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PTERIDOPHYTIC FLORA OF INDIA: A REVIEW OF ACHIEVEMENTS AND FUTURE CHALLENGES IN THE SYSTEMATICS AND TAXONOMY

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Pteridophytes, the seedless vascular plants constitute a fair composition of the flora of India. Within the present political boundaries of the country there are recorded at least 600 well defined species, out of which 100 species belong to the fern-allies and 500 species to the ferns. Pteridophytic members characterise the vegetation of the tropical, sub-tropical and warm temperate forests throughout the country. But not many species are recorded from the low-hill, thorny, or high altitude scrub forests. In several localities certain ferns are dominant and thus lend a physiogonomic characteristic to the landscape. Gleichenia (Dicranopteris and Hicriopteris), the tree ferns (Cyathea and Alsophila) and the low-land climber Stenochlaena palustris (Burm.) Bedd. going upto 12-15 meters on the adjoining trees catch prompt attention in the hills. Quite often, the members of the genus Lycopodium, commonly called the clubmosses, beautifully hang from the branches of trees as L. squarrosum Forst. and L. phlegmaria L. in low hill tropical forests of Sikkim State in the Eastern Himalayas. Amongst the prominent members of the plains may be mentioned Azolla pinnata in Northern India and Salvinia auriculata in Eastern and Southern India often covering the surfaces of village ponds,

Exhaustive and authoratative taxonomic account of the Indian ferns had been completed towards the close of the 19th century by R. H. Beddome (1863-1865?, 1865-1870, 1876, 1883, 1892, 1893, 1908), C. B. Clarke (1880), C. W. Hope (1899-1904) and Roxburgh (1894). Album of the Indian ferns as compiled by Baynes (1887) is quite interesting. Fernallies were described by J. G. Baker (1887), N. P. Chowdhury (1937) and A. H. G. Alston (1945). But with the fast increasing knowledge about the nomenclature, re-demarcation of generic boundaries, phyletic interpretations and in the light of modern multi-character approach to plant taxonomy, these works, by and large need revisions. The generic and specific descriptions as given in some of these 'floras' (in particular Beddome's Handbook of Ferns) are not only deficient in certain significant morphological characters but quite a large number of species included therein are proving to be 'aggregates' and 'species complexes'. Even the generic boundaries need revisions. Therefore, the country badly needs a revised pteridophytic flora particularly after the renewed emphasis on the economic utilization of plants in the post independence period. Unfortunately for several reasons this significant group of plants remained almost neglected from a taxonomic view point, as is the case with other Cryptogamic plants. A brief review of the work so far done on the systematics, ecology, phytogeography and taxonomy of pteridophytes is attempted here.

SYSTEMATICS

Except for the classical works referred to above, most of the workers particularly during the last three decades or so concerned themselves only with compilation of systematic lists for the various regions of the country as: (a) Eastern Himalayas : Assam (Kachroo, 1953. 1975; Panigrahi, 1960), NEFA (now Arunachal) (Panigrahi, 1960) and Darjeeling-Sikkim State (Mehra & Bir, 1964).

(b) Eastern India: Orissa and Bihar (Panigrahi, 1960).

(c) Western Himalayas: Nainital (Strachey, 1918; Loyal & Verma, 1960), Mussoorie (Mehra, 1939; Stewart, 1942), Simla (Blanford, 1886, 1888; Hope, 1921; Bir, 1963, 1968; Bir & Shukla, 1966, 1968, 1971); Kangra (Schelpe, 1954); Dalhousie (Mehra & Dhir, 1968), Dharamsala (Dhir & Dutta, 1976 a, b; Dhir & Sheera, 1975) and Kashmir (Stewart, 1945, 1951, 1957).

(d) Nicobar & Andaman Islands : Car Nicobar and Nancoury Islands (Thothathri-1960 a), Andaman Islands (Thothathri, 1960 b) (Nayar & Srivastava, 1962).

(e) Western India : Mt. Abu (Bir & Verma, 1963 ; Sharma & Bohra, 1977), Rajasthan (Mittal, 1968 a, b).

(f) Central India and adjoining regions: Madhya Pradesh (Tiwari, 1964; Panigrahi & Dixit, 1966 a), Pachmarhi (Gamble, 1892; Bir & Vasudeva, 1972, 1973) and Maharashtra Bombay (Carstensen, 1891); (Blatter, 1909 Blatter & d' Almeida, 1922), Mahabaleshwar and Matheran (Birdwood, 1886, 1887, 1897) and Kanara (Macpherson, 1890). (g) South India: Kodaikanal-Palni Hills (Bir & Vasudeva, 1971, 1978; Manickam & Ninan, 1976), Shevaroy Hills (Subramanian *et al.* 1960), Cumbum valley and Pachaku-Matchi hills (Subramanyam *et al.* 1961).

ECOLOGY AND PHYTOGEOGRAPHY

Not many workers have engaged themselves in the ecological studies on the pteridophytes of India. Ecological and distributional notes have been provided by Kachroo (1953), Loyal & Verma (1960), Mehra (1939), Mehra & Bir (1964), Mehra & Dhir (1968), Bir (1963), Bir & Vasudeva (1971, 1972) and Dhir & Sheera (1975). Out of these, the most detailed account pertaining to the forest types and various habitats and ecological adaptations about the Pteridophytes of Darjeeling and Sikkim Himalayas is given by Mehra & Bir (1964). These studies reveal that the ferns constitute a prominent element of the epiphytic growth in dense forests. Members of Davalliaceae and Polypodiaceae, in particular. exhibit a special adaptation for this type of habitat. On the other hand, Aspidioid, Athyrioid and Thelypterioid ferns flourish mostly on the forest floor and are conspicuous by the total absence of epiphytic habit.

Phytogeographical distribution of the ferns and fern-allies have been discussed in detail only for Pachmarhi (Bir & Vasudeva, 1972), Assam (Kachroo, 1975) and Dharamsala (Dhir & Sheera, 1975). The fern flora of the Western Himalayas exhibits similarities with the European flora while on the other hand Eastern Himalayas abound in Malayan and Chinese elements. Further, the fern vegetation of Sikkim State is quite conspicuous in having close similarities with that of Yunnan province of the Chinese mainland. Although Pachmarhi in Central India shares the characteristic species of the Himalayas and South Indian mountains yet its Pteridophytic vegetation is more akin to South India and Ceylon. The occurrence of Asplenium pumilum var. hymenophylloides, an Abyssinian element, at Mt. Abu is Rajasthan (Western India) is noteworthy.

TAXONOMY

A comprehensive review on the subject has recently been given by the writer (Bir, 1976) wherein literature up to the end of 1973 was included. Very useful information about 40 new taxa of Indian ferns published after 1960 was included therein. Along with it is appended a list of Indian ferns which have undergone name changes and were not included in the 'Index Filicum' Supplementum Quartum (pro annis, 1934-1960) by Pichi Sermolli (1965). Latest nomenclature along with synonymy as provided by Mehra & Bir (1964) and Nayar & Kaur (1974) have gone a long way in the compilation of revised lists of ferns of restricted areas.

So far, on country-wide basis, taxonomic revision of only eighteen genera, namely, Selaginella (Alston, 1945; Panigrahi & Dixit, 1966 b, 1967, 1968 a); Ophioglossum (D' Almeida, 1922; Chakravarty, 1951; Balakrishnan et al. 1960; Mahabale, 1962; Panigrahi & Dixit, 1969 a; Mittal, 1968 a), Botrychium (Panigrahi & Dixit, 1969 a), Osmunda (Panigrahi & Dixit, 1969 b), Plagiogyria (Nayar, 1962), Adiantum (Nayar, a), Pityrogramma (Chandra, 1961 1963), Vittaria (Bir, 1962), Gleichenia (Panigrahi & Dixit, 1968 b, 1969 c, 1971), Cystopteris (Bir & Trikha, 1972), Lepisorus (1968 b. 1969. 1974), Microsorium (Nayar, 1961 c; Bir & Trikha, 1968 a), Phymatodes (Bir & Devi, 1968), Polypodium and Goniophlebium (Bir et al. 1974), Drynaria and Pseudodrynaria (Nayar, 1961 b) and Marsilea (Gupta, 1962; Gupta & Bhardwaja, 1956, 1957, 1958) has been taken up. As a result of such generic

revisions the number of species in India has far exceeded the previous estimates as in the case of *Lepisorus* where, as many as 20 species are now known from the country, against the earlier record of 10-12 species.

CONCLUSIONS

As appraisal of work on the taxonomy of Pteridophytes in India reveals a dismal situation, as is the case with seed plants. The main reasons for this situation are that firstly, with the young botanists there has been a general dying out of the spirit of adventure [and thrills as afforded by] involved field botany and secondly, the majority of plant scientists are averse to taking up work on floristics, systematics and taxonomy because these disciplines are considered these days 'to be out of fashion.'

In the absence of up-to-date floras, classical works of Baker (1807) on fern-allies and Beddome (1892), Clarke (1880) and Hope (1899-1904) on ferns are still considered to be standard the reference books although nomenclatural and taxonomic concepts have greatly changed during the past two-three decades because of improved methodology and general awareness about replacing the 'herbarium approach' with field studies of the living materials in nature. So far, only 15% of a total of nearly 120 pteridophytic genera from the country have been taxonomically revised.

Although we have comprehensive checklists of pteridophytes of various regions compiled during the last four decades or so, yet we do not, even to-day, have an illustrated and fully descriptive (with keys to the genera and species) flora for any of the regions of the country. However, illustrated and descriptive accounts of some fern families from Simla and Dharamsala are available. The value of systematic lists compiled so far is very much limited. These serve only as a record about the occurrence of a particular species from the area or region and these lists are the means for the compilation of exhaustive self-contained floras and not an end in themselves.

Preparatory to the work on the pteridophytic flora of the country, it is essential to carry out extensive field surveys particularly of the unexplored areas (e.g. western ghats) for the compilation of inventories for different floristic regions of the country. This would facilitate the preparation of the regional floras which could be helpful in both teaching and research. In this direction the perplexing genera which require immediate attention are Cheilanthes, Pteris, Dryopteris, Polysti-Diplazium, Thelypteris, chum, Athyrium, Cyclosorus and Pyrrosia. These genera include roughly 40% of the Indian ferns. Another problem is, the segregation and taxonomic status of about 125 cytotypes recorded through cytological studies to exist within nearly 55 'aggregate' or 'polymorphic' species of Indian ferns (cf. Bir, 1973). All this, calls for concerted efforts towards taking up of the taxonomy of pteridophytes in right earnest with due application of the existing knowledge about cytology, morphology, anatomy. phytochemistry, numerical taxonomy and palynology of the members.

Ecological studies which have hitherto been a neglected aspect, also need to be taken up extensively. The ultimate aim should be the compilation of an up-to-date 'Pteridophytic flora' of the country with adequate ecological and distributional data. This must be done on priority basis during the coming decade. But all this needs a fairly large number of dedicated workers and presently the number of persons interested in research on Pteridophytes and more so, on taxonomical aspects is disappointingly low.

Before concluding, it will be pertinent to point out that there is dire necessity of conservation of flora of the country because several rare species are in the process of elimination from different regions. An illustrative example is of Lebong, (c. 1500 m) forest near Darjeeling which was once (up to the end of fifties of the present century) a repository for quite a large number of species of uncommon and rare ferns particularly the polypodiums. But now the entire forest has been cut down and the mountain slopes cleared, for tea plantation. This general destruction of vegetation cover has resulted in eradication of several fern species from the area. In this direction there is a need for the enlightenment of the public about the importance of Pteridophytic vegetation in relation to natural vegetation cover. Because of a general lack of economic importance of the members of the group, persons concerned with nature and environmental conservation. by and large, only think of seed plants. Thus a full-fledged programme of conservation of flora in totality has to be taken up. Here it may be stressed that vast areas within the inner ranges of the Himalayas still remain unexplored. This is a challenge to the lovers of field botany.

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