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VARIETAL PERFORMANCE AND CHEMICAL CONTROL USED AS TACTICS AGAINST SUCKING INSECT PESTS OF COTTON

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ABSTRACT

Cotton Varietal screening test and Chemical control trials were conducted at Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan. The experiments were laid out in Randomized Complete Block Design (RCBD) during 2008, with three replications to decipher the comparative resistance of nine varieties of cotton viz. CRIS-125, CRIS-9, B.T, CIM-506, DNH-105, CIM-554, BH-167, GOMAL-93 and DNH-57 and comparative efficacy of Acetamiprid 20 SP, Imidacloprid 25% WP, Bifenthrin 10 EC, Cypermethrin 10 EC, Triazophos 40 EC, Lambda Cyhalothrin 2.5EC, Rani 20SL against sucking insect pests (whitefly, Jassid and Thrips) of cotton. Among all the tested varieties DNH-105 and CIM-506 were found relatively resistant to sucking insect pest as they showed least infestation and higher seed cotton yield. Other agronomic traits studied were also better in these varieties. Among insecticides, Rani 20 SL and Acetamiprid 20 SP were more effective against the sucking insect pests and in increasing seed cotton yield as compared to the other tested insecticides.

Key Words: **Chemical control, whiteflies, jassid, thrips, cotton varieties, insecticides.**

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INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is an important cash crop of Pakistan; contributing about 11.7% of value added in agriculture and about 2.9 percent of GDP (Anonymous, 2003). It also contributes 69.5 % share in national oil production (Awan, 1994). In Pakistan about 145 species of cotton pests are recorded (Bo, 1992). Among these, jassid, *Amrasca devastans* (Dist.), whitefly, *Bemisia tabaci* (Genn.) and thrips, *Thrips tabaci* (Lind.) are very serious. Jassid causes 18.78 percent reduction in cotton yield (Ali, 1992). Whitefly causes great damage indirectly to cotton by secreting honeydew and transmitting viral diseases (Khan *et al.* 1995). These insects inflict heavy losses to the cotton crop from seedling stage to the harvesting stage and reducing its yield and quality (Amer *et al.* 1999).

Pakistan ranks 4th as a grower and 3rd as an exporter of raw cotton in the World (Ahmad, 1999), but still lint yield is very low as compared to other countries. Among other factors contributing to the low yield, insect pests are the major ones, as different pests cause 20-40% loss to cotton in Pakistan (Ahmad, 1999). So it is very important to overcome the incidence of insect pests attack in order to fulfill the food and clothing requirements of the country. One of the most promising way to increase cotton production is to grow insect resistant varieties, which is most effective, economical, and environment friendly tactics (Pedigo, 1989). In some studies (Hassan *et al.* 2000; Raza and Afzal, 2000; Anonymous, 2002-2003) different genotypes of cotton were tested for resistance against insect pests. The hair density and gossypol glands in cotton had shown a significant resistance against cotton insect pest complex (Ali *et al.* 1999). Mumtaz *et al.* (1997) found that among seven genotypes of cotton viz. S-12, NIAB-86, NIAB-78, CIM-240, NIAB-26, NIAB-26B and Karishma, NIAB-78 was preferred by maximum and NIAB-26 was less preferred by whitefly population. Wahla *et al. (*1998) stated that cultivar LDS-170 of cotton showed more resistance to the insect-pest complex in general, whereas Ravi was the most resistant to jassid and whitefly specifically. Shad *et al.* (2001) observed population of sucking insect pests on four cotton varieties viz. Karishma, CIM-443, CIM-448, BH-136 and BH-634 and reported that CIM-443 was the most susceptible to thrips (20.24/leaf), resistant to jassid (0.74/leaf) and BH-136 had higher whitefly attack (12.39/leaf). According to Sial *et al.* (2003) genotype, FH-925 showed significant resistance to whitefly attack while NIAB-Karishma was found highly susceptible to whitefly. Ahmad *et al.* (2004) observed that out of eighteen cotton cultivars, CRIS-82 and MNH-536 were found susceptible, while CRIS-467 and CRIS-134 were noted resistant to *A. devastans*. The cultivars having higher density were found resistant and cultivars having lower hair density were susceptible to jassid. Hair length had no significant effect on the population of jassid.

The other most effective method in managing cotton insect pests is chemical control, but should only be used as last resort (Korejo *et al.*, 2000). Pesticides are to be used judiciously in combination with proper spray technology. Economic threshold levels have been recommended to reduce pesticide loads (Bakhetia *et al.*, 1996). About 50% of the present cotton yields in world are attributable to the use of agrochemicals (ICAC, 1998). The most effective insecticides for control of jassid were Confidor and Mospilan, while Advantage was found ineffective against jassid population, Mospilan and Actara were effective against whitefly and Mospilan, Confidor and Tamaron were recorded highly effective against thrips (Aslam *et al.* 2004). Tayyib *et al.* (2005) obtained lowest populations of 2.54 jassids, 1.79 whiteflies, 4.16 thrips and 7.00 mites per leaf with application of Novastar, which was non-significantly different from Confidor in suppressing insect pests' population.

The present study was undertaken with objectives to manage sucking insect pests population of cotton by growing relative by resistant its varieties and to figure out the efficacy of different insecticides against sucking insect pest complex in separate experiments.

MATERIALS AND METHODS

Two separate research trials were conducted at the experimental farm of Faculty of Agriculture, Gomal University, Dera Ismail Khan during cotton growing season 2008. Each experiment is detailed as under:

Relative Resistance of Cotton Varieties against Sucking Insect Pests

An experiment was conducted in Randamized Complete Block Design (RCBD) at the Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan to observe the comparative resistance of nine cotton varieties viz. CRIS-125, CRIS-9, B.T, CIM-506, DNH-105, CIM-554, BH-167, GOMAL-93 and DNH-57against sucking insect pests (whitefly, Jassid and Thrips). Each variety was replicated three times. Seeds of these varieties were obtained from Agricultural Research Institute, Ratta Kulachi, Dera Ismail Khan and sown by dibbling method on 2X3 m^2 plot size. Plant to plant and row-to-row distance was kept 30 and 70cm, respectively. Similar cultural practices were adopted for all treatments as and when needed.

Data were recorded on weekly basis (from 23rd June to 30th September, 2008).early in the morning by counting No. of whiteflies, jassids and thrips with the help of magnifying glass from six randomly selected leaves from six plants, in such a way that one leaf from the upper portion of the one plant, 2nd leaf from the middle portion of the 2nd plant and 3rd leaf from the lower portion of the 3rd plant and so on.

Efficacy of different Insecticides against Cotton Sucking Insect Pest Complex

The experiment was laid out in a Randomized Complete Block Design at the farm area of the Faculty of Agriculture, Gomal University, Dera Ismail Khan to check the efficacy of eight insecticides against sucking insect pests (Jassid, Thrips and whitefly. The treatments included Acetamiprid 20 SP, Imidacloprid 25% WP, @ 615g, Bifenthrin 10 EC, 625ml, Cypermethrin 10 EC, @625ml, Triazophos 40 EC, @ 2 l, Lambda Cyhalothrin 2.5EC, @825 ml, Rani 20SL @312 ml ha^{-1} and untreated Control. Each treatment was replicated three times. Seed of cotton variety CIM-506 was obtained from Agricultural Research Institute, Ratta Kulachi, Dera Ismail Khan and sown during cotton season 2008 by dibbling method. The plot size maintained for each treatment was 2X3 m^2. Plant to plant and row to row distance was kept 30 and 70cm, respectively. Similar cultural practices were given uniformly to all treatments from seedling to harvesting.

Recommended doses of insecticides were sprayed with hand operated knapsack sprayer. The data of jassids, thrips and whitefly population were recorded after one, two, three days and one week of the treatment in the same way as described in the above experiment.

At the end of both experiments, all the recorded data were averaged to aggregate means and subjected to ANOVA technique and LSD test by using MSTATC computer software package (Bricker, 1991).

RESULTS AND DISCUSSION

Cotton Varieties Performance against Sucking Insect Pests

Each tested cotton variety was evaluated for its resistance against sucking insect pest complex (White fly, jassid and thrips) simply on the basis per leaf population of each species. The species wise data are presented as under:

Cotton Whitefly

The population of whitefly starts from the end of June and remains active upto mid September. None of the variety was free from the whitefly however, maximum population of whitefly (2.80 $leaf^{-1}$) was found on BH-167 (Table I). Although, this variety had maximum number of whiteflies, yet it was statistically similar to B.T (2.78 $leaf^{-1}$), CIM-554 (2.74 $leaf^{-1}$) and CRIS-9 (2.72 $leaf^{-1}$). The least number of whiteflies per leaf were found on DNH-105 (1.78) followed by GOMAL-93 with 2.09 whiteflies $leaf^{-1}$ and found relatively resistant as compared to the other varieties tested. Overall results showed that per leaf population of whiteflies found on CRIS-125, CRIS-9, B.T, CIM-506, CIM-554 and DNH-57 was not significantly different to one another. These findings are in a great analogy with the work of Mumtaz *et al.* (1997), who identified NIAB-26 as the most resistant among the seven varieties tested against whitefly. Wahla *et al.* (1998) also found a variable tolerance among the tested genotypes to whitefly.

Table-I *Comparative resistance levels of some cotton varieties against whitefly, jassid and thrips*

Varieties	Whitefly	Jassid	Thrips
CRIS-125	2.51 ab	1.06 c	6.79 cd
CRIS-9	2.72 ab	1.04 c	7.81 bcd
B.T.	2.78 a	1.06 c	8.44 bc
CIM-506	2.46 ab	0.99 c	8.08 bcd
DNH-105	1.78 c	0.67 d	3.97 e
CIM-554	2.74 ab	1.36 ab	9.29 b
BH-167	2.80 a	1.41 a	11.72 a
GOMAL-93	2.09 bc	1.13 bc	7.85 bcd
DNH-57	2.44 abc	1.36 ab	6.39 d
LSD Value	0.6631	0.2566	1.996

Means followed by common letters in the respective category are not significantly different from each other by LSD at $\alpha = 0.05$.

Cotton Jassid

It is further evident from data Table I that DNH-105 was found relatively resistant to jassids among the varieties tested, as it showed least number of jassids per leaf (0.67) followed by CIM-506 with 0.99 leaf^{-1} jassids. While BH-167 was found to be the most susceptible as it showed maximum jassids per leaf (1.41), however it was statistically at par with CIM-554 and DNH-57 heaving 1.36 leaf^{-1} jassids each. Overall results showed that CRIS-125, CRIS-9, B.T, CIM-506 and GOMAL-93 were found statistically similar for jassids per leaf. Wahla *et al.* (1997) and Shad *et al.* (2001) also observed a variability among the tested cultivars for their resistance to jassid population.

Cotton Thrips

The results (Table I) revealed that among the tested varieties of cotton DNH-105 showed not only resistance to whitefly and jassid but also to thrips as well. It showed least number of thrips (3.97 leaf^{-1}) followed by DNH-57 with 6.39 leaf^{-1} thrips. Similarly maximum number of thrips per leaf was found on BH-167 (11.72) followed but significantly different to CIM-554 (9.29 thrips leaf^{-1}). Per leaf thrips on CIM-554, B.T, CIM-506, GOMAL-93 and CRIS-9 were not significantly different to one another, whereas CIM-506, GOMAL-93, CRIS-9, CRIS-125 and DNH-57 were also found statistically similar for leaf thrips (Table I). These inferences are corroborated with the previous work of Pedigo (1989), Ali *et al.* (1999) and Hassan *et al.* (2000).

Plant Height

The data (Table II) showed that DNH-105 showed comparatively more mean plant height (127.8 cm), followed by GOMAL-93 (125.7cm), BH-167 (121.5cm), DNH-57 (116.1 cm), CIM-554 (113.3cm), B.T (106.6 cm) and CIM-506 (106.5cm). GOMAL-93 (125.7cm), BH-167 (121.5cm), DNH-57 (116.1 cm), CIM-554 (113.3cm), B.T (106.6 cm) and CIM-506 (106.5cm) were found non-significantly different from one an other for plant height .Among all the tested varieties, least plant height was found in CRIS-125 (88.73 cm) which was significantly different from DNH-105.

Table-II *Performance of tested varieties of cotton for agronomic characters and seed cotton yield*

Varieties	Plant Height	No. of Main Branches	No. of Sub Branches	No. of Bolls plant^{-1}	Seed Cotton Yield (kg ha^{-1})
CRIS-125	88.73 c	10.73 bc	11.67 b	13.00 c	1156 c
CRIS-9	103.4 bc	12.87 abc	15.67 b	15.47 c	822.2 d
B.T	106.6 abc	12.67 abc	9.467 b	22.80 c	1133 c
CIM-506	106.5 abc	14.60 ab	17.73 ab	50.23 b	1644 ab
DNH-105	127.8 a	16.00 a	25.27 a	76.80 a	1889 a
CIM-554	113.3 ab	12.40 abc	14.07 b	18.53 c	1133 c
BH-167	121.5 ab	10.33 c	16.20 b	24.00 c	1333 c
GOMAL-93	125.7 ab	11.60 bc	16.40 b	20.13 c	1400 bc
DNH-57	116.1 ab	13.07 abc	16.97 ab	45.50 b	1622 ab
LSD Value	23.20	4.185	8.319	11.51	277.4

Means followed by common letters in the respective category are not significantly different from each other by LSD at $\alpha = 0.05$.

Number of Main Branches

Results (Table II) revealed that comparatively more branches were found on DNH-105 (16.0) followed by CIM-506 (14.60), DNH-57 (13.07), CRIS-9 (12.87), B.T (12.67) and CIM-554 (12.40). Similarly lesser mean No. of main branches were found in BH-167 (10.33) followed but statistically similar to CRIS-125 (10.73), Gomal-93 (11.60). Overall results revealed that all the varieties were found statistically similar in producing mean number of main branches except CRIS-125 (88.73), which was statistically at par with CRIS-9 (103.4), B.T. (106.6) and CIM-506 (106.5).

Number of Sub Branches

Results presented in (Table II), revealed that comparatively more sub branches were found on DNH-105 (25.27) followed by CIM-506 (17.73) and DNH-57 (16.97) and were non-significantly different from each other. Similarly lesser sub branches were found on B.T (9.47), which was statistically similar to all other tested varieties of cotton except DNH-105.

Number of Bolls Plant^{-1}

The results (Table II) revealed that variety DNH-105 showed significantly more Number of bolls (76.8) per plant followed by CIM-506 (50.23) and DNH-57 (45.50). These two varieties were found non-significantly different from each other. All other varieties were found statistically similar in producing mean No. of bolls per plant.

Seed Cotton Yield

Cotton varieties showed significant differences in per hectare yield (Table II). Owing to its tolerance to sucking pests DNH-105 was found to be producing highest seed cotton yield (1889 kg ha^{-1}) compared to other tested varieties. CIM-506 and DNH-57 with 1644 & 1622 kg ha^{-1} seed cotton yield respectively were found non significantly different to DNH-105, however. Among all other tested varieties, CRIS-9 produced significantly least seed cotton yield (822.2 kg ha^{-1}). Varieties CIM-554, B.T, CRIS-125, BH-167 and GOMAL-93 were found non-significantly different to one another in respect of per hectare seed cotton yield.

These findings are in partial agreement with Wahla *et al.* (1998), Dhillon *et al.* (1999), Shad *et al.* (2001), Leghari *et al.* (2001), Nizamani *et al.* (2002), Syed *et al. (*2003), Khan *et al. (*2003), Kulkarni *et al.* (2004), Chandramani *et al.*(2004), Ahmad *et al.* (2004), Memon and Chang (2005) and Ali & Aheer (2007), had tested different sets of cotton genotypes/ cultivars/varieties in their trials for resistance/tolerance against sucking insect pests but none of them tested the instant set of cotton varieties.

Efficacy of different Insecticides against Cotton Sucking Insect Pests

Data regarding efficacy of different insecticides against sucking insect pest (whiteflies, jassid and thrips) after 1, 2, 3 and 7 days after treatment (DAT) are presented in (Tables III – VI).

Table-III ***Mean population of white fly as affected by different insecticides***

Treatments	**Dose (ha^{-1})**	**1 DAT**	**2 DAT**	**3 DAT**	**7 DAT**
Acetamiprid 20SP	312 g	0.944d	1.330d	1.833d	2.110 de
Imidacloprid 25WP	625 g	1.830 c	2.220c	2.830c	3.720bc
Bifenthrin10EC	625 ml	2.773 b	3.330b	3.830b	4.387b
Cypermethrin10EC	625 ml	1.387cd	2.167c	2.667c	3.220c
Triazophos40EC	2000 ml	1.330 cd	2.163c	2.497c	2.883cd
Lambda cyhalothrin2.5 EC	825 ml	1.163d	2.107c	2.553c	2.940cd
Rani 20 SL	312 ml	0.997d	1.217d	1.497d	1.887e
Control		5.107 a	5.277a	5.107a	5.887a
LSD Value		0.5647	0.5728	0.4984	0.8721

Means followed by common letters in the respective category are not significantly different from each other by LSD at $\alpha = 0.05$.

Whitefly

Results (Table III) recorded 1, 2, 3 and 7 days after treatment (DAT) revealed that varied significant variations were found among the treatments. Data recorded 1 DAT, showed that comparatively fewer number of white flies per leaf were found in plots treated with Rani (0.997) followed by (although not significantly different) Acetamiprid (0.994), Lambdacyhalothrin (1.163), Triazophos (1.33) and Cypermethrin (1.387). Similarly maximum number of whiteflies per leaf after control plot (5.107) were found in plots treated with Bifenthrin (2.773) followed by Imidacloprid (1.83).

Results of 2 DAT revealed that maximum number of whiteflies per leaf after control (5.277) was recorded in plots treated with Bifenthrin (3.330). Whiteflies Per leaf population recorded in plots treated with Imidacloprid, Cypermethrin, Triazophos and Lambdacyhalothrin were found not significantly different from one another. Similarly comparatively lesser number of whiteflies per leaf were found in the plots treated with Rani (1.217) followed by Acetamiprid (1.330).

On 3 DAT, Bifenthrin treated plot showed maximum number of whiteflies (3.830 leaf^{-1}) after control plot (5.107 leaf^{-1}) followed by Imidacloprid (2.83 whitefly leaf^{-1}). Population of whiteflies found in Imidacloprid, Cypermethrin, Triazophos and Lambdacyhalothrin treated plots (2.83, 2.667, 2.497 and 2.553 leaf^{-1}, respectively) were found non significantly different from each other Comparatively less per leaf population of whiteflies were showed by the plots treated with Rani (1.497) and Acetamiprid (1.833) as compared to other tested chemicals.

On 7 DAT, all of the tested chemicals were found statistically similar except Rani and Acetamiprid which were significantly different to each other as well all other treatments as they showed least No. of whiteflies per leaf on 7 days after treatment (1.887 and 2.110, respectively). After control plot (5.887 whiteflies leaf^{-1}), relatively more whiteflies per leaf (4.387) were found on Bifenthrin treated plot followed by (although statistically similar) Imidacloprid with 3.720 whitflies leaf^{-1}.

Jassid

It is evident from the data (Table IV), that among the tested chemicals most of the treatments were found statistically similar in control jassids on 1 DAT. The least Number of jassids (0.4967 leaf^{-1}) were found in Rani treated plot which was statistically similar to that of Acetamiprid (0.943 leaf^{-1}), Lambdacyhalothrin (1.16 leaf^{-1}), Triazophos (1.22 leaf^{-1}) and Cypermethrin (1.33 leaf^{-1}) treated plots. After control plot (4.663 leaf^{-1}), the maximum jassids on 1 DAT were found in Bifenthrin (2.943 leaf^{-1}) treated plot.

Table-IV ***Mean population of jassid as affected by different insecticides***

Treatments	Dose (ha^{-1})	1 DAT	2 DAT	3 DAT	7 DAT
Acetamiprid 20SP	312 g	0.9433d	1.167d	1.163cde	1.663b
Imidacloprid 25% WP	625 g	1.940c	2.053c	1.497bcd	2.253b
Bifenthrin 10EC	625 ml	2.943b	2.773b	2.053b	2.387b
Cypermethrin 10EC	625 ml	1.330cd	1.663cd	1.833bc	2.273b
Triazophos 40EC	2 l	1.220cd	1.160d	1.053de	1.717b
Lambda cyhalothrin 2.5 EC	825 ml	1.160cd	1.163d	1.110de	1.553bc
Rani 20 SL	312 ml	0.4967d	0.3867e	0.4967e	0.7167c
Control		4.663a	4.663a	3.883a	4.330a
LSD Value		0.9233	0.5075	0.7156	0.8964

Means followed by common letters in the respective category are not significantly different from each other by LSD at $\alpha = 0.05$.

Data recorded on 2 DAT showed that non-significantly different number of jassids per leaf was found in the plots treated with Acetamiprid, Cypermethrin, Triazophos and lambdacyhalothrin. Least Number of jassids per leaf were found in plots treated with Rani (0.387) followed by Acetamiprid (1.167 leaf^{-1}). Similarly after control plot (4.663 leaf^{-1}), relatively more jassids per leaf were found in Bifenthrin treated plot (2.773) followed by Imidacloprid (2.053).

On 3 DAT (IV), Rani proved its effectiveness by showing least jassids population per leaf (0.497) followed by (though statistically similar to) Triazophos (1.053 leaf^{-1}), Lambdacyhalothrin (1.110 leaf^{-1}) and Acetamiprid (1.163 leaf^{-1}). Similarly after control plot (3.883 leaf^{-1}), maximum mean No. of jassids per leaf were found in plots treated with Bifenthrin (2.053), Cypermethrin (1.833) and Imidacloprid (1.497).

On 7 DAT (Table IV) after control plot (4.330 leaf^{-1}) population of jassids increased in the plots treated with Bifenthrin (2.387 leaf^{-1}) followed by (though statistically non-significantly different) Cypermethrin (2.273 leaf^{-1}), Imidacloprid (2.253 leaf^{-1}), Triazophos (1.717 leaf^{-1}), Acetamiprid (1.663 leaf^{-1}) and Lambdacyhalothrin (1.553 leaf^{-1}). Rani treated plot performed better than the other treated plots and gave control up to 7 DAT with only 0.717 Jassids leaf^{-1}.

Thrips

The results (Table V) reveal that among the tested chemicals, significant differences were found in the control of cotton thrips, however, all the treatments gave significantly better control than that of untreated plot. On 1 DAT maximum population of thrips after control plot (18.33 leaf^{-1}) was found in Bifenthrin treated plot (9.163 leaf^{-1}) followed by (though significantly different) Triazophos (6.550 leaf^{-1}). Per leaf thrips found in Triazophos treated plot were non significantly different to Imidacloprid (6.273 leaf^{-1}) and Lambdacyhalothrin (5.443 leaf^{-1}). Similarly relatively least Number of Thrips per leaf were found in Rani treated plot (3.497) followed by (though statistically similar) Acetamiprid with 3.777 thrips per leaf.

On 2 DAT, all the treatments gave significantly better control than untreated plot. Least number of thrips were found in plots treated with Rani and Acetamiprid having 3.827 and 4.053 thrips per leaf, respectively. Maximum number of thrips per leaf were found in Bifenthrin treated plots (9.72) after control (19.44). The number of thrips per leaf found in Triazophos (7.00) and Imidacloprid (6.663) treated plots were found non significantly different from one another.

On 3 DAT maximum thrips per leaf were found in Bifenthrin treated plots (9.720) after control (19.72). Similarly least No. of thrips were found in Rani treated plot (3.607 leaf^{-1}) followed but significantly different to acetamiprid (40.720 leaf^{-1}). Per leaf thrips found in Acetamiprid treated plot were not significantly different to cypermethrin at 3 DAT. Similarly per leaf thrips found in Imidacloprid (7.053), Triazophos (6.993) and Lambdacyhalothrin (6.330) were also non significantly different from each other.

On 7 DAT, least No. of thrips per leaf were found in Rani treated plot (2.997) followed but significantly different to Acetamiprid (4.887). Per leaf thrips in Acetamiprid were found non significantly different to Cypermethrin (5.330). Among the tested chemicals Imidacloprid (7.667 leaf^{-1}), Triazophos (7.387 thrips leaf^{-1}) and Lambdacyhalothrin (6.440 leaf^{-1}) produced statically similar results. Bifenthrin treated plot showed maximum No. of thrips per leaf (10.61) after control plot (20.66 thrips leaf^{-1}).

Overall results of the present study reveal that Rani 20 SL and Acetamiprid 20 SP performed better than other treatments and maintained significant difference at 1,2,3 and 7 days after treatment against all sucking insect pest complex (Table V).

Table -V ***Mean population of thrips leaf^{-1} as affected by different insecticides***

Treatments	Dose (ha^{-1})	1 DAT	2 DAT	3 DAT	7 DAT
Acetamiprid 20SP	312 g	3.777 e	4.053f	4.720d	4.887e
Imidacloprid WP	625 g	6.273cd	6.663cd	7.053c	7.667c
Bifenthrin 10EC	625 ml	9.163b	9.717b	9.720b	10.61b
Cypermethrin 10EC	625 ml	4.830de	5.273e	5.167d	5.330de
Triazophos 40EC	2 l	6.550c	7.000c	6.993c	7.387c
Lambda cyhalothrin 2.5 EC	825 ml	5.443cd	5.997de	6.330c	6.440cd
Rani 20 SL	312 ml	3.497e	3.827f	3.607e	2.997f
Control		18.33a	19.44a	19.72a	20.66a
LSD Value		1.469	0.9431	0.8288	1.546

Means followed by common letters in the respective category are not significantly different from each other by LSD at $\alpha = 0.05$.

Seed Cotton Yield

Results presented in (Table VI) revealed that significant variation was found among all the treatments and gave comparatively more seed cotton yield than control (1642 kg ha^{-1}). However, maximum seed cotton yield was found in Rani treated plot (1784 kg ha^{-1}) followed by (though not significantly different to) Acetamiprid (1755 kg ha^{-1}). It is more evident from the data, that seed cotton yield Cypermethrin (1729 kg ha^{-1}), Lambdacyhalothrin (1702 kg ha^{-1}), Triazophos (1686 kg ha^{-1}), Imidacloprid (1668 kg ha^{-1}) and Bifenthrin (1654 kg ha^{-1}) treated plots were found non-significantly different from each other. Overall Bifenthrin (1654) and Imadacloprid (1668 kg^{-} ha $^{-1}$) failed to surpass to their yield from the control.

Table-VI ***Comparison of seed cotton yield as affected by tested insecticides***

Treatments	Dose (ha^{-1})	kg ha^{-1}
Acetamiprid 20SP	312 g	1755 ab
Imidacloprid 25% WP	625 g	1668 def
Bifenthrin 10EC	625 ml	1654 ef
Cypermethrin 10EC	625 ml	1729 bc
Triazophos 40EC	2 l	1686 de
Lambda cyhalothrin 2.5 EC	825 ml	1702 cd
Rani 20 SL	312 ml	1784 a
Control		1642 f
LSD Value		34.96

Means followed by common letters are not significantly different from each other by LSD at $\alpha = 0.05$.

CONCLUSION

From the present study it is concluded that DNH-105 and CIM-506 showed least infestation and higher yield compared to other tested varieties of cotton under agroclimatic conditions of Dera Ismail Khan and Rani 20 SL and Acetamiprid 20 SP found to be very effective against sucking insect pests compared to other insecticides tested. The plots treated with these insecticides also produced comparatively more seed cotton yield than other treated plots and also out yielded the control treatment.

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