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Screening of *Gossypium hirsutum* L. Genotypes Against Insect Pests Under Unprotected Conditions

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ABSTRACT

Forty genotypes of *Gossypium hirsutum L.* were evaluated for their reaction to pest complex of cotton under unprotected conditions in randomised block design at Regional Agricultural Research Station,Lam during 2006-07. The entries NH 615 (0.6 no./3 leaves), CNDTS 52 (2.1 no./ 3leaves), CA 100 (2.3 no./3 leaves), GSHV 152 (2.4no./3 leaves) and BS 144 (2.5 no./ 3 leaves) recorded lowest population with jassid grade I and found promising against jassids. The per cent open boll damage due to *Heliothes armigera* varied between 2.65 to 39.76 among the genotypes with non-significant difference. The entry H 1300 showed inherent resistance to pink bollworm by recording lowest larval incidence of 12 larvae/ 20 bolls and 40% green boll damage.

Key words : Bollworms, Genotypes, *Gossypium hirsutum,* Sucking pests

Cotton crop (*Gossypium hirsutum* L.) in Andhra Pradesh is attacked mainly by sucking pests *viz.,* jassids and whitefly and bollworms *viz.,* American bollworm and pink bollworm resulting in poor seed cotton yields. The pest control is only possible through 10-12 sprays done at 10 day interval with conventional insecticide and synthetic pyrethriod on alternate turns (Dhawan, 1993).The over reliance on chemical based plant protection led to failure of insecticides resulting in resistance to insecticides and resurgence of pests besides environmental pollution. The increased pesticidal usage in cotton system has endangered human health and thus has been identified as a significant factor causing massive ecological disruption (Gupta, 1999). Utilization of resistant varieties against insect pests of different crops is an important tool in IPM technology and is based on sound ecological principles (Painter, 1951 and Maxwell and Jennings, 1980). The present study was carried out to identify the cotton genotypes resistant to insect pests with more seed cotton yield to utilize them as one of the reliable component in ecofriendly integrated pest management.

MATERIAL AND METHODS

A total of 40 *Gossypium hirsutum* genotypes were screened for their reaction against major sucking pests and bollworms under rainfed conditions at Regional Agricultural Research Station, Lam, Guntur during 2006-07. The genotypes were sown at a spacing of 120 cm X 60 cm in black cotton soils and sowing was done in second fortnight of July. The experiment was laid in randomised block design and each variety was replicated twice. The agronomic practices were adopted as per the recommendations and the crop was maintained under completely unprotected conditions for all the pests.

The incidence of sucking pests and bollworms were recorded from 10 randomly selected plants at fifteen days interval during peak infestation for sucking pests,whereas for *Helicoverpa armigera* at 120 DAS and pink bollworm at 140 DAS for each entry. Sucking pests such as jassids and whiteflies were recorded from three leaves, each one from top, middle and bottom canopies of the plant. The larval incidence of pink bollworm, *Pectinophora gossypiella* was recorded from 20 randomly collected green bolls through destructive sampling and per cent boll damage was also recorded. The open boll damage and open locule damage due to *H.armigera* during first picking at 120 DAS, number of good opened bolls and seed cotton yield from all the picking were recorded for all the genotypes. The data was subjected to analysis after applying appropriate transformations.

RESULTS AND DISCUSSION

The population of jassids varied from 0.6 to 12.2 no./3 leaves among the different genotypes. Entries NH 615 (0.6 no./3 leaves), CNDTS 52 (2.1 no./ 3leaves), CA 100 (2.3 no./3 leaves), GSHV 152 (2.4 no./3 leaves), BS 144 (2.5 no./ 3 leaves) and AKH 2017 (2.7 no./ 3 leaves) recorded lowest incidence which were found at par with each other

Table 1. Reaction of *Gossypium hirsutum* L. genotypes against jassids and whiteflies

S. No	Name of the entry	Jassid/ 3 leaves	Jassid Injury Grade	White flies/3 leaves	S. No	Name of the entry	Jassid/ 3 leaves	Jassid Injury Grade	White flies/3 leaves
1	L 769	7.80 (2.96)	III	0.20 (1.09)	21	RS 2461	9.20 (3.18)	IV	0.30 (1.13)
2	SCS 601	6.30 (2.70)	III	0.40 (1.18)	22	RAH 216	12.20 (3.63)	IV	0.10 (1.05)
3	GJHV 374	3.90 (2.21)	II	0.20 (1.09)	23	CNDTS 51	5.80 (2.61)	II	0.00 (1.00)
4	NH 615	0.60 (1.26)	I	0.00 (1.00)	24	LRA 5166	8.10 (3.02)	IV	0.30 (1.13)
5	CA 100	2.30 (1.79)	I	0.30 (1.13)	25	RSA 2495	7.90 (2.97)	III	0.30 (1.14)
6	CPD 812	4.10 (2.25)	II	0.30 (1.14)	26	RAH 219	5.70 (2.56)	III	0.30 (1.13)
7	CSH 3119	4.50 (2.35)	II	0.20 (1.09)	27	F 2157	5.70 (2.56)	III	0.20 (1.10)
8	TCH 1706	4.80 (2.31)	II	0.00 (1.00)	28	TSH 9812	4.90 (2.42)	II	0.40 (1.17)
9	P 514	5.20 (2.43)	III	0.00 (1.00)	29	CSH 3114	6.00 (2.64)	III	0.00 (1.00)
10	RS 2455	4.90 (2.42)	II	0.00 (1.00)	30	HS 276	4.80 (2.36)	II	0.00 (1.00)
11	ADB 134	6.30 (2.67)	III	0.20 (1.10)	31	LH 2111	5.40 (2.53)	III	0.20 (1.10)
12	AKH 2017	2.70 (1.91)	II	0.00 (1.00)	32	CCH LS 2	6.80 (2.79)	III	0.20 (1.10)
13	GSHV 152	2.40 (1.84)	I	0.10 (1.05)	33	BS 3	4.50 (2.34)	II	0.10 (1.05)
14	LC 604	5.50 (2.54)	III	0.00 (1.00)	34	ARBH 813	5.80 (2.60)	III	0.00 (1.00)
15	Bihani 161	5.80 (2.61)	III	0.00 (1.00)	35	H 1300	3.60 (2.13)	II	0.10 (1.05)
16	CNDTS 52	2.10 (1.76)	I	0.40 (1.17)	36	CCH 226	6.00 (2.63)	III	0.30 (1.14)
17	GTHV 02/ 45	7.50 (2.80)	III	0.40 (1.17)	37	RHC 2004	3.40 (2.10)	II	0.40 (1.18)
18	HAGH 810	4.50 (2.34)	II	0.20 (1.10)	38	CSH 7	4.10 (2.25)	II	0.00 (1.00)
19	CNHO 23	6.50 (2.73)	III	0.10 (1.05)	39	BS 144	2.50 (1.84)	I	0.20 (1.09)
20	F 2052	6.30 (2.70)		0.00	40	RB 557	4.40 (2.28)	II	0.00 (1.00)
						F test	Sig		NS
						SEd	0.42		0.10
						CD (P=0.05)	0.82		NS
						CV%	17.2		9.6

* Figures in parentheses are $\sqrt{X+1}$ transformed values

Table 2. Reaction of *Gossypium hirsutum* L. genotypes against *Helicoverpa armigera*

S. No	Name of the entry	Open boll damage (%)** Boll Basis	Locule basis	S.No	Name of the entry	Open boll damage (%)** Boll Basis	Locule basis
1	L 769	10.85 (13.88)	4.30 (11.79)	21	RS 2461	27.56 (31.37)	9.77 (18.29)
2	SCS 601	19.01 (25.21)	11.90 (19.19)	22	RAH 216	15.63 (19.36)	10.37 (18.13)
3	GJHV 374	20.70 (26.36)	12.89 (19.80)	23	CNDTS 51	22.12 (23.73)	13.50 (21.52)
4	NH 615	17.65 (22.48)	12.92 (18.29)	24	LRA 5166	13.99 (19.28)	10.84 (17.62)
5	CA 100	15.74 (22.87)	8.49 (16.60)	25	RSA 2495	14.13 (19.62)	10.48 (17.87)
6	CPD 812	14.28 (20.14)	9.53 (16.04)	26	RAH 219	14.80 (20.66)	11.41 (18.85)
7	CSH 3119	11.08 (17.69)	7.64 (14.38)	27	F 2157	11.68 (17.88)	8.40 (13.99)
8	TCH 1706	19.46 (25.61)	12.55 (20.14)	28	TSH 9812	16.98 (23.84)	12.29 (19.57)
9	P 514	39.76 (39.00)	19.52 (26.19)	29	CSH 3114	13.88 (21.27)	8.82 (15.98)
10	RS 2455	23.89 (29.18)	15.55 (23.06)	30	HS 276	11.82 (19.10)	8.19 (15.15)
11	ADB 134	22.37 (26.72)	18.31 (23.63)	31	LH 2111	18.70 (25.08)	11.74 (19.33)
12	AKH 2017	18.34 (24.82)	15.62 (22.89)	32	CCH LS 2	16.44 (23.64)	8.47 (16.59)
13	GSHV 152	25.39 (29.69)	17.16 (23.83)	33	BS 3	21.70 (27.34)	14.90 (21.93)
14	LC 604	20.06 (26.44)	13.32 (21.05)	34	ARBH 813	11.06 (17.78)	6.94 (13.67)
15	Bihani 161	19.84 (25.88)	12.70 (20.12)	35	H 1300	17.86 (24.63)	12.71 (20.25)
16	CNDTS 52	18.68 (23.59)	10.98 (15.37)	36	CCH 226	13.42 (20.84)	7.82 (15.39)
17	GTHV 02/ 45	9.17 (17.59)	7.22 (15.37)	37	RHC 2004	8.67 (17.04)	6.84 (15.07)
18	HAGH 810	6.01 (12.31)	3.48 (9.47)	38	CSH 7	5.26 (13.20)	3.80 (11.19)
19	CNHO 23	2.65 (8.70)	1.49 (9.16)	39	BS 144	6.09 (14.19)	4.78 (12.62)
20	F 2052	5.95 (13.99)	3.44 (10.49)	40	RB 557	10.19 (18.61)	8.16 (16.25)
					F test	NS	NS
					SEd	6.98	6.23
					CD (P=0.05)	NS	NS
					CV%	32.1	35.8

** Figures in parentheses are arcsine transformed values

Table 3. Reaction of *Gossypium hirsutum* L. genotypes against pink bollworm

S. No	Name of the entry	Pink bollworm larvae/ 20 bolls*	Pink bollworm green boll damage (%)**	S.No	Name of the entry	Pink bollworm larvae/ 20 bolls*	Pink bollworm green boll damage (%)**
1	L 769	44.00 (6.69)	100.00 (90.00)	21	RS 2461	45.00 (6.78)	75.00 (60.12)
2	SCS 601	39.00 (5.90)	100.00 (90.00)	22	RAH 216	37.00 (6.07)	80.00 (64.18)
3	GJHV 374	63.00 (7.96)	90.00 (76.72)	23	CNDTS 51	67.00 (8.21)	95.00 (80.78)
4	NH 615	69.00 (8.27)	90.00 (76.72)	24	LRA 5166	40.00 (6.39)	90.00 (71.56)
5	CA 100	37.00 (6.15)	90.00 (76.72)	25	RSA 2495	57.00 (7.61)	85.00 (67.50)
6	CPD 812	30.00 (5.46)	70.00 (57.11)	26	RAH 219	42.00 (6.56)	95.00 (80.78)
7	CSH 3119	42.00 (6.54)	80.00 (63.44)	27	F 2157	47.00 (6.92)	75.00 (60.12)
8	TCH 1706	70.00 (8.23)	95.00 (80.78)	28	TSH 9812	28.00 (5.37)	75.00 (60.12)
9	P 514	34.00 (5.85)	85.00 (73.40)	29	CSH 3114	40.00 (6.40)	90.00 (71.56)
10	RS 2455	48.00 (6.99)	100.00 (90.00)	30	HS 276	35.00 (6.00)	80.00 (64.18)
11	ADB 134	61.00 (7.84)	90.00 (71.56)	31	LH 2111	52.00 (7.28)	75.00 (60.12)
12	AKH 2017	50.00 (7.12)	85.00 (67.50)	32	CCH LS 2	49.00 (7.03)	90.00 (71.56)
13	GSHV 152	74.50 (8.67)	85.00 (73.40)	33	BS 3	52.00 (7.20)	80.00 (64.18)
14	LC 604	26.00 (5.20)	75.00 (60.12)	34	ARBH 813	37.00 (6.12)	95.00 (80.78)
15	Bihani 161	55.00 (7.48)	95.00 (80.78)	35	H 1300	12.00 (3.41)	40.00 (38.67)
16	CNDTS 52	51.00 (7.20)	95.00 (80.78)	36	CCH 226	47.00 (6.79)	80.00 (64.18)
17	GTHV 02/ 45	41.00 (6.37)	90.00 (71.56)	37	RHC 2004	49.00 (7.07)	85.00 (67.50)
18	HAGH 810	56.00 (7.55)	100.00 (90.00)	38	CSH 7	35.00 (5.99)	85.00 (67.50)
19	CNHO 23	47.00 (6.88)	95.00 (80.78)	39	BS 144	48.00 (6.95)	95.00 (80.78)
20	F 2052	53.00 (7.33)	80.00 (63. 44)	40	RB 557	27.00 (5.27)	75.00 (60.12)
					F test	Sig	Sig
					SEd	1.16	13.03
					CD (P=0.05)	2.28	25.54
					CV%	17.30	18.30

* Figures in parentheses are $\sqrt{X+1}$ transformed values
** Figures in parentheses are arcsine transformed values

Table 4. Seed cotton yield from *Gossypium hirsutum* L. genotypes

Name of the entry	Good opened bolls/5 plants	Seed cotton yield (q/ha)	Name of the entry	Good opened bolls/5 plants	Seed cotton yield (q/ha)
L 769	47.5	6.25	RS 2461	46.0	3.16
SCS 601	102.5	10.90	RAH 216	99.5	9.33
GJHV 374	92.0	13.16	CNDTS 51	72.5	7.36
NH 615	108.5	10.52	LRA 5166	103.0	8.85
CA 100	89.0	8.89	RSA 2495	77.0	6.87
CPD 812	91.0	11.63	RAH 219	87.0	8.16
CSH 3119	96.5	5.80	F 2157	90.5	8.06
TCH 1706	105.5	11.74	TSH 9812	96.5	8.16
P 514	48.5	3.99	CSH 3114	73.0	5.35
RS 2455	101.0	7.81	HS 276	61.5	6.42
ADB 134	77.5	7.19	LH 2111	76.5	8.06
AKH 2017	101.0	9.20	CCH LS 2	81.5	8.85
GSHV 152	91.0	9.55	BS 3	87.0	10.03
LC 604	80.0	9.20	ARBH 813	75.0	8.12
Bihani 161	79.0	7.08	H 1300	68.5	9.64
CNDTS 52	74.0	7.50	CCH 226	82.0	7.20
GTHV 02/45	103.5	11.98	RHC 2004	93.5	8.33
HAGH 810	97.5	7.99	CSH 7	82.0	7.64
CNHO 23	101.0	7.83	BS 144	108.5	8.30
F 2052	111.5	9.48	RB 557	88.0	8.09
F test				NS	Sig
SEd				22.49	2.12
CD (P=0.05)				NS	4.16
CV%				26.1	25.5

but significantly superior over the rest of the genotypes. At the end of peak infestation all these entries recorded jassid grade I with minimum damage to leaves except AKH 2017 which recorded jassid grade II. Among the sucking pests jassid causes considerable damage to plants which require frequent interventions with insecticides. The entries found promising can be utilised in cultivation for managing the pest or can be utilized as donor parent in host plant resistance breeding. The variety, RAH 216 was found highly susceptible with highest incidence (12.2 no./ 3 leaves) of jassids among all the genotypes evaluated followed by RS 2461 (9.20 no./ 3 leaves) and LRA 5166 (8.10 no./3 leaves) with jassid grade IV showing complete reddening of leaves and RSA 2495 (7.90 no./3 leaves) with jassid grade III . The rest of the entries recorded 3.4 to 7.8 no./3 leaves and recorded jassid grade II and III. The incidence of whiteflies was very low throughout the season which varied from 0.00 to 0.40 no./3 leaves and there were no significant differences among the genotypes (Table.1).

The incidence of *Heliothes armigera* larva was low during the season among all the genotypes which was observed upto 100 DAS. The per cent open boll damage due to *H.armigera* at 120 DAS during first picking on boll basis varied between 2.65 to 39.76 and on locule basis between 1.49 to 19.52 among the genotypes and the differences between the genotypes were non-significant(Table 2). Though the entries are stastically on par the variation in the damage level may be due to quantitative difference in allelochemicals or a complex effect of mix of allelochemicals or by the presence of inducible factors which was earlier reported by Kranthi *et al.,* (2001).

The incidence of pink bollworm larvae was very high in all the genotypes which ranged from 12.0 to 74.5 larvae/ 20 green bolls at 140 DAS and varied significantly among the different genotypes. The variety, H 1300 (12.0 larvae /green 20 bolls) was found promising with lowest larval number over all the genotypes followed by LC 604 (26.0 larvae/ 20 green bolls), RB 557 (27.0 larvae / 20 green bolls)

and TSH 9812 (28.0 larvae / 20 green bolls). While, the genotypes, GSHV 152 (74.5 larvae/20 green bolls) and TCH1706 (70.0 larvae /20 green bolls) were found susceptible with the highest number of pink bollworm larvae(Table.3). Damage to the bolls formed at the end of the season is high as the boll damage due to pink bollworm was recorded between 40 to 100 % among the entries with damage limited to one or more locules in each boll. The entry H 1300 showed inherent resistance to pink bollworm by recording lowest larval incidence of 12 larvae/20 bolls and 40% green boll damage. Pink bollworm is a late season pest on cotton which appears after completion of all plant protection measures and the damage is invisible. The young bolls at later stages of the crop are highly vulnerable to pink bollworm as suggested by earlier studies that 2-3 week old green bolls were favoured by pink bollworm (Singh *et al.,* 1988) and the resistant cultivars identified in the study are useful for combating this pest.

The highest number of good opened bolls/5 plants was recorded in F 2052 (111.5/5 plants) followed by NH 615 and BS 144 (108.5/ 5 plants) and the lowest was recorded in RS 2461 (46.0/5 plants) but there were no significant differences among the different genotypes. The seed cotton yield under unprotected conditions to all the pests varied from 3.16 q/ha (RS 2461) to 13.16 q/ha (GJHV 374) and 12 genotypes out of 40 genotypes are statistically on par and found superior over the rest of the entries (Table.4).The entry GJHV 374,which recorded highest yield showed resistance to jassids by registering grade II with 63 pink bollworm larvae/ 20 green bolls and 20.7% open boll damage due to *Helicoverpa.* The next best entry in terms of yield is GTHV 02/45 which recorded relative resistance to bollworms by recording 9.17% open boll damage to *Helicoverpa* and 41 pink bollworm larvae/20 green bolls but found susceptible to jassids by recording grade III. The entry H 1300 which showed resistance to pink bollworm and relative resistance to jassids with grade II registered 9.64 q/ha seed cotton yield. Among the entries which were found promising against jassids, NH 615 recorded an yield of 10.52 q/ha.

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