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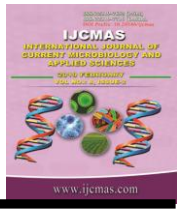

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Screening of Brinjal Cultivars against Bacterial Wilt Disease under Artificially Inoculated Conditions at Bastar Plateau Zone of Chhattisgarh

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A B S T R A C T

Resistance to bacterial wilt of brinjal disease incited by *Ralstonia solanacearum* (Smith) is very common in Bastar plateau of Chhattisgarh state. To identify the resistant sources against bacterial disease of few brinjal varieties and hybrids were screened in artificially inoculated in soil under pot culture. Observations on per cent plant mortality were recorded starting from 25 days after transplanting till 95 days interval of 10 days. The plants showing symptoms were examined using ooze test to confirm the disease. The variety Hara gold improved and Mukta keshi recorded resistant with low mortality (18 per and 20 per cent). Eight cultivars *viz.*, VNR 60, Sakya, Pusa kranti, Green round, Super white long, Pusa purple cluster and Grafted brinjal found moderately resistant (>21 – 40% mortality). Remaining five varieties (VNR 212, Navina, Mathy 112, White gucchedar and Green long (Pahuja)) were recorded moderately susceptible (>41 – 60% mortality).

Introduction

Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous crop of sub-tropics and tropics. The brinjal is much importance in the warm areas of Far East, being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. Brinjal has been cultivated in India for the last 4,000 years, although it is often thought of as a Mediterranean or mid-Eastern vegetable. In the year 2016-17, India accounts for about 12.4 million tons production with an area of 669,000 hectares under cultivation and 67 million tons production with area of 36,000 hectares at Chhattisgarh state (Horticultural Statistics at a Glance 2017). This plant is very susceptible for different wilt diseases among wilt diseases bacterial wilt is major problem among farmers of Chhattisgarh. Bacterial wilt of brinjal provoked by *Ralstonia solanacearum* (Smith) (syn *Pseudomonas solanacearum* EF Smith) is one of the devastating bacterial diseases affecting vascular bundles of plants (Sood and Singh 1993). This complex bacterial species has been subdivided into five host-specific races and five biovars based on their biochemical

properties (Hayward, 1991). Due to its wide range of hosts, the pathogen is distributed worldwide including tropical and subtropical regions, mainly in warmer and more humid regions. This disease attacks over 450 plant species (Daughtrey *et al.,* 1995). The pathogen has a very wide host range and almost all the solanaceous vegetables are susceptible. The yield loss in India due to this disease has been estimated up to 10-90 per cent (Singh *et al.,* 2012). Due to diverse biological habit of R. solanacearum, eradication of pathogen is not possible but can be managed. Various management strategies have been employed such as use of chemicals, host resistance, organic soil amendments, biological control, alterations in the date of planting, crop sanitation etc. Resistance to this disease is rarely observed. Therefore, at present study was done to identify resistant sources against bacterial wilt for Chhattisgarh state. Some popularly grown brinjal varieties and hybrids were screened in artificially inoculated soil under pot culture.

Materials and Methods

The present investigation was conducted at Saheed Ghundhadur College of Agriculture and Research Station, Jagdalpur, Bastar (C.G.) during *Rabi* 2017 and 2018. The experimental material comprised of sixteen commercial cultivar of brinjal including hybrids. The nursery of all sixteen brinjal cultivars was raised separately in sterilized potting mixture in germination trays under the controlled condition. The daily temperature of the glasshouse was ranged 25–27^{o}C. The trays were watered when moisture required. The screening of brinjal cultivars were done in polythene bags measuring 12.75 x 10.15 cm. The bags were filled with sterilized soil containing sand, silt and compost at 3:1:1 ratio, respectively. Initial pH of pot soil was 5.8 to 6.2. Twenty five days old seedlings were transferred individually to polythene bags. 50 plants were kept in each treatment. Treatment was arranged randomly at the temperature 25-30^{o}C and properly moistened in alternative days in green shed net house. After one week of transplanting, plants of each cultivar were inoculated with 50 ml of bacterial culture containing 1 x 10^{7} cfu/ml through soil drenching (Fig. 1 A). One-third root system of each cultivar was slightly injured by inserting a sharp sterilized knife about 2 cm away from the stem prior to drenching to facilitate penetration of the bacterium (Aslam *et al.,* 2017). After inoculation, the plants were watered at alternative days and symptoms of bacterial wilt were observed (Fig. 1 B). The plants showing symptoms were examined using ooze test to confirm the disease (Fig. 1 C). Observations on bacterial wilt incidence were recorded applying 0-5 grade disease rating scale (Winsted and Kelman, 1952) given in Table 1. The data was averaged and percent bacterial wilt disease incidence was calculated at 20 days after inoculation of pathogen by following formula.

Percent disease incidence (PDI) = Number of plants showing wilt symptoms / Total number of plants X 100

All percent disease incidence figures were transformed in arcsin value at 0% (Gomez A.A. and Gomez K.A., 2012).

Results and Discussion

Popularly grown brinjal cultivars by the farmers of Chhattisgarh state were evaluated against bacterial wilt disease under green shed net house in pot culture and data on per cent disease incidence were collected. Considerable variability was found in per cent disease incidence among all commercial varieties evaluated under the artificial inoculation condition in pot culture study. During 2017 disease incidence was varied

from 0.0 to 14.18, 0.0 to 25.10, 18.44 to 33.21, 25.10 to 36.87, and 25.10 to 48.45 per cent at 15, 30, 45, 60 and 75 days after transplanting (DAT), respectively. The verities VNR 60 and Pusa kranti was found free from the disease up to 30 DAT and four varieties Shakya, Haragol Improved, Pusa purple cluster and Grafted brinjal plant were found free from the disease up to 15 DAT, and rest of the varieties were appeared wilting symptoms at 15 DAT (Table 2). During 2018 disease incidence was varied from 0.0 to 16.43, 0.0 to 23.58, 11.54 to 33.21, 21.97 to 46.15 and 25.10 to 53.13 per cent at 15, 30, 45, 60 and 75 days after transplanting, respectively. Single variety Green long was found free from the disease up to 30 DAT, while two varieties *viz;* Hara gol improved and Pusa purple cluster were registered free from disease up to 15 days after transplanting, rest of the varieties showed first symptoms of wilting at 15 to 30 DAT (Table 2). Rahman *et al.,* 2011 screened eight eggplant varieties against Bacterial, Fungal and Nematode wilt disease and found that the cultivars Kata Begun graded as resistant for both Bacterial and Fungal wilt. The mean disease incidence of both the year (2017 and 2018) showed that, it varied from 0.0 to 14.18, 5.74 to 24.35, 15.34 to 33.21, 24.35 to 41.55 and 25.10 to 50.18 per cent at 15, 30, 45, 60 and 75 days after transplanting, respectively. The mean per cent incidence of both the year (2017 and 2018) showed that at 75 DAT. The lowest per cent incidence of bacterial wilt was observed in Hara gold improved 18 (25.10) followed by Mukta keshi 20 (26.56). Seven cultivars *viz*; VNR 60, Sakya, Pusa kranti, Green round, Super white long, Pusa purple cluster and Grafted brinjal plant were found moderately resistant (>21 – 40% mortality) against bacterial wilt. Remaining five varieties (VNR 212, Navina, Mathy 112, White gucchedar and Green long (Pahuja)) were recorded moderately susceptible (>41 – 60% mortality). The highest mean per cent incidence was recorded in Mahy 112 (50.18) followed by VNR 212 (48.45) and Navina (47.29) against bacterial wilt (Table 2). Earlier, similar studies were conducted on tomato genotypes against bacterial wilt by Kumar and Sharma (2004), they reported that higher disease mortality in highly susceptible genotypes followed by susceptible, moderately susceptible and moderately resistant with absence of vascular bundle discoloration index (VBDI) and low mortality in genotypes recorded as resistant towards bacterial wilt disease.

Table.1 Disease rating scale for bacterial wilt of solanaceous crop caused by *R. solanacearum* (Winstead and Kelman 1952)

Grade	% Incidence	Disease Reactions
0	Highly resistant (HR)	Plants did not show any wilt symptom
1	Resistant (R)	1 - 20 % plants wilted
2	Moderately resistant (MR)	21-40 % plants wilted
3	Moderately susceptible (MS)	41- 60 % plants wilted
4	Susceptible (S)	61- 80% plants wilted
5	Highly susceptible (HS)	More than 80% plant wilted

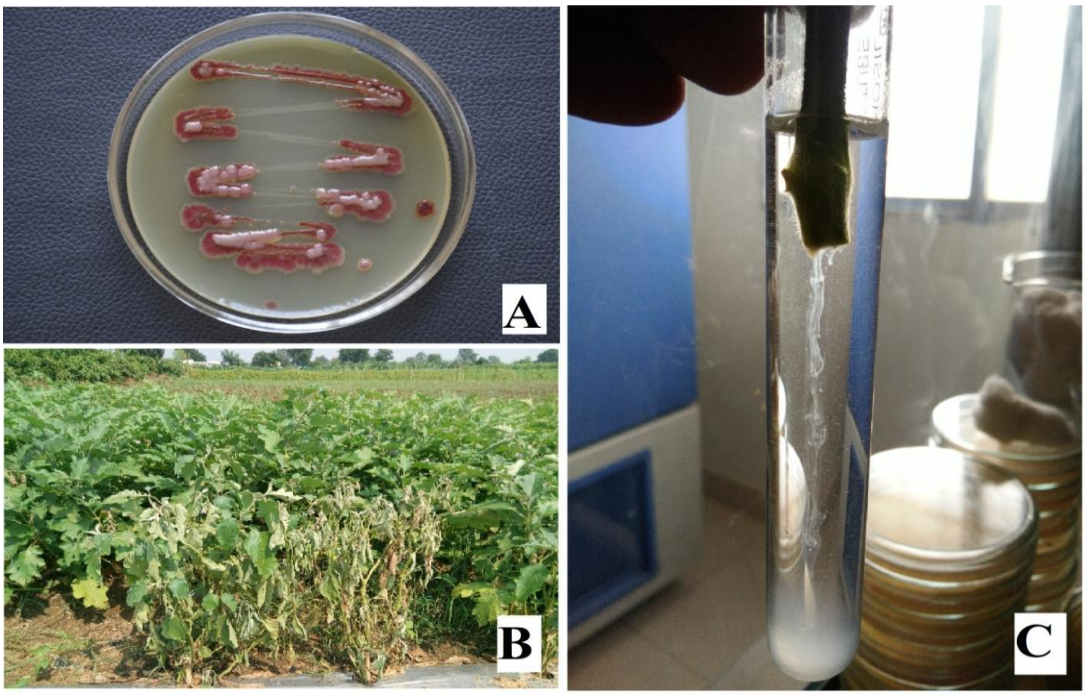
Table.2 Reaction of brinjal cultivars against bacterial wilt disease under artificially wilt sick soil condition

Var.no.	Variety	Marketed by	Year	Percent Disease incidences at days after transplanting					Variety Reaction
				15	30	45	60	75	
V_1	**VNR 60 (F1 Hybrid)**	VNR Seeds, Raipur, Chhattisgarh	2017	0 (0.0)	0 (0.0)	10 (18.44)	30 (33.21)	36 (36.87)	MR
			2018	4 (11.54)	8 (16.43)	12 (20.27)	16 (23.58)	18 (25.10)	R
			Mean	**2 (8.13)**	**4 (11.54)**	**11 (19.37)**	**23 (28.66)**	**27 (31.31)**	**MR**
V_2	**VNR 212 (F1 Hybrid)**	VNR Seeds, Raipur, Chhattisgarh	2017	4 (11.54)	18 (25.10)	24 (29.33)	36 (36.87)	48 (43.85)	MS
			2018	8 (16.43)	16 (23.58)	30 (33.21)	52 (46.15)	64 (53.13)	S
			Mean	**6 (14.18)**	**17 (24.35)**	**27 (31.31)**	**44 (41.55)**	**56 (48.45)**	**MS**
V_3	**Navina (F1 Hybrid)**	VNR Seeds, Raipur, Chhattisgarh	2017	4 (11.54)	12 (20.27)	18 (25.10)	36 (36.87)	48 (43.85)	MS
			2018	6 (14.18)	14 (21.97)	30 (33.21)	48 (43.85)	60 (50.77)	MS
			Mean	**5 (12.92)**	**13 (21.13)**	**24 (29.33)**	**42 (40.40)**	**54 (47.29)**	**MS**
V_4	**Utkal (F1 Hybrid)**	VNR Seeds, Raipur, Chhattisgarh	2017	2 (8.13)	6 (14.18)	12 (20.27)	30 (33.21)	38 (38.06)	MR
			2018	4 (11.54)	8 (16.43)	12 (20.27)	20 (26.56)	28 (31.95)	MR
			Mean	**3 (9.98)**	**7 (15.34)**	**12 (20.27)**	**25 (30.00)**	**33 (35.06)**	**MR**
V_5	**Mahy112 (F1 Hybrid)**	Mahyco, Dawalwadi, Maharastra	2017	6 (14.18)	6 (14.18)	30 (33.21)	32 (34.45)	56 (48.45)	MS
			2018	4 (11.54)	16 (23.58)	30 (33.21)	50 (45.00)	62 (51.94)	S
			Mean	**5 (12.92)**	**11 (19.37)**	**30 (33.21)**	**41 (39.82)**	**59 (50.18)**	**MS**
V_6	**Shakya (F1 Hybrid)**	Mahyco, Dawalwadi, Maharastra	2017	0 (0.0)	4 (11.54)	12 (20.27)	18 (25.10)	34 35.67	MR
			2018	2 (8.13)	6 (14.18)	12 (20.27)	18 (25.10)	26 (30.66)	MR
			Mean	**1 (5.74)**	**5 (12.92)**	**12 (20.27)**	**18 (25.10)**	**30 (33.21)**	**MR**
V_7	**Pusa Kranti**	Pearl Seeds, New Delhi	2017	0 (0.0)	0 (0.0)	12 (20.27)	24 (29.33)	36 (36.87)	MR
			2018	2 (8.13)	6 (14.18)	10 (18.44)	14 (21.97)	20 (26.56)	R
			Mean	**1 (5.74)**	**3 (9.98)**	**11 (19.37)**	**19 (25.85)**	**28 (31.95)**	**MR**
V_8	**Green Round**	Pearl Seeds, New Delhi	2017	4 (11.54)	8 (16.43)	16 (23.58)	24 (29.33)	38 (36.87)	MR
			2018	4 (11.54)	16 (23.58)	22 (27.97)	32 (34.45)	40 (39.23)	MR

			Mean	**4 (11.54)**	**12 (20.27)**	**19 (25.84)**	**28 (31.95)**	**39 (38.65)**	**MR**
V_9	**Hara Gol Improved**	Chandrika Seeds, Khalilabad, Uttar Pradesh	2017	0 (0.0)	8 (16.43)	12 (20.27)	18 (25.10)	18 (25.10)	R
			2018	0 (0.0)	4 (11.54)	10 (18.44)	16 (23.58)	18 (25.10)	R
			Mean	**0 (0.0)**	**6 (14.18)**	**11 (19.37)**	**17 (24.35)**	**18 (25.10)**	**R**
V_{10}	**Mukta Keshi**	Chandrika Seeds, Khalilabad, Uttar Pradesh	2017	4 (11.54)	4 (11.54)	12 (20.27)	18 (25.10)	22 27.97	MR
			2018	4 (11.54)	8 (16.43)	12 (20.27)	16 (23.58)	18 (25.10)	R
			Mean	**4 (11.54)**	**6 (14.18)**	**12 (20.27)**	**17 (24.35)**	**20 (26.56)**	**R**
V_{11}	**Super White Long**	Chandrika Seeds, Khalilabad, Uttar Pradesh	2017	2 (8.13)	4 (11.54)	10 (18.44)	18 (25.10)	26 (30.66)	R
			2018	6 (14.18)	12 (20.27)	18 (25.10)	24 (29.33)	34 (35.67)	MR
			Mean	**4 (11.54)**	**8 (16.43)**	**14 (21.97)**	**21 (27.28)**	**30 (33.21)**	**MR**
V_{12}	**White Gucchedar**	Chandrika Seeds, Khalilabad, Uttar Pradesh	2017	6 (14.18)	14 (21.97)	30 (33.21)	30 (33.21)	56 (48.45)	MS
			2018	6 (14.18)	12 (20.27)	18 (25.10)	28 (31.95)	38 (38.06)	MR
			Mean	**6 (14.18)**	**13 (21.13)**	**24 (29.33)**	**29 (32.58)**	**47 (43.28)**	**MS**
V_{13}	**Green Long**	Green India, Faizabad, Uttar Pradesh	2017	4 (11.54)	4 (11.54)	16 (23.58)	36 (36.87)	48 (43.85)	MS
			2018	6 (14.18)	12 (20.27)	20 (26.56)	26 (30.66)	36 (36.87)	MR
			Mean	**5 (12.92)**	**8 (16.43)**	**18 (25.10)**	**31 (33.83)**	**42 (40.40)**	**MS**
V_{14}	**Green Long**	Pahuja Seeds, Delhi	2017	2 (8.13)	2 (8.13)	10 (18.44)	26 (30.66)	26 (30.66)	MR
			2018	0 (0.0)	0 (0.0)	4 (11.54)	18 (25.10)	28 (31.95)	MR
			Mean	**1 (5.74)**	**1 (5.74)**	**7 (15.34)**	**22 (27.97)**	**27 (31.31)**	**MR**
V_{15}	**Pusa Purple Cluster**	VNR Seeds, Raipur, Chhattisgarh	2017	0 (0.0)	2 (8.13)	18 (25.10)	30 (33.21)	48 (43.85)	MS
			2018	0 (0.0)	4 (11.54)	10 (18.44)	16 (23.58)	20 (26.56)	R
			Mean	**0 (0.0)**	**3 (9.98)**	**14 (21.97)**	**23 (28.66)**	**34 (35.67)**	**MR**
V_{16}	**Grafted brinjal plant**		2017	0 (0.0)	10 (18.44)	24 (29.33)	24 (29.33)	36 (36.87)	MR
			2018	6 (14.18)	12 (20.27)	14 (21.97)	16 (23.58)	18 (25.10)	R
			Mean	**3 (9.98)**	**11 (19.37)**	**19 (25.84)**	**20 (26.56)**	**27 (31.31)**	**MR**

*Figures in parentheses are arcsin values at 0% (Source: Gomez A.A. and Gomez K.A., 2012)
*Resistant (R); Moderately resistant (MR); Moderately susceptible (MS); Susceptible (S)

Figure.1 *R. solnacearum* colonies on TZC agar medium (A); typical symptom of bacterial wilt on a brinjal plant (B); Bacterial oozing from a stem section of a brinjal plant infected with bacterial wilt (C)



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