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Selected Leaf Diseases of Rubber: Symptoms and Control – A Review

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ABSTRACT: This paper is a review article with the objective of providing valuable, recent and solid information and critical understanding of symptoms and control of selected leaf diseases of rubber tree (*Hevea brasiliensis* Muell. Arg) using secondary information and data harvested from previously published studies found online. Data gathered showed that *H. brasiliensis* is subject to a plethora of economically important diseases mainly of fungal origin, classified as leaf, stem and branch, panel and root disease. Some fundamental causal organisms of leaf diseases in *H. brasiliensis* includes *Pseudocercospora ulei*, *Oidium heveae*, *Colletotrichum gloeosporioides* and *Corynespora cassiicola*. *Corynespora* leaf fall caused by *Corynespora cassiicola* is currently accepted as the leaf disease which causes about 45% of yield loss to rubber in mostly Asian and African continents. The symptoms of South American Leaf Blight (SALB) range from discoloration of lamina to death of tree when untreated. Leaf disease symptoms range from white powdery patches to shriveling and falling off of tender leaves and translucent brownish yellow spots in semi-matured leaves in *Oidium* leaf disease. *Colletotrichum* leaf disease symptoms range from necrosis of tender leaves of young plants to defoliation and death of entire plant. Disease control is achieved by the use of chemicals and planting of disease-resistant varieties. Some phylloplane fungi are prospective biological control agents. The best treatment to manage *Corynespora* leaf fall disease (CLFD) in nurseries is the introduction of overhead shading coupled with application of the fungicide mancozeb. Diseases affecting the leaves of *H. brasiliensis* can be devastating and can lead to loss of multiple rubber trees and reduction in the latex production of the trees. Therefore, adequate preventive, curative and control measures against the diseases should be taking to ensure maintenance of a healthy rubber tree plantation.

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Hevea brasiliensis Muell. Arg., the Para rubber tree, sharing tree, seringueira, or, most commonly, the rubber tree, belongs to the family Euphorbiaceae. It is the most economically important member of the genus *Hevea*. It economic importance is due to the fact that the milky latex extracted from the tree is the primary source of natural rubber (Anonymous, 2017). The rubber tree is subject to a plethora of economically important diseases mainly of fungal origin (Omorusi *et al.*, 2012). The four main parts of rubber tree affected by these diseases are the stem, leaves, root and panel area (Mazlan *et al.*, 2019). The South American Leaf Blight (SALB) is acclaimed to be the most devastating disease of rubber, and the *Corynespora* Leaf Fall (CLF) disease appears to be next in ranking to SALB, in its destructive effects (Omorusi *et al.*, 2012). This study was aimed at reviewing the symptoms and control of selected leaf diseases of rubber tree (*Hevea brasiliensis* Muell. Arg) using secondary information and data harvested from previously published studies found online.

Selected Leaf Diseases Affecting Rubber:
South American Leaf Blight: South American Leaf Blight (SALB) is a fungal disease of the rubber tree organs above the ground. It majorly occurs on leaves

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but sometimes on leaf stalks and stem in cases of very serious attack. The first symptoms are a discoloration of the lamina, then graying-green spot with a powdery appearance on the underside of the leaves, as a result of conidial sporulation. The pathogen responsible for the disease is the Ascomycete fungus, *Pseudocercospora ulei* (Jean and Vincent, 2018). This disease, for which no economical and effective control has yet been developed, remains a threat to rubber cultivation worldwide (Jean and Vincent, 2018).

Plate 1: a. Rubber tree (*H. brasiliensis*) plantation; **b.** latex collection from the trunk of *H. brasiliensis*
Source: Ken (2014)

on the pattern of wintering, clonal vulnerability and the conditions of the weather at refoliation (Liyanage, 1985).

Plate 2: South American Leaf Blight (SALB) disease of *H. brasiliensis* leaves
Source: Oghenekome and Clifford (2012)

Plate 3: *Oidium* leaf disease (powdery mildew) of *H. brasiliensis leaves*
Source: World Agriculture Info (2013)

Oidium leaf disease: The causal agent of powdery mildew of rubber was first described as *Oidium hevea* but later research on the morphological characteristics suggests that *O. hevea* was in the past confused with *Erysiphe quersicola.* However, the most appropriate classification is still under debate between the genera *Golovinomyces* or *Podosphaera* (Liyanage *et al.*, 2016). This disease caused by the ascomycete fungus *Oidium heveae* is the most common leaf disease of rubber. It affects the tender leaves produced soon after wintering, causing secondary leaf fall. It spreads widely and the extent of damage to the tree depends

Symptoms: The copper brown and apple green leaves are vulnerable to infection; white powdery patches characterize the appearance of the disease, as the fungal hyphae grow radially to form extensive circular colonies. When tender leaves are affected, they shrivel and fall off, and the leaf stalks are left behind 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 (Liyanage, 1985). 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, especially at higher elevations, could even result to decline of food reserves leading to dieback of twigs and branches, assisted by secondary invaders. The fungus also affects the flowers causing them to drop prematurely (Liyanage, 1985).

Generally, cool, misty mornings with intermittent light showers, during the refoliation period, provide most suitable conditions for the fungus to be propagated and disseminated quickly. Under these conditions, the fungus produces barrel shaped wind-dispersed conidia (Liyanage, 1985).

Control: Disease-tolerant clones such as RRIC 102 should be planted. Infection will be reduced by planting early wintering clones, as the new foliage can mature before the beginning of weather conditions suitable for the fungus (Liyanage, 1985). 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 epecially 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 (Liyanage, 1985). Dusting should commence when 10-20% of the trees show signs of refoliation. Dusting operations should preferably be completed before 7:00 am. to take advantage of the absence of wind and the presence of dew, which allows for sulphur retention 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. in order to ensure that the sulphur reaches the leaves on the tree tops (Liyanage, 1985). Application of an extra dose of nitrogen just after wintering also helps in the reduction of the intensity of leaf fall by *Oidium* by allowing the leaves to mature quickly (Liyanage, 1985)

Colletotrichum leaf disease (CLD): Since 1900's, the pathogen *Colletotrichum gloeosporioides* has been considered as the causative agent of this disease in all rubber growing countries in the world (Thambugala and Deshappriya, 2009). However, observation of a recent study in Sri Lanka revealed that the fungus *Colletotrichum acutatum* also plays significant role in the development of CLD in rubber plantations (Thambugala and Deshappriya, 2009). Investigation carried out using in vitro study showed that *C. acutatum* causes larger lesion than *C. gloeosporioides* (Thambugala and Deshappriya, 2009). Result obtained from the experiment also revealed that the two fungi can synergize in causing CLD if *C. acutatum* is introduced before *C. gloeosporioides* (Thambugala and Deshappriya, 2009). 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 (Liyanage, 1985).

Plate 4: ***H. brasiliensis leaves infested with Colletotrichum leaf fall disease***
Source: World Agriculture Info (2013)

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 petiole on the stem for a short period. 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 (Liyanage, 1985). 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 (Liyanage, 1985).

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 quickly taken into the plant and redistributed to tender leaves, hence preventing the disease from being established. If the disease results in 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. Sufficient manure must be applied to trees subjected to extensive damage to improve the health of the plant (Liyanage, 1985). A study carried out by Evueh and Ogbebor (2008) revealed that phylloplane fungi can serve as biocontrol agent against *Colletotrichum* leaf disease of rubber (*H. brasiliensis* Muell. Arg.). *Aspergillus* sp. lysed the cytoplasm of *Colletotrichum gloeosporioides* on Potato Dextrose Agar while *Trichophyton* sp. and *Gliocladium* sp. antagonised *C. gloeosporioides* by overgrowing on it (Evueh and Ogbebor, 2008).

The Corynespora Leaf Fall (CLF): Corynespora leaf fall caused by *Corynespora cassiicola* is currently accepted as the leaf disease which causes rubber destruction the most in Asian and African continents; about 45% of yield loss (Umoh and Fashoranti, 2018). The widespread and epiphytotic status of the disease has been reported in most rubber-growing countries of South East Asia. The CLF disease was first reported in India in 1958 and Malaysia in 1960 with an epidemic proportion in 1965 affecting two outstanding clones RRIC 103 and RRIM 275 (Omorusi *et. al.,* 2012).

Plate 5: Die back caused by *C. cassicoll*
Source: Ogbebor (2010)

The increase and seriousness of the disease may be linked to the pathogen's ability to cause various kinds of disease in the host plant (Dixon *et al*., 2009). *Corynespora* had the greatest incidence of leaf diseases with an index range of 26.19 to 40.19; while *Colletotrichum* leaf fall had the least, ranging from 7.61 to 17.91(Ogbebor, 2010). The pathogen causes the fall of both young and old leaves all year round. This may lead to dieback (Plate 4), delay in maturation of young rubber trees, yield decline of about 45% of mature rubber trees (Ogbebor, 2010) and even plant death on vulnerable clones (Jinji *et al*., 2007). According to Malaysian observations, spore dispersal is at the peak during dry season, but infections occur when the leaf surface is wet (Jayasinghe, 2000a).

Control of Corynespora Leaf Fall Disease (CLFD): Jayasinghe (2000b) have recommended frequent spraying of fungicides on polybag nurseries during the rainy season. The best treatment to manage *Corynespora* leaf fall disease (CLFD) in nurseries is by introducing overhead shading coupled with application of the fungicide mancozeb. The fungicide mixture (carbendazim + mancozeb) applied at 7 days interval and carbendazim sprayed at 2 weeks interval alongside with shade, showed equally good results. Carbendazim (0.5 g/l) sprayed at 7 or 10 days interval, the application of other fungicides, mancozeb, metalaxyl 8% + mancozeb 64%, captan and propineb, at 3 g/l at 7 days interval was also effective (Fernando *et al.,* 2010).

Conclusion: Diseases affecting the leaves of *H. brasiliensis* can be devastating leading to loss of multiple rubber trees and reduction in the latex production of the trees and hence a reduction in rubber-exporting nation's foreign exchange as a result of decline in rubber exportation. Therefore, adequate preventive, curative and control measures against the diseases should be taken to ensure maintenance of a healthy rubber tree plantation.

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