VARIETAL RESISTANCE AGAINST JASSID, *AMRASCA DEVASTANS* DIST. IN COTTON AND ROLE OF ABIOTIC FACTORS IN POPULATION FLUCTUATION

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ABSTRACT

Seven genotypes of cotton viz. BH-124, BH-121, BH-125, BH-147, SLH-257, SLH-244 and NIAB-98 were studied for resistance/susceptibility against jassid (*Amrasca devastans* Dist.) during 2002. BH-125 showed maximum population of jassid nymph (1.05/leaf), while SLH-257 appeared as resistant (0.63/leaf), Maximum jassid adult was recorded on BH-121 (0.17/leaf), and minimum on NIAB-98 (0.04/leaf). Maximum temperature exerted significant and negative effect on jassid nymph in case of SLH-257. Minimum and average temperatures and relative humidity showed positive and significant correlation with jassid adult with r-values of 0.592, 0.532 and 0.581, respectively in case of NIAB-98.

The effect of average temperature and rainfall was also significant and positive on jassid adult for BH-121 and SLH-257, respectively. All the abiotic factors when computed together exerted 18.7 and 6.4 percent role in population fluctuation of jassid nymph and adult, respectively.

KEYWORDS: *Gossypium hirsutum;* genotypes; Amrasca; pest resistance; Pakistan.

INTRODUCTION

Among various sucking insects of cotton jassid (*Amrasca devastans* Dist.), commonly known as leaf hopper, is important. Afzal and Ghani (1) and Ahmed and Haq (2) reported the retardation in plant growth, deterioration of lint quality as well as loss of cotton yield in non-hairy susceptible cotton varieties due to jassid alone.

Anonymous (4) reported that jassid population was significantly less in the second and third week of July which increased gradually later on and reached its peak in the third week of August. Anonymous (6) studied 16

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varieties of cotton for resistance against Jassid. Its population remained below ETL on all genotypes. Maximum population was observed on BH-36 (0.83/leaf) and minimum on CIM-446 (0.41/leaf).

Anonymous (7) reported that out of 12 cotton varieties genotype 642/98 and MNH-552 were the most susceptible to jassid, while BH-125 had minimum susceptibility.

The present study was undertaken to determine the comparative resistance/susceptibility in seven genotypes of cotton against jassid and also to find the role of abiotic factors in population fluctuation of the pest.

MATERIALS AND METHODS

Seven genotypes of cotton viz. BH-121, BH-124, BH-125, BH-147, SLH-244, SLH-257 and NIAB-98 were sown in the research area of Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad under RCBD replicated thrice on May 28, 2002. The plot size was 3.85 × 8.87 meter. Plant to plant distance was maintained as 23 cm and row-to-row 0.7 meter. The data on jassid population were recorded from 30th June to 13th October at weekly interval from 15 randomly selected plants, from each plot in such a way that one leaf from upper portion of plant, 2nd leaf from middle portion of second plant and 3rd from the bottom portion of third plant was sampled and so on.

Data were analyzed statistically and means were compared by Duncan's multiple range test (P = 0.05). Simple correlation was worked out between population of insect pest (jassid nymph and adult) and weather factors (maximum, minimum and average temperature, relative humidity and rainfall). The impact of weather factors on insect pest population fluctuation was determined through multiple linear regression models.

RESULTS AND DISCUSSION

The results (Table 1) revealed highly significant varietal difference regarding population of jassid nymphs. BH-125 was found as the most susceptible (1.05/leaf) while SLH-257 the resistant (0.63/leaf). These results contradict to the findings of earlier workers (5, 7) who reported that BH-124 and BH-125 were resistant. These findings also do not agree to some others (6) due to differences in their materials and methods.

The results (Table 2) further reveal that genotypes differed significantly

regarding jassid adult population. BH-121 was found as the most susceptible (0.17/leaf) while NIAB-98 appeared comparatively to be resistant (0.04/leaf). These results disagree to some previous studies (5, 6, 7) due to differences in their materials.

BH- 121 showed maximum peak during 4th week of July whereas, NIAB- 98 showed maximum population of Jassid nymphs on 13-10-2002. The second peak was observed on 1-9-2002 and third peak on 9-10-2002. The trend in population fluctuation to the year was almost similar recorded on other varieties during year 2000 with some exception. For example BH-121 showed maximum population on 28-2-2002.

The population of jassid nymph on subsequent dates was low on some varieties. This variation might be due to low succulence in varieties.

The data (Table 1) also indicated that population of jassid nymph started to build up in the 4th week of June and increased gradually reaching to maximum level in 4th week of July. Second peak of population was observed in 1st week of September. The population again showed a downfall thereafter and in October rising trend was observed. The 3rd peak was recorded in 2nd week of October. Thus three peaks were observed in whole season and higher population was observed in last week of July. These results partially coincide with those of Yunus *et al.* (14) and Sattar and Khan (12) who recorded three peaks and last peak was observed in September. However, results do not agree to the study of Anonymous (5) who observed low population in July, and higher in August. The differene in results may be due to different genotypes and ecological conditions.

BH-121 showed maximum population during third week of July while BH-125 on 1-9-2002, NIAB-98 possessed very low adult population of jassid throughout the crop season.

The results (Table 2) further reveal that population of jassid adult appeared in 4th week of June, which increased gradually and reached its maximum in 3rd week of July. Afterwards it decreased down to zero during 2nd week of August. It again started to increase and reached upto 0.13 per leaf in first week of September. The population decreased down thereafter in the start of 3rd week of September. Third peak was observed in the end of third week of September and again decreased during the subsequent weeks. So there were three peaks in the season. Third week of July was the most favourable

Table 1. Jassid nymph population per leaf recorded on various cotton genotypes at different dates during 2002.

Varieties	30/6	7/7	14/7	21/7	28/7	4/8	11/8	18/8	25/8	1/9	8/9	15/9	22/9	29/9	9/10	13/10	Mean
BH -124	0.37	1.13	0.22	1.02	2.73	0.57	0.15	0.28	0.55	0.64	0.13	0.26	0.12	0.5	0.63	1.03	0.67c
BH -121	0.78	1.55	0.80	2.27	3.3	0.8	0.09	0.49	0.97	1.2	0.13	0.28	0.3	0.85	0.97	0.69	0.96ab
BH -125	0.37	1.2	0.69	2.64	1.92	1.43	0.2	0.11	0.97	1.2	0.55	0.35	0.4	0.5	1.53	2.2	1.05a
BH -147	0.09	0.8	0.33	1.37	1.67	1.27	0.23	0.57	0.73	0.82	0.17	0.11	0.29	0.6	1.3	2.6	0.82abc
SLH -257	0.24	0.58	0.20	1.31	1.87	0.97	0.13	0.09	0.37	0.47	0	0.21	0.22	0.37	1.19	1.67	0.63c
SLH -244	0.37	0.51	0.13	1.92	2.03	0.8	0.11	0.04	0.40	0.70	0.04	0.06	0.17	0.33	0.85	1.83	0.65c
NIAB-98	0.33	0.45	0.04	0.71	1.37	1.2	0.06	0.09	0.37	2.42	0.13	0.15	0.15	0.29	1.42	3.7	0.72bc
Means	0.35f	0.89de	0.32f	1.59bc	2.13bc	1.00d	0.14f	0.22f	0.57ef	1.26cd	0.15f	0.18f	0.23f	0.49f	1.13d	1.96ab	

Table 2. Jassid adult population per leaf recorded on various genotypes of cotton at different dates during 2002.

Varieties	30/6	7/7	14/7	21/7	28/7	4/8	11/8	18/8	25/8	1/9	8/9	15/9	22/9	29/9	9/10	13/10	Means
BH -124	0.04	0.13	0.18	0.62	0.41	0.07	0	0.09	0.11	0.11	0.09	0	0.15	0.13	0.03	0	0.13 a
BH -121	0.11	0.42	0.26	0.86	0.45	0.28	0	0	0.07	0.11	0.07	0.02	0.02	0.12	0.02	0	0.17a
BH -125	0.09	0.26	0.15	0.53	0.15	0.13	0	0.04	0.15	0.24	0.15	0.07	0.22	0.1	0	0	0.14a
BH -147	0.07	0.02	0.11	0.15	0.2	0.22	0	0.09	0.11	0.21	0.07	0.02	0.35	0.15	0.12	0	0.15a
SLH - 257	0	0.24	0.06	0.20	0.1	0.02	0	0.09	0.02	0.08	0	0	0.07	0.03	0	0	0.05b
SLH -244	0.08	0.20	0.06	0.22	0.15	0.25	0	0.04	0.04	0.11	0.06	0	0.07	0.07	0	0	0.09ab
NIAB-98	0.02	0.04	0.11	0.04	0.09	0.04	0	0.04	0.06	0.09	0	0	0.02	0	0.03	0	0.04 b
Means	0.05d	0.20bc	0.11bcd	0.34a	0.22b	0.20bc	0d	0.07cd	0.08cd	0.13bcd	0.06d	0.02d	0.13bcd	0.09cd	0.03d	0d	

Mean sharing similar letters do not differ significantly at (P=0.05)

period with maximum population of jassid adult. These results are in confirmity with those of Sattar and Khan (12) who reported higher peak of jassid population in August. The present findings cannot be compared with those of Anonymous (4) who reported significantly less population in second and third week of July and gradually increased reaching to its maximum in 3rd week of August.

Maximum temperature affected jassid nymph negatively for all genotypes. However, effect of these temperatures was significant on SLH-257. Minimum temperature was correlated positively with all genotypes except BH-125, SLH-244 and SLH-257 where effect was non–significant. Average temperature had a negative impact on population of jassid nymph except BH-121, BH-124, NIAB-98 and BH-147, which had positive behaviour. The present findings are in partial conformity with those of Bishoni *et al.* (8) and Wahla *et al.* (13). The response of relative humidity was positively correlated with all genotypes except NIAB-98 and SLH-244 but effect was non-significant on all genotypes.

The effect of rainfall was positive on all genotypes except SLH-244, BH-125, SLH-257 and NIAB-98 and the correlation was non-significant (Table 3). These results agree to those of Riaz *et al.* (10) and Salim (11).

Table 3. Correlation coefficient values between jassid nymph population and various weather factors.

Varieties	Temperature ^{0}C			Relative humidity (%)	Rainfall (mm)
	Maximum	Minimum	Average		
BH-124	-0.44	0.193	0.437	0.277	0.060
BH-121	-0.004	0.237	0.267	0.177	0.216
BH-147	-0.428	0.088	0.183	0.102	0.079
BH-125	-0.428	-0.360	-0.081	0.042	-0.416
SLH-257	-0.652**	-0.080	0.174	0.010	-0.263
SLH-244	-0.367	-0.173	-0.020	-0.084	-0.228
NIAB-98	-0.189	0.021	0.036	-0.181	-0.007

** Highly Significant ($P \leq 0.01$)

The data also revealed positive effect of maximum, minimum and average temperatures on population of jassid adult for all genotypes except BH-125 and SLH-244 (Table 4). The correlation between jassid adult and minimum temperature was highly significant. These findings are in conformity with those of Ali *et al.* (3), and Wahla *et al.* (13).

The effect of relative humidity was also positive and non-significant for all the genotypes except BH-125. However, effect of relative humidity affected jassid

population highly significantly in case of NIAB-98. The present results do not agree to some earlier findings (2, 12) which report negative correlation. This negative correlation may be due to variation of genotypes or weather conditions. The correlation effect of rainfall was positive for all genotypes except BH-125 and SLH-244. Effect of rainfall on jassid nymph was negative and significant for genotype SLH-257. This positive has also been reported by Riaz *et al.* (10) and Salim (11).

Table 4. Correlation coefficient values between jassid adult population and various weather factors.

Varieties	Temperature °C			Relative humidity (%)	Rainfall (mm)
	Maximum	Minimum	Average		
BH-124	0.164	0.269	0.293	0.300	0.250
BH-121	0.127	0.388	0.777**	0.393	0.377
BH-147	0.204	0.336	0.364	0.245	0.225
BH-125	-0.355	-0.283	-0.349	-0.261	-0.176
SLH-257	0.163	0.374	0.370	0.393	0.647**
SLH-244	-0.003	0.270	0.238	0.141	-0.005
NIAB-98	0.257	0.592**	0.532*	0.581**	0.349

*Significant (P = 0.05), **Highly Significant (P = 0.01)

It was also found (Table 5, 6) that weather factors did not have significant influence on population fluctuation of jassid nymph and adult ($100R^2$ values 18.7 for jassid nymph and 6.4 for adult).

Table 5. Regression equations for jassid nymph.

Regression equation	R^2	$100R^2$
Y1 = 8.264378–1.1890X1	0.082	8.2
Y1 = 9.199766–1.5535X1+0.24976X2	0.108	10.8
Y1 = 7.719738–1.1864X1–0.11259X2+0.13838X3	0.122	12.2
Y1 = 7.109859–1.0741X1–0.19133X2+0.18241X3–0.0087411X4	0.124	12.4
Y1 = 6.12278–4.6070X1–3.1285X2+0.15611X3+0.005822X4+6.7058X5	0.187	18.7

Y1= Population of jassid nymphs per leaf X1 = Maximum temperature, X2 = Minimum temperature, X3 = Relative humidity, X4 = Rainfall, X5 = Average temperature,

Table 6. Regression equations for jassid adult

Regression equation	R^2	Variance %
Y2 = 0.8164623-0.0052057X1	0.00	0.0
Y2 = 1.127287-0.12635X1+0.08299X2	0.027	2.7
Y2 = 1.315105-0.17295X1+0.12898X2-0.06325X3X3	0.029	2.9
Y2 = 10948046-0.28941X1+0.21069X2-0.069X2-0.06325X3+0.0090716X4	0.046	4.6
Y2 = 1.948046-0.28941X1+0.21069X2-0.06325X3+0.011593X4+101611X5	0.064	6.4

Y2 = Population of jassid adult per leaf, X1 = Maximum temperature, X2 = Minimum temperature, X3 = Relative humidity, R2 = Coefficient of determination,

REFERENCES

1. Afzal, M. and M. A. Ghani. 1953. Cotton jassid (*E. devastans*) in Punjab. V. A note on the characters of the plant associated with jassid resistance. Indian J. Entomol. (1-2):41-51.
2. Ahmed, A. and A. Haq. 1982. Relative susceptibility of some cotton cultivars to Insect pest. J. Res. Univ. Agric., Faisalabad, 4(2): 141-147 [Rev. Appl. Entomol. (A), 76(4): 226,1988].
3. Ali, M, M.A. Bhatti and K.J. Ahmed. 1993. Role of weather in fluctuating the population of *Amrasca devastans* (Dist.) and *Thrips tabaci* (bind.). Proc. Pak. Cong. Zool. 13:133-139.
4. Anon. 1998-99. Screening of some cotton varieties against sucking insect pests complex. Annual Report, Entomol. Sec., AARI. Faisalabad. p. 19-20.
5. Anon. 1999-2000. Varietal resistance of cotton against insect pest attack. Annual Report. Entomol. Sec., AARI, Faisalabad. p. 6,7.
6. Anon. 2000-2001. Varietal resistance against insect pest complex in cotton. Annual Report, Entomol. Sec., AARI, Faisalabad. p.10.
7. Anon 2001-2002. Varietal susceptibility against Insect pest complex of cotton and virus Incidence. Annual Report. Entomol. Sec., AARI, Faisalabad.
8. Bishoni, O.P., M. Singh, V.Y.M. Rao, R. Niwas and P.D. Sharma. 1996. Population dynamics of cotton pests in relation to weather parameters. Indian J. Entomol.58(2):103-107.
9. Bhatti. M., S.A.S. Hussain and M. Rao. 1986. Morpho- physical factors affecting resistance in genotypes of cotton against sucking insects pests. Haryana. Agric. Univ. Res. J. 16(1) : 291-294.
10. Riaz, M., M.A. Chaudhry, A. Ali and L. Khan. 1987. Physio -chemical aspects of resistance in cotton to insect pests complex. Sarhad. J. Agric. 3(4):491-497.
11. Salim, M. 1998. Varietal resistance of different cultivars of cotton against insect pest complex. M.Sc. Thesis, Deptt. Agric. Entomol., Univ. Agric., Faisalabad, Pakistan.
12. Sattar, A. and M. R. Khan. 1976. Some studies on the population dynamics of major pests of cotton at Faisalabad. Pak. J. Agri. Sci., 13(2): 245-248.
13 Wahla, M.A., M.J. Arif and M. Afzal. 1696. The impact of physical factors on the population dynamics of sucking insect pests of FH-87, cotton. Pak. Entomol. 18 (1-2): 81-83.
14. Yunus, M., M. Yousaf and G. Jalani. 1975. Insect and spider mite pest of cotton in Pakistan. Annual Report, PL-480., Entomol. Deptt., Univ. Agric., Faisalabad.