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Evaluation of eggplant accessions for resistance to bacterial wilt caused by *Ralstonia solanacearum* (E.F. Smith) Yabuuchi *et al.*

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ABSTRACT

Forty-one eggplant accessions were screened in a sick plot for bacterial wilt resistance at Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru. Nine accessions, viz., IIHR-322, AVT-IIRES-1, AVT-IIRES-2, AVT-IIRES-4, AVT-IIRES-5, IIHR500-A, BPLH-1, IIHR-3 and IIHR-5 showed highly resistant reaction, with no wilting of plants; five accessions, viz., RES-2, RES-5, RES-6, 37-36-4-4 and 36-37-13, showed resistance reaction per cent wilt 3.33 -10.0. Two accessions, viz., 36-37-3 and 37-4-20, showed moderately resistant reaction, with 11.0 and 12.0 per cent wilt incidence, respectively; while, 22 accessions were 'moderately susceptible to highly susceptible', with wilt incidence ranging from 25.45 to 100.0%.

Key words: Eggplant, bacterial wilt, resistance screening

INTRODUCTION

Eggplant or Brinjal (*Solanum melongena* L.) belongs to the family Solanaceae and is the most important and widely-consumed vegetable in India. It is grown in 691,000 hectares with production of eight to nine million tonnes (equivalent to one quarter of global production), which makes India the second largest producer of eggplant in the world. Bacterial wilt, caused by *Ralstonia* (=*Pseudomonas*) *solanacearum* (E.F. Smith) Yabuuchi *et al*, is a major constraint in eggplant production in India. The disease is widely distributed in tropical, subtropical and some warm temperate regions of the world. The pathogen is difficult to control since it is soil-borne and has a wide host-range, including several hundred species representing 44 families of plants. Infection is through root-to-root transmission, movement of soil and dissemination by farm implements, and insect transmission. A combination of high temperature and poor drainage favour development of the disease which causes 75 to 81% yield loss during summer in India (Das and Chattopadhyay, 1953; Rai *et al*, 1975; Rao *et al*, 1976). Bacterial wilt in brinjal is being managed by application of bactericides, copper fungicides and by crop rotation, with no adequate control. Once the disease develops and wilt symptoms appear in the field, application of bactericides and copper fungicides has no effect on the bacterium. Crop rotation is not a viable control method, as, the bacteria can persist indefinitely in infested fields (Jaworski and Morton, 1964; Sonoda, 1978). In the absence of effective chemicals and bactericides for managing this disease, emphasis is laid on developing eggplant (brinjal) cultivars with resistance to *Ralstonia solanacearum*. Though resistance to bacterial wilt has been studied in several crops, especially tomato, there is little published work on bacterial wilt resistance in eggplant (Chaudhary and Sharma, 2000; Zakir Hussain *et al*, 2005; Mondal *et al*, 2013). Work on breeding for resistance to bacterial wilt in eggplant is in progress at Indian Institute of Horticultural Research, Bengaluru. A large number of eggplant accessions were evaluated for resistance to bacterial wilt and the results are reported in their paper.

MATERIAL AND METHODS

A total of 41 eggplant accessions, including resistant and susceptible checks (Table 1), were evaluated during the year 2010-2011 in bacterial-wilt sick plot at Indian Institute of Horticultural Research farm, Hessaraghatta, Bengaluru. 35 day old eggplant seedlings of these accessions raised in pro-trays were transplanted to wilt-sick soil which had a pathogen population of 1.0 x 10^8cfu/gm soil. Infested soil was used because it permits assessment of field resistance by allowing the infection process to take place under natural conditions, with realistic doses of naturally-produced inoculum. Recommended package of practices for growing brinjal crop were followed from transplanting up to harvest. The bacterium, *R. Solanacearum*, was isolated from freshly wilted eggplant on Triphenyl Tetrazolium Chloride agar medium (TTC) (Kelman, 1954) and multiplied on 523 enriched medium (Kado and Haskett, 1970). Bacterial suspension from 523 medium was diluted in sterile distilled water and its concentration adjusted to 0.3 OD at 600nm (1.0 x 10^6cfu/ml) using a spectrophotometer. To ensure infection, the plants were also inoculated with bacterial suspension (10^6cfu/ml) by axil-puncture method at 15th and 30th day after transplanting (Winstead and Kelman, 1952; Rashmi *et al*, 2012). All the 41 accessions were replicated thrice, with 30 plants in each replication, in Randomized Block Design. Periodical, observations were recorded on incubation period and per cent bacterial-wilt incidence. To assess length of the incubation period, an average of 10.0 per cent of wilted plants from each accession was taken (Atabug and Juan, 1981) and bacterial infectivity was confirmed by the ooze test, as also by isolating the bacterium on TTC medium.

Wilt symptoms and number of wilted plants per accession were recorded and graded on 0-5 scale, as per Winstead and Kelman (1952) and Zakir Hussain *et al* (2005), with some modification. The modified rating scale is given below:

0 - Highly Resistant (HR) with no wilt symptom; 1 - Resistant (R), with 1 - 10% wilted plants; 2 - Moderately Resistant (MR) with 11 -20% wilted plants; 3 - Moderately Susceptible (MS), with 21-30% wilted plants; 4 - Susceptible (S) with 31- 40% wilted plants, and, 5 - Highly Susceptible (HS) with > 40% wilted plants.

The experimental data were statistically analyzed. Data on per cent incidence of wilt were transformed into arc sine, and analysis of variance was carried out with transformed values. The means were compared for statistical significance using Duncan multiple range test (Panse and Sukhatme, 1989). The accessions were categorized as highly resistant to highly susceptible, depending on the percentage of wilted plants.

Table 1. Evaluation of eggplant accessions for bacterial wilt resistance

Sl. No.	Accession	Wilt incidence Mean* (%)	Reaction
1.	AVT-1 RES-1	54.44 (47.53)	HS
2.	RES-2	04.44 (12.13)	R
3.	RES-3	60.00 (50.76)	HS
4.	RES-4	33.33 (35.23)	HS
5.	RES-5	03.33 (10.48)	R
6.	RES-6	10.00 (18.36)	R
7.	IIHR-322	00.00 (0.00)	HR
8.	AVT-IIRES-1	00.00 (0.00)	HR
9.	AVT-IIRES-2	00.00 (0.00)	HR
10.	AVT-IIRES-3	96.66 (79.94)	HS
11.	AVT-IIRES-4	00.00 (0.00)	HR
12.	AVT-IIRES-5	00.00 (0.00)	HR
13.	BPLH-1	00.00 (0.00)	HR
14.	PH-5	100.00 (89.96)	HS
15.	MEBH-9	100.00 (89.96)	HS
16.	H-925	100.00 (89.96)	HS
17.	IIHR-500A	00.00 (0.00)	HR
18.	Eggplant green long	30.00 (33.15)	MS
19.	IIHR-3	00.00 (0.00)	HR
20.	IIHR-5	00.00 (0.00)	HR
21.	37-36-4-4	10.00 (18.42)	R
22.	36-37-13	05.00 (12.88)	R
23.	36-37-3	11.00 (19.32)	MR
24.	37-4-20	12.00 (20.23)	MR
25.	37-36-4-9	100.00 (89.96)	HS
26.	Purple Rani	100.00 (89.96)	HS
27.	Eggplant round	100.00 (89.96)	HS
28.	2BMG-1 X PH-2	90.00 (72.07)	HS
29.	IIHR-104	100.00 (89.96)	HS
30.	PB-4	100.00 (89.96)	HS
31.	PH-6	100.00 (89.96)	HS
32.	MEBH-11	100.00 (89.96)	HS
33.	IIHR-106	100.00 (89.96)	HS
34.	IIHR-500A X IIHR-575	75.00 (60.00)	HS
35.	Eggplant purple long	25.45 (30.26)	MS
36.	MG Round	100.00 (89.96)	HS
37.	MGR-2 (spineless)	100.00 (89.96)	HS
38.	Manjari	100.00 (89.96)	HS
39.	Arka Nidhi (RC)	00.00 (0.00)	HR
40.	Arka Keshav (RC)	00.00 (0.00)	HR
41.	Arka Shirish (SC)	100.00 (89.96)	HS

CD ($P=0.05$): 2.39, CV (%): 3.46, SEm±: 0.85
*Mean of three replications
Figures in parenthesis are angular transformed values
R = Resistant HS = Highly Susceptible
HR = Highly Resistant MS = Moderately Susceptible
MR = Moderately Resistant

RESULTS AND DISCUSSION

Results presented in Table 1 showed that nine accessions, viz., IIHR-322 (Fig. 1), AVT-IIRES-1, AVT-IIRES-2, AVT-IIRES-4, AVT-IIRES-5, IIHR500-A, BPLH-1, IIHR-3 and IIHR-5, were highly resistant with no wilting of plants; five accessions, viz., RES-2, RES-5, RES-6, 37-36-4-4 and 36-37-13, showed resistant reaction with per cent wilt ranging from 3.33 to 10.0; two accessions, viz., 36-37-3 and 37-4-20, showed moderately resistant

Fig 1. Brinjal variety IIHR-322: highly resistant to bacterial wilt

Fig 2. Brinjal variety Arka Shirish: highly susceptible to bacterial wilt

reaction, with 11.0 and 12.0 per cent wilt incidence, respectively; and 22 accessions (Table 1) showed 'moderately susceptible to highly susceptible' reaction ranging from 25.45 to 100.0% wilt incidence. The resistant check varieties, Arka Keshav and Arka Nidhi, showed no bacterial wilt incidence, and, the susceptible check, Arka Shirish showed 100% wilt incidence (Fig. 2). Similar observation was also made by Chaudhary and Sharma (2000), who found that genotype SM 6-6 to be resistant to bacterial wilt, with Arka Keshav, Arka Neelkanth and Arka Nidhi as the resistant checks. Mondal *et al* (2013) found that out of eight lines of local eggplant germplasm screened in bacterial-wilt sick soil, 'Midnapur Local' and 'Bhangar' were tolerant to the disease.

Normally, under field conditions, wilt symptom appears at the time of flowering, which is approximately 30 to 40 days after transplanting. In the highly-susceptible variety Arka Shirish, the first symptom of wilt appeared after six days from the first inoculation (20.0% wilt), which was 21 days after transplanting and extended for 35 days (100.0% wilt); whereas, in the resistant accession (RES-5 and RES-6) which showed wilt incidence of 3.33 to 10.0%, the initial symptom was noticed 14 days after the first inoculation, and had a longer incubation period of 60 days. Similar observation was made by Rahman *et al* (2011) on incubation of the pathogen in resistant cultivar Katabegun, which showed 30.0% bacterial wilt incidence after 55 days of transplanting to wilt-sick soil.

Thus, the present results indicate that resistant accessions had longer incubation period compared to the susceptible ones. Similarly, Rahman (1997) reported in chilli that resistant accessions had a longer incubation period and took a longer time to produce disease symptoms, than the susceptible accessions.

Accessions found to be highly resistant in the present study are being further used in breeding programmes for developing bacterial wilt resistant eggplant hybrids.

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