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# Identification of Native Brinjal Germplasm Resistant to Bacterial Wilt in the Sundarban Region of West Bengal

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## ABSTRACT

Brinjal (*Solanum melongena* L., Solanaceae) is a popular vegetable crop farmed as a cash crop all over the world. The crop is infected with a dreadful disease called bacterial wilt caused by *Ralstonia solanacearum* (Smith) Yabuuchi *et al.* which results in significant crop loss. Due to its soil-borne and systemic nature, the disease management is extremely complex. Host resistance plays a vital role in the integrated disease management without hampering the ecological equilibrium. Field screeningtrials of native brinjal germplasm in Sundarban region of West Bengalwere conductedin a naturally selected sick plot at Nimpith, South 24 Parganas during 2011 to 2013 to find out resistance sources against bacterial wilt disease. Among the eight germplasm tested Baruipur Local, Bhangar and Lurki (Canning) were being promising entries against bacterial wilt of brinjal having excellent botanical characters with high yielding potentiality. These resources can be utilized by the breeder in disease resistance breeding program in future.

**Keywords** Bacterial wilt, Brinjal, Native germplasm, *Ralstonia solanacearum*, Sundarbans.

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## INTRODUCTION

Brinjal (*Solanum melongena* L., Solanaceae) is grown almost in all states and union territories of India including the Sundarban region of West Bengal. Among the vegetable crops in West Bengal, brinjal ranked first in terms of area and production (Kumar *et al*. 2011). The area and production of brinjal in south 24 Parganas are 9.99 thousand ha and 179.50 thousand MT and in North 24 Parganas are 10.06 thousand ha and 201.30 thousand MT, respectively (Anonymous 2013, Indian Horticulture Database 2013). In West Bengal, brinjal is cultivated both as summer, winter and *kharif* vegetable as cash crop and maximum diversity of brinjal varieties in terms of both quality and quantity has been found in diverse agro-climatic zones of West Bengal. Eastern part of India particularly Gangetic region is the geographic origin and also a richest source of brinjal germplasm where a wide

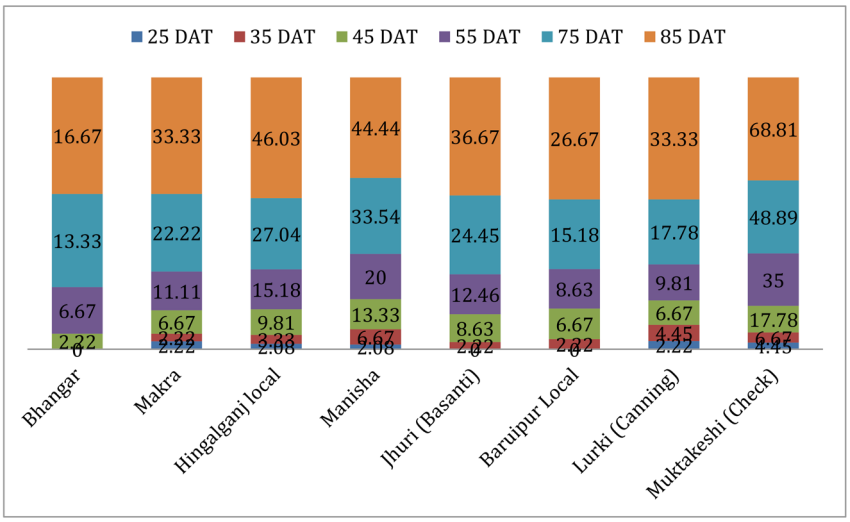


**Fig. 1.** Performance of native brinjal germplasm against bacterial wilt at different dates of transplanting (1st season).

genotypic variations with phenotypic characters are observed. Brinjal is attacked by a number of biotic and abiotic stresses. Bacterial wilt caused by *Ralstonia solanacearum* (Smith) Yabuuchi *et al*. is one of the main constraints for cultivation of solanaceous vegetables in West Bengal, which sometime causes cent percent crop loss (Khatua and Maity 1982, Mondal *et al*. 2011). Management of bacterial wilt is much difficult with conventional methods and fungicides (Hayward 1991) as the causal pathogen can survive easily in soil up to next cropping season (Chatterjee *et al*. 1999), infect a number of common wild plants

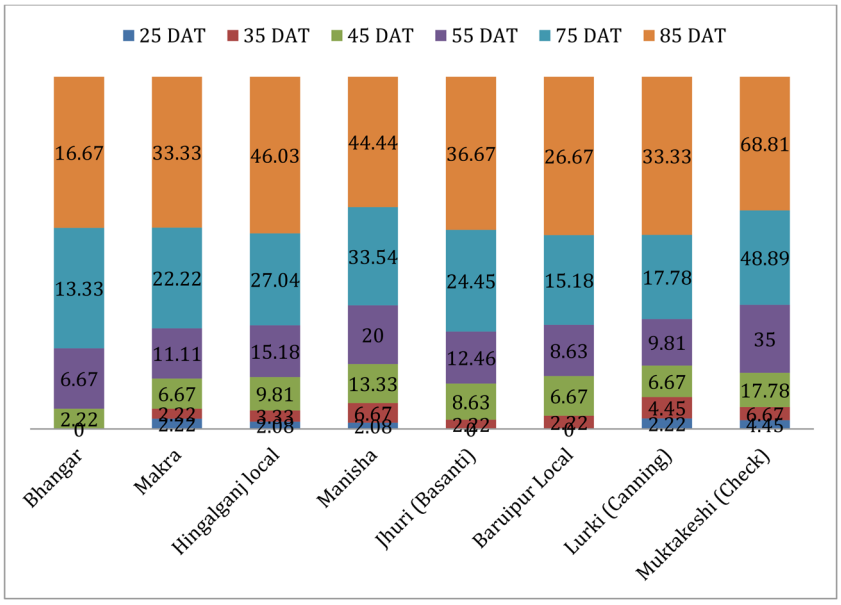


**Fig. 2.** Performance of native brinjal germplasm against bacterial wilt at different dates of transplanting (2nd season).

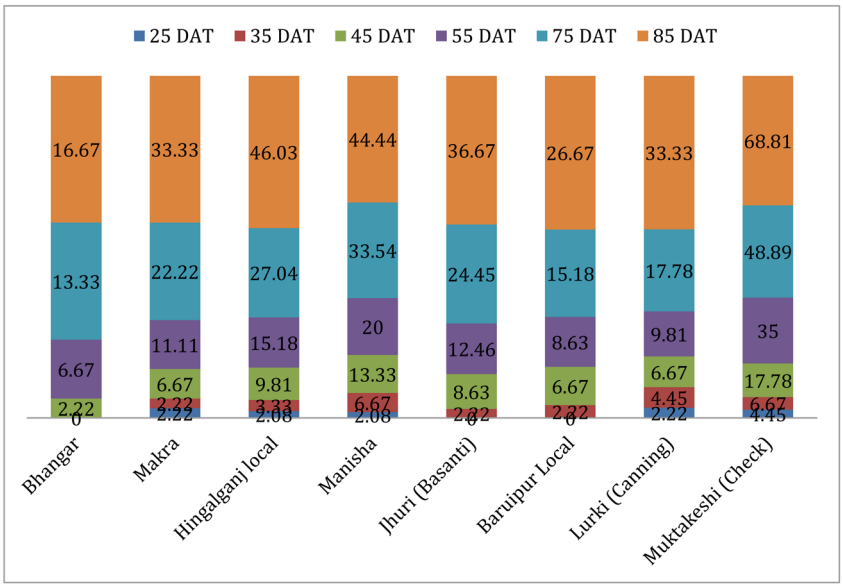


**Fig. 3.** Performance of native brinjal germplasm against bacterial wilt at different dates of transplanting (3rd season).

(Kelman 1953, Chatterjee 1996, Samaddar *et al.*1998, Mondal *et al*. 2014). Management of bacterial wilt will be more effective if resistant cultivars are used with other crop management practices such as crop rotation, soil amendments (Quezado-Soares *et al.* 1997, Chatterjee *et al*. 1999, Mondal *et al.* 2005) and irrigation (Quezado-Soares *et al*. 1997).This experiment was carried out to investigate resistant

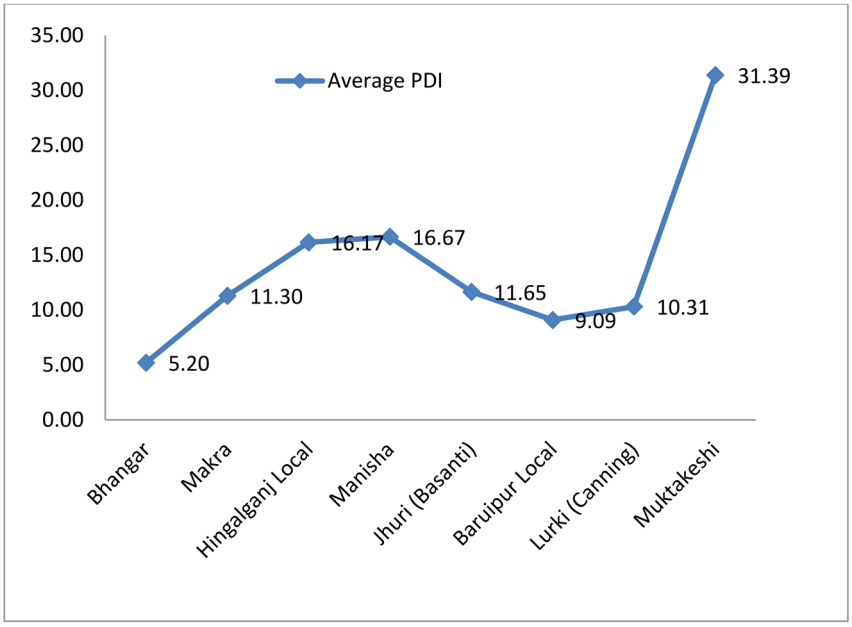


**Fig. 4.**Three years average disease reaction at 55 DAT.

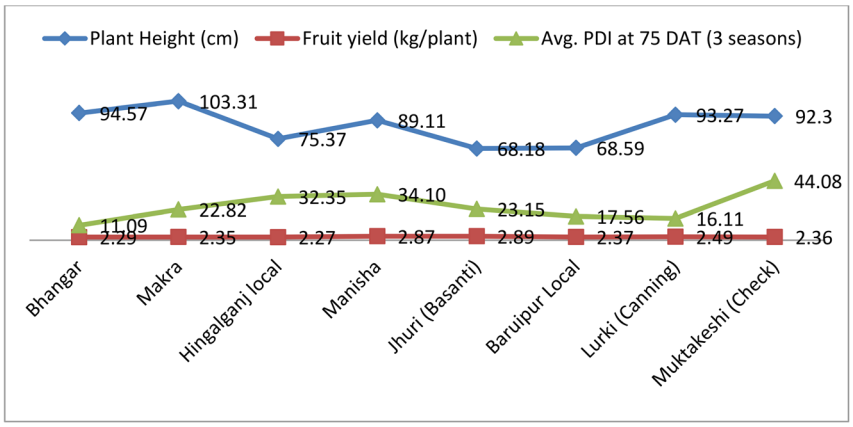


**Fig. 5.** Growth and yield parameters of native brinjal germplasm and their susceptibility to bacterial wilt.

sources of native brinjal germplasm against bacterial wilt in the Sundarban region of West Bengal in order to develop a disease management module.

## MATERIALS AND METHODS

Experiments were undertaken in a naturally selected sick plot at Nimpith, South 24 Parganas, to screen native brinjal germplasm against bacterial wilt. For the characterization of such germplasm, studies were carried out in a plot with no previous history of bacterial wilt. Eight native germplasm were grown in the same season of three consecutive years (transplanted on September 2011, September 2012 and September 2013) in RBD with three replicates. Fifty seedlings of twenty five days' old were transplanted in rows for each variety with spacing of 60 cm × 60 cm. For successful crop cultivation, the recommended crop husbandry was used.The data on onset of wilt disease in the experimental plot and subsequent rate

**Table 1**. Reaction of native brinjal germplasm against bacterial wilt (Sept, 2011). DAT = Days after transplanting, * Figures in parentheses indicate the corresponding angular transformed values.

| Entries | Percentage of wilted plant as on DAT | | | | | |
|---|---|---|---|---|---|---|
| | 25 DAT | 35 DAT | 45 DAT | 55 DAT | 75 DAT | 85 DAT |
| Bhangar | 0.00 | 0.00 | 2.08 | 4.17 | 10.42 | 14.58 |
| | (0.40) | (0.40) | (8.29) | (11.78) | (18.83) | (22.44) |
| Makra | 1.67 | 2.08 | 4.17 | 11.11 | 22.92 | 31.67 |
| | (7.42) | (8.29) | (11.78) | (19.47) | (28.60) | (34.24) |
| Hingalganj local | 2.08 | 4.17 | 12.50 | 16.67 | 36.67 | 48.89 |
| | (8.29) | (11.78) | (20.70) | (24.09) | (37.26) | (44.36) |
| Manisha | 1.67 | 4.17 | 11.11 | 16.67 | 35.42 | 44.45 |
| | (7.42) | (11.78) | (19.47) | (24.09) | (36.52) | (41.81) |
| Jhuri (Basanti) | 0.00 | 4.17 | 6.25 | 12.50 | 25.00 | 35.00 |
| | (0.40) | (11.78) | (14.47) | (20.70) | (30.00) | (36.27) |
| Baruipur local | 0.00 | 2.08 | 4.17 | 10.00 | 20.83 | 22.22 |
| | (0.40) | (8.29) | (11.78) | (18.43) | (27.15) | (28.12) |
| Lurki (Canning) | 0.00 | 2.08 | 4.17 | 10.00 | 15.00 | 20.83 |
| | (0.40) | (8.29) | (11.78) | (18.43) | (22.78) | (27.15) |
| Muktakeshi | 6.25 | 8.33 | 18.75 | 29.17 | 41.67 | 76.67 |
| (Check) | (14.47) | (16.77) | (25.65) | (32.68) | (40.20) | (61.11) |
| SEm (±) | 3.51 | 3.28 | 3.11 | 3.00 | 2.16 | 1.98 |
| CD (p=0.05) | 10.14 | 9.87 | 8.76 | 8.82 | 6.68 | 5.96 |

**Table 2.** Reaction of native brinjal germplasm against bacterial wilt (September 2012). DAT = Days after transplanting, * Figures in parentheses indicate the corresponding angular transformed values.

| Entries | Percentage of wilted plant as on DAT | | | | | |
|---|---|---|---|---|---|---|
| | 25 DAT | 35 DAT | 45 DAT | 55 DAT | 75 DAT | 85 DAT |
| Bhangar | 0.00 | 0.00 | 1.67 | 4.17 | 9.52 | 14.17 |
| | (0.40)* | (0.40) | (7.42) | (11.78) | (17.97) | (22.11) |
| Makra | 1.67 | 1.67 | 4.45 | 11.67 | 23.33 | 30.00 |
| | (7.42) | (7.42) | (12.17) | (19.97) | (28.88) | (33.21) |
| Hingalganj local | 1.67 | 2.08 | 11.67 | 16.67 | 33.33 | 41.11 |
| | (7.42) | (8.29) | (19.97) | (24.09) | (35.26) | (39.87) |
| Manisha | 1.67 | 3.33 | 8.33 | 13.33 | 33.33 | 39.58 |
| | (7.42) | (10.51) | (16.77) | (21.41) | (35.26) | (38.98) |
| Jhuri (Basanti) | 0.00 | 3.33 | 7.14 | 10.00 | 20.00 | 31.67 |
| | (0.40) | (10.51) | (15.49) | (18.43) | (26.56) | (34.24) |
| Baruipur local | 0.00 | 1.67 | 5.00 | 8.63 | 16.67 | 24.45 |
| | (0.40) | (7.42) | (12.92) | (17.08) | (24.04) | (29.63) |
| Lurki (Canning) | 1.67 | 3.33 | 4.45 | 11.11 | 15.55 | 22.22 |
| | (7.42) | (10.51) | (12.17) | (19.47) | (23.22) | (28.12) |
| Muktakeshi | 5.00 | 8.33 | 13.33 | 30.00 | 41.67 | 72.41 |
| (Check) | (12.92) | (16.77) | (21.41) | (33.21) | (40.20) | (58.31) |
| SEm (±) | 3.62 | 3.23 | 2.87 | 2.56 | 2.05 | 1.84 |
| CD (p=0.05) | 10.87 | 9.89 | 8.86 | 7.95 | 6.48 | 5.63 |

of wilting were recorded at 10 days interval.The qualitative and quantitative characters of these entries have been recorded as per the documented descriptor of NBPGR. Five plants per replication were selected randomly and tagged for recording different quantitative and qualitative characters.The recorded data was then subjected to statistical analysis after necessary transformation (Gomez and Gomez 1984).

**Table 3.** Reaction of native brinjal germplasm against bacterial wilt (September 2013). DAT = Days after transplanting, * Figures in parentheses indicate the corresponding angular transformed values.

| Entries | Percentage of wilted plant as on DAT | | | | | |
|---|---|---|---|---|---|---|
| | 25 DAT | 35 DAT | 45 DAT | 55 DAT | 75 DAT | 85 DAT |
| Bhangar | 0.00 | 0.00 | 2.22 | 6.67 | 13.33 | 16.67 |
| | (0.40)* | (0.40) | (8.56) | (14.96) | (21.41) | (24.09) |
| Makra | 2.22 | 2.22 | 6.67 | 11.11 | 22.22 | 33.33 |
| | (8.56) | (8.56) | (14.96) | (19.47) | (28.12) | (35.26) |
| Hingalganj local | 2.08 | 3.33 | 9.81 | 15.18 | 27.04 | 46.03 |
| | (8.29) | (10.51) | (18.25) | (22.93) | (31.33) | (42.72) |
| Manisha | 2.08 | 6.67 | 13.33 | 20.00 | 33.54 | 44.44 |
| | (8.29) | (14.96) | (21.41) | (26.56) | (35.38) | (41.80) |
| Jhuri (Basanti) | 0.00 | 2.22 | 8.63 | 12.46 | 24.45 | 36.67 |
| | (0.40) | (8.56) | (17.08) | (20.67) | (29.63) | (37.26) |
| Baruipur local | 0.00 | 2.22 | 6.67 | 8.63 | 15.18 | 26.67 |
| | (0.40) | (8.56) | (14.96) | (17.08) | (22.93) | (31.93) |
| Lurki (Canning) | 2.22 | 4.45 | 6.67 | 9.81 | 17.78 | 33.33 |
| | (8.56) | (12.17) | (14.96) | (18.25) | (24.93) | (35.26) |
| Muktakeshi | 4.45 | 6.67 | 17.78 | 35.00 | 48.89 | 68.81 |
| (Check) | (12.17) | (14.96) | (24.93) | (36.27) | (44.36) | (56.04) |
| SEm (±) | 3.66 | 3.30 | 2.76 | 2.40 | 2.28 | 1.98 |
| CD (p=0.05) | 10.70 | 9.64 | 8.22 | 7.20 | 6.64 | 5.85 |

**Table 4.** Morphological features of the native brinjal germplasm.

| Brinjal cultivar | Plant height (cm) | No. of branches | Fruit girth (cm) | Fruit length (cm) | Fruit yield (kg/ plant) | Flowering pattern | Flower color | Fruit shape | Fruit color |
|---|---|---|---|---|---|---|---|---|---|
| Bhangar | 94.57 | 3.42 | 8.33 | 10.46 | 2.29 | Solitary | Light Purple | Oblong | Whitish |
| Makra | 103.31 | 3.22 | 12.57 | 8.59 | 2.35 | Solitary | White | Round | Greenish with White spot |
| Hingalganj local | 75.37 | 2.75 | 7.30 | 15.49 | 2.27 | Solitary | Purple | Cylindrical | Purple |
| Manisha | 89.11 | 2.82 | 10.07 | 14.99 | 2.87 | Solitary | Purple | Oval | Purple |
| Jhuri (Basanti) | 68.18 | 2.75 | 3.71 | 10.35 | 2.89 | Solitary | Whitish | Long | Light Green |
| Baruipur local | 68.59 | 3.15 | 11.59 | 12.68 | 2.37 | Solitary | White | Oblong | Light Green |
| Lurki (Canning) | 93.27 | 3.75 | 5.29 | 10.58 | 2.49 | Cluster | White | Oblong | Greenish with White spot |
| Muktakeshi (Check) | 92.30 | 2.82 | 13.67 | 15.06 | 2.36 | Solitary | Purple | Oval | Deep Purple |
| SEm (±) | 4.61 | 0.34 | 0.52 | 0.64 | 0.13 | – | – | – | – |
| CD (p=0.05) | 13.72 | 0.98 | 1.51 | 1.96 | 0.40 | – | – | – | – |

## RESULTS AND DISCUSSION

### Screening of germplasm against bacterial wilt

Percent disease incidence (PDI) of some native brinjal germplasm against bacterial wilt was recorded in three different seasons and is shown in Figs. 1-5 and in Tables1-3. . It appears from the results of the experiment that out of eight varieties tested four viz. Bhangar, Jhuri (Basanti), Baruipur local and Lurki (Canning) did not show wilting up to 25 DAT in three seasons. These four varieties differ significantly from the check cultivar, Muktakeshi in respect to PDI.There were no significant differences among all of the cultivars studied up to 35 DAT in any of the seasons except Bhangar. The Bhangar cultivar did not show any signs of wilting until 35 DAT. Despite this, the genotypes Makra, Baruipur local and Lurki (Canning) were found to be more promising than other germplasm due to reduced disease infestation. There was no significant different among Muktakeshi, Manisha and Hingalganj local after 45 days. All other kinds were statistically similar, with Bhangar having the lowest disease incidence.Up to 55 DAT, Bhangar, Baruipur local and Lurki (Canning) were comparable and could be classified as part of the first group (1st group), which had a lower disease incidence (avg PDI range 5.20 -10.31%). Muktakeshi was found to be very similar to Manisha and was placed in the third category (3rd group), which has a high disease incidence (avg PDI range 16.67-31.39%). Rests were assigned to the second group (2nd group), which had a moderate disease incidence (avg PDI range 11.30-16.17) (Fig. 4).Similar trend was also recorded upto the final observation (Fig. 5). Bhangar and Baruipur local appeared statistically similar in 75 and 85 DAT. Makra, Jhuri (Basanti) and Baruipur local variants were found to be comparable. Manisha and Hingalganj local variants were statistically significant to local check Muktakeshi.Bhangar cultivar has the lowest PDI compared to other cultivars in all DATs during all seasons, followed by Lurki (Canning), Baruipur local, Makra and Jhuri (Basanti). The highest PDI was observedin Muktakeshi.

### Screening of germplasm for characterizing morphological feature

Table 4 summarizes the comparison of quantitative morphological parameters of native brinjal cultivars. Maximum height of plant was found in Makra, Bhangar, Lurki (Canning) and Muktakeshi (Fig. 5). Maximum number of branches were recorded in Lurki (Canning), Bhangar, Makra, Baruipur local, Manisha and Muktakeshi. Muktakeshi and Makra have the largest fruit girths. Fruits of the greatest length were found in Hingalganj local, Muktakeshi, and Manisha. The highest yields were recorded in the Jhuri (Basanti), Manisha, Lurki (Canning) and Baruipur local (Fig. 5). The cultivar, Bhangar was significantly different from all others as the cultivar showed least PDI and moderate yield. Higher yield and lower PDI

values were obtained from the cultivars, Baruipur local, Makra and Lukri (Canning). From, the above results, it can be concluded that if PDI is considered to be the most vital followed by yield, then Baruipur local and Bhangar are the best among the native cultivars followed by Lurki (Canning) and Makra.

According to Mondal *et al.* (2013), Midnapore local and Bhangar are resistant sources of native brinjal germplasm against bacterial wilt with excellent agronomic and yield contributing features. Bhangar and Baruipur local, on the other hand, were shown to be disease-tolerant having tremendous yield potentialities in this experiment.

## COCLUSION

Over dependence and indiscriminate use of agro-chemicals made our agriculture non-sustainable due to its luxuriant nature which is not fully effective and unsafe for ecosystem. While, host resistance plays an important role in the Appropriate Integrated Crop Management System (AICMS) that may possibly keep the environment safe. Baruipur local and Bhangar may be considered as tolerant lines and having good morphological characters as well as higher yield potentiality, which can be utilized by the breeder for further research. In the present investigation only eight familiar native brinjal cultivars are considered for comparison purpose. More number of brinjal cultivars may be collected and further investigation for obtaining a still better cultivar with more tolerance to bacterial wilt.

### REFERENCES


Anonymous (2013) Directorate of Horticulture, Govt of West Bengal.

Chatterjee S (1996) Epidemiology and management of bacterial wilt disease in West Bengal. PhD thesis.Submitted to Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, pp 133.

Chatterjee S, Mukherjee N, Khatua DC, Mondal RK (1999) Source and survival of Pseudomonas solanacearum infecting jute. In: Palil P, Pathak S, Sing DP (eds). Jute and allied: Fiber agriculture and processing CRIJAF, Barrackpore, India, pp 221-235.

Gomez AA, Gomez KA (1984) Statistical procedure for agricultural research. 2nd edn. John Willey and Sons, Inc New York.

Hayward AC (1991) Biology and epidemiology of bacterial wilt caused by *Pseudomonas solanacearum. Ann Rev Phytopathol* 29: 65-87.

Indian Horticulture Database (2013) Tiwari RK, Mistry NC, Singh B, Gandhi CP eds (2013) National Horticulture Board, Ministry of Agriculture, Govt. of India, pp 301. http://www.nhb.gov.in

Kelman A (1953) The bacterial wilt caused by *Pseudomonas solanacearum*. A Literature Review and Bibliography. Tech Bull of North Carolina Agricultural Experiment Station, pp 99:194.

Khatua DC, Maiti S (1982) Vegetable diseases in West Bengal and their control. In: Mukhopadhyay S (ed). Plant Protection in West Bengal, BCKV, pp 79-93.

Kumar B, Mistry NC, Singh B, Gandhi CP (2011) Indian Horticulture Database (2011). National Horticulture Board, Ministry of Agriculture, Government of India, 85, Institutional Area, Sector18, Gurgaon 122015, India, http://nhb.gov.in/area-pro/database-2011.pdf, pp 278.

Mondal B, Cattopadhyay SB, Bhattacharya I, Khatua DC (2005) Efficacy of different antibiotics and anti-bacterial compounds against bacterial wilt disease of tomato in West Bengal. *Environ Ecol* 23: 73-77.

Mondal B, Bhattacharya I, Khatua DC (2011) Crop and weed host of Ralstonia solanacearum in West Bengal. *J Crop Weed* 7 (2): 195-199.

Mondal B, Bhattacharya I, Khatua DC (2014) Incidence of bacterial wilt disease in West Bengal, India. *Acad J Agr Res* 2 (6): 139-146.

Mondal B, Bhattacharya I, Sarkar A, Khatua DC (2013) Evaluation of local brinjal (*Solanum melongena* L.) germplasm for bacterial wilt resistant. *Int J Agricult Stat Sc*i 9 (2): 709-716.

Quezado-Soares AM, Lopes CA, Ribeiro CSC (1997) Breeding for resistance to bacterial wilt of eggplant in Brazil. 2nd IBWS, June 22-27,1997, Gaudeloupe, French West Indies.

Samaddar KR, Chakraborty M, Kanjilal S (1998) Identification of the race of *Pseudomonas solanacearum* causing wilt of solanaceaus vegetables in West Bengal and its survival. *J Mycopathol Re*s 36 (2): 51-58.