; veins 4-5 pairs of which only  $1\frac{1}{2}$ -2 ( $-2\frac{1}{2}$ ) lower pairs anastomose; sori restricted to a single row on either side of costa, in pairs between the costules and situated on proximal veins, with occasional sori on the next pair of veins (but up to 3 sori present on each side of the costules on one frond); indusium glabrescent with minute scattered hairs; spores brownish black, ovoid or  $\pm$  reniform, rugose with a thin perispore,  $37 \times 27 \mu\text{m}$  in size.

Distribution: Sri Lanka, endemic.

CEYLON. Ad Kittol Gale, insulae Zeylonae, *Thwaites* 3391 (BM).

*Nephrodium zeylanicum* Fée (1865) is based on *Thwaites* C.P. 3391 from Ceylon, but on transfer to the genus *Thelypteris*, cannot bear the epithet *zeylanica* because of the name *T. zeylanica* Ching (1936) based on a different type, also from Ceylon, viz. *Thwaites* C.P. 3050, located at Kew and Paris. I, therefore, propose the specific epithet *srilankensis*, following Sri Lanka, the new political name for Ceylon.

*Thelypteris zeylanica* Ching differs from *T. srilankensis* in having a short erect caudex with fascicled fronds bearing oblanceolate pinnae with long attenuate bases and serrate or incised upper margin and *all its veins free, the anterior basal vein running almost to the sinus*.

Amongst the species from the Indian region with anastomosing veins, *T. srilankensis* is more closely allied to *T. latipinna* (Hook. f. ex Bak.) K. Iwats. and to *T. semisagittata* (Roxb.) Panigrahi, **comb. nov.** [Syn.: *Polypodium semisagittatum* Roxb. in Calc. Journ. Nat. Hist. 4:491 (1844)]. *T. latipinna* is easily distinguished by its suberect or short-creeping rhizome, and broader ( $\pm 2$  cm wide) lateral pinnae and by occasionally having thick glandular hairs on the lower surface of veins and costules. *T. semisagittata* is recognised by its erect to suberect caudex with tufted fronds, shorter stipe with larger (up to 70 cm long) lamina and in having 5-6 pairs of lower pinnae gradually reduced and prominently auricled with the veins in the winged auricles branched and forming even areoles.

Apart from the 'types', I have seen only one more specimen mounted on the sheet *Hook. & Thomson Ind. Col.* 238 (viz. the smaller one on the right—BM); this bears a note by Alston (Aug. 1956) that it represents C.P. 3390 (should be 3391) seen at Kew.

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