Weather based forewarning model for powdery mildew disease of mustard

ABSTRACT-To develop the weather based forewarning model for powdery mildew disease of mustard crop at Sardarkrushinagar, weekly powdery mildew data of 12 years (2010/11to 2021/22) collected from Centre for Oilseed Research, S.D. Agricultural University, Sardarkrushinagar. The data were pooled over the yearsand correlated with corresponding weather parameters recorded in Agromet Observatory, S.D. Agricultural University, Sardarkrushinagar.The forewarning regression equation developed with the help of weather variables to predict the incidence of disease in an advance. The results revealed that the maximum temperature and minimum temperaturewere significantly positively correlated(r= 0.714) with powdery mildew disease of mustard. While morning and evening relative humiditycorrelated significantly negative(r=0.558)with disease severity. Regression equation developed with maximum temperature and morning relative humidity caused variability up to 96 % in the powdery mildew disease of mustard.

Key word:*Weather, Powdery mildew, Forewarning equation,relative humidity*

Introduction

Mustard (*Brassica Juncea*) is one of the most important oilseed crop grown under wide range of agro-climatic conditions in India. This crop is affected by various biotic and abiotic factors of the environment. The weather conditions particularly temperature and relative humidity are the most congenial parameters for outbreak of powdery mildew, which has been a limiting factor for successful cultivation of mustard. Dange *et al.,* (2002) reported 17 per cent yield loss due to this disease in mustard in Gujarat state. Weather parameters such as temperature and relative humidity play an important role in disease development (Gadre *et al.,* 2002; Desai *et al.,* 2004 and Kohire*et al.,* 2008). However, scanty information is available on the epidemiological aspects in relation to weather of this disease under north Gujarat agro-climatic conditions where the crop is cultivated during rabi seasonmainly in Banaskantha districtas major crop (Kumar et al., 2013; Kumar and Chakravarty, 2008). The crop is mainly affected by

powdery mildew disease causing considerable losses in terms of both quality and quantity of the grain. Hence, the present investigation was carried out at Sardarkrushinagarto determine the influence of meteorological parameters on diseasedevelopment.

Materials and Methods

Weekly powdery mildew disease data of 12 years (2010/11 to 2021/22) from 3rd to 13th standard meteorological week (SMW) was collected from Centre for Oilseed Research, S.D. Agricultural University, Sardarkrushinagar. The data on disease intensity were pooled over the year and used for analysis and results interpretation. Weekly disease intensity was correlated with corresponding weekly weather parameters which were recorded in nearby agro-meteorological observatory, S.D. Agricultural University, Sardarkrushinagar. The weather variables like maximum temperature (Tmax), minimum temperature (Tmin), morning relative humidity (RHI, afternoon relative humidity (RH II), rainfall (RF), sunshine hours (SSH) and wind speed (WS) were used for correlation study. The weather parameters those have significant relationship with powdery mildew disease, were used to develop step wise regression for disease forecasting. In present study, SPSS v. 20, a computer window was used to carry out the correlationand regression analysis. Since the diseases are not influenced by a single weather parameter but by interaction of more than one variables, hence multiple regression equations were developed for powdery mildew disease of mustard.

$$Y = a_1X_1 + a_2X_2 + a_3X_3 + C$$

Where, Y = disease intensity

X_1, X_2 and X_3 = weather variables

a_1, a_2 and a_3 are partial regression coefficients

C = constant

Results and Discussions

1. Weather factors and disease development

The average maximum and minimum temperature during the period of disease incidence varied from 26.2 to 38.1 ^{0}C and 8.7 to 18.5 ^{0}C respectively. Similarly, relative humidity during morning and afternoon varied from 67 to 73 percent and 27 to 35 percent, respectively. The disease intensity during the period ranged from 0.2 to 98.0 percent on pooled basis. The incidence of disease increased with advancement of maximum and minimum temperature. Correlation study revealed that, the maximum and minimum temperature showed significant positive correlation with disease incidence. The relationship between disease intensity and morning and afternoon relative humidity was found significant negative. The correlation of rainfall, sunshine hours and wind speed with PDI was found to be non significant. Highest correlation coefficient (r = 0.973**) obtained with maximum temperature followed by minimum temperature (r = 0.964**) (Table 1). Thus, it is clearly indicated that the temperature and relative humidity play an important role in powdery mildew disease development in mustard crop. Similar resultswere reported by Saharan and Kaushik (1981); Dang *et al.*, (1998) and Gadre *et al.*,(2002). They reported that temperature had significant positive relationship with the powdery mildew disease of mustard. The present findings wasalso in close conformitywith the results reported by Desai *et al.* (2004); Kohire*et al.* (2008).Similar results wasalso reported by Kanzaria *et al.* (2013), where they stated that maximum and minimum temperature showed significantly positive correlation with PDI while morning and afternoon relative humidity had significantly negative relationship with disease.

2. Forecasting model for powdery mildew disease

Forecasting of disease, regression equation was developed with those weather variables which had significant correlation with disease intensity. Stepwise regression procedure was followed for disease prediction in an advance. The equation PDI = 62.837 + 8.072 Tmax - 3.919 RH Iwith R^2 value 0.96 and error of estimate 7.43 developed with maximum temperature and morning relative humidity could explained 96 per cent variability in powdery mildew disease (Table 2). Thus, maximum temperature and morning relative humidity found most influencing weather parameters (predictors) for disease forecasting.Such model could be used successfully for disease forecasting in an advance in mustard crop in the region. It could also be used in agro-advisory services bulletins to timely spraying in the crop for controlling the disease incidence.

Table 1: Correlation coefficient between weather variables and powdery mildew disease

Sr. No.	Weather variables	Correlation coefficient (r)
1.	Tmax	0.973**
2	Tmin	0.964**
3.	RH I	-0.754**
4.	RH II	-0.899**
5.	RF	0.494
6.	SSH	0.048
7.	WS	0.408

Table 2: Regression equation for prediction of powdery mildew disease

Sr. No.	Regression equation	R^2	Error of estimate
1.	PDI = 62.837 + 8.072Tmax - 3.919 RH I	0.96	7.43

Conclusion

The incidence of powdery mildew disease of mustard under north Gujarat agro-climatic condition increased rapidly with an increase in temperature. The maximum temperature and morning relative humidity found were the most influencing weather variables for disease development.

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