

Research Article

Dynamics of *Corynespora* Leaf Fall and *Colletotrichum* Leaf Spot Diseases of Rubber Plants (*Hevea brasiliensis*)**M J Manju, V I Benagi, T H Shankarappa, C Kuruvilla Jacob and K K Vinod***Hevea Breeding Sub-Station, Rubber Research Institute, Kadaba 574221, Karnataka, India. E-mail: manjumjm@yahoo.co.uk***Abstract**

A field study was carried out to understand the dynamic nature of two major leaf diseases, *Corynespora* leaf fall (CLF) and *Colletotrichum* leaf spot (CLS) of rubber plants (*Hevea brasiliensis*). These diseases appeared regularly in the rubber plantations and caused more damages to younger leaves. Fresh infection of CLF disease was observed in the plantation from the second fortnight of January during the period of refoilation and the disease intensity was maximum from the second fortnight of March to the first fortnight of April. The disease decreased considerably after the onset of rains and remained mild until the next reflushing season. The disease intensity was limited to refoilation period after the annual wintering and warm humid periods only. The CLS disease was present throughout the year in the plantation at all the stages of leaves. However, the disease intensity was mainly confined to younger plantations. The disease was found to establish with the refoilation and became more severe during the rainy season and warm humid months. Unlike CLF, this disease did not cause considerable economic damage to mature rubber, but it is a serious problems in nurseries and for very young rubber plants in the main field.

Key words: *Colletotrichum* leaf spot, *Corynespora* leaf fall, *Hevea brasiliensis*, rubber plants

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Leaf diseases of rubber plants (*Hevea brasiliensis* L.) caused by *Colletotrichum* sp and *Corynespora cassiicola* have become more apparent in almost all rubber growing countries. These two leaf diseases are more common in rubber growing regions in India and appear regularly in rubber plantations of all ages including nurseries. Normally *Corynespora* leaf fall (CLF) disease occurs during the drier months after the refoilation (Manju et al 2001) and *Colletotrichum* leaf disease (CLS) is more prominent during the rainy season as well as high humid months (Deka et al 1996; Singh et al 1998). Severe outbreaks of these diseases make the trees bare of leaves or with unhealthy foliage and retarded growth, thus prolonging the immaturity period. Epidemic and repeated occurrence of these diseases cause severe yield losses in yielding plantations and economic impact of these diseases has been reported from major rubber growing countries in South and Southeast Asia (Edathil et al 2000; Jacob et al 2006). Both these disease are reported to be serious threat for rubber growers in Sri Lanka as well as Indonesia (Chee 1990). In Sri Lanka, a popular high yielding clone RRIC 103 had to be uprooted and withdrawn from the planting recommendation due to severe outbreak and spread of CLF disease (Jayasinghe et al 1996).

Rubber plantations in India is mainly concentrated in coastal Karnataka, Kanyakumari district of Tamil Nadu and Kerala. This region has warm humid

climate with prominent rainy season. Hence, a study on the development of the diseases and severity during the period of infection is more essential for forecasting the disease progress and advocating timely control measures. Therefore, the present investigations were undertaken to study the dynamic nature and development of major leaf diseases in rubber plantations in Karnataka.

Materials and Methods

The study was carried out at Hevea Breeding Sub-Station of the Rubber Research Institute at Nettana, Karnataka during 2007 – 2009. Experiments were designed and conducted in a susceptible clone RRII 105. For assessment of *Corynespora* leaf fall (CLF) infection, plots with 25 plants were selected. Selected plots were maintained unsprayed throughout the study. Disease assessment for *Colletotrichum* leaf spot (CLS) was done in bud wood nursery. Periodic observations on disease progress were recorded from the demarcated plants at fortnightly intervals. From each selected plant, five leaflets from randomly selected four twigs were scored for the disease intensity. Severity of the disease was assessed on a 0 to 5 scale based on the intensity of spotting, leaf deformation and leaf fall. The scale used for CLF disease assessment was: 0 = No disease, 1 = very light (five spots), 2 = light (up to 10 spots and 5% leaf fall), 3 = moderate (lesions and 10.1 - 25% leaf fall), 4 = severe (lesions and 25.1 - 50% leaf fall), 5 = very severe (many lesions and >50% leaf fall). For CLS

disease assessment, the scale as per Manju et al (1996) was employed. Disease severity percentage was calculated in both the cases (McKinney 1923). Average disease severity over months was computed from the seasonal data. To depict the pattern of disease occurrence and establishment, the observed data were compared with the leaf development pattern during the year.

Results and Discussion

Periodic development of CLF and CLS diseases in rubber plantation in three consecutive disease seasons are presented in Table 1. The periodic disease intensity in relation to temperature and rain fall is depicted in Fig.1. Results of the study indicated that both the diseases persist in the rubber plantation throughout the year and intensity varies from period to period.

Development of CLF disease. During the first season CLF disease recorded greater severity from the March second fortnight (60.9%) to the first fortnight of May (59.8%), with the maximum disease severity of 75.6% during the second fortnight of April (Table 1). Similar trend was noticed during second and third seasons also. During the second season, high (56.6%) disease severity was recorded during the second fortnight of March, and it was 68.5% during the first fortnight of April during the third season. The relative disease severity was more during the first disease season than the other two.

Development of CLS disease. This was found to be severe during the rainy season as well as high humid months, from July to November. In the first season, the

disease was seen to commence from second week of March and increased up to June. The highest severity of 60.0% was reached during the first fortnight of August, receding to mild levels by the end of November (Table 1). Similarity of the infection trend was observed during subsequent seasons too, reaching maximum intensity of 49.8, and 49.7% during the first fortnight of August in second and third disease seasons, respectively. Like CLF disease the severity of the CLS disease was more during the first season.

In the present study, it was found that maximum temperature (T_{max}) ranged between 30 – 40 °C in all seasons during March, followed by high temperature and moderate rainfall during April. During this period CLF disease had reached its maximum severity and CLS was found gaining more severity as rainy months approached by June (Fig. 1). Weather parameters play an important role in disease severity, among them temperature, humidity and rainfall are the major factors to influence the infection rate especially during refoliation period (Sailajadevi et al 2005). *Corynespora cassiicola* thrives very well under high humid condition with the temperature range of 28 - 30 °C and long sunshine hours (Situmorang et al 1996; George and Pannikar 2000). Unlike *C. cassiicola*, *Colletotrichum* is less aggressive and prefers cloudy weather, more rainy days, slight sunshine and temperature of 29 °C (IRRDB 1994). Also damage caused by CLS in main field was less, but can cause severe damage in the nursery of the first and second year old plantations.

Table 1. Development of *Corynespora* leaf fall and *Colletotrichum* sp. leaf spot diseases during three disease seasons (2007 – 2009)

Months	Disease severity (%)				Disease severity (%)				Disease severity (%)			
	Season I				Season II				Season III			
	CLF disease		CLS disease		CLF disease		CLS disease		CLF disease		CLS disease	
	I FN	II FN	I FN	II FN	I FN	II FN	I FN	II FN	I FN	II FN	I FN	II FN
Jan	1.7	2.3	2.5	2.8	1.6	2.2	2.8	2.4	2.0	2.5	2.7	2.9
Feb	6.4	14.5	2.3	3.1	8.4	19.8	2.4	2.9	7.0	16.6	2.8	3.9
Mar	31.0	60.8	10.4	12.6	33.2	56.6	9.2	11.2	31.6	58.0	10.0	11.6
Apr	74.4	75.6	13.4	16.0	45.0	32.8	12.4	15.6	68.5	50.4	13.6	16.3
May	59.8	34.4	17.2	17.5	27.0	19.6	16.2	17.6	30.7	13.0	19.2	20.2
Jun	15.1	11.4	22.0	30.0	11.4	8.8	19.6	24.4	9.5	5.3	21.6	27.6
Jul	4.4	3.4	31.2	36.0	3.0	3.1	28.0	31.5	3.0	2.8	28.8	31.6
Aug	3.1	2.6	60.0	58.0	2.1	2.0	49.3	48.0	2.0	1.60	49.6	47.0
Sep	2.6	2.5	47.0	40.0	1.8	1.9	39.7	30.9	1.6	1.8	44.0	38.0
Oct	2.0	2.00	36.0	30.0	1.7	1.8	26.0	24.7	1.7	1.3	37.6	35.6
Nov	1.9	1.8	23.3	20.0	2.0	1.7	20.0	13.5	1.3	1.4	28.0	17.3
Dec	1.9	1.7	12.4	8.4	1.6	1.6	7.9	6.8	1.4	1.3	8.6	8.4

Note: FN = Fortnight.

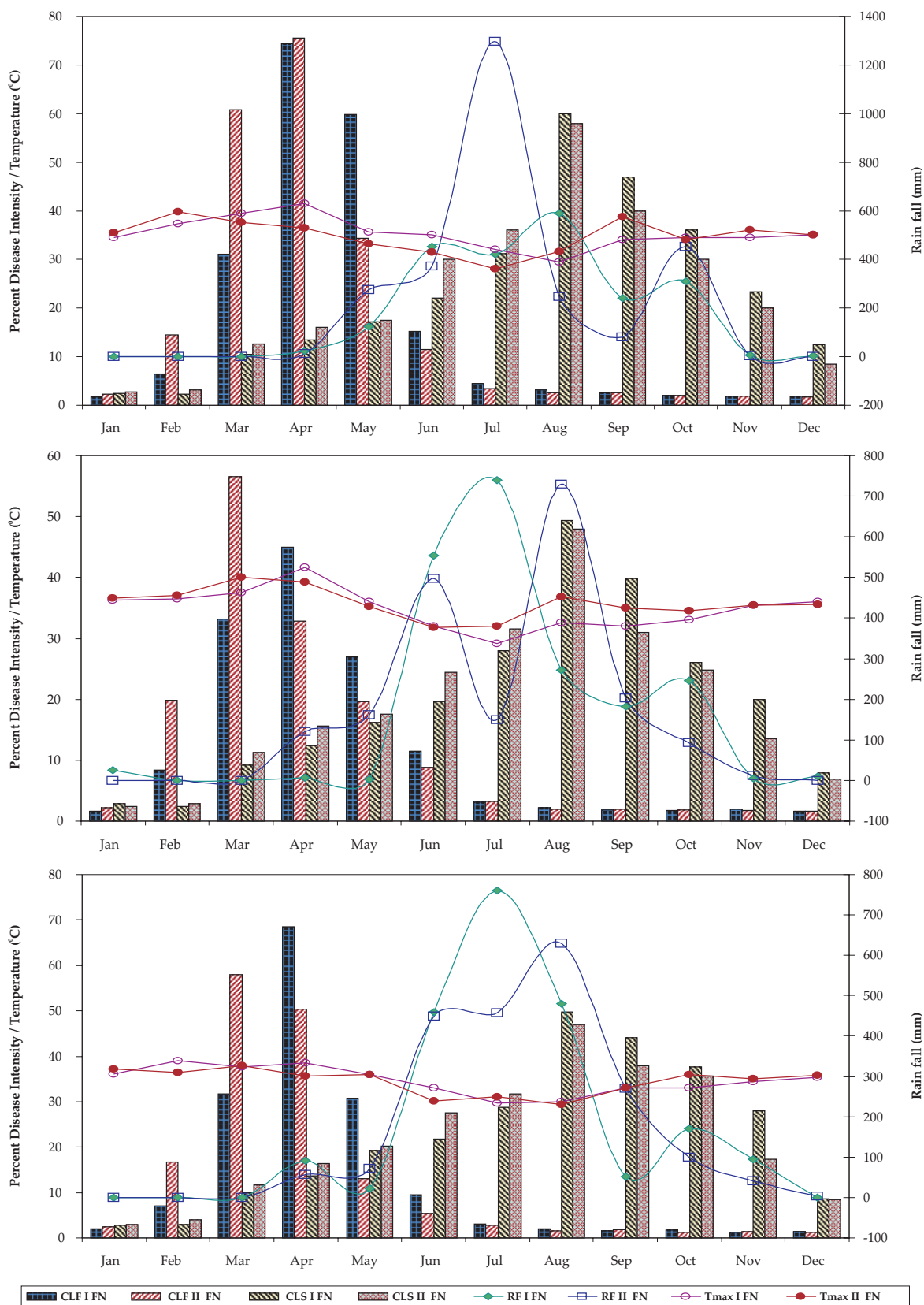


Figure 1. Severities of *Corynespora* leaf fall and *Colletotrichum* leaf spot diseases in relation to mean monthly maximum temperature and rainfall during three disease seasons (2007 - 2009)

The general stage of leaves in plantations throughout the year is depicted in Table 2. A pictorial representation of the disease development round the year for both the disease is given in Fig. 2. In case of CLF the disease severity reached maximum during March - April and it remained mild (<10%) during June-January. The period from February to April coincides with the natural refoliation in rubber plants after the annual regular leaf fall called wintering. *Corynespora cassiicola* attacked new flushes and fresh infections were generally noticed during the second fortnight of February. It was found that, under natural conditions, severe disease was noticed at the stage when a greater portion of the canopy was covered with light green leaves. After the establishment of the fresh infection in plantation, the disease progress was rapid, severity increased almost instantaneously soon after the formation of young leaves. Moreover, the infection at this stage caused severe leaf shedding, and the infected trees were rapidly exhausted of their reserves as the flushes developing subsequently were also infected (Table 1). This is the reason for the availability of young leaves during the month of May, where again disease severity was high. The disease, however, gets considerably suppressed after the onset of continuous rains, and the leaves developed after May generally mature without much infection. The disease symptoms are observed to be present in the plantation without causing much damage during rainy season.

CLS disease on the other hand, was found throughout the year in the plantation, except during December-February, which is the actual leaf fall period. It is found to establish from the period of refoliation,

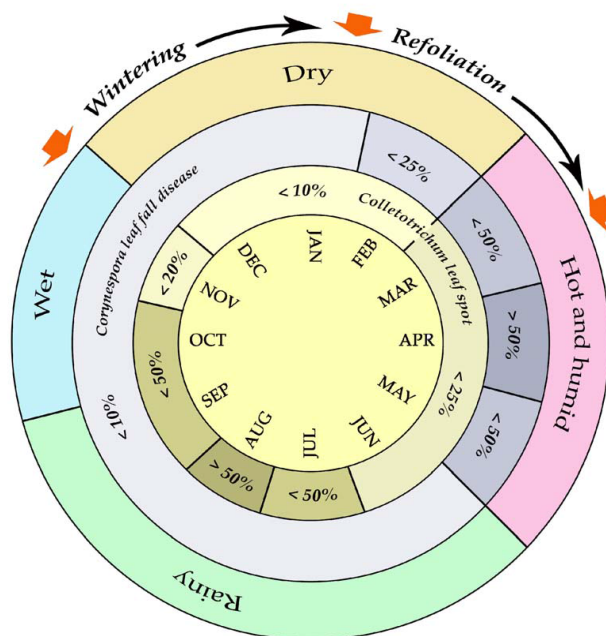


Figure 2. A generalized annual development pattern of *Corynespora* leaf fall and *Colletotrichum* leaf spot diseases in infected rubber plantations

causing considerable damage at very young leaves at the copper brown stage and light brown stage. Unlike CLF, this disease does not cause leaf fall in the stages beyond light brown stage. In light green stage and beyond it causes severe deformation, thereby reducing the active leaf area considerably. It becomes more severe and infects the young leaves which develop after the onset of

Table 2. Different developmental stages of leaves and their approximate representation of canopy during different months of a year

Month	Leaf stages									
	Copper Brown		Pale Brown		Light green		Green		Dark green	
	I FN	II FN	I FN	II FN	I FN	II FN	I FN	II FN	I FN	II FN
Jan*	—	—	—	—	—	—	++	+	++	++
Feb	+	++	—	+	—	+	—	—	—	—
Mar	+++	+	++	++	+	+++	+	+	—	—
Apr	+	—	+	+	+++	++	++	++	+	++
May	—	—	—	—	+	+	++	++	++	+++
Jun	—	—	—	—	—	—	+	—	+++	+++
Jul	—	—	—	—	—	—	—	—	+++	+++
Aug	+	—	—	+	—	—	—	—	+++	+++
Sept	—	+	—	—	+	—	+	—	+++	+++
Oct	—	—	—	—	+	+	+	+	+++	+++
Nov	—	—	—	—	—	—	—	—	+++	+++
Dec*	—	—	—	—	—	—	—	—	+++	++

* Wintering in progress; FN = Fortnight; Leaf stage score scale: — = Nil; + = 0-25%; ++ = 26-50%; +++ = 51 - 100%.

rains, besides prevailing on mature leaves as leaf spots and deformation, thus making it more of a rainy or wet season disease. However, this disease does not cause exhaustion to the infected trees like that in CLF disease by repeated defoliation.

Both these diseases are considered to be major leaf diseases of rubber plants, as both in combination are present throughout the year in plantations. These diseases, especially CLF can cause severe damage at the refoliation period, causing repeated leaf fall, leading to die back and even death of the plant in severe cases. Therefore, control or suppression of disease in their peak severity period is very essential to maintain the health of the plantations in subsequent seasons.

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