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Short communication

Effect of agrometeorological parameters on incidence of downy mildew in pearl millet*

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Pearl millet is an important food crop of the world in arid and semiarid tropics. The crop can be grown on the poorest soil and under harsh climatic conditions where no other crop can grow (Singh, 1995). Downy mildew [*Sclerospora graminicola* (Sacc.)] is one of the major biotic yield reducing factors for this crop. Mittar and Tandon (1930) confirmed the seriousness of the green ear disease in low lying areas in north India in addition to the downy mildew phase of the disease. The reduction of yield during the green ear stage alone claims 12% and the loss may be upto 65% if the disease incidence is in both seedling and green ear stage (Appaji *et al*., 1989). Deyol (2005) surveyed for the incidence of downy mildew in pearl millet in different districts of Haryana state viz., Hisar, Jind, Sonepat, Rohtak, Jhajjar, Fatehabad, Bhimani, Mahendargarh and Rewari during *kharif* season of 2003 and found 0-20% incidence in all popular pearl millet hybrids. Weather parameters play an important role in the initiation and spread of plant diseases (Thind *et al*., 2008). Sheoran *et al*. (1997) developed prediction model for downy mildew disease in pearl millet using multiple regression analysis. They suggested that these prediction models were useful in forecasting the occurrence of downy mildew disease, especially in Delhi agroclimatic conditions. Keeping these points in view, the present investigation was undertaken to develop the prediction models of downy mildew progression in pearl millet using agrometeorological parameters.

A study on prediction of downy mildew in pearl millet on the basis of agrometeorological parameters was undertaken at the experimental field of Department of Plant Pathology, CCS Haryana Agricultural University, Hisar during the *kharif* season of 2007. The experiment was conducted in split plot design with two different growing environments viz., inoculated site and non-inoculated site in the main plots and three varieties viz., HBB-67 Improved, HHB-67 and 7042-S in sub-plots with four replications. Number of plants affected by downy mildew had been noted from each plot at 15 days interval starting from 20 DAS. The dry and wet bulb temperatures were measured with the help of Assmann psychrometer at top, middle and bottom of crop canopy on the same day of disease observation. The relative humidity was calculated using psychrometric tables. Agrometeorological indices : growing degree days, helio-thermal units, photo-thermal units, thermal use efficiency and radiation use efficiency were computed for different pearl millet cultivars in both environments using the daily meteorological data recorded at Agrimet Observatory.

The disease intensity was transformed using the disease progression models (Anil kumar *et al*, 2010). Disease intensity in per cent and transformed values by different models were correlated with agrometeorological parameters.

Correlation coefficients obtained between agrometeorological indices and downy mildew incidence are presented in Table 1. The agrometeorological indices : growing degree days (GDD), helio-thermal units (HTU), photo thermal units (PTU), thermal use efficiency (TUE) and radiation use efficiency (RUE) were taken into consideration for correlation study with per cent disease incidence and transformed disease intensity with Logistic model (LM) and Gompertz model (GM) at inoculated, non-inoculated site and their pooled data (inoculated and non-inoculated condition). Among the agrometeorological variables under consideration, PTU, TUE and RUE showed high correlation with disease incidence TUE and RUE showed significant negative correlation with disease incidence (%) and their transformed values, whereas PTU showed positive significant correlation except in case of transformed values in 7042-S. The significant weather indices affected the disease incidence in pearl millet; it means that a unit change in the value of these indices resulted in a unit change in downy mildew incidence. Among agrometeorological indices, the correlation coefficient of thermal use efficiency with disease spread was highest. This might be due to the fact that it took care of effect of disease incidence on biomass accumulation.

Correlation coefficients obtained between meteorological parameters and downy mildew incidence are

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Table. 1: Correlation matrix between downy mildew disease and meteorological indices in different pearl millet cultivars (Pooled for both inoculated and non-inoculated environments)

Indices	HHB-67 Improved			HHB-67			7042-S		
	DI	LM	GM	DI	LM	GM	DI	LM	GM
GDD	-0.35	-0.80*	0.80*	-0.37	-0.13	0.63*	-0.30	-0.25	-0.27
HTU	0.13	0.32	0.29	0.09	0.19	0.34	0.00	0.18	0.03
PTU	0.46*	0.83*	0.84*	0.45*	0.08	0.59*	0.34	-0.33	-0.32
TUE	-0.64*	-0.75*	-0.78*	-0.25	-0.62*	-0.87*	-0.61*	-0.61*	-0.57*
RUE	-0.29	-0.76*	-0.77*	-0.43*	-0.38	-0.72*	-0.54*	-0.57*	-0.49*

*Significant at P<0.05 (r=0.404, n=24).
Where, GDD–Growing degree days, HTU–Helio-thermal units, PTU–Photo-thermal units, TUE–Thermal use efficiency, RUE–Radiation use efficiency, DI–Disease incidence in per cent, LM–Logistic model for disease progression, GM–Gompertz model for disease progression.

Table 2 : Correlation matrix between downy mildew disease and meteorological parameters in different pearl millet cultivars (Pooled for both inoculated and non-inoculated environments)

Parameters	HHB-67 Improved			HHB-67			7042-S		
	DI	LM	GM	DI	LM	GM	DI	LM	GM
$Temp_{Max}$	0.57*	0.41*	-0.06	0.86*	0.52*	0.39	0.81*	0.82*	0.90*
$Temp_{Range}$	0.89*	-0.58*	-0.63*	0.32	0.32	0.30	0.38	0.52*	0.56*
$Temp_{Average}$	0.08	0.31	0.27	0.50*	0.44*	0.28	0.64*	0.61*	0.68*
$Temp_{Min}$	-0.29	0.47*	0.46*	-0.13	0.15	0.03	0.09	0.04	0.06
VPD_{Max}	0.47*	0.23	0.16	0.73*	0.22	0.58*	0.07	0.11	-0.13
VPD_{Range}	0.86*	-0.20	-0.27	0.87*	0.10	0.23	0.10	0.15	-0.10
$VPD_{Average}$	-0.69*	-0.55*	0.15	-0.50*	-0.25	0.41*	-0.68*	-0.43*	0.13
VPD_{Min}	-0.63*	0.71*	0.73*	-0.69*	0.15	0.51*	-0.25	-0.30	-0.07
RH_{Max}	0.63*	-0.66*	-0.67*	0.528	-0.24	-0.62*	-0.02	0.00	-0.20
RH_{Range}	0.66*	0.12	0.06	0.88*	0.27	0.29	0.05	0.10	-0.21
$RH_{Average}$	0.47*	-0.70*	-0.70*	0.33	-0.22	-0.85*	-0.02	0.02	0.17
RH_{Min}	-0.17	-0.56*	-0.51*	-0.34	-0.47*	-0.84*	-0.08	-0.11	0.09

*Significant at P<0.05 (r=0.404, n=24).
Where, Temp–Temperature, VPD–Vapour pressure deficit and RH–Relative humidity.

presented in Table 2. The meteorological parameters : maximum, minimum and mean air temperatures, temperature range, maximum, minimum and mean relative humidity and vapour pressure deficit and its range within the canopy were taken into consideration for correlation study with per cent disease incidence and transformed values by Logistic model and Gompertz model at inoculated, non-inoculated site and their pooled data (inoculated and non-inoculated condition). Maximum temperature and average vapour pressure deficit were found significantly correlated with downy mildew disease incidence. The response of disease incidence was positive with maximum temperature and negative with vapour pressure deficit. In all of the cultivars, maximum temperature was positively associated with disease incidence. This could be explained by the fact that temperature increase within favourable range might cause increase in growth rate of pathogens. On the contrary, Saxena *et al.* (1978) reported that temperature had the most negative direct effect on ergot infection index in pearl millet. Saharan and Saharan (2001) found that Alternaria blight of clusterbean was negatively and significantly correlated with minimum temperature.

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