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Research Article

STEM AND PETIOLE ANATOMY OF *CHELIENTHES TENUIFOLIA* (BURM) SW SYN FILL (PTERIDACEAE, PTERIDOPHYTA)

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ABSTRACT
The study is aimed on stem and petiole anatomy of *Cheilanthes tenuifolia* (Burn) Sw.Syn.Fil., a fern plant. The lower part of the stem consists of two meristeles. During their upward course they unite together to form a single bundle with 3 xylem groups. One xylem group and two laterals are formed together by a protoxylem group in vascular cylinder in the intermodal region. But at the node two xylem groups present and are enclosed in the same endodermis as a single str and one of the xylem bundles form an adaxially curved structure and separates into a single leaf trace. The stipe receives it and further develops into a single vascular bundle as in the mature stem and it passes into the midvein of leaf. The study revealed the climatic adaptation of *C.tenuifolia* as said by Williams (1927).

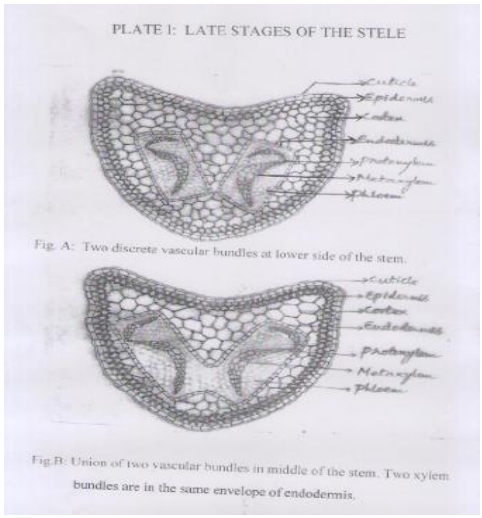
Key Words: *Cheilanthes tenuifolia, Node, Internode, Vascular Bundles, Midvein*

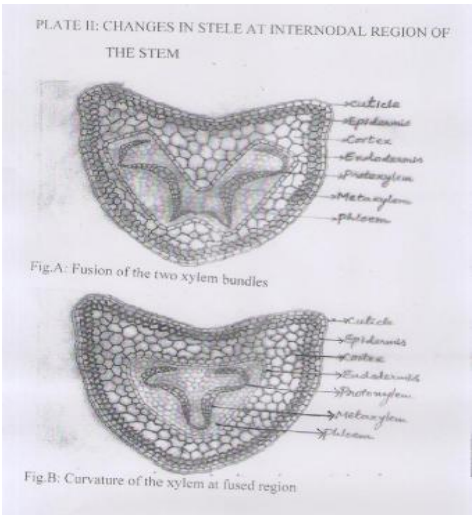
INTRODUCTION
Williams, M (1924) said that the stem and petiole structure of the genus *Cheilanthes* is simply and fundamentally the result of an adaptation to the dem and s made upon these parts by the foliage. Taking this fact into consideration it might be well to look to the habitat of these ferns for explanations of any peculiar types of structure present in the stem or petiole. The writer has also suggested that the structure of the petiole with the peculiar movement of the median protoxylem group is of the nature of a response to the unique environment of these ferns.
Anatomy of *C. tenuifolia* was studied by Williams M. (1924) and he said that the rhizome possesses a true dictyostelic structure, while the petiole stele consists of a single str and, hence it lies an interest. Stipe characters of different pteridophytes have been studied in the past by Tansley (1907, 1908), Sinnott, (1911), Brower (1914, 1926), Kato (1972), Ogura (1972), Lucan sky and White (1974), Linn and Devol (1977, 1978), Khare (1984), Srivastava (2008a, 2008b) etc.
The plant *C.tenuifolia* has slender creeping rhizome with crowded, pale brown, glabrous, glossy stipes. Lamina is ovate or lanceolate in shape. The leaf is quadripinnate at bottom, tripinnate at the middle, and bipinnate at the apex. Pinnae are dark green, glabrous, thin and herbaceous. Veins are slightly distinct, and forked once or twice. Sori are marginal in position and protected by reflexed margin. Spores are dark brown in color.

MATERIALS AND METHODS
For the present study, the material is collected from Ahobilam hills of Kurnool district, and hra Pradesh, India. Ahobilam is located at $15^0$08’00 N $78^0$43’00” E 15.1333^0 N 78.7167^0 E. It has an average elevation of 327 meters (1076 feet). At higher elevations the plants grow in shady places even during summer. Pieces of young and mature stem and petiole are fixed in farmer’s fluid (ethyl alcohol and acetic acid 3:1) and subsequently stored in 70% ethyl alcohol. They are later washed thoroughly with tap water and dehydrated in a graded series of tertiary butyl alcohol. Serial h and sections are cutted. These sections are stained with the usual Safranine – fast green combination. They are observed under the microscope. Fresh sections are treated with saturated solution of Sudan IV prepared in 70% ethanol (Margolena, 1932). The appearance of red color confirmed the presence of cuticle layer.

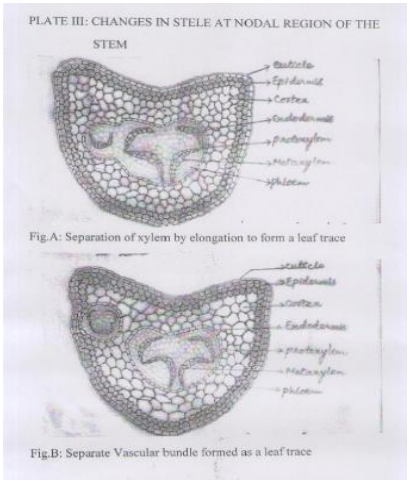
RESULTS AND DISCUSSION

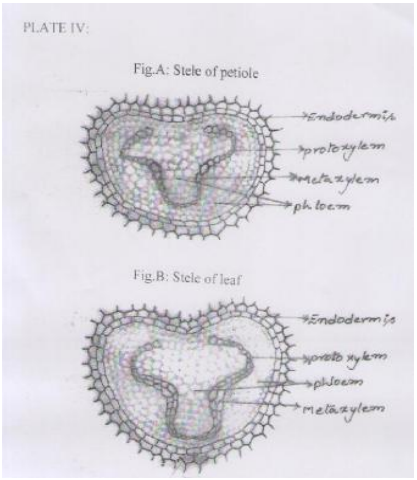
Transverse sections of stem and petiole have shown a single layered epidermis with thin walled cells. The Bulks of them were composed of ground tissue. It was differentiated into two zones. The outer zone consists of 3-4 layers of thick walled Sclerenchymatous cells. Inner zone consists of large, thin walled polygonal cells. Two widely separated 'S' shaped vascular str and s are present at the base of the stem embedded in the parenchymatous ground tissue (Figure 1, A), each str and has a single layered endodermis. Endodermis is followed by a single layered pericycle containing thin walled cells. Xylem lies in the centre of the vascular str and it is Figure - like with two protoxylem points in exarch condition. Xylem is surrounded by phloem (Figure I, A).





Phloem has sieve cells and parenchyma. Xylem has simple tracheids of various sizes. Metaxylem tracheids have scalariform and pitted thickenings while protoxylem tracheids have annular and spiral thickening. The vascular str and s in the stem during their upward course gradually fuse with each other (Figure I, B; Figure-II, A) and forms one str and at the end of internodes.





During the fusion, first the endodermis at base of the internode and at slightly higher level of the internode the pericycle and ultimately the phloem and xylem bundles of the two str and s are fused together (Figure II, B). This contains three groups of xylem bundles. Two lateral bundles are endarch and

median group is exarch in condition. Between the two lateral metaxylem groups, protoxylem forms the sole junction. At nodal region, where the petiole arises, it is detached from the metaxylem elements and seen as a separate adaxially curved structure.

At nodal region of the stem, prior to fusion of two xylem bundles, one of it cuts off into a smaller Figure shaped xylem bundle and enclosed by a separate endodermis resulting a leaf traces (Figure III, A and B). Both petiole and leaf transverse sections showing the fused bundles in the endodermis resemble an older part of the stem (Figure IV, A and B).

Williams, M (1924), said that the vascular cylinder of *C.tenuifolia*, is an advanced type since it is more frequently broken by leaf gaps and it is described as true dictyostyly both in *C.tenuifolia* and *C.vellea*. But in present study it is revealed that the cortex is made up of parenchyma and the stele has two meristeles in young parts of the stem. These are merged as one at the end of internode and again these two bundles are separated by the detachment of protoxylem group at the nodal region of the stem from where the petiole arises. The matured part of the petiole and leaf has shown similar type of vascular cylinder. This study indicates that the single str and of vascular cylinder in stem, petiole and leaf are formed from the two meristeles of a stem. Here, there are no leaf gaps as in William's study where true dictyostyly is described.

It is an adaptive character attributed to the climate of Ahobilam hills, where much cool climatic conditions are present due to continuous water flow and heavy vegetation on hills. Williams (1924 and 1927) collected the material from a xerophilous flora of New South Wales. Thus it had shown more sclerenchyma in the cortex where as in the present study more parenchyma was observed.

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