DISEASES OF RUBBER AND THEIR CONTROL

By

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Rubber *(Hevea brasiliensis)* is one of the important plantation crops in Sri Lanka. The rubber tree is affected by a number of diseases of economic importance and they can be divided for convenience into four categories: leaf; stem and branch, panel and root diseases.

LEAF DISEASES

Oidium leaf disease

Oidium leaf disease caused by the ascomycete fungus *Oidium heveae* is the commonest leaf disease of rubber. It affects the tender leaves produced soon after wintering, causing secondary leaf fall. It is widespread and the severity of the disease depends on the pattern of wintering, clonal susceptibility and the weather conditions at refoliation.

Symptoms – The copper brown and apple green leaves are susceptible to infection. The disease appears as white powdery patches, as the fungal hyphae grow radially to form extensive circular colonies. When tender leaves are affected, they shrivel and fall off, leaving the petioles on the stem for some time. When semi-mature leaves are affected, characteristic translucent brownish yellow spots are clearly seen, and such leaves persist throughout the year with the necrotic spots.

A severe attack of *Oidium* leads to extensive defoliation, resulting in poor canopies being retained on the trees and often with loss of yield. It can also result in a serious retardation of the rate of growth, and bark renewal. Repeated defoliation, particularly at higher elevations, could even lead to depletion of food reserves resulting in dieback of twigs and branches, assisted by secondary invaders. The fungus also affects the flowers causing premature flower drop.

Generally cool, misty mornings with intermittent light showers, during the refoliation period, provide ideal conditions for the rapid propagation and dissemination of the fungus. Under these conditions, the fungus produces barrel shaped conidia which are dispersed by wind.

Control – Clones tolerant to the disease such as RRIC 102 should be planted. Planting of early wintering clones will help to reduce the infection, as the new foliage can mature before the onset of weather conditions conducive for the fungus. Application of an extra dose of nitrogen just after wintering also helps to reduce the intensity of leaf fall by *Oidium* by allowing the leaves to mature quickly.

To combat the spread of the disease, sulphur is dusted at 9 kg/ha per round. Four, weekly rounds are recommended, if the attack is extensive and cover a wide area in the estate. It may be desirable to dust susceptible clones, particularly if favourable conditions for the fungus coincide with the refoliation period. It would be beneficial to carry out spot dusting in badly infected areas, with a view to reducing the inoculum potential.

Dusting should commence when 10-20% of the trees show signs of refoliation. Dusting operations should preferably be completed before 7.00 a.m. to take advantage of the absence of wind and the presence of dew, which helps to retain the sulphur on the leaves. It is important that the dusting machines be carried across the direction of the prevailing wind, at a walking speed of about 3.5 Km.p.h. so as to ensure that the sulphur reaches the leaves on the tree tops.

Abnormal leaf fall

Phytophthora leaf disease, caused by a species of the phycomycete fungus *Phytophthora* occurs mainly in the wetter rubber growing districts during the South-West monsoon season. *Phytophthora* leaf fall is closely linked with the presence of infected green pods.

Symptoms – The characteristic symptom of the disease is the production of a brown-black lesion, anywhere along the length of the petiole with globules of coagulated latex on them. The infection causes the leaves to fall and they are shed while the leaflets are still attached to their leaf stalks. These can be readily distinguished from wind blown leaves in that the leaflets are easily detached when the leaves are vigorously shaken by the stalks.

Green mature pods form an ideal substrates for growth and sporulation of the fungus. During the wet season in June-August these pods get encrusted with a mat of white mycelium which produce sporangia. The zoospores liberated from the sporangia are washed down with the rain water, to cause infection of petioles, leaves, green twigs and bark. Generally continuous, cool, wet weather with constant high humidity and overcast conditions fare favourable for the spread of the disease.

Control – Prophylactic treatment with oil based copper fungicides are effective in controlling the disease. However, this practice is not warranted, as a routine measure, under local conditions as abnormal leaf fall is confined only to certain pockets and is not known to have serious effects on the yield of rubber.

Colletorichum leaf disease

Colletotrichum leaf disease is caused by the ascomycete fungus *Gloeosporium alborubrum*. This disease attacks tender leaves of young plants and also leaves developing toward the latter part of the refoliation season. It also causes dieback of weakened green shoots. *Colletotrichum* leaf disease could be found throughout the year but becomes dominant with the onset of wet weather conditions, to cause extensive defoliation, in the most susceptible clones.

Symptoms – Tender leaves produced soon after bud burst are most susceptible to infection. Usually, when the immature leaves are affected the infection begins at the tip of the leaf and spreads towards the base of the leaf, causing it to produce a necrotic area. If the damage is extensive the leaves are distorted, wither and fall leaving the petioles on the stem for a short period. Sometimes the diseased portions drop away leaving behind the unaffected area of the lamina on the shoot. When semi-mature or mature leaves are infected, the natural resistance of the host usually prevents extensive damage. Such leaves are covered with numerous spots having a brown margin surrounded by a yellow halo. The spots become raised and prominent, as the leaf gets older.

Repeated defoliations due to *Colletotrichum* could result in dieback of succulent shoots of young buddings, sometimes the fungus grows down affecting the bud patch and killing the entire plant. It can also cause gradual death of the twigs and branches and may even kill the entire tree, when it is highly susceptible to the disease especially at higher elevations or in areas where wet weather is experienced continuously.

Control – Copper fungicides have been used extensively but its efficacy is reduced, as most of the fungicide is washed off during the rains, when the fungus is most active. Systemic fungicides like Antimucin, Bavistin, Benlate, Baycor, Daconil are known to afford better protection, as they are rapidly taken into the plant and redistributed to tender leaves, thus preventing the establishment of the disease. If the disease causes dieback the infected portion must be pruned a few centimeters below the limit of the dieback. The sloping cut end must be protected with a fungicide and sealed off with a waterproof fungicide. Trees subjected to extensive damage must be manured generously, to improve the vigour of the plant.

STEM AND BRANCH DISEASES

Pink disease

Pink disease caused by the Basidiomycete-fungus *Corticium Salmonicolor* is essentially a disease of young trees, 2-8 years old. It is confined only to certain rubber growing areas and is not a serious problem. However, the disease can be of considerable economic importance as it caused extensive destruction of main branches, during the wet season, with the consequent loss of canopy, which retards the growth and extends the period of immaturity.

Symptoms – The first indication of an attack is the exudation of drops of latex from branches. This is quickly followed by the appearance of white silky cob-web like mycelium on woody branches, usually at the fork, where several branches join the main trunk. Later, the stem assumes a characteristic pink colour.

Two types of spores are produced, during the wet weather season. Wind borne basidiospores are produced from the salmon pink crust and necator spores from the orange-red pustules, which appear to be spread by rain splash. The fungus stops growing and remains quiescent during the dry weather period and becomes active with the onset of rainy weather.

Control – Early recognition of the disease is essential for successful control of the disease. When branches are girdled with the infection, they cannot be saved. Application of a fungicide such as Fylomac 90 or Calixin form the ground, using a knapsack sprayer equipped with a long lance or nozzle can bring about effective control or brush on formulations can also be applied, which is rather a cumbersome operation. Pruning of affected branches should be done with the advent of the dry season.

PANEL DISEASES

Bark rot or black stripe

Bark rot or black stripe caused by the Phycomycete fungus *Phytophthora meadii* is the only panel disease of economic importance in Sri Lanka. It generally occurs in almost every rubber growing district except the drier areas. The clone PB 86 which is widely grown, is very susceptible to this disease.

Symptoms – The first sign of the disease is the appearance of a series of sunken, parallel, vertical depressions, just above the tapping cut. These eventually coalesce, to form a continuous irregular depressed patch on the panel. On paring off the bark, distinct black vertical lines are seen in the wood, which gives the disease its various names *e.g.* black stripe and black thread. When the disease is neglected or unnoticed, the infection can spread in the renewed bark as well as into the untapped bark causing vertical fissures. Sometimes gaping wounds could be seen with the formation of foul smelling latex pads under the bark. The trees affected by the disease, if left untreated may become dry or die as a result of fungal infection. This is often followed by borer infestation of the dead tissue. However, when the infection is not so severe prominent burrs are formed due to uneven callusing of the tapped bark, rendering it difficult or unsuitable for retapping. Occasionally, the fungus can infect untapped bark anywhere along the trunk resulting in bleeding and this is generally referred to as stripe canker.

Phytophthora – disease is associated with wet weather, being favoured by prolonged cool and rainy periods. Zoospores produced in the sporangia on rubber pods are washed down the trunks of trees during the rainy period and gain entry through a fresh tapping wound and spreads rapidly within the tree. The fungus is also known to survive in the soil for a short period and tapping cuts close to the ground could easily be infected, by spores splashed on to the panel during heavy rain.

Control – As a preventive measures it is extremely important to ensure that wet trees are not tapped, during the South-West monsoon season from May - August, when pod rot and leaf fall phases of the disease are evident. As a prophylactic measure application of fungicides such as 1% Pylomac 90, Antimucin 1:120 or 15% Brunolinum plantarium, Difolatan 0.8 - 1.6% Ridomil 0.2 - 0.4% should be made only during the danger period, on clones that are known to be highly susceptible to the disease, such as PB 86 and RRIM 600 in areas where the diseases is endemic and in pockets known to be highly susceptible to the disease, such as those lying in sheltered areas and where the atmosphere is continuously damp. Fungicides should be applied on every tapping day at collection time or at the earliest opportunity thereafter, if rain interferes with this operation. Water-proof panel dressings such as Kankerdood, Candarsan or Shell TB 192 are used to seal off the wound.

Adoption of proper cultural measures such as grooming of trees, pruning of heavy canopies and control of undergrowth will also help to reduce the incidence of the disease by increasing the air circulation thereby helping the trees to dry quickly. Opening up new tapping cuts or changing of panels should also be avoided during the South West monsoon season. Clones that are known to be highly susceptible *e.g.* RRIC 36, RRIC 45, PR 107 and RRIM 600 should not be planted.

Control – It is important to detect the disease at the initial stages of development, when vertical depressions are seen just above the tapping cut. This helps to minimise the removel of bark from the tapping cut thereby helping the wound to callus over quickly. All the affected tissue should be completely scraped out well into the healthy tissue, until minute drops of latex begin to appear, leaving a smooth sloping edge to the resultant wound. This helps the water drain off rapidly and encourages even callusing of the bark. The discoloured wood need not be removed, only a superficial scraping would suffice, because the disease does not appear to spread in the wood once the affected bark is removed. Moreover, there is less danger of trunk snap, if the wood is left intact. The resulting wound should then be treated with a water miscible fungicide followed by the application of water proof panel dressing. The exposed wood should be painted with tar to prevent borer infestation, taking great care to ensure that tar does not come in contact with the injured bark, as it would lead to scorch. Bark rot treatment should be undertaken in dry weather.

ROOT DISEASES

White root disease

White root disease caused by the Basidiomycete fungus *Rigidoporus lignosus* is the most serious disease affecting rubber in Sri Lanka. It causes damage both to immature and mature rubber trees. Besides, it affects a number of other cultivated and jungle hosts. Usually in replanted areas the incidence of the disease reaches a peak in about 2-5 years and thereafter it declines. It becomes a problem in mature rubber, only, if the disease is neglected during the early stages of the growth of rubber.

Symptoms – The fungus penetrates the roots and causes damage to the water conducting tissues and as such the first above ground symptom is the general discolouration of the foliage. Initially, the leaves become greenish yellow and later turn brown, producing symptoms very similar to those shown by a tree starved of water during a drought period. This is followed by leaf fall and dieback of branches and death of the tree. Usually immature trees succumb to infection in a few months but mature trees could survive longer and this depends to a great extent on the severity of the disease and the extent of the root system.

When the roots of plants showing characteristic foliar symptoms are exposed, typical thick, ramifying white mycelial strands, known as rhizomorphs, are clearly seen on the affected roots. These assume a brownish colour with age and are known to grow epiphytically for a considerable distance on the root surface before penetration. The wood of infected roots is usually cream in colour and later becomes soft and friable.

Infection begins when roots of young plants come in contact with the infected roots left behind at the time of clearing the land. If the disease is neglected or unnoticed the infection spreads by root contact destroying large extents of land.

Control – The removal of potential sources of infection is the most essential prerequisite in reducing the incidence of white root disease. Therefore, at the time of uprooting the old stand, infected areas in the old stand should be demarcated and special attention must be paid to remove as much of the infected roots within practical and economic limits. All the infected plant debris must be burnt, preferably *in situ.*

At the time of replanting 100 g of sulphur should be sprinkled on the surface of the ground around the plant, to cover about a square meter. Application of sulphur should be confined to those areas which showed a high incidence of white root disease in the old stand. It is important to take great care to avoid sulphur coming in contact with the root of the budded stumps as this could lead to scorch. A second application should be made when the plants are about one year old. Thereafter, quarterly rounds of foliage inspection should be carried out to detect any infected trees.

The establishment of leguminous covers should also help to reduce the infection. This is achieved by accelerating the decay of stumps left behind in the field, promoting antagonistic microflora and by diffusing the inoculum amongst the roots of the cover crops, thereby reducing the inoculum potential. It is important to keep the covers well clear of the rubber plants.

The trees showing characteristic foliar symptoms are generally beyond saving but they serve to locate the foci of infection, so that the adjacent trees within the row and between rows that are healthy and in early stages of infection can be saved.

Control – The root system of infected plants should be exposed, taking care to avoid damage to the roots and the source of infection or "food base" should be traced and removed. All the lateral roots penetrated by the fungus should be excised. These can be recognised by the lack of latex on slight scraping of the root surface. Any superficial growth of fungal mycelia or rhizomorphs left over should be carefully scraped. A collar protectant such as "Fomac 2", or "Collar Protectant" which have pentachloronitobenzene as their active ingredient, should then be applied round the collar and basal portion of the laterals and the top of the tap root, before refilling the soil. It is important to apply a collar protectant as a prophylactic measure on the root system of adjacent healthy plants. The infected roots must be burnt preferably on the spot without allowing them to be accidently introduced into the rest of the clearing as these could become potential foci of fresh infections.

Control of white root disease in mature areas mainly consists of the removal of diseased plant material with a view to preventing the spread of infection to healthy trees. Therefore, the only remedial measure that could be adopted is to uproot and burn as much of the infected material as possible. Isolation of the infected area by sprinkling sulphur dust in a cleared narrow band should also help to prevent further spread of the disease.