ACTINOSTELOPTERIS PAKURENSE GEN. ET SP. NOV. FROM THE RAJMAHAL HILLS, INDIA

B. D. SHARMA & D. R. BOHRA
Department of Botany, University of Jodhpur, Jodhpur, India

ABSTRACT

Description is given of an interesting plant collected recently from a newly discovered locality of Pakur in the Rajmahal Hills. Vascular cylinder is actinostelic with mesarch protoxylem points. Leaf trace is C-shaped with an adaxial concavity. Outer surface of stem is covered with multicellular scales. Relationships of the new material are discussed with allied families of pteridophytes.

INTRODUCTION

THE Rajmahal Hills have yielded the largest number of fossil plants known from the Jurassic rocks of India. The main constituents are ferns, cycads, Bennettitales, Pentoxyleae and conifers (Sahni & Rao, 1953; Ganju, 1946; Sahni, 1948; Gupta, 1954, etc.). In addition, there are a few lycopods (Mittre, 1959), *Equisetites*, Thinnfeldias, and *Ginkgoites* (Sah & Jain, 1965; Bose & Sah, 1968; Sharma *et al.*, 1971). During a recent visit to the Rajmahal Hills the senior author found a new locality with petrified plants. This locality is situated four kilometres north west of the railway station Pakur and near the village Sonagariha in the Santhal Pargana, district of Bihar. The fossiliferous rock rests on a thick layer of trap which is made up of closely placed, black, hexangular pillars, while the fossiliferous rock is yellowish white. It is a chert which preserves the plant remains as petrifactions.

Slides were prepared by the usual grinding and polishing processes and mounted in canada balsam. Sometimes, canada balsam made the section so transparent that the cellular details disappeared. In such cases, the sections were examined under a water film.

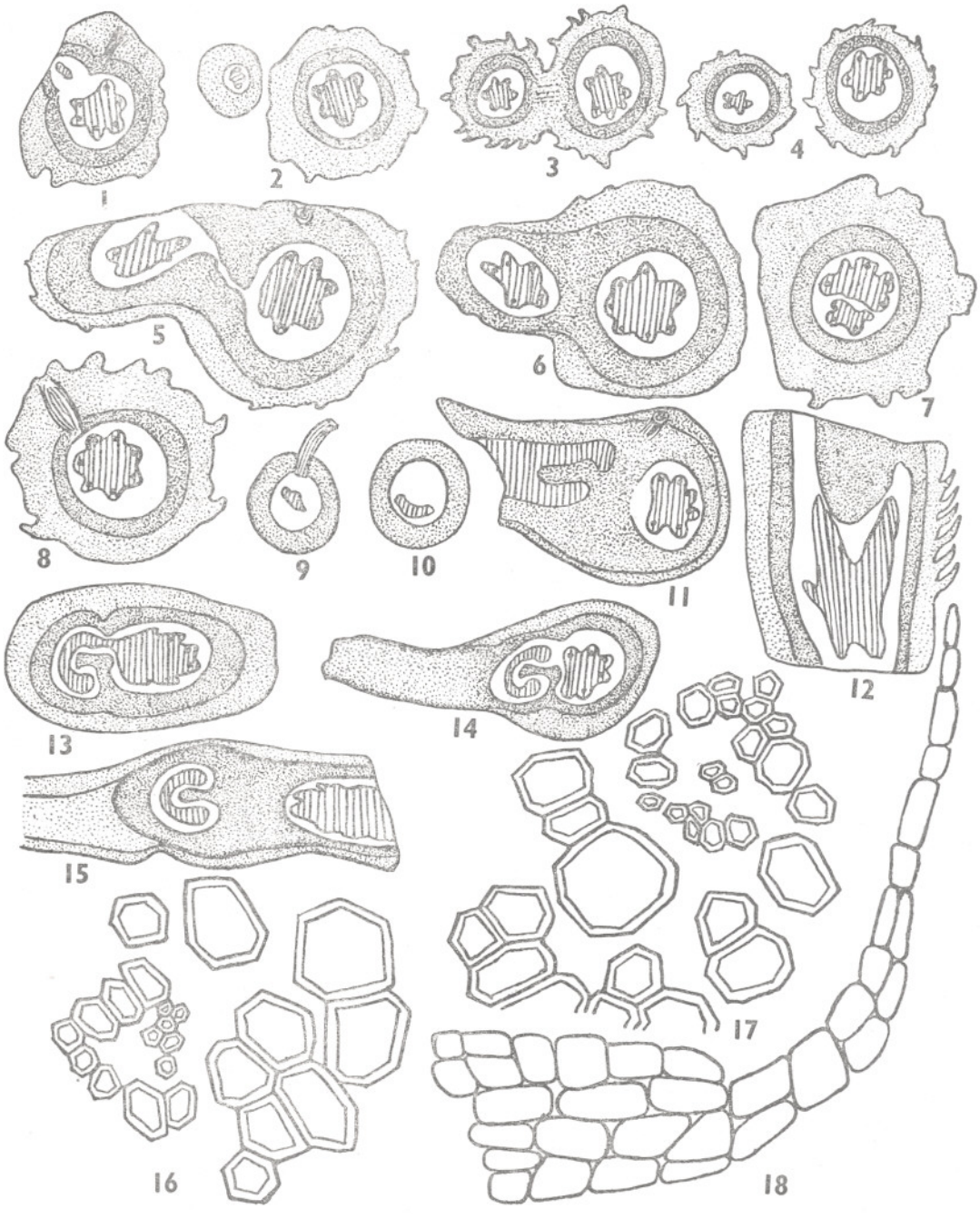
DESCRIPTION

Actinostelopteris pakurense gen. et sp. nov.

Diagnosis — Stem cylindrical, 2·2 to 3·8 mm in diameter, monopodially branched, branches arise at acute angles and covered with scales, scales numerous, multicellular, 400×80 mm in size. Cortex 0·8-1·2 mm thick, differentiated into zones; xylem angular, 0·6-0·8 mm in size, interspersed with parenchyma, protoxylem at angles and mesarch, tracheids wide, circular or angular with spiral, scalariform or reticulate thickenings. Branch trace actinostelic like that of stem; petiolar trace large, C-shaped facing concavity on the adaxial side; adventitious roots many, root trace diarch, 0·3-0·5 mm thick.

There are present a number of specimens in authors collection including the stem of this species. Anatomically they all are similar except for minor differences in size (Text-figs. 2, 4 & 6) and mode of preservation. The stems are ranging in diameter from 2·2 to 3·8 mm. Length is unknown. However, the largest specimen present in collection is 6 cm (Specimen no. BD.P6/Raj. PAK).In some of the sections the outer surface is smooth (Pl. 1, fig. 1), while in others it is provided with scales (Pl. 1, fig. 3; Text-figs. 3 & 4). The scales are multicellular, curved, 300-400 μ long, 4-6 cells wide in the proximal part but only one cell thick in the distal half (Pl. 1, fig. 8; Text-fig. 18). Cells are parenchymatous and rectangular. The scales arise as a result of modification and elongation of outer cortical cells (Pl. 1, fig. 7).

The cortex is 0·8-1·2 mm wide and in most of the specimens it is differentiated into two zones (Text-figs. 1, 7 & 8); except the terminal part in which the cortex is homogeneous and comparatively thin (Pl. 1, fig. 4; Text-figs. 9 & 10). The outer zone of cortex is wider than the inner zone and is made up of thick walled parenchyma, while the inner is purely sclerenchymatous. Inside the cortex, there is a fistular area in which the angular xylem is present. This fistular zone is present in all the sections prepared for the present purpose. Probably, it represents the unpreserved



TEXT-FIGS. 1-18. *Actinostelopteris pakurense* gen. et sp. nov. 1-6. Origin of branches in stems of different thickness. 7. Unequal division of xylem just before the initiation of branch. 8. Endogenous origin of a root trace. 9-10. Terminal portions of stems with reduced xylem and cortex. 11. C-shaped petiolar trace. 12. L.S. stem showing origin of a branch trace. 13-15. Origin of C-shaped petiolar traces. 16-17. Xylem portion enlarged showing mesarch protoxylem points. 18. A multicellular scale from the stem surface. (1-15 × 10, 16-18 × 200).

phloem region, as it is present between the xylem and the cortex.

Xylem is angular throughout the length of stem except the terminal part in which it becomes small and nonangular (Pl. 1, fig. 4). The number of angles vary from 5 to 9. The xylem is made up of circular or angular tracheids (Pl. 1, fig. 2), which are interspersed with thin walled xylem parenchyma. Metaxylem tracheids are 24-60 μ in diameter, while protoxylem tracheids are much narrower and 10-20 μ wide (Pl. 1, fig. 2; Text-figs. 16 & 17). Protoxylem tracheids are partially mesarch and present at the angles (Pl. 1, fig. 2). Each protoxylem point is consisted of 4-10 tracheids. Tracheids are provided with spiral, scalariform and reticulate thickenings on their lateral walls (Pl.1, fig. 9).

Branches are produced frequently at narrow and acute angles. Just before the initiation of branch, the xylem of the parent stem breaks up unequally (Text-fig. 7) into two; the smaller part which is provided with 2-3 protoxylem points passes into the branch and the remaining portion continues in the stem. The branch trace acquires actinostelic shape during its way through the cortex (Text-figs. 1-6) and the branch base it appears like that of the parent stem (Pl. 1, fig. 3).

Petioles arise sparsely at wide angles. The petiolar trace originates from a single protoxylem point (Pl. 1, fig. 5; Text-fig. 13). An angle of stem xylem elongates and takes an adaxial curve in the cortex, as a result of which the tissue of the cortex protrudes into the cavity (Pl. 1, fig. 5) and the trace acquires a C-shaped structure. As the trace moves outward, its connection breaks with the stem stele (Text-fig. 14) and in the base of petiole there is present the C-shaped stele (Pl. 1, fig. 6; Text-figs. 11 & 12).

Root traces arise endogenously (Pl. 1, fig. 4; Text-fig. 8) and quite frequently throughout the length of the stem. They are diarch.

Comparison — In habit, size and nature of stele the present material shows the characters of typical herbaceous lycopods (Seward, 1910, pp. 41-45), especially *Selaginella fraiponti* Schlanker & Leisman (1969) described from the Carboniferous rocks of America. But the present material differs in morphological as well as anatomical details. Unlike the latter, scales (leaves of lycopods) are non-vascularised, protoxylem points are mesarch, tracheids are interspersed with parenchyma and petiolar traces are C-shaped structures showing megaphyllous nature of leaves. Comparison was also made with *Lycoxylon* type 2 (Mittre, 1959, p. 48, pl. 1, fig. 3; text-fig. 3) described from Nipania in the Rajmahal Hills, but the present material differs in the nature of xylem, position of protoxylem points and C-shaped leaf traces.

The mixed xylem with peripheral protoxylem points and the manner of origin of leaf traces in the present material are similar to those found in the family Gleicheniaceae (Bower, 1926, p. 199, fig. 481). But differs from the latter in the shape of xylem, nature of cortex and other anatomical details.

Comparison is also made with the Schizaceous fern *Lygodium* which possesses an angular protostele in its rhizome with zylem parenchyma interspersed with tracheids. But the latter differs from the present material in the exarch positions of protoxylem points and nature of petiolar traces.

Type specimen no. BD. P1/Raj. PAK. (Sharma Collections, University of Jodhpur)

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EXPLANATION OF PLATE

Actinostelopteris pakurense gen. et sp. nov.

1. T.S. Actinostele and cortex (Slide no. BD. 201/Raj. PAK). × 24.

2. T.S. A portion of xylem enlarged showing interspersed parenchyma and mesarch protoxylem points at the angle. (Slide no. BD. 201/ Raj. PAK). × 72.

3. T.S. Branch and parent stem showing similar stele (Slide no. BD. 202/Raj. PAK.) × 24.

4. T.S. Terminal part of stem with reduced xylem and endogenous origin of root trace (Slide no. BD. 203/Raj. PAK). × 24.

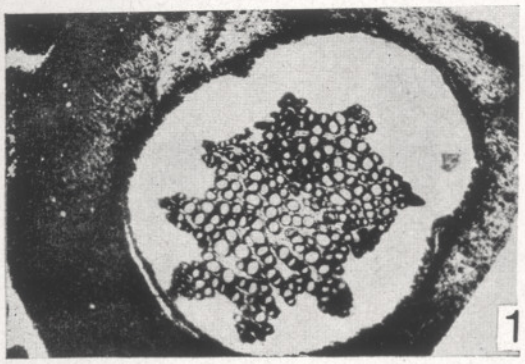
5. T.S. Origin of a petiolar trace from stem stele (Slide no. BD. 204/Raj. PAK). × 24.

6. T.S. A departed C-shaped petiolar trace (Slide no. BD. 205/Raj. PAK). × 24.

7. T.S. Modification of outer cortical cells for the production of scale (Slide no. BD. 206/Raj. PAK). × 72.

8. T. S. A multicellular scale on the stem surface (Slide no. BD. 202/Raj. PAK). × 72.

9. L.S. Tracheids provided with spiral, scalariform and reticulate thickenings. (Slide no. BD. 207/Raj. PAK). × 300.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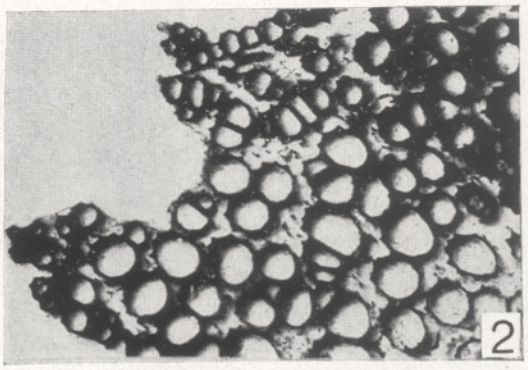
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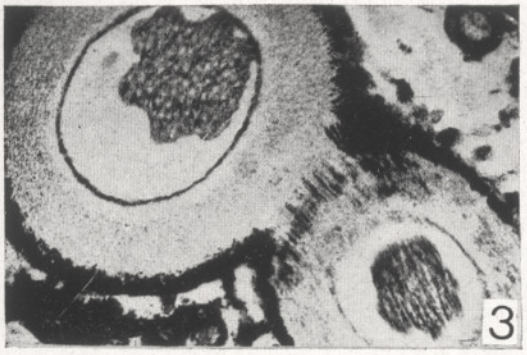
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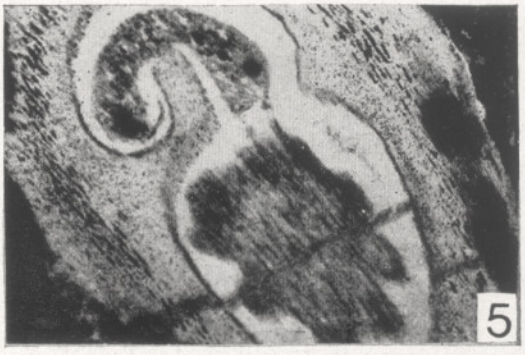
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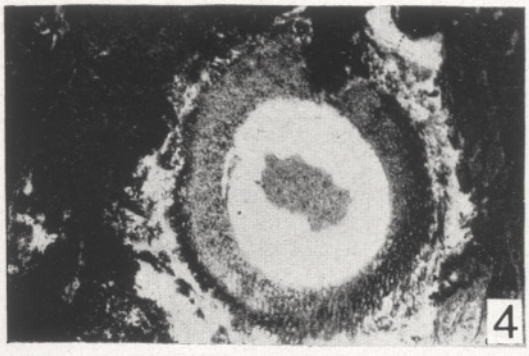
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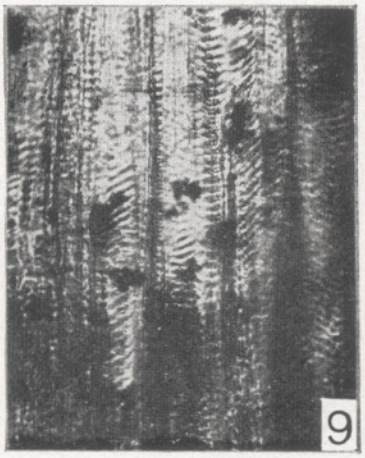
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