Original Research Article

Evaluation of Genotypes against Bacterial blight and Tobacco streak virus diseases in Cotton

ABSTRACT:

Cotton screening was conducted at the Regional Agricultural Research Station (RARS) in Warangal, Telangana, India. The experimental material consisted of 52 cotton germplasms and 13Bt cotton hybrids with a check were tested against bacterial blight and tobacco streak virus diseases during*Kharif*-2016 at RARS,Warangal. Out of 52 cotton germplasms**,**17 entries viz.,HYPS-152,H-1250,RAH-4,KH-2244N,LH-900,SA-434,RAH-12,JK-354,GBHU-164,NA-340,BS-37,TCH-724,ICMF-23,ICMF-20,SA-1004,ARB-89001 and BB-2 were found resistant to bacterial blight disease and eighteen entries namely.,SA-53-1,RHH-101,KH-2244N,KH-134,TCH-1649,NH-557,IH-08,PH-1008,TCH-724,JK-205,MRK-38,LH-2170,AKH-2822,ARB-8901,G-COT-10,JK-2764,CCH1071and CCH-11germplasms were noticed tobacco streak virus disease rating scale 0 (Immune).Out of 13 Bt cotton hybrids , two entries viz.,Balhwan and Raja were moderately resistant to bacterial blight disease and eleven entries namely viz., Bhakti, Raja, Balhwan, Akka,First class,RCH-812,Ankur-3224,ACH-199,RCH-836,RCH-812 and ATM entries were showed disease rating scale 1(resistant) to tobacco streak virus disease.

Keywords: Germplasms,Cotton,Resistantsources,Screening,Bacterial blightandTobacco streak virus diseases**.**

INTRODUCTION

Cotton crop is affected by bacterial, fungal and viral diseases.In India, foliar diseases are estimated to cause yield loss up to 20 to 30 per cent (Mayee and Mukewar, 2007). Among bacterial diseases,bacterial blight of cotton caused by *Xanthomonas axonopodis pv malvacearum* (Smith) is an important disease in Andhra Pradesh causing economic losses to the tune of 22.0 to 36.3 per cent (Bhattiprolu 2013,2018). Environmental conditions influence the pests and disease incidence in cotton (Kumar et al 2018).Tobacco streak virus is the type member in of ILAR (Isometric labile Ringspot) virus of family Bromoviridae which causes severe yield losses in cotton , vegetables, oilseeds and pulses(Kannan R.2023). The symptoms of the disease appear as necrosis of leaf lamina resulting in twisting of the leaf. The necrosis extends through to the petiole and stem and finally terminate at tip of the shoot of the plant. The plants fail to produce flowers if infected early and finally die. The disease was found to infect the crop at all stages starting from seedling to maturity.

Hence, it is imperative to identify resistant genotypes so as to utilize them in breeding programs to evolve resistant hybrids. Resistant cultivars are compatible with all other tactics, contribute stability and offer advantages to an integrated disease management system.

Identification of sources of resistance facilitates to development of resistant genotypes/hybrids, which in turn will be useful to the farming community in reducing the disease damage and fungicide consumption.

MATERIAL AND METHODS

Screening of the genotypes against the bacterial blight and tobacco streak virus diseases :

52 cotton germplasms were screened with LRA 5166 check and 13 Bt cotton hybrids were screened against to bacterial blight and tobacco streak virus diseases in under field conditions. To identify the source of resistance in cotton at RARS, Warangal during *Kharif* 2016.Each genotype was planted in two rows of 10 meter length with row spacing of 90 cm and the distance between plants is 60cm. The experiment was in RBD with two replications. Susceptible checks, LRA 5166 and RCH-929were included after every 5 test rows for comparison in non Bt germplasms and Bt cotton respectively.

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-ordinate Research Project on Cotton. It was expressed in Per cent Disease

Index (PDI). Disease score was recorded on ten randomly selected plants in each entry on 0-4 scale (Sheo Raj, 1988).

Data collected :

Disease observations were noted from 10 tagged plants at random from each entry. Three leaves at bottom, four in the middle and three at the top of each plant thus total 10 leaves were collected from tagged plant.Disease scored at peak intensity was observed by using disease grades. Depending on the scores collected, Per cent disease intensity (PDI) was calculated by using the formula by Wheeler (1969).

$$PDI = \frac{\text{[Sum of all the numerical ratings]}}{\text{[Total number of leaves scored x Maximum disease grade]}} \times 100$$

In case of Tobacco Streak Virus (TSV) per cent disease incidence was recorded as follows

$$\text{Percent disease incidence} = \frac{\text{[Number of infected plants]}}{\text{[Total number of plants]}} \times 100$$

List 1 :Scale adopted for cotton bacterial blight disease and tobacco streak virus disease

Scale	Grade	% leaf area infected bacterial blight disease	% disease incidence of tobacco streak virus disease
0	Immune	Completely free from disease	Completely free from disease
1	Resistant	Spots few scattered upto 5%	upper leaves showing chlorosis or necrosis from 0.1 to 5.0 %
2	Moderately resistant	Leaf area covered from 6 to 10%	Moderate square drying and few branches affected from 5.1 to 10.0 %
3	Moderately Susceptible	Leaf area covered from 11 to 20%	Severe drying of squares and more branches affected from 10.1 to 20.0 %
4	Susceptible	Leaf area covered >20%	Severe stunting inclusive of above symptoms > 20.0 %

RESULTS and DISCUSSION

Evaluation of bacterial blight disease:

On Screening of 52 Cotton germplasms against bacterial blight disease revealed that the 17 entries viz.,HYPS-152,H-1250,RAH-4,KH-2244N,LH-900,SA-434,RAH-12,JK-354,GBHU-164,NA-340,BS-37,TCH-724,ICMF-23,ICMF-20,SA-1004,ARB-89001 and BB-2 were resistant to bacterial blight disease (Table 1a).

On Screening of 13 Bt cotton hybrids against bacterial blight disease, two entries Balhwan and Rajawere found moderately resistant to bacterial blight disease(Table 2a).

Hosagoudar et al (2008) reported that on screening of eighty six non-Bt and nine Bt cotton hybrids against bacterial blight disease,twenty seven varieties were immune to bacterial blight disease .

Gurava Reddy et al (2015), out of 50 Bt cotton hybrids,Pratheek BG-II and Bigboss BG-I were found resistant to bacterial blight disease.

Thirty one entries with a check (LRA 5166) were screened. Out of them, nine entries were found immune to bacterial blight disease in cotton (Patel et al.,2016).

On screening 221 cultivated genotypes for resistance against bacterial leaf blight disease, 80 genotypes showed immune reaction, 69 genotypes were resistant and 13 genotypes were moderately resistant to bacterial blight disease (Patole et al .,2016).

Prashant et al 2017 evaluated thirty nine entries including the check . Out of these entries, twenty five entries were observed disease free , six entries were found resistant and balance six entries were moderately resistant to bacterial blight disease.

According to Bhattiprolu et al., 2017, Ninety two Bt and five Non Bt cotton hybrids were evaluated. Four Bt entries were found to moderately susceptible reaction to bacterial blight disease.
Patel et al reported (2019) that 7 cotton genotypes were observed as disease free and GBav-123 was resistant against bacterial blight disease.
Among 62 advance lines/commercial varieties, eight entries were found immune to bacterial blight disease and four entries were moderately resistant to bacterial blight disease (Abdul Rashid et al., 2020).
According to Medrano et al., 2021, seven commercial cotton varieties were evaluated; Resistant variety NG 5711 and partially resistant variety DP 1948 had significantly less than 5% disease incidence and severity.Susceptible varieties NG 3406 and DP 1725 had 50%-60% greater disease incidence and 20%-30% greater disease severity compared to the resistant variety to bacterial blight disease.
335 U.S. Upland cotton accessions were evaluated for bacterial blight disease resistance to race 18 using artificial inoculations by scratching cotyledons on an individual plant basis in a greenhouse. The analysis of variance detected significant genotypic variation in disease incidence and 50 accessions were resistant including 38 lines with no symptoms on either cotyledons or true leaves (H Elassbli et al., 2021).,
Sowmiya et al., 2022 reported that the mean district incidence of the bacterial blight during the winter and the summer seasons of 2021 and 2022 ranged from 3.5 to 16.0 PDI and 2.6 to 13.8 PDI respectively in Tamil Nadu State.

54 cotton germplasms/hybrids/varieties with a check were screened against to bacterial blight disease. Out of them,thirteen entries viz., H-1492, Kharif DS-28 Deltapine-66, CCH-3114, CPD-731, ARB-8815, Hartsvilly, ADB-39, CPT-571, CPD-7575, CPD-812, TCH-1716 and NDLH-1967 were resistant to bacterial blight disease (Vijaya Bhaskar,2023).

Evaluation of tobacco streak virus disease:

On Screening of 52 Cotton germplasms against tobacco streak virus disease, eighteen entries namely SA-53-1,RHH-101,KH-2244N,KH-134,TCH-1649,NH-557,IH-08,PH-1008,TCH-724,JK-205,MRK-38,LH-2170,AKH-2822,ARB-8901,G-COT-10,JK-2764,CCH1071 and CCH-11 germplasms were immune , 26 germplasms were resistant(Scale1) and 6 germplasms were moderately resistant(Scale2) to tobacco streak virus disease(Table 1b).
On screening of 13Bt cotton hybrids against tobacco streak virus disease,11 entries viz.,Bhakti,Raja,Balhwan,Akka,Firstclass,RCH-812,Ankur-3224,ACH-199,RCH-836,RCH-812 and ATM entries showed disease rating scale 1(resistant) to tobacco streak virus disease (Table 2b).
Among evaluated fifty Bt cotton hybrids, three hybrids were immune and twenty two entries were resistant to tobacco streak virus disease (Guravareddy et al., 2015).
Varieties and hybrids belonging to *Gossypium hirsutum*, *Gossypium barbadense* and *Gossypium arboreum* were screened. Tobacco streak virus disease incidence was noticed up to a maximum of 50 per cent in hybrids, more than the incidence in varieties under natural condition in different cotton growing areas of Tamil Nadu (Rageshwari et al., 2016).
Telangana had the highest incidence of tobacco streak virus (51.11 PDI-hybrid RCH659) among the surveyed locations including Tamil Nadu, Andhra Pradesh, Telangana and Maharashtra states of India (Vinodkumar et al., 2017).
According to Valarmathi et al.,2020 ,maximum per cent tobacco streak virus disease incidence was observed 26.6% in ICB 71 and 20.5% in CCB 129 during 2017-2018 .Per cent disease incidence was maximum in SXP(35.8 per cent), followed by Suvin (32.5%) and ICB-25 (26.6%) with disease grade of 3 during 2018-2019. 54 cotton germplasms with a check were screened against to tobacco streak virus disease. Out of them, ARB-8815 showed immune reaction to tobacco streak virus disease (Vijaya Bhaskar,2023).

CONCLUSION

Out of 52 cotton germplasms,17 entries viz.,HYPS-152,H-1250,RAH-4,KH-2244N,LH-900,SA-434,RAH-12,JK-354,GBHU-164,NA-340,BS-37,TCH-724,ICMF-23,ICMF-20,SA-1004,ARB-89001 and BB-2 were resistant to bacterial blight disease. Eighteen entries namely SA-53-1,RHH-101,KH-2244N,KH-134,TCH-1649,NH-557,IH-08,PH-1008,TCH-724,JK-205,MRK-38,LH-2170,AKH-2822,ARB-8901,G-COT-10,JK-2764,CCH1071 and CCH-11 were immune to tobacco streak virus disease .On screening of 13 Bt cotton hybrids,Balhwan and Raja entries were moderately resistant to bacterial blight disease and 11 entries namely Bhakti, Raja, Balhwan, Akka,First class,RCH-812

,Ankur-3224,ACH-199,RCH-836,RCH-812 and ATM were showed disease rating scale 1(resistant) to tobacco streak virus disease.

The promising germplasm entries viz., HYPS-152,H-1250 and RAH-4 were found to be resistant to multiple diseases namely bacterial blight disease and tobacco streak virus disease.

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Table1a: Screening of Cotton germplasms against bacterial blight disease

Sl. no.	Germplasms	%Bacterial blight leaf area infection (PDI)	Scale (0-4)	Reaction
1	MCU-13	25.34	3	MS
2	HYPS-152	1.0	1	R
3	H-1250	3.1	1	R
4	SA-434	2.1	1	R
5	SA-53-1	36.38	3	MS
6	RAH-912	3.4	1	R
7	RAS-3438	6.7	2	MR
8	RHH-101	12.64	3	MS
9	RAH-216	34.23	4	S
10	RAH-4	2.9	1	R
11	KH-2244N	5.0	1	R
12	TCH-1020	7.3	2	MR
13	KH-134	9.0	2	MR
14	TCH-1649	28.54	4	S
15	G-CO-12	23.34	4	S
16	NH-557	16.66	3	MS
17	JK-354	3.3	1	R
18	IH-08	8.5	2	MR
19	ICMF-23	4.3	1	R
20	ICMF-20	3.2	1	R
21	PH-1008	10	2	MR
22	TCH-724	3.0	1	R
23	K-3409	8.9	2	MR
24	NA-640	3.5	1	R
25	BS-37	2.7	1	R
26	RCH-2	64.32	4	S
27	JK-205	18.24	3	MS
28	CNK-1094	9.0	2	MR
29	CSH-3118	40.0	4	S
30	MRK-38	19.72	3	MS
31	BRS-23	7.7	2	MR
32	BWR-44	8.2	2	MR
33	F-2089	32.84	4	S
34	LH-2170	15.50	3	MS
35	L-389	11.34	3	MS
36	AKH-2822	36.34	4	S
37	LH-900	1.9	1	R
38	SA-1004	3.4	1	R
39	ARB-8901	4.4	1	R
40	GBHB-170	13.66	3	MS
41	BB-2	2.0	1	R
42	G-COT-10	14.84	3	MS
43	JK-2764	5.5	2	MR
44	NH-615	7.8	2	MR

45	D-6	9.7	2	MR
46	CCH1071	8.0	2	MR
47	SCS-101	8.0	2	MR
48	GBHU-164	1.0	1	R
49	CCH-11	28.64	4	S
50	RAH-100	24.34	4	S
51	HOC-5	56.82	4	S
52	LRA5166 (C)	58	4	S

[R-Resistant,MR-Moderately resistant,MS-Moderately Susceptible and S-Susceptible]

Table 1b:Screening of Cotton germplasms against tobaccostreak virus disease

Sl. no.	Germplasms	Tobacco streak virus disease Scale (0-4)	Per cent Disease Incidence(PDI)	Reaction
1	MCU-13	1	1.3	R
2	HYPS-152	0	0.8	I
3	H-1250	0	1.0	I
4	SA-434	1	2.1	R
5	SA-53-1	0	0.0	I
6	RAH-912	1	1.6	R
7	RAS-3438	1	0.9	R
8	RHH-101	0	0.0	I
9	RAH-216	1	3.2	R
10	RAH-4	0	1.2	I
11	KH-2244N	0	0.0	I
12	TCH-1020	1	1.8	R
13	KH-134	0	0.0	I
14	TCH-1649	0	0.0	I
15	G-CO-12	1	3.2	R
16	NH-557	0	0.0	I
17	JK-354	1	3.6	R
18	IH-08	0	0.0	I
19	ICMF-23	2	8.6	MR
20	ICMF-20	1	4.2	R
21	PH-1008	0	0.0	I
22	TCH-724	0	0.0	I
23	K-3409	1	3.8	R
24	NA-640	1	2.4	R
25	BS-37	1	2.0	R
26	RCH-2	1	1.5	R
27	JK-205	0	0.0	I
28	CNK-1094	1	1.9	R
29	CSH-3118	1	2.8	R
30	MRK-38	0	0.0	I
31	BRS-23	3	18.2	MS
32	BWR-44	2	8.4	MR
33	F-2089	2	8.9	MR
34	LH-2170	0	0.0	I
35	L-389	1	3.7	R
36	AKH-2822	0	0.0	I
37	LH-900	2	6.9	MR
38	SA-1004	1	3.2	R
39	ARB-8901	0	0.0	I
40	GBHB-170	1	4.1	R
41	BB-2	1	3.4	R
42	G-COT-10	0	0.0	I

43	JK-2764	0	0.0	I
44	NH-615	1	4.2	R
45	D-6	1	3.3	R
46	CCH1071	0	0.0	I
47	SCS-101	1	4.0	I
48	GBHU-164	2	8.9	MR
49	CCH-11	0	0.0	I
50	RAH-100	2	9.4	MR
51	HOC-5	1	3.8	R
52	LRA 5166 (C)	4	28.6	S

[O-Immune ,R-Resistant,MR-Moderately resistant,MS-Moderately Susceptible and S-Susceptible]

Table 2a: Screening of Bt cotton hybrids against bacterial blight disease

Sl no.	Hybrids	%Bacterial blight leaf area infection (PDI)	Scale (0-4)	Reaction
1	Bhakti	28.4	4	S
2	Balhwan	5.4	2	MR
3	Raja	6.9	2	MR
4	Akka	14.6	3	MS
5	Khushi	24.1	4	S
6	Ankur -3224	42.3	4	S
7	First class	30.2	4	S
8	ACH-155	34.6	4	S
9	ACH-199	46.0	4	S
10	RCH-836	48.6	4	S
11	RCH-812	16.8	3	MS
12	ATM	42.4	4	S
13	RCH929(C)	52.60	4	S

[R-Resistant,MR-Moderately resistant,MS-Moderately Susceptible and S-Susceptible]

Table 2b: Screening of Bt Cotton hybrids against tobacco streak virus disease

Sl no.	Hybrids	Tobacco streak virus disease scale (0-4)	Per cent Disease Incidence (PDI)	Reaction
1	Bhakti	1	4.1	R
2	Balhwan	1	3.2	R
3	Raja	1	4.6	R
4	Akka	1	2.6	R
5	Khushi	2	9.3	MR
6	Ankur -3224	1	2.0	R
7	First class	1	1.5	R
8	ACH-155	1	1.8	R
9	ACH-199	1	0.9	R
10	RCH-836	1	2.1	R
11	RCH-812	1	2.4	R
12	ATM	1	0.9	R
13	RCH929 (C)	4	23.4	S

[R-Resistant,MR-Moderately resistant, MS-Moderately Susceptible and S-Susceptible]