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PURPLE ROOT DISEASE AND ITS CONTROL IN RUBBER PLANTATIONS

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ABSTRACT

Purple root disease of *Hevea brasiliensis* caused by *Helicobasidium compactum* Boedijn has recently been reported from India. Experiments were conducted in a badly infected seedling nursery and on polybag plants to identify effective and economic control measures for the disease. Efficacy of fungicides viz. tridemorph, propiconazole, hexaconazole and thiram was evaluated. The survival of plants in the fungicide-treated nursery beds and recovery in polybags (at initial stage of infection) were significant. The budded stumps at advanced stage of infection survived around 50% when grown in polybags after fungicide treatment. Recovery was better when chemical treatment was done at initial stage. All fungicide treatments were on par in their efficacy. Hexaconazole (0.01%) and thiram (0.75%) were the cheapest fungicides effective in controlling purple root disease.

.. ITRODUCTION

Purple root disease, also known as violet root disease of rubber (*Hevea brasiliensis*) caused by *Helicobasidium compactum* Boedijn has become increasingly important, but its incidence and distribution vary greatly among the rubber producing countries. Though the disease was first reported in 1921 (Snowden, 1921) from Africa, an epidemic form of the disease could be seen only in 1935 (Van der Goot, 1936) in Dutch East Indies. In China, this disease is considered to be one of the three major root diseases afflicting rubber plants (Zhang *et al.*, 1990). The occurrence of purple root disease was first reported in India in a seedling nursery in 1994 (Rajalakshmy and Joseph, 1994). Since then, sporadic incidence of the disease has been reported from traditional and non-aditional rubber growing regions. Compared to brown and Poria root diseases, the damage caused by purple root disease is less significant in India.

The causative fungus can infect many plant species, both wild and cultivated including *Manihot esculenta*, *Pueraria phaseoloides*, *Centrosema pubescens*, *Chromolaena odorata*, coffee, tea, jack etc. (Huang, 1990; Rajalakshmy and Joseph, 1994). Studies conducted in China indicate that poor soil conditions predispose the plants to infection, whereas the rich soil has the ability to curb infection (Zhang and Chee, 1989; Huang, 1990).

Management of violet root disease involves maintaining good soil conditions, intercropping and use of fungicides. Very few studies have been undertaken worldwide on the management of this disease. The present study is the first on disease management being undertaken in India to identify the effective and economic fungicides against purple root disease.

MATERIALS AND METHODS

The studies were carried out in the seedling nursery in the Rajagiri estate, Pathanamthitta Dist, Kerala where from the first serious outbreak of purple root disease had been reported in 1994. Both bud-grafted seedlings and seedlings ready for budding were maintained in the nursery and the rate of infection was more or less same in both. Based on *in vitro* studies, four fungicides were selected for screening their efficacy at field level in containing purple root disease (Table 1). The plants/plots without any fungicide treatment served as control.

Two methods were adopted for evaluating the fungicides. In the first method, the bud-grafted seedlings from the affected nursery were uprooted and made into stumps after pruning the roots. The stumps with lateral root infection and no infection on tap root were grouped as 'initial' and those with partially damaged tap root as 'advanced' stage. These budded stumps having initial and advanced stages of infection were dipped in respective fungicide solutions and planted in polythene bags filled with soil from disease-free areas. The bags were also drenched with the same fungicide solution in which the dipping of stumps was done. The stumps taken from the infected nursery having disease symptoms were planted in polythene bags and no fungicide treatment was done for comparison.

In the second method, the seedlings in the affected nursery were uprooted and nursery beds of 10x 2' size were retained after proper weeding. The nursery beds were then drenched with respective fungicide solutions. Approximately 20L solution was used per bed. Healthy budded stumps were planted in the beds and the plants raised from such stumps were observed for disease development (Experiment 1). The same experiment was repeated in another area of the disease infested nursery (Experiment II) after leaving the nursery beds fallow for one year.

The plants raised in polythene bags and nursery beds were observed at periodic intervals and the disease development was monitored for three years. The recovery of plants in each case was assessed and the percentage recovery of plants was analysed statistically.

RESULTS AND DISCUSSION

The recovery of plants grown in polybags is furnished in Table 2.

The recovery was significant in treated plants at initial stage of disease development compared to untreated ones. More than 70% plant mortality was recorded among untreated plants whereas the maximum mortality was only 29% in treated ones. The rate of recovery from disease was on par in all the fungicides tested.

None of the plants in the advanced stage of disease survived when fungicide treatment was not given. However, 50% plants recovered consequent to fungicide treatment.

The better recovery in the initial stage was due to the healthy tap root these plants had, but in the advanced cases the partially damaged tap root could not get a speedy recovery thereby affecting lateral root development and many plants succumbed to disease. Infection usually originates at the tip of the lateral roots and proceeds towards tap root. The cortex of the affected lateral roots die first and adventitious roots develops from the diseased-healthy interface. The repetitive course of infection leads to death of entire lateral roots and few adventitious roots developed thereafter remain (Figure I). In artificial inoculation studies, root infection is reported to be initiated within 20 days in one-year-old seedlings and drying noticed in 66 days (Zhang and Chee, 1989; Zhang *et al.*, 1990). In this study also, the death of untreated plants occurred within three months of planting in the polythene bags. However, Zhang and Chee (1989) observed low mortality rate in trees even when spread of disease was rapid.

In the nursery bed evaluation, a similar trend of survival as in polybags could be noticed (Table 3).

Table1: Fungicides screened against purple root disease

Chemical name	Trade name	Concentration (% a.i)
Tridemorph	Calixin	0.25
Propiconazole	Tilt	0.10
Hexaconazole	Contaf	0.01
Thiram	Thiride	0.75

Table 2: Recovery of plants in polybags

Treatment	Recovery of plants(%)	
	Initial stage of infection	Advanced stage of infection
Tridemorph	79.0	50.0
Propiconazole	79.0	50.0
Hexaconazole	71.0	33.0
Thiram	71.0	50.0
Control	29.0	0.0
χ^2 test	Significant	NS

Table 3 : Survival of plants in nursery beds

Treatment	Survival of plants (%)	
	Experiment I	Experiment II
Tridemorph	70.0	85.0
Propiconazole	70.0	90.0
Hexaconazole	55.0	80.0
Thiram	68.0	70.0
Control	15.0	30.0
CD (P=0.05)	16.04	28.85

Fig. 1. Purple root disease

The difference in disease control was significant between fungicide-treated and untreated in both the experiments. In the Experiment I, the mortality was 85% in beds without any fungicide treatment. Tridemorph, propiconazole, hexaconazole and thiram were on par in containing the disease. In the Experiment II with same fungicides, the mortality rate was less in all the treatments. The survival in untreated was 30% compared to only 15% in Experiment I.

The better survival of plants in the Experiment II could be attributed to less inoculum level in soil. Leaving beds fallow for one year might have reduced the inoculum as there was no living host. Studies conducted in China indicated that soil from disease-affected plantation could continue to spread the disease for a long time (Huang, 1990)

The efficacy of tridemorph and triazole derivatives in controlling root disease of rubber has already been reported (Huang, 1990; Lam and Chin, 1993; Tran, 1994). Thiram was also found effective in checking brown and Poria root diseases in India (Idicula *et al.*, 2002). Against violet (purple) root disease in mature stand, exposure of collar for 10-15 days and application of organic manure are also recommended (Huang, 1990). Zhang *et al.*, (1990) suggested that nurseries should be located on an area with good drainage facility and fertile soil. If on cultivated land, the soil should be ploughed and exposed to sunlight. Drenching of Calixin or Bavistin is also recommended.

The cost of all the effective fungicides at the dosages tried is presented in Table 4

Hexaconazole (0.01%) is the cheapest fungicide followed by thiram (0.75%) in controlling purple root disease.

Table 4: Cost of fungicides effective against purple root disease

Fungicide	Concentration (%)	Cost* Rs. Ps
Tridemorph	0.25	3.30
Propiconazole	0.10	6.00
Hexaconazole	0.01	1.40
Thiram	0.75	1.80

*Cost per litre of fungicide solution

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