

CYLINDROCLADIUM
**CYLINDROCLADIUM LEAF SPOT DISEASE OF RUBBER: A REVIEW
ON THE CAUSATIVE AGENT**

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SUMMARY

Cylindrocladium leaf spot disease of rubber is presently confined to Malaysia and China and identified as a potential leaf disease of *Hevea* in Sri Lanka. It causes numerous chlorotic pin-head type of spots leading to leaf fall during monsoon periods with overcast humid weather. The causative fungus, *Cylindrocladium quinquesepatum* is easily identified from the multiseptate cylindrical conidia, septate stipe with clavate vesicle and pigmented chlamidospores which aggregate to form microsclerotia. This pathogen is widely distributed in the humid tropics and has a wide host range. Fungicide

screening tests carried out in Australia, India and Sri Lanka revealed that benomyl, captan, mancozeb and carbendazin are potential chemicals in the management of the diseases caused by this fungus.

Key words: *Cylindrocladium quinqueseptatum*, geographic distribution, *Hevea brasiliensis*, host range, management

Cylindrocladium leaf spot disease (CLSD) was first reported on rubber in Malaysia in 1972 (Anon, 1972). The only other rubber growing country where this disease is present on *Hevea* is China (Kaiming, 1987). In Malaysia, the damage caused was insignificant up to late 1980's and in 1987 the disease caused defoliation of several clones in budwood nurseries and in the field plants. The most susceptible *Hevea* clones in Malaysia were PB 86, RRIM 607, RRIC 36, PC111 and PC 121 (Anon, 1990). In 1988, at a workshop held in Rubber Research Institute of Malaysia, Experimental Station, Sungei Buloh, CLSD was shown to be a potentially threatening leaf disease of *Hevea* rubber. Two years later attention of the pathologists was drawn to CLSD again by Chee (1990) stating that this disease has come into prominence in Malaysia.

Although the causative agent, *Cylindrocladium quinqueseptatum* is not yet recorded on rubber in Sri Lanka, this fungus has been proved to be a serious pathogen of clove, a popular spice tree grown in same localities where rubber is also cultivated. Cross inoculation studies carried out in 1996 indicated that clove isolate is capable of attacking rubber plants and pathogen is wide spread in most of the agroclimatic zones where cultivation of rubber is recommended (Jayasinghe & Wijesundera, 1996b). Further, it is of interest to note that the clone RRIC 36, one of the rubber clones severely affected in Malaysian budwood nurseries was developed in Sri Lanka and sent to Malaysia in 1954 under the multi lateral clone exchange programme.

With the above background this presentation reviews the species concept, host range, geographic distribution and management strategies of the causative agent of CLSD in rubber.

Causative fungus, Cylindrocladium quinqueseptatum

The fungus *Cylindrocladium quinqueseptatum* was first isolated in Indonesia during the year 1941 by W. Ch. Slooff, from leaves of clove seedlings. The pathogenicity of the fungus was established and has been the subject of a companion paper by Reitsma and Slooff (1950). The original description of the species was also documented in the same year by Boedijn & Reitsma and the species was erected as *Cylindrocladium quinqueseptatum* Boedijn & Reitsma (Boedijn & Reitsma, 1950). Later, Peerally (1974) provided a short account on the morphology, pathogenicity, host range and geographic distribution of this fungus. More recently keys to identify this species were published in the reviews by Peerally (1991) and Crous & Wingfield (1994). Jayasinghe and Wijesundera (1996a) studied culture characteristics and

reproductive morphology of the clove isolate from Sri Lanka and reported that colonies on Czapek dox agar (CDA) had submerged mycelial growth. Centre of the colony was whitish brown and slightly cottony. Periphery was dark reddish brown, gelatinous, flattened with numerous chlamidospores in chains. They may aggregate to form microsclerotia. Conidiophore hyaline, dichotomously branched near the apex. The main axis of the conidiophore elongates into a septate stipe which terminates as a clavate vesicle. Conidia (70-110 x 5-8 µm) hyaline, cylindrical, 3-8 septate mostly with 5-septate. Pigmented chlamidospores are produced on CDA in chains. They may aggregate to form microsclerotic arranged in rows.

Jayasinghe and Wijesundera studied the biology of this fungus extensively and provided information on cultural and pathogenic variation among the different isolates (1996b); production, germination and viability of spores (1995a) and biochemical strategies in infection (2000). They pointed out that *C. quinqueseptatum* isolates show a great deal of variation in their morphology and biology. Further, free water or a film of water (resulted as dew formation at 100% RH) was shown to be essential for spore germination and to cause the infection. It was also proposed that toxins play a vital role in initial stages of infection and development of symptoms while latter stages of interaction may be due to the activity of cellulolytic enzymes.

Disease symptoms on rubber

Disease spreads during the overcast wet weather. Under favourable weather conditions young rubber leaves infected with the fungus shrivel, blacken and fall. On mature leaves, spots appear as numerous chlorotic pin-heads and the infected leaves turn purplish brown, surrounded by a prominent yellow halo.

Host range and geographic distribution

Cylindrocladium quinqueseptatum causes damping-off, root rot, seedling blight, leaf spot, foliage and shoot blight, extensive defoliation and die-back on a wide variety of hosts including ornamental and forest plants and the fungus is widely distributed in the humid tropics. It has been consistently recorded as a serious pathogen of several *Eucalyptus* spp, including *E. grandis* (Hills) Maiden, *E. tereticornis* Sm. *E. microcorys* F. Muell. in Northern Australia (Pitkethley, 1976; Bolland *et al.*, 1985), Brazil (Figueiredo & Namekara, 1967) Central and Southern India (Sharma & Mohanan, 1982), Mauritius (Peerally, 1974) and Vanuatu (Ivory *et al.*, 1993).

This species is a major pathogen of *Eugenia caryophyllata* L. (clove) in nurseries and plantations and the first report of the occurrence of *C. quinqueseptatum* on clove was reported in 1950 from Indonesia (Reitsma & Slooff, 1950). There are several reports of this pathogen causing seedling and leaf blight on cloves in high rainfall areas during the monsoon in (June-September) Kerala, India. Sarma & Nambiar (1978) has reported the fungus on leaves of mature clove trees and on

seedlings. According to Wilson *et al.*, (1979) *C. quinqueseptatum* in mixed infection with *Colletotrichum capsici* caused leaf spots on mature clove and seedling death in Kerala. In Sri Lanka, *Cylindrocladium quinqueseptatum* was first isolated from clove in 1982 (Jayasinghe & Liyanage, 1982) from Ratnapura district where it was reported to cause considerable mortality of seedlings in nurseries. Subsequently, it was found that this pathogen also causes severe defoliation of young plants especially during the South-West monsoon (May-August) period.

C. quinqueseptatum is also reported to infect *Hevea brasiliensis* Muell. Arg. in Malaysia (Anon, 1972) and in China (Kaiming, 1987) as stated above.

Leaf spots and premature defoliation of *Acacia* spp. caused by *C. quinqueseptatum* has been reported from India. The severely affected species are *A auriculiformis*, *A Cunn.* ex Benth and *A mangium* Wild (Mohanani & Sharma, 1988). The other hosts where the natural infections have been recorded are *Annona squamosa* L in Brazil (Figueiredo & Namekata, 1967), *Terminalia paniculata* Roth in India (Mohanani & Sharma, 1985) and *Camellia sinensis* (L) Kuntz. in Mauritius (Peerally, 1974).

In addition to the reports of natural occurrence, various workers have shown the susceptibility of wide variety of hosts by inoculating them with a conidial suspension or actively growing cultures of *C. quinqueseptatum*. For instance, Sarma and Nambiar (1978) observed that this pathogen could infect five myrtaceaeus hosts namely, *Eucalyptus globulus*, *Eucalyptus grandis* W. Hill ex maiden, *Eucalyptus maculata* Hook, *Eugenia jumbolana* and *Pimenta dioica* in India. Other Indian reports show that additional fourteen hosts viz., *Achras sapota* L, *Ageratum conyzoides* L, *Anacardium occidentale* L, *Citrus sinensis* Osbeck, *Clerodendran infortunatum* Gaertn, *Croton sparsiflorus* Morong, *Euphorbia hirta* L, *Lucas aspera* Spreng, *Malphigia puniceifolia* L, *Manihot esculenta* Crantz, *Myristica fragrans* Houtt., *Psidium quajava* L, *Side acuta* L and *Synedrella nodiflora* L are susceptible to *C. quinqueseptatum* on inoculation. Bolland *et al* (1985) carried out a screening programme in Northern Australia on *Eucalyptus* spp. and reported that *E cloeziana* F Muell. and *E sphaerocarpa* Johnson & Blaxell are the most susceptible species.

Disease management

Several *in vitro* and *in vivo* investigations have been carried out to screen fungicides against different isolates of *C. quinqueseptatum* in Australia, India and Sri Lanka.

With regard to the *Eucalyptus* isolate Bolland *et al.*, (1985) showed that benomyl, captan and mancozeb may be used in management of twig and branch lesions which result in blight of *Eucalyptus* spp. while only mancozeb is capable of controlling leaf spots. Further, he added that chemical control is possible only when trees are small and hence, the practical solution will be the use of disease tolerant species. Anahosur and others (1977) showed that carbendizim followed by thiram, hexaferb and mancozeb are effective in inhibiting the growth of the fungus. Sharma

and Mohanan's (1991) study on evaluation of fungicides against clove isolate of *C. quinqueseptatum* offers valuable results as they employed a conidial germination inhibition technique, poisoned food technique and soil fungicide screening technique in their screening procedure. From the results of this detailed study they showed that carbendazim is very promising in checking spore germination, growth of microsclerotia and mycelia of *C. quinqueseptatum*. Jayasinghe and Wijesundera (1995b) performing the same techniques showed that benomyl, mancozeb, metalaxyl 8% + mancozeb 64% and oxadixyl 10% + mancozeb 56% are potential chemical in the management of the clove isolate of *C. quinqueseptatum*. Further, same authors identified several *Hevea* genetic material resistant to CLSD and suggested to incorporate these material in *Hevea* breeding programmes as a long term solution to this problem (Jayasinghe & Wijesundera, 1996b).

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