

secondary phloem towards outside which lies on the same radius. However, the larger strands of xylem that are so formed meet at the centre of the stele and merge with the primary xylem and give rise to a stellate appearance while the smaller xylem strands do not meet at the centre of the stele. The vascular strands that are formed are imbedded in the parenchymatous cells that are formed also from the cambium and the parenchymatous cells are elongated radially.

In thicker roots successive rings of cambium arise outside the normal core of vascular tissue and each cambial ring produces collateral strands of xylem and phloem imbedded in the parenchyma (Fig. 1). In some of the xylem vessels tyloses are formed and abundant starch grains accumulate in the cells of the parenchyma. The presence of crystals of calcium oxalate in some of the parenchymatous cells is a common feature (Fig. 2). A ring of sclerenchyma encircles each ring of vascular tissue. In the peripheral part of the root, a phellogen arises and forms cork to the exterior and one or two layers of phellogen to the interior.

The anomalous secondary thickening that is described above could also be observed in the roots of *Tiliacora acuminata*, Miers. and *Cissampelos periera*, Linn.

Thanks are due to Dr. C. R. Metcalfe for helpful suggestions, to the U.G.C. for an honorarium and to the authorities of A.N.R. College for facilities.

Department of Botany,
A. N. R. College, Gudivada,
October 5, 1978.

B. S. M. DUTT.

1. Metcalfe, C. R. and Chalk, L., *Anatomy of the Dicotyledons*, Vol. I. Oxford, Clarendon Press, 1950.

A FREAK IN THE ANATOMY OF SANDALWOOD (*SANTALUM ALBUM* LINN.)

DURING the course of examining the smuggled but seized sandal billets (*Santalum album* L.) and the residuary stumps remaining on the field in sandal forests, the author had the opportunity of cutting a large number of wood sections—transverse, radial and tangential—of several billets and stumps, preparing their microslides and examining them under microscope. During a re-examination of one of the slides prepared in 1959, (No. R-3-B) of the Shikaripur Police Station sandal case, a huge multi-seriate medullary ray was observed in the tangential section, vide Fig. 1. It is having 6 cells in width in the middle and 200 μ wide, the cells being alternately and irregularly arranged. In height there are approximately 35 cells,

measuring 840 μ . According to Pearson and Brown¹, sandalwood rays are "1-2 seriate, heterogeneous, the largest 25-30 μ wide, and 12 plus cells and 200 plus μ high (max. 18 cells and 335 μ)", and so the medullary ray under report does not conform to this description. It does not either agree with the description recorded by Metcalfe and Chalk². It is, therefore, a freak ray which is many times wider and higher than the normal rays around it. The walls between the ray cells are abnormally thick. A few of the ray cells are several times bigger than the normal ray cells. Amidst the normal rays, this freak looks like a huge giant.



FIG. 1

The author is grateful to Dr. Syamsundar Joshi of Botany Department, U.A.S., Bangalore, for his valuable suggestions.

Department of Farm Forestry, B. K. C. RAJAN.
Univ. of Agricultural Sciences,
Bangalore 560 065, October 12, 1978.

1. Pearson, R. S. and Brown, H. P., *Commercial Timbers of India*, Vol. II, Government of India, Central Publication Branch, Calcutta, 1932.
2. Metcalfe C. R. and Chalk L., *Anatomy of the Dicotyledons*, Vol. II, Clarendon Press, Oxford, 1950.