ROLE OF INJECTION WOUNDS ON BARK ROT DISEASE INCIDENCE IN *HEVEA BRASILIENSIS*

Bark rot or black stripe disease on tapping panel of *Hevea brasiliensis* is caused by species of *Phytophthora*. The characteristic symptom in the case of this disease is rotting of bark followed by formation of vertical black lines in the wood after infection. *Phytophthora meadii, P. palmivora* and *P. nicotianae* var. *parasitica* have been isolated as causative organisms of the disease from the rubber tree in India, *P. meadii* and *P. palmivora* in Sri Lanka and *P. botryosa, P. heveae* and *P. palmivora* in Malaysia. Since so many species are involved, the causal fungus will be referred to as *Phytophthora,* not mentioning the individual nomenclature.

Of late, considerable work is going on in the field of induced disease resistance associated with hypersensitive reactions or necrotic responses. Living plant cells respond to physical injuries. The damaged cells as well as cells adjacent to them die and in the process produce various compounds (Day, 1974). These compounds are regarded simply as secondary plant metabolites or stress metabolites (Cruickshank, 1980). These are potent fungicides and antibiotics (Wheeler, 1975). Phytoalexins are low molecular weight antimicrobial compounds accumulated in plants after exposure to micro-organisms (Ouchi, 1983). Previously the antimicrobial stress metabolites were believed to be formed when living cells are invaded by a parasite (Muller and Borger, 1940), but later it has been proved that chemicals and wounding can do the same as well with varying efficiency and thus replace primary parasites as triggers of resistance (Van der Plank, 1975). Phytoalexins and phytostilbenes are known groups of fungitoxic stress metabolites produced in quantity in plant tissues as a result of injury. It has been reported that the phytoalexin elicitors such as physical damage not only induce localised accumulation of phytoalexins but also travel through tissues amplifying resistance reactions or may even be translocated to far distant parts of the plants which would cause a systemic resistance (Ouchi, 1983). This paper presents the results of an experiment to study the effect of streptomycin pressure injection on bark rot disease incidence in *Hevea brasiliensis* which interestingly culminated in the finding that irrespective of the treatment, wounding-induced callusing has reduced bark rot disease development to a great extent.

A statistically laid out field experiment was conducted at the RRII's Central Experiment Station at Chethackal, Ranni, situated 50 km from Kottayam in Kerala State. Four year old trees of RRII 118 were selected for the experiment. Randomised block design with four treatments and five replications was adopted. The details are presented in Table 1.

Volume injected per tree was one litre and all injections were carried out using the pressure injection equipment fabricated at the RRII and in the manner described by Thankamma et al. (1979). Injection was done through two opposite holes made on the trees at a height of one metre from the ground. Bordeaux mixture was sprayed at the rate of four litres per tree using a Rocker sprayer. Injection was done during July-

August, 1984 and the treated trees were inoculated during November, 1984 with 10 mm oat agar culture discs of three week old culture of *Phytophthora meadii*. The bark was punctured using a cork-borer of 10 mm dia. and the bark bit was removed. Latex exuded was wiped off and the hole plugged with culture disc, covered with moist cotton and wrapped with polythene sheet and kept in position using cellotape or twine. The inoculated portions were observed after a fortnight and length of lesion was measured. After recording the observation, the wounds were treated with Bordeaux paste. The distance between the injection wounds and inoculation wounds was measured and recorded. It ranged from 7.0 to 15.0 cm with an average of 11.0 cm.

The inoculated region from above the bark surface did not show any discolouration except for the brownish discolouration of the exposed cambium on the wood surface. But when the outer bark was scraped off, brownish black discolouration of tissues was observed extending both upwards and downwards in the form of a spindle, at an angle to the vertical. When the bark around the inoculated area was removed to expose the wood, brownish discolouration with black streaks were visible. The data on the length of lesion were subjected to statistical analysis and presened in Table 1. Significant control of bark rot disease of *Hevea* was achieved more or less uniformly in the three treatments with injection wound when compared to the unwounded control. In other words, wounding and injection of fluids have produced significant disease control in the case of bark rot disease of *Hevea brasiliensis*. The effect of streptomycin on bark rot disease, if any, might have been masked by the effect of wound callusing stress metabolites so that the two different streptomycin concentrations and the water injected control all behaved more or less uniformly towards the inoculated pathogen when compared to the unwounded Bordeaux sprayed control.

Table 1. Mean length of lesion formed as a result of *Phytophthora* inoculation on rubber wood surface

Treatments	Mean lesion length (cm)
Tree injection with streptomycin 10 g/tree	4.74
Tree injection with streptomycin 5 g/tree.	4.61
High volume spray with 1 per cent Bordeaux mixture	6.07
Tree injection with water	4.43

S.E = 0.26 C.D = 0.80 (P = 0.05)

Even though there are reports to the effect that physical injuries just like other biotic and abiotic phytoalexin elicitors induce phytoalexin production creating resistance to the host against plant pathogenic micro-organisms, there is no report on any case of disease control in any crop obtained consequent on wound callusing except in the case of Eucalyptus where pink disease was successfully managed by previously made controlled wounding (Thankamma et al., 1985). This is a first report of callused wounds resulting in disease control in *Hevea* in the case of bark rot disease caused by *Phytophthora*.

REFERENCES

Cruickshank, I. A. M. (1980). Defences triggered by the invader. Chemical defences. *Plant Diseases* Vol. 5. (ed. Horsfall, J. G. & Cowling, E. B.). Academic Press, New York. pp. 247–267

Day, P. R. (1974). *Genetics of host-parasite interaction*. Freeman and Company, San Francisco, pp. 238.

Muller, K. O. & Borger, H. (1940). Experimentelle Untersuchungen uber die *Phytophthora*. Resistez der Karloffel. Arb. Biol. Abt. (Aust Reichsanst). Berlin **23**: 183–231.

Ouchi, (1983). Induction of resistance or susceptibility. Annual Review of Phytopathology **21**: 289–315.

Thankamma, L., Rajendran, T. P. and Joseph Mani. (1979). A pressure machine for injecting rubber trees. Proceedings of the second Annual Symposium on Plantation Crops. II. (ed. Venkataram, C.S.) 181–189.

Thankamma, L., Madhavan Nair, J., Deo, A. D. & Dinesh Kumar. (1985). Role of stress metabolites on pink disease management in *Eucalyptus tereticornis*. Indian Forester (In press).

Van der plank, J. E. (1975). *Principles of plant infection*. Academic press, New York. pp. 216.

Wheeler, H. (1975). *Plant Pathogenenesis*. Springer Verlag, New York. pp. 106.

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OCCURRENCE OF *COLLETOTRICHUM* LEAF SPOT DISEASE OF RUBBER IN INDIA

A disease with severe spotting on rubber leaves leading to defoliation in some cases has been found recently in certain plantations in South India. The disease appears to be widespread and very serious. Severe incidence was noticed on six-year old trees of RRII 105 and RRIM 701 in 1983 in an estate in Manimala, Kerala State. Subsequently the disease was found in many other rubber growing areas also, affecting both mature trees and budwood plants. The disease makes its appearance on the leaves during February-March and the infected leaves persist throughout the year. This disease has been reported earlier in Malaysia (John, 1952) and it was described as *Colletotrichum* leaf disease. There is another leaf disease of rubber known as anthracnose which is also caused by *Colletotrichum gloeosporoides*. The symptoms of *Colletotrichum* leaf disease and anthracnose are quite different, though the pathogen involved in both diseases is the same. The present paper is a report of the incidence of *Colletotrichum* leaf spot disease of rubber in India.

The *Colletotrichum* leaf disease was first reported on rubber seedlings in Ceylon and the pathogen was identified as *Colletotrichum heveae* Petch (Petch, 1906). Later in Malaysia a species of *Colletotrichum* attacking seedlings in nursery and young rubber trees in the field in association with *Helminthosporium* and *Gloeosporium* was reported (Beeley, 1937). A species of *Colletotrichum*, different from *Colletotrichum heveae*, was observed by Altson (Altson, 1950 a) and he has also reported an anthracnose on rubber caused by *Colletotrichum ficus* Koorders (Altson, 1950 b). In India the pathogen *Colletotrichum* was first observed on rubber in Andamans (Mitra and Mehta, 1938) and its occurrence in the mainland was known when the anthracnose (secondary leaf spot) caused by *Glomerella cingulata* was described (Ramakrishnan and Radhakrishna Pillay, 1961). Though several species of *Colletotrichum* and *Gloeosporium* are reported on rubber, they represent conidial stages of *Glomerella cingulata* S. & V. S. (Carpenter and Stevenson, 1954). However, the symptoms caused by *Gloeosporium*