

JURASSIC FLORA OF THE RAJMAHAL HILLS, BIHAR : *SOLENOSTELOPTERIS JURASSICA* BOHRA & SHARMA AND ITS ASSOCIATED ORGANS

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ABSTRACT

Description is given of the anatomy of the rhizome of *Solenosteleopteris jurassica* and its associated organs i.e. the petioles, roots and the fertile spike. On this basis a restoration has been attempted of the plant *Solenosteleopteris jurassica* and is taxonomically assigned to the family Schizaeaceae.

Key Words : Jurassic Flora, Rajmahal Hills, *Solenosteleopteris*.

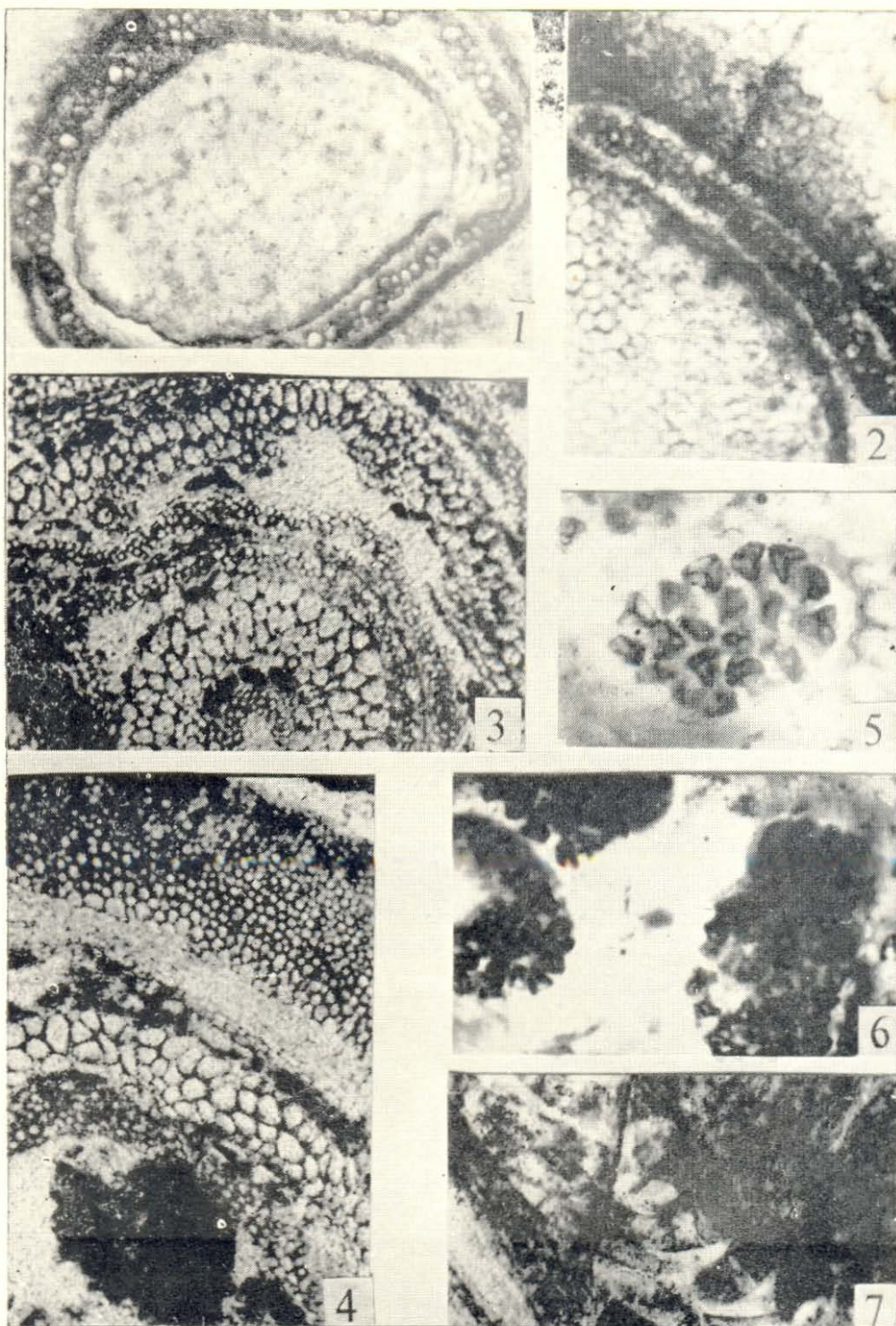
INTRODUCTION

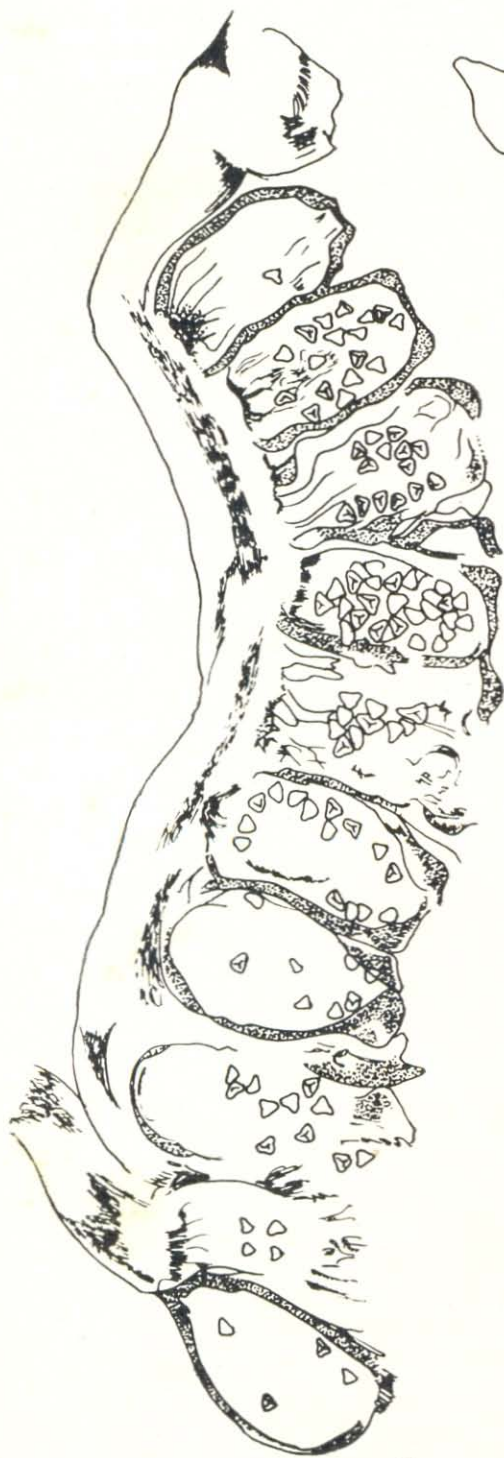
Kershaw (1910) believed *Solenosteleopteris* a davalloid fern, while Skog (1976) related this genus with Loxsomaceae. Five species are known of *Solenosteleopteris* throughout the world (Sharma & Bohra 1976, Bohra & Sharma 1979) of which three come from the Indian Jurassic horizon. These are *S. nipanica* Mittre (1959), *S. sahnii* Mittre (1959) and *S. jurassica* Bohra & Sharma (1979). In the present paper further observations are given on *S. jurassica* on the basis of fresh collections from Sonajori in the Rajmahal Hills. Anatomy of associated petioles, roots and sporangia are also described. A reconstruction has been attempted of the plant *Solenosteleopteris jurassica*. The material was collected from Sonajori near Pakur in the Rajmahal Hills, Bihar. It is a hard, silicified chert. Sections were cut with the help of diamond saw and slides were prepared by the usual grinding and polishing techniques. Sections were studied under water film as mounting with canada balsam made the section so transparent that all cellular details disappeared.

DESCRIPTION

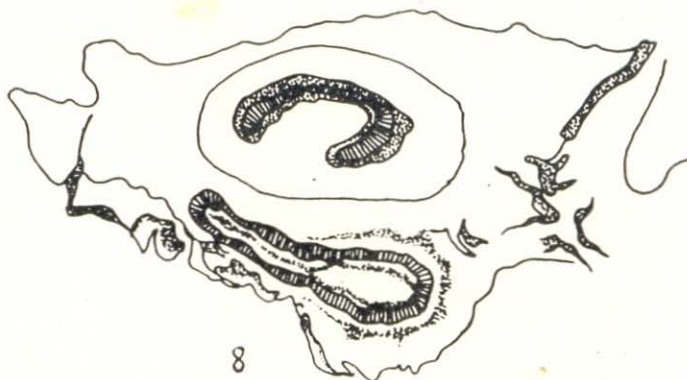
Rhizome : The rhizome has been cut in various planes i.e. T.S., L.S. and oblique sections to study all internal details. Cross sections (Figs. 1, 8-10) show that the rhizome is circular, elliptical or irregular in outline with a distinct epidermis. The surface is either smooth or uniseriate multicellular hairs are present on it (Fig. 7). The cortex is well developed, parenchymatous containing a number of root traces. In some of the sections a large, C-shaped leaf trace with an adaxial concavity is seen (Figs. 8-10). It originates as a result of detachment of a portion of the cauline amphiphloic solenostele (Fig. 1), leaving a large and wide leaf gap, 3-6 cells thick layer of the inner portion of cortex is made up of comparatively small, thick walled cells (Fig. 2). Similarly, the peripheral 1-3 layers of cells of the pith are also thick walled, whereas, rest of the pith is parenchymatous.

The stele is amphiphloic solenostele with distinct endodermal layers. The phloem is generally unpreserved. The xylem is 1-5 cells thick ring made up of angular tracheids (Fig 1).

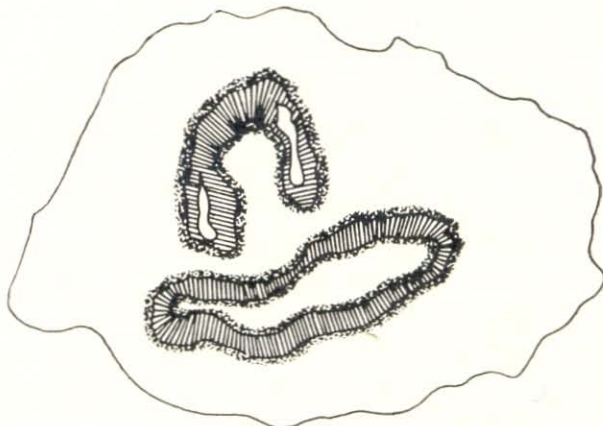




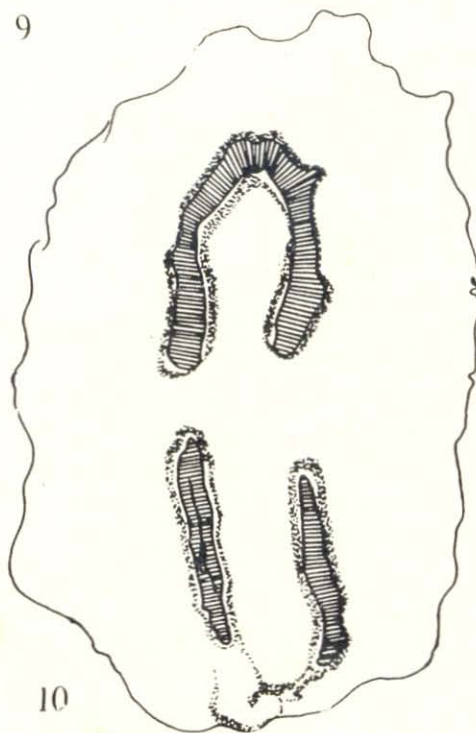
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Protoxylem points are exarch. Xylem parenchyma is absent. The tracheids are provided with spiral and scalariform thickenings on their lateral walls.

Petiole : Cross sections through petioles or rachides (Figs. 3-4, 12-16) show wide variations in shape, size and internal structure. The basal portion of petiole is elliptical (Fig. 12) and slightly curved in cross section. It has a wide homogenous cortex. The stele is large, fundamentally a C-shaped structures, but broken into 3 or 4 pieces i.e. the abaxial long arm (broken into 2 pieces in this figure) and the two lateral, curved portions which are seen detached from the long arm. The xylem is 2-6 cells thick consisting of angular cells (Fig. 3-4.) Xylem parenchyma is absent. Protoxylem points are endarch 8 to 12 in the entire vascular trace (in 4 pieces mentioned above). Phloem is in 3-4 cells thick layer which surrounds the xylem on all sides (Figs. 3-4). It consists of uniform, narrow, closely placed angular cells. Endodermis and pericycle are indistinct.

In an another section, through the middle portion of rachis, the outline is circular (Fig. 5) with an adaxial groove. The stele is made up of three pieces i.e. a long arm and two lateral, curved portions, each is surrounded by its own phloem.

In Fig. 7 there are seen three curved C-shaped steles in addition to the long arm (broken in two pieces). One of the curved stele is a pinna trace. Its origin is of extra-marginal type similar to the one known in *Gleicheniorachis mittrii* Bohra & Sharma (1979). Figure 15 also shows more or less a similar condition of vasculature. In the apical portion of the rachis, the cross section shows a simple, C-shaped xylem without detached lateral arms (Fig. 16).

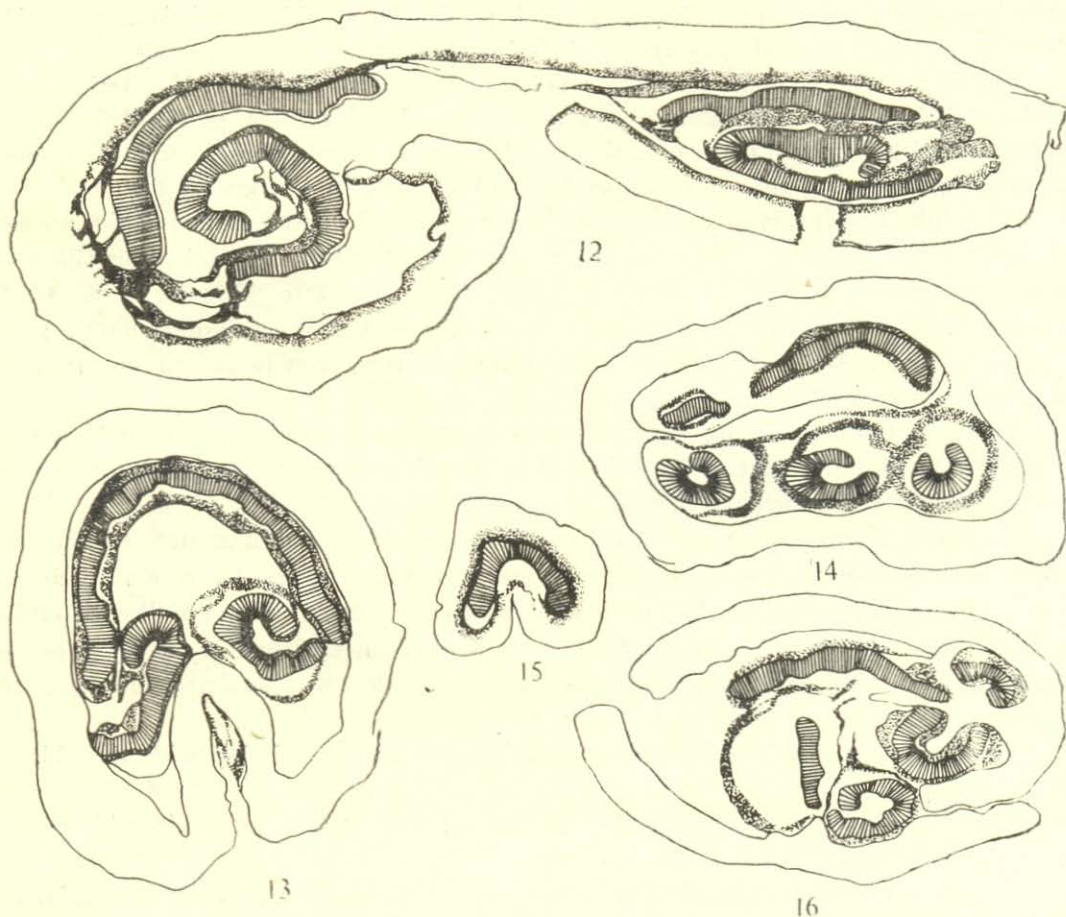
Roots : A number of small, circular, roots are seen in association with the rhizome of *Solenostelepteris*. Epiblema distinct, cortex 3-4 cells wide made up of radially arranged cells. Xylem 2-4 arch, poorly developed. These roots are comparable with that of *Filicoamyelon actinostachyoides* Bohra & Sharma (1979).

Sporangia : Intermingled with the petioles and rhizomes there are present sporangia either detached (Figs. 5-6) or adhered to the parent leaf midrib (Fig. 11). These are attached in rows by their broad bases. The wall is one cell thick made up of rectangular or elongated cells with an apical annulus (Fig. 6). The sporangia are filled with trilete spores having parallel striations and triradiate mark. Bohra & Sharma (1978) described similar sporangia under the taxon *Schizaeangium jurassica* and assigned the spores to the genus *Cicatricosporites*.

Restoration : On the basis of present study an attempt has been made to reconstruct the plant *Solenostelepteris jurassica* (Fig. 17). The rhizome is irregularly branched with smooth surface except the young growing portions which are covered with uniseriate,

Figs. 1-7 (page 47) : *Solenostelepteris jurassica*. 1. C.S. rhizome showing amphiphloic solenostele. X 48. 2. Same, thick walled cells in inner portion of cortex adjacent with stele. X 48. 3, 4. C.S. petiole showing amphiphloic vascular traces and endarch protoxylem points. X 120. 5, 6. Sporangia filled with spores and provided with apical annuli, X 72. 7. C.S. young portion of rhizome with uniseriate, multicellular hairs on surface. X 48.

Figs. 8-11 (page 48) : *Solenostelepteris jurassica*. 8, 9, 10. C.S. rhizome showing origin of C-shaped leaf trace. X 24. 11. Attachment of sporangia in a longitudinal row on the midrib of pinna. X 72.

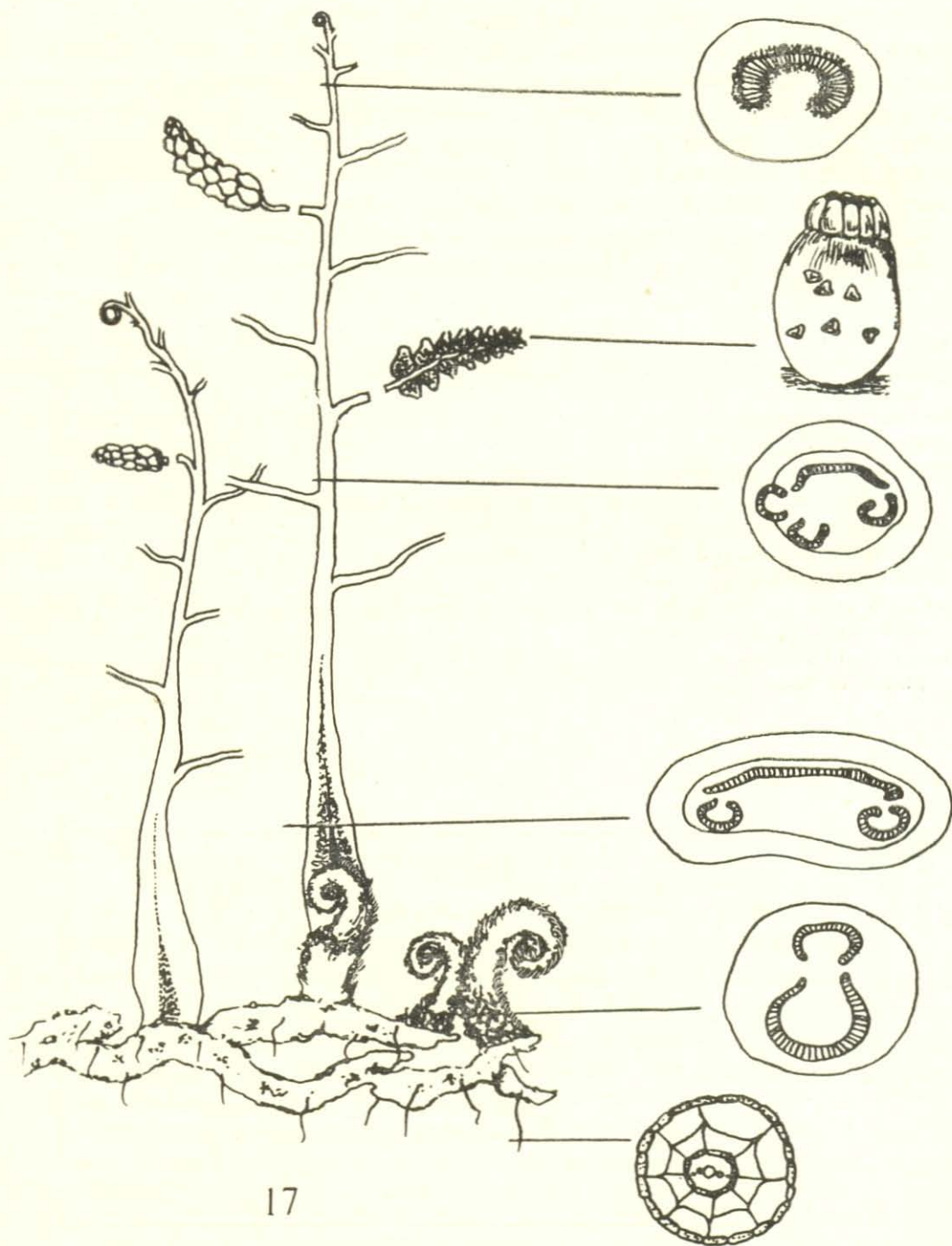


Figs. 12-16. *Solenostelepteris jurassica* C.S. petiole through different portions from base to apex. Pinna trace originates in extra marginal type. X 24.

multicellular hairs. The young leaves show circinate vernation and are covered with hairs. The leaf is pinnate, pinnae alternate, fertile pinnules non laminated and provided with 2 or more rows of closely placed sporangia. Sporangia leptosporangiate with apical annuli and are filled with trilete spores.

DISCUSSION

Amphiphloic solenostele occurs in the rhizome of a number of taxonomically separated living ferns e.g. *Adiantum*, *Loxsomopteris*, *Dennstaedtia*, *Marsilea*, *Dicksonia*, *Davallia*, etc. (Bohra & Sharma 1979) and so this parameter can not be used as a tool in the taxonomy of ferns. However, the exarch protoxylem points and the single, large C-shaped leaf trace suggest *Solenostelepteris* a primitive fern. In the associated petioles the basal portion is large,



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Figs. 17. *Solenosteleopteris jurassica*. A restoration of the plant showing anatomy of different organs.
X ca 1.

elliptical and possess C-shaped vascular trace which breaks up into three pieces i.e. a long arm and two lateral curved portions. Pinnae traces originate in 'extra marginal type', a character which occurs in a number of primitive families of ferns e.g. Gleicheniaceae and Schizaeaceae. However, the petiole of *Solenostelepteris* is different from that of Gleicheniaceae (Sharma & Bohra 1977; Bohra & Sharma 1979) in the absence of central scleranchymatous column and the presence of inner phloem in the vascular trace. Pinnae traces are opposite in Gleicheniaceae while alternate in *Solenostelepteris*.

The sporangia are typical schizaeaceous with apical annuli and trilete striated spores. Bohra & Sharma (1979) created a new genus *Schizaeangium* for similar sporangia.

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INDIAN PTERIDOLOGY

In order to acquaint the research workers on ferns about the work done in India, it has been decided to publish a yearly bibliography beginning with 1983 when The Indian Fern Society was established. The Editor will be happy to receive year-wise information from the Indian scientists about the literature published by them from time to time. The lists of published papers and books should be prepared in accordance with the style of the journal and sent in duplicate. In this venture the co-operation of the Indian Pteridologists particularly the members of The Indian Fern Society, is solicited.

EDITOR