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Field screening of some improved and hybrid varieties of tomato against leaf curl virus

PARTHA SARATHI NATH, SAJID ALI AND B. K. DE
Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741 252, Nadia, West Bengal

A field screening had been made against the leaf curl virus disease in tomato to identify the source of resistance for future multiplication, genetic improvement and cultivation in new alluvial zone of West Bengal. Twentyone open pollinated (improved) and twentytwo hybrid lines/germplasms/varieties were selected and screened in two consecutive years (1997-98, 1998-99) under natural field condition. None of the lines were found free from the disease. Very low or low disease incidence were found in hybrid lines like Utsav (4.16%), ARTH-168 (5.41%) HYTH-2(7.50%) and ARTH-16 (7.19%) and in the open pollinated lines like CO-3 (3.75%), SEL-7 (4.5%) and Arka Vikash (7.08%). The yield was also higher in these lines. In both cases Pusa ruby was taken as check.

Key Words : Tomato leaf curl virus, tomato, disease incidence

INTRODUCTION

Tomato belongs to the Family Solanaceae and genus *Lycoperiscon.* The genus is further sub-divided into sub-genera i) *Eulycopersicon,* ii) *Eriopersicon.* The cultivated tomato *esculentum* and *pimpine-llifolium* species are included in *Eulycopersicon* sub-genera.

Tomato is said to be the native of tropical America (Thompson and Kelly 1957). It is one of the most popular and widely grown vegetables in the world ranking second in importance to potato in many countries. It becomes popular in India within last 5 decades. The different varieties are cultivated in different countries. Most of these varieties are prone to a numer of diseases. The cause of those diseases may be fungi, bacteria, virus, nematode or abnormal environment. Among the virus diseases leaf curl, fern leaf, mosaic and spotted wilt are very important.

Leaf curl is the most serious virus disease of tomato particularly in India and cause heavy loss in yield. The disease is spread in nature by an insect vector known as whitefly *(Bemisia tabaci* Genn.)

Because of the immense economic significance of this disease, investigations are being carried out, both at the national and international level to develop appropriate control strategies. The breeding of resistant varieties is the most effective method of control of viruses; it is always desirable to have resistant high yield varieties. The present investigation aims to screen some hybrid and improved varieties of tomato against tomato leaf curl virus disease at the new alluvial zone of West Bengal and to identify suitable resistant varieties recommendable for cultivation in this zone.

MATERIALS AND METHODS

The seeds were collected from All India Co-ordinated Vegetable Improvement Project, Bidhan Chandra Krishi Viswavidyalays, Kalyani sub-centre. Twenty-two improved and twenty hybrid seeds were sown in raised seedbeds during *rabi* season 1997-98 and 1998-99, following usual agronomic practices. The seedlings emerging from seeds in seed beds were ready for transplanting after 30 days. The one-month-old seedlings were then transplanted in replicated pots. The plots were prepared following usual agronomic practice except

application of any pesticides. The sizes of the plots were 3.6 m × 3 m at a spacing of 60 cm × 45 cm. The total number of plants in each plot was 40.

In each plot, the number of leaf curl infected plants were noted by visual observations. The number of leaf curl infected plants in each plot was observed on the 30th, 45th, 60th, 75th and 90th days after transplating (DAT). The disease percentage was calculated by dividing the number of infected plants

Table 1 : Incidence of tomato leaf curl in different improved germplasms / varieties / lines in tomato and its yield during 1997-98 and 1998-99.

Variety	Disease incidence (%)			Yield (q/ha)		
	1997-98	1998-99	Pooled	1997-98	1998-99	Pooled
Sel-7	5.0 (12.63)	4.0 (11.32)	4.50 (11.98)	129.46	122.52	125.99
RHRT-3-3-1	8.33 (16.50)	16.66 (23.93)	12.50 (20.22)	118.89	87.43	103.16
RHRT-6-1	10.33 (25.27)	35.00 (36.02)	26.66 (30.64)	92.71	71.41	85.06
RHRT-7-2	81.66 (64.85)	63.33 (53.59)	72.50 (59.22)	64.03	66.29	65.16
RT-JOB-21	60.83 (51.29)	50.00 (44.99)	55.41 (48.14)	59.99	56.38	58.19
HYT-1	75.00 (60.46)	80.00 (63.70)	77.50 (62.08)	55.98	44.89	50.44
Improved Shalimar	22.00 (28.29)	19.16 (25.77)	20.83 (27.03)	94.22	103.65	98.94
Co-3	5.83 (13.62)	1.66 (6.06)	3.75 (9.84)	123.82	131.22	127.52
BT-188-4-1-1	71.66 (58.68)	56.66 (48.85)	64.16 (53.76)	54.17	84.76	69.46
BT-315-3-3-1	61.66 (52.01)	59.16 (50.33)	60.41 (51.17)	74.28	82.38	78.33
BT-20-2-1	67.50 (55.49)	53.33 (47.06)	60.41 (51.27)	56.94	84.11	70.52
Pant T-3	25.00 (29.82)	20.00 (26.47)	22.50 (28.15)	79.48	128.41	103.95
Arka Vikash	8.33 (16.50)	5.83 (13.91)	7.08 (15.20)	122.14	132.98	127.56
Sel-14	15.00 (22.74)	14.16 (21.63)	14.58 (22.18)	130.70	127.89	129.29
DVRT-1	21.66 (26.82)	11.66 (19.04)	16.66 (22.93)	111.67	102.57	107.12
DVRT-2	15.00 (22.74)	16.66 (24.04)	15.83 (23.26)	113.83	106.00	109.91
M-Sel-7	39.16 (38.70)	28.33 (31.62)	33.75 (35.16)	90.33	100.63	95.48
M-Sel-15	13.33 (21.13)	5.83 (12.96)	9.58 (17.05)	132.27	134.92	133.59
Punjab Chuhara	23.33 (28.78)	56.66 (49.10)	40.00 (38.94)	91.41	97.86	94.63
JT 99	75.00 (60.46)	65.83 (55.09)	70.41 (57.78)	52.41	75.52	63.96
NDT-3	10.00 (8.11)	25.83 (30.50)	17.91 (24.30)	113.18	87.50	100.34
Pusa Ruby (Check)	83.3 (66.40)	76.66 (61.65)	80.00 (64.03)	35.39	65.94	50.67
S.Em±	3.23	4.39	2.66	4.20	4.15	2.99
C.D. at 5%	9.23	1.56	7.60	12.01	11.87	8.53

by the total number of plants and multiplied by 100.

$$\text{Disease percentage} = \frac{\text{Number of infected plants per plot}}{\text{Total number of plants per plot}} \times 100$$

Yield was also recorded in kg/plot and converted to q/ha. In all the cases Pusa Ruby variety was taken as check variety.

RESULTS AND DISCUSSION

It was found that the varieties under trial were infected by the virus with varied percentage of infection. None of the variety showed immune response against tomato leaf curl virus (TLCV) under field conditions (Table 1). During 1997-98 the lowest infections (7.08%), M. Sel-15 (9.58%), RHRT-3-1 (12.5%) and the highest infections were observed and recorded in improved tomato varieties viz. Co-3 (3.75%), Sel-7 (4.5%), Arka Vikash JT 99 (70.41%), HYT-1 (77.50%) and the check variety Pusa ruby (80.00%). Remaining thirteen other varieties showed comparatively medium to high infection, which ranged from 14.58% to 64.16%. During 1998-99 the lowest infections were recorded

Table 2 : Incidence of tomato leaf curl virus in different hybrid germplasms/varieties/ lines in tomato and its yield during 1997-98 and 1998-99.

Variety	Disease incidence (%)			Yield (q/ha)		
	1997-98	1998-99	Pooled	1997-98	1998-99	Pooled
ARTH-168	6.66 (14.75)	4.16 (11.36)	5.41 (13.06)	140.93	122.04	131.48
HYTH-2	4.16 (11.64)	10.83 (19.10)	7.50 (15.37)	172.94	144.20	158.57
Basudhara	18.33 (25.19)	16.66 (23.93)	17.50 (24.56)	158.51	99.96	129.23
Utsav	1.66 (6.06)	6.66 (14.24)	4.16 (10.15)	175.96	117.19	146.57
NS-815	38.33 (38.21)	80.83 (64.22)	59.58 (51.21)	122.22	116.40	119.31
ARTH-164	20.83 (27.14)	29.16 (32.60)	25.00 (29.87)	169.11	98.97	134.04
ARTH-3	31.66 (34.24)	0.83 (3.03)	16.25 (18.63)	120.03	95.24	107.63
BSS-107	75.00 (60.01)	66.66 (55.75)	70.83 (57.88)	90.18	92.52	91.35
ARTH-4	50.00 (45.04)	3.33 (8.33)	26.66 (26.68)	79.20	163.07	121.14
ARTH-128	72.50 (85.99)	81.66 (64.96)	77.08 (61.97)	74.82	91.29	83.05
ARTH-16	15.00 (21.32)	0.83 (3.03)	7.91 (12.17)	200.87	163.59	182.23
Ratna	7.50 (15.32)	34.16 (34.98)	20.83 (25.15)	184.61	87.07	135.84
Larica	81.66 (64.85)	80.83 (65.51)	81.25 (65.18)	77.04	66.53	71.99
BSS-20	7.50 (15.23)	17.50 (24.62)	12.50 (19.93)	235.81	126.84	181.32
Avinash-2	7.50 (15.23)	40.83 (39.67)	24.16 (27.78)	181.82	89.56	135.69
Phule Hy-1	49.16 (44.47)	63.33 (52.99)	56.25 (48.73)	72.51	84.35	78.43
BSS-39	15.83 (21.90)	13.33 (17.71)	14.58 (19.81)	162.98	107.94	135.46
BRH-1	68.33 (56.08)	29.16 (32.33)	48.75 (44.20)	67.55	90.98	79.26
ARTH-43	16.66 (22.43)	85.83 (68.84)	51.25 (45.64)	147.38	73.62	110.50
ARTH-13	26.66 (31.07)	71.66 (58.76)	41.16 (44.91)	110.13	71.65	90.89
Pusa-Ruby (check)	75.83 (60.58)	60.83 (52.13)	68.33 (56.35)	51.14	73.52	62.33
S.Em ±	4.60	6.73	3.18	13.46	8.52	8.91
C.D.	13.15	19.25	9.10	38.47	24.37	25.49

Table 3 : Percentage of infection of tomato leaf curl virus recorded on different improved varieties at different days after transplanting (DAT).

Variety	Infection (%) average of three replications									
	30 DAT		45 DAT		60 DAT		75 DAT		90 DAT	
	97-98	98-99	97-98	98-99	97-98	98-99	97-98	98-99	97-98	98-99
Sel-7	0.83	0.0	0.83	0.0	2.5	0.83	5.0	1.66	5.0	4.00
RHRT-3-3-1	2.5	1.66	5.0	3.33	8.33	12.5	8.33	16.66	8.33	16.66
RHRT-6-1	3.33	5.0	14.16	15.83	16.66	31.66	18.33	31.66	18.33	35.00
RHRT-7-2	4.16	13.33	19.16	53.33	60.00	58.33	74.16	60.00	81.66	63.33
RT-JOB-21	8.33	1.66	43.33	17.50	60.00	43.33	60.83	50.00	60.83	50.00
HYT-1	7.50	5.0	44.16	31.66	75.00	72.50	75.00	80.00	75.00	80.00
Improved Shalimar	4.16	2.5	7.50	5.0	17.50	16.66	22.50	19.16	22.50	19.16
Co-3	0.0	0.0	0.0	0.0	0.0	0.83	3.33	1.66	5.83	1.66
BT-188-4-1-1	8.33	4.16	50.83	15.00	71.66	51.66	71.66	56.66	71.66	56.66
BT-315-3-3-1	5.0	6.66	36.66	23.33	59.83	55.00	61.66	59.16	61.66	59.16
BT-20-2-1	0.0	8.33	34.16	21.66	66.66	46.66	66.66	53.33	67.50	53.33
Pant T-3	0.83	0.0	9.19	0.83	17.50	11.66	24.16	20.00	25.00	20.00
Arka Viksh	0.0	0.0	0.0	0.0	5.0	5.83	8.33	5.83	8.33	5.83
Sel-14	0.0	0.83	14.16	5.00	14.16	14.16	14.16	14.16	15.00	14.16
DVRT-1	0.0	7.50	12.50	10.83	16.66	11.16	21.66	11.16	21.66	11.16
DVRT-2	2.5	0.0	5.0	0.0	12.50	8.33	12.50	16.66	15.00	16.66
M-Sel-7	10.0	10.0	31.66	20.0	35.66	28.33	39.16	28.33	39.16	28.33
M-Sel-15	6.66	0.0	0.33	8.83	8.83	2.50	11.66	5.83	13.33	5.83
Punjab Chuhara	4.16	7.50	12.50	46.66	21.66	51.66	23.33	53.66	23.33	56.66
JT-99	4.16	10.83	19.16	38.33	65.83	60.00	65.83	65.00	75.00	65.83
NDT-3	0.0	0.83	4.16	11.66	9.16	21.66	9.16	23.50	10.00	25.83
Pusa - Ruby (Check)	2.50	20.00	50.00	50.00	79.16	73.33	81.66	76.66	83.33	76.66

Table 4 : Percentage of infection of tomato leaf curl virus recorded on different hybrid varieties at different days after transplanting (DAT).

Variety	Infection (%) average of three replications									
	30 DAT		45 DAT		60 DAT		75 DAT		90 DAT	
	97-98	98-99	97-98	98-99	97-98	98-99	97-98	98-99	97-98	98-99
ARTH-168	0.0	1.66	3.33	2.5	4.16	4.16	5.0	4.16	6.66	4.16
HYTH-2	3.33	0.83	3.3	4.16	4.16	4.16	4.16	10.83	4.16	10.83
Busundhara	0.0	0.0	0.0	5.83	16.66	16.66	18.33	16.66	18.33	16.66
Utsav	0.0	0.0	0.83	0.0	1.66	2.5	1.66	6.66	1.66	6.66
NS 815	3.33	5.0	16.83	20.00	25.83	53.33	38.33	80.00	38.33	80.83
ARTH-164	1.66	0.0	12.5	0.0	20.83	22.50	20.83	29.16	20.83	29.16
ARTH-3	0.0	0.0	0.0	0.83	0.0	0.83	31.66	0.83	31.66	0.83
BSS-107	0.0	3.33	35.0	27.50	64.16	52.50	64.16	66.66	75.00	66.66
ARTH-4	2.5	0.0	15.83	2.50	25.83	3.33	50.00	3.33	50.00	3.33
ARTH-128	0.0	10.0	22.50	48.33	49.16	74.16	71.66	74.16	72.50	81.66
ARTH-16	0.0	0.83	12.50	0.83	15.00	0.83	15.00	0.83	15.00	0.83
Ratna	16.66	0.0	0.0	0.0	3.33	16.66	7.50	25.00	7.50	34.16
Larica	0.0	6.66	17.50	61.66	72.50	73.16	77.50	75.83	81.66	80.83
BSS-20	0.0	0.0	5.83	5.83	7.50	15	7.50	17.50	7.50	17.50
Avinash-2	0.0	0.0	0.0	0.83	2.50	1.66	7.50	1.66	7.50	40.83
Phule HY-1	0.0	9.116	26.66	22.50	40.0	53.16	49.16	63.33	49.16	63.33
BSS-39	0.0	0.0	0.0	8.50	14.16	13.33	15.83	13.33	15.83	13.33
BRH-1	0.0	0.0	25.66	0.0	50.83	11.66	68.33	29.16	68.33	29.16
ARTH-34	0.0	1.66	0.0	2.33	8.33	65.83	15.83	85.83	26.66	85.83
ARTH-13	3.33	0.0	6.66	2.5	21.66	62.50	26.66	71.50	26.66	71.50
Pusa-Ruby (check)	6.66	5.83	35.83	38.33	57.33	58.33	72.50	60.83	75.83	60.83

in Co-3 (1.66%), Sel-7 (4.0%), Arka Vikash (5.83%) and M.Sel-15 (5.83%), medium infections were found in DVRT-1 (11.66%), Sel-14 (14.16%) and DVRT-2 (16.66%) and rest of the varieties showed medium to high infection, which ranged from 19.16% to 80%. The two years pooled data showed that Co-3, Sel-7, Arka Vikash and M Sel-15 had low incidence of leaf curl disease. The percentage of incidence were 3.75, 4.50, 7.08 and 9.58 respectively, rest of the varieties were recorded medium to high incidence of the disease, which ranged from 12.50% to 80.00%. The yeild was also higher in those varieties, which have low incidence of disease (Table 1).

In hybrid varieties the percentage of infection was higher in comparison to improved varieties (Table 2). During 1997-98 the low incidence was found in Utsav (1.66%), HYTH-2 (4.16%) ARTH 168 (6.66%) and BSS-20 & Avinash-2 (7.50%) and rest of the varieties showed medium to high incidence of the disease, which ranged from 15.00% to 81.66%. During 1998-99 very low incidence was found in ARTH-3(0.83%) & ARTH-16 but in 1997-98 these varieties showed medium to high percentage of infection, which were 31.66% and 15.00% respectively. From two years pooled data it was found that Utsav, ARTH-168, HYTH-2 and ARTH-16 had low incidence of disease which were 4.16%, 5.41% 7.50% and 7.91% respectively. The highest yield was obtained in BSS-20 (182.23 q/ha) followed by ARTH-16 (181.32 q/ha), HYTH-2 (158.57 q/ha) and Utsav (146.57 q/ha) The incidence of the disease was medium in BSS 20(12.17%).

A gradual increase of TLCV infection in the varieties in both the years have been observed with increase of the age of the plants. The incidence of the disease at different growth stages have been presented in Tables 3 and 4. During 1997-97 first disease symptom appeared in RHRT-3-3-1, Sel 7, RHRT-7-2, RT-JOB-21, HYT 1 Improved Shalimar BT-188-4-1, BT 215-3-3-1, Pant T 3, DVRT-2, M Sel-7, M-Sel-15, Punjab Chuhara and Pusa Ruby in improved varieties and ARTH-164, HYTH-2, MS 815, ARTH-4, ARTH-128, Larica, Phule Hy-1, BRH-1, ARTH-3, ARTH 13 and Pusa Ruby in hybrid varieties. Percentage of incidence of disease gradually increased with the increase of plant age and was observed upto 75 DAT. The incidence of the disease was comparatively lower upto 45 DAT but it was found higher at an age between 45 and 60 DAT.

The rate of increase of infection followed a similar pattern with the increase of the age of the plant in all varieties and both the years.

Similar type of varietal trials against TLCV has also been conducted in different vegetable growing areas of India. Raghupathy *et al.* (1997) indicated that Sel-7, Co-3 were the highly resistant varieties to TLCV. Channarayappa *et al.* (1992) screened 1200 cultivars and found that all are susceptible to the disease. Saikia and Muniyappa (1986) tested 161 tomato lines under field conditions and only two were found to be TLCV resistant.

From the above findings it may be concluded that improved varieties like Co-3, Sel-7, Arka Vikash and M Sel-15 and hybrid varieties like Utsav, ARTH-168, HYTH-2, ARTH-16 are suitable for the cultivation in new alluvial zone of West Bengal.

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