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Chapter 16

Stem diseases

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1. INTRODUCTION

The stem, including the tapping panel region, of the rubber tree is susceptible to various diseases. Of these, pink disease, black stripe (bark rot), patch canker, dry rot, mouldy rot, bark necrosis, *etc.* have attained varying importance in NR producing countries.

2. PINK DISEASE

Pink disease, the most serious stem disease of rubber, is predominantly a disease of young rubber trees and has become increasingly important for two to seven-year-old plants. During this stage, extensive destruction of main branches is noticed resulting in loss of canopy leading to extension of the immaturity period of the plant.

The earliest record of pink disease was on coffee by Thwaites from Sri Lanka in 1870 and later in Malaysia (Ridley, 1897; Hilton, 1958). In rubber, it was first recorded from Java in 1901 and from India in 1908 (Zimmermann, 1901; Van Hall, 1921; Wright, 1925). Depending on the weather conditions and planting materials, the intensity of the disease varies within the rubber growing areas in India. In Kanyakumari district, the incidence is sporadic and the intensity is mild whereas many areas in Kottayam, Pathanamthitta and Idukki districts in Kerala are highly prone to this disease. Other plants of economic importance like tea, cocoa, mango, jack, cashew, citrus, camphor, cinchona, eucalyptus, *etc.* are also found to be affected by this disease.

2.1 Disease development and symptoms

The disease is noticed during the southwest monsoon period in the traditional rubber growing areas in South India. But many of the non-traditional areas are free from this disease probably due to the difference in weather conditions. The weak southwest monsoon and absence of prolonged wet conditions are attributed as reasons for the mild disease incidence in Kanyakumari district (Ramakrishnan and Pillay, 1962). In Malaysia, the disease does not occur in coastal areas (Hilton, 1958).

The infection starts during June and may continue up to October/November, depending on the rainfall pattern. Continuous rain, high relative humidity and low temperature which prevail during southwest monsoon period are very conducive for the development of the disease. During this period, when the brown stem of the susceptible plant remains wet for longer period, infection commences with the arrival of primary inoculum in the form of spores of the pathogen or thin flakes of infected and dried bark blown by wind. The disease occurs anywhere on the brown bark from collar to the branches at the distal end. In young plants up to the age of three years, infection is often noticed on the main stem. As the plant grows, the main loci of infection are on fork or branches (Jacob and Edathil, 1986). The disease may also be seen even at the base of young plants and on the tapping panel of mature trees.

The superficial growth of the mycelia over the bark marks the initial attack of the pathogen. It appears as cob-web which is white or light pink, glistening on a sunny day when the bark is dry. It is difficult to detect fresh growth when the bark is wet. This stage is termed as 'cob-web stage' (Plate 47. a). The mycelial growth extends up and down from the point of infection, sometimes covering few metres in length all around the bark. The pathogen penetrates into the bark and grows inside the tissues. Under favourable conditions the pathogen ramifies inside the bark and wood causing extensive damage to the internal tissues. Consequent to the damage to the latex vessels, exudation of latex occurs (Plate 47. b) which dries up to form black streaks on the affected region of the stem. Depressions are noticed on the affected bark which later dries up and gets adpressed to the wood. The enlargement of lenticels could be seen at the affected region.

Cracks are formed in the dried up bark and the adpressed bark later falls off exposing the wood. Meanwhile the translocation of water and mineral assimilates is interrupted due to the damage caused to the internal tissues. This results in discolouration of the foliage which turns yellow and finally dry up (Plate 47. c). The dried up leaves remain attached to the dead branch which is a typical symptom of the disease. New sprouts are formed just below the infected regions (Plate 47. d).

As infection progresses, small cushion-like structures called 'pustules', which are light pink in colour are seen erupting in parallel lines all over the affected bark through the cracks in the bark and through lenticels. This stage is called 'pustular stage'. These sterile pustules, many a times, appear immediately after the bleeding stage which signify the death of bark. Orange-red pustules are then formed on the upper or lighted surface of the affected bark which is termed as 'necator stage'. These pustules consist of irregular polygonal pseudoparenchymatous cells which produce necator spores. These necator spores are hyaline and unicellular and aid in rapid spread of the disease.

The pink encrustation, which gives the disease its name, is an advanced stage of the disease and may take a few weeks to develop. The crust is interspersed with irregular cracks and is typically confined to the lower or shaded side of the infected branch. The pathogen produces basidiospores in these crusts which also play an important role in the spread of the disease. This basidial stage is also known as 'corticium stage' of the disease.

Under unfavourable weather conditions infection remains quiescent with little mycelial activity for several months. Mycelia start growing when congenial conditions recur.

2.2 Causal organism

The disease is caused by *Corticium salmonicolor* Berk. & Br. The fungus can easily be cultured in media. Production of necator-like spores in culture has been reported (Rajalakshmy and Pillay, 1975). Under field conditions, the fungus produces two types of wind-borne spores *viz.* necator and basidiospores, either of which can spread the disease.

2.3 Economic importance

The loss due to this disease is primarily dependent on the age of the plant and loci of infection. During the immature stage of plant growth, if the disease occurs on the main stem or on the forking region, the canopy dries up and the plant gets reduced to a mere stump when the canopy is chopped off. In such cases, a healthy sprout formed below is allowed to grow which remains stunted due to competition from neighbouring healthy plants. These sprouts seldom get adequate light due to the shade from heavy canopy of neighbouring plants and are frequently attacked by secondary pathogens. Hence, incidence of the disease in young plants may result in considerable loss of stand or the immaturity period of the surviving plants is prolonged due to poor girthing. In mature plants, the disease may result in drying up of few branches which may affect the yield but not necessarily result in complete loss of the plant. In Malaysia, pink disease is known to delay maturity for up to two years (Tan and John, 1985).

2.4 Clonal susceptibility

Among the modern and widely-planted clones, PB 217, PB 311 and RRII 105 are highly susceptible to the disease in the traditional rubber growing areas. High incidence

of the disease was noticed in clones like Tjir 1, BD 10, LCB 1320, RRIM 501, RRIM 701, RRIM 707, PB 28/59, *etc.* But clones like PB 86, RRIM 513, Gl 1, PR 107, GT 1 and PB 260 are less susceptible (Ramakrishnan and Pillay, 1962; RRIM, 1992).

2.5 Control measures

Pruning of the dried branches is recommended in India. Spraying of an effective fungicide, before cutting, would reduce the spread of fungal propagules. The cut ends may be painted with an effective fungicide (Plate 48. a). However, in Malaysia, the drying branches are left in place till the advent of dry weather and pruned later as a part of general plantation upkeep (RRIM, 1974).

The main aim in treating the affected trees with chemicals is to arrest the course of infection and to prevent the fungus from sporulation. The use of Bordeaux mixture against pink disease was being practised since the beginning of the century (Anstead, 1914). Spraying of one per cent Bordeaux mixture on the main stem also, along with the spraying against abnormal leaf fall, is recommended to reduce the disease severity (Ramakrishnan and Pillay, 1962). Two rounds of spraying with Bordeaux mixture reduced disease incidence by 35 per cent in a third year plantation (Jacob and Idicula, 1997). Tapping trees are not treated with copper fungicides to avoid the risk of contamination of latex with copper (Wastie and Yeoh, 1972). Prophylactic application of Bordeaux paste on two and three-year-old plants, of highly susceptible clones and planted in high disease prone areas, is recommended (Thankamma *et al.*, 1994). The paste may be applied from ground using a long-handled brush before the onset of monsoon on the forking region and c the main stem where brown bark merges with green. In Malaysia, prophylactic treatme.. is not recommended, considering this operation as uneconomic, though it may temporarily reduce the number of new outbreaks (RRIM, 1974).

In India, Bordeaux paste is widely used for the control of this disease as a curative method. For best results, this may be applied 30 cm above and below the affected areas and after drying, the applied surface is scraped. The paste is applied again as done earlier (Plate 48. b). This reduces the chances of spread by fungal propagules from an affected plant to neighbouring healthy plants. Thiram 0.75 per cent (TMTD-Thiride) was found effective in containing the disease when incorporated in a petroleum wound dressing compound (Edathil and Pillay, 1976). Petroleum compounds like Rubberkote, Sopkot, Treseal, *etc.* can be used for this purpose. If needed, the petroleum compound may be heated for melting and, after cooling, the fungicide is incorporated at the molten stage by thorough stirring. If the colour of the petroleum compound is black, it is advisable to whitewash the tree surface to avoid sunscorch. Tridemorph (Calixin) one per cent and propiconazole (Tilt) 0.1 per cent were found effective against pink disease. A polyvinyl acetate (Pidivyl) – china clay compound prepared at a proportion of 1:2:4 with water is recommended as a carrier for these fungicides (Jacob and Edathil, 1986). Tridemorph (Calixin) two per cent incorporated in one per cent ammoniated latex is also effective in controlling the disease (Edathil and Jacob, 1983).

Detection of affected trees in the early stages of infection ensures maximum protection. Weekly inspection of plants for the disease may have to be carried out from June to the end of the disease season. In the early stages of infection, when superficial

mycelium only is present, the fungicide may be applied 30 cm above and below the affected areas. If the infection is advanced, the bark surface may be scraped to remove the decayed tissues and then the fungicide applied as mentioned.

3. BLACK STRIPE

Black stripe disease, also termed as black thread or bark rot, is a tapping panel disease prevalent in rubber plantations in India during the southwest monsoon period. The disease was first reported as early as 1909 from Sri Lanka and later on from other countries (Petch, 1921b; Sanderson, 1925).

3.1 Disease development and symptoms

The inoculum for the spread of the disease is abundant in rubber plantations in South India during southwest monsoon period because of the widespread occurrence of abnormal leaf fall disease, which is also caused by the same fungus. The most important requisite for the disease development is a wound, only through which the fungus can enter into the bark. The intact bark is reported to be immune to infection of *Phytophthora* (Peries, 1975). The continuance of tapping during rainy season and the resulting wounds are the main predisposing factors for the disease. In India, the incidence of this disease was less in earlier times as tapping was discontinued during monsoon period. But when rainguarding became popular, regular tapping in rainy season has become a practice and has resulted in high incidence of black stripe disease (Ramakrishnan and Pillay, 1963a). In Malaysia and Sri Lanka, the incidence of this disease is reported to be more. The weather conditions favouring the disease are the same as that of abnormal leaf fall disease. The spread of bark rot is closely associated with the production of fruits. The spores from the fruits are carried in the water droplets and are also washed down along the tree trunk. These spores germinate readily in the wet panel and cause infection. The artificial inoculation trials have shown that infection takes place readily in susceptible clones when inoculum was applied to an injury regardless of external weather conditions (Peries, 1975). In Sri Lanka, trees bearing infected fruits and panels having surface moisture are not recommended for tapping and this has resulted in the reduction of disease by about 90 per cent (Peries and Liyanage, 1985). The depth of tapping influences the spread of the disease with the maximum when cambium is injured (Liyanage *et al.*, 1984). An injured bark is susceptible to infection for five to six days, but the percentage of infection decreases rapidly after 24 h. Callus tissue starts to form soon after the injury and a distinct callus layer, formed within five to six days, protects the bark from further fungal invasion (Peries, 1975).

Early symptom is the appearance of shallow or sunken and slightly discoloured areas just above the tapping cut. At times, the early symptoms may not be so striking. These lesions sometimes coalesce due to rotting of bark. Vertical fissures may also be seen above the cut on the renewed bark, in slightly more advanced cases. The infected bark later dries up and gets adpressed to the wood. On paring away the lesions on the renewed bark, narrow, vertical black lines extending upwards into the renewed bark and downwards into the untapped bark, are noticed (Plate 48. c). In severe cases, the disease may vertically extend to wood as far as 15 cm below the tapping cut and 2 to 5 cm upwards on to the regenerating bark. Pads of latex are sometimes formed beneath the bark causing

extensive bark splitting and bleeding (Lim, 1979). A more severe form of the disease appears in Sri Lanka where the infection in advanced cases extends upwards to the first branches to a height of 2 m or more and down to ground level (Peries, 1975). The fungus seldom penetrates deep, but discolouration on wood due to infection is visible in many cases.

The infected bark may later fall off exposing the discoloured wood. The ultimate effect of the disease is uneven regeneration of the bark resulting in bur formation which makes subsequent tapping difficult. Badly infected trees may become prone to borer attack and wind snap (Zhang *et al.*, 1994).

3.2 Causal organism

Several species of *Phytophthora* are found to be associated with black stripe disease. The same species that cause abnormal leaf fall disease can gain entry into the bark through wounds and result in black stripe disease. *P. meadii* and *P. palmivora* are the predominent species found in India.

The fungus produces sporangia and oospores in the affected tissues. In artificial inoculation trials, although a highly concentrated spore suspension caused more damages to the bark, lower concentrations of even 10 zoospores per ml was sufficient to initiate the infection (Liyanage *et al.*, 1984). The fungus gains entry into the bark tissue in about 6 h and establishes an infection within 48 h (Peries, 1975).

3.3 Economic importance

As the fungus invades the cambium and prevents the regeneration of the healthy bark, tissues in the tapping panel region are lost. As a result, the yield is considerably reduced. It was reported in Malaysia that 6 cm band of renewing bark is lost due to this disease in a season. This loss of bark is estimated to be equivalent to three months tapping or to the yield of about 310 kg per ha per year (Tan and John, 1985).

The disease intensity in plantations which follow daily or alternate daily tapping is more as compared to tapping on every third day. The virgin panel is more easily attacked than the renewed panel. In disease prone areas, the change over of tapping panel in wet months may be avoided. It has been observed that new panels are more invaded by the fungus, perhaps because on a new cut more cambium is exposed (Lim, 1979). The spread of the disease is reported to be much greater above the tapping cut than below it.

The spread of disease is found more, in Sri Lanka, when tapped with 'Jebong' than 'Michie-Golledge' knife, presumably due to greater damages to bark tissues caused by less controlled tapping. No relationship is noticed between the spread of the disease and the direction in which the tapper moved, revealing that the fungus is not carried by the knife and its disinfection between tappings is not essential as recommended elsewhere (Liyanage *et al.*, 1984). The intensity of black stripe is almost same where skirt-type rainguard and tapping shades are used (George, 1983).

3.4 Clonal susceptibility

No distinct tolerance/resistance is noticed in any of the popular clones. Under field conditions, the clone PB 217 is moderately affected though this clone is reported to be tolerant to *Phytophthora* leaf fall. The disease incidence is severe in clones like RRIM 600, PB 235, PB 311 and PB 28/59.

3.5 Control measures

Panel washing with organomercurial fungicides had been practised earlier for controlling the disease (Ramakrishnan and Pillay, 1963a). Considering the carcinogenic nature of the mercurial fungicides, the use of such chemicals has been prohibited lately. Copper fungicides are not recommended for panel diseases as it may contaminate the latex as excess of copper (>8 ppm) affects the quality of rubber products. Dithiocarbamate derivatives like mancozeb (Dithane/Indofil M45) is found to be an alternative to organomercurials in checking the disease (Edathil *et al.*, 1988). Further trials conducted at the Rubber Research Institute of India (RRII) revealed that mancozeb at 0.375 per cent and phosphorous acid (Akomin or Phosjet) at 0.08 per cent are the most effective chemicals for controlling this disease. Weekly application of the chemicals gives significantly better protection from the disease than fortnightly application (Jacob *et al.*, 1995).

In other rubber producing countries, captafol (0.08%) and metalaxyl (0.2%) are effectively used against this disease (Zhang, 1981; Tan, 1989). The use of captafol is discouraged as it is found toxic to human beings. In the trials in Sri Lanka, hexaconazole, propiconazole and bitertanol were found effective. (Jayatissa *et al.*, 1994).

The fungicide solution may be applied as a spray or brushed on the tapping cut and just above (Plate 48. d). If the fungicide is applied on the next day of tapping, removal of tree lace before its application is found more effective. However, the application of fungicides after latex collection gave better protection (Peries, 1975). Application of a panel dressing compound on the renewed bark just before the onset of monsoon keeps off moisture and also enables better renewal of bark (Ramakrishnan and Pillay, 1963a).

4. PATCH CANKER

This disease is noticed during wet monsoon months on rubber plants of all age groups. The loci of infection could be anywhere on the stem from collar region to branches. It is occassionally noticed even on tap roots or lateral roots. The first report of this disease was from Sri Lanka (Young, 1955) and later it was reported from most of the rubber producing countries.

4.1 Disease development and symptoms

Copious exudation of latex from the infected region is the typical symptom of the disease (Plate 49. a). Many a times, the exudate is reddish or purplish. The exudates later dry up to form black streaks below the affected portion. Simultaneously, latex coagulates under the bark at the site of infection forming a pad, which protrudes out as a bulge on the bark (Plate 49. b). Cracking of the bark is also seen at this stage. While removing the coagulated pad, foul smell emits and discolouration of bark as well as wood is noticed. The infected tissues are initially yellowish grey with brown border and later turn to dirty red with black border.

4.2 Causal organism

The disease is caused by *Phytophthora* spp. or *Pythium* sp. In India, *Phytophthora palmivora, P. meadii* or *Pythium vexans* is found associated with this disease. *Pythium* is isolated usually when infection is seen at collar or root region. In other countries, several other species of *Phytophthora* are reported to be the causative agent for the disease. The

fungus infects the rubber plants through wounds and results in canker development. The causative fungus produces typical symptoms of abnormal leaf fall disease in artificial inoculation studies (Sharples, 1936; Ramakrishnan, 1964). The weather conditions conducive for the development of this disease are the same as that of abnormal leaf fall disease. Incidence of patch canker is observed to be high in areas prone to wind. The disease is also noticed following lightning damages in the plantation. The incidence of patch canker could be high in plantations infested by bark feeding caterpillar.

4.3 Clonal susceptibility

The clones susceptible to abnormal leaf fall and black stripe diseases are also susceptible to this disease. The clone PB 260 is highly susceptible to this disease.

4.4 Control measures

The disease affected portions may be cleaned thoroughly by removing the rubber pad and damaged or rotten tissues and then a fungicide solution may be applied at this region. Ever since the withdrawal of organomercuric fungicides, this disease is controlled by the application of mancozeb 0.75 per cent (Dithane/Indofil M45). Application of a wound dressing compound like Rubberkote, Sopkot, Treseal, *etc.* is recommended on the treated surface. Bordeaux paste is also recommended, but only on young plants or in tapping trees where the infection is on the opposite side of the tapping panel (Ramakrishnan, 1964). The effectiveness of new fungicides like metalaxyl-mancozeb, cymoxanil-maneb or dodine in controlling patch canker is also reported (Pereira and Santos, 1995).

5. DRY ROT

Dry rot is also termed as collar rot or charcoal rot. This disease can cause extensive damage to rubber plantations if proper attention is not given in time. In general, the disease is considered to be of less significance in India.

5.1 Disease development and symptoms

The disease is noticed at collar region, main trunk or any major branches of the rubber tree. The symptoms appear as copious exudation of latex from the affected region (Plate 49. c). The exudation may continue for several days and once it ceases, black streaks of latex could be seen on bark below the infected region. Meanwhile the pathogen damages the nearby tissues resulting in rotting of bark.

The fungus produces fructifications on the surface, which are circular to irregular in shape, greyish white in colour and soft in the beginning (Plate 49. d). The fruiting bodies enlarge and coalesce and become brittle, change their colour to olive grey and finally black. The fruiting bodies initially contain conidia and later bear perithecia producing ascospores.

The fungus penetrates the wood and ramifies inside making it soft and dry. As a result, the tree breaks at the infected portion. Double black lines formed by the fungus inside the wood are seen at times. Sprouts are formed just beneath the affected areas.

The fungus needs a wound for penetration (Petch, 1921a) and this could be the reason for the high disease incidence after heavy winds. It is noticed that deep wounds

resulted in significantly more infections than medium or light wounds. Infection is also possible through lenticels and moribund root initials (Varghese, 1971). The disease is more prevalent in rubber plantations from June to November. The retention of old rubber stumps in plantations is favourable for inoculum development. The fungus harbours on such stumps and produces large number of fructifications containing conidia and ascospores.

5.2 Causal organism

The causative fungus is *Ustulina deusta* (Hoffm. ex Fr.) Lind. This organism is a facultative parasite which can grow on dead and decaying wood and stumps. The fungus can be cultured and grows well at 23°C. The mycelium is white to grey initially but becomes greyish brown with formation of conidia and black after two to three weeks (Hawksworth, 1972).

5.3 Clonal susceptibility

The disease is noticed in clones RRIM 600 and RRII 105. Not much information is available on clonal susceptibility to this disease.

5.4 Control measures

Field sanitation is very important. All unwanted stumps bearing fructifications of the fungus may be cut and burnt. Infected stumps retained in the field serve as the main source of inoculum.

The infected region, especially with the fructifications of the fungus, must be disinfected by brushing with an effective fungicide solution. Earlier, organomercurial fungicides were effectively used in India for the control of this disease. But their use is, now banned.

Experiments conducted at the RRII revealed that 0.75 per cent thiram (Thiride), 0.5 per cent oxycarboxin (Plantvax), 0.5 per cent carbendazim (Bavistin) and 0.2 per cent propiconazole (Tilt) were effective in controlling the disease. Bordeaux paste was found ineffective. Petroleum wound dressing compound is a good carrier for the fungicide and incorporating the fungicide into it and applying to the affected area is as effective as applying fungicide solution to the affected area followed by application of petroleum compound (Idicula *et al.*, 1990). Hexaconazole (0.02%) incorporated in petroleum wound dressing compound is also effective (Joy and Jacob, 1998).

6. MOULDY ROT

Mouldy rot occurs on the tapping panel during the rainy season. The first record of this disease on rubber was from Peninsular Malaysia in 1916 and later its occurrence was reported from many countries including India (Sharples, 1925; Wright, 1925; Ramakrishnan and Pillay, 1963b). In India it is of very minor significance, whereas in Malaysia it poses serious problem, if neglected.

6.1 Disease development and symptoms

The symptoms appear as depressed discoloured spots just above the tapping cut in the renewed bark resembling the early symptoms of black stripe disease. These spots

coalesce to form an irregular sunken band running parallel to the tapping cut. Greyish fungal growth is noticed over the infected areas under congenial climatic conditions. As the infection progresses, the infected bark rots and later falls off exposing the wood, similar to that developed from bad tapping. The ultimate effect is the formation of uneven burs on the tapping panel rendering the renewed bark unsuitable for tapping (Ramakrishnan and Pillay, 1963b).

Damp conditions and bad tapping favour the disease development. The disease is usually prevalent in swamp or shady areas having high humidity. High density planting results in shade and the poor aeration inside such plantations is congenial for the spread of fungus. Deep tapping also encourages the disease initiation, but in an infected panel under high moist conditions, the disease progresses regardless of deep or shallow tapping.

6.2 Causal organism

The causative fungus is *Ceratocystis fimbriata* Ellis & Halst. It produces two types of spores. Under favourable conditions, hyaline thin-walled spores are produced abundantly over the surface where mouldy growth is seen. The other type, which are thick walled and produced in small numbers at later stage of disease, enables the fungus to oversummer. The spores from infected trees are carried by insects and air currents.

This fungus is also found attacking other plants like coconut, coffee, sweet potato, cocoa, mango, *Crotalaria* spp., *etc.*

6.3 Clonal susceptibility

RRIM 600 and PR 107 are highly susceptible clones whereas PB 5/51 and GT 1 are less susceptible.

6.4 Control measures

Avoidance of damp conditions and deep wounding of bark during tapping reduce the disease incidence. The control of undergrowth to avoid humidity is recommended. In Malaysia, disinfection of tapping knives after each tapping and restrictions in the movement of tappers from infected to uninfected areas are recommended. Use of 0.5 per cent Benlate once in four days is also recommended for controlling the disease (Chee, 1970). Panel washing with mancozeb (0.375 %) can also be practised.

7. BARK NECROSIS

The disease mainly affects the untapped bark in mature trees during rainy season. Except for some large-scale incidence in clone PB 28/59 several years back, the disease is considered to be of minor significance in India.

7.1 Disease development and symptoms

The formation of brownish or purplish red necrotic spots on the tapping cut or on the lower portion of the cut is the initial symptom of the disease. These spots are rarely seen in the renewing bark. The inner tissues get affected and the infection spreads quickly in all directions. The cortex region in the bark is mainly affected. Formation of cracks in the bark is also noticed. On scraping off the outer bark, the necrotic tissue is seen purple red or brownish with a well-defined black border. In dry weather, the dead

cortex tissue falls off and normal bark regeneration takes place. But in a prolonged wet weather, the cambium is also affected resulting in profuse bleeding and formation of large wounds. The bark gets totally dried up and borer beetles attack the affected region.

7.2 Causal organism

The aetiology of the disease is not known. However, *Fusarium* and *Colletotrichum* were isolated from the affected bark, but no concrete evidence is available making them responsible for the disease.

7.3 Clonal susceptibility

The disease is reported to occur in clones like PB 5/51, PB 28/59, GT 1 and PR 107 in Malaysia.

7.4 Control measures

Disinfection of tapping knives and restricting the movement of tappers from infected areas to non-infected areas are recommended in Malaysia. As the guide marks for tapping serve as loci of infection, marking trees during rainy season should be avoided. The chemicals effective against black stripe disease are expected to give good control of this disease also.

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