

## SOME OBSERVATIONS ON THE RELATION OF THE INTERNAL TEMPERATURE OF *P. RADIATA* TO INFESTATION BY *SIREX*

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In 1917, having no previous knowledge whatever of growing trees, I planted fifty acres in *P. radiata* at Braeburn, Upper Moutere. Under the advice of the late Mr Thompson of the Selwyn River Board Plantations, planting was at six foot spacing. In the tenth year approximately half were thinned out.

When the trees were thirteen years old, my plantation manager, Mr C. A. Newport, drew my attention to the number of trees with yellowing tops. We were then even more ignorant than now about *P. radiata*, and speculated as to the cause. For some months we watched; the yellow tops increased. We became anxious, made enquiries, and for the first time learned of the wood wasp, giant horntail *Sirex*.

We cut down a yellowing tree, split it up, and found it teeming with larvae of the borer. We noticed that quite healthy, strong trees were growing alongside infested trees, and that the latter were trees that had not been doing well.

A visit was made to another plantation thirty miles away, the Kanui plantation at Belgrove, which was found to be similarly affected. The overseer of that plantation at that time was Mr Prosser who had been interested in timber all his life; a very observant man.

I asked him why it was that *Sirex* appeared to attack the non-thriving trees. He replied at once, "It's the temperature of the tree. The tree the horntail enters is warmer than the others."

"How can you tell that?" I asked.

"By my hand," he said, "I put my hand on the horntailed tree, and can feel it is warmer than the healthy tree," and he held out a palm thickened by handling tools.

This taxed my credulity until I reflected that I could myself detect in a patient, by hand, an elevation of temperature about a degree and a half over normal; so I decided to investigate.

A number of stout glass thermometers were procured, and an auger of diameter just sufficient to take the thermometer in its bore. For three months, every Sunday afternoon, I went into the plantation to test the internal temperature of the trees. This was in the summer of 1931.

The system followed was to choose four classes of tree:

- (1) Strong, well-growing trees with good foliage.
- (2) Suppressed trees, not doing well, but not showing the yellowing tips of *Sirex* infestation.
- (3) Obviously infested trees.
- (4) Dead trees.

Into each class, in equal numbers, I bored holes of depth of half the radius of the tree in order to find the temperature midway between the centre of the tree and the surface. This, I assumed rightly or wrongly, would indicate the mean internal temperature of breast height. Into the hole the close-fitting thermometer was pushed, and alongside the thermometer in the tree another was suspended on the bark in order to compare the temperature inside the tree with that of the air surrounding the tree. The operation was done always on the shady side to avoid any confusion from direct warmth of the sun; for I soon found that the sun beating on a tree trunk warmed it up a great deal.

What with choosing the trees, boring the holes, placing the thermometers, giving time for the reading and making records, it took more time than might be expected, so only ten or twelve readings would be made in an afternoon.

The results obtained from this primitive enquiry were that:

- (1) The strong, healthy tree with good foliage kept its internal temperature well below the air temperature by 2 degrees to 5 degrees centigrade.
- (2) The suppressed tree, not doing well, not having robust foliage, but not obviously infested, had an internal temperature about, or very little below the air temperature, no more than two degrees below, and sometimes over.
- (3) The *Sirex*-infested tree was actually feverish. Its internal temperature was always higher than the air temperature by one to five degrees centigrade.
- (4) Dead trees just followed air temperature with a long time lag; slow to warm and slow to cool.

What conclusions, if any, are to be drawn from this simple and incomplete research? More extended observations would be necessary to be on safe ground; but it is tentatively suggested—

- (1) That Mr Prouse's observation is correct that the *Sirex*-infested tree has a higher than normal temperature.
- (2) That the internal temperature of healthy, well-foliaged trees is kept lower than that of trees undergoing suppression and having poorer foliage, and below air temperature.

The reason for this is probably that the well-growing tree regulates its temperature by transpiration from abundant foliage, while the suppressed or diseased tree is unable to do so by reason of inefficient foliage.

It would, perhaps, be going too far to assume that the temperature of a tree influences *Sirex* in her choice of tree of ovi-positing. It is more likely that ovi-positing is indiscriminate; but in the suppressed tree, with higher temperature and less sap rising, conditions are more favourable for the hatching of the egg and the boring activities of the larvae than in the flourishing tree with lower temperature and more moisture.

This latter supposition is borne out by the fact that, on discovery of *Sirex* infestation, my plantation underwent a rigorous second thinning. All infested trees were cut, and release thinning done to about three hundred per acre. The infestation was promptly arrested.

At the same time the Cawthron Institute kindly introduced some two dozen *Rhyssa*. These, I am sure, were of value in the subsequent control of *Sirex*; but it is hard to believe that the release of that small number of *Rhyssa* could possibly have had the effect that followed the thinning.

In three successive thinnings over the past twenty years, for saw-timber, we have found hardly any evidence of *Sirex*, the stand being now about eighty-five trees per acre. The moral seems to be, if growing *P. radiata* for timber, thin early, and keep on thinning till maturity, so as to give the roof space and crown space for strong foliage.

This matter of the internal temperature of trees may have wider implications. This small experiment was made with one type of evergreen tree, in one part of the day and one season of the year. How does the temperature vary day and night, at different seasons, in evergreen and deciduous trees? May it not be that temperature, as in animals and humans, has a relation to different diseases? It is hard to believe it is a subject that has never been thought of before, but I have not been able to find any reference. If there has been no investigation there is a field of enquiry open to the young.

#### AS OTHERS SEE US

“The authors of this book are foresters and perhaps a little over-serious as a consequence.”

From an anonymous book-reviewer in *Gardener's Chronicle*, Vol. 141, No. 15, April 1957.