

## Evaluation of tomato against bacterial wilt (*Ralstonia solanacearum*) in Jharkhand

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**ABSTRACT:** The experiment was conducted with eight tomato parental lines and 28 F<sub>1</sub> crosses developed at the station were tested in bacterial sick plot during 2000-01 to 2002-03. Finally five most promising parental lines and four F<sub>1</sub> crosses were tested during rainy monsoon during 2005-06 to evaluate the yield and resistance. The mean of four years (2000-01 to 2002-03 & 2005-06) data revealed that three parental lines viz; CHDT-4 (EC 339074 released as Swarna Lalima), CH-180 (BT-17) and CHDT-5 (EC-369060-A released as Swarna Naveen) and three F<sub>1</sub> crosses CHDT-4 x CHDT-1, CHDT-1 x CH-180 and CH-195 x CH-180 resulted resistant reaction to bacterial wilt sick plot. The maximum yield was harvested in parental line CHDT-4 (EC 339074) followed by CH-180 (BT-17). Among the F<sub>1</sub> crosses, the crosses, CHDT-4 x CHDT-1 (EC-339074 x EC-386021 recently released as Swarna Sampada), CHDT-1 x CH-180 (EC-386021 x BT-17) and CH-195 x CH-180 (Sonali x BT-17) showed resistant reaction. The F<sub>1</sub> cross viz; EC-339074 x EC-386021 (Swarna Sampada) was found superior than others with respect to resistant and yield in bacterial sick plot.

**Key words:** *Ralstonia solanacearum*, tomato, resistance, parental lines and F<sub>1</sub> crosses

Tomato (*Lycopersicon esculentum*) is one of the important vegetable crops, which suffers badly from bacterial wilt disease caused by *Ralstonia solanacearum* Yabuuchi. The disease is prevalent in temperate, tropical and sub-tropical regions of the world (Kelman, 1954). Besides infecting tomato, the pathogen has also been reported on various other solanaceous vegetables (Rao and Sohi, 1977; Sinha, 1979) in summer than rainy and winter seasons in India because the disease is favoured at high temperature (28-36°C) and high moisture (50-100%) water holding capacity. The disease assumes severe proportion and appears quite causing loss in yield from 10.80-92.62% (Ramkishun, 1987; Mishra *et al.*, 1995) in India. Elsewhere, the losses as to the tune of \$ 496000/ha during June-October has been reported from Taiwan (Hartman *et al.*, 1991) due to bacterial wilt.

In Jharkhand, bacterial wilt it is considered to be a most important limiting factor in successful cultivation of tomato during rainy and summer seasons when price advantage in the local and distant market. Deployment of resistance by breeding and growing resistant tomato is the only

useful method for the control of the disease. In this background evaluation of tomato germplasm was intensified at this station in 90's which further received support from NATP on 'Development of hybrids in vegetable crops' from 2000's. Present investigation reports findings of the trials on evaluation of high yielding bacterial wilt resistance.

### MATERIALS AND METHODS

Eight lines viz; CH-9-1 (EC-164336-A-1), CHDT-2 (EC-368860), CHDT-4 (EC-339074), CHDT-5 (EC-369060-A), CHDT-1 (EC-386021), CH-195 (Sonali), CH-180 (BT-17) and CH-193 (BT-18) of tomato and 28 F<sub>1</sub> half diallel crosses generated using them were transplanted in a *R. solanacearum* wilt sick plot in randomized block design with two replications during post-monsoon season of 2000-01. Selection of parental lines was done from the evaluation of large number of germplasm made during 90's. The sickness of soil was maintained by continuous growing of susceptible cultivars of tomato / brinjal, and the population of the pathogen ascertained periodically which was found to range from 3.8 x 10<sup>5</sup> to 7.8 x 10<sup>5</sup> cfu/g soil. Twenty-five days old

seedlings were transplanted at 50 x 50 cm spacing in 5 m rows. The susceptible check "Pusa Ruby" was transplanted on each side of the block of 10 test entries. The standard cultural practices were followed for growing tomato. The observations on survival of plants were recorded on every ten days. Bacterial ooze test was carried out on the wilted plants to confirm bacterial wilt. The plant survival at 90 days was used to grade plant based on their reaction against disease following scale of Valdez (1985). All eight parental lines and 13 promising crosses were again screened in above season during 2001-02 in sick plot. The plant survival at 90 days was used for disease reaction.

Finally, five promising parents viz; CHDT1, CHDT4, CHDT5 and CH-180 and CH-192 and four promising crosses viz; CHDT 4 x CHDT 1, CHDT 4 x CH 193, CHDT 1 x CH180 and CHDT 195 x CH 180 were screened during rainy season of 2000-01 to 2002-03 and they were again screened during 2005-06 in plot size 2.5x2.0 m<sup>2</sup> in sick plot. These elite lines were also screened in pot condition with artificial inoculation with *Ralstonia solanacearum* culture with OD=0.3 at 600 nm. The plant survival at 90 days was used for disease reaction (Valdez, 1985). The statistical analysis was done after transformed value of percentage plant survival (Snedecor and Cochran, 1967). Grading them in normal field soil also compared the yield of tomato for the parents and crosses under sick plot.

## RESULTS AND DISCUSSION

### Reaction of parental lines

It is evident from Table 1 that out of eight invariably lines tested in bacterial sick for 3 years, two lines viz CHDT-5 (EC-369060-A) and CH-180 (BT-17) remained resistant, and while line CH-193 (BT-18) invariably exhibited moderately resistant reaction. Line CH-195 (Sonali), CHDT-1 (EC-386021), CHDT-4 (EC-339074), was also promising and exhibited resistance in some years and moderately resistance in others, while line CH-193 (BT-18) invariably exhibited moderately resistance in all the three years.

The genotypes, Acc 99, Sweet 72, Acc 151 and Hy 54 (Tewari, 1986) and BWR -1 and BWR -5 (Bora *et al.* 1993 and Seshadri, 1998) were reported as resistance lines. However, the line

BWR-1 (Arka Abha) has been reported as moderately resistant line by Sharma and Kumar (1997), BT- 17) and BT- 18 (Utkal Gyatri) has been reported resistant lines from Bhubaneshwar (Mishra *et al.*, 1995), Sonali has been reported as resistant (Patil *et al.*, 1990). Several exotic collections have been reported as resistant lines viz., EC -179906, EC- 179908, EC -179909, EC- 191535 and EC-191538 were suitable for heterosis breeding and development of resistant open pollinated varieties through conventional breeding methods (Vidyasagar and Kumar, 1992). Sharma *et al.* (1999) reported that two exotic collections viz, EC-339074 and EC -369060-A were resistant to bacterial wilt from Ranchi. Thus based on four years (2000-06) mean data on plant survival the parental lines viz, CHDT-4 (EC-339074 recently the elite line was released as Swarna Lalima, Rai, *et al.* 2003), CHDT -5 (EC-369060-A recently the elite line was released as Swarna Naveen, Rai, *et al.* 2003) and CH -180 (BT-17) showed resistance reaction to bacterial wilt showing 82.2%, 86.7% and 86.7%, plant survival, respectively. The mean yields recorded in these lines were 268.25, 221.72 & 240.67q/ha, respectively in sick plot (Fig.-1).

### Reaction of F<sub>1</sub> half diallel crosses

A total of 28 F<sub>1</sub> crosses were tested during 2000-01 revealed that 14 crosses showed resistant reaction and 10 crosses showed moderately resistant reaction against bacterial wilt. Again the above resistant crosses were tested during 2001-02, only four crosses viz., CHDT-4 x CHDT-1, CHDT-4 x CH- 193, CHDT- 1 x CH-180 and CH-195 x CH-180 were found resistant. Further, all the four resistant crosses were tested during 2002-2003, only three crosses CHDT- 4 x CHDT-1, CHDT-1 x CH-180 and CH-195 x CH-180 were found resistant and CHDT-4 x CH-193 was moderately resistant to bacterial wilt.

All the test elite lines showed resistant to *Ralstonia solanacearum* against biovar III & V *in vitro*. Thus the mean of four years (2000-05) data (Table1) revealed that the crosses CHDT- 4 x CHDT- 1 (EC-339074 x EC - 386021), CHDT- 1 x CH -180 (EC -386021 X BT-17) and CHDT- 195 x CH- 180 (Sonali x BT-17) showed resistance reaction and their yield were 331.75, 304.95 & 264.62q/ha (Fig 1). Sathyanarayana and Anand (1992) reported that all the 30 F<sub>1</sub>'s tested were

**Table1.** Plant survival and yield of promising elite lines of tomato in different years

| Elite Lines          | Plant survival (%) |                 |                 |                 |                 | Yield (q/ha) |         |         |         |        |
|----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|--------------|---------|---------|---------|--------|
|                      | 2000-01            | 2001-02         | 2002-03         | 2005-06         | Mean            | 2000-01      | 2001-02 | 2002-03 | 2005-06 | Mean   |
| CHDT 4               | 65.0<br>(53.73)    | 85.0<br>(67.21) | 90.0<br>(71.57) | 88.7<br>(70.76) | 82.1<br>(65.81) | 186.6        | 234.0   | 293.2   | 359.2   | 268.25 |
|                      | MR                 | R               | R               | R               | R               |              |         |         |         |        |
| CHDT 5               | 95.0<br>(77.08)    | 85.0<br>(67.21) | 80.0<br>(63.43) | 86.6<br>(68.53) | 86.6<br>(69.28) | 191.0        | 204.0   | 270.2   | 221.72  | 221.73 |
|                      | R                  | R               | R               | R               | R               |              |         |         |         |        |
| CHDT 1               | 70.0<br>(56.79)    | 80.0<br>(63.43) | 36.7<br>(37.35) | 85.0<br>(67.35) | 67.9<br>(56.23) | 104.9        | 228.0   | 130.0   | 226.2   | 172.27 |
|                      | MR                 | R               | S               | R               | MR              |              |         |         |         |        |
| CH 180               | 95.0<br>(77.08)    | 80<br>(63.43)   | 83.3<br>(63.43) | 88.7<br>(70.76) | 86.7<br>(69.28) | 218.4        | 198.3   | 188.0   | 358.0   | 240.67 |
|                      | R                  | R               | R               | R               | R               |              |         |         |         |        |
| CH 193               | 70.0<br>(56.79)    | 65.0<br>(53.73) | 60.0<br>(50.77) | 70.0<br>(57.55) | 66.2<br>(54.71) | 252.0        | 182.5   | 152.0   | 335.6   | 230.52 |
|                      | MR                 | MR              | MR              | MR              | MR              |              |         |         |         |        |
| CHDT 4 x<br>CHDT 1   | 95.0<br>(77.08)    | 80.0<br>(63.43) | 93.3<br>(75.0)  | 90.0<br>(72.79) | 89.5<br>(71.95) | 229.0        | 253.6   | 383.1   | 461.3   | 331.75 |
|                      | R                  | R               | R               | R               | R               |              |         |         |         |        |
| CHDT 4 x<br>CH 193   | 80.0<br>(63.43)    | 63.3<br>(52.71) | 74.4<br>(59.6)  | 91.2<br>(74.63) | 77.2<br>(62.59) | 257.5        | 280.5   | 188.0   | 400.3   | 281.57 |
|                      | R                  | MR              | MR              | R               | MR              |              |         |         |         |        |
| CHDT 1 x<br>CH180    | 90.0<br>(71.57)    | 80.0<br>(63.43) | 83.3<br>(65.88) | 95.0<br>(77.08) | 87.0<br>(69.49) | 228.5        | 320.3   | 287.0   | 384.0   | 304.95 |
|                      | R                  | R               | R               | R               | R               |              |         |         |         |        |
| CHDT 195 x<br>CH 180 | 80.0<br>(63.43)    | 80.0<br>(63.43) | 90.0<br>(71.57) | 83.3<br>(71.57) | 83.3<br>(66.07) | 270.0        | 247.9   | 276.0   | 264.6   | 264.62 |
|                      | R                  | R               | R               | R               | R               |              |         |         |         |        |
| Pusa Ruby            | 30.0<br>(33.21)    | 25.0<br>(30.0)  | 26.7<br>(31.11) | 10.0<br>(17.85) | 22.9<br>(28.04) | 76.3         | 60.4    | 39.0    | 32.9    | 52.15  |
|                      | S                  | S               | S               | S               | S               |              |         |         |         |        |
| CD (P=0.05)          | (21.1)             | (11.8)          | (7.4)           | (9.96)          | (10.46)         | 86.6         | 56.9    | 46.9    | 75.51   | 79.71  |

Figures in parenthesis are angular transformed value of % plant survival

R (Resistant) = 80-100% Plant survival, MR (Moderately Resistant) = 60-79% Plant survival,

MS (Moderately Susceptible) = 30-59% Plant survival, S (Susceptible) = 0-29% Plant survival

highly resistant to bacterial wilt with 93 to 100 per cent survival. The mean yield of resistant crosses CHDT-4 x CHDT-1, CHDT-1 x CH-180 and CH-195 x CH-180 were 28 8.6 q/ha, 278.6 q/ha and 264.6 q/ha than control (Pusa Ruby, 52.15q/ha) in bacterial sick plot.

Thus the best parents were CHDT- 4 (EC-339074) and CH- 180 (BT-17) which showed

maximum yield and resistant to bacterial wilt. Whereas the best cross was CHDT -4 x CHDT- 1 (EC-339074 x EC- 386021) which was released in the name of "Swarna Sampada" from the Institute for Jharkhand state, which yielded maximum and resistance to bacterial wilt and yield, was six times more than susceptible check Pusa Ruby (52.15 q/ha) in sick soil.

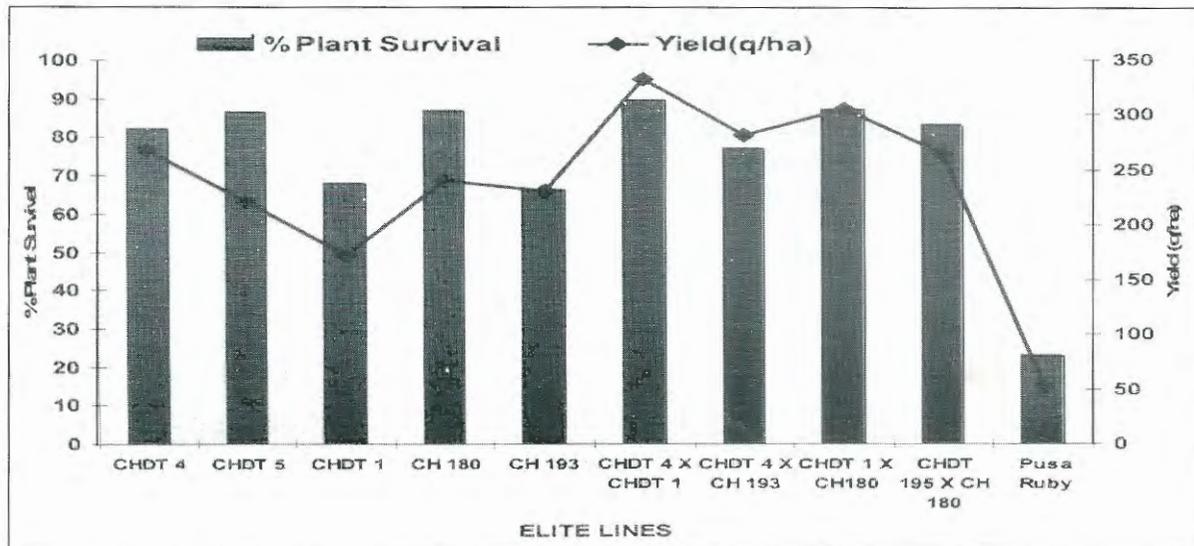


Fig. 1. Mean plant survival and yield of tomato elite lines in bacterial wilt sick plot (2000-01 to 2005-06)

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