CHAPTER VII

DISCUSSION

Discussion:

A. aureum L. is a genus included in Pteridaceae by most of the taxanomists or when it is not included in Pteridaceae it is at least closely related to Pteridaceae. In most of the anatomical and morphological characters it stands at advanced stage of evolution in homosporous ferns.

The evolutionary concepts put forth by F.O.Baver 1935 are still accepted by most of the taxanomists. According to Bower the short, erect rhizome is an advanced condition than horizontally creeping rhizome. A. aureum has the short, erect rhizome and in this respect it stands at higher level of evolution.

The Filicales are characterised by highly varied leaf forms. It seems that in Filicean Ferns in general the pinnate pattern is predominant. It is the characteristic of most of the primitive families like Gleicheniaceae, Hymenophyllaceae, Schizaeaceae, Osmundaceae etc. and hence the pinnate form of the leaf is considered as primitive (Bierharst 1971). This is also supported by Wagner 1952 and R. Tryon 1964. Genus Acrostichum aureum has got pinnate fronds and sometimes the fronds are with a single pinna. Thus it stands at intermediate stage of evolution of fronds in Filicales.

The venation pattern in accordance with leaf evaluation has been interpreted as progressing from dichotomous to pinnate having free veins to anastomised veins. A.aureum stands at higher stage of evaluation as the pinnae are characterised by anastomising veins without included veinlet.

The dermal appandages have evolved possibly from papillate hairs to simple hairs and finally the palae. The palae in A. aureum have broad base, prominent midrib and spine like projections marginally. Sc in morphology of epidermal appendages also it stands at higher level of evolution.

In the evolution of sorus, the position of sorus on a pinna has been regarded as one of the principal criterion to assess phylogeny and to group the ferns into taxa. Bower 1935 has shown that the most primitive condition among ferns is one in which solitary, large sporangium is formed at the vein tips. During evolution the sorus spread along the veins and ultimately a stage where sporangia are found spread all over the leaf surface and not restricted to the veins thus forming the typical acrostichoid sorus.

Indusium in ferns has developed secondarily during evolution presumably for protection of the sorus. A

typical indusium is present only in Cyatheoid line of ferns in which it has developed as a special appendage. In schizaeoid ferns the function is taken over by leaf margin and progressively it is altogether lost in Acrostichum. The sporangia while young are protected by paraphyses.

The receptacle in A. aureum is spread all over the lower surface of the leaf except the tip portion and mid-rib. The sorus is a mixed type of scrus from an early stage of development and thus Acrostichum in this respect also stands at advanced stage.

The sporangial wall is one cell thick at maturity, with well defined annulus and stomium ard a stalk consisting of two rows of slender, elongate cells. Thus it exhibits all the characteristics of an advanced sporangium.

The palynological studies of ferr spores by Bir et al.1976 have shown that the spore morphology can be used to distinguish various taxa and even the species of ferns. It is also considered as one of the significant tool in understanding phylogeny and evolutionary trends among modern ferns (Nayar & Kaur 1968). The trilete spores is a characteristic of primitive ferns. Most of the advanced ferns are characterised by bilateral spores. Acrostichum is a genus derived along Pteridaeous line and hence has

got Schizaeaceous ancestary. In Schizacan derivatives the bilateral forms have evolved late in evolutionary sequence and hence many of the genera are characterised by trilete spores. A. aureum has trilete. tetrahedral spores and hence stands at lower level of evolution.

In primitive ferns the spores have a smooth exine or perhaps having a negative ornamentation. Advancement is indicated by the exine bearing characteristic excrescences. The exine in A. aureum is thick, densely grannulose, papillate. It is found that most of advanced taxa have very conspicuous and crowded excrescences. A. aureum spores have crowded granulose and papillate exine and hence stand at higher level of evolution.

Anatomical Characters :

The vascular system of higher ferns range from protestele- amphiphloic siphenostele to dictyostele with amphicribal bundles. A simple protostele with or without a degree of modullation is assumed to be ancestral to more elaborated steles of Filicales. According to Bierhorst 1971 from a solenostele with a complete ring of xylem, internal and external phloem and endodermis the dictyostele and polycyclic dictyostele has evolved by overlapping of leaf gaps. In A. aureum the stem is short, erect with closely placed, spirally arranged leaves. In small

rhizomes the vascular cylinder is amphiphloic siphonostele with included medullary strand. In mature rhizomes due to division of medullary strand, over lapping leaf gaps and division of leaf trace the stele appears to be polycyclic dictyostele. Thus the genus is at advanced stage of evolution as far as rhizome anatomy is considered.

According to Bower 1935 in ferns of relatively advanced type the leaf trace may be divided into two or more separate vascular tracts. But these are still so arranged as to represent more or less clearly the underlying horse-shoe curve. In A. aureum the leaf trace comes off bodily as a sector of the vascular ring and this single trace soon divides into number of traces which become so arranged to represent the horse-shoe curve.

The pinnae traces in A. aureum are derived by abstriction from the margin of meristele and thus margined in origin. Such a marginal origin of pinna trace according to Bower 1935 is a primitive method of supply of lateral pinnae.

Kondo 1962, Kondo & Toda 1956, Thurstan 1969 have shown the usefulness of stomatal types in plant taxanomy. Among the four types of stomata described in Filicales by Kondo 1962 the polycytic stomata with a single subsidiary cells is characteristic of slightly advanced ferns.

A. aureum has stomata restricted to lower surface only and has polycytic type of stomata. Thus it is at an advanced stage of development.

The genus Acrostichum is related to pteridaceae by most of taxanomists. Bierhorst 1971 states that pteridaceae through it is one of the advanced family of filicales in some respects it stands at lower level of evolution. A. aureum studied here stands at advanced stage of evolution in most of the morphological and anatomical characters.

Acrostichum aureum as a halophyte :

Acrostichum aureum L. studied here for its morphology and anatomy of sporophyte grows well in brackish water region. So it is a member of halophytes. But it is generally found in water having low salinity. It is never associated with the mangroves which grow in deep saline waters.

Generally speaking the appearance and structure which characterise a certain group of plants sum up to a great extent their ecological and physiological means of adaptation. Halophytes are also characterised by their typical and specific structural characteristics which make them distinguishable from other groups of plants.

Changes in plant structure brought about by salt had been recorded in the second part of 18th century.

However most investigations on effects of salt were performed on glycophytic crop plants. Relatively little information on natural halophytes has been accumulated. Yaov Waisel 1972 have discussed the various modifications observed in halophytes.

As far as habit of the mangroves is considered they range from a small herb to large trees. Acrostichum aureum is a small shrubby plant.

High salinity causes severe internal water deficits and plants which are easily affected by such stress sometimes develop xeromorphic structures under such conditions. Reduced water absorption bring about certain modifications in plant anatomy and the plant appears succulent.

Like most water plants A. aureum develope adaptive characteristics. The root system is aerenchymatous . These aerenchymatous roots help in anchoring plants in the mud. This is also an efficient system since it increases the root surface without an increase in the quantity of respiring material.

The endodermis of A. aureum roots has conspicuous and distinctive casparian strip and is highly developed like that of most of the hydrohalophytes and xerohalophytes.

The stem in A. aureum is underground, stout,

straight growing rhizome. The ground tissue is partly parenchymatous and partly sclerenchymatous. The Sclerenchyma are found in groups as well as associated with meristeles. The parenchyma are packed with starch grains. This starch in rhizome may provide sugar to cope with salinity fluctuations. The extreme lignification of stele or presence of living fibres in the vascular tissues of shrubs which is the characteristic of many of the halophytes (Fahn 1964) is not seen in A. aureum.

A. aureum does not exhibit the succulence as these of other halophytic plants. The leaves of A. aureum are thick, leathery in texture. The epidermal cells have a thick cuticle characteristic of halophytic leaves. The single layer of hypodermis on the dorsal surface of leaves consists of slightly enlarged cells and they are non-chlorophyllous. These cells probably function in storage of water as in Pyrrosia (Nayar & Chandra 1965).

In A. aureum the stomata are restricted to the lower epidermis only. They are of polocytic type. Shetty 1971 has studied the distribution of stomata in saline and non-saline plants of A. aureum grown in garden. The number of stomata is low in saline plants as compared to the observations made in non-saline plants. In saline plants it is approximately 938 per sq. cm. while in

garden plants it is about 1263 per sq. cm. The size of the stomata is large in saline plants of A. aureum (84.95). It is found that the saline plants have low perimeter value for stomatal aperture. This low perimeter value for stomatal aperture reduction frequency of stomata indicate low rate of transpiration under saline conditions.

The leaves of A. aureum are neither succulent nor they show presence of salt gland characteristic of most of the non-succulent halophytic leaves. According to Van Ejik 1939 chloride rather than Na plays the major role in induction of succulence in halophytes. A. aureum though it is a brakish water fern the values for Na, K and Cl are not as high as those generally found in case of other halophytes (Shetty 1971). The amount of Cl present in A. aureum leaves are not sufficient to produce succulence in leaves.

The plants of A. aureum are found in water having low salinity. During winter the salinity still decreases as these are flooded with fresh water of rivers. The early stages of development of plants are mostly completed under such low salinity conditions. By the time the salinity increases the spores become mature. Thus A. aureum is a

'facultative halophyte where growth is favourably affected by NaCl but where Na can be substituted by K. (Wissenbode 1969).

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