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Research Article

Correlation of Weather Parameters with the Development of Grey Mildew Disease of Cotton Caused by *Ramularia areola*

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ABSTRACT

Cotton is an important economic crop, which occupies an important position in the national economy. However, foliar diseases affect cotton crop throughout the season. Grey mildew caused by Ramularia areola is one of the important fungal foliar disease affecting cotton in India. The experiment was conducted with a view to study the influence of different weather parameters on the initiation and spread of grey mildew and develop a suitable weather based disease forewarning equation. The correlation studies indicated that rainfall (-0.531) had significantly negative correlation with the disease development whereas Morning RH (-0.747) and Evening RH (-0.761) had highly significant negative correlation. The weather conditions during 39th to 43rd SMW were observed to be the most congenial for the crop infection and further rapid build-up of grey mildew disease. In best fit multiple regression equation, coefficient of determination R^2 value (0.80) obtained represent that 80 per cent variation in development of grey mildew severity was explained by weather parameters.

Keywords: *Cotton, Ramularia areola, Weather parameters, Correlation, Regression.*

INTRODUCTION

Cotton (*Gossypium* spp.) is one of the most important commercial crop playing a key role in economics of the World. India has 126.58 lakh hectare area under cotton and emerged as the largest producer in the world with 330 lakh bales and productivity with 443 kg/ha during 2018-19 (Anon., 2019). In Maharashtra, the area under cotton cultivation is 42.18 lakh hectares with a production of 65.93 lakh bales and an average productivity of 265 kg/hectare

(Anon, 2019). The cotton crop suffers from many fungal diseases, of which foliar diseases take a heavy toll. Among the diseases, grey mildew (*Ramularia areola*) causes the yield losses up to 38 per cent (Chidambaram & Kannan, 1989; Chattannavar et al., 2010; Bhattiprolu, 2012; & Monga et al., 2013). In Marathwada region of Maharashtra (India), the occurrence of grey mildew disease has been reported in destructive epidemic form earlier (Kolte, 1973; & Badgire, 1980).

Weather conditions play a predominant role in determining the course and severity of epidemics. Hence, present studies were taken up to study the role of major weather factors *viz.*, rainfall, temperature and relative humidity on infection and development of grey mildew and secondly to develop forecasting model for it.

MATERIALS AND METHODS
The experiment was conducted at the research farm, Cotton Research Station, Nanded, Maharashtra, India. Non replicated trial of cotton (*Bt* hybrid RCH 2 BG II) was laid out during *Kharif* season 2020 having a plot size 10x10 m. The research farm is situated at longitude 19°08'08.6"N and latitude 77°20'41.9"E. The soil type was black basalt soil. No plant protection measure was applied. All the standard agronomic practices were adopted during the experiment.

Meteorological data related to the temperature, relative humidity and rainfall during growth period of the crop were obtained from the Meteorological Observatory of Cotton Research Station, Nanded. Observations were recorded at first appearance of the disease symptoms on leaves till the harvest of crop at weekly intervals. The intensity of grey mildew was recorded as per the disease scale (0-5) of AICRP on Cotton. The Percent Disease Index (PDI) was calculated as per the following formula given by Wheeler (1969).

$$PDI = \frac{\text{Sum of numerical values}}{\text{Number of leaves observed}} \times \frac{100}{\text{Maximum disease rating value}}$$

Statistical analysis
Correlation coefficients (r) were computed between the cotton grey mildew disease intensity and meteorological parameters. Regression analysis was carried out to develop the relationship of grey mildew disease with significant weather parameters. SPSS Statistics ver. 20, software was used for statistical analysis.

RESULTS AND DISCUSSION
Grey mildew of cotton appeared during 39th meteorological week (24th to 30th Sept., 2020) with maximum temperature (Tmax) 29.7^{0}C, minimum temperature (Tmin) 18.4^{0}C, morning relative humidity 84.28% (RH I), evening relative humidity 84.28% (RH II) and rainfall was 57 mm/week at flowering stage. Grey mildew increased progressively and reached its peak 21.86% during the 43rd meteorological week (22nd to 28th Oct., 2020) at the boll maturity stage, with maximum temperature 32.7^{0}C, minimum temperature 20.7^{0}C,

morning relative humidity 76.14% and evening relative humidity 63.42% (Figure 1). Similar observation was reported by Venkatesh et al. (2015) who reported that grey mildew disease was initiated in August, increased in September and reached peak level in the month of October at Dharwad. Bhattiprolu et al. (2016) showed that grey mildew disease was initiated in October and reached peak level in the month of December at Lam, Guntur.

Correlation
The correlation of grey mildew disease intensity with weather parameters are presented in Table 1. The correlation studies indicated that rainfall (-0.531) had significantly negative correlation with the disease development whereas Morning RH (-0.747) and Evening RH (-0.761) had highly significant negative correlation. Maximum temperature (0.342) and minimum temperature (0.052) showed positive non-significant correlation with grey mildew disease.

Table 1: Correlation coefficient (r) between weather parameters and grey mildew of cotton

Weather parameters	Correlation coefficient (r)
Rainfall (mm)	-0.531*
Maximum temperature (^{0}C)	0.342
Minimum temperature (^{0}C)	0.052
Morning RH (%)	-0.747**
Evening RH (%)	-0.761**
Note. * p < .05, ** p < .01	

Multiple regression

It is obvious that no single weather parameter could independently influence the disease development. The influence of interactions among various weather parameter was probably involved in affecting the disease development. Therefore, for multiple regression, the best fit model was used and the coefficient of determination (R^2) was developed for the prediction of grey mildew disease in cotton as given below.

Regression equation:

Y= 561.648 – 0.284*Rainfall -17.536*Tmax 11.798*Tmin 0.589* Morning RH -3.556* Evening RH

Where, Y= Grey mildew disease severity

The best fit multiple regression analysis revealed that, rainfall, maximum temperature and evening relative humidity were negatively correlated with grey mildew disease severity. The coefficient of determination R^2 value was equal to 0.80, which implies that 80% variation in the development of grey mildew severity was explained by weather parameters *viz*., rainfall, maximum temperature, minimum temperature, morning and evening relative humidity. The best fit prediction equation is presented in Figure 2.

Therefore, it was evident that for every one per cent increase in *viz*., rainfall, maximum temperature and evening relative humidity there were corresponding decrease of 0.28%, 17.53%, 3.55% in percent disease index of grey mildew, respectively, whereas one per cent increase in maximum temperature and morning relative humidity there were corresponding increase of 11.79% and 0.58% in percent disease index of grey mildew, respectively. Our findings are in agreement with earlier findings (Johnson et al., 2013; Venkatesh et al., 2015; & Bhattiprolu et al., 2016). These findings can be used further to disease prediction model and timely application of fungicides.
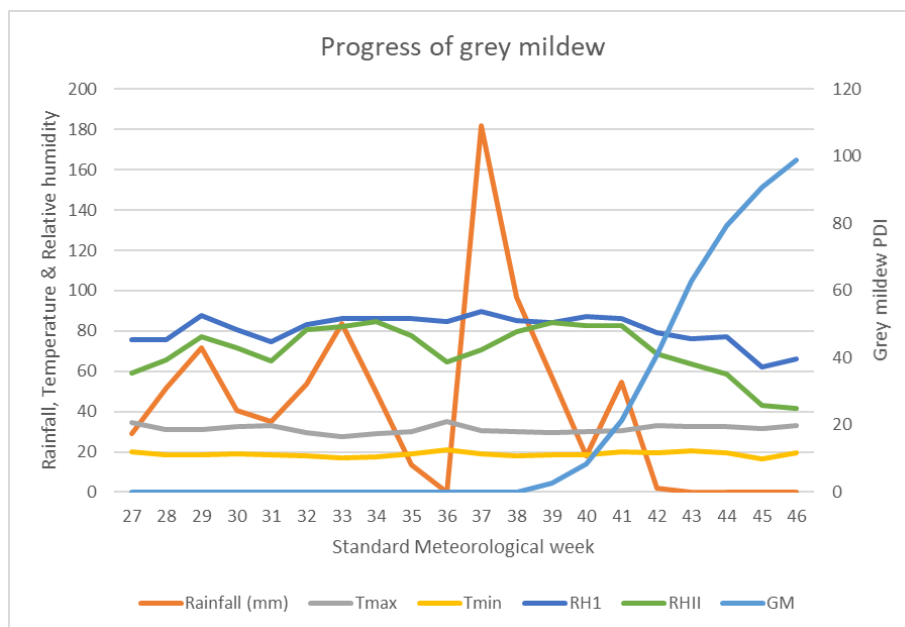
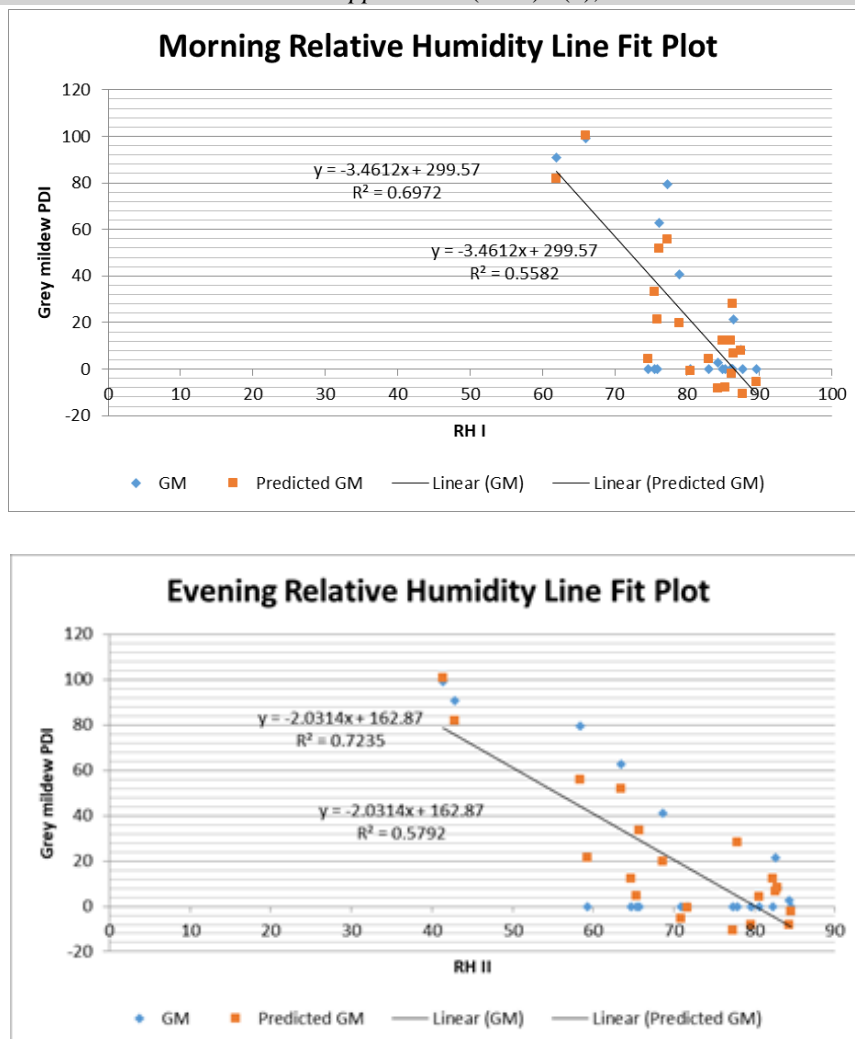**Figure 1: Development of grey mildew of cotton**
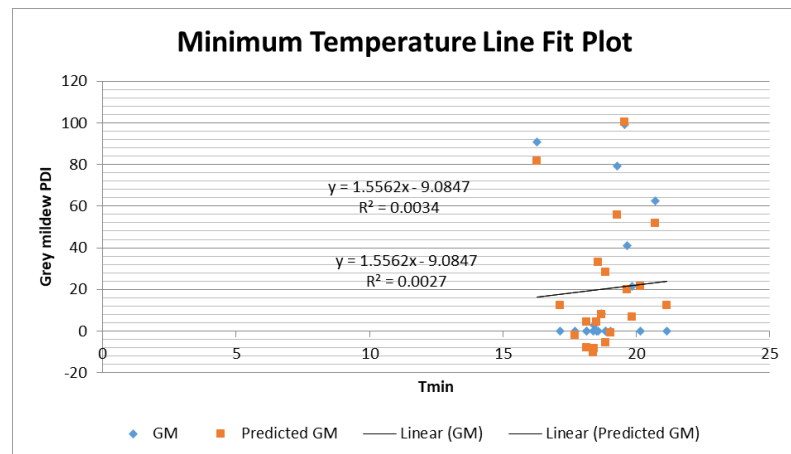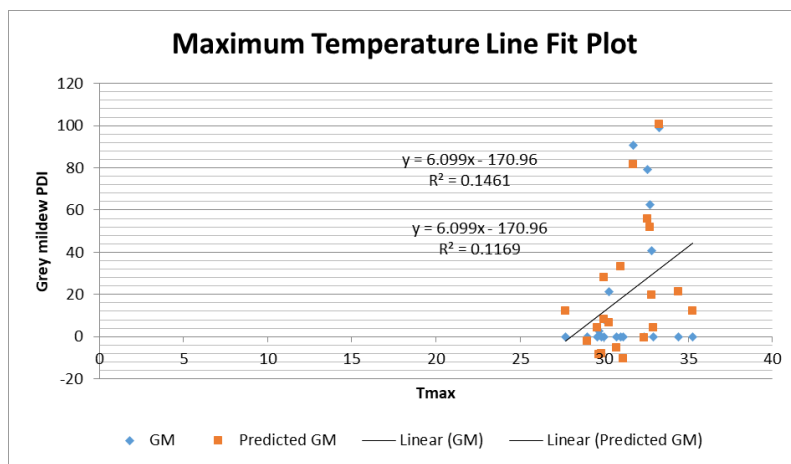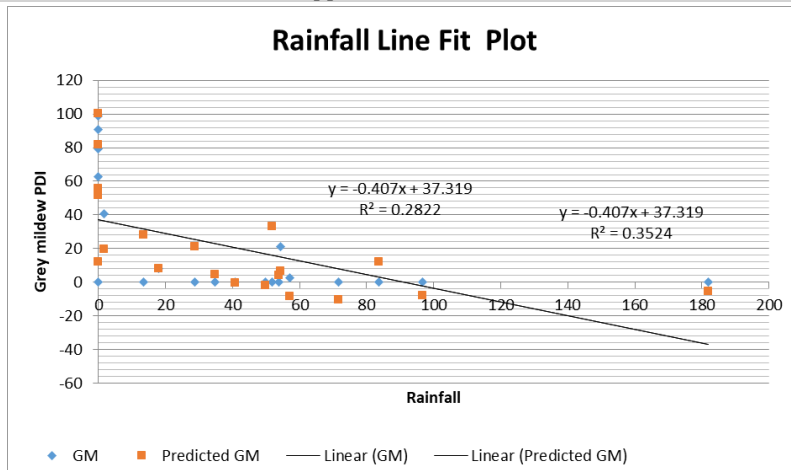
Figure 2: Best fit prediction equations for grey mildew

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