Yellow Vein Mosaic virus Resistant Hybrids in Okra (*Abelmoschus esculentus* (L.) Moench)

K. Nirosha[1], P. Irene Vethamoni[2], V. A. Sathiyamurthy[3]

[1,2,3]*Department of Vegetable Crops, Tamil Nadu Agriculture University, Coimbatore-3, India.*

ABSTRACT

Seven parents and forty two hybrids of okra were screened for resistance/susceptibility to yellow vein mosaic virus. The parents P_1 (AE 64 (White)), P_2 (AE 64 (Pink)) and P_4 (AE 65 (Pink) were found complete resistance to disease. The parents P_3 (AE 65 (White)), P_6 (AE 70 (White)) and P_7 (AE 71 (White) were found tolerant to disease. The parent P_5 (AE 66 (Pink) found susceptible to disease. Twelve out of 42 hybrids did not show any symptom of YVMV and were $P_1 \times P_2$, $P_1 \times P_3$, $P_1 \times P_4$, $P_1 \times P_5$, $P_1 \times P_7$, $P_2 \times P_1$, $P_2 \times P_4$, $P_4 \times P_1$, $P_4 \times P_2$, $P_4 \times P_3$, $P_4 \times P_5$ and $P_4 \times P_7$. Eight hybrids viz., $P_2 \times P_3$, $P_3 \times P_1$, $P_3 \times P_2$, $P_3 \times P_4$, $P_4 \times P_6$, $P_5 \times P_1$, $P_6 \times P_4$ and $P_7 \times P_4$ were highly resistant to the YVMV disease with the incidence of 7.14, 3.57, 7.14, 7.14, 7.14, 3.57, 3.57 and 3.57 per cent respectively at 105 DAS.

Keywords: Okra, resistance, yellow vein mosaic virus, screening, parents, hybrids.

1. INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench) is one of the most popular vegetable crops cultivated throughout India. Because of high consumer's demand and thereby better price, farmers grow okra widely during summer season. Okra yellow vein mosaic virus is the most destructive disease, which causes colossal losses up to 92-94% in the crop by affecting the quality and yield of fruits. Sharma and Arora, (1989), Singh (1985), Batra and Singh (2000), Vinod *et al.* (2000), Rattan and Aravind Bindal (2000), Rashid *et al.* (2002), Debnath and Nath (2003), Indurani *et al.* (2003), Aneesha (2010), Amaranatha (2011), Benchasri (2011), Tiwari *et al.* (2012) and Reddy *et al.* (2013) also reported different degree of resistance, hence the present studies were undertaken for the screening of okra varieties for the incidence of yellow vein mosaic.

2. MATERIALS AND METHODS

The present investigation was carried out during the rainy season in the Department of Vegetable Crops, TNAU, Coimbatore with seven parents AE 64 (White), AE 64 (Pink), AE 65 (White), AE 65 (Pink), AE 66 (Pink), AE 70 (White) and AE 71 (White) and their 42 hybrids with border sowing of highly susceptible hybrid Arka Anamika under field conditions during summer season of 2013. The disease incidence was recorded at fifteen days interval up to 105 days after sowing based

on scale 0 = immune, 1-10 = highly resistant, 11-25 = moderately resistant, 26- 50 = tolerant, 51-60 = moderately susceptible, 61-70 = susceptible and 71-100 = highly susceptible (Ali *et al.* 2005).

The experiment was laid out in a randomized block design with three replications having a plot size of 4 m^2 with a spacing of 60 x 30 cm. The per cent disease infection (PDI) was recorded and the results are presented in Table 1.

Rating scale	Type	Disease incidence (%)
0	Immune	0
1	Highly resistant	1-10
2	Moderate resistant	11-25
3	Tolerant	26-50
4	Moderate susceptible	51-60
5	Susceptible	61-70
6	Highly susceptible	71-100

3. RESULTS AND DISCUSSION

Parents P_1, P_2 and P_4 did not show any symptom of yellow vein mosaic virus disease. They are immune to the disease as they are completely free from incidence. These results confirm the earlier findings of Dhankar *et al.* (1998), Rattan and Aravind Bindal (2000), Batra and Singh (2000), Vinod *et al*. (2000), Debnath and Nath (2002) and Tiwari *et al*. (2012). This was further confirmed by artificial inoculation of virus through whiteflies. Indurani (1999) also confirmed resistance of genotypes by vector transmission.

Parent P_5 showed YVMV incidence of 7.14, 32.14, 71.43 and 82.14 per cent at 60, 75, 90 and 105 DAS respectively. This parent is referred as highly susceptible parent. Same result was reported by Vinod *et al*. (2000), Rashid *et al*. (2002) and Nizar *et al*. (2004). Whereas P_3, P_6 and P_7 are referred as tolerant parents based on PDI. This is line with the findings of Tiwari *et al*. (2012). P_6 showed incidence of 7.14, 17.86, 25 and 46.43 per cent at 60, 75, 90 and 105 DAS respectively. P_3 showed incidence of 7.14, 28.57 and 42.83 per cent at 75, 90 and 105 DAS respectively. P_7 showed incidence of 3.57, 10.71, 21.43 and 39.29 per cent at 60, 75, 90 and 105 DAS respectively. These results confirm the experimental results of Batra and Singh (2000), Rashid *et al*. (2002), Debnath and Nath (2002), Nizar *et al*.(2004), Benchasri (2011), Tiwari *et al*. (2012) and Kamalpreet *et al*. (2013).

Twelve out of 42 hybrids did not show any symptom of YVMV and were P_1 x P_2, P_1 x P_3, P_1 x P_4, P_1 x P_5, P_1 x P_7, P_2 x P_1, P_2 x P_4, P_4 x P_1, P_4 x P_2, P_4 x P_3, P_4 x P_5 and P_4 x P_7. Rattan and Aravind Bindal, (2000) and Batra and Singh, (2000) supported these results. Among them eight hybrids were direct crosses and four were reciprocal cross combinations. Four crosses *viz.,* P_3 x P_5, P_5 x P_6, P_6 x P_5 and P_6 x P_7 were highly susceptible for yellow vein mosaic virus with the incidence of 82.14, 100, 92.85 and 85.71 per cent respectively at 105 DAS. The cross P_5 x P_3 is a susceptible with the incidence of 64.29 per cent at 105 DAS. This is in accordance with the experimental results of Tiwari *et al*. (2012). Eight hybrids *viz.,* P3 x P6, P3 x P7, P5 x P4, P5 x P7, P6 x P3, P7 x P1, P7 x P3, P7 x P5 and P7 x P6 were tolerant to YVMV with the incidence of 46.43, 35.71, 28.57, 46.43, 14.29, 39.29, 46.43 and 42.86 per cent respectively at 105 DAS. This is line with the experimental results of Sankara *et al.* (2012).

Eight hybrids *viz.,* P_1 x P_6, P_2 x P_5, P_2 x P_6, P_2 x P_7, P_5 x P_2, P_6 x P_1, P_6 x P_2 and P_7 x P_2 were moderately resistant to the yellow vein mosaic virus disease with the incidence of 17.86, 21.43, 14.29, 10.71, 21.43, 17.86, 14.29 and 10.71 per cent respectively at 105 DAS. This is line with the experimental results of Sankara *et al.* (2012) and Kamalpreet *et al*. (2013). Eight hybrids *viz.,* P_2 x P_3, P_3 x P_1, P_3 x P_2, P_3 x P_4, P_4 x P_6, P_5 x P_1, P_6 x P_4 and P_7 x P_4 were highly resistant to the YVMV disease with the incidence of 7.14, 3.57, 7.14, 7.14, 7.14, 3.57, 3.57 and 3.57 per cent respectively at 105 DAS. This is line with the experimental results of Sankara *et al.* (2012).

4. AKNOWLEDGEMENT

This study was conducted at Department of Vegetable Crops, Tamil Nadu Agriculture University.

Table 1. Screening of parents and F_1 hybrids for YVMV incidence (PDI (Per cent)) at 15 days interval in okra

Parents and Hybrids	YVMV incidence					
	Days after sowing					
	45	60	75	90	105	Score
P_1	0	0	0	0	0	I
P_2	0	0	0	0	0	I
P_3	0	0	7.14	28.57	42.83	T
P_4	0	0	0	0	0	I
P_5	0	7.14	32.14	71.43	82.14	HS
P_6	0	7.14	17.86	25	46.43	T
P_7	0	3.57	10.71	21.43	39.29	T
P_1 x P_2	0	0	0	0	0	I
P_1 x P_3	0	0	0	0	0	I
P_1 x P_4	0	0	0	0	0	I

P_1 x P_5	0	0	0	0	0	I
P_1 x P_6	0	0	0	7.14	17.86	MR
P_1 x P_7	0	0	0	0	0	I
P_2 x P_1	0	0	0	0	0	I
P_2 x P_3	0	0	0	0	7.14	HR
P_2 x P_4	0	0	0	0	0	I
P_2 x P_5	0	0	0	10.71	21.43	MR
P_2 x P_6	0	0	0	3.14	14.29	MR
P_2 x P_7	0	0	0	3.14	10.71	MR
P_3 x P_1	0	0	0	0	3.57	HR
P_3 x P_2	0	0	0	0	7.14	HR
P_3 x P_4	0	0	0	0	7.14	HR
P_3 x P_5	0	10.71	42.86	60.71	82.14	HS
P_3 x P_6	0	3.57	10.71	25	46.43	T
P_3 x P_7	0	3.57	7.14	21.43	35.71	T
P_4 x P_1	0	0	0	0	0	I
P_4 x P_2	0	0	0	0	0	I
P_4 x P_3	0	0	0	0	0	I
P_4 x P_5	0	0	0	0	0	I
P_4 x P_6	0	0	0	7.14	7.14	HR
P_4 x P_7	0	0	0	0	0	I
P_5 x P_1	0	0	0	0	3.57	HR
P_5 x P_2	0	0	0	7.14	21.43	MR
P_5 x P_3	0	0	14.29	28.57	64.29	S
P_5 x P_4	0	0	0	10.71	28.57	T
P_5 x P_6	0	3.57	14.29	42.85	100	HS
P_5 x P_7	0	3.57	10.71	28.57	46.43	T
P_6 x P_1	0	0	3.57	7.14	17.86	MR
P_6 x P_2	0	0	0	3.57	14.29	MR
P_6 x P_3	0	3.57	14.29	28.57	46.43	T
P_6 x P_4	0	0	0	0	3.57	HR
P_6 x P_5	0	10.71	35.71	71.43	92.85	HS
P_6 x P_7	0	7.14	32.14	75	85.71	HS
P_7 x P_1	0	0	0	3.57	14.29	T
P_7 x P_2	0	0	0	3.57	10.71	MR
P_7 x P_3	0	3.57	10.71	17.86	39.29	T
P_7 x P_4	0	0	0	0	3.57	HR
P_7 x P_5	0	7.14	14.29	50	46.43	T
P_7 x P_6	0	7.14	7.14	25	42.86	T

REFERENCES

[1] S. Ali, M. A. Khan, A. Habib, S. Rasheed and Y. Iftikhar. 2005. Correlation of environmental conditions with okra yellow vein mosaic virus and *Bemisia tabaci* population density. *Int. J. Agri. Biol.,* **7:**142-144.

[2] M. R. Amaranatha. 2011. Heterosis and combining ability of yield and yield related components and resistance to yellow vein mosaic virus in okra (*Abelmoschus esculentus* (L.) Moench). *M. Sc. (Agri.) Thesis*. University of Agriculture Sciences, Dharwad, Karnataka.

[3] A. K. Aneesha. 2010. Studies on the performance of F_1 hybrids in bhendi (*Abelmoschus esculentus* (L.) Moench) for growth, yield and yellow vein mosaic virus resistance. *M.Sc. (Hort.) Thesis*. Tamil Nadu Agriculture University, Coimbatore.

[4] V. K. Batra and J. Singh. 2000. Screening of okra varieties to yellow vein mosaic virus under field conditions. *Veg.Sci.,* **27**(2): 192-193.

[5] S.Benchasri. 2011**.** Screening for yellow vein mosaic virus resistance and yield loss of okra under field conditions in southern Thailand**.** *J. Anim. & Plant Sci.,* **12**(3): 1676-1686

[6] S.Debnath and P. S. Nath. 2003. Performance of okra varieties in relation to yield and tolerance to YVMV. ***Ann. Pl. Protec. Sci.,*** 11**(2):400-401.**

[7] S. K. Dhankar, B. S. Dhankar and A. S. Tewatia. 1998. A role on heterosis and combining ability in okra (*Abelmoschus esculentus* (L.) Moench.). *Haryana J. Hort. Sci.,* 27: **211-214.**

[8] **C. Indurani. 1999. Studies on the development of F_1 hybrids in okra (*Abelmoschus esculentus* (L.) Moench) with high yield and resistance to yellow vein mosaic virus. *M.Sc. (Hort.) Thesis.* Tamil Nadu Agriculture University, Coimbatore.**

[9] C. Indurani, D. Veeraragavathatham and I. Muthuvel. 2003. Performance of parents and hybrids of okra (*Abelmoschus esculentus* (L.) Moench). *Madras Agric. J.,* **90**(4-6): 322-325.

[10] K. Kamalpreet, P. Mamta, K. Satinder, P. Dharminder and C. Neena. 2013. Assessment of morphological and molecular diversity among okra (*Abelmoschus esculentus* (L.) Moench) germplasm. *African J. Biotech***.,** **12**(21):3160-3170

[11] M.A. Nizar, K. Joseph and R. Karuppaiyan. 2004. Evaluation of okra germplasm for fruit yield, quality and field resistance to yellow vein mosaic virus. *Indian J. Plant Genet. Resour.* **17**(3): 241-244.

[12] M. H. Rashid, L. Yasmin, M. G. Kibria, A. K. M. S. R. Mollik and S. M. Monowar Hossain. 2002. Screening of okra germplasm for resistance to yellow vein mosaic virus under field conditions. *Pakistan J. Plant Pathol.,* **1**(2): 61-62

[13] R. S. Rattan and Aravind Bindal. 2000. Development of okra hybrids resistant to yellow vein mosaic virus. *Veg.Sci.,* **27**(2): 121-125.

[14] M. T. Reddy, K. Haribabu, M. Ganesh, H. Begum, R. S. K. Reddy and J. D. Babu. 2013. Exploitation of hybrid vigour for yield and its components in okra (*Abelmoschus esculentus* (L.) Moench). *American J. Agric. Sci. Tech.,* **1:** 1-17.

[15] R. K. Sankara and P. Acharyya. 2012. Incidence of yellow vein mosaic virus disease of okra (*Abelmoschus esculentus* (L.) Moench) under summer and rainy environments. *Int. J. Curr. Res.,* **4**(5): 18-21

[16] B. R. Sharma and S. K. Arora. 1989. Advances in breeding in okra in India. *Im: Proc. 6th Int. Cong. SABRAO*, pp. 285-288.

[17] R. S. Singh. 1985. *Disease of vegetable crops*. Oxford and IBH Publisher Co., New Delhi.

[18] A. Tiwari, B. Singh, T. B. Singh, S. K. Sanval and S. D. Pandey. 2012. Screening of okra varieties for resistance to yellow vein mosaic virus under field condition. *Hort Flora Research Spectrum***, 1(1):** 92-93