Chapter 6

Summary

Hevea brasiliensis, belonging to the family, *Euphorbiaceae* is the major source of Natural Rubber (NR). Latex is produced in the latex vessels or laticifers distributed in the bark and is exploited by the process called tapping. The present system of tapping was formulated based on the inclination of laticifers towards the right at $3 - 5^0$. . But the laticifers were found to be inclined towards the right or left within the bark of *Hevea*. Anatomically, *Hevea* bark is composed of concentric layers of sieve tubes, companion cells, phloem fibers, parenchymatous tissues and network of latex vessels. Most of the bark characters were interrelated.

Detailed investigations were carried out on the structure of the bark of *Hevea brasiliensis* with special emphasis on alignment, orientation and angle of deviation of latex vessels. The main objectives were to study: (1) the variation in different structural characters within and between clones (2), association and inter relationship of various structural characters of bark (3), the alignment and angle of inclination of laticifers and phloic elements. (4), angle of inclination of laticifers in seedling and budded plants at the juvenile stage. (5), structural factors influencing inclination of latex vessels in the bark and (6), histochemical localization of the reserve metabolites such as starch, total polysaccharides, lipids, proteins, phenols, tannins and lignin in the bark.

Ten clones of H. brasiliensis, *viz.* Tjir 1, Gl 1, PB 86, GT 1, PB 28/59, RRII 105, RRIM 600, RRIM 703, PB 235 and RRII 300, at the age of 17-21 years planted in Randomised Block Design (RBD) with three replicates and three trees per plot, were used to study the bark structural traits and histochemical investigations in the mature stage. Seedling progenies of two cross combinations and budded plants of RRII 105 and RRIM 600 at the age of 4 years were selected to investigate the inclination and orientation of laticifers in the juvenile stage.

The data generated were subjected to detailed statistical analysis *viz.* Coefficient of Variation(CV), Correlation, Analysis of variation (ANOVA) and Regression analysis.

Structurally the bark of *Hevea brasiliensis* consists of three distinguished zones *viz.* (i) the inner region contiguous to cambium called the soft bark (SB), (ii) the middle zone consisting of latex vessels and with stone cells called inner hard bark and (iii) the outer zone, made up of highly sclerified stone cells called outer hard bark. The latex vessels in *Hevea* are compound articulated, anastomosing, interconnected tubes formed in concentric rings sandwiched in between layers of other phloic elements. The latex vessels are vertically interwoven around phloic rays along the longitudinal axis of the tree.

The tree girth recorded low tree to tree variation but had significant clonal variability. Positive association of tree girth with many of the bark anatomical characters such as bark thickness, latex vessel rows, number of stone cell rows and total ray frequency, was noticed

Significant clonal variability was observed in the thickness of inner and outer hard bark. The major portion of the bark was occupied by the outer hard bark followed by inner hard bark and then by the soft bark. Correlation studies clearly indicated their close association with many of the bark characters.

Laticifer rows are mainly distributed in the soft bark and in the inner hard bark. The proportion of latex vessel rows in the inner hard bark comes about 60% of the total number of laticifer rows. Both these characters depicted tree to tree variation and significant clonal variability. Inter laticifer row distance in soft bark and inner hard bark did not show any significant difference. Clonal variation in the inter laticifer row distance was significant in the inner hard bark.

Latex vessels are running around the phloic rays in longitudinal direction. About 90% of the latex vessels in *Hevea* bark are distributed contiguous to rays indicating that ray system and laticifers are closely related in distribution. Though tree to tree variation was low, clonal variation was highly significant for these characters. As the laticifers in *Hevea* are articulated anastomosing types, the frequency of interconnections between them also showed significant clonal variation. Certain other factors like the thickness of soft bark, number of laticifer rows in the inner hard bark, girth and laticifer area index also showed negative association with frequency of interconnections. Low tree to tree variation with significant clonal variability was observed in the diameter of latex vessels. This trait showed positive association with bark thickness and laticifer area index

The present study revealed that in *Hevea*, the phloic rays and latex vessels were closely associated with respect to orientation and inclination. The alignment and inclination of phloic rays and latex vessels were found to be almost same. Out of the ten clones studied , six clones (RRIM 703, GT 1, RRII 300, Tjir 1, PB 235 and Gl 1) possessed laticifers inclined towards the right. In PB 86 the laticifers were inclined towards the left. In clones like RRII 105, PB 28/59 and RRIM 600, the inclination of laticifers were either towards right or left and even in both directions.

Correlation and regression analysis conclusively proved that the inclination pattern of phloic rays was the most influencing parameter which determines the inclination of laticifers. The frequency of rays in the latex vessel free zone in soft bark showed significant clonal variability whereas those rays contiguous to laticifers in both soft and inner hard bark did not show clonal variability. The total

frequency of phloic rays was higher in soft bark than the inner hard bark where the width of phloic rays was considerably increased in the inner hard bark.

The frequency of stone cells in the inner hard bark depicted low tree to tree variation and insignificant clonal variability. However, area occupied by stone cells in the inner and outer hard bark recorded considerable clonal variation. These characters were also closely associated with various other bark characters.

Histochemical studies revealed the localization status of reserve metabolites such as starch, lipids, proteins, phenols, tannin, cell wall polysaccharides and lignin. Starch, phenol and tannin compounds were absent in the soft bark zone, but abundant in the inner and outer in the inner hard bark region especially in axial parenchyma cells. Proteins and lipids were distributed mainly in rays. Total polysaccharides were localized in the cell wall of all phenolic elements including laticifers. Lignification was observed mainly in stone cells and also in the cell wall of those cells which undergo sclerification leading to stone cell formation.

The data on the inclination of latex vessels in this study needs to be endorsed with its effect on latex yield which will subsequently necessitate further debate on the subject especially on the tapping slope.