Developmental Breeding for Jassid tolerance in *G. hirsutum*

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Concept of Developmental Breeding

- Developmental breeding is synoymous with pre-breeding or genetic enhancement as defined by Charles Rick (1984)
- We selected resistant donors bearing the beneficial morphological features and incorporated into selective elite cultivars
- Donors used were Deltapine -66 very hairy, G-21-19-619 , sparsely hairy , REX- hairy with high hair density, CIHS-9-7- sparsely hairy

Earlier pioneering work done in Breeding for Jassid tolerance

- First mention of the occurrence of jassids was made by Lefroy(1906) and Roberts(1913)
- The first selection of cotton for resistance was made beginning 1913 against ‘red leaf blight’ thought be a disease but later on understood as injury caused by leaf hopper(Kottur,1922)
- Pioneering work was initiated in 1925 by Parnell which became the basis for evolution of jassid resistant varieties in South Africa
- The first variety U-4 was developed which occupied a major area in South Africa at that time and lower populations of leaf hoppers were observed.
- Afzal et.al. 1943 reported that the tolerance involved is independent of preference
- Afzal and Ghani (1948) reported a correlation between leaf vein toughness and hairiness; between leaf vein toughness and leaf hopper populations

Recent evidences for the existence of jassid tolerance

- Ahmed and Haq(1981) reported in a study that B 557 was resistant to jassids(maximum hair length-1506.26 microns) and maximum hair density both on mid rib(310.25/cm) and leaf lamina(166.58/9 sq mm) . It was inferred that the hair density and hair length was negatively correlated with jassid population which was in confirmity with other workers as well.
- Syed et.al.(2003) in a study of 20 varieties inferred that hair density and gossypol glands attributed to lower jassid population and relative resistance.
- Roy et.al.(2017) worked out the genetics of jassid resistance and inferred that 13: 3 (13 susceptible : 3 resistance type of plants), inhibitory of gene action dominat genes with epistasis type of gene action for resistance (a study in interspecific hybrid between *G.barbadense* and *G.hirsutum*

The mechanism of resistance

- Prof. Reginald H.Painter (1951) has given description of the basis of jassid tolerance.
- He attributed to three factors viz., Preference, Antibiosis and Tolerance.
- Preference (For oviposition, food or shelter)
- Antibiosis(Adverse effect of plant on the biology of insect)
- Tolerance (repair, recovery to withstand infestation)
- New addition-Antixenosis- repellent nature of the plants to insects (Peterson et.al.2017)

Morphological features which play role in jassid tolerance

- Leaf trichomes or hairs.
- Hair length
- Hair density
- Scoring of jassids (1-5 grade(1-highly tolerant, 2-Tolerant,3-Moderately susceptible, 4,Susceptible, 5- highly susceptible)

Evaluation of selectively identified jassid tolerant cultures (2014-15)

Sr.no.	Name of entry	Yield (kg/ha)	Boll wt(g)	Jassid injury score	Got(%)	Fibre length(mm)	Fibre strength(g/tex)	MIC value
1	SPS9-1	374	2.3	2	35	24.9	19.5	3.4
2	SPS9-2	229	2.3	2	33.2	24.9	19.7	3.9
3	SPS9-3	138	2.1	1	37.2	25	20.2	3.6
4	SPS9-4	307	2.6	1	39	25.8	20.8	3
5	SPS9-5	212	2.5	2	33.1	28.4	24.2	2.8
6	**SPS9-6**	170	3	2	34.3	**29.8**	**25.8**	**3.6**
7	**SPS9-7**	183	2.1	1	36	**30**	**23.3**	**3.7**
8	**SPS9-8**	162	2.4	1	35	**29.7**	**23**	**2.8**
9	SPS9-9	179	3.2	2	43	27	20.5	3.4
10	SPS9-10	131	2.7	1	33	27.3	22	2.9
11	SPS9-11	1076	3.1	1	42	26.9	21.4	3.7
12	SPS9-12	481	3.1	1	44	27.2	20.7	3.2
13	SPS9-13	83	1.8	1	32	26.5	19.9	3.5
14	SPS9-14	551	3.8	2	39.1	27.5	21.7	3.5
15	SPS9-15	327	3.4	1	41.2	26.2	22.3	3.8
16	SPS9-16	183	2.5	2	39.2	25.8	21.1	3.9

Evaluation of selectively identified jassid tolerant cultures (2014-15) continued

Sr.no.	Name of entry	Yield (kg/ha)	Boll wt(g)	Jassid injury score	Got(%)	Fibre length(mm)	Fibre strength (g/tex)	MIC value
17	SPS9-17	614	2.9	2	39	28	21	4.5
18	SPS9-18	433	2.5	1	36.1	27.2	21	4.5
19	**SPS9-19**	337	2.8	1	41.4	**31**	**23.8**	**3.7**
20	SPS9-20	216	2.2	2	42	26.6	20.7	3.9
21	SPS9-21	87	2.3	1	34	28	20.1	3.3
22	SPS9-22	177	2.3	1	41	29.5	22	3.4
23	SPS9-23	235	2.6	1	41.2	27.5	21.4	3.5
24	SPS9-24	144	2.8	1	39.3	26.9	21.1	3.4
25	SPS9-25	183	2.5	2	37	28.5	21.9	2.9
26	**SPS9-26**	320	2.4	1	32.3	**28.9**	**23.9**	**2.9**
27	**SPS9-27**	183	2.2	2	30.4	**29.1**	**24.5**	**2.9**
28	**SPS9-28**	340	2.8	2	33	**28.6**	**23.2**	**2.4**
29	SPS9-29	266	2.2	2	34.4	26.4	21.5	2.9
30	SPS9-30	218	2.5	2	36	27.8	21.6	2.9
31	SPS9-31	205	2.8	2	38.1	28	21.8	3
32	SPS9-32	140	2.2	2	40	25.2	19.7	3.5

Evaluation of selectively identified jassid tolerant cultures (2014-15) continued

Sr.no.	Name of entry	Yield (kg/ha)	Boll wt(g)	Jassid injury score	Got(%)	Fibre length(mm)	Fibre strength (g/tex)	MIC value
33	SPS9-33	98.156	2.8	2	41	27.8	21.2	3.5
34	**SPS9-34**	72.228	2.3	1	35	**30.6**	**21.9**	**3.4**
35	SPS9-35	133.344	3	1	41	31.7	23.2	3.2
36	SPS9-36	109.268	2.5	1	38	27.5	22.7	3.6
37	**SPS9-37**	227.796	2.2	1	35.4	**32.8**	**24.6**	**2.8**
38	SPS9-38	312.988	2.5	2	40	25.6	20.3	4.3
39	SPS9-39	261.132	3	2	39	26.3	21.6	3.4
40	SPS9-40	329.656	2.2	2	36.3	28.5	21.4	3.5
41	SPS9-41	300.024	2.2	1	37	28.5	21.2	3.7
42	SPS9-42	174.088	2.8	3	36	27.3	21.5	3.6
43	SPS9-43	281.504	2.4	2	39	26	19.7	3.8
44	**SPS9-44**	329.656	2.6	2	39	**29.2**	**22.3**	**3.5**
45	SPS9-45	338.916	2.3	2	38	27.9	21.3	3.7
46	SPS9-46	155.568	2.7	1	41	26.6	22.2	3
47	**SPS9-47**	146.308	2.1	2	39	**29.2**	**22.5**	**3.5**
48	**Suraj (check)**	787.1	3	3	43	**30.4**	**24.7**	**3.3**

Evaluation of selectively identified jassid tolerant cultures (2015-16)

Sr.no.	Name of entry	Yield (kg/ha)	Boll wt(g)	Jassid injury score	Got(%)	Fibre length(mm)	Fibre strength (g/tex)	MIC value
1	SPS9-1	153	2	2	27.44			
2	SPS9-2	334	2.9	2	25.68	22.7	23	3.3
3	**SPS9-3**	**965**	3	1	34.12	24.9	24.5	3.4
4	SPS9-4	365	2.7	1	37.03	24.9	23.7	4.5
5	SPS9-5	605	2.9	2	31.77	26.8	25.9	2.5
6	**SPS9-6**	**826**	2.8	2	35.21	26.4	26.7	2.4
7	**SPS9-7**	**1109**	2.3	1	35.97	26.8	26.3	2.6
8	SPS9-8	744	2.3	1	36.82	26.3	24.7	2.7
9	SPS9-9	922	1.9	2	35.26	25.2	23.3	3.5
10	SPS9-10	713	2.1	1	35.57	23.7	23.8	2.9
11	**SPS9-11**	**1447**	3.1	1	35.73	25.8	25.1	2.9
12	SPS9-12	878	3	1	37.62	25.5	25.4	3.1
13	SPS9-13	514	2.5	1	35.94	25.3	24.4	2.2
14	SPS9-14	680	2.2	1	37.96	24.6	24.3	3.1
15	SPS9-15	904	2.5	1	35.65	22.3	23.7	3.4
16	SPS9-16	665	2.5	2	34.37	23.8	24.4	3.2

Evaluation of selectively identified jassid tolerant cultures (2015-16) continued

Sr.no.	Name of entry	Yield (kg/ha)	Boll wt(g)	Jassid injury score	Got(%)	Fibre length(mm)	Fibre strength (g/tex)	MIC value
17	**SPS9-17**	**1421**	2.1	2	31.94	25.3	24.3	4.5
18	SPS9-18	676	2.4	1	38.36	25	24.2	3.5
19	SPS9-19	827	2.7	1	36.66	27.2	24.3	3.02
20	SPS9-20	520	2.9	2	37.87	23.8	24.8	3.5
21	SPS9-21	412	2.6	1	32.21	25.6	24.7	2.9
22	SPS9-22	778	2.4	1	37.82	24.6	24	2.3
23	SPS9-23	975	2.9	1	35.69	23.7	23.9	3.6
24	SPS9-24	728	2.9	1	36.1	27.5	25.3	3.4
25	SPS9-25	811	3.2	2	37	26	25.2	3.07
26	SPS9-26	813	2.7	1	36.83	26.7	25.4	2.6
27	**SPS9-27**	**1136**	2.9	2	36.88	25.4	24.6	3.2
28	**SPS9-28**	**1235**	2.5	2	36.97	24.8	24.9	3.2
29	SPS9-29	873	2.1	2	37.05	27	25.3	2.5
30	SPS9-30	768	1.8	2	34.73	24.6	24.3	2.7
31	SPS9-31	939	2.1	2	37.09	26.6	24.9	2.1
32	SPS9-32	595	2.8	2	36.22	24.2	24.5	2.7

Evaluation of selectively identified jassid tolerant cultures (2015-16) continued

Sr.no.	Name of entry	Yield (kg/ha)	Boll wt(g)	Jassid injury score	Got(%)	Fibre length(mm)	Fibre strength (g/tex)	MIC value
33	**SPS9-33**	**971.75**	2.4	2	35.55	25.7	25.1	3.04
34	SPS9-34	670.8	3.2	1	35.18	26.7	24.7	3.06
35	SPS9-35	485.7	2.3	1	32.76	29.1	25.2	3.02
36	SPS9-36	676.16	2.9	1	35.78	25.3	24.4	2.9
37	SPS9-37	582.23	3	1	30.97	27	25.9	2.6
38	SPS9-38	786.3	2.8	1	39.06	24.6	24.5	3.6
39	**SPS9-39**	**1187**	2.7	2	31.59	27.3	25.8	2.9
40	SPS9-40	629.52	2.6	2	36.73	23.6	24.1	3.5
41	**SPS9-41**	**1115**	3	1	34.67	24.4	25.02	3.08
42	SPS9-42	829	2.3	2	35.13	26.6	24.7	3.2
43	SPS9-43	649	2.3	2	37.77	23.4	24.1	4.1
44	**SPS9-44**	**1273**	2.7	2	36.85	25.7	24.7	3.5
45	SPS9-45	881	2.9	2	33.39	28.5	26.8	2.8
46	SPS9-46	829	3.1	2	34.05	26.2	25.2	2.7
47	**SPS9-47**	**1003**	3.1	2	34.59	26.4	25.1	3.9
48	**Suraj (check)**	**1220**	2.3	3	36.42			

Table 3. Evaluation of Jassid tolerant cultures (2016-17)

								ICC mode		
Sr.No	**Culture name**	Boll wt(g)	**Boll n0/plant)**	Yield/ha(kg)	Jassid grade(score-1-4)	**GOT (%)**	**Seed index**	**Fibre Length (mm)**	**Fibre Strength (g/tex)**	**Micronaire**
1	**CNH-2053**	3.5	30.0	**3148**	1	35.0	6.9			
2	CNH-2054	3.3	37	1944	1	34.4	7.7			
3	CNH-2049	3.1	28	2870	1	33.7	8.3	**30.0**	23.3	3.7
4	CNH-2055	4.6	25	2037	1	35.8	7.7	27.0	20.5	3.4
5	CNH-2056	4.2	40	2592	1	34.6	8.5	26.9	21.4	3.7
6	CNH-2057	3.7	26	2592	1	35.0	7.0	26.2	22.3	3.8
7	CNH-2058	4.4	31	2592	1	36.5	7.6	26.6	20.7	3.9
8	CNH-2059	2.8	31	2222	1	32.6	8.5	28.9	23.9	3.1
9	CNH-2060	3.1	28	2685	1	33.8	8.2	29.1	24.5	2.9
10	CNH-2061	3.2	28	2500	1	33.6	7.6	28.6	23.2	2.4
11	CNH-2062	4.2	33	2407	1	33.2	8.6	31.7	23.2	3.2
12	CNH-2063	4.4	25	2870	1	35.8	9.6	27.5	22.7	3.6
13	**CNH-2064**	3.2	29	2870	1	32.8	8.9	**32.8**	**24.6**	2.8
14	CNH-2065	3.1	33	2500	1	34.1	8.4	26.3	21.6	3.4
15	CNH-2066	3.2	38	2685	1	37.0	8.1	26.0	19.7	3.8
16	**CNH-2067**	3.8	31	**3055**	1	32.8	9.3	29.2	22.3	3.5
17	CNH-2068	3.4	39	2870	1	35.6	7.6	29.6	22.6	3.4
18	CNH-2069	3.0	32	2685	1	35.2	7.9	28.7	21.5	3.5
19	**CNH-2052**	3.3	32	2500	1	32.5	8.8	**32.1**	**25.4**	3.7
20	**Suraj**	4.4	31	2222	2	36.2	8.7	30.4	24.7	3.3
21	NH-615	3.9	33	2222	1	33.7	9.5	30.6	22.4	4.1
22	LRA-5166	4.9	26	2500	2	32.8	8.4			
S.Ed.		238.25								
C.D.(0.05)		700.82								
C.V.		13.36								

Managing pest –predator complex

- Populations of lady bird beetles were seen to frequent cotton plants
- The crop was not sprayed for a decade for sucking pests since 2007
- Hence natural in-built resistance could be witnessed which aided in rigorous selections for tolerance.

Cultures identified for various traits with jassid tolerance

- Cultures identified for productivity viz., CNH 2053(3158 kg/ha) and CNH- 2067(3055 kg/ha)
- Cultures identified for boll wt viz., (CNH-2055(4.6 g) and CNH- 2063(4.4 g)
- Cultures identified for fibre quality viz., CNH-2064 (fibre length- 32.8 mm, fibre strength- 24.6 g/tex(ICC mode) and CNH- 2052 (fibre length-32.1 mm and fibre strength- 25.7 g/tex)

Conclusions

- Cultures with tolerance to jassids with enhanced productivity has been developed
- Cultures with tolerance to jassids with superior fibre quality has been derived
- Tolerance cultures exhibited variation in productivity and fibre quality
- Tolerant cultures were both hairy and sparsely hairy

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