



RESISTANCE OF THE MAIZE VARIETY *JALAL* AGAINST CORN LEAF APHID *RHOPALOSIPHUM MAIDIS*, ITS IMPACT ON PEST DENSITY AND EFFECTS ON YIELD AND YIELD COMPONENTS

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ABSTRACT

The corn leaf aphid *Rhopalosiphum maidis*, is a serious pest of maize whorl and inflicts heavy losses to the crop, particularly when the plant is under drought stress. Resistance in maize has been amply documented by various workers and is reflective of the numbers of aphid present. An effort is made to test the resistance of the newly released variety Jalal (Formerly known as PSEV-3 by the Cereal Crops Research Institute Pirsabak), along with two indigenous varieties, Azam and Sarhad White. Pesticides in three different formulations with full and half strengths indicated that imidacloprid as seed dressing with full marketable strength, resulted in lowest aphid density, higher yield and yield components in the Jalal variety, compared to granular and foliar formulations of Kadan and dimethoate, respectively. The granular application with full strength proved to be useful, as it stood second in its efficacy against *Rhopalosiphum maidis*, but the foliar sprays failed to provide effective protection against the pest. The mean yield of the three maize varieties showed that Jalal is the most productive. It resulted in 2928.76kg of grain per hectare compared to 2868 and 2814kg per hectare in Azam and Sarhad white, respectively.

Keywords: maize, corn leaf aphid, pest, yield, aphid, resistance, density.

INTRODUCTION

The maize aphid (*Rhopalosiphum maidis*) is one of the major pests infesting maize crop in Pakistan. It is often kept in check by *Menochilus sexmaculata* (Pirzada et al 1996). Fareed (1991) reported 3.42 to 42.17 aphids per plant. In areas with mild summers, the pest could become a threat to the early as well as late maize plantations Mishwani and Karimullah (1990) reported 98.66 to 202 .55 aphids per plant in Kalam Valley of Swat where the summers are mild and pleasant. *Rhopalosiphum maidis* is found in Barley maize and occasionally in wheat. Its most common wild host is Johnson grass (Aphablaza and Tiska 1973). Both Jhonson grass and maize leaf aphids are mainly associated with orchard and cereal field in central Chile and they show quite similar distribution pattern (Artigas 1994). Timing of arrival, magnitude of migrants' flight, and development of *Rhopalosiphum maidis* populations in cereal crops are highly variable and prone to rapid change. Temperature is probably the most important physical factor-influencing rate of aphid development and reproduction (Carter 1957, Sing and Painter 1964, El-Ibrashy, et al 1972).

Ganguli and Ray Chaudry (1985) concluded that *Rhopalosiphum maidis* caused severe damage to maize and other plants. It was observed that wheat, Barley, and Sorghum were primary food plants while two weeds, *Chromolaena odorata* and *Cynodon dactylon* acted as alternate food plants and kept the aphid population alive in October-March.

Field experiments showed that crops could be protected by emulsion concentrates of 30% Dimethoate or 50% dimethyl Demeton diluted in sprays to 25% and applied once at pretassel stage and twice more later at 10-15 days intervals. Seed furrow treatment of granular or

liquid Disulfoton gave season long control of green bug and about six weeks control of the corn leaf aphid, *Rhopalosiphum maidis*. Phorate granules applied in direct contact with the seed provided several weeks of residual control, but caused a significant reduction in plant stand (Cate et al 1973).

Ahmed et al (2001) evaluated mixtures of imidacloprid and tebuconazole to determine their effects on plant stand, aphid's population and wheat grain yield. Plant stand increased and aphids' populations were effectively controlled for six to eight weeks after sowing. Substantial differences were observed among the treatments in the number of grains per ear and the 1000-grain weight. The differences reflected in 90-30% increase in the total grain yield.

MATERIALS AND METHODS

Field experiments were conducted to find out the efficacy of different insecticides against maize aphid, *Rhopalosiphum maidis*, using a recently released maize variety-Jalal along with two other indigenous varieties; Azam and Sarhad white. The experiment was laid down in RCB design with a split plot arrangement at Malakandher Research Farm, NWFP Agricultural University Peshawar. The plot size was 3x5m with three replications of each treatment and a control. There were six treatments along a check plot with five rows per plot. One-meter distance was kept between rows and plants were planted 30cm apart. The treatments included, seed dressings, granular application and foliar sprays of half and full strength.

- A. Seed dressing with confidor @ 10g kg⁻¹ of seed.
T₁ = Half strength



- T₂ = Full strength
- B.** Granular application Kadan (Cartap) @9kg hac⁻¹.
T₃ = Half strength
T₄ = Full strength
- C.** Foliar spray Dimethoate @400ml acre⁻¹.
T₅ = Half strength
T₆ = Full strength

All other agronomic practices were kept constant. Aphid's density, on each cultivar was examined at a week interval starting from two-leaf stage till the maturity of crop. Seeds were treated with confidor one day before

sowing. Granular application with kadan was initiated on 20th August and foliar spray of Dimethoate was applied on 25th September. Aphid's numbers were determined by counting aphids infesting unfolded leaves of three randomly selected leaves in each replication. The data was analyzed using M STAT-C software.

RESULTS

Results of average population density of *Rhopalosiphum maidis* treated with confidor are presented in Table-1.

Table-1. Average R. maidis Population on maize cultivars on 13th August during 2002-03.

Variety	Treatments (Seed dressing) Half and Full			Mean
	Control	T ₁ (Half)	T ₂ (Full)	
Jalal	1.683 bc	0.333 ef	0.000 f	0.672 b
Azam	2.413 ab	1.000 cde	0.777 def	1.397 a
S. White	2.820 a	1.443 cd	1.333 cd	1.866 a
Mean	2.306 a	0.926 b	0.703 be	-----

LSD at 5% level of significance for variety = 0.5235

LSD at 5% level of significance for treatments = 0.4915

LSD at 5% level of significance for V × T = 0.8513

These observations were started from 13th August and continued till the maturity of crop. The data revealed that the average population density of aphids plant⁻¹ on different cultivars was significantly different. The newly released variety Jalal recorded the least number of insects. The treatments effect was also significant, but the difference between half and full strength of the seed dressing were non-significant.

Table-2 represents the seed dressing along with granular effects of the pesticides. The results revealed that

the population of R. maidis on different varieties remained significantly different. There was less number of aphids on Jalal than the other two varieties. The results also indicated that all four treatments significantly affected the aphid population as compared to the check plot, but the effect of T₄ (full strength) of granules was more pronounced than the half strength T₃. The interaction among the varieties and the treatments was significant. The treatment effects were more prominent on Sarhad white than Jalal.

Table-2. Average R. maidis population on maize cultivars on 20th August during 2002-03.

Variety	Treatments			Mean
	Control	T ₁	T ₂	
Jalal	4.553 c	0.333 d	0.443 d	1.777 c
Azam	9.930 b	1.000 d	0.776 d	3.902 b
S. White	14.49 a	1.000 d	0.666 d	5.384 a
Mean	9.657 a	0.777 b	0.628 b	-----

LSD at 5% level of significance for variety = 0.9968

LSD at 5% level of significance for treatments = 0.6989

LSD at 5% level of significance for V × T = 1.210

Table-3 shows the combined effects of seed dressing, granular application and foliar spray. The varietal performance still remains significantly different from each other. The aphids population on Jalal variety were the minimum as compared to the other two varieties.

The results further revealed that T₆ recorded the least number of aphids as compared to T₁. The mean number of aphids recorded in all three varieties was significantly different from each other and ranged from 3.01 to 8.39 aphids per leaf. The treatment means were also significant.



The highest number of 10.0 aphids per leaf were recorded in the control while the lowest, 1.44 aphids per leaf were recorded in T₆.

Table-3. Average R. maidis Population on Maize Cultivars on 9th October During 2002-03.

Variety	Treatments							Mean
	Control	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Jalal	4.667 g	3.333 gh	2.333 hij	3.667 gh	3.110 h	2.333 hij	1.667 ij	3.016 c
Azam	11.00 bc	10.00 cd	9.00 de	7.667 ef	6.33 f	2.443 hi	1.667 ij	6.873 b
S. White	14.33 a	11.67 b	10.00 cd	8.00 e	1.667 ij	1.00 j	0.000 k	8.397 a
Mean	10.00 a	8.333 b	7.814 bc	7.111 c	5.814 d	2.148 e	1.444 e	-----

LSD at 5% level of significance for variety = 0.5824

LSD at 5% level of significance for treatments = 0.7796

LSD at 5% level of significance for V × T = 1.350

Performance of the different varieties regarding their yield and yield components is given in Tables 4 to 7. The overall mean numbers of cobs per plant are

significantly greater in Jalal (0.86) followed by Azam (0.81), while Sarhad white produced minimum number (0.75) of cobs per plant (Table-4).

Table-4. No of cobs per plant.

Variety	Treatments							Mean
	Control	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Jalal	0.780	0.983	1.00	0.813	0.847	0.803	0.810	0.862 a
Azam	0.747	0.830	0.890	0.903	0.800	0.747	0.753	0.810 b
S. White	0.713	0.780	0.790	0.760	0.767	0.713	0.727	0.750 c
Mean	0.747 g	0.864 b	0.893 a	0.826 c	0.804 d	0.754 f	0.763 e	

LSD for treatments = 0.0271

LSD for varieties = 0.00135

Table-5. No of grains per cob.

Variety	Treatments							Mean
	Control	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Jalal	273.000	292.667	298.000	281.000	283.000	271.000	272.000	281.57 a
Azam	266.000	280.000	283.667	273.333	274.667	267.000	264.667	272.76 b
S. White	261.000	273.000	274.667	271.333	272.333	262.000	262.000	268.05 c
Mean	266.667 e	281.889 b	285.444 a	275.222 d	276.667 c	266.667 e	266.333 e	

LSD for treatments = 1.317

LSD for varieties = 2.929

**Table-6.** Weight of thousand grains.

Variety	Treatments							Mean
	Control	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Jalal	208.000	226.000	230.000	217.667	224.667	208.333	209.000	217.667 a
Azam	203.333	211.333	221.000	201.000	204.667	196.333	197.667	205.048 b
S. White	174.667	181.333	186.667	172.667	175.667	175.667	176.667	177.619 c
Mean	195.33 de	206.22 b	212.556 a	197.111d	201.667 c	193.444 e	194.44de	

LSD for treatments = 2.971

LSD for Varieties = 3.736

Table-7. Grain yield kg ha⁻¹.

Variety	Treatments							Mean
	Control	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	
Jalal	2902.000	2956.000	2962.000	2934.333	2938.667	2903.667	2904.667	2928.762 a
Azam	2847.000	2887.333	2893.000	2874.667	2876.333	2849.000	2850.333	2868.238 b
S. White	2799.667	2825.333	2831.000	2816.333	2821.333	2804.000	2807.000	2814.952 c
Mean	2849.56 f	2889.56b	2895.33 a	2875.11d	2878.78 c	2852.22 e	2854.00 e	-----

LSD for treatments = 1.819

LSD for Varieties = 7.932

Among the various treatments of insecticides, full strength of confidor resulted in significantly greater number (0.89) of cobs per plant while its half dose stood next in performance. Confidor was followed by full dose of granular formulation of Kadan. Foliar spray of Dimethoate was the least effective.

The above results were also reflected in the mean number of grains per cob (Table-5). The data show a significantly greater number of grains per cob in the Jalal variety followed by Azam and Sarhad white. Among the various pesticides formulations, confidor in full strength proved to be outstanding in the number of grains per cob (285.44) followed by its half strength (281.89). The impact of granular formulation in full strength was significantly greater than its half strength. Both concentrations of foliar spray were non significant and were at par with check.

The results of weight of 1000 grains as influenced by various treatments are given in Table-6. As evident from their performances, significantly heavier grains (217.67gm) are produced by Jalal followed by Azam while grains with minimum weight (177.61gm) are produced by Sarhad White. The impact of insecticidal treatments on TGW indicates that confidor with full strength produced better results than its formulation with half strength. Full strength of granular application was significantly different from its half strength, while foliar sprays with either of the two strengths failed to enhance the grain weight.

The mean yield of the three maize varieties (Table-7) shows that Jalal performed better with 2928.76kg ha⁻¹ followed by Azam and Sarhad white with 2868 and 2814kg ha⁻¹, respectively. Taking into consideration the above mentioned parameters, it is evident that Jalal proved to be comparatively resistant to the infestation of maize aphid. These findings are fully supportive of the findings of Karamat (2003), who reported moderate insect resistance in Jalal than the other varieties of corn.

Among the treatments, imidacloprid (Confidor) gave better results than the other two formulations. Gray et al (1996) reported reduced cereal aphid infestation in the imidacloprid treated oats and wheat fields. The pesticide offers several advantages in terms of its long lasting systemic activity and its mode of application. As a seed treatment, the quantities of the active ingredient are minimized; there are little wastages and therefore the environmental impacts are reduced. The effectiveness of the compound at reducing the fecundity and fertility of several aphid species is an added advantage in controlling secondary spread of viruses.

DISCUSSION

Though summer temperatures in Peshawar valley are not conducive to aphids' survival still *R. maidis* manages to survive. The pest is present in low densities in the spring grown maize and comparatively greater numbers exist in the summer grown crops. The pest is observed in small number at the end of June and early July and the population increases in the first week of August. A



number of Parasites and predators are actively associated with the pest and there seems to exist a perfect harmony between them (personnel observation).

Resistance to *R. maidis* is rare and a few accessions of maize have shown this trait (Verma 1993). In the present trial, Azam and Sarhad white proved to be susceptible to *Rhopalosiphum maidis* infestation while Jalal exhibited a substantial resistance. These findings are in agreement with Fareed (1991) who tested eight varieties of maize and reported that Sarhad white and Azam were susceptible to *R. maidis*.

The findings of the present study also indicate that Imidachloprid gave better results than the other chemicals. It offers several advantages both in terms of its long lasting systemic activities and its mode of application. Knaust and Poeling (1992) reported that Imidachloprid exerted a prolonged effect on adult apterae of *Sitobion avenae*; reducing duration of survival, secretion of honeydew and fertility. Foilar spray of Dimethoate was not as effective as the other two chemicals, but the importance of the foliar sprays cannot be ignored as it may provide instant relief in some emergency situation.

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