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Correlation of Environmental Conditions with Okra Yellow Vein Mosaic Virus and *Bemisia tabaci* Population Density

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ABSTRACT

Correlation of environmental conditions (maximum and minimum air temperature, relative humidity, rainfall, clouds and wind velocity) with okra yellow vein mosaic virus (OYVMV) disease severity and *Bemisia tabaci* population was determined on commercially grown varieties of okra i.e. Pahuja, Safal, Subz Pari and Surkh Bhindi. Minimum temperature and relative humidity had significant correlation with OYVMV disease severity and whitefly population. The disease incidence increased with the rise in minimum temperature and whitefly population decreased with increase in the relative humidity. Surkh Bindi was found to be highly resistant among the okra cultivars.

Key Words: Correlation; Okra cultivars; Environmental conditions; Whitefly population

INTRODUCTION

Okra (*Abelmoschus esculentus L. Moench*) commonly known as Bhindi is an important vegetable crop due to its nutritional value. It is good source of vitamin A, B, C and is also rich in protein, minerals and iodine (Baloch *et al.*, 1990). Okra requires a long and warm growing season for optimum growth and development. In the plains two crops of okra (early & late) are sown. Its average yield in Pakistan is 800-1000 kg ha^{-1} (Anonymous, 2002) which is very low as compared to the yield in the USA which is 17, 000-20,000 kg ha^{-1} (Telbert & Thompson, 1953). This vegetable is attacked by a number of fungi, bacteria, virus, mycoplasma, nematodes and insects. The total loss of vegetable on this account has been estimated up to 20-30% but if pathogens are allowed to develop, this may increase up to 80-90% (Hamer & Tthompson, 1957). Yellow vein mosaic is the most serious viral disease of okra. The disease is characterized by a homogenous interwoven network of yellow veins enclosing islands of green tissues within its leaf. In case of severe infection, the infected leaves become yellowish or creamy color. Infected plants remain stunted and bear very few deformed small fruits. Plants infected 50 and 65 days after germination suffer a loss of 84 and 49%, respectively (Sastry & Singh, 1974).

The objective of this study was to evaluate different okra cultivars against OYVMV under field condition and to determine the correlation of environmental factors with OYVMV disease severity and whitefly population density on okra varieties.

MATERIALS AND METHODS

Four okra varieties (Pahuja, Safal, Subz Pari and Surrkh Bhindi) were sown in the research area of Department of Plant Pathology, University of Agriculture, Faisalabad in June 2002. Each variety was sown in three replications with 60cm row to row and 20cm plant to plant distance. The conventional agronomic practices were followed to keep the crop in good condition. The disease on each test entry was assessed by a self designed scale.

Rating Scale	Severity Range (%)
0 – Immune	0 %
1 – Highly resistant	1-10 %
2 – Moderately resistant	11-25 %
3 – Tolerant	26-50 %
4 – Moderately susceptibility	51-60 %
5 – Susceptibility	61-70%
6 – Highly susceptibility	71-100%

The same four varieties were also grown in pots in the green house to visualize the response of graft inoculation. Five pots of each variety were inoculated with OYVMV by the method of graft inoculation as described by Pullaiah *et al*. (1998). The buds of diseased plants were collected from the field and grafted to the plants grown in the pots. The other five pots were left untreated as control. In the green house data of diseased plants was recorded after 15 days from the graft-inoculated plants for the confirmation of OYVMV. Environmental data, consisting of maximum and minimum temperature (^{o}C), rainfall (mm), clouds, relative humidity (%) and wind velocity were collected from a meteorological station, 100 m away from research trial area i.e., Department of Crop Physiology, University of Agriculture, Faisalabad. Data regarding OYVMV and whitefly population was recoded on weekly basis and subjected to correlation and regression (Steel *et al*., 1997).

RESULTS AND DISCUSSION

None of the varieties evaluated was found to be immune with regard to OYVMV and *Bemisia tabaci.* The response of the varieties to OYVMV varied when compared on the basis of percent plant infection. Surkh Bhindi showed resistant response to OYVMV with only 3.30% plant infection. Two varieties Subz Pari and Safal showed 12.10 and 24.42% plant infection respectively and graded as moderately resistant. Pahuja was the variety which showed 27.19% plant infection and graded as tolerant. Singh and Gupta (1991) screened 24 okra varieties for susceptibility to YVMV under field conditions. None of the varieties was highly resistant, three were resistant, eight were moderately susceptible, three were susceptible and 10 were highly susceptible. Srivastava *et al*. (1995) studied the reaction of 12 okra varieties against YVMV in the field at three sites. Varsha Uppar and HRB 55 were free of the disease at Karnal and Hy 6 at Andhra Perdesh. Arka Anamika showed moderate resistance at karnal. The virus was not observed in any variety at Nashik. Dhankhar *et al*. (1996) screened 51 *Abelmoshus esculentus* hybrids and their 20 parents for YVMV. Only one parent, Parbhani Karanti and 4 hybrids were highly resistant to OYVMV. P-7 was moderately resistant, while the rest of the parents and hybrids were susceptible or highly susceptible. Sannigrahi and Choudhury (1998) evaluated seven okra cultivars against OYVMV. Arka Anamika and Arka Abhey were the most suitable yellow vein mosaic virus resistance okra cultivars for commercial cultivation. Batra and Singh (2000) screened eight okra varieties against YVMV, Okra No.6, LORM-1, VRO-3 and P-7 were found free from disease whereas VRO-4 showed mild reaction.

In the green house mild symptoms were observed on two plants of variety Pahuja and one plant of Safal after graft inoculation. There were no symptoms present on Surkh Bhindi and Subz Pari after inoculation (Table I).

Among the environmental factors, temperature played vital role in the development of the disease on okra varieties (Table II). The minimum temperature had significant correlation with OYVMV severity on all okra varieties. The correlation of whitefly population with maximum temperature on Pahuja, Safal and Subz Pari was non significant while on Surrkh Bhindi it was significant. The correlation of whitefly population with minimum temperature on Pahuja, Surkh Bhindi and Safal was significant but on Subz Pari, it was non significant. This may be attributed to differential response of varieties to environmental conditions. The correlation of relative humidity with both OYVMV and whitefly population on all okra varieties was highly significant. Rainfall had significant correlation with OYVMV on Safal and Surkh Bhindi while non significant correlation on Pahuja and Subz Pari. The correlation of rainfall with whitefly population was non significant. All the four varieties showed non significant correlation of clouds with OYVMV and whitefly population. The correlation of wind velocity with OYVMV on Pahuja, Safal and Surkh Bhindi was significant but on Subz Pari it was non significant (Table III). Singh (1990) noted that hot weather with little or no rainfall was conducive for disease development of OYVMV and also for multiplication of *Bemisia tabaci*. Cooler weather with high relative humidity and rainfall were detrimental to whitefly population and spread. Sangar (1997) evaluated eight okra varieties for resistance to YVMV in the rainy and summer season. The incidence of YVMV was higher during the rainy season when relative humidity was very high. Arka Anamika was highly resistant, Arka Abhey resistant, Parbhani Kranti and V-6 were moderately resistant to disease. Others were susceptible or highly susceptible. Bhagat *et al.* (2001) observed the rate of dissemination of okra yellow vein mosaic virus in okra cultivars. Pusa Sawani (highly susceptible) Vaishali, Vadhu (susceptible) and Parabhani Kranti (resistance) during rainy season when relative humidity was very high.

Table I. Disease severity of OYVMV on four okra varieties in green house after inoculation

Serial No.	Name of variety	Disease severity of YVMV before inoculation.	Disease severity of YVMV after inoculation.	Disease severity of YVMV on check plant
1	Pahuja	0	2	0
2	Safal	0	1	0
3	Subz Pari	0	0	0
3	Surkh Bhindi	0	0	0

Table II. Correlation of environmental conditions with yellow vein mosaic virus disease severity recorded on four okra verities

Varieties	Environmental conditions					
	Temperature (°C)		Relative Humidity	Rainfall	Clouds	Wind Velocity
	Max.	Min.				
Pahuja	0.436	0.779**	0.843**	0.453	0.092	0.533*
Safal	0.432	0.813**	0.875**	0.496	0.024	0.563*
Subz Pari	0.384	0.754**	0.759**	0.451	0.217	0.419
Surrkh Bhindi	0.448	0.531*	0.931**	0.504*	0.115	0.482*

** = Highly Significant; * = Significant; NS = Non Significant

Table III. Correlation of environmental conditions with whitefly population recorded on four okra verities

Varieties	Environmental conditions					
	Temperature (°C)		Relative Humidity	Rainfall	Clouds	Wind Velocity
	Max.	Min.				
Pahuja	0.422	0.539**	0.817**	0.278	0.043	0.446
Safal	0.245	0.627**	0.805**	0.464	0.137	0.300
Subz Pari	0.385	0.398	0.666**	0.451	0.211	0.420
Surrkh Bhindi	0.479	0.471*	0.774**	0.172	0.159	0.566*

CONCLUSION

From the present study it was concluded that out of six environmental variables, only clouds and rainfall had statistically non significant correlation with OYVMV and whitefly population. Rise in minimum temperature was conducive for disease development while increase in relative humidity was detrimental to whitefly population. These findings can be used to develop a disease forecasting model to apply chemicals economically.

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