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Evaluation of Cotton Genotypes against Root Rot and Bacterial Blight

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Abstract : Studies were carried out to identify the sources of resistance to root rot and bacterial blight of cotton diseases, which pose a major threat to cotton production in Tamil Nadu. Screening was done at Cotton Research Station, Srivilliputtur. Fifty two advance lines/commercial varieties were screened against bacterial blight and root rot diseases during 2022-2023 and 2023-2024 under field condition. The cotton cultures namely TCH 1999, TSH 419, TCH 1941, TVH 007,TKH 0762,TSH 423, TSH 492, TSH 529, TSH 541,TSH 544, TSH 490, TSH 589, TSH 590,TSH 591,TSH 597,TSH 600,TSH 601, TSH 406, TSH 489, TSH 486, TCH 2001, KC3, BGDS1063, TCH 1966,TVH 1901,TVH 1907,CO 15, TSH 387,TSH 383,and TSH 357 were found to be moderately resistant to bacterial blight disease. A total of 10 lines/varieties showed moderately susceptible response while 11 were susceptible to bacterial blight. With regard to root rot, the entries viz., TSH 419, TSH 528, TSH 529, TSH 579, TSH 589 and TSH590 were found to be moderately resistant to root rot disease. A total of 13 cultures /varieties showed moderately susceptible response while 33 were susceptible to root rot under the same set of environmental and soil conditions None of the commercial varieties/lines were found resistant to these diseases which indicates scarcity of durable resistance to these diseases in the cotton germplasm evaluated.

Key words: Bacterial blight, cotton, germplasm, moderately resistant, root rot, screening, susceptible.

Cotton is an important cash crop occupying nearly 33 million hectares in 77 countries as a major source of natural fibre worldwide (Singh and Rathore 2020). India is the second largest producer of cotton after China, but contributes only 18 per cent of total world cotton production against 23 per cent of world cotton area. Cotton crop is continuously exposed to biotic stress and considered as a major biological challenge to exploit cotton productivity.

Cotton crop is affected by more than sixty diseases, including root rot, wilt, boll rot, leaf spot complex, grey mildew, bacterial blight and leaf curl (Chohan *et al.*, 2020). Bacterial blight incited by *Xanthomonas citri* pv. *malvacearum* is a major disease prevailing in entire cotton growing regions of India. The disease was first reported in United states during 1891 and at present it is a wide spread devastating disease across the world. (Kemerait *et al.*, 2017). Depending on the cultivars and crop age, the yield loss due to bacterial blight ranges from 1 to 27 per cent (Mishra and Ashok, 2001).

Root rot caused by *Macrophomina phaseolina* is one of the limiting factors for cotton production. This pathogen is a polyphagous, notorious, soil borne destructive plant pathogen with a wide host range and is responsible for causing pre and post emergence seedling mortality, rotting of seedling and mature plants. If the affected plants are pulled out and examined, the entire root system may be found rotten. Minute fungal sclerotia appear as minute black dots on the surface of woody tissues and the root bark. (Kumar *et al.*, 2022). The incidence of root rot disease in individual fields ranged from 0 to69 per cent in different parts of the country (Mongo and Raj,1996)

MATERIALS AND METHODS

Disease screening was carried out during 2022-2023 and 2023-2024 under field condition at Cotton Research Station, Srivilliputtur by sowing advanced lines of cotton. The seeds of these lines were neither treated with fungicides

nor given acid delinting to increase the chances of initiation of diseases. Each line was sown in two rows of six meters length with a spacing of 75x30 cm. Highly susceptible variety (SVPR 2) was used as spreader which was sown around the field and one row of this variety after every two entries. The trial was laid out in RBD with two replications. All agronomic practices were followed to keep the crop in good condition. No pesticides were sprayed to develop maximum disease pressure. For recording disease intensity, standard disease scale was adopted.

Disease severity/PDI was assessed with 0-4 scale/grade as per the standard evaluation system followed in All India Co-ordinated Research Project in Cotton. Bacterial blight was expressed in Per cent Disease Index. Disease observations were made from 10 tagged plants at random from each entry during crop seasons. Three leaves at bottom, four leaves in the middle and three at the top of each plant. Thus, total ten leaves were collected from a tagged plant. Disease scored at peak intensity was observed by using disease grades. Depending on the scores collected, PDI was calculated by using the formula by Wheeler (1969) as given below.

$$PDI = \frac{\text{Sum of all numerical rating}}{\text{Total number of leaves observed}} \times \frac{100}{\text{Maximun grade}}$$

Root rot was expressed in percentage. Each month, healthy plants and disease infected/dead plants were observed and the per cent disease incidence was calculated as per the following formula.

$$PDI = \frac{\text{Total number of plants}}{\text{Number of diseased plants}} \times 100$$

RESULTS AND DISCUSSION

Screening of cotton varieties/genotypes against bacterial blight and root rot would be a great help for breeding programmes to identify disease resistant sources. Since the pathogens are disseminated through seed, soil and air, disease spreads very fast.

Field based assessment of resistance in promising genotypes of cotton against bacterial blight and root rot of cotton was done at Cotton Research Station, Srivilliputtur during 2022-2023 and 2023-2024. Field evaluation is an useful and convenient method for identifying cotton genotypes with natural resistance against diseases.

Evaluation of bacterial leaf blight disease

Water soaked lesions appeared on the lower surface of leaves which turned in to necrotic angular spots later on. Screening of 52 cotton advance lines/commercial varieties against bacterial leaf blight disease revealed that the cotton cultures *viz.*, TCH 1999, TSH 419, TCH 1941, TVH 007, TKH 0762, TSH 423, TSH 492, TSH 529, TSH 541, TSH 544, TSH 490, TSH 589, TSH 590, TSH 591, TSH 597, TSH 600, TSH 601, TSH 406, TSH 489, TSH 486, TCH 2001, KC3, BGDS1063, TCH 1966, TVH 1901, TVH 1907, CO 15, TSH 387, TSH 383, and TSH 357 were found to be moderately resistant to bacterial blight disease with PDI ranging from 11-20. A total of 11 lines/varieties showed moderately susceptible response while 11 were susceptible to bacterial blight under the same set of environmental and soil conditions. (Table 1). Chopra *et al.* (1983) and Singh *et al.* (1987) reported immune reaction of some genotypes of *Gossypium arboreum* and resistant response of upland *Gossypium hirsutum*. Diverse virulences of bacterial blight pathogen have been reported from different parts of the world (Brinkerhoff, 1963; Nayudu, 1964; Brinkerhoff and Hunter, 1965; Verma and Singh, 1975; Randhawa and Singh, 1980). The pathogen is both externally as well as internally seed borne (Verma and Singh, 1974). Screening of cotton germplasm against bacterial blight has been reported by several research workers (Chauhan *et*

Table 1. Screening of cotton entries against diseases under field condition

S. No.	Entry	Root rot (%)	Reaction	BLB (PDI)	Reaction	S. No.	Entry	Root rot (%)	Reaction	BLB (PDI)	Reaction
1.	TCH 1999	33.33	S	8.13	MR	27.	TSH 591	20.0	MS	9.38	MR
2.	TSH 406	25.0	MS	17.5	MS	28.	TSH 597	31.66	S	8.13	MR
3.	TSH 419	8.33	MR	7.5	MR	29.	TSH 600	24.0	MS	8.75	MR
4.	TCH1941	38.23	S	6.25	MR	30.	TSH 601	24.08	MS	8.13	MR
5.	TVH 007	33.33	S	6.25	MR	31.	TSH 406	20.83	MS	8.75	MR
6.	TKH 0762	35.0	S	9.4	MR	32.	TSH 489	22.0	MS	7.5	MR
7.	CO 14	32.0	S	21.25	S	33.	TCH 2003	64.28	S	12.50	MS
8.	RCH 659	66.66	S	19.38	MS	34.	TSH 486	25.00	S	9.38	MR
9.	MCU 5	18.0	MS	15.63	MS	35.	TSH 498	36.36	S	22.50	S
10.	TSH 423	19.35	MS	6.25	MR	36.	TCH 2001	36.84	S	9.38	MR
11.	TSH 492	33.93	S	7.50	MR	37.	SVPR 6	46.88	S	15.0	MS
12.	TSH 528	10.94	MR	22.25	S	38.	KC 3	50.00	S	8.75	MR
13.	TSH 529	14.29	MR	6.25	MR	39.	BGDS 1063	45.83	S	9.38	MR
14.	TSH 541	35.19	S	9.38	MR	40.	TCH 1966	30.00	S	8.13	MR
15.	TSH 542	36.20	S	18.75	MS	41.	TVH 1901	53.57	S	9.38	MR
16.	TSH 543	38.46	S	18.75	MS	42.	TVH 2010	32.14	S	16.88	MS
17.	TSH 544	47.5	S	7.50	MR	43.	TVH 1907	30.00	S	9.38	MR
18.	TSH 490	27.59	S	8.63	MR	44.	CO 17	60.71	MS	25.0	S
19.	TSH 579	12.06	MR	20.0	MS	45.	CO 15	28.57	S	7.50	MR
20.	TSH 582	19.64	MS	16.25	MS	46.	Suraj	22.22	S	26.25	S
21.	TSH 584	22.41	MS	22.25	S	47.	TSH 387	38.88	S	8.75	MR
22.	TSH 586	33.33	S	23.25	S	48.	TSH 383	35.66	S	9.38	MR
23.	TSH 587	19.64	MS	21.25	S	49.	TSH 429	39.38	S	22.50	S
24.	TSH 588	24.13	MS	21.25	S	50.	TSH 478	50.00	S	25.00	S
25.	TSH 589	12.32	MR	6.88	MR	51.	TSH 357	50.00	S	8.75	MR
26.	TSH 590	6.25	MR	8.13	MR	52.	TSH 488	27.5	S	12.75	MS
						53.	SVPR 2	60.71	S	32.50	S

al., 1986; Dizon and Reyes, 1987, Bhaskar, 2023).

Evaluation of root rot disease

Root rot causes stunting, yellowing and wilting of plants even when the moisture is adequate. Roots are brown to black and soft or mushy. The outer portion of the root can be easily pulled away from the core which leaves a fine hair like thread.

Screening of 52 cotton germplasms against root rot disease revealed that the entries *viz.*, TSH 419, TSH 528, TSH 529, TSH 579, TSH 589 and TSH590 were found to be moderately resistant to root rot disease. A total of 13 cultures /varieties showed moderately susceptible response while 33 were susceptible to root rot under the same set of environmental and soil conditions (Table 1).

Management of the diseases through host plant resistance is the best practice in developing IDM strategy. These studies will help the breeders to incorporate moderately resistant advanced lines in their breeding programme to develop high yielding varieties with tolerance to bacterial blight and root rot. It will also help the research workers and farmers to apply integrated pest management strategies on moderately resistant varieties thus exploiting their genetic potential to get high yield by following recommended agronomic practices.

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