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Ratio of Fusiform and Ray Initials in the Vascular Cambium of *Madhuca indica* J.F. Gmel

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Abstract: The anatomical studies of the vascular cylinder revealed in tangential longitudinal plane have fusiform initials and ray initials arranged in non-stratified manner like majority of dicots. It is generally believed that fusiform initials constitute more than 90% of the vascular cambium but contrary to above reports, 60 to 83% fusiform initials have been observed in different tropical tree and in certain extreme cases their proportion may fall as low as 25%. Keeping in view the above variations, the present communication aims at presenting the proportions of the fusiform initials which was found to be 65% mean tangential area in the cambial zone of presently investigated species.

Key words: Cambium, fusiform initials, ray initials, *Madhuca indica*

INTRODUCTION

As a result of detailed analysis of several trees, Bailey (1923) had indicated that fusiform initials constitute about two-third of the total area of cambial zone. Later, Wilson (1963) calculated the surface area of the different cambial initials in *Abies concolor* and found that these occupy more than 90% volume in the cambial zone. Subsequently, Kozłowski (1971) and Butterfield (1972) also recorded a similar high percentage of fusiform initials. Contrary to the above reports, Ghouse and Hashmi (1977), Khan and Siddiqui (1980), Khan (2001) and Mahmood (2001) have repeatedly observed the fusiform cells to vary from 60 to 83% in the different tropical trees. Keeping in view the aforesaid developments, the present work was undertaken with an aim to find out in what proportion the fusiform and ray initials occur in the cambial zone of branches of various girths of *Madhuca indica* J.F. Gmel. It is a medium- sized to large deciduous tree, usually with a short bole and large rounded crown, found through out the greater part of India up to an altitude of 1200 m and belongs to family Sapotaceae. The tree is of much economic importance. Mahua oil extracted from its seeds has emollient properties and is used in skin diseases, rheumatism and headache. Mahua tree yields a constructional timber, but the tree is too valuable to be felled for this purpose unless very old.

MATERIALS AND METHODS

The study was conducted in the Plant Anatomy Laboratory, Department of Botany, Aligarh Muslim

University, Aligarh (India). Cambial samples along with some sapwood and bark of 1-2 cm² size were collected (20 samples) from the main trunk of *Madhuca indica* J.F. Gmel. Samples were fixed on the spot in F.A.A. and then transferred to 70% ethanol after 72 h for preservation. Samples were sectioned on a sliding microtome in tangential plane at a thickness of 10-12 μ . Sections were stained in tannic acid-ferric chloride (Foster, 1934) and mounted in Canada balsam after dehydration in ethanol series. Camera Lucida diagrams were made, out of all samples, the portions containing ray initials were removed and weighed. The portions containing fusiform initials (after removal of ray initials) were weighed separately. The weighing was done on a sensitive digital balance. The proportion of fusiform initials to ray initials per unit area was calculated on the basis of the weights thus obtained in the Department of Botany, A.M.U. Aligarh.

RESULTS AND DISCUSSION

The vascular cambium in *Madhuca indica* J.F. Gmel is made up of vertically elongated, spindle shaped elements with tapering end walls-the fusiform initials and radially aligned almost isodiametric elements-the ray initials. The ray initials are grouped together forming rays of varying height and width, which traverse radially. The vertical cylinder is made up of compactly placed, vertically arranged fusiform initials with tapering end walls, overlapping each other to various degrees. Arrangement of different components of vascular cambium in *Madhuca indica* thus leads to the formation



Fig. 1: TLS showing fusiform and ray initials of *Madhuca indica* X 10

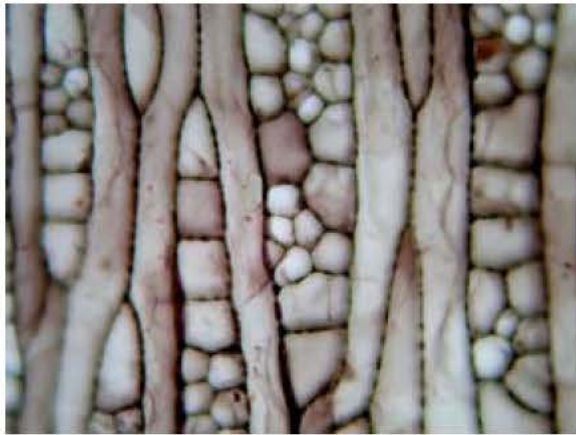


Fig. 2: TLS showing fusiform and ray initials of *Madhuca indica* X 40

of non-stratified structure. Analysis of the data obtained reveals that the fusiform cells occupy a total of 65% mean tangential area in the cambial zone of *Madhuca indica* (Fig. 1 and 2) while the ray initials make up 35% mean

tangential area of the total cambial zone. In no case, the fusiform initials were found to constitute 90% or more as reported by the earlier workers in certain conifers and dicotyledons (Wilson, 1963, Butterfield, 1972). Thus the present findings, however, go in agreement with the earlier reports (Ghouse and Hashmi, 1977; Khan and Siddique, 1980, 1983; Mahmood, 2001).

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