

# Investigations of *Hevea* Bark Anatomy.

**T**HE above is the title of a Progress Report by Herbert Ashplant, A.R.C.S., Rubber Specialist in South India, which appears in the current number of the Bulletin of the Rubber Growers' Association. As the subject matter of the Report is of interest to rubber planters, an abstract is given below.

The investigations summarised in the Report have been carried on at intermittent periods since 1923. In Mr. Ashplant's words, the points on which information was sought were:—

1. Number of rows of latex vessels in trees at different ages.
2. Quantitative relation between number of rows of latex vessels and bark thickness.
3. Quantitative relation between rows of latex tubes and girth increase.
4. Direction and disposition of latex vessels.
5. Quantitative relation between number of rows and yield of dry rubber given by tree.
6. Assuming relation found is definite enough for utilisation under practical conditions, what is the earliest age at which the enumeration of latex tubes would give a reliable indication of a tree's yielding power?
7. To ascertain whether, apart from the number of rows of latex tubes, there are any other anatomical characters which can be correlated with high or low milking powers.
8. To ascertain whether there are any differences in the calibre of the latex tubes in the various rings, and also whether the capacity of the latex tubes or ring complexes appreciably varies from tree to tree.
9. To settle definitely the mode of origin of latex tubes and ascertain whether the rate of formation of new tubes is susceptible to any external influences which can be brought to bear on the tree.

The data accumulated in connection with points 1 to 6 are found to corroborate the results obtained by other workers. They are not given in the Report and will be published elsewhere. It is claimed, however, that important findings have been made in connection with points 7 and 8, findings which promise to be of practical value.

## New Factors Determining Yield Capacity.

The weakness of the correlation between yield and number of latex-vessel rows stimulated a search for other factors, and led to a study of latex-tube bore, the mechanical aspects of latex flow, and the differences in latex-tube bore.

It is estimated that the diameter of the latex tube varies between  $1/1200$  and  $1/500$  inch. Further, in the conversion of cell-rows into latex tubes in nature, the cross-walls of the one-time separate cells are frequently only partially cleared away, and the existence along such fine tubes of projecting vestiges of wall must constitute a serious impediment to latex flow. The impediment is accentuated by the physical nature of latex, to overcome the high viscosity of which tremendous forces are necessary. The very high rubber content of the latex and its consequently increased viscosity are held to account for the failure of trees to respond fully to tapping for the first few days, and the subsequent increase in flow is attributed to the fall in concentration and lessened viscosity of the latex rather than to a physiological "wound reaction."

The diameter of the tube is equally important from the point of view of capacity. It should be remembered that capacity varies as the square of the diameter, *i.e.*, if the diameter is doubled the capacity increases four-fold. It is therefore conceivable that variation in diameter of tube may affect both actual capacity for latex and rate of flow on tapping.

Measurements of latex-vessel bore are found to present great technical difficulties, which are increased by the observations that the tubes are elliptical rather than circular in cross-section (the ratio between radial and tangential diameters being about 7:10) and that the bore increases from the cambium outwards.

These difficulties, coupled with the realisation of the common mode of origin of latex tubes and ordinary cortical cells, led to an examination of the latter (as being more easy of measurement) and to an attempt to correlate average diameter of cortical cells and yield. The attempt was not without difficulties, as, owing to the great variations in cortical-cell sizes, it proved almost as difficult to detect differences in average cell size as difference in latex-tube bore. It is claimed, however, that close and detailed acquaintance has established definitely that the average cortical-cell diameter differs in individual trees, the diameter being, as a general rule, large in high-yielding trees and small in poor yielders, and that the two characters are to one another in the relation of cause and effect. The degree of correlation between size of cortical cells and yield has not yet been worked out, but, assuming that the correlation is satisfactory, there would here appear to be a relation of diagnostic value. The magnitude of that value turns on the hitherto-undetermined question as to whether cell size is a hereditary and constant factor, for, if it is so, a tree which is to possess large cells in later life will possess those cells in the seedling stage. It should therefore be possible to tell a future high yielder by a microscopic examination of the cortical tissues of the seedling. There is evidence, both in plant and animal cytology, that cell size is hereditary and constant, but it is obvious that, where so great a practical value turns on the truth of this question, it must be worked out in detail and either verified or disproved.

## Correlation between Latex Rings and Yield at Different Heights on the Tree.

It is known that, whereas the ratio of the number of latex rings at three feet from the ground to those at ground level is as 1:1.6, the ratio between the yields at the same levels is as 1:2, a discrepancy which has hitherto been explained on "physiological grounds." It is now claimed that the matter is entirely one of spatial arrangement of latex vessels and that there is no need to invoke the aid of physiology. Examination of a

large number of trees shews that the individual rings stand out further from the cambium in the basal region of the tree than at higher levels. It follows that tapping to an identical depth will open a greater proportion of the total rings present at ground level than at three feet. Examination of 238 trees gives the following relations:—

Height	Relative No. of latex rings altogether (tappable and untappable)	Relative No. of latex rings tappable
3 feet	75	64
1·5 feet	100	100
Ground level	125	136

It is assumed in computing the figures in column 3 that a constant thickness of 1·5 mm. is left untapped. The figures then show that the numbers of latex-vessel rows present in all but the innermost 1·5 mm. of bark at three feet, at 1·5 feet and at ground level are in the ratio 64:100:136. In column 2 we see that the total numbers of latex-vessel rows at the same heights are in the ratio 75:100:125. Therefore, while the ratio of total latex-vessel rows at three feet and ground level is as 75:125, *i.e.*, as 1:1·67, the ratio of *tappable* latex rows at the same heights is as 64:136, *i.e.*, as 1:2·125, which is near to the ratio of 1:2 for yields at these heights. It is held that the relative number of latex rings in the tappable zone is adequate and more than adequate to explain the differential yield value of *Hevea* cortex at the various tapping heights.

The variation in arrangement of the rings within the bark is pointed out, and attention is drawn to the fact that such variation upsets the correlation between latex rings and yield.

J. C. H.