SOUTH AMERICAN LEAF BLIGHT OF RUBBER

by

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South American leaf blight (SALB) is the most destructive disease of rubber. At present, it is confined to South America and the Caribbean islands, with Asia and Africa being free from the disease. It is present in countries like Brazil, Bolivia, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Trinidad & Tobago, Haiti, Panama, Costa Rica, Nicaragua, Salvador, Honduras, Guatemala, Belize and Mexico. SALB has destroyed thousands of hectares of rubber plantation in some of these countries, including 100,000 ha in Brazil in 1986. In Costa Rica, it was found that SALB can cause serious problems within six to seven years after establishment of the rubber plantation upon infection. Due to its devastating nature, SALB is categorised as a quarantine disease by rubber producing countries in Asia and the Pacific. There are concerted efforts by the FAO-APPPC (Asia and the Pacific Plant Protection Commission) to prevent SALB incursion into Asia and the Pacific regions. Malaysia, a member of the APPPC, is actively pursuing this goal.

The causal organism and disease symptoms

The disease pathogen is a fungus, *Microcyclus ulei* (P. Henn) v. Arx, with synonyms, *Dothidella ulei* (P. Henn.) and *Melanosammopsis ulei*. It has many races, thereby producing different degrees of disease severity. It infects only rubber plants (*H. brasiliensis, H. benthamiana, H. guianensis, H. spruceana, H. camporum*). It spreads rapidly with the right weather conditions, i.e. high humidity and absence of prolonged dry weather. This fungus can reproduce both sexually and asexually. Its life-cycle can go through three stages, the conidial, pycnidial and perithecial stages, each producing spores known as conidia (asexual), pycnospores and ascospores (sexual) respectively, with the first and the last being infective and capable of disease spread. The asexual conidial stage may not necessarily proceed to the other stages for re-infection to occur. These spores can be dispersed by wind, rain splash, insects, animals and man (through their attire and farm implements).

The fungus can infect the young leaves (leaflets), young stems, petioles, inflorescences and fruit, although seed infection has not been established. Young copper brown leaves are the most susceptible. Leaf resistance to the disease increases with leaf maturity. Young infected leaves show dark or olive green leaf lesions (due to the powdery conidia) on the undersurface of varying sizes, depending on the age and clone of the leaves. If the infection is severe, the leaves then crinkle, shrivel and drop, leaving the petioles behind for a few more days. On the upper surface of the maturing leaves, pycnidia (protuding structures) are formed around the edge of the lesions on the lower surface. These produce the pycnospores. Later, large black protuding bodies (perithecia) are formed at the site of the pycnidia, with asci carrying ascospores. The asci burst releasing the ascospores that continue the cycle of infection. When the infected leaflet matures, shot holes appear at the centre of the old lesion, surrounded by the perithecia. As the infection becomes severe, leaf defoliation occurs leaving skeletal looking trees, retarding them and eventually killing them.

SALB management

The use of resistant clones is the primary element of disease management. Breeding for resistance was carried out in Brazil with some success. The resistance of some clones broke down when a new race of the fungus appeared. In the late 1950s, Malaysia attempted breeding for SALB resistance using some introduced clones (Fx and IAN clones). The progenies were assessed for SALB resistance at the RRIM SALB Unit in Trinidad and Tobago, which has unfortunately ceased operation. Michelin in Brazil has produced some resistant clones with good latex yield. These are presently being assessed.

Chemical control, using fungicides, are effective on nursery and young plants. However, on tall rubber trees, applications of fungicides are not as efficient. This is one of the reasons why it is difficult to eradicate SALB.

Crown budding with resistant clones has been practised. This technique involves grafting an immune *Hevea* sp. (eg. *H. pauciflora, H. guianensis* var. marginata or *H. rigidofolia*) or a tolerant clone on to a high latex yielding trunk with a good rootstock. However, this technique is not without its own challenges. It is expensive to establish a crown budded plant. There is often incompatibility between the crown and trunk due to uneven growth rates, or the crown clone can sometimes depress the latex production by the trunk clone. Resistance of the crown clone has also been known to break down such as for the clones Fx 25 and Fx 3925.

Studies have also been conducted on the use of biological control agents like the fungi, *Dicyma pulvinata* and *Periconia manihoticola*, on small scale trials. Molecular techniques, using the QTL (quantitative trait loci, i.e. pieces of DNA sequences that are part of genes that are linked to a measurable trait) for resistance to SALB are being established.

A molecular diagnostic technique is urgently required for quick identification of the fungal pathogen to facilitate the implementation of quarantine measures. Traditional morphological identification of the fungus is highly dependent on the conidia, which can take approximately two weeks to grow. Research on the fungus can only be done in SALB countries or countries where rubber is not grown as a commodity. This approach of research is very costly, and most non-SALB rubber producing countries cannot sustain it. This is one of the main reasons why research on SALB is comparatively slower than research on other rubber diseases. Only a large corporation like Michelin, that is highly dependent on rubber, can sustain its research on rubber in Brazil. It carries out research on breeding for SALB resistance and high latex yield.

The implications of SALB incursion into Asia and the Pacific region

It has been said by Peter Wade in Fortune magazine that "it is an open secret in the industry that SALB, should it cross the Pacific, could wipe out the supply of natural rubber". A famous scientist, Richard E. Shultes, was of the opinion that "SALB would run through the Asian rubber plantations within five years". These opinions are not to be taken lightly. Although there are fungicides that can kill the SALB fungus, their application faces some constraints, making them not very effective on tall rubber trees. The rapid spread of the spores by wind and rain splash and their ability to survive for a considerable number of days on non-vegetative material play a prominent role in the quick spread of the disease. The weather conditions that are ideal for rubber planting are also ideal conditions for the

propagation of the fungal spores. The fact that SALB has destroyed thousands of hectares of rubber plantations in the South American and the Carribean islands is something we should take heed seriously.

According to the Malaysian Rubber Board, in 2009 there were 1,237,000 ha of rubber planted in Malaysia, with 1,174,000 ha by 264,894 smallholders and 63,000 ha by estate owners. The 2009 production of rubber was 857,000 tonnes. Rubber manufacturing products contributed RM 10.6 billion in export earnings in 2009. In Indonesia, the rubber industry contributed US$ 3.2 billion in foreign exchange in 2009, and is a source of income for 10 million people. The other rubber producing countries in Asia are Thailand, India, Vietnam, China, Sri Lanka, Philippines and Cambodia. Should there be a SALB incursion into Asia, the economic losses in export earnings and loss of jobs will be catastrophic, not to mention the social problems that will arise.

Due to the severity of the disease, an incursion of SALB into any part of Asia and the Pacific region will have tremendous adverse effects on international trade, as well as the tourism industry. Consignments of agricultural products and agriculture or forestry products from SALB infected countries will be subjected to intensive quarantine entry inspections and regulations. Tourists and accompanying luggage from infected countries will be subjected to rigorous inspection for both viable and non-viable host material. Camping equipment, hiking boots, farm equipment and decorative plant material will have to be decontaminated. Expensive equipment for screening cargo and passengers at ports and airports will become necessary. Additional port and airport quarantine officers will have to be recruited; and delays in clearance of cargo, tourists and their luggage can become a bane of importers and tourists.

How can we keep SALB out of Asia and the Pacific region?

Since SALB is a regional concern amongst Asian and the Pacific rubber growing countries, there should be a camaraderie amongst our countries to ensure that each country take its role seriously in keeping SALB out of the region. Importation of rubber planting material and rubber related products from SALB infected countries should be discouraged. Importation of rubber planting material from countries without SALB should be limited to brown budwood (as the fungal spores can survive for longer periods on green budwood) of one metre length (to facilitate phyto-sanitary treatments by the exporting country). Permits and phyto-sanitary certificates for the importation of other agricultural products from SALB infected countries should be sought from the National Plant Protection Organisation (NPPO) of each importing country, and all regulations strictly adhered to. Rubber planters should report suspected cases of SALB in their plantations to the NPPO. It is advised that travellers to SALB infected countries launder all their clothes, clean their footwear, headwear and other personal ítems before embarking on the journey home. Breaking their homeward bound journey by staying overnight or longer in another country will decrease the chances of fungal spore survival on personal effects. Public awareness on the severe consequences of SALB incursion must be followed by a concerted effort to keep SALB out of Asia and the Pacific region.

The photographs and some of the information presented here are by courtesy of Dr. Ismail Hashim, a Malaysian consultant on SALB. The references used here are from the FAO Regional Standards for Phytosanitary Measures on Guidelines for Protection against South American Leaf Blight of Rubber (APPPC RSPM No.7 published in 2012, and the two

volumes of FAO publications, Volumes I & II) on Protection against South American Leaf Blight of Rubber in Asia and the Pacific Region published in 2011 and 2012, respectively.

Fig. 1: A rubber plantation with SALB in Brazil

Fig. 2: Rubber plantation in Brazil with empty space due to removal of dead trees infected with SALB

Fig. 3: A defoliated SALB infected rubber plant in Brazil

Fig. 4: SALB infected rubber seed pods