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South American leaf blight-a potential threat to the natural rubber industry in Asia and Africa*

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Abstract

South American leaf blight (SALB) caused by the fungus Microcyclus ulei (P Henn.) v. Arx is the main limiting factor to the development of the *natural rubber (Hevea brasiliensis)* industry in South and Central America. It also poses a great danger to the rubber grown extensively in Africa and South-east Asia. Present knowledge of its distribution, epidemiology and spore viability, the risks of its entry into Asia and Africa and its possible behaviour in these countries are reviewed. In the control of this devastating disease, application *of defoliants and fungicides,* breeding for leaf blight resistance and crown budding of high yielding susceptibe panel clones with leaf blight-resistant crowns are measures currently being investigatad. Present quarantine regulations appear inadequate. The need for more rigorous measures are stressed.

Introduction

South American leaf blight is the most damaging disease of Para rubber *(Hevea brasiliensis)*. This disease is at present wholly confined to the American continent and has caused the abandonment of ambitious programmes of extensive rubber *cultivation in the South American* humid tropics during the early part of this century. Over 90% of the world's natural rubber requirement is being met by production from the Far East (Holliday, 1970). All the planted African and Asian rubber is extremely susceptible and the climatic conditions present in the rubber growing areas of Asian and African countries are comparable with that of the American tropics, hence introduc*tion of leaf blight into these* parts of the world could destroy all the existing plantations and the result would be disastrous to the entire world.

Historical background and distribution

In the past, this disease went unnoticed among the widely scattered wild rubber plants in the Amazon forest. But during the beginning of this century, when attempts were made to cultivate rubber on an extensive plantation scale in South America, the disease assumed epidemic proportions and almost destroyed all the early plantations resulting in the abandonment of rubber *over large areas in Guiana,* Panama and Costa Rica (Bodkin, 1922; Altson. 1924; 1926; 1951) In the existing plantations it reduced the yield by over 90% (Altson, 1923).

Leaf blight is present in Bolivia, Brazil, Peru, Ecuador, Colombia, Venezuela, Guyana, Surinam, French Guiana, Trinidad, Panama, Costa Rica, Nicaragua, ElSalvador, Honduras, Guatemala, Haiti, Belize and Mexico (Holliday, 1970; compagnon, 1976) (Figure 1).

The pathogen and its survival

The causal fungus *Microcyclus ulei* is specific to *Hevea* spp. Even though the fungus can affect petioles, green stems, inflorescences and fruits, the most obvious infection is on the young leaves. Symptoms of the asexual stage vary with the age of the leaf at infection. In the *primary stage conidia develop* mostly on the abaxial surface of 4—9 days old expanding tender leaves. They appear as grey-black dull lesions covered with olive-green powdery sporing masses. On the young infected leaves, lamina distortion, growth arrest, crinkling and shrivelling of leaflets, blackening, drying and abscission are common symptoms. Leaves 10-16 days old do not usually fall. In such cases *infection produces irregularly* outlined necrotic patches and the leaves become severely distorted, ragged and shot-holed. The conidial state is known as *Fusicladium macrosporum* sporum (Anstead, 1919)
The secondary stages develop on the *adaxial surface of the leaves* as it hardens. The black pycnidal from increases in number and size, forming clusters and ring-like groups, several millimetres *across. Very rarely, the leaf* falls after the emergence of pycnidia. By the time the leaf matures, the stomata become more and more massive because the ascocarp form is emerging. It develops as charcoal-black bodies arranged around the *margin of the holes in a series* of rings. Infection results in repeated rounds of defoliation, dieback of the shoots and even death of mature trees (Figure 2) (Stahel, 1927; Holliday, 1970; Rao, 1973a).

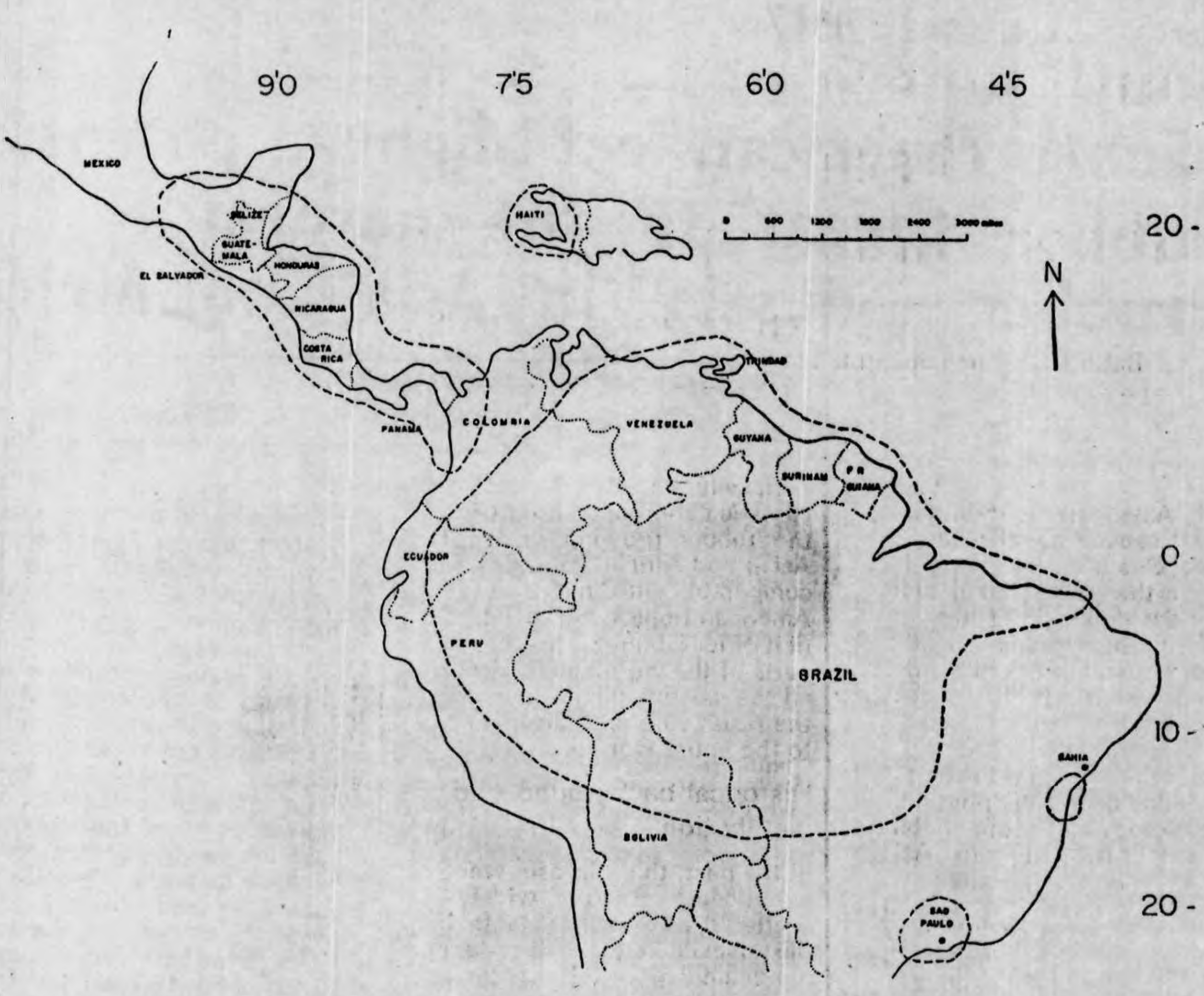

Figure 1. Countries in South and Central America where South American leaf blight is present. (Adapted from Holliday, 1970). ....national borders: ------limit of distribution or Mycrocyclus ulei *on* Hevea brasiliensis.

It was observed in Trinidad that conidia have a maximum dispersal in June and July and peak ascospore concentrations occurred in August to November during the wet season. (Chee, 1976c). In a mature stand or rubber, a fresh disease cycle probably starts when ascospores are released from leaves, falling due to wintering and also from infected leaves remaining on the trees. As infection builds upon the newly emerging flushes conidia take over the spread, during the wet season, to complete the disease cycle.

Viability of spores and methods of dispersal

Stahel (1917) reported that ascospores caused little infection in the field, but Langford (1945) observed that both ascospores and conidia did so and that conidia are of more practical importance. Recent investigations by Chee (1976b; 1976c and 1977) have shown that ascospores also infect young leaves and both the spore forms are equally important in completing the disease cycle. The view of Stahel about the non-infectiveness of pycnospores has been confirmed by the poor germination of these spores. Their production in abundance prior to the ascigerous stage suggests that they function as male gametes (spermatia) for fertilization.

Dry air currents up to km/h did not remove conidia of *M. ulei* from the leaves, whereas water applied on the conidial lesions instantly released the spores. This suggested that rain is highly important in the spread of leaf blight. Conidia are dependent on free moisture or a saturated atmosphere for germination and infection (Chee and Wastie, 1980). Studies on diurnal periodicity of dispersal revealed that significant increases in the number of conidia in the air was invariably associated with rain. Liberation of conidia at its peak about 10.00 a. m. and of ascospores is about 06.00 a. m. (Holliday, 1969; Chee, 1976c.) Rainfall probably has an initial effect of liberating spores through mechanical action (Hirst and Stedman, 1963).

It is believed that rain is the most effective disseminator of larger masses of the spores of *M. ulei* and wind is the chief means of dispersal (Langford, 1945). But high temperatures and intense irradiation during daytime are lethal to spores. Hence transmission of the pathogen by windborne spores to distant places is most unlikely, there as rain splashes help in the spread of thedisease in short distances. Stahel (1917) believed that conidia survive less than 24h and that ascospores survive about 6h. This may be true under dry conditions in the shade at high temperatures. Langford (1945) found that germination was still high after three days (27° C and 70% r.h.) but did not occur after seven days. De Jonge (1962) and Brookson (1963) observed that conidia survived for two weeks under normal laboratory conditions. The long survival period of conidia was confirmed by Chee (1976b), who observed that 50% of the conidia in leaf lesions still germinated after the leaf had been stored in a dessicator for 15 weeks, or frozen for two weeks or kept at 40°C for several days. However, the longevity of conidia decreases as relative humidity increases. In 85-95% r.h., conidia survive for 3 weeks and at 100% r.h. conidia are killed within one week. It seems probable, that leaf blight could be spread as conidia carried on plants, plant parts or man himself. This last means of dispersal is particularly important since conidia have been recovered from clothes and finger nails after a visit to a nursery infected with *M ulei* (Chee, 1980).

Until recently, very little information has been available on the survival of perithecia and ascospores. It was generally believed that ascospores survive longer than conidia since they are protected by perithecia. But the survival period of perithecia and ascospores differ. Perithecia on detached leaves can release ascospores in three days to three weeks, depending on the moisture content in them (Chee,1980). Leaves which fall during wintering discharge ascospores readily after rain. At 24°C, under moist conditions, perithecia lose their viability after 12 days on green leaves and after 9 days on fallen brown leaves. At the optimum temperature (24°C), ascospores germinate in 2.5 h in darkness and 6 h in light. Ascospores die at high humidity (>80%), but survive up to 15 days in a dessicator. They are killed by 4 minutes exposure to u. v. light. The germination rate of fresh conidia ranges from 10–90% whereas that of ascospores is consistently higher (Chee,1976a).

Weather conditions favouring the spread of the disease

Outbreaks of leaf blight occur when the daily temperature is under 22°C for longer than 13 hours, relative humidity over 92% for a period longer than 10 hours and rainfall above 1m m per day for the previovs seven days (Holliday, 1969; Chee, 1976c).

Rain

Showery rain, well distributed throughout the year, is more favourable to the disease than continuous periods of heavy rain (Stahel, 1917). According to Chee (1980) leaf blight is less severe in North-East Trinidad (annual rainfall 2500 mm or more) than in the North-west (annual rainfall 1300-2500 mm). Similarly, damage due to leaf blight is greater at Navajoa (East Guatemala, annual rainfall 2500 mm) than at Las Clavellins (West Guatemala annual rainfall 3500mm). Heavy rain for a long period can effectively wash off the available inoculum whereas humid conditions coupled with intermittent and distributed light showers favour disease development and dispersal. In Trinidad it was observed that conidia were completely removed from the lesions on days having 2 cm or more rain (Chee, 1980).

Rainfall in the rubber growing tracts of Asia and Africa would seem to be adequate for leaf blight to occur (2000–4500 mm annually). But the severity of the disease would depend on the pattern and distribution of rainfall. Over inland Malaysia the diurnal rainfall pattern has its peak during the mid or late after noon (Dale, 1959; 1960). In South India, when a north-easterly monsoon occurs during the afternoon or evening, such a pattern might lengthen the period of leaf wetness and hence the time favourable for infection.

Humidity

It was observed that conidia of *M. ulei* survive best under dry conditions, but high humidity is required for their production and germination (Chee, 1976b) Relative humidity of more than 95% for 10 consecutive hours for 18 days caused severe outbreak of *M ulei* on susceptible clones in Bahia, Brazil and in Trinidad (Chee, 1980). In central America it was reported that frequent dew formation on leaves for more than 8 hours is needed for *M. ulei* infection (Langford, 1945.) It would seem that relative humidity in most months of the year in Peninsular Malaysia is suitable for leaf blight. (Malaysian Meteorological Services, 1971–1973, 1975).

Temperature

From the experimental evidence on growth and conidial sporulation *in vitro*, conidial germination and ascospores discharge, it can be observed that the optimum temperature for *M. ulei* is 23°C or less (Holliday, 1970; Chee, 1976b). But in the laboratory trials of screening for clonal susceptibility by the leaf disc-inoculation method, it was observed that under a 16/8 h light/dark period of six days, 24°C–26°C is the optimum temperature for the development of lesions on inoculated leaf discs (Chee. 1976a).

Epidemiology

The severity of leaf blight in various localities in South America was related to the local climatic conditions. Leaf blight has reached Haiti and evidence suggests that it was brought over by wind and rain from Guiana and Trinidad (Compagon, 1976). It was observed by many people that sea breeze can reduce the disease intensity in coastal areas. This may be due to the shortening of

Figure 2. A young rubber plantation affected with Microcyclus ulei *in Itubera, Brazil.*

the period of high relative humidity. Thus *Hevea* plantings on the east coast of Trinidad suffered little infection (Rands, 1924; Stahel, 1927; Tollenaar, 1954).

In an epidemiological study of leaf bilght conducted in Itubera, Bahia, Brazil it was observed that the disease may occur in every month of the year and peak infection is attained between September and October when annual refoliation following wintering occurs. Most conidia were recorded in spore traps during September to December, which coincides with refoliation. Observations made at different heights of a hill revealed that severity of the disease was most at the bottom with highest aerial spore count as well as the largest number of falling leaflets. This was presumably due to the higher relative humidity (<95%) for longer periods at the bottom than at the summit or slope. Another interesting observation was that when spore traps were fixed at three different heights, viz 1,5 and 10 m each on summit, slope ands bottom of the hill, in all the case more counts of conidia were obtained in the spore trap kept at a height of 1 m. The catch gradually decreased with increase in height of exposure of the slides (Rocha and vasconcelos Filho, 1978). This indicates that for plimary infection of the disease in the nurseries, the pattern of spore dispersal is contributing factor in addition at humid microclimate and the presence of tender leaves throughout the year.

Possible introduction and likely behaviour of the disease in Asia and Africa

It can be argued that because leaf blight has not appeared during nearly 100 years of existence of *Hevea* in the Orient, it is unlikely that it will spread to South-east Asia and Africa. However it is dangerous to hold this view, considering for example the history of coffee leaf rust caused by *Hemileia vastatrix*. Originating from East Africa' the fungus almost destroyed the coffee plantation industry in Asia more than a century ago. The crop has since been grown primarily in Brazil, where it enjoyed complete freedom from coffee leaf rust up to 1970. However, during that year it was discovered that coffee rust had spread to Brazil also. It is believed that the disease came to Brazil from West Africa through uredospores in air currents across 1000 km of the Atlantic Ocean. But, on the other hand, conidia and ascospores of *M ulei* cannot be carried to such long distances by air currents since they are much larger spores (conidia measure 23–65 X 5 10 μm on an average). A carrier like the host plant, other plants or plant parts, animals or man carrying the spores of the pathogen on their body may be required for any spread of the disease to far away places. If leaf blight is introduced into Asian and African countries it will spread rapidly through the nurseries and the vast, often contiguous rubber plantations. (Hilton, 1955).

Frequent air travel from American tropics to Asian and African countries are the main chance for spreading this disease in these countries. The picture of leaf blight in tropical America suggests that it would follow a more or less similar pattern in Asia and Africa, because of the similarity of climatic conditions in the rubber growing areas-humid tropical rain forests converted to plantations. The likelihood of its becoming more destructive in these two continents than in the Americas is greater, because of the extremely high susceptibility of the high-yielding oriental clones planted over large areas (Rao, 1973b).

If we consider the different rubber producing countries all the evidence indicates that those which have a well distributed rainfall or prolonged periods of humidity at the time of refoliation are subject to the greatest danger of infection in the nurseries and also to the greatest danger of infection in the nurseries and also to the greatest risk of spread of the disease to the mature plantations. This appears to be the case of Malaysia, Sumatra, South west Sri Lanka, Southwest India, the Cameroon, Ivory Coast and the Congo basin of Zaire.

In countries situated in higher latitudes and which have a more or less prolonged dry season, it is certain that even if infection did occur the disease would be less serious. The risks of infection are obviously less if there is less likelihood of the various conditions favourable to the germination of spores occurring together. One can be sure, however, that there is no rubber producing country where those conditions are not found at least in certain sitess and at certain periods of the year, and where the disease would not become endemic after the primary infection.

It is extremely probable that if accidental introduction occurred in Africa or the Far East, even in areas where climatic conditions are not favourable to a serious form of the disease, then all other producing countries in Africa or the Far East would be infected later unless there was rapid and complete eradication of the disease at the first infection site (Compagnon, 1976).

Mycrocyclus infects young leaves and developing shoots, as does *Oidium heveae* Steinm and *Colletotrichum gloeosprioides* [Penz.] Sacc. For the outbreak of all these three diseases rainfall is the main predisposing climatic factor. In Brazil leaf blight develops strongly in the state of Bahia which has an evenly distributed annual rainfall exceeding 2100 mm. Rao. [1973a] compared the epidemiology of *M ulei* with those of *O. heveae* and *C gloeosporioides* and concluded that the epidemiology of leaf blight is closer to that of *C. gloesporioides*. Chee [1980] considering the different climatic conditions in which leaf blight occurs, the biology of the fungus and mode of spore dispersal by rain and wind, stated that *M. ulei* could also behave like *O. heveae*, which survives the year round on scattered flushes on pollarded stumps, unhealthy plants under shaded conditions and in nurseries. This pathogen develops severely on the young leaves produced after wintering. *M. ulei* could similarly survive on the old leaves and provide an ascospore inoculum all year round [Chee 1976b].

Measures against the introduction and spread of South American leaf blight

Eradication

In case of an accidental introduction of this disease despite the phytosanitary measures, immediate adoption of eradication procedures should receive top priority. Destruction of the foliage and green shoots with the use of an appropriate defoliant would emliminate the opportunity for the pathogen to develop and sporulate. In Malaysia, as a precautionary test in the eradication of leaf blight, n-butyl 2,4,5-T was applied from the air to defoliate the rubber trees. A good result with a concentration of 5% [8% acid equivalent] in gasoline applied at the rate of 35 litres/ha was obtained. After one application, treated trees remained leafless for 4-6 weeks. Concentration was not critical in defoliation, but has marked effects upon the rate and amount of refoliation [Hutchinson, 1958]. Later, many similar trials have been conducted in Malayasia and a scheme for quick eradication of the disease in the event of an accidental introduction to South-east Asia has been worked out [Abdul Aziz, 1976; Lim and Hashim, 1977].

Aircrafts are essential for spraying large areas within a short period of time following a confirmed outbreak. It is also necessary to restrict movements of personnel through an infected area. An eradication belt of 500 meters wide around the infected area, which would be necessary[Rao, 1973b].

Chemical Control

Recent research on chemical control of leaf blight has produced good results in Brazil. From Belem, Rogers and Peterson [1976] reported good canopies and increased latex yield following chemical treatment. Rocha *et al* [1975] reported an increase in yield of 475 kg/ha following control of the disease. Alencar *et al* [1975) recorded an increase of 82.5% and Mainstone *et al* [1977] found that sprayed tasks yielded 60% more than the control tasks, with a maximum potential of over twice the yield of untreated tasks. It is therefore apparent that chemical control has great importance in combating the disease.

Nursery screening trials in Trinidad showed that four fungicides are effective in controlling leaf blight: thiophanate methyl [0.07% a.i.] benomyl (0.025% a.i] Chlorothalonil (0.15% a. i. and mancozeb (0.32% a.i.] Chee, 1978]. For suppression of conidial sporulation benomyl can be used. whereas thiophanate methyl [0 14% o.i.] inhibits the ascospore release. Hence, benomyl can be used during the early rounds in order to reduce sporulation of conidia and ascospores respectively [Chee, 1977; 1978]. The new systemic fungicide triadimefon has also shown promise. Thiophanate methyl, benomyl, chlorothalonil and mancozeb are being used on plantation scale in Brazil (Chee and Wastie, 1980]. Recently triadimefon [0. 015% a.i) triforine [0.038% a.i.] and bitertanol [0.03% a.i.] have also been shown to be effective in nursery trials. It was also observed that mixtures of systemic and protective fungicides are more effective than individual fungicides alone [Santos *et al*, 1984].

The use of various types of aircraft for spraying in Brazil against leaf blight has been discussed in detail [Matthews, 1976]. For aerial spraying, the concentration of fungicides used per ha is 300 gm Benlate [benomyl], 200 gm thiophanate methyl, 300 gm Bayleton [triadimefon], 1.6 kg Bravonil [chlorothalonil] or 2 kg Dithane M 45 [mancozeb For fogging, 200 g of thiophanate methyl or 1kg mancozeb per ha is used. Large scale fogging trials using three makes of fog generators are being conducted in Brazil. It was observed that, with an improved model of fog generator, about 200 ha can be effectively covered in a day. Fogging starts well before refoliation and continues for two months covering the entire refoliation period, with 12 rounds at an interval of 4–7 days. It has been claimed that 30-38% yield increase by fogging in the leaf blight-effected area in Brazil (Chee and Wastie, 1980; Martins e. Silva, 1978) was obtained.

In recent fogging trials conducted in India, against *Phytophthora* leaf fall disease, it has been observed that fogging is much cheaper than any other method of application (Thomson- *et al 1984*). Hence, fogging appears to have bright prospects in the control of leaf blight in the future, especially when encountering difficulty in securing sufficient numbers of aircraft in time.

Breeding for resistance

Breeding for disease resistance combined with high yield is the most important and permanent solution for combating leaf blight in Latin America and other parts of the World. The Ford Motor Company's breeding programmes have produced such promising clones as FX 25, FX 3899 and FX 3164 in Brazil while a similar effort by Firestone Rubber Company has produced numerous resistant clones in their MDF and MDX series in Liberia and Guatemala. *H. brasiliensis* from Madre de Dois and *H. benthamiana* from Rio Negro were found useful as sources of resistance against leaf blight (Subramanian, 1969). Of the vast number of resistant clones bred in Brazil only 14 of the first generation seem commercially acceptable for large scale planting. Among these only six clones are most generally acceptable: FX 25, 3810, 3899, 3925, IAN 710 and 717. Of these, four have the most effective resistant parent F. 4542 (*H. benthamiana*) and the other two have resistance from *H. brasiliensis* (IAN 710 from F 409 and FX 25 from F 351). One complicating factor noted is that in many instances susceptibility varies between localities. Thus FX2261 is suscetible in Belem and moderately resistant in Bahia, whereas FX 3899 and IAN 717 behave in the opposite fashion (Chee and Wastie, 1980). Breakdown of resistance by the occurrence of physiologic races is another problem encountered in breeding for resistance (Langdon, 1965)

Breeding for leaf blight resistance in Asia was primarily carried out by the Rubber Research Institutes of Malaysia and Sri Lanka. On the basis of an agreement signed in 1950 between RRIM and the Instituto Agronomico do Norte, Belem, Para, Brazil, exchange of clones between Malaysia and Brazil was started (Hilton, 1955). The leaf blight resistant clones imported into Malaysia during 1953/54 consisted of nine selections made in Fordiandia (six of *H. brasiliensis*, three of *H benthamiana*), two selections of *H. brasiliensis*, seedlings of Belem origin and 14 selections from cross of Ford clones and

Eastern clones (F1) a total of 25 clones (Brookson, 1956).

During 1957, a total number of 42 leaf blight resistant clones were introduced into Sri Lanka on an exchange basis from USDA plant introduction Station, Miami, Florida. These consisted of 15 selections of crosses of *Microcyclus* resistant clones, mainly F 4542 with high-yielding Eastern clones and 13 selections of first out crosses of clone F 4542 to an Eastern clone (Baptiste, 1958, 1959) The performance of leaf blight resistant clones in Malaysia was promising. An illegitimate progeny of FX25 proved to be the best population for yield and vigour. *H. benthamiana* from Rio Negro and *H. brasiliensis* from Madre de Dois gave lower yields compared with modern oriental selections but were, however fair, related to the original Wickham material. Nevertheless they are good sources of genes for resistance to *Mycrocyclus* (Subramanian, 1969).

Crown budding

The first attempt of crown budding with a leaf blight resistant crown on a high yielding trunk was made at Ford's Beltera in the Amazon Basin. All trees with eastern panel clones were top-budded with clones that had shown resistance to the disease at Fordlandia. Subsequently, this technique was practiced for a good number of years in the Americas (Tollenaar, 1959). Clones recommended for Crowns were FX 25, FX 614, FX 636, FX 645. FX 516, FX 2261, FX 2784, EX 3810, FX 3864, FX 3899, FX 3925, IAN 717, IAN 6486, IAN 7388, IAN 7390, IAN 7614AN 7657 and *H. pauciflora* clone PA 31 (Holliday, 1970; Pinheiro *et al* 1982).

The double graft technique did not become popular because of the effect of yield depression by the resistant crown on high yielding panel clones. However, recent developments in crown budding show promising results (Holliday, 1970) When *H. brasiliensis* panel clone was crown budded with *H. guianensis*, *H. spruceana*, *H. collina* and *H. confusa*, yield was better than that of the respective clones with the same tapping panel and crown (Ostendorf, 1948). However, it is suggested that to avoid an unfavourable interaction of the crown on the panel clone, crown budding should be done at a height of at least 2½ metres. (Rands, 1946).

Phytosanitary and quarantine measures

Strict phytosanitary and quarantine measures are being observed by Asian and African countries in importing plants, plant products and other materials from the leaf blight-endemic countries. (Anon, 1971; 1972). The RRIM has laid down the regulation that persons who are in contact with *M ulei* in leaf blight-endemic countries should arrange their visit to the East through Europe or temperate North America and stay there at least 4 days. Clothes, shoes, books and other personal belongings should be cleaned or disinfected there, during the stay. The International Rubber Research and Development Board (IRRDB) is also endeavouring to educate people about the danger of the spread of leaf blight by exhibiting posters in all international airports and by arranging training of scientists from leaf blight-free nations on leaf blight in Brazil.

Regional co-operation has been requested against introduction and spread of leaf blight. The measures recommended include strengthening plant quarantine, prompt action on eradication and establishment of country and regional committees entrusted with the duty to prevent introduction and spread of leaf blight. It is also stressed that an effective phytosanitary barrier is the only means to prevent the introduction of leaf blight (Rao, 1972, 1973 b).

The present quarantine measures would only be effective when the concerned person is well aware of the danger of the introduction of leaf blight into the disease-free areas. However, we need to reappraise these measures in the light of increased air travel from the American tropics to the Eastern hemisphere. Many of the travellers are not aware of the danger of leaf blight, and would not like to stop over in Europe or temperate North America. A quarantine break of journey in a temperate zone for about one week would seem superfluous unless all clothes are laundered and other personal effects disinfected, since the spore forms of *Microcyclus* can survive up to two weeks or even more in normal conditions.

Conclusion

South American leaf blight is the most destructive disease of *Hevea* rubber plant. Much progress has been made in the research on leaf blight in Brazil, the home of natural rubber. The possibility of the spread of this disease to the Eastern hemisphere is real Asian and African countries are much aware of this fact, and IRRDB and RRIM are taking great precautions to prevent the entry of leaf blight into the disease-free countries. However, the present phytosanitary and quarantine measures do not seem to be adequately effective in the prevention of intentional or non-intentional introduction of this disease. Therefore, the case for strengthening the quarantine measures is clearly strong.

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NEW TECHNIQUE FOR LINING CANAL

The Indira Gandhi Canal project authorities are going for a new technique to line the 4,800 km long distributory system under stage II of the canal's construction. The Central Water Power Commission has given clearance on an experimental basis, according to a spokesman. If the work, comprising rubber lining with a single tile cover, proves successful, the benefit of the project would accrue two years ahead of schedule.

Stage I of the canal is lined with brick tiles while stage II is lined with brick tiles in the initial stages and with cement concrete block with low density polythene sheets at a later stage.

No good quality clay is available to manufacture brick tiles in the area where the work is now under execution. Moreover, the area never had any tile culture because of the easy availability of stone. If the current system of double tile coverage is retained, the lining of the 4,800 km long distributaries would require no less than 200 crore such tiles.

The alternative was suggested to the project organisation by a number of senior engineers who had worked in Iraq, Iran, Algeria and Egypt. Hungary and Japan are manufacturing the special type of rubber sheets.