BLUMEA 23 (1976) 13—16

CELL LENGTH VARIATION IN PHLOEM FIBRES WITHIN THE BARK OF FOUR TROPICAL FRUIT TREES AEGLE MARMELOS, MANGIFERA INDICA, SYZYGIUM CUMINI, AND ZIZYPHUS MAURITIANA

A. K. M. GHOUSE and FIROZ A. SIDDIQUI

Department of Botany, Aligarh

Muslim University, Aligarh
India

SUMMARY

Bark samples from collections made at monthly intervals during the calendar years 1973 and 1974, were studied to estimate the average length of phloem fibres in different positions within the bark of four tropical fruit trees, viz. *Aegle marmelos* Correa, *Mangifera indica* L., *Syzygium cumini* L., and *Zizyphus mauritiana* Lamk. In all the species studied, fibre elements found in the vicinity of vascular cambium are longer than those situated in the outer regions of the bark. The length variation of fibre elements is attributable partly to the increase in size of cambial initials with increasing age of the cambium and partly to the apical elongation of elements by intrusive growth.

INTRODUCTION

In a previous communication the authors have reported that phloem fibres vary in length at different positions within the bark in some tropical trees (in press). The length variation has been considered as a combined effect of intrusive growth and the changes in fusiform cells occurring with the growing age of the cambium of the concerned species. The present report deals with the cell length variation of phloem fibres in four Indian tropical fruit trees.

MATERIALS AND METHODS

Bark samples in the form of 2 cm^2 size, were collected at monthly intervals for two calendar years (1973 and 1974) from the main trunks of four tropical fruit trees, viz. *Aegle marmelos* Correa (*Rutaceae*), *Mangifera indica* L. (*Anacardiaceae*), *Syzygium cumini* L. (*Myrtaceae*), and *Zizyphus mauritiana* Lamk. (*Rhamnaceae*), and fixed in F. A. A. on the spot. They were later preserved in 70% ethanol. Phloem fibres were macerated from the above collections following the method described by Ghouse *et al.* (1974). For every slice, 1000 fibres were measured and thus 8000 to 12000 elements were considered per sample depending on the thickness of bark. For each species 24 samples were studied out of the total collections. The data are presented as an average of 24 samples for any concerned positions in the bark.

OBSERVATIONS

The secondary phloem in the species investigated presently, is made up of sieve tube elements accompanied with companion cells, vertically oriented parenchyma cells and

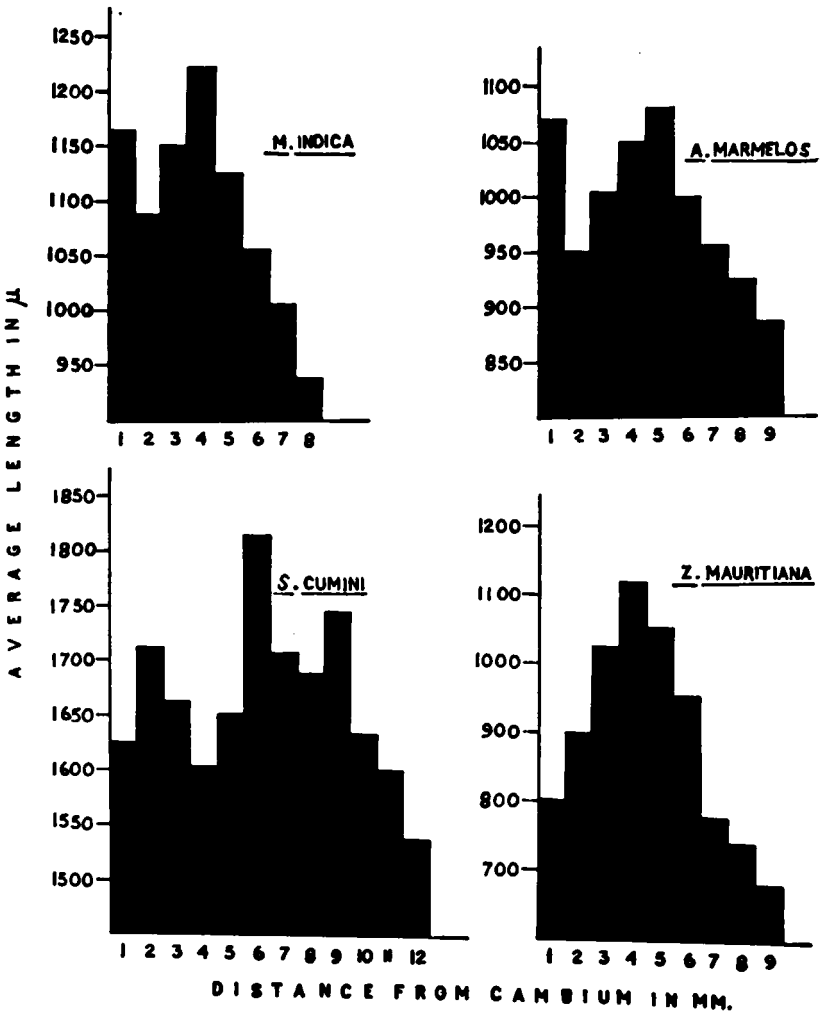

Fig. 1. Histogram indicating average fibre length at different positions from cambial zone.

fibre elements. The present study is confined only to fibres. The length measurements made on fibre elements obtained by maceration at different positions has shown that they differ in their average length from place to place within the bark in all the species studied (Fig. 1). It further shows that the trend of variation is not the same in all the plants investigated. In *M. indica* and *A. mermelos*, the fibre elements situated in the vicinity of cambium are longer than those situated 1 mm. away from it, while in the other two, they are shorter near the cambium than in other places excepting the peripheral ones. The longest elements are found in all cases somewhere in the middle of the bark, the shortest at the periphery. In *Z. mauritiana*, a gradual increase in everage length has been recorded from the first to fourth mm from cambium and a gradual decrease in the subsequent ones. More or less the same trend has been recorded in the case of *A. marmelos* and *M. indica* with the exception of one position which is at the vicinity of vascular cambium. In *S. cumini*, the increase of fibre length does not follow any gradual measure as in the others. In this species the variation trend appears to be very uncertain as it has several maxima occurring at different positions within the same bark.

The average lengths of fibre elements in different positions within the bark range from 887—1159 μ in *A. marmelos*, 937—1219 μ in *M. indica*, 1587—1813 μ in *S. cumini* and 680—1115 μ in *Z. mauritiana*.

DISCUSSION

It has been reported in case of wood fibres that their average length shows a gradual increase from the centre of the trunks towards the cambium, i.e. the elements situated near to the pith area are of shorter dimension than those placed away from the pith (Dinwoodie, 1961; Kedharnath *et al.*, 1963; Parameswaran, 1964; Burley, 1969). The average lengths of phloem fibres obtained in the present study, also show a certain trend, although the change in size is not only a function of the distance from the periderm. The longer elements obtained in between the cambium and periderm in all the cases studied, are due to apical elongation of elements by intrusive growth, a phenomenon found to be general in phloem fibres in a number of tropical trees studied in this laboratory and elsewhere (Liese & Parameswaran, 1972; Ghouse & Sabir, 1974; Ghouse & Yunus, 1975). Since the final length of the elements depends not only on the size of fusiform cells of the cambium from which they have been derived, the other factors, like intrusive growth and the internal conditions favourable for such growth activity also contribute to a considerable extent in determining their average length. Therefore, the variation in length of phloem fibres obtained in the present study is attributed to the combined effect of the changes in length of fusiform cells of the cambium with the growing age of the tree (Bailey, 1923; Bannan, 1962; Evert, 1963; Ghouse & Yunus, 1973) and the degree of intrusive growth, which the concerned elements undergo after completing their symplastic phase of growth.

Further work in the same direction on other tropical trees is in progress and will be reported elsewhere.

ACKNOWLEDGEMENTS

The authors are thankful to Prof. R. Khan for providing laboratory facilities. They are also thankful to Miss Farzana Farooqui, Research Fellow in the Department of Botany for the help rendered by her in collecting the materials. The second author (F.A.S.) records his appreciation on the financial assistance offered by the Council of Scientific and Industrial Research, New Delhi, in the form of a Junior Fellowship.

REFERENCES

BAILEY, I. W. 1923. The increase in girth of the cambium. Am. J. Bot. 10: 499—509.
BANNAN, M. W. 1962. Cambial behaviour with reference to cell length and ring width in Pinus strobus L. Can. J. Bot. 40: 1057—1062.
BURLEY, J. 1969. Tracheid length variation in single tree of Pinus kesiya Royle ex Gord. Wood Sci. Technol. 3: 109—116.
DINWOODIE, J. M. 1961. Tracheid and fibre length in timber. A review of literature. Forestry 34: 125—144.
EVERT, R. F. 1963. The cambium and seasonal development of phloem in Pyrus malus. Am. J. Bot. 50: 149—151.
GHOUSE, A. K. M., & D. SABIR. 1974. Intrusive growth in phloem fibres of Erythrina indica and Pongamia glabra. Israel J. Bot. 23: 223—225.
—, & M. YUNUS. 1973. Some aspects of cambial development in the shoots of Dalbergia sissoo Roxb. Flore B 162: 549—558.
—, & M. YUNUS. 1976. Cell length variation in the secondary phloem of Dalbergia spp. with increasing age of the vascular cambium. Ann. Bot. 40: 13—16.
—, M. YUNUS, F. FAROOQUI, & D. SABIR. 1974. A simple maceration technique for the separation of sieve elements from the barks of woody plants. Curr. Sci. 43: 424—425.
KEDHARNATH, S., V. I. CHACKO, S. K. GUPTA, & J. D. MATHEWS. 1963. Geographic and individual tree variation in some wood characters of teak (Tectona grandis L. f.). Silvae Genet. 12: 181—187.
LIESE, W., & N. PARAMESWARAN. 1972. On the variation of cell length within the bark of some tropical hard wood species. In 'Research Trends in Plant Anatomy'. A. M. K. Ghouse and M. Yunus, eds. Tata McGraw-Hill, New Delhi, pp 83—90.
PARAMESWARAN, N. 1964. Uber die Lange der septierten Fasern bei Tectona grandis. Naturwiss. 51: 317—318.