

PTERIDOLOGICAL RESEARCH AT A GLANCE

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PTERIDOLOGICAL SCENARIO IN INDIA

The pteridophytes are non flowering, vascular and spore-bearing plants including ferns and fern-allies. They grow luxuriantly in moist tropical and temperate forests and their occurrence in different eco-geographically threatened regions from sea level to the highest mountains are of much interest (Dixit, 2000). The world flora consists of approximately 12, 000 species of pteridophytes of which around 1000 species distributed in 70 families and 192 genera are likely to occur in India. Many foreign scientists have done lot of work on the pteridophytes of India. Out of that, R. H. Beddome, C. B. Clarke and C. W. Hope were the prominent pteridologists working upto the end of 19th century. Beddome's "Handbook of the ferns of British India, Ceylon and Malay Peninsula" published in 1883 was a very authentic work and is even useful in today's works on pteridophytes. Many Indian Scientists like S.S. Bir, B.K. Nayar, S.P. Khullar, P.N. Mehra, K.K. Dhir and V.S. Manickam *et al* have done significant work on the taxonomy and nomenclature of pteridophytes in India.

The pteridophytes being an important part of the flora of a region, form the next important part after the angiosperms. There are a large number of indigenous species of which a considerable percentage is rare and threatened. Due to over-exploitation of natural resources and large scale land transformations, the pressure on the threatened and endangered species has increased manifolds and hence, they may face the brunt of extinction in the coming times. The IUCN has done significant job in documenting the species which are facing threats and the RED Data Book gives an insight into such species and their conservation status. Their World Conservation Monitoring Centre at Cambridge, England, listed 1650 threatened species of Pteridophytes world-wide (Jermy, 1990), under the following categories: Presumed Extinct - 20, Endangered -

67, Vulnerable - 91, Rare - 354, Candidate species for conservation – 1318 (Chandra *et al*, 2008). Some studies have also been carried out on the threatened pteridophytes of India. Jain and Sastry (1980) listed 17 rare and endangered pteridophytes from India alongwith Angiosperms while Dixit (1983) and Datta (1983) listed 25 rare and interesting and rare pteridophytes respectively. Bir (1987) identified 104 rare and endangered pteridophytes from different parts of India and later Bir (1988) listed 49 endangered species. Nayar and Sastry (1987, 1988, 1990) included 31 threatened pteridophytes in the volumes of the Botanical Survey of India's Red Data Book of Indian Plants. Madhusoodanan (1991) listed rare and endangered ferns of the Western Ghats of Kerala and later on, Manickam (1995) reported 44 rare and endangered species from the Western Ghats of South India. Bhardwaj *et al* (1987) enumerated 36 endangered species belonging to 21 genera of ferns and fern-allies from Rajasthan.

Mr. C.R.F. Jenkins has also contributed enormously on the taxonomical work of pteridophytes in the South Asian region. He has critically examined the specimens with his expertise and has cleared many taxonomical confusions occurring in pteridology. He revised the taxonomy of 300 Indian sub-continental pteridophytes and published that in the form of a book in 2008. Based on the field observations, data from herbarium collections and literature reference, Jenkins and other Indian pteridologists assessed the rare and threatened pteridophytes of India (Chandra *et al*, 2008). He made field trips not only in different parts of India, but also in adjacent countries to collect the specimens and verify the results. A vast herbarium collection was also developed by him which became veery useful for ready comparison and cross-verification of pteridophytic species. This study yielded the results that a total of 219 species were 'At Risk' out of which 160 were 'Critically Endangered'. 82 species were considered to be 'Near Threatened' while 113 species were considered under the category 'Rare'. Jenkins also assessed the endemic and pseudo-endemic species of India (Jenkins, 2008). Based on this study, he stated that out of about 530 pteridophytic species reported to be as endemics by the recent studies, only 47 were true endemics. The remaining 483 were 'pseudo-endemics' and were mistaken as endemics mainly due to insufficient investigative taxonomic research.

The Indian sub-continent is bestowed with a wide range of climatic and altitudinal variations. The pteridophytes in India are distributed in different biogeographic regions from plains to mountains, coastal regions, arid regions, riverine ecosystems, etc. However, the major distribution of pteridophytes can be observed in the Himalayas, Western Ghats, Eastern Ghats and Panchmarhi Biosphere Reserve. The uniqueness of the Pteridophytic flora of Himalayas has been discussed in detail by Bir (1993). The decrease in the rainfall from the Eastern Himalayas towards the Western hills results in the decrease in pteridophytic diversity. The maximum number of about 700 species of pteridophytes occurs in the Eastern Himalayas and its adjoining states making it one of the Hot spots diversity centre for pteridophytes (Dixit, 2000). In the other regions, about 400 species of pteridophytes occur in Southern India, about 300 species in North-West India, about 100 species in the Central India and about 125 species in Andaman and Nicobar Islands.

According to Dixit (2000), the different studies carried out on the diversity of pteridophytes throughout the country reveal that on all India basis, maximum number of 150 species occur in the family Polypodiaceae. Other major families of pteridophytes in India include Dryopteridaceae (109 species), Athyriaceae (101 species), Thelypteridaceae (88 species), Aspleniaceae (70 species), Aspediaceae (50 species), Hymenophyllaceae (35 species), Cheilanthaceae (30 species), Adiantaceae (30 species), Lindasaeaceae (26 species), Bolbitidaceae (22 species) and Vittariaceae (20 species). On the genus level, the maximum diversity of about 70 species was observed in genus *Asplenium*, followed by *Selaginella* (62 species), *Pteris* (60 species), *Dryopteris* (57 species), *Polystichum* (40 species), *Athyrium* (35 species), *Adiantum*, *Cheilanthus*, *Lepisorus*, *Pyrossia* each with 30 species, *Christella* (25 species) and *Lindsaea* (23 species).

IMPORTANT PTERIDOLOGICAL CONTRIBUTIONS IN SOUTH INDIA

In the past many studies have been carried out to determine the angiospermic plant diversity and less focus was laid on the smaller group of plants like pteridophytes. However, some earlier workers carried out a significant work on South Indian fern diversity which form the baseline for the studies even till now. Van Rheedee in 1703 gave the illustrations of few ferns and fern allies.

However, the only comprehensive work on the ferns of South India was by R.H. Beddome (1864) wherein he included 271 species recorded by him from South India and Sri Lanka. After this work, in 1950s, Dr. A. Abraham and his students at the Kerala University, Thiruvananthapuram, Kerala, carried out significant studies on the cytology of South Indian ferns. Abraham *et al* (1962) worked on the cytology of 100 species of pteridophytes of South India. From 1955 onwards, Prof. Ninan carried out the studies on cytology of *Psilotum*, *Lycopodium*, *Huperzia*, *Equisetum*, *Osmunda*, *Angiopteris*, *Marattia*, *Ceratopteris*, *Botrychium* and *Ophioglossum*. Prof. P.I. Kuriachan also contributed to the cytology of South Indian ferns by working on cytology of *Selaginella* (1963), *Nephrolepis* (1976), *Salvinia* (1979), *Cyathea* (1981), *Marsilea* (1991) and some other ferns. Prof. Bhavanandan in 1981 also studied the cytology of family *Aspidiaceae* in South India. Bir and Vasudeva (1971) recorded 118 species of ferns from the Palni hills and Bir (1965) also studied the cytology of some ferns of the Palni hills. Dr. N.C. Nair and others published a series of papers on ferns and fern allies after 1965.

Prof. V.S. Manickam has contributed significantly towards the studies on pteridophytes of South India. He completed his PhD under Prof. Ninan and continued to work on cytology and taxonomy of the ferns of South India at St. Xavier's College, Palayamkottai, Tamil Nadu. He published the "Ecological studies on the Fern Flora of Palni hills" in 1984 and "Fern Flora of Palni Hills, South India" in 1986. Later, in 1988, Manickam and his student V. Irudayaraj provided the cytological information of about 200 ferns of South India in "Cytology of the ferns of Western Ghats, South India". Manickam and Irudayaraj (1992) also published the "Pteridophyte flora of Western Ghats, South India" in which they described and gave illustrations for 256 ferns and fern allies collected from the Western Ghats region lying south of Palghat Gap. Manickam and Rajkumar (1999) explained the polymorphism in 100 south Indian ferns. The phytochemistry of South Indian ferns was also explored by Manickam and his team including Joseph *et al* (1991, 93), Jesudass *et al* (1992, 2001) and Raja *et al* (1995). Benjamin and Manickam (2007) discussed the medicinal uses of 61 different species of pteridophytes occurring in the Western Ghats for treating various diseases and ailments. Benniamin *et al* (2008) developed a key for identification of rare and endangered ferns and fern allies in the Western Ghats.

Dr. B.K. Nayar was associated with NBRI, Lucknow and did wonderful work on different aspects of pteridophytes like anatomy, morphology, palynology and gametophyte development (Madhusoodanan *et al*, 2001). After joining Calicut University, Kerala in 1970, he contributed on taxonomy, palynology and gametophytes of South Indian ferns. Nayar and Madhusoodanan (1977) reported the occurrence of *Microsorium liguaforme* from Kerala and a new species of *Microlepidia* (Nayar and Madhusoodanan, 1984). A new genus namely *Nistarika* which is now treated as synonym of *Leptochilus* was reported by Nayar *et al* (1985). Nayar and Geevargheese (1993) gave elaborate descriptions of 170 species of ferns in the book “Fern flora of Malabar”.

His student Dr. P.V. Madusoodanan also contributed significantly and came out with excellent work on the South Indian Pteridophytes. He later joined Department of Botany, Calicut University as Professor and guided many students for their PhD work on different aspects of ferns and fern allies. He worked on the diversity, taxonomy, morphology, anatomy, cytology and palynology of the pteridophytes of South India. Madhusoodanan (1987, 1989a, b, 1994) studied the problems posed by exotic weed *Salvinia molesta* in Kerala state. K. R. Leena & P. V. Madusoodanan (1991, 96) worked on the Thelypteroid ferns of South India whereas Hameed & Madhusoodanan (1998 a, b, c, 1999) worked on Filmy ferns of South India. The Lomariopsid ferns of South India were worked upon by Majeed *et al* (1994 a, b, c, 1995) while the Aspleniaceae of Kerala was worked upon by Azeez *et al* (1996). Sevichan and Madhusoodanan (1991 a, b, 1993, 1995, 1996 a, b, and 1998) studied the effects of *Azolla* spp. as biofertilizer in the paddy fields of Kerala. Madhusoodanan *et al* (2001) reviewed the studies and contributions made by different eminent pteridologists on the various aspects of ferns and fern-allies of South India from 1947 to 1997.

A 400 km long stretch of Western Ghats passes through the state of Karnataka which is exceptionally rich in flora and fauna. Many studies have been carried out which have revealed the presence of rare, endangered, threatened and endemic plant species in the Western Ghats region of Karnataka. In spite of this, the cryptogams have received very less attention by the botanists and as a result, pteridophytes have not been studied exhaustively in this region. Some noticeable studies which had been carried out in this region include the collection and listing of 75 species of ferns from North Canara (Uttara Kannada) district by Matchperson (1890). Later, in 1992, Blatter & Almeida included 90 species of ferns from Uttara Kannada district, then a part

of Bombay Presidency, in their "Ferns of Bombay". Alston (1945) recorded 58 species of *Selaginella* from India of which 4 species have been recorded from Karnataka. Kammathy *et al* (1967) listed 25 species of ferns and fern-allies in their "Contribution towards a Flora of Biligirirangana Hills". Razi and Rao (1971) published an artificial key to the Pteridophytes of Mysore city and its neighbouring areas in which they included 70 species of ferns and fern-allies spread over 41 genera. Bhaskar & Razi (1973) recorded 7 species of ferns and one species of *Selaginella* from aquatic and semi-aquatic habitats of Mysore district. Holttum (1976) included 10 members of Thelypteridaceae in the "Flora of Hassan District". Yoganarsimhan *et al* (1981) re-recorded 12 species of ferns in their "Flora of Chikmagalur District". However, the only in depth and comprehensive work on the pteridophytes of Karnataka has been done by Dr. P.K. Rajagopal and Prof. K.G. Bhat. They gathered the data on Pteridophyte diversity of Karnataka state from 1988-1995 and hence as a result, published the "Pteridophytic Flora of Karnataka state, India" in 1998.