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Evaluation of Genotypes against Bacterial Blight, Anthracnose Leaf Spot and Tobacco Streak Virus Diseases in Cotton

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***Abstract*:** The 54 cotton germplasms/hybrids/varieties and 13 Bt cotton hybrids with a check were screened against to anthracnose leaf spot, bacterial blight and tobacco streak virus diseases during *Kharif*-2017 at RARS, Warangal Telangana State. The thirteen entries viz., H-1492, 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, three entries namely; Bikanerinerma, WGCV-26 and CPD 731-1 to anthracnose leaf spot disease and ARB-8815 was showed immune reaction to tobacco streak virus disease. Out of 13 Bt cotton hybrids screened against bacterial blight disease, five entries namely; Akira, Ashirwad, Moneymaker, RCH-839 and Superb were resistant to bacterial blight disease.

Keywords: Cotton germplasms, Bt Cotton, Bacterial blight, Anthracnose leaf spot, Tobacco streak virus diseases

Cotton crop is affected by fungal, bacterial and viral diseases. Among fungal diseases, Anthracnose leaf spot is an important disease which results the lower yields. In India, foliar diseases estimated to cause yield loss up to 20 to 30 per cent (Mayee and Mukewar 2007). 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 and 2018). Environmental conditions influence disease in cotton (Kumar et al 2018). Hence, it is imperative to identify resistant genotypes so as to utilize in breeding programs to evolve resistant varieties/hybrids. Resistant cultivars are compatible with all other tactics, contribute stability and offer advantage to integrated disease management system. Identification of sources of resistance facilitates to evolve resistant genotypes/varieties/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, Anthracnose leaf spot and Tobacco streak virus diseases: 54 cotton germplasms/ hybrids/varieties were screened with LRA 5166 check and 13 Bt cotton hybrids were screened against to anthracnose, bacterial blight and tobacco streak virus diseases in under field conditions to identify the source of resistance in cotton at RARS, Warangal during *kharif* 2017. Each genotype was planted in two rows of 10 meter length with row spacing of 90 cm and the distance between plants was 60cm. The experiment was in randomized block design with two replications. Susceptible checks, LRA 5166 and RCH-629 were 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 (Table 1).

Disease severity/PDI was assessed with 0-4 scale/grade as per the standard evaluation system followed in All India

Table 1. Scale adopted for cotton bacterial blight disease, anthracnose leaf spot and tobacco streak virus disease

Scale	Grade	Percent leaf area infected bacterial blight disease	Percent leaf area infected anthracnose leaf spot disease	Percent disease incidence of tobacco streak virus disease
0	Immune	Completely free from disease	Completely free from disease	Completely free from disease
1	Resistant	Spots few scattered upto 5%	Leaf area covered upto 5%	upper leaves showing chlorosis or necrosis from 0.1 to 5.0 %
2	Moderately resistant	Leaf area covered from 6 to 10%	Leaf area coveredfrom 6 to 20 %	Moderate square drying and few branches affected from 5.1 to 10.0 %
3	Moderately susceptible	Leaf area covered from 11 to 20%	Leaf area coveredfrom 21 to 40%	Severe drying of squares and more branches affected from 10.1 to 20.0 %
4	Susceptible	Leaf area covered >20%	Leaf area covered >40 %	Severe stunting inclusive of above symptoms > 20.0 %

Co-ordinate Research Project on Cotton. It was expressed in percent Disease Index (PDI). Disease score was recorded on ten randomly selected plants in each entry on 0-4 scale (Sheo Raj1988).

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, % disease intensity (PDI) was calculated by using the formula by Wheeler (1969).

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

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

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

RESULTS AND DISCUSSION

Evaluation against bacterial blight disease: On screening of 54 cotton germplasm against bacterial blight disease, thirteen entries were resistant to bacterial blight disease (Table 1a). The 13 Bt cotton hybrids against bacterial blight disease, five entriesAkira, Ashirwad, Moneymaker, Rch-839 and Superb resistant to bacterial blight disease (Table 2a). Hosagoudar et al (2008) reported, twenty seven varieties were immune to bacterial blight disease. Guravareddy et al (2015), observed, Pratheek BG-II and Bigboss BG-I resistant to bacterial blight disease. Screened 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 bacterial blight disease (Patole et al 2016).

Against bacterial blight disease, Prashant et al (2017) found that 25 entries were disease free, 6 entries were resistant and 6 entries were moderately resistant, Bhattiprolu et al 2017 noticed that 4 Bt entries had moderately susceptible reaction, Patel et al 2016 and 2019 observed that 7 genotypes were disease free, GBav-123 was resistant and Abdul Rashid et al 2020 found that 8 entries were immune and 4 entries were moderately resistant .

Evaluation of anthracnose leaf spot disease: Out of 54 entries screened, three entries were found resistant to Anthracnose leaf spot (Table 1b). On screening against alternaria leaf blight disease, Hosagoudar et al (2008) found that JKCDH 501 was moderately resistant, Chattannavar et al 2009 found that 9 test entries were resistant, Gurava

Table 1a. Screening of germplasms against bacterial blight disease

Germplasms	% Bacterial blight leaf area infection (PDI)	Scale (0-4)	Reaction
Akala -629	20	3	MS
H-1492	4	1	R
Bikanerinerma	8	2	MR
G-67	9	2	MR
Delfos	8	2	MR
Deltapine -66	4	1	R
CCH-3114	3	1	R
CH-156	7	2	MR
CCH-1831	6.5	2	MR
CPD-814	6	2	MR
CPD-731	5	1	R
RAH-902	12.5	3	MS
Anjali	15	3	MS
AV1SP	25	4	S
ARB-8815	4	1	R
GSHV-97/59	15	3	MS
GSHV-97/13	15	3	MS
Hartsvilly	5	1	R
ADB-39	3	1	R
AV-3469	20	3	MS
GJHV-97/29	15	3	MR
HS-271	10	2	MR
BS-30	8.9	2	MR
GJHV-502	6.0	2	MR
CPT-571	4	1	R
CPD-7575	4.5	1	R
CPD-812	3	1	R
TCH-1716	4.5	1	R
Akala-1512	10	2	MR
NA-777	25	4	S
NA-1568	17	3	MS
WGCV-29	15	3	MS
WGCV-43	15	3	MS
WGCV-26	10	2	MR
CPD-731-1	9.34	2	MR
CNH-1025	9.60	2	MR
CSH-3167	15	3	MS
GSHV-160	10	2	MR
RS-2569	25	4	S
RS-2557	10	2	MR
WGCV-116	15	3	MS
LH-2153	20	3	MS
DS-28	4.5	1	R
JK-2602	7.8	2	MR
JK-344	15	3	MS
PRS-02	14.60	3	MS
WGCV-135	12	3	MS
JK-5	10	2	MS
L-620	10	2	MR
NDLH-1967	3	1	R
RAH-221	10	2	MR
WGCV-92	15	3	MR
WGCV-115	25	4	S
LRA-5166 (SC)	54	4	S

R-Resistant, MR-moderately resistant, MS-Moderately susceptible and S-Susceptible

Table1b. Screening of cotton germplasms against anthracnose leaf spot and tobacco streak virus diseases

Germplasms	Anthracnose leaf spot (PDI)	Scale (0-4)	Reaction	Tobacco streak virus disease scale (0-4)	PDI	Reaction
Akala -629	25	3	MS	1	0.9	R
H-1492	20	2	MR	1	1.2	R
Bikanerinerma	2.6	1	R	1	2.0	R
G-67	15	2	MR	1	1.5	R
Delfos	18	2	MR	1	2.5	R
Deltapine -66	20	2	MR	1	3.0	R
CCH-3114	22	3	MS	1	3.2	R
CH-156	16	2	MR	1	2.6	R
CCH-1831	19	2	MR	1	2.9	R
CPD-814	14	2	MR	1	3.2	R
CPD-731	20	2	MR	1	4.0	R
RAH-902	17	2	MR	2	8.2	MR
Anjali	25	3	MS	1	3.4	R
AV1SP	20	2	MR	1	4.0	R
ARB-8815	18	2	MR	0	0	I
GSHV-97/59	26	3	MS	1	2.1	R
GSHV-97/13	22	3	MS	1	2.6	R
Hartsvilly	23	3	MS	1	3.0	R
ADB-39	18	2	MR	1	2.4	R
AV-3469	20	2	MR	2	9.0	MR
GJHV-97/29	17	2	MR	1	1.2	R
HS-271	22	3	MS	1	2.8	R
BS-30	18	2	MR	1	3.0	R
GJHV-502	15	2	MR	1	3.4	R
CPT-571	22	3	MS	1	4.0	R
CPD-7575	20	2	MR	1	4.6	R
CPD-812	14	2	MR	1	3.2	R
TCH-1716	12	2	MR	3	15.2	MS
Akala-1512	15	2	MR	3	18.4	MS
NA-777	26	3	MS	1	1.2	R
NA-1568	34	3	MS	1	3.4	R
WGCV-29	20	2	MR	1	3.0	R
WGCV-43	20	2	MR	1	4.3	R
WGCV-26	2.5	1	R	1	2.8	R
CPD-731-1	5.0	1	R	1	3.0	R
CNH-1025	20	2	MR	2	7.6	MR
CSH-3167	26	3	MS	1	2.2	R
GSHV-160	18	2	MR	1	3.4	R
RS-2569	28	3	MS	3	18.6	MS
RS-2557	15	2	MR	1	2.0	R
WGCV-116	24	3	MS	1	3.2	R
LH-2153	16	2	MR	1	4.5	R
DS-28	23	3	MS	2	7.8	MR
JK-2602	18	2	MR	1	1.2	R
JK-344	35	3	MS	1	2.0	R
PRS-02	17	2	MR	1	3.2	R
WGCV-135	21	3	MS	1	4.0	R
JK-5	18	2	MR	1	3.8	R
L-620	27	3	MS	1	2.6	R
NDLH-1967	36	3	MS	1	1.8	R
RAH-221	20	2	MR	1	2.0	R
WGCV-92	48	4	S	1	2.2	R
WGCV-115	24	3	MS	1	3.4	R
LRA-5166 (SC)	50	4	S	4	25.6	S

R-Resistant, MR-moderately resistant, MS-Moderately susceptible and S-Susceptible

reddy et al 2015 found that Ganesh BG-II was resistant and Gawande et al 2016 noticed that one was exotic, 10 were indigenous and 19 were wild genotypes.

According to Hosagoudar et al (2008) Eighty six non-Bt and nine Bt cotton hybrids/ varieties/genotypes were screened against alternaria leaf blight disease, one was moderately resistant (JKCDH 501); 196 cotton hybrids/cultivars/genotypes were screened for resistance to alternaria blight disease, 9 test entries were found resistant (Chattannavar et al 2009); out of fifty Bt cotton hybrids, Ganesh BG-II was found resistant (Gurava reddy et al 2015);

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

Hybrids	% Bacterial blight leaf area infection (PDI)	Scale (0-4)	Reaction
Akira	2.4	1	R
Ashirwad	2.6	1	R
Deta Pine 912	20	3	MS
Khazana	15	3	MS
Money Maker	4.9	1	R
Neo	15	3	MS
Punnami 9	20	3	MS
Rch 797	25	4	S
Rch 839	3.8	1	R
Superb	4.5	1	R
Suvarna	15	3	MS
Ujwal	20	3	MS
Rch 929 (Sc)	50	4	S

R-Resistant, MR-moderately resistant, MS-Moderately susceptible and S-Susceptible

Exotic (01); 10- Indigenous and 19-Wild genotypes were identified as highly resistant (Gawande et al 2016) to the alternaria leaf blight disease.

According to Bhattiprolu et al 2017 noticed that RCH-530 BG-II was resistant and 38 were moderately resistant to helminthosporium leaf spot, 28 hybrids showed moderately resistant reaction to myrothecium leaf spot, Tulasi-118 BG-II was free and seven hybrids Bt were found resistant reaction to cercospora leaf spot disease. Two glandless cotton genotypes and three commercial cultivars were found more resistance to alternaria leaf spot disease (Yi Zhu et al 2017); Twenty-one genotypes showed resistant reaction (Rajesha et al 2021); one hundred and forty three Bt. cotton hybrids, two hybrids viz., Tulasi-144 BG-II (3.75 PDI) and U5-SS-33 BG-II (4.38 PDI) were recorded resistant (Durga Prasad et al 2017); Thirteen entries were showed resistant reaction (Chaudhari et al 2022) to alternaria leaf spot disease.

Evaluation of tobacco streak virus disease: Out of evaluated 54 entries, one entry was noticed immune response (scale 0), 45 entries were resistant (scale 1) and four entries were noticed scale 2 (moderately resistant) to tobacco streak virus disease (Table 1 b).

On screening of 13 Bt Cotton hybrids, seven entries showed rating scale 1 (resistant) to tobacco streak virus disease (Table 2b).

Three hybrids were immune and twenty two entries were resistant to tobacco streak virus disease (Guravareddy et al 2015), Tobacco streak virus disease incidence was noticed upto 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),

Table 2b. Screening of Bt cotton hybrids against anthracnose leaf spot and tobacco streak virus diseases

Hybrids	Anthracnose leaf spot (PDI)	Scale (0-4)	Reaction	Tobacco streak virus disease scale (0-4)	PDI	Reaction
Akira	20	2	MR	1	2.1	R
Ashirwad	25	3	MS	2	8.4	MR
Deta Pine 912	32	3	MS	1	2.5	R
Khazana	55	4	S	2	9.0	MR
Money Maker	25	3	MS	3	18.6	MS
Neo	38	3	MS	1	2.6	R
Punnami 9	46	4	S	1	3.8	R
Rch 797	58	4	S	3	20	MS
Rch 839	36	3	MS	2	9.2	MR
Superb	25	3	MS	1	4.0	R
Suvarna	46	4	S	1	3.6	R
Ujwal	40	4	S	1	3.9	R
Rch 929	60	4	S	4	23.4	S

R-Resistant, MR-moderately resistant, MS-Moderately susceptible and S-Susceptible

Telangana had the highest incidence of tobacco streak virus (51.11 PDI-hybrid RCH 659) among the surveyed locations including Tamil Nadu, Andhra Pradesh, Telangana and Maharashtra states of India (Vinodkumar et a l2017), Valarmathi et al 2020 found that maximum per cent tobacco streak virus disease incidence was observed 26.6% in ICB 71 and 20.5% in CCB 129 and 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.

CONCLUSIONS

Out of 54 cotton germplasms, 13 entries were found resistant to bacterial blight disease, 3 entries (Bikanerinerma, WGCV-26 and CPD 731-1) were found resistant to anthracnose leaf spot disease and ARB-8815 was noticed immune reaction to tobacco streak virus disease.ARB-8815 was found to be multiple disease resistance to bacterial blight and tobacco streak virus diseases. Out of 13 Bt cotton hybrids, Akira was found moderately resistant to anthracnose leaf spot disease; Akira and Superb hybrids were found multiple disease resistant to bacterial blight and tobacco streak virus diseases.

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