



RESEARCH PAPER

Identification of sources of resistance against boll rot complex of cotton

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Abstract : One hundred and eighteen genotypes/ varieties/ hybrids belonging to all four species of *Gossypium viz.*, *G. arboreum*, *G. herbaceum*, *G. barbadense* and *G. hirsutum* were screened against boll rot complex disease under natural epiphytotic conditions at Agriculture Research Station, Dharwad farm, University of Agricultural Sciences, Dharwad during *Kharif* 2017. Among these 118 germplasm lines tested, one line of *Gossypium arboreum i.e.*, FDK 281 and two lines of *G. herbaceum* namely, ANGH-1607 and GShv 894/13 showed highly resistant reaction against the disease. In addition, five lines of *G. arboreum* (CNA 2031, DLSA 17, NDLA 3086, PBD 22, PSCANOI-46), eight lines each of *G. herbaceum* (DDh-11, DwDh-1601, DwDh-1602, GBhv-308, G Cot 23/DDhc 11, GShv 898/13, GShv 907/13, Gvhv-767) and *G. barbadense* (ARBHB-1601, BCS-23-18-7, DB-1602, DHB-1601, GBHV-184, LAHB-1, RHB-1008, Suvin), five lines of *G. hirsutum* (ARBH- 813, LHDP 3, NNDC-10, NNDC-21, NNDC-55) and five intrahirsutum (ATM, Bindas, Dr. Brent, DHH- 11, DHH- 263) hybrid lines showed moderately resistant reaction against boll rot. Out of four species, germplasm lines of *G. herbaceum* has showed better performance against the disease.

Key Words : Cotton, Boll rot complex, Resistant sources

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INTRODUCTION

Cotton (*Gossypium* spp. Family: Malvaceae) is one of the world's leading agricultural crops which is wide spread, plentiful and economically produced and ranks first among the fibres. It is not only a source of natural fibre but also a protein and oil source in animal feed and an excellent source for pharmaceutical uses.

Cotton is vulnerable to many biotic and abiotic stresses as it is subjected to diseases caused by various pathogenic fungi, bacteria and virus and to damage by nematodes and physiological disturbances, which

accounts for its low yield potential and in turn the high cost of production. *Fusarium* wilt, *Verticillium* wilt, *Alternaria* blight, angular leaf spot, boll rot and leaf curl are the major diseases which are responsible for loss of yield and quality parameters in cotton.

There are many pathogens that can cause boll rot, such as *Alternaria* spp., *Ascochyta gossypii*, *Aspergillus flavus*, *Bacillus pumilus*, *Colletotrichum* spp., *Diplodia gossypina*, *Erwinia aroideae*, *Fusarium* spp., *Lasiodiplodia theobromae*, *Myrothecium roridum*, *Pantoea agglomerans*, *Phomaexigua*, *Phomopsis* sp., *Phytophthora* spp., *Rhizoctonia solani* and *Xanthomonas*

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citri sub sp. *malvacearum*. Various symptoms may be due to the existence of a complex of pathogens. Commonly, the bolls get soft and blackened or fail to crack open (Belot and Zambiasi, 2007).

Boll rot complex of cotton has become a major production constraint in all the cotton growing areas of the country. Many pathogens such as *Alternaria* spp., *Ascochyta gossypii*, *Aspergillus flavus*, *Bacillus pumilus*, *Colletotrichum* spp., *Diplodia gossypina*, *Erwinia aroideae*, *Fusarium* spp., *Lasiodiplodia theobromae*, *Myrothecium roridum*, *Pantoea agglomerans*, *Phomaexigua*, *Phomopsis* sp., *Phytophthora* spp., *Rhizoctonia solani* and *Xanthomonas citri* subsp. *malvacearum* are involved in boll rot complex. Management of disease with chemicals is always laborious, non-economical and hazardous to environment. Identification of sources of resistance is a long term sustainable approach in addressing this issue. The present investigation added new information on identification of sources of resistance against boll rot complex.

MATERIAL AND METHODS

Twenty varieties of UAS, Dharwad which are under pipeline, 81 germplasm lines of AICRP and 13 private Bt hybrids and four UAS, Dharwad released non-Bt varieties/hybrids belonging to all four species of *Gossypium* viz., *G.*

arboreum, *G. herbaceum*, *G. barbadense* and *G. hirsutum* were screened against boll rot complex disease under field conditions at Agriculture Research Station, Dharwad farm, University of Agricultural Sciences, Dharwad during *Kharif* 2017. These 118 genotypes were collected and screened under natural epiphytotic conditions. Each of the test entries were taken up in two rows and after every five entries one susceptible check was used. Observations were recorded by using 0-9 scale (Mayee and Datar, 1986). Based on their reaction, genotypes were categorized into absolute resistant, highly resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

Per cent disease incidence was calculated by using the formula given below:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected bolls}}{\text{Total number of bolls observed}} \times 100$$

The experiment was conducted using RCBD with spacing of 90 cm × 30 cm. All the recommended package of practices except the targeted disease management strategies was performed as per UAS, Dharwad recommendations.

RESULTS AND DISCUSSION

The results indicated that, among the 118 genotypes screened, none of them showed absolute resistance

Table A : Genotype categorization based on disease rating (Mayee and Datar, 1986)

Category	Reactions	Description
0	Absolute resistant (AR)	No symptoms on bolls
1	Highly resistant (HR)	1 % or less bolls exhibiting boll rot symptoms
3	Moderately resistant (MR)	1-10 % of bolls exhibiting symptoms
5	Moderately susceptible (MS)	11-20 % of bolls exhibiting symptoms
7	Susceptible (S)	21-50 % of bolls exhibiting symptoms
9	Highly susceptible (HS)	51 % or more bolls exhibiting symptoms

Table B: Cotton varieties of UAS, Dharwad under pipeline screened against boll rot complex

Sr. No.	Name of entry	Sr. No.	Name of entry
<i>Gossypium arboreum</i>		<i>G. barbadense</i>	
1.	ARBAS 131	11.	BCS-23-18-7
2.	ARBHA-35	12.	BG-BS-1
3.	DAS 385	13.	BG-BS-4
4.	DLSA 17	14.	SB (YF) 425
5.	PSCANOI-46	15.	SB-289E
<i>G. herbaceum</i>		<i>G. hirsutum</i>	
6.	ANGH-1607	16.	NNDC-10
7.	DDh-11	17.	NNDC-21
8.	DwDh-1601	18.	NNDC-35
9.	DwDh-1602	19.	NNDC-53
10.	Jayadhar	20.	NNDC-55

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Table C: AICRP germplasm lines of cotton screened against boll rot complex					
Sr. No.	Name of entry	Sr. No.	Name of entry	Sr. No.	Name of entry
	<i>Gossypium arboreum</i>		<i>G. barbadense</i>	56.	GBHV-184
1.	CNA 1031	28.	AKH-09-5	57.	GBHV-195
2.	CNA 2031	29.	AKH-1301	58.	GISV -272
3.	DLSa 17	30.	ARBC 1551	59.	GSHV-180
4.	DWDa-1602	31.	ARBC-1651	60.	GTHV-13/32
5.	FDK 281	32.	ARBH-1551	61.	LAHB-1
6.	GAM 223	33.	ARBHB-1601	62.	LAHH 26
7.	JLA-1110	34.	ARBHB-1602	63.	LAHH 29
8.	NDLA 3086	35.	BGDHH 1703	64.	LHDP 1
9.	PAIG 326	36.	BGDS 1033	65.	NDLH - 2028-2
10.	PA 255	37.	BGDS 1072	66.	RAH 1071
11.	PA 363	38.	BS 1	67.	RAHC 1020
12.	PA 781	39.	BS 30	68.	RAHH 455
13.	PA 778	40.	Bunny	69.	RHB-1008
14.	PA 808	41.	CCB 29	70.	RHCb-1014
15.	PA 810	42.	CCB 51	71.	Sahana
16.	PA 812	43.	CCH 15-8	72.	SB SG 1-5
17.	PA 827	44.	CCH 16-7	73.	SCS 1061
18.	PBD 22	45.	CNH 09-62	74.	Suraj
	<i>G. herbaceum</i>	46.	CPD-1651	75.	Suvin
19.	DwDh-1701	47.	CPD-1652	76.	TKH 1185/1/3
20.	DwDh-1702	48.	DB-1601		<i>G. hirsutum</i>
21.	GBhv-308	49.	DB-1602	77.	CNH 1128
22.	GBhv-310	50.	DCH 32	78.	CNH 2048
23.	G Cot 23/DDhc 11	51.	DHB-1501	79.	GBHV 186
24.	GShv 894/13	52.	DHB-1601	80.	LHDP 3
25.	GShv 898/13	53.	DHH-1751	81.	RHC HD 1433
26.	GShv 907/13	54.	DHH-1752	82.	Abadhita (Check)
27.	Gvhv-767	55.	DSC-1651		

Table D: Private and UAS, Dharwad released Bt and non- Bt varieties/ hybrids of cotton screened against boll rot complex			
Sr. No.	Name of entry	Sr. No.	Name of entry
1.	Ajeet 155	11.	Dr. Brent Bt
2.	Ajeet 199	12.	First class
3.	ARBH- 813	13.	Jadu
4.	Arjun- 21	14.	MRC- 7351
5.	ATM	15.	President gold
6.	Bindas	16.	Shalimar
7.	Chiranjeevi	17.	Yuva
8.	DHH- 11	18.	Abadhita (Check)
9.	DHH- 263	19.	Jayadhar (Check)
10.	DHH- 1062		

Table 1: Grouping of genotypes based on genetic composition against boll rot complex disease

Grade	Disease reaction	<i>Gossypium arboreum</i>	Total entries (23)	<i>G. herbaceum</i>	Total entries (14)	<i>G. barbadense</i>	Total entries (54)	<i>G. hirsutum</i>	Total entries (12)	Intra hirsutum	Total entries (16)	Total entries (119)
0	Absolute resistant	-	0	-	0	-	0	-	0	-	0	0
1	Highly resistant	FDK 281	1	ANGH-1607, GShv 894/13	2	-	0	-	0	-	0	3
3	Moderately resistant	CNA 2031, DLSA 17, NDLA 3086, PBD 22, PSCANOI-46	5	DDh-11, DwDh-1601, DwDh-1602, GB hv-308, G Cot 23/ DD hc 11, GShv 898 /13, GShv 907/13, Gvhv-767	8	ARBHB-1601, BCS-23-18-7, DB-1602, DHB-1601, GBHV-184, LAHB-1, RHB-1008, Suvin,	8	ARBH-813, LHDP 3, NNDC-10, NNDC-21, NNDC-55	5	ATM, Bindas, Dr. Brent, DHH-11, DHH-263	5	31
5	Moderately susceptible	ARBAS 131, ARBHA-35, CNA 1031, DAS 385, DLSa 17, DWDa-1602, GAM 223, JLA-1110, PA 781, PA 808, PA 810, PA 812, PA 827	13	DwDh-1701, DwDh-1702, GBhv-310, Jayadhar (Check)	4	AKH-09-5, AKH-1301, ARBC-1651, ARBH-1551, ARBHB-1602, BGDHH 1703, BGDS 1033, BGDS 1072, BS 1, CCB 29, CCB 51, CPD-1651, CPD-1652, DB-1601, DCH 32, DHB-1501, DHH-1751, GBHV-195, GISV -272, GSHV-180, LHDP 1, LAHH 29, NDLH -2028-2, RAH 1071, RAHC 1020, RAHH 455, RHCb-1014, Sahana, SB SG 1-5, SCS 1061, TKH 1185/1/3	31	CNH 1128, CNH 2048, GBHV 186, NNDC-35, NNDC-53	5	Ajeet 155, Ajeet 199, Arjun- 21, Chiranjeevi, DHH- 1062, First class, Jadu, MRC-7351, Shalimar, Yuva	10	63
7	Susceptible	PA 255, PA 363, PA 778, PAIG 326	4	-	0	ARBC 1551, BG-BS-1, BG-BS-4, BS 30, Bunny, CCH 15-8, CCH 16-7, CNH 09-62, DHH-1752, DSC-1651, GTHV-13/32, LAHH 26, SB-289E, SB (YF) 425, Suraj	15	RHC HD 1433, Abadhita (Check)	2	President gold	1	22
9	Highly susceptible	-	0	-	0	-	0	-	0	-	0	0

reaction. The entries ANGH-1607, FDK 281 and GShv 894/13 were found highly resistant. The genotypes ARBH-813, ARBHB-1601, ATM, BCS-23-18-7, Bindas, CNA2031, DB-1602, DDh-11, DHB-1601, DHH- 11, DHH- 263, DLSA 17, Dr. Brent Bt, DwDh-1601, DwDh-1602, GBHV-184, GBhv-308, G Cot 23/DDhc 11, GShv 898/13, GShv 907/13, Gvhv-767, LAHB-1, LHDP 3, NDLA 3086, NNDC-10, NNDC-21, NNDC-55, PBD 22, PSCANOI-46, RHB-1008 and Suvin showed moderately resistant reaction. Whereas the entries Ajeet 155, Ajeet 199, AKH-09-5, AKH-1301, ARBAS 131, ARBC-1651, ARBH-1551, ARBHA-35, ARBHB-1602, Arjun- 21, BGDS 1033, BGDS 1072, BGDHH 1703, BS 1, CCB 29, CCB 51, Chiranjeevi, CNA 1031, CNH 1128, CNH 2048, CPD-1651, CPD-1652, DAS 385, DB-1601, DCH 32, DHB-1501, DHH- 1062, DHH-1751, DLSa 17, DWDa-1602, DwDh-1701, DwDh-1702, First class, GAM 223, GBHV 186, GBHV-195, GBhv-310, GISV -272, GSHV-180, Jadu, JLA-1110, LAHH 29, LHDP 1, MRC- 7351, NDLH - 2028-2, NNDC-35, NNDC-53, PA 781, PA 808, PA 810, PA 812, PA 827, RAH 1071, RAHC 1020, RAHH 455, RHCb-1014, Sahana, SB SG 1-5, Shalimar, SCS 1061, TKH 1185/1/3, Yuva and ARBC 1551, BG-BS-1, BG-BS-4, BS 30, Bunny, CCH 15-8, CCH 16-7, CNH 09-62, DHH-1752, DSC-1651, GTHV-13/32, LAHH 26, PA 255, PA 363, PA 778, PAIG 326, President gold, RHCHD 1433, SB-289E, SB (YF) 425, Suraj were found moderately susceptible and susceptible against boll rot, respectively. None of the genotypes were highly susceptible for the disease. The susceptible checks Jayadhar (5 grade) and Abadhita (7 grade) recorded moderately susceptible and susceptible reactions, respectively, indicating high level of disease pressure (Table 1).

Out of 23 screened germplasm lines of *Gossypium arboreum*, one has showed highly resistant reaction, five have shown moderately resistant reaction, 13 have recorded moderately susceptible reaction and four have shown susceptible reaction against boll rot complex.

Out of 14 screened germplasm lines of *Gossypium herbaceum*, two has showed highly resistant reaction, eight have showed moderately resistant reaction, four have showed moderately susceptible reaction against boll rot complex.

In case of 54 screened germplasm lines of *Gossypium barbadense*, eight have showed moderately resistant reaction, 31 have showed moderately susceptible reaction and 15 have showed susceptible reaction against boll rot complex.

In case of 12 screened germplasm lines of *Gossypium hirsutum*, five entries showed moderately resistant reaction, five have showed moderately

susceptible reaction and two have shown susceptible reaction against boll rot complex.

In case of 16 Intrahirsutum hybrids screened, five have showed moderately resistant reaction, 10 have showed moderately susceptible reaction and one has showed susceptible reaction against boll rot complex.

Among 13 private Bt hybrids (Intrahirsutum) screened, three entries have showed moderately resistant reaction, nine have shown moderately susceptible reaction and 1 has showed susceptible reaction against boll rot complex.

Among the four screened non Bt genotypes of UAS, Dharwad, two hybrids and one variety have showed moderately resistant reaction and one hybrid has shown moderately susceptible reaction against boll rot complex.

Among the 118 germplasm lines tested, one line of *Gossypium arboreum* and two lines of *G. herbaceum* showed highly resistant reaction against the disease. In addition, five lines of *G. arboreum*, eight lines each of *G. herbaceum* and *G. barbadense*, five lines of *G. hirsutum* and five intrahirsutum hybrid lines showed moderately resistant reaction against boll rot (Table 1). Out of four species, germplasm lines of *G. herbaceum* have showed better performance against the disease. These investigations were previously reported by Hiremath *et al.* (1989).

The resistance host to boll rot complex was more in *G. herbaceum* sources compared to *G. hirsutum* and *G. barbadense* sources. This may be due to the resistance genes present in germplasm lines. The study identified good number of resistance sources in germplasm lines, Bt and non-Bt varieties and hybrids which can be further used for contemporary resistance breeding programmes in cotton.

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