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International Journal of Current Research
Vol. 4, Issue, 05, pp.018-021, May, 2012

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

SHORT COMMUNICATION

INCIDENCE OF YELLOW VEIN MOSAIC VIRUS DISEASE OF OKRA [*Abelmoschus esculentus* (L.) Moench] UNDER SUMMER AND RAINY ENVIRONMENTS

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ARTICLE INFO

Article History:
Received 18th February, 2012
Received in revised form
16th March, 2012
Accepted 15th April, 2012
Published online 30th May, 2012

ABSTRACT

Okra or bhindi [*Abelmoschus esculentus* (L.) Moench] is an important Vegetable crop in the tropics and the subtropics. The Okra crop is very susceptible to white fly (*Bemisia tabaci Genn.*) transmitted yellow vein mosaic virus causing heavy losses by infecting at all the stages of plant growth. In India, occurrence of this disease was first reported by Kulkarni (1924) in Bombay province. It has been reported that when plants were infected within 20 days after germination, the losses can be up to 98 percent. Similarly, when plants were infected at 35 and 50 days after germination, the loss in yield was 83 and 49 percent respectively (Sastry and Singh, 1975). Infection of Y.V.M.V. under natural field conditions depends on the environmental parameters, crop characteristics and efficient vector population (Khan & Mukhopadhyay, 1986; Bhagabati and Goswami, 1992). Susceptibility of cultivars encourages its incidence in the field in presence of the active vectors. Considering it as one of the major constraints of Okra cultivation, it is essential to gather basic information to understand the nature of infection, source and gradual increase with the increase of plant age survival capacity of the virus and mode of spread among different varieties in a cropping season.

Varma (1952) studied the relationship of Y.V.M.V. and its vector white fly. Though a single insect was able to transmit the virus, the minimum number of flies required to produce 100 percent infection was about 10. The first visual symptom is the clearing of small veins, which usually starts at various points near the leaf margins in about 15 – 20 days after inoculation of plants. Affected plants early come to flower and chemical control of the disease is difficult. Destruction of alternative hosts, control of white fly and other sucking insects and uprooting and burying of infected plants are some of the measures to reduce the vector population and also the diseased. Wild Okra species such as *A. pungens, A. crinitus, H. vitifolius, H. panduracformis* are immune to this virus. During the last two decades several resistant varieties have been developed which are giving sustainable high yields in virus prone areas.

Another interesting finding by Sharma (1995) was the estimation of chemical constituents of Y.V.M.V. infected plants. A sharp reduction of total chlorophyll, reducing sugar, phosphorus and potassium was observed where as total phenol, total sugars, non – reducing sugars, nitrogen and protein content increased. The extent of increase or decrease of these constituents varied with the different stages of plant growth. The experiments were conducted at the Agricultural experimental farm of Calcutta university at Baruipur,South 24 parganas during summer and rainy season of 2005.The experiment was laid out in Randomized Block Design having three replications of each genotype in March 2005(Summer crop) and July 2005 (Rainy Season crop). For assessing the Yellow vein Mosaic Virus in Okra Varieties, the intensity of yellow vein mosaic disease was calculated according to method suggested by Banarjee and Kalloo (Table 1).

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DISEASE INCIDENCE

Yellow Vein Mosaic Virus: (Y.V.M.V)

Occurrence of the disease was recorded on the basis of visual observations. On symptomatological studies three different types of symptoms were found in the field. The types of symptoms recorded are –

Type – I: Vein and Vein let chlorosis, chlorotic spots appearing regularly in the inter venial region, whole lamina becomes uniformly crinkled and yellow with regularly distributed green tissue in the inter venial regions.

Type – II: Vein and Vein let becomes chlorotic, spots appear irregularly in the inter venial region and entire lamina becomes intensely yellow with no differentiation of colour between veins and mesophyll tissue and leaves become thickened.

Type – III: Veins and Vein let becomes pale yellow and no chlorosis appeared in the infected plants.

The coefficient of infection (CI) was calculated by multiplying the percent disease incidence (PDI) by the response value assigned to each severity grade.

$$PDI = \frac{\text{Number of diseased plants}}{\text{Total Number of plants observed}} \times 100$$

Table 1: Scale for classifying disease reaction against yellow vein mosaic virus. (Banerjee and Kalloo, 1987)

Appearance of YVMV symptom	Symptom	Response value.	CI	Reaction
Absent	0	0	0 – 4	HR
<25% leaves (mild)	1	0.25	5 – 9	R
25 – 50% leaves	2	0.50	10 – 19	MR
51 – 75% leaves	3	0.75	20 – 39	MS
75 – 90% leaves	4	1.00	40 – 69	S
>90% leaves	5	---	70 – 100	HS

Where,
CI = Coefficient of infection. HR = Highly resistant.
R = Resistant. MR = Moderately resistant
HS = Highly susceptible. S = Susceptible.
MS = Moderately susceptible

EVALUATION OF OKRA ACCESSIONS AGAINST YELLOW VEIN MOSAIC VIRUS

Thirty Days After Sowing

The estimates of the disease reaction for fifteen genotypes is depicted in (Table 2a). Out of these, seven genotypes viz. Bhindi Hyb. No. 18, Sagun, Makhmali, Mahyco – 10, Bhindi Selection – 5, Sresta and HR – 1 were found to be highly resistant during summer season while the same cultivars baring Mahyco – 10 behave as resistant cultivars during rainy season when the outbreak of yellow vein mosaic virus was more severe as compared to summer season. Cultivars like Parbhani Kranti, Ankur – 40, Bhindi No. 101 and Harita, were observed to be resistant under both the environments. Resistant cultivars in summer environment, which behaved as moderately resistant under rainy environment are Satdhari green, Sel – 11, Shamali.

Sixty Days After Sowing

During this period cultivars (Table 2b) found to be highly resistant under summer environment are Mahyco – 10 and Bhindi selection – 5 while under rainy environment none of the cultivars were found to be highly resistant.

Table 2a: Incidence of Yellow Vein Mosaic Virus on Different Okra Cultivars

THIRTY DAYS AFTER SOWING

Sl. No.	Genotype	Env.	Avg. severity grade	Response Value (RV)	P.D.I. (%)	C. I. (PDI x RV)	Reaction
1.	Parbhani Kranti	S	3	0.75	16.30	5.43	R
		R	2	0.50	16.00	8.00	R
2.	Bhindi hyb.	S	1	0.25	2.53	2.53	HR
	No. 18	R	1	0.25	9.33	9.33	R
3.	Sagun	S	1	0.25	3.19	3.19	HR
		R	1	0.25	6.66	6.66	R
4.	Satdhari green	S	1	0.25	5.49	5.49	R
		R	1	0.25	10.66	10.66	MR
5.	Ankur - 40	S	1	0.25	5.26	5.26	R
		R	2	0.50	12.00	6.00	R
6.	Makhmali (F_1)	S	0	0	3.29	3.29	HR
		R	1	0.25	5.33	5.33	R
7.	Arka Anamika	S	2	0.50	14.13	7.06	R
		R	1	0.25	22.66	22.66	MS
8.	Sel-11 (Pankaj)	S	2	0.50	10.52	5.26	R
		R	1	0.25	16.00	16.00	MR
9.	Mahyco - 10	S	0	0	2.15	2.15	HR
		R	1	0.25	4.00	4.00	HR
10.	Shamali	S	2	0.50	12.0	6.00	R
		R	2	0.50	20.00	10.00	MR
11.	Bhindi Sel – 5	S	0	0	1.03	1.03	HR
		R	1	0.25	6.66	6.66	R
12.	Sresta	S	1	0.25	1.14	1.14	HR
		R	1	0.25	5.33	5.33	R
13.	Bhindi No. 101	S	1	0.25	5.31	5.31	R
		R	1	0.25	9.33	9.33	R
14.	Harita	S	2	0.50	9.47	4.73	R
		R	2	0.50	13.33	6.66	R
15.	HR - 1	S	1	0.25	1.47	1.47	HR
		R	1	0.25	8.00	8.00	R

Note: S – Summer, **R – Rainy,** CI – Coefficient of Infection,
RV – Response Value, PDI – Plant Disease Intensity (%)
R – Resistant, HR – Highly resistant,
MR – Moderately resistant, MS – Moderately susceptible,
S – Susceptible, HS – Highly Susceptible.

Table 2b: Incidence of Yellow Vein Mosaic Virus on Different Okra Cultivars

SIXTY DAYS AFTER SOWING

Sl. No.	Genotype	Env.	Avg. severity grade	Response Value (RV)	P.D.I. (%)	C. I. (PDI x RV)	Reaction
1.	Parbhani Kranti	S	3	0.75	33.69	11.23	MR
		R	3	0.75	33.33	11.11	MR
2.	Bhindi hyb.	S	1	0.25	10.12	10.12	MR
	No. 18	R	1	0.25	22.66	22.66	MS
3.	Sagun	S	1	0.25	9.57	9.57	R
		R	2	0.50	21.33	10.66	MR
4.	Satdhari green	S	2	0.50	16.48	8.24	R
		R	2	0.50	21.33	10.66	MR
5.	Ankur - 40	S	2	0.50	14.73	7.36	R
		R	3	0.75	21.33	7.11	R
6.	Makhmali (F_1)	S	1	0.25	9.89	9.89	R
		R	2	0.50	12.00	6.00	R
7.	Arka Anamika	S	2	0.50	30.43	15.21	MR
		R	2	0.50	34.66	17.33	MR
8.	Sel-11 (Pankaj)	S	3	0.75	26.31	8.77	R
		R	1	0.25	26.66	26.66	MS
9.	Mahyco - 10	S	1	0.25	3.89	3.89	HR
		R	1	0.25	14.66	14.66	MR
10.	Shamali	S	2	0.50	25.0	12.5	MR
		R	2	0.50	29.33	14.66	MR
11.	Bhindi Sel – 5	S	1	0.25	4.12	4.12	HR
		R	2	0.50	16.00	8.00	R
12.	Sresta	S	1	0.25	5.21	5.21	R
		R	2	0.50	14.66	7.33	R
13.	Bhindi No. 101	S	2	0.50	17.02	8.51	R
		R	1	0.25	18.66	18.66	MR
14.	Harita	S	3	0.75	25.26	8.42	R
		R	2	0.50	22.66	11.33	MR
15.	HR - 1	S	1	0.25	10.29	10.29	MR
		R	2	0.50	14.66	7.33	R

Table 2c: Incidence of Yellow Vein Mosaic Virus on Different Okra Cultivars

NINETY DAYS AFTER SOWING

Sl. No.	Genotype	Env.	Avg. severity grade	Response Value (RV)	P.D.I. (%)	C. I. (PDI x RV)	Reaction
1.	Parbhani Kranti	S	4	1.00	60.86	15.21	MR
		R	2	0.50	40.00	20.00	MS
2.	Bhindi hyb.	S	2	0.50	21.51	10.75	MR
	No. 18	R	1	0.25	29.33	29.33	MS
3.	Sagun	S	2	0.50	22.34	11.17	MR
		R	2	0.50	30.66	15.33	MR
4.	Satdhari green	S	2	0.50	29.67	14.83	MR
		R	2	0.50	32.00	16.0	MR
5.	Ankur - 40	S	2	0.50	29.47	14.73	MR
		R	2	0.50	32.00	16.00	MR
6.	Makhmali (F_1)	S	2	0.50	16.48	8.24	R
		R	2	0.50	24.00	12.00	MR
7.	Arka Anamika	S	3	0.75	50.0	16.66	MR
		R	2	0.50	40.00	20.00	MS
8.	Sel-11 (Pankaj)	S	2	0.50	48.68	24.34	MS
		R	1	0.25	37.33	37.33	MS
9.	Mahyco - 10	S	1	0.25	12.98	12.98	MR
		R	1	0.25	24.00	24.00	MS
10.	Shamali	S	3	0.75	39.0	.13	MR
		R	3	0.75	33.33	11.11	MR
11.	Bhindi Sel – 5	S	1	0.25	14.43	14.43	MR
		R	2	0.50	21.33	10.66	MR
12.	Sresta	S	1	0.25	17.24	17.24	MR
		R	2	0.50	21.33	10.66	MR
13.	Bhindi No. 101	S	2	0.50	34.04	17.12	MR
		R	1	0.25	22.66	22.66	MS
14.	Harita	S	3	0.75	42.10	14.03	MR
		R	2	0.50	34.66	17.33	MR
15.	HR - 1	S	2	0.50	26.47	13.23	MR
		R	2	0.50	30.66	15.33	MR

Note: (Table 2b & 2c) S – Summer, **R – Rainy,** CI – Coefficient of Infection,
RV – Response Value, PDI – Plant Disease Intensity (%)
R – Resistant, HR – Highly resistant,
MR – Moderately resistant, MS – Moderately susceptible,
S – Susceptible, HS – Highly Susceptible.

Those showing resistance were Ankur – 40, Makhmali, Bhindi selection – 5 and Sresta. Cultivars showing moderate resistance behaviour under both the environments were Parbhani Kranti, Arka Anamika and Shamali, while those showing moderate resistance in either of the environments were Bhindi Hyb. No. 18, Sagun, Satdhari green, Mahyco – 10, Bhindi No. 101, Harita, HR – 1.

Ninety Days After Sowing

Incidence of yellow vein mosaic virus in this period on the cultivars are depicted in (Table 2c). None of the varieties were found to be highly resistant under both the environments. 'Resistant' response was showed by Makhmali during the summer period and 'Moderately resistant' response was seen in rest of the cultivars in summer environment and selected of them i.e. Sagun, Satdhari green, Ankkur – 40, Shamali, Bhindi selection – 5, Sresta, Harita, HR – 1 showed moderately resistance response even during rainy season. The variety Sel – 11 (Pankaj) was found to be moderately susceptible under both the environments. Some moderately resistant cultivars behaved as moderately susceptible in the rainy environment. The field screening of Okra cultivars under study was done at three stages that is thirty, sixty and ninety days after sowing. The cultivars showed different coefficient of infections under different environments. The more susceptible response being observed during rainy season. Overall we can visualise wise from the (Table 2a, 2b and 2c) none of the cultivars were found to be highly resistant throughout the three phases of screening. The resistance to moderate resistance once are Parbhani Kranti, Makhmali, Ankur – 40, HR – 1, Bhindi Sel – 5, Harita, Sagun, Mahyco – 10 and Sresta. The cultivars which showed more incidence of Y.V.M.V. at thirty and sixty days after sowing was found to have greater loss in yield rather than those cultivars which were having the same intensity of the disease at later stage of growth. So, emphasis must be given on selection of resistant cultivars at earlier stage of disease incidence, which goes by the findings of Shastri and Singh (1975). Further the incidence of Y.V.M.V was more during the rainy season, which may be due to elevated vector population as opined by Costa and Muller (1980) or due to difference

In virus strain as reported by Singh and Dutta (1986). Selection during rainy environment will be more amenable. Field screening based on "Coefficient of infection" revealed that none of the cultivars were found to be highly resistant throughout the three phases of screening i.e. thirty, sixty and ninety days after sowing. 'Resistant' to 'Moderate Resistant' behavior were observed in Parbhani Kranti, Makhmali, Ankukr – 40, HR – 1, Bhindi Sel – 5, Harita, Sagun, Mahyco – 10 and Sresta. The rate of increase of infection was more at the earlier stages rather than at later stages of the plant growth. Emphasis must be given on selection of resistant cultivars at earlier. Stage of disease incidence coupled with selection during rainy environment, when the incidence was more due to elevated vector population.

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