PINK DISEASE OF *HEVEA BRASILIENSIS* IN NORTHERN WEST BENGAL AND NORTH EAST INDIA

G.C. Mondal, H.K. Deka, Shammi Raj* and Sabu P. Idicula**

Rubber Research Institute of India, Regional Research Station,
Housefed Complex, Dispur, Guwahati - 781006, Assam, India
*Regional Research Station, Rubber Research Institute of India, Agartala -799 006, Tripura, India
**Rubber Research Institute of India, Kottayam - 686 009, Kerala, India

Received: 02 September 2013 Accepted: 10 February 2014

Mondal, G.C., Deka, H.K., Raj, S. and Idicula, S.P. (2014). Pink disease of *Hevea brasiliensis* in northern West Bengal and North East India. *Rubber Science*, **27**(1): 91-97.

A survey was carried out in 180 locations covering in northern West Bengal and North East India, from August to November, during 1990-2011,on pink disease of rubber (*Hevea brasiliensis*) caused by *Corticium salmonicolor* (Berk. & Br.). The incidence of pink disease on rubber was higher in northern West Bengal than Meghalaya and Assam. Maximum incidence of pink disease was observed on four to six-year-old rubber plants at Rango (7.5%) followed by Jiti rubber estate (3.0%) in northern West Bengal. The disease was noticed on the main trunk of five-year-old rubber plants at Rango and Jiti rubber estates during September, 2001 for the first time in northern West Bengal and caused a total loss of the affected trees. Weather factors like monthly rainfall (mm), number of rainy days, maximum temperature (°C) and relative humidity (%) from July to September during 1996-2011 are also reported. The monthly rainfall above 500 mm and more than 17 continues rainy days were the major predisposing factors influencing the development of pink disease.

Keywords: Climatic factors, North West Bengal, North East India, Pink disease

Pink disease of rubber (*Hevea brasiliensis* Muell. Arg.) caused by *Corticium salmonicolor* (Berk. & Br.) is prevalent in South India during south west monsoon period. Though the incidence of pink disease is noticed on rubber plants of all age groups, the adverse effects due to infection were found to be more damaging for two to twelve-year-old plants (Ramakrishnan and Pillai, 1962). The pink disease occurs in almost all rubber growing locations in Kerala and causes considerable loss of canopy that ultimately retards the growth resulting in extension of immaturity period (Ramakrishnan and Pillai, 1962). The incidence of pink disease in north east region of India was first reported by Mondal *et al*. (1994) from Assam and Tripura and from Meghalaya by Deka *et al*. (1998). As the detailed scientific report on the occurrence of pink disease on different parts of rubber trees of various clones in northern West Bengal and North East India and its management is not available, this study was carried out in

Correspondence: G.C. Mondal (Email: gopalchandra@rubberboard.org.in)

different rubber growing locations of non-traditional regions.

A field survey was conducted during 1990-2011 on rubber plants of various age groups from August to November in northern West Bengal and North East India to identify the affected pockets of pink disease of *H. brasiliensis*. Since the area of survey comes under non-traditional tracts of rubber plantation, the characteristic symptoms of the pink disease and the site of infection in different clones *viz*. RRIM 600, RRII 105 and GT 1 were studied. The collateral hosts of the pathogen causing pink disease were also surveyed by recording the symptoms of the disease on those plants. Weather parameters *viz*. monthly rainfall (mm), number of rainy days, monthly mean of maximum temperature (^{o}C) and relative humidity (%) were recorded during July to September from 1996 to 2011 in Regional Experiment Station (RES), Nagrakata in northern West Bengal, at Sarutari Research Farm in Assam and at Ganolegre Research Farm in Meghalaya. Bordeaux paste 10 per cent (the conventional fungicide for control of pink disease of *Hevea*) was applied on the affected portion up to 30 cm above and below the affected region of rubber plants using a long-handled brush at the initial stages of infection and then scrapped to remove superficial growth of silky white mycelia from the infected bark surface which was followed immediately by a second application of Bordeaux paste (Ramakrishnan and Pillai, 1962). An attempt was also made to control pink disease by application of tridemorph 0.5 per cent (6.25 ml Calixin L^{-1} water) over the affected portion at the initial stages of infection on both immature/mature rubber trees at Rango in northern part of West Bengal and also in Assam and Meghalaya. The method of tridemorph application was the same as that of Bordeaux paste. After drying of second application of tridemorph, rubber kote was applied over the affected portion for quick healing.

At the initial stages of infection, superficial growth of cob-web like film of silky white mycelia was noticed on the brown bark surface of main trunk of four to six-year-old rubber plants, on first forking region of seven to nine-year-old plants and on branches above the first forking region of more than nine-year-old rubber plants. At the advanced stage of infection, the mycelial growth extending to a distance of 60 cm or more, both up and down from the point of infection, completely encircled the affected portion of the stem. The white silky thread on the infected bark surface was easily visible from the ground on sunny days when the infected bark surface was not wet (Fig. 1). Gradually, the hyphae of the pathogen penetrated the bark and ramified inside the cortical tissue. With the advancement of infection and extensive damage of the bark/internal tissue, the exudation of latex from the infected region of the main trunk/first fork/branches above the first fork was noticed (Fig. 2). Later, mycelia turned pink in colour and the affected branches started drying up; dead branches with dried leaves along with black streaks of coagulated latex and growth of many side shoots from the dormant buds just below the dried points was noticed (Fig. 3). Due to extensive damage to the bark and internal tissue, the upward and downward translocation of water and food materials in the plant system might have been blocked which ultimately resulted in initial yellowish discoloration of foliage catering to drying up of the distal portion of the affected region (Ramakrishnan and Pillai, 1962). Pink masses of mycelium started to develop 'pustular' and 'crust' stage during October when the outer affected bark dried up. The pustules were salmon pink in colour and

Fig. 1. Infection of pink disease on the main trunk showing cob-web like white silky mycelia.

Fig. 3. Pink diseases affected plant showing many side shoots just below

Fig. 2. First fork and branches affected with pink disease showing exudation of latex.

erupted in line through the cracks of the affected bark.

A total of 180 locations covered in northern part of West Bengal (9 nos.), Assam (71 nos.), Meghalaya (22 nos.), Tripura (67 nos.), Arunachal Pradesh (9 nos.) and Mizoram (2 nos.) were surveyed during 1990-2011 for pink disease of rubber. The incidence of pink disease was noticed in three locations in northern West Bengal, three locations in Meghalaya and two locations in Assam during the survey. Pink disease was noticed in September 2001 for the first time in northern West Bengal while Meghalaya and Assam registered first in September 1996 and October 2011, respectively. The incidence of pink disease was higher in northern West Bengal than Assam and Meghalaya. The data on the occurrence of pink disease on various parts

of rubber plants in different clones and locations are shown in Table 1. Higher incidence of pink disease was observed in the rubber plantation at Rango (7.5 per cent and 1.8 per cent in RRII 105 plants of age 4-6 years and 7-9 years, respectively and 5.7 per cent in RRIM 600 plants of above nine-year-old plants) followed by Jiti rubber estate and RES, Nagrakata (1.8%) under Jalpaiguri district in northern West Bengal. The severity of pink disease varies from one locality to another according to the rainfall pattern (Tan and Yeoh, 1976). Based on the age of rubber tree, the infection of pink disease was found to be dispersed on the main trunk, forking region and branches above the forking region of the affected tree. At the age of four/five years, the maximum infection of pink disease was observed on the main trunk of the affected tree at Rango (7.5%) followed by Jiti Rubber estate (3%) during September 2001 in northern West Bengal and caused a total loss of stand as the infection was left untreated. The maximum damage due to infection of pink disease was observed on the main trunk of five-year-old rubber plant at Rangsal (1.8%) under East Garo Hill district in Meghalaya causing a loss in plant stand. The total damage due to infection of pink disease on the main trunk of rubber plant at Sahipara under Kamrup district in Assam was also observed. The damage on the first forking region and above first fork at DDC, Jenggitchakgre (1% and 0.8% respectively) under West Garo Hill district and on main trunk and first forking region at Mahadev (0.5% and 0.85 respectively) under South Garo Hill district in Meghalaya was observed. Whereas in mature plants above nine years, infection of pink disease caused drying up of one or two branches that resulted in considerable loss of canopy. However, complete loss of plant stand was

Table 1. **Pink disease of rubber in different clones at various age groups**

State	Location	Clones	Infection site of pink disease on rubber trees (Nos.)			Total number of affected trees	Disease incidence (%)
			Trunk (A)	First fork (B)	Branches above the first fork (C)		
West Bengal	Jiti	RRII 105	12	6	0	28	7
		RRIM 600	0	0	10		
	Rango	RRII 105	30	7	0	60	15
		RRIM 600	0	0	23		
	RES, Nagrakatta	RRII 105	0	7	0	7	1.8
Assam	RRTC, Hahara	RRII 429	2	2	1	5	1.3
	Sahipara	RRII 105	2	0	0	2	0.5
Meghalaya	DDC, Jenggitchakgre	RRII 105	0	4	0	7	1.8
		RRIM 600	0	0	3		
	Mahadev	RRII 105	2	3	0	5	1.3
	Rongsal	RRII 105	7	0	0	7	1.8

A: 4 to 6 years; B: 7 to 9 years; C: Above 9-year-old rubber plants.

not observed. In Malaysia, pink disease is known to delay maturity of rubber plants for up to two years (Tan and John, 1985). The whole branch might be destroyed when the infection of pink disease would be on the first fork of a six-year-old young rubber tree (Hilton, 1958).

High incidence of pink disease was observed on RRII 105 at the main trunk and first fork region of four to nine-year-old rubber plants (Table 1) indicating thereby that the clone RRII 105 was highly susceptible to pink disease. The damage due to infection of pink disease on the main trunk, first fork and branches above the first forking region was observed on RRII 429 (0.5%, 0.5% and 0.3% respectively) at Rubber Research and Training Centre (RRTC), Hahara in Assam. In RRIM 600 infection was seen only on the branches above the first fork in the three locations surveyed, *i.e*. Rango and Jiti in West Bengal and DDC in Meghalaya.

The data on rainfall (mm), number of rainy days, maximum temperature (°C) and relative humidity (%) observed during July to September from 1996 to 2011 are shown in Table 2. In Meghalaya and northern part of West Bengal, the monthly mean of maximum temperature over 16 years observed during July to September was at the range from 30.5 °C to 30.8 °C and 31.6 °C to 32.1 °C, respectively while high in Assam (32.7 °C to 33.1 °C) indicating thereby that the presence of high temperature above 32 °C during July to September in Assam was less conducive for the development of pink disease. Monthly rainfall (529.7 mm to 1015.7 mm) and number of rainy days (17.4 to 24.3) over 16 years were very high in northern West Bengal whereas in Meghalaya and Assam the rainfall and number of rainy days during July to September was less. High rainfall with number of rainy days above 17 might be the conducive weather factors for high incidence of pink disease in northern part of West Bengal. Low incidence of pink disease in Meghalaya and Assam might be due to less rainfall and number of rainy days during July to September compared to northern part of West Bengal. The incidence of pink disease on *H. brasiliensis* was observed only in the locations where the rubber plantation was just near to the river bank or spring creating a congenial atmosphere for the spreading of

Table 2. **Climatological parameters of Assam, Meghalaya and northern West Bengal (1996-2011)**

State	Month	Weather parameters (Mean over 16 years)			
		T max (°C)	RH m(%)	Total rainfall (mm)	No. of rainy days
Assam	July	32.8	92.2	303.5	15.7
	August	33.1	91.9	243.7	15.1
	September	32.7	92.1	169.2	9.7
Meghalaya	July	30.7	91.9	504.5	14.8
	August	30.8	91.5	359.6	13.0
	September	30.5	91.2	282.8	11.1
West Bengal (North)	July	31.6	93.5	1015.7	24.3
	August	32.1	94.0	704.4	21.5
	September	31.9	93.7	529.7	17.4

infection. The critical factors like high rainfall above 500 mm and number of rainy days above 17 with relative humidity above 93 per cent observed in northern part of West Bengal during July to September might be the reasons for high incidence of pink disease on rubber. In Malaysia, high relative humidity above 90 per cent is normally prevailing in wet months under rubber canopy and therefore, high RH is not a critical factor for governing the incidence of pink disease on rubber as compared to rainfall and number of rainy days (Shamsuri *et al*., 1997).

During the survey in North East India and northern West Bengal, the characteristic symptom of pink disease was also observed on a wide range of host plants like mango, jack-fruit, orange, tea, coffee and eucalyptus which were also reported as collateral hosts of the pathogen of pink disease (Hilton, 1958; Ramakrishnan and Pillai, 1962).

After treatment with Bordeaux paste at the initial stages of infection on immature rubber trees, observation on the incidence of pink disease was carried out during the next disease season. The incidence of disease was completely controlled by Bordeaux paste. Tapping trees were not treated with copper fungicides to avoid the risk of contamination of latex with copper (Wastie and Yeoh, 1972). Treatment with tridemorph (0.5%) at the initial stages of infection on immature/mature rubber trees also completely controlled the incidence of pink disease during the next disease season indicating thereby that the application of tridemorph on immature/mature rubber trees was found to be effective. Tridemorph (Calixin) 1 per cent and propiconazole (Tilt) 0.1 per cent were also found to be effective in controlling pink disease (Jacob and Edathil, 1986).

The incidence of pink disease on *H. brasiliensis* was very high in northern West Bengal as compared to Meghalaya and Assam. Maximum infection of pink disease observed on the main trunk of five-year-old rubber plants which caused a total loss of the affected stands. The monthly total rainfall above 500 mm and number of rainy days above 17 during July to September are the major predisposing factors influencing the incidence of pink disease. The pink disease was completely controlled by treating the immature rubber trees with Bordeaux paste (10%) or immature/mature trees with tridemorph (0.5 %) at the initial stages of infection.

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