

THE GENUS *PTERIDIUM* GLEDITSCH EX SCOPOLI IN THE INDIAN SUB-CONTINENT

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ABSTRACT

In the Indian sub-continent the genus *Pteridium* is represented by two species viz. *P. aquilinum* (L.) Kuhn and *P. esculentum* (Forst.) Cockayne. The taxonomy of these species is discussed with regard to Indian materials.

INTRODUCTION

Detailed reviews on the taxonomic history of the genus *Pteridium* Gleditsch ex Scopoli have been presented by St. Hilaire (1823), Kuhn (1879), Nakai (1925) and Tryon (1941). The name *Pteridium* Gleditsch ex Scopoli stands conserved (see Lanjow, 1966).

The genus is distributed throughout the temperate and tropical regions of the world except deserts. They form thickets in open places and have a preference for light soils. Their rhizomes penetrate deep into the earth and consequently they are not destroyed by forest fire. Not only that, they also sprout vigorously after forest fire, the rhizome having sustained no injury. The capacity to spread rapidly by means of deeply placed rhizomes makes Bracken a weed of some consequence in cultivated fields elsewhere, but not in India. *Pteridium* prefers dry habitat, but to complete its sexual cycle needs free water. Consequently vegetative propagation is more frequent than sexual reproduction. The genus shows a marked dislike for limestone.

Presence of more or less vestigial inner indusium, initial basipetal succession of sporangia, presence of hairs but not scales on the rhizome, equal dichotomy of the axis in its early development, and open venation were regarded by Bower (1928) to indicate its primitive status in the Pteridaceae. Bliss

(1939), on the otherhand, pointed out that the vascular system is highly organized in the stem and petiole indicating advanced status. It also has true vessels since endwalls of scalariform elements are perforated (McLean & Ivimey-Cook, 1951), a rare feature among ferns. Holttum (1954) considered it as the link between the *Pteris* subfamily and the primitive members of the family Dennstaedtiaceae. A more or less similar view was expressed earlier by Copeland (1947) also. Manton (1958) and Mehra (1961), on the otherhand, held that *Pteridium* is not related to *Dennstaedtia* or *Pteris*. Mehra and Khanna (1959) suggested that *Hypolepis*, *Pteridium* and *Paesia* together with *Histiopteris* form a very natural assemblage and favoured their inclusion in the family Hypolepidaceae. Abraham *et al.* (1962) treated *Pteridium* along with *Hypolepis* in Dennstaedtiaceae.

Diels (1899) and Christensen (1905) recognized only one species in the genus. Tryon (1941) also considered it to have only a single species separable into 12 varieties. This treatment has not been accepted universally. Copeland (1947) was of opinion that the genus is better treated as having more than six closely allied species and this view is endorsed here. There are only two species in the Indian sub-continent.

The specimens examined for the present

study were from the herbarium of Komarov Botanical Institute, Leningrad (LE), from the Central National Herbarium, Howrah (CAL) and the herbarium of the Cryptogamic Unit of the Botanical Survey of India, Calcutta (CAL-CR).

Pteridium Gleditsch ex Scopoli, Fl. Carn. 169, 1760 (nom. cons.)

Rhizome subterranean, up to 2.5 cm thick, extensively creeping, repeatedly branched, covered by fine hairs and having a perforated solenostele with medullary strands and vessels. Fronds alternate on the dorsal surface, large, covered with fine hairs when young; stipe long and with numerous vascular bundles arranged irregularly; rachis costae and costules grooved on the upper surface; blade often bipinnate, less frequently quadripinnate and with prolonged apical growth; segments numerous, ovate to linear, subcoriaceous or firm, margins revolute; lateral veins free, obliquely forked, raised on the lower surface, often very hairy. Sori submarginal, continuous, linear, seated on a commissure joining the apices of the veins and protected by thin reflexed edge of the lamina and a scarious lower indusium attached below the receptacle. Sporangia with annular ring just on one side of the stalk. Spores prominently granulose, tetrahedral.

Type: *Pteridium aquilinum* (L.) Kuhn in v.d. Decken, Reisen in Ost-Africa 3: 11, 1879.

KEY TO THE SPECIES IN THE INDIAN SUB-CONTINENT

Leaflet segments dissected to the vein, touching one another, falcate or subfalcate, broadly ovate to linear, glabrous to woolly beneath, long or short acuminate; indusia mostly ciliate; rachis mostly hairy in the grove ... 1. *P. aquilinum*

Leaflet segments not quite cut to the vein, linear, widely spaced (only some of the segments decurrent), with an angular sinus between the segments, subfalcate, acute or blunt, woolly or pubescent beneath with white or dark hairs; indusia mostly glabrous or very rarely ciliate; rachis mostly glabrous not hairy in the grove ... 2. *P. esculentum*

Pteridium aquilinum (L.) Kuhn in v.d. Decken Reisen Ost.-Afrika 3: 11. 1879; Mehra, Ferns Muss. 11. 1939; Holttum, Ferns Malaya 389. 1954; Alston et Bonner in Candollea 15: 198. 1956; Stewart in Biologia 3: 23. 1957; Bir in Bull. Bot. Surv. India 5: 158. 1963; Ito in Hara Fl. East. Himal. 465. 1966. *Pteris aquililina* L. Sp. Pl. 1075. 1753; Clarke in Trans. Linn. Soc. Lond. Ser. 2, 1: 468. 1880; Bedd. Handb. Ferns Brit. India 115. 1883 et with Suppl. 115. 1892; Hope in Jour. Bomb. nat. Hist. Soc. 13; 455. 1901. *Pteris densa* wall. Cat. 99. 1829 (nomen nudum), Isotype at CAL, *vidi*. *Pteris firma* Wall. Cat. 100. 1829 (nomen nudum). *Pteris recurvata* Wall. [Cat. 113, 1829 (nomen nudum)] ex Agardh, Rec. Pterid. 50. 1839. *Pteris wightiana* Wall. Cat. 2178. 1829 (nomen nudum). *Pteris lanuginosa* Bory ex Willd. Sp. Pl. 5: 403. 1810. *Pteris recurvata* Wall. ex Agardh var. *wightiana* Agardh, Rec. Pterid. 50. 1839. *Pteris lanuginosa* Bory ex Willd. var. *capensis* (Thunb.) Agardh, Rec. Pterid. 51. 1839. *Circinalis lanuginosa* (Bory ex Willd.) Trevis. Atti. Soc. Ital. Sci. nat. 17: 239. 1875. *Pteris aquilinum* (L.) Kuhn var. *lanuginosum* (Bory ex Willd.) Kuhn in v. d. Decken Reisen Ost.-Afrika 3: 11. 1879. *Pteridium lanuginosum* (Bory ex Willd.) Clute in Fern Bull. 8: 38. 1900. *Filix aquilina* (L.) Woynar in Hedwig. 56: 383. 1915. *Pteridium capense* (Thunb.) Krasser var. *densa* Nakai in Bot. Mag. Tokyo 39: 109. 1925. *Filix-foemina aquilina* (L.) Farewell, Amer. Mid. Nat. 12: 290. 1931. *Pteridium aquilinum* (L.) Kuhn var. *typicum*. Tryon in Rhodora 43: 15. 1941. *Pteridium aquilinum* (L.) Kuhn var. *wightianum* (Agardh) Tryon in Rhodora 43: 22. 1941; Ito in Hara, Fl. East. Himal. 465. 1966.

Type: Figure of *Filix foemina* Fuchs, Hist. 596, misprinted 569, 1542; illustration cited by Linnaeus 1753.

• **Type locality:** Europe.

Illustrations: Bedd. Ferns South India t. 42. 1863; Lowe, Native Ferns 2; 407, t. 61. 1867; Holttum, Ferns Malaya Fig. 225. 1954.

Underground portion consists of two main parts, a deeper system of thicker storage branches, 0.5-2.5 cm in diameter and a less deeper system of thinner branches closely beset with petiolar bases and dense covering of fine roots (frond bearing branches); rhizome dichotomously branched, the two limbs unequal, one remaining very short; tip of rhizome with tuft of dark hairs. Fronds up to 1.5 m tall; pinnate and deeply pinnatifid, ovate-triangular; stipe longer or shorter than pinnae; rachis grooved above, usually hairy in the groove, subglabrous or glabrous below or very rarely glabrous throughout; pinnae and pinnules long or short acuminate; pinnules usually at right angles to the costa, about 20 cm long and about 3.5 cm wide (if pinnatifid) or up to 7 cm (if bipinnatifid); costules densely pubescent beneath or (very rarely) glabrous or glabrescent; ultimate segments cut almost to the costa, segments contiguous, sub-falcate, broadly ovate to linear, apex rounded or acute, lower surface often densely pubescent, sub-coreaceous, margins entire, serrate or lobed; indusia ciliate or very rarely glabrous; spore mother cells in a sporangium usually 15-16; spores 20-40 μ with a mean diameter 29 μ , brown, prominently granulose, tetrahedral.

Clarke (1880) considered that the North Indian specimens belong to the variety *lanuginosa* (Bory ex Willd.) Kuhn, with ultimate segments approximate, oblong, yellow hairy beneath. Tryon (1941) treated the Indian material in a variety *wightianum* (Agardh) Tryon because of the densely pubescent rachis, long-acuminate rather than subacute or obtuse pinnae and pinnules. Most of the Indian specimens are more hairy than the European Bracken. The characters chosen by Clarke (loc. cit.) and Tryon (loc. cit.) are not constant and intermediates are frequent. Some of the specimens from N. W. Hima-

layas such as Gilgit Expedition, Kashmir, 1885, G. M. Giles s.n. (LE, CAL), without precise locality, Stewart 6492 (LE) are completely glabrous. The leaf segments also tend to be oblong. If these are compared with hairy specimens with falcate leaves the two groups will appear distinct. But, gradations between these two extremes are seen in materials from Kashmir [*Schlagintweit* 5145, Aug. 5-10, 1886 (LE)] and Nilgiris [*W. W. Marcovicz* s.n. 1926 (LE)]. The long acuminate and subacute or obtuse nature of the pinnae and pinnules are also found to be not constant. Because of these gradations in the materials examined, var. *lanuginosa* (Bory ex Willd.) Kuhn and var. *wightiana* (Agardh) Tryon are not considered critical varieties. They may be habitat forms, but this needs confirmation.

Two forms can be distinguished on the basis of leaf segments—one with long (up to 1.75 cm) linear, subfalcate segments with rounded apex and the other with short coreaceous triangular segments with acute apex. These characters also intergrade and therefore may only be habitat forms.

The taxon is generally found on dry hill slopes and forest clearings from an altitude of 400 to 3000 m. In forest areas this fern does not produce sporophylls in abundance. This reduced fertility may be due to shade acting as a limiting factor (see Schawbe, 1951; Conway, 1957) as has been suggested earlier by Goebel (1905).

At the base of the first two pinnae there are nectaries consisting of patches of little sunken tissue from which a sugary secretion exudes through the stomata. According to McLean and Ivimey-Cook (1951) their function is unknown. Tryon (1941), on the other hand, considered them to be myrmecophilous nectaries and black ants visit them.

Sporangial maturation proceeds from the base of the frond to the apex. This results in that the spore dispersal begins in the lower branches while the sporangia in the

upper branches are in the process of maturation. The production of fertile fronds in any population vary widely. Open or slightly sheltered places with deep soil seems to be ideal.

Bower (1899) estimated the spore development in Bracken to be normally 48 per sporangium. But it usually is 60-64 in South Indian materials. Each sphenosorus (Bower, 1928), when fully differentiated may show 4-6 ranks of fertile sporangia.

Field studies in Madhya Pradesh, Orissa and Kerala indicate that prothallus and young sporophytes are very rare even in places where large populations are growing (see also Conway, 1953).

Both apogamy and apospory have been reported in the species (Bower, 1884; Farlow, 1889; Steil, 1949; Bell and Richards, 1958; Whittier and Steeves, 1960; Whittier, 1966).

Specimens examined: EASTERN INDIA, BANGLADESH AND EASTERN HIMALAYAS: Above Rengging (Assam), March 1912, *I. H. Burkill* 36832 (CAL); Betni (Sarbhong Division, Bhutan), alt. 1650-1850 m, Dec. 1963, *G. Sen Gupta* 1083 (CAL-CR); Birti (Sarbhong Division, Bhutan), alt. 600-1000 m, April 1964, *G. Sen Gupta* 1335 (CAL-CR); Chittagong, 1821, *Wallich* 101 (CAL), isotype of *Pteris terminalis* Wall.; Darjeeling, alt. 2200 m, April 1876, *C. B. Clarke* 27495D (CAL), 27496 (LE); Duphla Hills (Assam), 1874, *J. L. Listy* s. n. (CAL); E. India, *Griffith* s. n. (LE); E. Himalaya, alt. 1500-2700 m, *T. Thomson* s. n. (LE); Haflong (N. Cachar, Assam), Aug. 1908, *W. G. Craib* 308 (CAL); Khasia, July 1850, *J. D. Hooker* & *T. Thomson* s. n. (CAL), *Oldham* s. n. (CAL); Kohima (Naga Hills), Nov. 1886, *D. Prain* s. n. (CAL); Krihemabi (Manipur), April 1882, *G. Watt* 7484 (CAL); Manipur, April 1854, s. l., s. n. 2905 (CAL), NEFA, *R. Seshagiri Rao* s. n. (CAL); Nepal, 1829, *Wallich* 113 (CAL), isotype of *Pteris recurvata* Wall.; Shillong, *J. D. Hooker* 88 (CAL), May 1918, *H. G. Carter* 855 (CAL), *I. H.*

Burkill & *S. C. Banerjee* 6 (CAL); Sikkim, alt. 1000-2000 m, *J. D. Hooker* s. n. (LE), 151 (CAL); South slope of Bapu (Assam), April 1912, *I. H. Burkill* 36964 (CAL); Tama (Sarbhong Division, Bhutan), alt. 1500-1650 m, April 1964, *G. Sen Gupta* 1168 (CAL-CR); Tashigong to Yangtishali, March 1965, *Balakrishnan* 41307 (CAL); Thengali Bam (Assam), Nov. 1898, *Prain* 34 (CAL); Thengunasu (Assam) 1854, *B. Godfrey* 250 (CAL). EASTERN GHATS AND MADHYA PRADESH: Bailadilla, Sept. 1970, *N. C. Nair* 40575 (CAL), 40575A (CAL-CR); Mahabaleshwar, April 1846, illegible 411 (CAL). SOUTHERN INDIA: Castle Rock, March 1919, *Napa* 205529 (CAL); Kuttikanam (Kerala), May 1967, *N. C. Nair* s. n. (CAL-CR); Naduvattam (Nilgris), 1926, *W. W. Marcoviz* s. n. (LE); Nilgiris and Coorg, *G. Thomson* s. n. (LE), 1926, *W. W. Marcoviz* s. n. (LE); Ooty (Nilgris), April 1870, *C. B. Clarke* 11445 (CAL), *Hohenacker* 1271 (LE); Pathanamthitta (Kerala), June 1967, *N. C. Nair* s. n. (CAL-CR); Ranni (Kerala), June 1967, *N. C. Nair* s. n. (CAL-CR); Shevroy Hills (Salem Dist.), *Perrotet* 514 (CAL), *J. Ghatak* s. n. (CAL-CR); Thankamani (Idiki Dist., Kerala), alt. 1000 m, Oct. 1968, *N. C. Nair* 40431A (CAL-CR), 40431B (CAL-CR); Way to Devikulam Lake, Kerala, alt. 1933 m, April 1960, *J. C. Sengupta* 10233 (CAL-CR); Yercaud (Salem Dist.), alt. 1350 m, March 1962, *J. Ghatak* 45 (CAL-CR). NORTHERN INDIA AND N. W. HIMALAYAS: *Durrghurah* (Kumaon), Dec. 1848, *R. Strachey* & *J. E. Winterbottom* s. n. (CAL); Garhwal & Kumaon, *Falconer* 1257 (CAL); Hazara, Aug. 1895, *Inayat* 20430 (CAL); Kashmir, Gilgit Expedition, 1887, *G. M. Giles* s. n. (CAL, LE); Kashmir, Aug. 1856, *Schlagintweit* 5145 (LE); Mirga (Chitral), June 1895, *Harris* 16889 (CAL); Mussori, 1889, *G. King* s. n. (CAL); Kilar-Sach (Pangi), alt. 2800 m, July 1964, *N. C. Nair* 32685 (CAL-CR); Kothi (Kumaon), alt. 2400 m, *R. Strachey* & *J. E. Winterbottom* 8 (CAL), s. n. (LE); Kumaon, *Vicary* s. n.

(CAL); N. W. Himalayas, A. R. Tucker s. n. (CAL); N. W. India, 1869, *Falconer* s. n. (LE), *Giles* s. n. (LE), 1871, *J. L. Stewart* 3626 (LE); Pahalgam (Kashmir), alt. 2650. 3000 m, T. A. Rao 9685 (CAL-CR); Sonamerg (Kashmir), July 1891, G. A. Gammie s. n. (CAL).

Pteridium esculentum (G. Forst.) Cockayne Rep. Bot. Surv. Tongariro Natl. Park 34. 1908. *Pteris esculenta* G. Forst. Pl. Escul. 74. 1786. *Pteris lorigera* Wall. Cat. 103. 1829 (nomen nudum). *Pteris semihastata* Wall. Cat. 102. 1829 (nomen nudum). *Allosorus esculenta* (G. Forst.) Pr. Tent. Pterid. 154. 1836. *Pteris aquilina* L. var. *esculenta* (G. Forst.) Hook. Fil. Fl. N. Zel. 2: 25. 1854; Bedd. Handb. Ferns. Brit. India 116. 1883 and with Suppl. 1892. *Pteridium aquilinum* (L.) Kuhn var. *esculentum* (G. Forst.) Kuhn, Chaetopt. 347. 1882; Tryon in Rhodora 43(505): 61. 1941. *Pteridium esculentum* (G. Forst.) Nakai in Bot. Mag. Tokyo 39: 109. 1925; Holttum Ferns Malaya 391. 1954; Johnson Ferns Singap. Isl. 71. 1960. *Pteridium aquilinum* (L.) Kuhn var. *yarrabense* sensu Tryon in Rhodora 43: 63. 1941 (pro parte).

Illustration: Domin, Bibl. Bot. 85 (1): figs. 33, 34. 1914; Schk. Krypt. Gew. t. 97. 1809; Dobbie, New Zealand Ferns (ed. 3) 183. 1930; Tryon loc. cit. t. 650, figs. 11, 15, t. 653, fig. 1. 1941; Holttum loc. cit. 226. 1954.

Type: Forster, Location unknown. Tryon says that a fragment of ex Forster Herb. collected by L. M. Underwood is at Herb. New York Botanical Garden.

Type locality: Society islands. Copeland says "The sole Tahitian record is that of Forster".

Rhizome creeping 0.5-3 cm in diameter, dichotomously branched. Fronds up to 3 m tall; stipe as long as the ovate to triangular bi- to quadripinnatifid blade or longer, grooved above, hairy in the grove; rachis and costae of pinnules almost or quite glabrous

above; costules sub-glabrous above and pubescent below. Pinnules up to 14 cm long and up to 9 cm wide, apex long; segments of pinnules not dissected up to the vein, usually linear, widely spaced, lower surface pubescent, apex rounded, veins free. Sorus with two indusia, continuous. Indusia hairy or subglabrous.

Citing the isotype of *Pteris lorigera* Wall. Cat. 103, 1829 Tryon gave the distribution of *Pteris aquilinum* (L.) Kuhn var. *yarrabense* Domin in India. From a comparison of Wallich's specimen No. 103 at LE and CAL with *Pteridium esculentum* (G. Forst.) Cockayne from Malaya, Singapore and Australia I am constrained to construe that the Indian specimen is definitely *esculentum* itself.

This appears to be a very rare fern in India and there had been no recent collection of it in the Central National Herbarium. It is doubtful if this exists in the wild state anywhere in India.

Specimens examined: Kumaon, Wallich 103 (LE, CAL), isotype of *Pteris lorigera* Wall. There is a specimen each collected from India without precise locality by Helfer 412 in LE and CAL. A specimen marked India Orientalis is in LE and this gives no other details.

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