INFLUENCE OF WEATHER PARAMETERS ON THE INCIDENCE OF ROOT ROT (MACROPHOMINA PHASEOLINA) DISEASE IN MULBERRY

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ABSTRACT

Root rot disease caused by M. phaseolina is the major disease in mulberry. The study was conducted in 50 mulberry gardens covering 15 villages during the year 2012-13 by adopting random sampling method. The present survey was taken up in the districts viz., Coimbatore, Erode, Tirupur, Dharmapuri, Krishnagiri, Pudhukottai and Tuticorin to assess the incidence of root diseases. The environmental factors that most seriously affect the initiation and development of infectious plant disease are temperature and humidity of the air, amount of rainfall, soil temperature, moisture and fertility. These factors affect disease development through their influence on the growth and susceptibility of the host, on the multiplication and activity of the pathogen or on the interaction of host and pathogen relates to the severity of symptom development. Correlation studies have revealed that average temperature plays the key role in disease incidence invariably in all the locations studied except Tirupur district, which had no correlation with any of the weather variables, studied. The root rot incidence attained peak during a particular period of a month where weather parameters like Temperature, Relative Humidity, Rainfall, Soil Moisture, and Soil Temperature were favorable. The root rot incidence will be minimum if all these conditions are unfavorable. Seasonal analysis revealed that South West Monsoon season was the predominant season for root rot incidence in mulberry. All the locations had peak incidence during SWM season only. The least occurrence had no specific season as it occurs in all the remaining three seasons.

Keywords: Correlation, Mulberry, Root Rot, Seasonal Incidence

1. INTRODUCTION

Mulberry (Morus albaL.) is a valuable tree of immense importance in silk industry due to its foliage, which constitute the chief food for silkworm (Bomby xmoriL.). The

total area of mulberry cultivation in India is around 0.216 million hectares Anonymous (2012). Mulberry (Morus spp.) is a fast growing, deciduous, woody and perennial plant. Mulberry sericulture is mainly practiced in five states namely, Karnataka, Andhra Pradesh, West Bengal, Tamil Nadu and Jammu & Kashmir. About 97% of the total mulberry silk production in the country.The total area of mulberry in India is around 1,92,781 hectare, production in cocoon (60343 MT), Raw silk (7888 MT) and in Tamil Nadu is around 9,491 hectare Anonymous (2012), and the leaf produced per unit area has a direct bearing on cocoon harvest. Root rot disease has become more alarming because of its epidemic nature and propensity to kill the plant completely. M.phaseolina is a soil borne pathogen was reported as a major causative pathogen for root rot of mulberry in Coimbatore, Erode, Trichy and Thanjavur districts of Tamil Nadu Sridhar et al. (2000), Marimuthu (2005). The affected plants show sudden withering of leaves followed by death of plants along with decaying and rotting of roots and stem cuttings. The environmental factors that most seriously affect the initiation and development of infectious plant disease are temperature and humidity of the air, amount of rainfall, soil temperature, moisture and fertility. These factors affect disease development through their influence on the growth and susceptibility of the host, on the multiplication and activity of the pathogen or on the interaction of host and pathogen relates to the severity of symptom development Agrios (2005). The highest risk for root rot infection occurs when the temperature range is 28-30ºC and there from 36 to 72 hours of continuous environmental wetness Nelson (2008). Humidity increases the succulence of host plants and thus their susceptibility to certain pathogens, which affects the severity of disease Agrios (2005). Feeding of the diseased leaves affects the health of the silkworm adversely and cocoon yield in terms of quality and quantity Datta (2010). The problem is observed both in nursery and established fields R. Philip et al. (1995). The extent of damage in terms of leaf yield loss is 10-12 %.

2. MATERIALS AND METHODS

The present investigations were carried out to study the factor influencing mulberry root rot disease M. phasiolina.

2.1 SURVEY TO ASSESS THE OCCURRENCE OF ROOT ROT DISEASE IN MULBERRY

Root rot disease caused by M. phaseolina is the major disease in mulberry. The study was conducted in 50 mulberry garden scovering 15 villages during the year 2012-13 by adopting random sampling method.The present survey was taken up in the districts viz., Coimbatore, Erode, Tirupur, Dharmapuri, Krishnagiri, Pudhukottai and Tuticorin to assess the incidence of root diseases.

$$\text{Percentage of disease incidence} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

2.2 EFFECT OF VARIOUS FACTORS ON THE DEVELOPMENT OF ROOT ROT DISEASE IN MULBERRY

The environmental factors that most seriously affect the initiation and development of infectious plant disease are temperature and humidity of the air, amount of rainfall, soil temperature, moisture and fertility. These factors affect disease development through their influence on the growth and susceptibility of the host, on the multiplication and activity of the pathogen or on the interaction of host and pathogen relates to the severity of symptom development Agrios (2005). In order to evaluate the effect of weather variables on the development of root rot disease in mulberry, percentage of leaf infection and disease index were studied at one month interval during June to May of the year 2012 to 2013.

2.3 DATA COLLECTION

Weather parameters such as average air temperature, rainfall, relative humidity, soil moisture and soil temperature for the study area was collected from Agro Climate Research Centre (ACRC), Tamil Nadu Agricultural University. These parameters were recorded by the department through their Automatic Weather Station (AWS) network covering the length and breadth of Tamil Nadu.

2.4 COMPARATIVE STATISTICS

The error statistics viz., bias, root mean square error (RMSE) along with correlation coefficient (r) and index of agreement (Willmott)[11] (d) were estimated for prediction against CRU observation. The 25km resolution model outputs were interpolated to the CRU 0.5 x 0.5-degree grids using NCL 'natgrid' function and comparisons were made on grid-to-grid basis for the monthly and annual time series data. The equations used to calculate various statistics used in this study are given below.

Equations:

Correlation coefficient (r):

$$r = \frac{\sum P_i O_i \frac{\sum P_i \cdot \sum O_i}{n}}{\sqrt{\sum P_i^2 - \frac{(\sum P_i)^2}{n}} \cdot \sqrt{\sum O_i^2 - \frac{(\sum O_i)^2}{n}}}$$

Where:

$\bar{O} = Mean\ observed\ value \qquad P_i = Model\ value$

$O_i = Observed\ value \qquad n = Number\ of\ observations$

3. RESULTS AND DISCUSSION

A survey was made in seven mulberry growing districts of Tamil Nadu viz., Coimbatore, Erode, Dharmapuri, Tirupur, pudukkottai, Tirunelveli, and Krishnagiri to find out the occurrence of root rot disease in mulberry. The results showed that per cent disease incidence of root rot disease was found to be maximum in all the places but exhibited variations which was ranged from 19.60 per cent to 43.58 per cent. However, the maximum incidence was found in (Ayyampalayam) Erode district (43.58%) followed by Annur of Coimbatore district. (31.57%), Uthangaraiof Krishnagiridistrict (27.70%), Udumalpet of Tirupurdistrict (27.21%). Pappirettipatti of Dharmapuridistrict (23.58%) and Navaneethakrishnanpuram of Tirunelveli district (22.56%). The minimum disease incidence (19.60%) was recorded in Alangudi village of Pudukottai district (Table 1). T. Philip et al. (1992) reported that a survey on the incidence of root

Table 1 **Occurrence of mulberry root rot disease in different mulberry growing areas of TamilNadu**

Sl. No	Name of the Districts	Name of the village	Percent disease incidence*
1	Coimbatore	Annur	31.57 [b]
2	Erode	Ayyampalayam	43.58 [a]
3	Thirupur	Udumalpet	27.21 [c]
4	Dharmapuri	Pappirettipatti	23.58 [d]
5	Pudukottai	Alangudi	19.60 [f]
6	Tirunelveli	Navaneethakrishnanpuram	22.56 [e]
7	Krishnagiri	Uthangarai	27.66 [c]
CD (.05) = 0.7820			

*Values are the mean of the three replications
Means followed by a same letter are not significantly different at the 5 % level by DMRT.

rot disease showed its wide spread occurrence in almost all mulberry growing area of Kerala besides its prevalence in Karnataka and Andhra Pradesh. Merinbabu (2002) reported that incidence of stolon rot of mint was prevalent in all the areas surveyed and the incidence ranged from 16.48 to 36.81 per cent. Gangwar and Thangavelu (1991) conducted a survey covering 973 mulberry fields and 22 taluks of Tamil Nadu and reported an average incidence of 5.7 per cent. The highest incidence of 33.30 per cent was recorded in Kundadam taluk of Erode district followed by 14.30 per cent in Mettupalayam taluk of Coimbatore district.

Influence of weather parameter on root rot disease of mulberry

Based on rainfall distribution, irrigation pattern, soil characteristics, cropping pattern and other ecological, social and physical status, the state of Tamil Nadu was classified into seven distinct agro-climatic zones. The study area that was selected based on the occurrence of disease incidence spreads over the three agro climatic zones viz., Western zone, North Western zone and Southern zone. The relationship between the weather parameters and disease incidence was studied using correla-

tion. The results are described here under.

Correlation studies on incidence of root rot disease

Erode

In Erode district, the air temperature and soil moisture had significant relationship with root rot disease incidence. Air temperature (24.7ºC to 30.7ºC) had positive correlation (r= 0.66*), while the soil moisture (3.6% to 22.5%) had significant negative relationship (r= -0.71*) with root rot disease incidence (43.58 %) (Table 2).

Table 2 **Influence of weather parameter on root rot disease of mulberry – Erode**

Correlations

	MeanTemper c)	Relative Humidity (%)	Rain- fall (mm)	Soil moisture (%)	Soil Tem- perature (^{o} c)	Disease incidence (%)
Mean Tem- perature (^{o}c)	1.00	-0.77**	-0.07	-0.19	0.07	0.66*
Relative Humidity (%)	-0.77**	1.00	0.56	-0.14	0.07	-0.34
Rainfall (mm)	-0.07	0.56	1.00	-0.32	0.33	0.29
Soil moisture (%)	-0.19	-0.14	-0.32	1.00	-0.18	-0.71*
Soil Tempera- ture(oc)	0.07	0.07	0.33	-0.18	1.00	0.16
Disease incidence (%)	0.66*	-0.34	0.29	-0.71*	0.16	1.00

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Coimbatore

In Coimbatore district, the root rot disease incidence was positively correlated (r=0.74*) with air temperature. The air temperature prevailed during the study period ranged from 24.2ºC to 31.1ºC, which favored the incidence of root rot disease (31.57 %) (Table 3).

Table 3 **Influence of weather parameter on root rot disease of mulberry – Coimbatore**

		Correlations				
MeanTempe c)	Relative Humidity (%)	Rainfall (mm)	Soil moisture (%)	Soil Tem- perature (^{o} c)	Disease incidence (%)

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			Table 3 continued			
Mean Temperature (^{o}c)	1.00	-0.21	-0.03	-0.36	0.47	0.74**
Relative Humidity (%)	-0.21	1.00	0.74**	0.29	-0.44	-0.11
Rainfall (mm)	-0.03	0.74**	1.00	0.36	-0.30	0.09
Soil moisture (%)	-0.36	0.29	0.36	1.00	-0.40	-0.36
Soil Temperature(^{o}c)	0.47	-0.44	-0.30	-0.40	1.00	0.26
Disease incidence (%)	0.74**	-0.11	0.09	-0.36	0.26	1.00

** Correlation is significant at the 0.01 level (2-tailed).

Krishnagiri

In Krishnagiri district, the air temperature (r=0.98*) showed significant positive correlation with root rot disease incidence followed by soil temperature (r=0.67*). Air temperature of 23.6ºC to 36.1ºC and soil temperature of 25.3ºC to 34.5ºC influenced the root rot disease of mulberry (27.66%) (Table 4).

Table 4 Influence of weather parameter on root rot disease of mulberry – Krishnagiri

	Correlations					
	MeanTempe c)	**Relative Humidity (%)**	**Rainfall (mm)**	**Soil moisture (%)**	**Soil Temperature (^{o} c)**	**Disease incidence (%)**
Mean Temperature (^{o}c)	1.00	-0.52	0.45	-0.22	0.72**	0.98**
Relative Humidity (%)	-0.52	1.00	-0.16	0.73**	-0.69*	-0.47
Rainfall (mm)	0.45	-0.16	1.00	0.22	0.28	0.47
Soil moisture (%)	-0.22	0.73**	0.22	1.00	-0.57	-0.17
Soil Temperature(oc)	0.72**	-0.69	0.28	-0.57	1.00	0.67*

Table 4 continued					
Disease incidence (%)	0.98**	-0.47	0.47	-0.17	0.67*	1.00

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Tirupur

In Tirupur district, the weather parameters such as air temperature (24.1ºC to 30.2ºC), relative humidity (59.6% to 71.8%), rainfall (0.0mm to 3.9mm) and soil temperature (44.6ºC to 62.9ºC) showed positive correlation whereas soil moisture (5.6 % to 11.4 %) alone showed negative correlation. with root rot disease incidence (27.2 %) (Table 5).

Table 5 **Influence of weather parameter on root rot disease of mulberry – Tirupur**

Correlations

	MeanTemper c)	Relative Humidity (%)	Rain-fall (mm)	Soil moisture (%)	Soil Tem-perature (^{o} c)	Disease incidence (%)
Mean Temperature (^{o} c)	1.00	-0.03	-0.01	-0.25	0.09	0.35
Relative Humidity (%)	-0.03	1.00	0.45	0.41	0.34	0.18
Rainfall (mm)	-0.01	0.45	1.00	0.42	0.38	0.26
Soil moisture (%)	-0.25	0.41	0.42	1.00	-0.09	-0.40
Soil Temperature(oc)	0.09	0.34	0.38	-0.09	1.00	0.56
Disease incidence (%)	0.35	0.18	0.26	-0.40	0.56	1.00

Dharmapuri

In Dharmapuri district, the air temperature (23.6ºC to 30.7ºC) (r=0.82), relative humidity (57.1 % to 92.1 %) (r=-0.62) and soil temperature (26.4ºC to 36.5ºC) (r=0.74) had significant correlation with disease incidence. In which air temperature and soil temperature had positive correlation while Relative humidity had negative correlation. With root rot disease incidence (23.58%) (Table 6).

Table 6 **Influence of weather parameter on root rot disease of mulberry – Dharmapuri**

Correlations

	MeanTemper c)	Relative Humidity (%)	Rain-fall (mm)	Soil moisture (%)	Soil Tem-perature (^{o} c)	Disease incidence (%)
Mean Tem-perature (^{o} c)	1.00	-0.91	-0.32	-0.33	0.74	0.82**
Relative Humidity (%)	-0.91	1.00	0.48	0.62	-0.70	-0.62
Rainfall (mm)	-0.32	0.48	1.00	0.38	-0.07	-0.04
Soil moisture (%)	-0.33	0.62	0.38	1.00	-0.54	-0.09
Soil Tem-perature (^{o} c)	0.74	-0.70	-0.07	-0.54	1.00	0.74
Disease incidence (%)	0.82**	-0.62	-0.04	-0.09	0.74	1.00

 ** Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

Tirunelveli

In Tirunelveli district, the weather parameters such as air temperature (26.9ºC to 33.2ºC) (r=0.59), relative humidity (49.1 % to 78.3%) (r=-0.63), soil moisture (3.2 % to 13.7 %) (r=-0.20) and soil temperature (28.4ºC to 47.7ºC) (r=0.65) showed significant correlation with disease incidence (22.56 %) (Table 7).

Table 7 **Influence of weather parameter on root rot disease of mulberry – Tirunelveli**

			Correlations			
	MeanTemp c)	Relative Humidity (%)	Rainfall (mm)	Soil moisture (%)	Soil Tem-perature (^{o} c)	Disease incidence (%)
Mean Tem-perature (^{o} c)	1.00	-0.87**	-0.50	-0.38	0.60*	0.59**
Relative Humidity (%)	-0.87**	1.00	0.48	0.26	-0.54	-0.63
Rainfall (mm)	-0.50	0.48	1.00	0.32	-0.29	-0.25
Soil moisture (%)	-0.38	0.26	0.32	1.00	-0.47	-0.20

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Table 7 continued					
Soil Temperature (^{o} c)	0.60*	-0.54	-0.29	-0.47	1.00	0.65*
Disease incidence (%)	0.59**	-0.63	-0.25	-0.20	0.65*	1.00

** Correlation is significant at the 0.01 level (2-tailed).
 * Correlation is significant at the 0.05 level (2-tailed).

Pudukottai

In Pudukottai district, the air temperature (r=0.80) showed a significant correlation with disease incidence while all other parameters had non-significant correlation. Air temperature of 24.9ºC to 31.8ºC influenced the incidence of root rot disease (19.60%) (Table 8).

Table 8 **Influence of weather parameter on root rot disease of mulberry – Pudukottai**

Correlations						
	MeanTemper c)	**Relative Humidity (%)**	**Rain-fall (mm)**	**Soil moisture (%)**	**Soil Temperature (^{o} c)**	**Disease incidence (%)**
Mean Temperature (^{o} c)	1.00	-0.50	0.45	0.17	0.14	0.80*
Relative Humidity (%)	-0.50	1.00	-0.03	-0.05	-0.55	-0.35
Rainfall (mm)	0.45	-0.03	1.00	0.29	0.36	0.39
Soil moisture (%)	0.17	-0.05	0.29	1.00	0.00	-0.27
Soil Temperature(^{o} c)	0.14	-0.55	0.36	0.00	1.00	0.26
Disease incidence (%)	0.80*	-0.35	0.39	-0.27	0.26	1.00

** Correlation is significant at the 0.01 level (2-tailed).

Correlation studies have revealed that average temperature plays the key role in disease incidence invariably in all the locations studied except Tirupur district, which had no correlation with any of the weather variables, studied. Soil temperature had significant association in Dharmapuri district (r= 0.74), Krishnagiri district (r= 0.67*) and Tirunelveli district (r= 0.65*) while soil moisture had significant correlation at Erode district (r= -0.71*) and Tirunelveli district (r= -0.20). Disease incidence in Dharmapuri district (r= -0.62) and Tirunelveli district (r= -0.63) had significant correlation for Relative humidity. The infected saplings are the secondary

source of infection. The soil temperature of 26-35^{0}C with soil moisture below 60% favours the disease development in mulberry gardens. The water logging conditions for a longer period and poor health of soil, especially insufficient organics in soil also predispose the mulberry plants to root rot disease Gupta (2001), Sharma and Gupta (2005). Rainfall had no correlation in all the locations studied. Gangwar and Thangavelu (1991) studied the incidence and intensity of various mulberry diseases in different areas of Tamil Nadu. Gunasekhar et al. (1994) have recorded the incidence of various diseases in agro-climatic zones in South India.

Govindaiah et al. (2003) reported that many of the soil borne diseases including root rot are stress related and they are observed in the tropical and subtropical climatic conditions, where the crop is exposed to the environmental stress that predispose the crop to infection. The disease is favoured by high soil temperature and low to moderate soil moisture. With regard to types of soil, light textured loam and sandy loam soils favour spread of disease rapidly than clay and silt loam. Hence, the disease spread is very fast in the humid environment.

Monthly Analysis of root rot incidence

The root rot incidence attained peak during a particular period of a month where weather parameters like Temperature, Relative Humidity, Rainfall, Soil Moisture, and Soil Temperature were favorable. The root rot incidence will be minimum if all these conditions are unfavorable. The monthly percent disease incidence was used for this analysis (Table 9).

Erode

In Erode district, the root rot incidence was peak during the month of June (32.6%) followed by September (30.5%) and July (30.0%). Least incidence was recorded during the month of December (22.6%) followed by November (23.1%). All other months had intermediate disease severity. Erode had root rot incidence within the range of 22.6 per cent to 32.6 per cent.

Coimbatore

Root rot disease incidence was peak during the month of July (38.6%) followed by June(34.2%) and August (34.0%). Least incidence was recorded during the month ofMay (29.3%) followed by December (28.6%) andApril (28.3%). All other months had intermediate disease severity. Coimbatore had root rot incidence within the range of 28.3 per cent to 38.6 per cent.

Tirupur

In Tirupur district, the root rot incidence was peak during the month of June (31.3%) followed by September (29.3%). Least incidence was recorded during the month of April (21.3%) followed by February (21.5%). All other months had intermediate disease severity. Tirupur had root rot incidence within the range of 21.3 per cent to 31.3 per cent.

Dharmapuri

In Dharmapuri district, root rot incidence was peak during the month of June and February (28.4 %) followed by September (27.6 %). Least incidence was recorded

during the month of December (20.0 %) followed by November (23.4 %). All other months had intermediate disease severity. Dharmapuri had root rot incidence within the range of 20.0 per cent to 28.4 per cent.

Krishnagiri

Root rot incidence was peak during the month of June (31.0 %) followed by July(29.7 %). Least incidence was recorded during the month of December (21.0 %) followed by January (22.0 %) and November. All other months had intermediate disease severity. Krishnagiri district had root rot incidence within the range of 21.0 per cent to 31.0 per cent.

Pudukottai

Root rot incidence was peak during the month of June (28.9 %) followed by July(27.5 %) and August. Least incidence was recorded during the month of November (22.6 %) followed by December and April (22.8 %). All other months had intermediate disease severity. Pudukottai district had root rot incidence within the range of 22.6 per cent to 28.9 per cent.

Tirunelveli

In Tirunelveli district, the root rot incidence was peak during the month of August(30.8 %), which is typical as other months had peak during September (29.9 %). The peak incidence in august was followed by September and July. Least incidence was recorded during the month of March (24.2 %) followed by December (25.0 %). All other months had intermediate disease severity. Tirunelveli district had root rot incidence within the range of 24.2 per cent to 30.8 per cent.

Monthly analysis of seven districts revealed that highest incidence of root rot occurred during the month of June in except Coimbatore district (34.2%) and Tirunelveli district (26.6%), which had peak occurrence during July (38.6%) and August (30.8%) respectively. The lowest incidence was recorded in the months March (24.2%), April (27.1%). Tirunelveli had its least occurrence during the month of March (24.2%). Pudukottai district alone had its least incidence during November (22.6%) and the locations Erode district (23.1%), Dharmapuri district (20.0%) and Krishnagiri district recorded that lowest disease incidence during December (21.0%).

Seasonal Analysis of root rot incidence

The seasonal influence of weather conditions that favors the peak incidence of root rot disease in mulberry, was studied and the average percent disease incidence values for every season viz., SWM – South West Monsoon (June, July, August and September), NEM – North East Monsoon (October, November and December), CWP – Cold Weather Period (January and February), HWP - Hot Weather Period (March, April, May) were recorded and presented (Table 10).

Seasonal Analysis of root rot incidence in western zone

In Coimbatore district, root rot incidence was highest during the Southwest monsoon (34.7 %) (SWM) season followed by Cold weather period (CWP) (30.9 %) and Northeast monsoon (NEM) (30.1 %) and Hot weather period (HWP) (29.2 %) had the

lowest percent of disease incidence. In Erode, root rot incidence was highest during the Southwest monsoon (30.6 %) season followed by HWP (26.0 %) and NEM (24.8 %) and CWP (24.2 %) had the lowest percent of disease incidence. In Tirupur district, root rot incidence was highest during the Southwest monsoon season (29.2 %) followed by NEM (24.9 %), HWP (23.7 %) and CWPhad the lowest percent of disease incidence 22.6 per cent.

Seasonal Analysis of root rot incidence in Northwestern zone

In Dharmapuri district, disease incidence was peak during SWM (26.9%) season followed by CWP (26.4%), HWP (25.2%) and NEM recorded the lowest percent incidence of root rot (22.6%). In Krishnagiri district the peak was during SWM (29.7%) season followed by HWP (25.3%), NEM (23.6%) and CWP recorded the lowest incidence (23.2%).

Seasonal Analysis of root rot incidence in Southern zone

In Pudukottai district, disease incidence was peak during SWM (27.2%) season followed by CWP (25.0%), HWP (24.0%) and lowest percent was recorded during NEM (23.4%). For Tirunelveli district peak incidence of root rot occurred during SWM (29.1%) followed by CWP (25.8%), NEM (25.6%) and least by HWP (25.5%).

Seasonal analysis revealed that South West Monsoon season was the predominant season for root rot incidence in mulberry. All the locations had peak incidence during SWM season only. The least occurrence had no specific season as it occurs in all the remaining three seasons.

4. CONCLUSION

Mulberry is an important food plant for rearing silkworm is affected bythe root rot disease. Correlation studies have revealed that average temperature plays the key role in disease incidence invariably in all the locations studied except Tirupur district, which had no correlation with any of the weather variables, studied.The environmental factors like temperature, rainfall, most seriously affect the initiation and development of infectious plant disease. These factors affect disease development through their influence on the growth and susceptibility of the host, on the multiplication and activity of the pathogen or on the interaction of host and pathogen relates to the severity of symptom development

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