

Influence of weather parameters on incidence of yellow vein mosaic virus in okra

SK DHANKHAR, PK CHOHAN and SURENDER SINGH¹

Department of Vegetable Science, ¹Department of Agri Meteorology

CCS Haryana Agricultural University, Hisar-125004, India

Email: dhankharsk@hau.ernet.in

ABSTRACT

Investigation was undertaken to find out influence of different weather parameters on incidence of YVMV disease in okra. Twelve okra genotypes were sown in randomized block design with three replications accommodating sixty plants of each genotype during rainy season of years 2007, 2008 and 2009. Incidence of YVMV disease was recorded at 30, 60 and 90 days after sowing in each genotype. Pooled data on per cent incidence of YVMV was subjected to correlation and regression analysis. Per cent incidence of YVMV disease was higher in 90 days old crop followed by 60 and 30 days old crops. Bright sunshine hours showed significantly positive association ($r = 0.94^{**}$) and minimum temperature showed significantly negative correlation ($r = -0.89^{**}$) with YVMV disease incidence. Morning relative humidity expressed positive correlation ($r = 0.14$) whereas, evening relative humidity expressed negative correlation ($r = -0.61$) with the disease incidence. All weather parameter except minimum temperature (78%) and bright sunshine hours (84%) expressed poor potential (below 2.0%) for the spread of the disease. However, when these parameters were taken together in the form of multiple regression equation, prediction potential was improved to the tune of 98%. Thus, most of the weather parameter in combination influenced the incidence of this disease. However, bright sunshine hours (9.0 ± 0.5 hrs) coupled with low night temperature ($21.5 \pm 2^{\circ}\text{C}$) played important role for the spread of YVMV disease in okra.

Key words: okra, yellow vein mosaic virus (YVMV), weather parameters

Okra, *Abelmoschus esculentus* (L.) Moench, is grown as vegetable crop in many parts of the world. However, in India *A. esculentus* is most common and has great commercial demand due to its nutritional and medicinal value. It is good source of vitamin A, B, C and also rich in protein, carbohydrates, fats, minerals, iron and iodine (Baloch et al., 1990; Norman, 1992). Okra is vulnerable to attack of fungi, bacteria, viruses, mycoplasma, nematodes and insects and which causes yield loss up to 20-30%. However in severe cases, the losses increases up to 80-90% (Hamer & Thompson, 1957). Plant disease forecasting being management system used to predict the occurrence or change in severity of plant diseases. At field scale, these systems are used by farmers to make decisions on disease treatments for control. Often the systems ask the farmers a series of questions about the susceptibility of the host crop, and incorporate current and forecast weather conditions to make a recommendation. The role of meteorological factors in influencing the rate and intensity of disease development is very significant. Sharma et al. (1987) found that temperature has significant effect on the incidence of YVMV in Okra. Among the common diseases of okra, yellow vein mosaic virus (YVMV) disease caused by a

begomovirus is the most serious disease, which causes serious loss in yield and quality. The virus can cause losses 50-90 per cent depending on the crop growth stage at which infection occurs (Sastry and Singh, 1974). The insect vector, white fly [*Bemisia tabaci* (Gennadius)] play important role in spreading of this disease (Verma, 1955) and occurring in various regions of India (Capoor and Verma, 1950; Sastry and Singh, 1974, and Singh *et. al.*, 1962). The present study was carried to investigate the role of various environmental factors on disease incidence and its development on okra plants so that a recommendation is made based on weather parameters whether disease treatment is required or not.

MATERIALS AND METHODS

Field experiment was conducted to find out the influence of weather parameters on incidence of YVMV disease in okra. Seeds of twelve okra inbreds viz. HRB-101, HRB-102, HRB-105, HRB-107, HRB-108, HRB-115, HRB-118, HRB-128, HRB-144, HRB-149 including two commercial varieties Pusa Sawani and Hisar Unnat were sown on raised beds at spacing of 60 cm between rows and 30 cm between plants in randomized block design with three replications during rainy seasons of the

Table 1: Mean of YVMV disease incidence (%) and weather parameters at 30, 60 and 90 days after sowing

Year	Days after sowing	DI (%)	Temperature (°C)		RH (%)		BSS (hrs)	PE (mm)	RF (mm)
			Max	Min	Morning	Evening			
2007	30	4.2	38.3	27.1	66.1	44.0	6.3	8.8	1.6
	60	23.9	36.0	24.9	77.1	50.9	7.9	6.3	3.1
	90	53.1	36.3	23.9	74.5	44.8	8.6	7.0	0.3
2008	30	7.0	35.3	24.8	75.5	54.4	6.2	6.9	1.3
	60	34.1	36.5	24.1	73.8	46.5	8.5	7.4	0.3
	90	85.2	36.5	18.6	73.5	36.2	9.3	6.4	0.2
2009	30	13.6	34.9	24.5	81.6	63.2	6.6	6.1	6.9
	60	36.0	34.4	23.4	81.9	63.2	7.8	5.0	4.4
	90	85.8	36.3	21.6	78.3	41.8	9.6	6.1	0.9
Overall mean of three year (2007-2009)									
2007-09	30	8.3	36.2	25.5	74.4	53.9	6.47	7.3	3.3
2007-09	60	31.3	35.6	24.1	77.6	53.5	8.1	6.2	2.6
2007-09	90	74.7	36.4	21.4	75.4	40.9	9.2	6.5	0.5

DI= disease incidence, RH= relative humidity, BSS= bright sunshine hours, PE= pan evaporation, RF= rainfall

years 2007, 2008 and 2009 at the Vegetable Research Farm of CCS Haryana Agricultural University, Hisar.

The Hisar region, representing the western agroclimatic zone of Haryana, India is situated in subtropics with semi-arid climate. It is generally very hot in summers and remarkably cold in winters. High temperatures of 45°C magnitude are recorded during the month of May in most parts of the region, whereas, in winters the temperature goes down to -2 to -3°C for a few days. Most of the rainfall (75 to 80 %) is received in the South-West monsoon season from June to September.

Twenty plants of each genotype per replication were maintained. Package of practices recommended by the university were adopted to raise the healthy crop. Incidence of YVMV disease in plants of each inbred was recorded at 30, 60 and 90 days after sowing (DAS) of the crop. The incidence of the disease was identified by typical symptoms on plants.

In every plot 10 plants were selected at random by moving diagonally in the plots. The percent disease incidence (PDI) was calculated by adopting following formula:

$$\text{PDI} = \frac{\text{Number of infected plants} \times 100}{\text{Total number of plants}}$$

The data of weather parameters viz., temperature

(°C), relative humidity (%), bright sunshine (hrs), evapotranspiration (mm) and rainfall (mm) were collected from the Agrometeorological Observatory (Latitude 29°10' N, Longitude 75°46'E, Altitude 215.2 m amsl) at the Research Farm of CCS Haryana Agricultural University, Hisar. The periodic average of weather parameters at 30 days interval was taken at the time of recording of disease for 30, 60 and 90 days after sowing (Table 1).

The correlation coefficients and regression equation between percent YVMV disease incidence and weather parameters were carried out to find association and prediction of disease incidence in relation to weather parameters in okra.

RESULTS AND DISCUSSION

The variation in per cent incidence of YVMV disease among inbreds of okra was observed during three years ranging from 0.0% at 30 days to 100.0% at 90 DAS. Mean disease incidence was highest (85.8%) at 90 DAS in 2009. It was minimum (4.2%) at 30 DAS in 2007. Mean value of disease incidence was highest in year 2009 for observations at 30, 60 and 90 DAS. High percentage of disease incidence at 60 and 90 days than 30 days was observed in all the three years of study (Table 1). It might be due to prevailing of comparatively low temperature during this period. The decrease in minimum temperature from 25.5°C to 21.4°C coupled with increase in bright sun shine hours from 6.4 to 9.2 hours with time resulted into an increase in incidence of disease from 8.3% at 30 days

to 74.7% at 90 DAS. Sharma et al. (1987) also reported that the temperature plays an important role in YVMV disease resistance in okra. Schroeder (1966) also reported the influence of temperature in resistance reaction to bean yellow mosaic virus in pea crop. The correlation computed between per cent incidence of YVMV and weather parameters showed that per cent incidence of YVMV disease exhibited significantly positive correlation (0.94**) with bright sunshine hours and negative correlation (-0.89**) with minimum temperature (night temperature). Correlation coefficient of disease incidence with other weather parameters was non significant but in negative direction. It is interesting to note that morning relative humidity expressed positive correlation ($r = 0.14$) whereas, evening relative humidity expressed negative correlation ($r = -0.61$) with the disease incidence. This indicated that the YVMV disease incidence increased with decrease in minimum temperature (night temperature) and longer bright sunshine hours. Ali et al. (2005) also observed a significant negative association of minimum temperature with disease incidence. In contrary, Sevakdas et al. (2011) reported positive association of minimum temperature with disease incidence. This might be due to consideration of more numbers of weather parameters in correlation study and locational differences. The computation of simple regression equation showed that all the weather parameters showed poor potential (2%) for the spread of the disease. Minimum temperature and bright sunshine hours showed the potential of 78 percent and 84 percent, respectively (Table 2). However, when these parameters were taken together in the form of multiple regression equation, prediction potential was improved to the tune of 98% ($R^2=0.98$). This indicated that 98% of variability of disease is influenced by a combination of weather parameters.

Table 2 : Regression equation of YVMV disease incidence (%) with weather variables

Sr No	Weather variables	Regression equation	R ²
1	Temp (Max)	Y= -1.66 Tmax +94.48	0.01
2	Temp (Mini)	Y= -11.59 Tmini +312.8	0.78
3	RH (M)	Y= 1.34 RHM- 63.10	0.04
4	RH (E)	Y= -1.77RHE+126.0	0.28
5	BSS (hr)	Y= 22.62BSS-139.3	0.84
6	Evaporation	Y= - 13.14 Evap +126.1	0.19
7	Rain fall (mm)	Y= -1.36RF+49.88	0.15

CONCLUSION

The present study indicated that the temperature, particularly minimum temperature around $21.5 \pm 2^\circ\text{C}$

along with 9.0 ± 0.5 hrs bright sunshine promoted the YVMV disease incidence in okra. Prediction of disease incidence would be more accurate when all weather parameters are considered together in the regression equation rather than single parameter. Thus, the weather information based YVMV disease incidence in okra would be a very handy tool of management system to predict the occurrence or change in severity of the diseases and the same can be utilized by the farmers to make decisions on disease treatments for control.

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