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Epidemiological studies of Leaf blight disease of Costus (*Costus speciosus*) caused by *Pyricularia grisea* and Leaf spot disease of Shivajata (*Uraria picta*) caused by *Curvularia boedijn*

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A fixed plot survey was conducted for consecutive two years at monthly interval to study the effect of different weather factors on development of leaf blight disease of Costus (*Costus speciosus*) caused by *Pyricularia grisea* and Leaf spot disease of Shivajata (*Uraria picta*) caused by *Curvularia boedijn* on the correlation of coefficients and Multiple regression analysis (MRA) between percent disease incidence of above mentioned diseases with different weather parameters for finding out the different role of weather parameters on development of diseases. From pooled data it showed that in case of Costus minimum temperature (-0.673) and maximum (-0.610) temperature were negatively correlated with PDI at 1% and 5% level of significance respectively. Others weather parameters i.e. relative humidity morning (-0.161) and evening (-0.125), rainfall (-0.401), wind speed (-0.465) were negatively and sunshine hours (0.278) was positively correlated with PDI but they were not statistically significant. For Shivajata maximum (-0.750) and minimum (-0.950) temperature, relative humidity evening (-0.710) and morning (-0.569) and rainfall (-0.774) were highly negatively correlated with PDI at 1% level of significance and wind speed (-0.357) and sunshine hours (0.042) were related negatively and positively respectively but were not statistically significant.

Keywords : *Costus speciosus*, *Uraria picta*, *Pyricularia grisea*, *Curvularia boedijn*, multiple regression analysis

INTRODUCTION

Medicinal plants belong to a big plant group with a great interest due to its pharmaceutical, cosmetic and nutritional application. In addition, they are also an alternative to traditional crop with species in high demand at the current international market. But now that medicinal plants are infected by several biotic and abiotic factors and that causing several diseases like root rots, cankers, wilts, leaf spots, scabs, blights, anthracnose, rusts, mildews, smuts, mosaics, yellows, root knots, etc. To study and understand the epidemiology of fungal diseases of medicinal plants is the basis for sustainable management of the diseases. The interdisciplinary development of sciences, especially the application of molecular biology technology and modern information technology to plant disease epidemiology, has promoted great progress in the studies on detection, monitoring, and epidemic law of crop fungal diseases and pathogens, pathogen population genetics, disease forecasting and early warning, and control of crop fungal diseases and facilitated the development of fungal disease epidemiology (Wang, 2022).

The diseases of medicinal plants vary from season to season depending on different climatic conditions. Kadam *et.al,* in 2014 worked on the epidemiology of Leaf blight disease of Turmeric caused by *Colletotrichum gloeosporioides* (Penz. and Sacc.) to study the effect of different weather parameters *viz*., maximum, minimum and mean air temperatures, night (I), day (II) and mean relative humidities, sunshine hours, evaporation, rainfall, number of rainy days and wind velocity.

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They reported that environmental factors play a great role in build-up of pathogen population and subsequently disease development. There were positive correlations with maximum temperature, sunshine and evaporation and negative correlation was observed with minimum temperature, mean temperature, relative humidity I, relative humidity II, mean relative humidity, wind velocity, rainfall and rainy days. Correlation coefficients between PDI and minimum temperature and rainy days were statistically significant where as it was highly significant with wind velocity. Sarkar and Dasgupta (2018) carried out a fixed plot survey at monthly interval to study of the effect of different weather parameters on development of Leaf blight disease of Pipul (*Piper Tongum* L) caused by *Fusarium* sp. and Leaf blight disease of Antamul [|*Tylophora indica* (Burm.f.) Merrill] caused by *Sclerotium rolfsii*.

As no work was carried out on the weather factor for the development of above important diseases of Costus and Shivajata, the present study was carried out epidemiological studies on the development of Leaf blight of Costus (*Costus speciosus*) caused by *Pyricularia grisea* and Leaf spot disease of Shivajata (*Uraria picta*) caused by *Curvularia boedijn.*

MATERIALS AND METHODS

Fixed plot survey

The survey was conducted at the medicinal plants garden situated at 'C' Block farm, BCKV, Kalyani at monthly interval. Survey was conducted with the initiation of the disease in field.

Ten plants were selected in every plot. For percent disease incidence, total no. of leaves infected in a plot were recorded and for percent disease index, no. of leaves infected per 10 plants in each plot were selected and rated on a 0-4 scale, where 0= healthy leaves; 1= 1 - 6% leaf area infected; 2= 7 - 12% leaf area infected; 3= 13 - 25% leaf area infected; 4= above 25% leaf area infected (Momin, 2009). Percent disease incidence and percent disease index were calculated from the following formulae :

$$\text{Percent disease incidence} = \frac{\text{No. of infected leaves per plant}}{\text{Total no. of leaves per plant}} \times 100$$

Weather data collection

Weather data from January to December were collected for calculation of correlation with disease incidence and severity from AICRP on Agro Meteorology, BCKV, Kalyani. Seven parameters (Maximum temperature, Minimum temperature, Relative humidity (morning) and Relative humidity (evening), Rainfall, Sunshine hrs. and Wind speed) were recorded.

Multiple Regression Analysis

The disease severity in leaves was changing day to day following development of initial foci (onset time). If this variable considered being a dependable variable with weather parameters being the in-dependable variables, then regression equation will describe the relationship. The disease severity is called the dependent (response) variable Y and is said to regress on the weather parameters are called the independent (determining) variables X. The application of regression analysis to join observations of these variables, permit evaluation of the importance of these independent variables on disease development and means for estimating the change in disease severity which can be expected from a unit change in these variables, thus providing a possible basis for the prediction of the disease severity using such variables as the predictor. For study of the multiple effects on dependent variables the multiple regression analysis is done (MRA) as a predictive equation :

$$v=b_0+ b_1x_1 +b_2x_2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots b_nx_n$$

Where v = predicted disease severity

b_0= intercept

$b_1b_2\ldots\ldots\ldots b_n$= regression co-efficient

$x_1x_2\ldots\ldots\ldots X_n$= indepe-ndent variable.

The prediction equation and stepwise multiple regression analysis was done by using the following:

$$v = A + b_ix_i+ e$$

Where, v = predicted severity,

a = intercept

b_i = regression co-efficient for x_i (I = 1 to…n)

x_i = independent variables (I = 1 to……n)

e = random error.

RESULTS AND DISCUSSION

Percent disease incidence

In Costus (*Costus speciosus*) maximum percent disease incidence of leaf spot disease was recorded during September – November and minimum during July – August. In Shivajata (*Uraria picta*), maximum percent disease incidence of leaf spot diseases were recorded during November – February and minimum percent disease incidence during May – September (Table 1).

Relation between weather parameters and percent disease incidence of leaf spot diseases of medicinal plants

To study the relation, correlation co-efficient between percent disease incidences of leaf blight disease of Costus (*Costus speciosus*) caused by *Pyricularia grisea* and Leaf spot Disease of Shivajata (*Uraria picta*) Caused by *Curvularia boedijn* (Bharadwaj,1969) with different weather parameters was done and the results are presented in (Table - 2)

Leaf blight disease of Costus

The results showed that First year in Costus, minimum temperature (-0.719) and wind speed (-0.709) were negatively correlated with PDI of leaf spot disease caused by *Pyricularia grisea*at at 5% level of significant and other weather parameters were non-significant. In second year, all the weather parameters were not significantly correlated with disease occurrence. In pooled analysis of two years data revealed that minimum temperature (-0.673) and maximum (-0.610) temperature were negatively correlated with PDI at 1% and 5% level of significance respectively. Others weather parameters i.e. relative humidity mornin (-0.161) and evening (-0.125), rainfall (-0.401), wind speed (-0.465) were negatively and sunshine hours (0.278) was positively correlated with PDI but they were not statistically significant (Table 2).

Leaf spot disease of Shivajata

From the first year, it was observed that in Shivajata, maximum (-0.734) and minimum (-0.975) temperature, relative humidity at morning (-0.827) and evening (-0.715) and rainfall (-0.820) were negatively correlated with percent disease incidence of leaf spot disease caused by *Curvularia boedijn*at 1 % level of significance. In second year, maximum (-0.783) and minimum (-0.934) temperature, relative humidity at evening (-0.710) and rainfall (-0.730) were negatively correlated with percent disease incidence at 1 % level of significance. In pooled analysis, maximum (-0.750) and minimum (-0.950) temperature, relative humidity evening (-0.710) and morning (-0.569) and rainfall (-0.774) were highly negatively correlated with PDI at 1% level of significance and wind speed (-0.357) and sunshine hours (0.042) were related negatively and positively respectively but were not statistically significant (Table 2).

Predicted disease severity of leaf spot diseases of leaf blight disease of costus and leaf spot disease of shivajata

MRA (Multiple regression analysis) was conducted for leaf spot diseases of above mentioned medicinal plants to determine the combined effect of weathers factors on disease development. Step down MRA was done to find out the suitable prediction equation for disease severity.

Leaf blight disease of Costus

In Costus, during first year (Table 3), the prediction equation for percent disease incidence of leaf spot disease caused by *Pyricularia grisea* indicated that maxT, rainfall and sunshine hours were positively and wind speed, minT, RHevening and RHmorning were negatively correlated with percent disease incidence. The coefficient of determination (R^2) between percent disease incidence and seven groups of independent

Table. 1: Percent Disease incidence of leaf blight disease of Costus caused by *Pyricularia grisea* and leaf spot disease of shivajata, caused by *Curvularia boedij*

Medicinal plants	Leaf spot of Costus[1] Causal organism : *Pyricularia grisea*			Leaf spot of Shivajata[2] Causal organism: *Curvularia boedijn*			
	Percent disease incidence						
Months	1st yr	2nd yr	Pooled	Months	1st yr	2nd yr	Pooled
Janauary	-	-	-	July	0.01	0.01	0.01
February	-	-	-	August	1.33	3.33	2.33
March	-	-	-	September	4.67	8.67	6.67
April	0.01	0.01	0.01	October	20.67	22.00	21.34
May	0.01	0.01	0.01	November	40.67	38.00	39.34
June	0.01	0.01	0.01	December	56.67	53.33	55.00
July	7.33	6.66	7.00	Janauary	57.60	55.00	56.30
August	21.67	25.67	23.67	February	57.60	55.67	56.64
September	62.66	58.98	60.82	March	32.50	30.66	31.58
October	73.66	67.66	70.66	April	21.56	19.50	20.53
November	83.55	78.98	81.27	May	9.67	8.67	9.17
December	-	-	-	June	0.01	0.67	0.34

[1] Costus (Annual crop), [2]Shivajata (Perennial crop)

Table.2: Correlation co-efficients of percent disease incidence of leaf blight disease of Costus, caused by *Pyricularia grisea* and leaf spot disease of shivajata, caused by *Curvularia boedijn*

Diseases and Causal organism	Year	Maximum temparature (°c)	Minimum temperature (°c)	RH morning %	RH evening %	Rainfall (mm)	Sunshine hrs	Wind speed
Leaf blight of Costus, *Pyricularia grisea*	1st yr	-0.643	-0.719*	-0.425	0	-0.302	0.245	-0.709*
	2nd yr	-0.598	-0.638	0.299	-0.318	-0.496	0.314	-0.598
	pooled	-0.610*	-0.673**	-0.161	-0.125	-0.401	0.278	-0.465
Leaf spot of Shivajata, *Curvularia boedijn*	1st yr	-0.734**	-0.975**	-0.827**	-0.715**	-0.820**	0.348	-0.461
	2nd yr	-0.783**	-0.934**	-0.404	0.710**	-0.730**	-0.239	-0.262
	pooled	-0.750**	-0.950**	-0.569**	-0.710**	-0.774**	0.042	-0.357

** Correlation is significant at the 0.01 level.
* Correlation is significant at the 0.05 level.

variables was found to be 0.894 suggesting that 89.4% change in percent disease incidence was caused by these seven factors. During this period of disease development, weather variables varied from 32.08 – 39.08ÚC maxT, 16.14 – 27.18ÚC minT, 80.60 – 96.00% RHmorning, 38.40 – 83.50% RHevening, 0 – 2437.0 mm total rainfall, 4.38 – 8.90 hrs sunshine and 0 – 0.28 km/hr wind speed. The Multiple regression equation derived from the data revealed that the percent disease incidence influenced by maxT (9.74 units), minT (10.90 units), RHmorning (1.92 units), RHevening (4.00 units), sunshine hours (11.96 units), wind speed (135.38 units). It indicated that with increase in max T, rainfall and sunshine hours there was significant increase in percent disease incidence whereas with decrease in wind speed, min T, RH evening and RH morning there was increase in percent disease incidence. It was confirmed by high R^2 value (0.894). The equation was, v=–194.18 + 9.74 maxT – 10.90 minT – 1.92 RHmorning – 4.00 RHevening + 0.00 rainfall + 11.96 sunshine hrs – 135.38 wind speed While deriving on step down regression equation of percent disease incidence of Costus it was clearly observed that wind speed (222.17 units) had

Table. 3: Full and step down prediction equation of percent disease incidence of leaf blight disease of Costus and leaf spot disease of shivajata,

Diseases abd Causal organism	Year	MRA	Prediction equation	R^2	Adj. R^2	SE estimate
Leaf blight of Costus *Pyricularia grisea*	1st	Full	$= -194.189 + 9.746 x_1 - 10.905 x_2 - 1.921 x_3 - 4.005 x_4 + 0.003 x_5 + 11.962 x_6 - 135.385 x_7$	0.894	0.801	15.652
		Step down	$= 53.217 - 222.170 x_7$	0.440	0.399	27.169
			$= 144.724 - 155.194 x_7 - 3.953 x_2$	0.597	0.534	23.920
	2nd	Full	$= -520.956 - 11.125 x_1 + 0.407 x_2 + 9.909 x_3 - 1.550 x_4 + 0.000 x_5 + 15.402 x_6 + 18.679 x_7$	0.900	0.812	14.209
		Step down	$= 163.749 - 5.088 x_2$	0.348	0.302	27.407
			$= -231.791 - 6.115 x_2 + 4.512 x_3$	0.585	0.522	22.684
			$= -668.808 - 4.332 x_2 + 8.007 x_3 + 10.860 x_6$	0.745	0.681	18.507
			$= -1038.251 - 6.082 x_2 + 12.228 x_3 + 12.703 x_6 + 20.594 x_7$	0.824	0.760	16.058
	Pooled	Full	$= 266.416 - 11.256 x_1 - 1.747 x_2 + 0.615 x_3 + 0.674 x_4 + 0.006 x_5 + 15.718 x_6 - 2.195 x_7$	0.729	0.650	19.762
		Step down	$= 168.492 - 5.366 x_2$	0.382	0.362	26.680
			$= 322.847 - 4.192 x_2 - 5.332 x_1$	0.517	0.484	24.003
			$= 431.569 + 0.640 x_2 - 14.415 x_1 + 13.708 x_6$	0.700	0.667	19.263
			$= 424.586 - 13.555 x_1 + 12.620 x_6$	0.698	0.677	18.988
Leaf spot of Shivajata *Curvularia boedijn*	1st	Full	$= 176.785 - 2.854 x_1 - 0.947 x_2 + 0.043 x_3 - 0.593 x_4 - 0.005 x_5 - 0.057 x_6 + 1.231 x_7$	0.976	0.934	5.980
		Step down	$= 102.983 - 3.678 x_2$	0.952	0.947	5.354
			$= 94.570 - 3.076 x_2 - 0.005 x_5$	0.973	0.966	4.245
	2nd	Full	$= -147.278 - 5.837 x_1 + 2.134 x_2 + 4.544 x_3 - 1.859 x_4 - 0.008 x_5 + 0.428 x_6 + 11.036 x_7$	0.996	0.990	2.205
		Step down	$= 101.133 - 3.398 x_2$	0.872	0.859	8.095
	Pooled	Full	$= 281.255 - 4.012 x_1 + 0.511 x_2 - 0.863 x_3 - 0.809 x_4 - 0.004 x_5 + 0.798 x_6 - 1.730 x_7$	0.972	0.960	4.389
		Step down	$= 101.324 - 3.500 x_2$	0.903	0.899	6.959

x_1= Maximum temperature (ÚC) (maxT), x_2= Minimum temperature (ÚC) (minT), x_3=Relative humidity at morning (%) (RHmorning), x_4=Relative humidity at evening (%) (RHevening), x_5= Rainfall (mm), x_6=Sunshine (hours), x_7=Wind speed (km/hr)

negative impact on disease incidence, in contrast min T (3.95 units) had also negative impact on percent disease incidence (Table - 3).

In Costus, during second year, the prediction equation for percent disease incidence of leaf spot disease caused by *Pyricularia grisea* indicated that min T, RH morning, rainfall, sunshine hours and wind speed were positively and max T and RH evening were negatively correlated with percent disease incidence. The coefficient of determination (R^2) between percent disease incidence and seven groups of independent variables was found to be 0.900 suggesting that 90.0 % change in percent disease incidence was caused by these seven factors. During this period of disease development, weather variables varied from 31.15 – 37.68ÚC maxT, 18.83 – 32.45ÚC minT, 88.88 – 98.25% RHmorning, 54.13 – 86.00% RHevening, 0 – 2844.80 mm total rainfall, 2.50 – 7.68 hrs sunshine and 0.03 – 1.28 km/hr wind speed. The Multiple regression equation derived from the data revealed that the percent disease incidence influenced by maxT (11.12 units), minT (0.40 units), RHmorning (9.90 units), RHevening (1.55 units), sunshine hours (15.40 units), wind speed (18.67 units). It indicated that with increase in minT, RHmorning, rainfall, sunshine hours and wind speed there was significant increase in percent disease incidence whereas with decrease in maxT and RHevening there was significant increase in percent disease incidence. It was confirmed by high R^2 value (0.900). The equation was, v= – 520.95– 11.12 maxT + 0.40 minT + 9.90 RHmorning – 1.55 RHevening + 0.00 rainfall + 15.40 sunshine hrs + 18.67 wind speed While deriving on step down regression equation of percent disease incidence of costus, it was clearly observed that min T (5.08 units) had negative impact on disease incidence, in contrast RH morning (4.51 units), sunshine hours (10.86 units) and wind speed (20.59 units) had positive impact on percent disease incidence (Table 3) From these two years data, pooled data was calculated and from that pooled data, the prediction equation for percent disease incidence of leaf spot disease caused by *Pyricularia grisea* indicated that RHmorning, RHevening, rainfall and sunshine hours were positively and maxT, wind speed and minT were negatively correlated with percent disease incidence. The coefficient of determination (R^2) between percent disease incidence and seven groups of independent variables was found to be 0.729 suggesting that 72.9 % change in percent disease incidence was caused by these seven factors. Weather variables varied from 31.62 – 37.43ÚC maxT, 17.48 – 29.70ÚC minT, 86.99 – 97.13% RHmorning, 47.00 – 84.75% RHevening, 0 – 2252.25 mm total rainfall, 3.08 – 7.81 hrs sunshine and 0.01 – 0.75 km/hr wind speed. The Multiple regression equation derived from the data revealed that the disease incidence influenced by maxT (11.25 units), minT (1.74 units), RH morning (0.61 units), RHevening (0.67 units), rainfall (0.006 units), sunshine hours (15.71 units), wind speed

(2.19 units). It indicated that with increase in RH morning, RH evening, rainfall and sunshine hours there was significant increase in percent disease incidence whereas with decrease in max T, wind speed and min T there was significant increase in percent disease incidence. It was confirmed by high R^2 value (0.729). The equation was, v=266.41– 11.25 maxT – 1.74 minT + 0.61 RHmorning + 0.67 RHevening + 0.00 rainfall + 15.71 sunshine hrs– 2.19 wind speed While deriving on step down regression equation of percent disease incidence of costus, it was clearly observed that min T (5.36 units) had negative impact on disease incidence (Fig. 1), in contrast sunshine hours (12.62 units) had positive and max T (5.33 units) had negative impact on percent disease incidence (Table -3). Rao and Satyanarayana (1991) carried out step down regression analysis with meteorological parameters and the disease which indicated that rainfall (49.9 mm/wk) distributed over 3.16 days/ wk with 39 h sunshine/wk (cloudy weather)

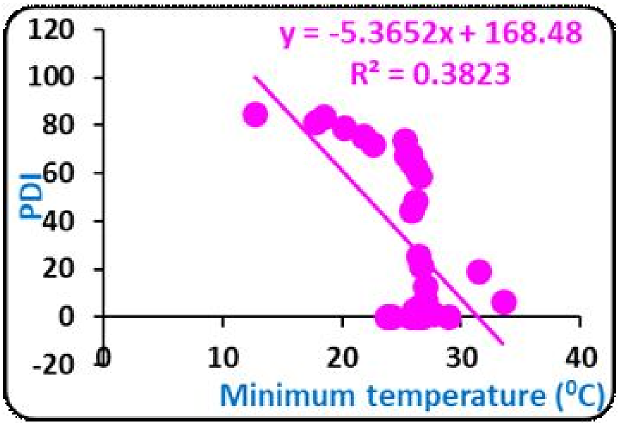

Fig. 1: Minimum temperature vs PDI of Costus

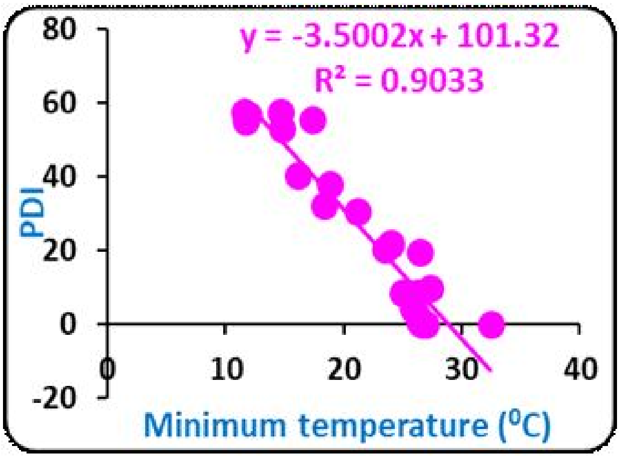

Fig. 2: Minimum temperature vs PDI of Shivajata

favoured build up and severity of grapes anthracnose. Kumar *et al*. (1999) reported that maximum anthracnose disease development was noticed after mid-July to mid-August, when weather variable *viz*., temperature (19-20ÚC), relative humidity (74-77%), rainfall (0.2-166.9 mm) and frequency of rains (2-5 days) were congenial in kidney bean. Two consecutive days of rain accompanied by cloudiness and high humidity are necessary for infection of *C. truncatum* in bean.

Leaf spot disease of Shivajata

In Shivajata, during first year (Table 3), the prediction equation for percent disease incidence of leaf spot disease caused by *Curvularia boedijn* indicated that, RH morning and wind speed were positively and minT, maxT, rainfall, sunshine hours and RH evening were negatively correlated with percent disease incidence. The coefficient of determination (R^2) between disease incidence and seven groups of independent variables was found to be 0.976 suggesting that 97.6 % change in percent disease incidence was caused by these seven factors. During this period of disease development, weather variables varied from 26.53 – 37.68ÚC maxT, 11.60 – 27.32ÚC minT, 80.60 – 96.00% RHmorning, 37.25 – 83.50% RHevening, 0 – 2555.0 mm total rainfall, 3.65 – 9.03 hrs sunshine and 0 – 1.28 km/hr wind speed. The Multiple regression equation derived from the data revealed that the percent disease incidence influenced by maxT (2.85 units), minT (0.94 units), RHmorning (0.04 units), RHevening (0.59 units), rainfall (0.00 units), sunshine hours (0.05 units), wind speed (1.23 units). It indicated that with increase in RH morning, and wind speed there was significant increase in percent disease incidence whereas with decrease in min T, max T, rainfall, sunshine hours and RH evening there was significant increase in percent disease incidence. It was confirmed by high R^2 value (0.976).

The equation was, v= 176.78 – 2.85 maxT – 0.94 minT + 0.04 RHmorning – 0.59 RHevening – 0.00 rainfall – 0.05 sunshine hrs + 1.23 wind speed While deriving on step down regression equation of percent disease incidence of shivajata it was clearly observed that minT (3.67 units) had negative impact on percent disease incidence, in contrast rainfall (0.005 units) had significant negative impact on percent disease incidence (Table 3). In Shivajata, during second year, the prediction equation for percent disease incidence of leaf spot disease caused by *Curvularia boedijn* indicated that minT, RHmorning, wind speed and sunshine hours were positively and maxT, RHevening and rainfall were negatively correlated with percent disease incidence. The coefficient of determination (R^2) between disease incidence and seven groups of independent variables was found to be 0.996 suggesting that 99.6% change in disease incidence was caused by these seven factors. During this period of disease development, weather variables varied from 25.60 – 39.25ÚC maxT, 11.65 – 32.45ÚC minT, 88.88 – 98.25% RHmorning, 46.63 – 86.00% RHevening, 0 – 2844.80 mm total rainfall, 2.50 – 8.35 hrs sunshine and 0.03 – 1.70 km/hr wind speed. The Multiple regression equation derived from the data revealed that the percent disease incidence influenced by maxT (5.83 units), minT (2.13 units), RH morning (4.54 units), RH evening (1.85 units), rainfall (0.008 units), sunshine hours (0.42 units), wind speed (11.03 units). It indicated that with increase in minT, RH morning, wind speed and sunshine hours there was significant increase in percent disease incidence whereas with decrease in max T, RH evening and rainfall there was significant increase in percent disease incidence. It was confirmed by high R^2 value (0.996).

The equation was, v = –147.27 – 5.83 maxT + 2.13minT + 4.54 RHmorning – 1.85 RHevening – 0.00 rainfall + 0.42 sunshine hrs + 11.03 wind speed While deriving on step down regression equation of percent disease incidence of shivajata it was clearly observed that minT (3.39 units) had negative impact on disease incidence (Table-3). From these two years data, pooled data was calculated and from that pooled data, the prediction equation for percent disease incidence of leaf spot disease caused by *Curvularia boedijn* indicated that minT and sunshine hours were positively and RHevening, RHmorning maxT, wind speed and rainfall were negatively correlated with percent disease incidence. The coefficient of determination (R^2) between disease incidence and seven groups of independent variables was found to be 0.972 suggesting that 97.2% change in percent disease incidence was caused by these seven factors. Weather variables varied from 26.13 – 37.52ÚC maxT, 11.63 – 29.70ÚC minT, 86.00 – 97.13% RHmorning, 42.88 – 84.75% RHevening, 0 – 2252.25 mm total rainfall, 3.08 – 8.15 hrs sunshine and 0.01 – 1.25 km/hr wind speed. The Multiple regression equation derived from the data revealed that the percent disease incidence influenced by maxT (4.01 units), minT (0.51 units), RHmorning (0.86 units), RHevening (0.80 units), rainfall (0.004 units), sun shine (0.79 units), wind speed (1.73 units). It indicated that with increase in minT and sunshine hours there was significant increase in percent disease incidence whereas with decrease in RHevening, RHmorning, maxT, wind speed and rainfall there was increase in percent disease incidence. It was confirmed by high R^2 value (0.972). The equation was, v = 281.25 – 4.01 maxT + 0.51 minT – 0.86 RHmorning – 0.80 RHevening – 0.00 rainfall + 0.79 sunshine hrs – 1.73 wind speed While deriving on step down regression equation of percent disease incidence of Shivajata it was clearly observed that min T (3.50 units) had negative impact on percent disease incidence (Fig. 2) (Table -3).

Sarkar and Dasgupta (2018) studied on correlation of coefficients and Multiple regression analysis (MRA) between percent disease incidence of Leaf blight disease of *Piper longum* caused by *Fusarium* sp. and Leaf blight disease of *Tylophora indica* caused by *Sclerotium rolfsii* with different weather parameters for finding out the different role of weather parameters on development of diseases. The result showed that the partitioning of correlation of coefficients into direct and indirect effect of above diseases were negatively correlated to different weather parameters. While deriving MRA of two years pooled data of leaf blight disease of *P. longum,* it was revealed that with increase in min T and sunshine hours there was significant increase in percent disease incidence whereas with decrease in RH evening, RH morning, max T, wind speed and rainfall there was increase in percent disease incidence which was confined by high R^2 value (0.893). While deriving MRA of two years pooled data of leaf blight disease of *T. indica*, it was revealed that with increase in RH evening, RH morning and sunshine hours there was significant increase in percent disease incidence whereas with decrease in min T, max T, wind speed and rainfall there was significant increase in percent disease incidence which was confirmed by high R^2 value (0.776). Important fungal diseases in medicinal and aromatic plants and their control has been reported by Avan (2021). Modern information technology will play a greater role in the epidemiology and control of fungal diseases of medicinal and aromatic plants, especially in the applications of disease identification and evaluation based on image-processing technology, which will promote the development of smart phytoprotection to ensure crop health and food security (Wang, 2023).

CONCLUSION

From the results it could be concluded that as all the recorded weather parameters were not responsible for the development of both the diseases of leaf blight disease of Costus (*Costus speciosus*) caused by *Pyricularia grisea* and Leaf spot Disease of Shivajata (*Uraria picta*) caused by *Curvularia boedijn*, the other weather parameters might be responsible for the development of above diseases.

DECLARATION

Conflict of interest. Authors declares no conflict of interest.

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