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New Approaches of Pink Disease Management in *Hevea*

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In the field experiments on the control of pink disease of Hevea *caused by* Corticium salmonicolor, *propiconazole, a new systemic fungicide, was effective at a concentration of 1000 ppm and tridemorph at 10,000 ppm when a newly formulated carrier was used. Bordeaux paste also was equally effective. The merits of the new carrier are discussed. Investigations carried out to detect the appropriate time of treatment of pink disease revealed that early detection at cobweb mycelial stage ensures maximum recovery. In a survey, the branches of the five-year old rubber tree above the third fork were found to the most vulnerable loci for infection.*

Effective control of pink disease of *Hevea* depends on several factors like timely detection and treatment, use of suitable fungicides and use of rainfast carrier formulations. Tridemorph (Calixin 80 EC) a systemic fungicide has been in use for the control of this disease (Wastie & Yeoh, 1972; Rao, 1973; Yeoh & Tan, 1974; Thomson & Jacob, 1983). Fungicide carriers like tar (Wijibrans & Tong, 1957), linseed oil (Ramakrishnan & Radhakrishna Pillai, 1962), natural rubber latex concentrate (Wastie & Yeoh, 1972), pre-vulcanised latex (Yeoh & Tan, 1974), Mahathotex wax (Thomson & Radhakrishna Pillai, 1976), and field latex (Thomson *et al.*, 1979) were used for the preparation of brush on formulations. Some of these carriers were found to cause phytotoxicity and were discarded subsequently. The present investigation was carried out for the evaluation of a new systemic fungicide for the control of this disease, development of a new rainfast carrier formulation, identification of the appropriate time of treatment in relation to disease development and to ascertain the most vulnerable loci of infection on the trees.

MATERIALS AND METHODS

Laboratory bioassay of the fungicides propiconazole (Tilt), tridemorph (Calixin) and tetra methyl thiuram disulphide TMTD (Thiride) was carried out by the method described by Thomson and Jacob (1983).

Compounds were prepared by incorporating polyvinyl acetate (Pidivyl 5100), china clay and water in different ratios. The fungicides used were either dispersed or diluted in the water component. The formulations were tested by applying them to young *Hevea* branches and observing for symptoms of phytotoxicity.

Field evaluation of the fungicides and the carrier was carried out by incorporating the fungicide in the carrier at the specific concentration and applying it to affected region of the tree covering 30 cm below and above, by using a brush. Two sets of control trees were also treated with Bordeaux paste and TMTD (Thiride – 2000 ppm) after scraping the bark in the affected region. During the 1985–86 season, all the treatments were applied after scraping

the affected region and the concentration of TMTD (Thiride) was increased to 7500 ppm. The field trials were repeated in three consecutive disease seasons *viz.* 1983–84, 1984–85 and 1985–86. During 1983–84, ammoniated field latex was used as carrier, but subsequently pidivyl china clay compound was used.

To determine the stage of the disease at which treatment is most effective, the trees were graded prior to treatment into the following groups:

- Cobweb mycelial stage
- Mycelial penetration indicated by oozing of latex
- Bark partially rotten

The treated trees were observed two months after treatment and the dried branches, if any, were removed after recording them. Observation was continued upto March/April after which no further drying was noticed. Trees which did not show any further development of the symptoms of the disease subsequent to fungicide application were recorded as recovered.

To detect the region mostly affected, a field with five-year old plants was surveyed by recording the region on which the disease was observed on the trees.

RESULTS AND DISCUSSION

In the laboratory bioassay it was observed that complete protection of the rubber wood pieces for one month was obtained in treatments of tridemorph (Calixin) 20,000 ppm and propiconazole (Tilt) 500 ppm, while growth of the fungus was noticed in treatments with TMTD (Thiride) 2000 ppm and the control (carrier *i.e.*, latex alone).

The formulated carrier compounds with higher quantities of polyvinyl acetate (Pidivyl) showed film formation on applied regions resulting in enlargement of lenticels due to asphyxiation. A ratio of 1:2:4 with polyvinyl acetate (Pidivyl), china clay and water was found to be the most satisfactory, permitting penetration of air for respiration and water to make the fungicide available at the infection court. It was also sticky enough for adherence to applied surface and had no phytotoxic effects on the trees.

The results of the field trial for evaluation of the carrier formulation are presented in *Table 1.*

TABLE 1.
PERCENTAGE RECOVERY OF *HEVEA* TREES TREATED FOR PINK DISEASE CONTROL USING TWO FUNGICIDE CARRIERS

Fungicides	*Carrier*	
	Pidivyl china clay compound	*Field latex*
Tridemorph (Calixin) 20,000 ppm	86	55
TMTD (Thiride) 2000 ppm	86	33
Bordeaux paste (control)	71	78

The pidivyl china clay compound was tested in clone RRII 118 planted during 1979 and field latex in the same clone planted during 1980. The results indicate that pidivyl china clay compound was superior to field latex as a carrier of the fungicides. The comparative merits of use of pidivyl china clay compound and latex as carriers of

fungicide and the conventional Bordeaux paste treatment are tabulated in *Table 2.*

The results of the field experiment for evaluation of the fungicides are presented in *Table 3.*

TABLE 2. COMPARISON OF TWO CARRIERS AND BORDEAUX TREATMENT AGAINST PINK DISEASE OF *HEVEA*

Pidivyl china clay compound	*Ammoniated latex*	*Bordeaux paste*
Long tenacity	Long tenacity	Washed out by continuous rain
Only one application required	Only one application required	Repeated application required in high rainfall areas.
Clearly visible	Not clearly visible	Clearly visible
Porous film	Continuous film	No film formation
Not very sticky and can be easily applied with brush	Sticky and difficult to apply with brush	Can be easily applied with brush

TABLE 3. RECOVERY OF TREATED PARTS OF *HEVEA* FROM PINK DISEASE AFTER APPLICATION OF DIFFERENT FUNGICIDES

Treatments	*1983 – 84**		*1984 – 85***		*1985 – 86***	
	No. of trees		*No. of trees*		*No. of trees*	
	treated	*recovered*	*treated*	*recovered*	*treated*	*recovered*
Propiconazole 250 ppm	20	11	–	–	–	–
Propiconazole 500 ppm	20	12	–	–	–	–
opiconazole 1000 ppm	–	–	21	13	30	29
Propiconazole 2000 ppm	–	–	21	12	–	–
TMTD 2000 ppm	20	5	21	10	–	–
TMTD 7500 ppm	–	–	–	–	30	28
Tridemorph 10,000 ppm	20	14	21	12	30	27
Tridemorph 20,000 ppm	20	13	21	9	–	–
Bordeaux paste	20	15	21	12	30	27

* Ammoniated latex used as carrier

** Pidivyl china clay compound used as carrier.

In 1983–84 trial,' when ammoniated field latex was used as the fungicide carrier, none of the treatments were superior to Bordeaux paste. However, when the carrier was changed to pidivyl china clay compound during 1984–85 and 1985–86, propiconazole (Tilt) 1000 ppm was found to be superior. TMTD (Thiride) also was superior when the dose was increased to 7500 ppm and

tridemorph (Calixin) was equal to Bordeaux paste. Hence, a difference in efficacy could be due to the effect of the carrier used.

The influence of the stage of development of the disease at the time of treatment on the recovery of the trees can be observed from the data presented in *Table 4*.

The data clearly indicate the significance of early detection of the disease in control operations.

The results of the survey on the region of infestation of pink disease in a five year old rubber plantation are presented in *Table 5*.

The infection due to pink disease was found to be dispersed on all the parts of the tree, the maximum being on the branches above the third fork. The first fork registered only 14 per cent infection, thus disproving the common belief that the first fork is the most vulnerable locus of infection.

CONCLUSION

In addition to Bordeaux paste, the conventional fungicide for pink disease control of *Hevea*, the systemic fungicides propiconazole (Tilt) 1000 ppm and tridemorph (Calixin) 10,000 ppm, and non systemic fungicide TMTD (Thiride)

TABLE 4. RECOVERY OF *HEVEA* TREES FROM PINK DISEASE WHEN TREATED AT DIFFERENT STAGES OF DISEASE DEVELOPMENT

Stage	*1983 – 84*		*1984 – 85*	
	No. of trees		*No. of trees*	
	treated	*recovered*	*treated*	*recovered*
Cob web	42	29	78	54
Latex oozing	42	22	–	–
Bark rotten	36	19	48	14

TABLE 5. INCIDENCE OF PINK DISEASE ON DIFFERENT REGIONS OF FIVE-YEAR OLD RUBBER TREES

Region affected	*No. of affected trees*		
	Clone RRII 105	*Clone RRII 203*	*Total*
Trunk	4	5	9
First fork	4	22	26
Second fork	6	27	33
Third fork	4	30	34
Other regions including branches	8	72	80
Total	26	156	182

7500 ppm were found to be effective. Except Bordeaux paste all other fungicides are applied with the new carrier formulation – pidivyl china clay compound. Any of these fungicides to be effective, must be applied after scraping the disease affected bark. Early detection of the diseased trees by careful inspection and fungicide treatment on the diseased part and 30 cm above and below it, ensure maximum recovery.

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