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Screening of Brinjal Genotypes against Bacterial Wilt caused by *Ralstonia solanacearum*

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ABSTRACT: An experiment was conducted to evaluate bacterial wilt resistance among different brinjal genotypes in Department of Plant Pathology, OUAT, Bhubaneswar during 2021-2022. Twenty five brinjal genotypes were screened by artificial inoculation with *Ralstonia solanacearum* inoculum at a concentration of 1.5 × 10^8 cfu/ml. Among them Utkal Keshari was highly resistant followed by Utkal Anushree, BB-67, Kanta Bagan and Arka Neelkanth. The variety Hazari Local showed wilt symptoms 50 days after inoculation (2.42%). Nayagarh spiny brinjal (1.56%), BB-67 (1.16%) showed wilt symptoms at 40 days after inoculation. Kanta Bagan (1.86%), Utkal Jyoti (1.17%), VNR-5 (3.57%) exhibited wilt symptoms 30 days after inoculation. Dhenkanal Local (1.49%), Utkal Anushree (1.84%), Utkal Tarini (3.33%) showed wilt symptoms 20 days after inoculation.

Keywords: Brinjal, bacterial wilt, *Ralstonia solanacearum*, genotypes.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the important vegetable crops growing worldwide. It belongs to the family Solanaceae. In India brinjal can be grown in almost all states, except in higher altitudes. Odisha is the second largest producer of brinjal after West Bengal with an area of 130 thousand ha with 21.2 MT production (APEDA, 2020-21). Brinjal has a number of health benefits such as it has ayurvedic medicinal properties. It is rich in antioxidant compounds and has hepatoprotective properties (Bhat *et al.,* 2013). Brinjal cultivation in India is severely affected by the incidence of bacterial wilt caused by *Ralstonia solanacearum* (Nishat *et al.,* 2015). The disease is widely distributed in tropical, subtropical and some warm temperate regions of the world (Ji *et al.,* 2005). In India the bacterial wilt of brinjal occurs frequently in all parts of the country and yield loss ranging from 11.67 to 96.67% (Bainsla *et al.,* 2016). Because of its broad geographical distribution and wide host range it causes yield losses ranged upto 95 per cent in brinjal according to Singh *et al.* (2019). The bacterium normally invades plant roots from the soil through wounds or natural openings, colonizes the intercellular space of the root cortex and vascular parenchyma and eventually enters the xylem vessel and spreads up into the stem and leaves, subsequently wilting of the foliage and usually progresses until complete wilting and collapse of the plant, expression of the symptoms and rate of disease development may vary depending on host susceptibility and the aggressiveness of the pathogenic strain (Rahman *et al.,* 2010).

The capacity of *R. solanacearum* survival in diverse environment, variability and their existence with an extremely wide host range, control of infection has been a major challenge due to limited possibility for their chemical control (Nguyen and Ranamukhaarachchi 2010). However, screening of some antibiotics may reduce the severity of wilt disease at some extent. Therefore, present research was conducted to identify resistant sources against bacterial wilt of brinjal in the Odisha state.

MATERIALS AND METHODS

The diseased plant samples were collected from different brinjal growing regions of the Odisha. On nutrient agar medium, the *Ralstonia solanacearum* culture was isolated. The pathogenicity of the virulent colonies of *Ralstonia solanacearum* was identified as dull white, fluidal with the slight red center was

observed on 2,3,5-triphenyl tetrazolium chloride agar medium.

The experimental materials included 25 commercial brinjal cultivars, including hybrids (Table 1) to evaluated bacterial wilt resistance under greenhouse condition. Potted soil was combined in a 2:1 ratio with FYM and sterilized with 5% formalin by thoroughly mixing it and then covering it with a polyethylene sheet for 72 hours. Then it was spread out into the open for 48 hours to discharge formalin fumes. Then the seedlings were transplanted to plastic bags containing sterilized soil. One brinjal plant per polythene bag was maintained. The plants of each cultivar were inoculated at root zone by making slight injury to the root with disposable tip and 5 ml of inoculum was poured to the injured portion with bacterial culture containing 1.5×10^8cfu/ml to facilitate bacterial infection. The plants were covered with polythene covers upto 3 days. The data was recorded at 3 days interval after inoculation (DAI) and the per cent disease incidence was calculated by using 0-5 grade disease rating scale (Winsted and Kelman 1952) given in Table 1. The reaction of each genotype was categorized on the basis of per cent disease incidence. The percent disease incidence of bacterial wilt was calculated at 10 days after inoculation of pathogen by following formula.

$$\text{Percent disease incidence (PDI)} = \frac{\text{Number of plants showing wilt symptoms}}{\text{Total no. of plants} \times 100}$$

Table 1: 0-5 scale of bacterial wilt of brinjal (Winstead and Kelman 1952).

Score	Percent mortality	Reaction
0	0	Highly Resistant (HR)
1	1-20%	Resistant (R)
2	21- 40%	Moderately Resistant (MR)
3	41- 60%	Moderately Susceptible
4	61- 80%	Susceptible (S)
5	>80%	Highly Susceptible (HS)

Table 2: List of brinjal germplasm and their sources of seed material used in the study.

Sr. No.	Genotypes	Hybrid/ variety	Sources of seed material
1.	Pusa Kranti	Variety	Indian Agricultural Research Institute, New Delhi
2.	Mahy112	F1 hybrid	Local market, Bhubaneswar, Odisha
3.	Blue Star	Local variety	Local market, Bhubaneswar, Odisha
4.	Dhenkanal Local	Variety	AICRP, Bhubaneswar, Odisha
5.	VNR 212	Variety	Local market, Bhubaneswar, Odisha
6.	Green Round	Variety	Local market, Bhubaneswar, Odisha
7.	Utkal Anushree	Variety	AICRP, Bhubaneswar, Odisha
8.	BB-67	Variety	AICRP, Bhubaneswar, Odisha
9	Kakedi Local	Variety	AICRP, Bhubaneswar, Odisha
10.	Kanta Bagan	variety	AICRP, Bhubaneswar, Odisha
11.	Utkal (F1 Hybrid)	F1 Hybrid	AICRP, Bhubaneswar, Odisha
12.	Arka Neelkanth	variety	AICRP, Bhubaneswar, Odisha
13.	VNR 60 (F1 Hybrid)	F1 Hybrid	AICRP, Bhubaneswar, Odisha
14.	Nayagarh spiny Brinjal	variety	AICRP, Bhubaneswar, Odisha
15.	Utkal Tarini	variety	AICRP, Bhubaneswar, Odisha
16.	Arka Nidhi	variety	Indian Institute of Horticultural Research, Karnataka
17.	Akshitha	variety	Local market, Bhubaneswar, Odisha
18.	Pusa Anupam	variety	Indian Agricultural Research Institute, New Delhi
19.	Hajari Local	variety	AICRP, Bhubaneswar, Odisha
20.	Pusa hybrid-5	variety	Indian Agricultural Research Institute, New Delhi
21.	IIHR-7	variety	Indian Institute of Horticultural Research, Karnataka
22.	Utkal Madhuri	variety	AICRP, Bhubaneswar, Odisha
23.	Utkal Jyoti	variety	AICRP, Bhubaneswar, Odisha
24.	PusaUttam	F1 Hybrid	Indian Agricultural Research Institute, New Delhi
25.	VNR-5	F1 Hybrid	Local market, Bhubaneswar, Odisha
26.	Utkal Keshari	variety	AICRP, Bhubaneswar, Odisha
27.	Pusa Purple Long	variety	IARI, New Delhi

RESULTS AND DISCUSSION

Twenty seven brinjal varieties were screened against more virulent RS7 isolate. Among them Utkal Keshari was highly resistant followed by Utkal Anushree, BB-67, Kanta Bagan and Arka Neelkanth. The variety Hazari Local showed wilt symptoms 50 days after inoculation (2.42%) (Table 3).

Table 3: Screening of brinjal genotypes against bacterial wilt disease.

Sr. No.	Genotype	Wilt incidence %						Reaction
		10-20 DAI	21-30 DAI	31-40 DAI	41-50 DAI	51-60 DAI	61-70 DAI	
1.	Pusa Kranti	2.26 (8.65)*	5.57 (13.65)	16.52 (23.98)	21.53 (27.65)	27.61 (31.70)	34.54 (35.99)	MR
2.	Mahy112 (F1 Hybrid)	4.38 (12.08)	11.33 (19.67)	21.50 (27.62)	27.04 (31.33)	34.79 (36.14)	47.33 (43.47)	MS
3.	Blue Star	3.97 (11.49)	9.55 (18.00)	17.43 (24.68)	21.56 (27.67)	29.28 (32.76)	37.41 (37.71)	MR
4.	Dhenkanal Local	0.00 (0.70)	1.49 (7.01)	2.66 (9.39)	4.32 (12.00)	6.55 (14.83)	7.62 (16.02)	R
5.	VNR 212 (F1 Hybrid)	4.66 (12.47)	6.34 (14.58)	11.39 (19.72)	16.36 (23.86)	24.48 (29.65)	41.23 (39.95)	MS
6.	Green Round	5.41 (13.45)	8.63 (17.08)	13.62 (21.66)	19.59 (26.27)	27.59 (31.69)	47.50 (43.57)	MS
7.	Utkal Anushree	0.00 (0.70)	1.84 (7.80)	3.38 (10.59)	6.35 (14.60)	7.71 (16.12)	9.45 (17.90)	R
8.	BB-67	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	1.16 (6.18)	3.31 (10.48)	5.68 (13.79)	R
9.	Kakedi Local	2.59 (9.26)	4.18 11.80)	9.37 (17.82)	11.37 (19.71)	13.79 (21.80)	17.44 (24.68)	R
10.	Kanta Bagan	0.00 (0.00)	0.00 (0.00)	1.86 (7.84)	1.45 (6.92)	3.35 (10.55)	4.22 (11.85)	R
11.	Utkal (F1 Hybrid)	3.71 (11.11)	7.14 (15.50)	12.53 (20.73)	18.59 (25.54)	25.83 (30.55)	36.33 (37.07)	MR
12.	Arka Neelkanth	3.66 (11.03)	5.81 (13.95)	9.32 (17.78)	11.54 (19.86)	14.45 (22.34)	16.34 (23.84)	R
13.	VNR 60 (F1 Hybrid)	12.52 (20.72)	17.53 (24.75)	21.23 (27.44)	26.53 (31.00)	35.41 (36.52)	49.43 (44.67)	MS
14.	Nayagarh Spiny Brinjal	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	1.56 (7.17)	3.55 (10.86)	4.46 (12.19)	R
15.	Utkal Tarini	0.00 (0.70)	3.33 (10.51)	4.47 (12.21)	7.44 (15.83)	11.42 (19.75)	17.25 (24.54)	R
16.	Arka Nidhi	3.57 (10.89)	5.57 (13.65)	8.78 (17.24)	11.36 (19.70)	14.51 (22.39)	16.21 (23.74)	R
17.	Keonjhar Local-1	2.46 (9.02)	3.72 (11.12)	5.39 (13.42)	7.57 (15.97)	10.48 (18.89)	12.56 (20.76)	R
18.	Akshita	4.23 (11.87)	13.46 (21.52)	21.58 (27.68)	29.43 (32.85)	35.26 (36.43)	46.78 (43.15)	MS
19.	Hajari Local	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	2.42 (8.95)	3.27 (10.42)	R
20.	Pusa Hybrid-5	4.38 (12.08)	11.26 (19.61)	19.47 (26.18)	26.52 (31.00)	34.73 (36.11)	42.59 (40.74)	MS
21.	IIHR-7	1.17 (6.21)	2.64 (9.35)	4.75 (12.59)	5.54 (13.61)	7.75 (16.16)	9.31 (17.77)	R
22.	Utkal Madhuri	1.73 (7.56)	5.03 (12.96)	8.06 (16.49)	12.48 (20.69)	14.47 (22.36)	17.59 (24.80)	R
23.	Utkal Jyoti	0.00 (0.70)	0.00 (0.70)	1.17 (6.21)	2.31 (8.74)	3.49 (10.77)	4.46 (12.19)	R
24.	Navina (F1 Hybrid)	6.55 (14.83)	12.48 (20.69)	19.44 (26.16)	26.65 (31.08)	34.57 (36.01)	43.47 (41.25)	MS
25.	VNR-5	0.00 (0.70)	0.00 (0.70)	3.57 (10.89)	5.38 (13.41)	6.64 (14.93)	8.39 (16.84)	R
26.	Utkal Keshari	0.00 (0.70)	0.00 (0.00)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	HR
27.	Pusa Purple Long	12.06 (20.32)	22.57 (28.36)	34.42 (35.92)	56.33 (48.64)	61.41 (51.60)	82.67 (65.40)	S
	S.Em±	0.43	0.16	0.15	0.11	0.17	0.21	
	CD at (5%)	1.27	0.47	0.44	0.39	0.48	0.60	

*Figures in the parenthesis indicate √x+0.5 transformation values

Nayagarh spiny brinjal (1.56%), BB-67 (1.16%) showed wilt symptoms at 40 days after inoculation. Kanta Bagan (1.86%) Utkal Jyoti (1.17%), VNR-5 (3.57%) wilt symptoms exhibited 30 days after inoculation. Dhenkanal Local (1.49%), Utkal Anushree (1.84%), Utkal Tarini (3.33%) showed wilt symptoms 20 days after inoculation. Dhenkanal Local, Utkal Anushree, BB-67, Kakedi Local, Kanta Bagan, Arka Neelkanth, Nayagarh Spiny Brinjal, Utkal Tarini, Arka Nidhi, Akshita, Hazari Local, IIHR-7, Utkal Madhuri, Utkal Jyoti, VNR-5 showed wilt incidence varied from upto 17.25% does not show 50% wilt incidence at 70

days after inoculation categorized under resistant genotypes according to disease rating scale for bacterial wilt of brinjal (0-5) given by Winstead and Kelman (1952) Pusa Kranti (34.54%), Blue Star (37.41%) and Utkal F1 hybrid (36.33%) revealed wilt incidence recorded at 70 days after inoculation considered as under moderately resistant category.

Mahy 112, (47.33%) VNR-212, (41.23%) Green Round, (47.50%), VNR-60, (49.43%) Pusa Anupam (46.78%), Pusa Hybrid-5 (42.59%) and Pusa Uttam (43.47%), wilt incidence was observed at 70 days after inoculation were categorized under moderately susceptible.

Present findings were corroborated with the findings of Sahoo *et al.* (2015) also screened five different brinjal germplasms against bacterial wilt disease. Out of which Utkal Tarini, Utkal Madhuri, Utkal Jyoti, Utkal Anushree showed high resistance Chaudhary and Sharma (2000) reported that the genotypes Arka Keshav, Arka Neelkanth, Arka Nidhi and SM 6-6 were observed to be resistant to bacterial wilt. Kumar *et al.*, (2014) revealed that among the accessions of brinjal evaluated Arka Nidhi was found most resistant. Bhanwar *et al.* (2019) investigated a few brinjal cultivars and hybrids grown in artificially inoculated soil in pot culture. Among them, Pusa Kranti was found to be moderately resistant.

Santhosha *et al.* (2015) screened 40 brinjal genotypes for bacterial wilt resistance. Among them, Arka Nidhi, was found to be resistant to bacterial wilt whereas, Pusa Hybrid-6, Arka Shirish, R-2585 and R-2583 were found to be highly susceptible to bacterial wilt. Bhattacharjee *et al.* (2022) screened twenty-five brinjal genotypes for bacterial wilt resistance under artificial and field conditions. Among them, 'Utkal Anusree' found to be resistant to bacterial wilt.

CONCLUSION

Twenty seven brinjal varieties were screened due to excess application of pesticides are being challenged now a days due to raising concerns about toxic substances causing soil pollution and health issues. Yet it is not feasible due to the development of antibiotic resistance. So that most promising strategy to combat the wilt disease is to develop resistance in the host plant. Based on the above findings, Utkal Keshari was highly resistant followed by Utkal Anushree, Kanta Bagan and Arka Neelkanth lines were found to be resistant. These genotypes can be used in breeding programme for developing resistance against bacterial wilt of brinjal.

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Conflict of Interest. None.

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