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Purple root disease of *Hevea brasiliensis* seedlings in nursery: a report from Assam and Meghalaya

G. C. Mondal and H. K. Deka*

Regional Research Station, Rubber Research Institute of India, Housefed Complex, Dispur, Guwahati – 781 006, Assam.

Abstract

The outbreak of purple root disease caused by *Helicobasidium compactum* Boedijn was observed on *Hevea brasiliensis* seedlings in nursery for the first time in Meghalaya in 1998 and in Assam during 2002 in North East India. High incidence of purple root disease (54.0%) was observed in seedling nursery at DDC, Jenggitchakgre, Tura in Meghalaya, which led to yellowing of leaves and caused a heavy loss of stands of the affected plants (95.5%). The development of spongy, resupinate, purple coloured typical fruiting body girdling the collar region of *Hevea* was found in nursery seedlings as well as on the collar region of alternate host plant (*Eupatorium odoratum*) growing nearby. A field trial was conducted on one year old seedlings of *Hevea* in nursery during 2000-01 at DDC, Jenggitchakgre (a highly susceptible pocket) for evaluation of fungicides (carbendazim and mancozeb) for the control of purple root disease. The incidence of purple root disease was significantly reduced (17.5%) by drenching with carbendazim (0.1%). The treatment with carbendazim(0.1% ai) was superior to mancozeb (0.75% ai) for the control of purple root disease of *Hevea* seedlings in nursery. The untreated control had 54% infection.

Key words: Hevea brasiliensis, purple root disease, seedling nursery, *Helicobasidium compactum*, disease control, Assam, Meghalaya.

Introduction

Purple root disease of rubber (*Hevea brasiliensis*) seedlings caused by *Helicobasidium compactum* Boedijn was first reported by Snowden (1921) from Africa. The development of the fruiting body of the fungus even on the tapping panel of a rubber tree in Dutch East Indies was reported by Boedijn and Steinmann (1930). An epidemic form of purple root disease was also reported from this region (Van der Goot, 1936). De flutier (1939) reported that the severe incidence of purple root disease on rubber caused a heavy loss of stands during 1935, 1938 and 1939 in Java and Indonesia. The severe outbreak of purple root disease on rubber seedlings in nursery caused a heavy loss of stands in isolated form of patches in Mexico and Uganda (Martin, 1947). In China, violet (purple) root disease is reported to be one of the major root diseases, which infects and destroys rubber plants of all age groups (Zhang and Chee,1989a, b; Zhang *et al.*,1990). The occurrence of purple root disease in *Hevea* seedlings in nursery was reported for the first time from South India by Rajalakshmi and Joseph (1994).

The pathogen is reported to attack *H. brasiliensis* seedli[illegible] and a wide range of host plants like *Centrosema pubescens*, *Peuraria phaseoloides*, *Asparagas* spp., *Coffea arabica*, *Tectona grandis* and *Thea sinensis* in South India (Rajalakshmi and Joseph,1994), it was not so far recorded in North East India. Reid (1975) also reported that the pathogen *H. compactum* has a wide range of host plants like *Albizzia falcata*, *Synedrella nodiflora*, *Vigna oligosperma* and *Pinus longifolia*. The present paper is the first report on the outbreak of purple root disease of rubber in Assam and Meghalaya in North East India.

Materials and Methods

Incidence and severity of the disease

Survey on the incidence and severity of purple root disease of rubber was carried out in Assam, Meghalaya, Tripura, Arunachal Pradesh and northern part of West Bengal. Incidence and severity of the disease were

* *Regional Research Station, Tura, Meghalaya.*

assessed in two locations, District Development Centre (DDC), Jenggitchakgre, Tura under West Garo Hills in Meghalaya and Avayapuri under Kokrajhar district in Assam. Assessment was carried out on one year old *H. bresiliensis* seedlings in nursery during April/May between 1998 and 2000. Disease incidence was estimated from one year-old seedling plants of experimental plots (3.0 x 1.2 m with 40 seedlings) replicated five times in a randomised block design. To estimate disease incidence, the total number of seedling plants and total number of diseased seedlings per experimental plots were recorded, irrespective of the grade of the disease (Samaradeewa *et al.*,1985). The disease incidence was recorded and expressed as percentage. The severity of the disease was assessed as percentage mortality of the affected plants per plot. Survey on the development of spongy purple coloured fruiting body of *H. compactum* on other host plants was also carried out in adjoining areas of rubber nursery in North East India.

Symptoms, aetiology and effects of root disease

Characteristic symptoms of the disease observed during survey, morphological characters of the causative organism of the disease and the effects of purple root disease on rubber seedlings were recorded.

Pathogenicity test

The parasitic nature of the pathogen was confirmed by artificial inoculation on one year old rubber seedlings in nursery (Rajalakshmi and Joseph, 1994). The inoculum consisted of 46 day old cultures of the causal organism grown on sterilised rubber wood blocks in flasks. The inoculum was kept adpressed to the roots without wounding. Uninoculated sterilised rubber wood pieces kept adpressed to the roots of rubber seedlings were also maintained as control. The test was repeated successfully four times following the principle of Koch's postulates.

Control of the disease

A field trial on *H. brasiliensis* seedlings in nursery was conducted during 2001-02 at DDC, Jenggitchakgre, (where the mortality of *Hevea* seedlings due to purple root disease was above 45% during 1998-2000) to evaluate the efficacy of fungicides for the control of purple root disease. Two fungicides *viz.*, carbendazim (Bavistin 0.05 and 0.1% a.i.) and mancozeb (Indofil M-45 0.37 and 0.75% a.i.) were used for treatments in different experimental plots. The fungicides were drenched for 3 rounds at an interval of 15 days during the preparation of experimental plot (3 x 1.2m with 40 seedlings) laid out in RBD with five replications. Germinated seeds were planted in treated plots during September, 2001. A control set was also maintained for comparison of the treatments. The incidence and severity of the disease in different experimental plots were recorded.

Results and Discussion

Symptoms, incidence and severity of the disease

No visible symptoms could be found from the above ground parts of seedlings at the early stages of infection. Shrivelled appearance with sparse crown and profuse growth of adventitious roots from the collar zone of seedlings were found in advanced stages of infection. The presence of 10 to 15 cm long, resupinate, 6 to 10 mm thick purple coloured distinct fruiting body girdling the collar region of the infected seedlings was observed as a typical symptoms of the disease(Fig.1c and c′). Finally, the infection led to yellowing of leaves and

Fig. 1. a: Healthy seedling plant of rubber; **a′**: Purple root disease affected seedling showing damaged tap root and surviving with adventitious roots; **b:** Healthy tap root; **b′**: Affected tap root damaged further by termite; **c:** Healthy collar zone; **c′**: Typical fruiting body of *Helicobasidium compactum* girdling the collar zone of the affected plant.

caused mortality of the affected plants (Fig.1d).

During survey, the incidence of purple root disease on *Hevea* seedlings in nursery was noticed in Assam and Meghalaya. The incidence of the disease was noticed for the first time in Meghalaya during November, 1998 and the mortality of the affected plants was above 45%. The incidence of purple root disease (below 10%) on *H. brasiliensis* seddlings in nursery was noticed during April, 2002. at a private nursery in Avayapuri under Kokrajhar district of Assam. In the survey, Tripura,

Fig.1.d: Purple root disease affected seedling plants showing dryness in patch form in nursery : e: Uprooted healthy seedling; e' : Dried seedling plants showing rotten tap root and adventitious roots due to attack by the pathogen causing purple root disease.

Arunachal Pradesh and northern part of West Bengal were found to be free from the incidence of purple root disease. The percentage of mortality during the period between 1998 and 2000 was between 80 to 85% at DDC. Jenggitchakgre in Meghalaya, whereas in Assam the mortality was between 35 to 40%. The development of typical fruiting body of *H. compactum* was also observed on *Eupatorium odoratum*, which grew abundantly near the nurseries. The presence of alternate host plants might favour the survival of the inoculum of the pathogen throughout the year and cause rapid spread of the pathogen to rubber plants.

Effect of purple root disease

The pathogen *Helicobasidium compactum* attacked the cortex of lateral roots. The infection originated on the tip of lateral roots from where it proceeded towards the tap root. The bark at the distal end of the roots was completely rotten for a considerable length and sloughed off easily exposing the wood. The bark surface of the infected roots was covered by purplish brown rhizomorphs and purple strands of the pathogen forming a network. Infected roots were covered by a purple coating. The rhizomorphic strands could be easily peeled off from the bark surface. The infected tap root and lateral roots were found to dry up (Fig.1e & e^{l}).

When the lateral roots were damaged, adventitious roots emerged from the healthy portions behind the infected tissue. Total destruction of the tap root led to profuse development of the adventitious roots from the healthy collar region. Under favourable conditions these adventitious roots were also attacked by the pathogen. In advanced stages of infection the infected wood showed discolouration and a dry rot. The dried wood was prone to attack by termites and colonisation by saprophytic fungi that eventually led to leaving a hollow outer bark (Fig.1b & b^{l}). Depending on the severity of attack, the plants either died or remained green and survived with the help of adventitious roots (Fig.1a & a^{l}).

Pathogenicity test

Typical disease symptoms developed in one year-old rubber seedlings after 70 days of inoculation. Purple coloured fungal threads were also noticed on the surface of the tap root and lateral roots. From the infected roots

Table 1. Effect of fungicides on the control of purple root disease of *Hevea brasiliensis* seedlings in nursery

Treatment	Total plants/plot	Incidence of purple root disease (Mean of 5 replications)				Reduction of disease over control(%)
		Affected plants/plot	Dried plants/plot	DI (%)	Severity (%)	
T_1 (Untreated control)	40	21.6	20.6	54.0	95.5	-
T_2 (Carbendazim 0.1%)	40	7.0	2.4	17.5	34.0	67.5
T_3 (Mancozeb 0.75%)	40	15.6	11.6	39.0	75.3	27.8
T_4 (Carbendazim 0.1% alternate with mancozeb 0.75%)	40	10.0	3.4	25.0	34.6	53.7
T_5 (Carbendazim 0.05% alternate with mancozeb 0.37%)	40	16.6	12.8	41.5	78.1	23.1
CD ($P \leq 0.05$)				5.88	11.01	

the pathogen was reisolated and it showed all characteristics of the fungus *H. compactum* Boedijn.

Control of the disease

Incidence and severity of purple root disease was found to be high in untreated control plots (T_1) and plots with treatments T_3 and T_6 (Table 1). On the other hand, a significant reduction of purple root disease over control was observed in plots treated with carbendazim (T_2 and T_4) which also proved to be more efficient than other treatments. In China, drenching the plant bases with tridemorph and carbendazim is recommended (Zhang *et al*., 1990).

In conclusion, it can be stated that the application of carbendazim (0.1%) was found to be superior to mancozeb (0.75%) for the control of purple root disease of *Hevea* seedlings in nursery. The presence of the pathogen on other host plants like *E. odoratum* in rubber growing areas of Assam and Meghalaya in North East India is a potential source of inoculum for widespread incidence of the disease. Field sanitation by eradicating alternate host plants in rubber growing areas may reduce the spread of the inoculum.

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