The Palaeobotanist, 30(2): 181-184, 1982.

STUDIES ON THE TRANSFUSION CELLS IN PETRIFIED LEAVES OF *PTILOPHYLLUM* AND *NIPANIOPHYLLUM* FROM THE RAJMAHAL HILLS, INDIA

B. D. SHARMA

Department of Botany, University of Jodhpur, Jodhpur 342 001, India

ABSTRACT

Transfusion cells have been recorded in the leaves of *Ptilophyllum* and *Nipaniophyllum*. In the former the transfusion cells are found in close association with the vascular elements, while in the latter they surround the bundle sheath. The relationship is discussed with the plants possessing allied type of arrangement of transfusion cells.

Key-words — *Ptilophyllum*, *Nipaniophyllum*, Transfusion cells, Rajmahal Hills, India.

सारांश

भारत की राजमहल पहाड़ियों से टाइलोफ़िल्लम् एवं निपनिओफ़िल्लम् की अश्मीभूत पत्तियों में संचरण कोशिकाओं का अध्ययन – ब्रह्मदत्त शर्मा

टाइलोफ़िल्लम् एवं निपनिओफ़िल्लम् की पत्तियों में संचरण कोशिकायें अभिलिखित की गई हैं। पहली प्रजाति में संचरण कोशिकायें संवहनी तत्वों के घनिष्ठ साहचर्य में पाई गई हैं, जबकि दूसरी में ये कोशिकायें बंडल-आच्छद को घेरे रहती हैं। संचरण कोशिकाओं के इसी प्रकार के विन्यास वाले पौधों की पारस्परिक बंधुता भी विवेचित की गई है।

INTRODUCTION

THE transfusion tissue includes three types of cells, i.e. transfusion tracheids, transfusion parenchyma and the albuminous cells. The transfusion cells occur invariably in all gymnosperms (Esau, 1965). In recent years a number of papers have been published on the structure and distribution of these cells in the stems of cycads (Greguss, 1969) and conifer leaves (Ghouse, 1973, 1974; Ghouse & Yunus, 1974, 1975; Kaushik, 1976; Kaushik & Bhattacharya, 1977). In fossil material the differentiation between transfusion parenchyma and albuminous cells is difficult. However, transfusion tracheids and the parenchyma could be recognized well in the fossil leaves.

Ptilophyllum and *Nipaniophyllum* leaves collected respectively from Amarjola and Nipania in the Rajmahal Hills, Bihar. The material of the former is soft and fragile, thus was boiled in canada balsam prior to sectioning with a wire band saw.

DESCRIPTION

Ptilophyllum — Serial sections were prepared in transverse as well as longitudinal planes through the petioles and rachises. A number of collateral, conjoint and endarch bundles are seen arranged in a double 'U'-shaped manner (Sharma, 1967). Both xylem as well as phloem are well-developed (Pl. 1, fig. 1). Xylem elements of the bundles of two rows face each other. Sclerotic cells are present in the inner portion of the cortex and adjacent to the phloem of the outer row of bundles (Pl. 1, fig. 3). These are arranged more or less in rows. The transfusion cells are present in between the two rings of bundles as well as on the lateral and outer sides of the bundles in close association with the vascular elements (Pl. 1, figs 1, 3). The transfusion tracheids are narrow, elongate, blunt end wall cells mostly having uniseriate bordered pits (Pl. 1, fig. 4). They occur in between the bundles and on the outer

periphery of the phloem (Pl. 1, fig. 3). The cells of transfusion parenchyma are large, rectangular and have scalariform thickenings (Pl. 1, fig. 4) or 2-3 seriate, opposite, simple pits (Pl. 1, fig. 2). They occur in between two rings of the bundles.

Nipaniophyllum — This leaf was cut in different planes. It is a simple leaf with distinct midrib from which the lateral veins arise at right angles and divide at all levels. The midrib possesses 5-11, or so, diploxylic bundles arranged in a saucer-shaped manner (Pl. 1, fig. 5). Each bundle possesses one cell thick, sclerenchyma sheath. The transfusion cells surround the sheath (Pl. 1, figs 5-7). The transfusion tracheids occupy lateral and abaxial sides of the bundles, while the transfusion parenchyma forms a well-developed zone on the adaxial side. The former are thick-walled cells with 2-3 rows of bordered pits on the lateral walls, while the latter are rectangular cells with simple pits. The transfusion cells are distinct and different from the cells of the bundle sheath which are typical sclerenchyma with uniseriate bordered pits.

DISCUSSION

Kaushik and Bhattacharya (1977) grouped conifers and taxads into different types on the basis of distribution of transfusion cells in their leaves. The studied leaves of *Ptilophyllum* resemble the needles of Pinaceae in the absence of distinct bundle sheath and in having transfusion cells all around the bundle and closely associated with the vascular elements. The transfusion tracheids are present on the lateral sides of the bundles, while the parenchyma occur on the abaxial/adaxial sides of the vascular elements.

In *Nipaniophyllum* the transfusion cells occur outside the bundle sheath. Worsdell (1897) suggested the term "accessory transfusion tissue" for such types of cells which are found in cycads and members of Podocarpaceae. However, *Nipaniophyllum* differs from them in detail. In the presence of transfusion tracheids in between the bundles and aggregation of the parenchyma on the adaxial side, the present leaf shows resemblances with the members of Araucariaceae (Kaushik & Bhattacharya, 1977). Rao (1943) also suspected the presence of transfusion tracheids in the leaf of *Taeniopteris spatulata* (later on renamed as *Nipaniophyllum raoi* Sahni, 1948), but could not decide whether the pitted tracheid-like cells were of the surrounding sclerenchymatous bundle sheath or are really transfusion cells. The present investigation confirms the exact nature of these cells.

Further studies on the transfusion cells in the petrified fossil plants might prove helpful in better understanding of their taxonomy and relationship with allied groups of plants.

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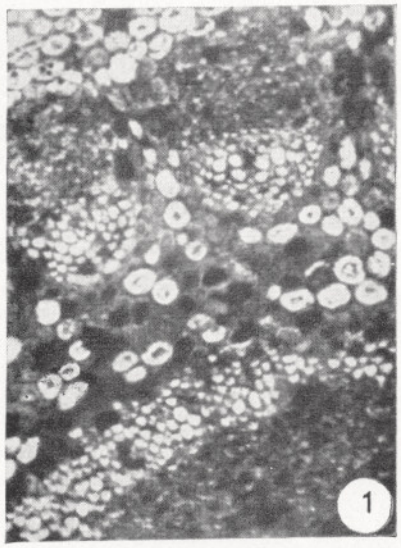
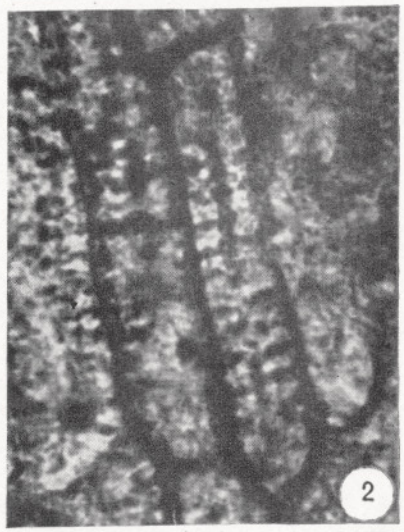
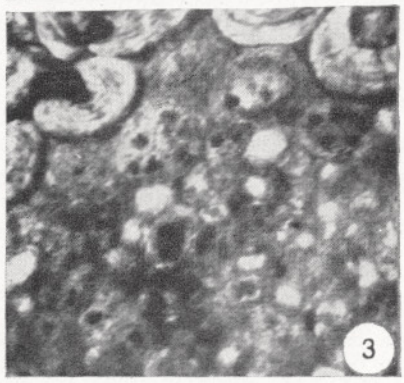
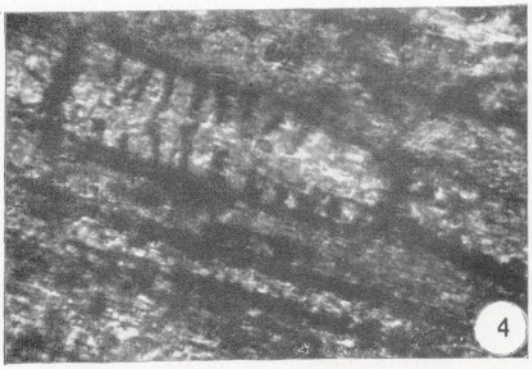
EXPLANATION OF PLATE

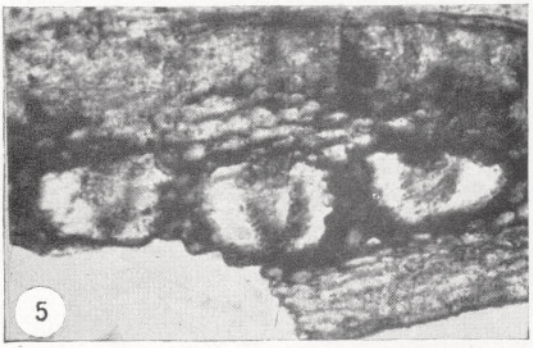
1. *Ptilophyllum*: C.S. Petiole, bundles of two rows and the associated transfusion cells. × 120.
2. Same. L.S. Transfusion parenchyma with two opposite rows of simple pits. × 450.
3. Same. C.S. Outer part of phloem with associated transfusion tracheids and sclerotic cells. × 300.
4. Same. L.S. Transfusion tracheids and the parenchyma. × 450.
5. *Nipaniophyllum*. C.S. Leaf showing diploxylic bundles and associated transfusion cells. × 24.
6, 7. Same. C.S. Bundles enlarged, showing the surrounding transfusion tracheids and the parenchyma. × 120.











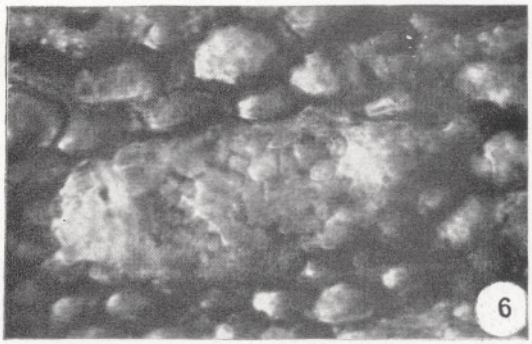


PLATE 1