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Major Diseases of *Hevea brasiliensis* in Rubber Growing Regions of South India

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Abstract Disease surveys were conducted to appraise the incidence and severity of major leaf diseases of rubber in the non-traditional rubber growing areas of South India. Abnormal leaf fall (ALF) disease caused by *Phytophthora* sp., powdery mildew (PM) caused by *Oidium heveae*, colletotrichum leaf spot (CLS) caused by *Colletotrichum* spp and corynespora leaf fall (CLF) caused by *Corynespora cassiicola* were the disease included in the study. The study revealed that ALF, PM and CLS occured consistently in almost all the plantations surveyed, while CLF was not so wide spread in hilly areas. In Subramanya, Puttur, Belthangady, Kundapura and Sullia areas the incidences of both CLS and CLF occurred to aggravate the damage. Observations on incidence of diseases on different clones revealed that the clones, RRIM 600 and GT 1 suffered severely from ALF and PM diseases where as RRH 105 from CLF and CLS diseases.

Keywords Coastal region, Disease survey, Hilly region, Rubber diseases.

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Introduction

Natural rubber (*Hevea brasitiensis* Muell. Arg.) plants suffer from several leaf diseases in different stages of its growth in nursery, immature and mature plantations. Among them, abnormal leaf fall caused by *Phytophthora* sp., colletotrichum leaf spot disease caused by *Colletotrichum acutatum*, powdery mildew caused by *Oidium heveae* and corynespora leaf fall disease caused by *Corynespora cassiicola* occur regularly and cause more damage to plant growth and yield. Abnormal leaf fall and gloeosponum leaf spot diseases appear during rainy seasons, whereas, powdery mildew and corynespora leaf fall diseases occur during dry season, just after the period of wintering. Abnormal leaf fall is reported to cause a yield loss of 30 to 50% [1]. A reduction in crop production of 7 to 45% due to gloeosponum leaf disease also has been reported [2]. Severe outbreak of powdery mildew was reported to cause an annual yield loss of 14 to 29% [1, 3]. Corynespora leaf fall disease in most cases leads to serious loss in production of about 20–25% [4]. Severe incidence of corynespora leaf fall disease was observed in coastal Karnataka region and is found spreading towards traditional rubber growing regions in Kerala. Considering the damage caused by these diseases, the investigations were undertaken to study the changes in disease distribution, severity and clonal susceptibility in the rubber growing locations of coastal and hills of Konkan regions.

Table 1. Occurrence of major leaf diseases of rubber in coastal and hilly regions of South India. ALF–Abnormal leaf fall, PM–Powdery mildew, CLS–*Colletotrichum* leaf spot, CLF–*Corynespora* leaf fall.

Location	Occurrence of diseases (%) ALF	PM	CLS	CLF
Coastal region				
Kundapura	89.77	100.00	91.52	79.20
Mangalore	100.00	100.00	100.00	85.00
Belthangady	100.00	100.00	100.00	100.00
Subrahmanya	100.00	100.00	100.00	100.00
Puttur	100.00	100.00	100.00	90.00
Sullia	100.00	100.00	100.00	100.00
Hilly region				
Thirthahalli	72.21	100.00	75.00	20.00
Sagar	81.94	100.00	76.38	25.00
Sampaje	100.00	100.00	100.00	76.76

Materials and Methods

Surveys on major diseases were carried out in the rubber growing locations in Konkan regions. Abnormal leaf fall (ABLF), colletotrichum leaf spot (CLS), powdery mildew (PM) and corynespora leaf fall (CLF) diseases were included in the survey. The surveys for PM and CLF diseases were undertaken between January—May and that of ALF and CLS was between July —October during the year 2009—12.

The plantation units distributed over Kundapura, Mangalore, Belthangady, Puttur, Subramanya and Sullia of coastal region and Thirthahalli, Sagar and Sampaje of hilly regions were studied for disease occurrence. A total of 214, 237 and 231 sites were visited respectively during the first, second and third consecutive disease seasons.

Disease assessment of each selected site was done from sample size of 25 randomly selected plants for each available clone. The severity of the disease was assessed on a 0—5 scale based on intensity of spotting, leaf deformation and leaf fall for CLS, PM and CLF from leaves of comparable growth stage and based on per cent leaf fall for ALF disease [5]. The per cent disease intensity was calculated from the average disease score by using the formula of McKinney.

Results and Discussion

The diseases studied for their incidence of occurrence were widely distributed throughout the regions. The occurrence of the disease among the locations surveyed is presented in Table 1. It was found that with an exception of Kundapura region, all the sites surveyed under coastal Karnataka region had three major diseases viz. ALF, PM and CLS. In Kundapura PM was found to be more prevalent than other diseases in most of the plantations, however CLF was

Table 2. Intensity of abnormal leaf fall and powdery mildew diseases of rubber in coastal and hilly regions. The location means followed by same letters under each year are significantly not different at $p = 0.05$ by LSD test.

Location	Disease intensity (%) Season–I ALF	PM	Season–II ALF	PM	Season–III ALF	PM
Coastal region						
Kundapura	43.00^{c}	51.75^{a}	22.50^{bed}	38.66^{ab}	46.25^{ab}	50.50
Mangalore	55.71^{a}	34.28^{c}	34.62^{abc}	25.33^{c}	52.85^{a}	31.60^{c}
Belthangady	45.55^{c}	36.00^{c}	36.11^{a}	28.28^{c}	51.43^{a}	35.33^{be}
Subrahmanya	58.46^{a}	34.00^{c}	35.00^{ab}	26.80^{c}	55.93^{a}	32.40^{c}
Puttur	53.50^{a}	33.66^{c}	33.33^{abc}	25.33^{c}	63.50^{a}	35.57^{c}
Sullia	52.72^{b}	41.42^{b}	44.37^{a}	32.80^{bc}	58.63^{a}	41.00^{abc}
Hilly region						
Thirthahalli	–	–	12.86^{d}	44.28^{a}	16.16^{c}	44.00^{ab}
Sagar	–	–	20.28^{cd}	42.40^{ab}	28.37^{bc}	41.33^{abc}
Sampaje	45.00	38.88^{be}	41.87^{a}	33.00^{abc}	53.63^{a}	41.33^{abc}

Table 3. Intensity and occurrence of *Colletotrichum* leaf spot and *Corynespora* leaf fall diseases of rubber in coastal and ghat regions. The location means followed by same letters under each year are significantly not different at p=0.05 by LSD test.

	Disease intensity (%)					
	Season–I		Season–II		Season–III	
Location	CLS	CLF	CLS	CLF	CLS	CLF
Coastal region						
Kundapura	37.50^{b}	31.14^{b}	39.88^{b}	32.20^{cd}	40.20^{be}	22.66^{be}
Mangalore	50.16^{ab}	28.60^{c}	48.00^{ab}	26.50^{c}	53.09^{ab}	24.25^{be}
Belthangady	53.30^{a}	29.83^{c}	46.75^{ab}	27.81^{c}	57.20^{a}	23.00^{be}
Subrahmanya	61.70^{a}	66.00^{a}	50.28^{ab}	51.92^{ab}	63.42^{a}	47.72^{a}
Puttur	59.00^{a}	158.56^{a}	57.62^{a}	54.43^{ab}	63.87^{a}	38.78^{ab}
Sullia	62.20^{a}	58.96^{a}	55.50^{a}	49.71^{abc}	65.16^{a}	39.26^{ab}
Hilly region						
Thirthahalli	–	–	18.42^{c}	–	23.57^{d}	7.33^{c}
Sagar	–	–	23.14^{c}	–	31.53^{c}	9.00^{be}
Sampaje	53.88^{a}	53.11^{ab}	46.12^{ab}	45.81$^{a–d}$	59.90^{a}	29.11^{abc}

found sever in some younger plantations. Among locations, under hilly region, Sampaje had a major distribution of ALF, PM and CLS, while all the plantations of Sagar and Thirthahalli regions were free from any of the diseases, except for powdery mildew. The CLF disease which had a recent entry into coastal regions, had totally invaded all the plantations included in the survey.

Intensity of ALF, PM, CLS and CLF diseases in the infected plantations under different locations during the three years are given in Table 2 and 3. In general, it was observed that intensity of the diseases like ALF, CLS and CLF was low in the hilly regions, while PM was found at higher intensity. This could be due to very conducive weather conditions available at slightly higher elevations of the hilly region like high humidity, optimum temperature of about 25^{0}C, prolonged mist and bright sunshine which might be string-pulling this disease [6, 7]. However, locations under coastal region showed all the diseases at higher intensity. On comparison of locations, it could be seen that the diseases were almost equally distributed among all locations of coastal areas, with only a marked exception of Subrahmanya, Puttur and Sullia having severe outbreak of CLF and CLS. Most of the plantations in these locations both CLF and CLS diseases were found to occur together during refoliation period causing extensive leaf fall and die back [8].

Among hilly regions, Sampaje recorded higher incidence of all diseases. This could be due to the fact that though this location is classified under hilly region, the elevation of this area is lower than the other two locations. Under the coastal region Kundapura had relatively lower incidence of all the diseases. One possible reason for this could be the lower precipitation received in this location than the others in coastal Karnataka.

It was found that the intensity of diseases observed in different locations was consistent and had shown high degree of correlation over different years. This indicated that the occurence of the diseases at these locations were not at random but are widely prevalent in nature. Manju et al. [5, 9] reported the occurrence of CLF at endemic proportion in the coastal regions of Karnataka and its spread towards the traditional rubber growing regions of Kerala.

The mean severity scores of different diseases among the popular clones under cultivation in these regions had indicated that the clones RRIM 600 and GT 1 were very susceptible to ALF, especially in coastal belt and to PM in all the areas. The susceptibility of these clones for ALF has already been estab-

lished [7]. However, the most popular clone in this region RPJI 105 was found severely infected with CLS and CLF in all the locations except in Thirthahalli and Sagar hilly regions, where the incidence was relatively low. The susceptibility of RRII 105 clone to CLF and CLS diseases has already been reported [8, 9]. Other clones, viz., PB 260 and PB 217 were found to have moderate infection of these diseases.

During the survey of plantation holdings in the coastal and hilly regions of Karnataka, it was observed that all the major leaf diseases of rubber had already been established in this region. Except *Oidium heveae*, many of these pathogens are capable of infecting a wide range of hosts including forest plants and they can survive either in the plantation or in the wild. Under favorable conditions they can cause outbreak of the disease causing severe damage to the rubber plants. One of the major factors which was noticed in these regions was that almost all these plantations in this region were small holdings, where individual management of the plantations are poor and often many of the instances of disease outbreaks are not properly managed causing further decline of the health of the tree. This may have resulted in further vulnerability of trees to disease outbreak while producing very low yield level. Though effective management procedures are available for all of these diseases, it is very important to have people participation for better management of the plantations in this region and to boost the productivity of the region in general.

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