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COMPARATIVE FIELD EVALUATION OF SOME NEWER VERSUS CONVENTIONAL INSECTICIDES FOR THE CONTROL OF APHIDS (HOMOPTERA: APHIDIDAE) ON OILSEED RAPE (*BRASSICA NAPUS* L.)

*M. SARWAR, N. AHMAD, MOULA BUX, NASRULLAH and M. TOFIQUE

Nuclear Institute of Agriculture (NIA), Tandojam-70060, Pakistan.

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This study was designed to evaluate the effects of new insecticides like, Imidacloprid (Confidor 200 EC), Thiomethoxam (Actara 25 WG) and Acetamiprid (Megamos 20 SL) belonging to Nitroguanidine group alongwith conventional insecticides such as, Chlorpyrifos (Lorsban 40 EC) and Dimethoate (Systoate 40 EC) belonging to Organophosphate group against aphids' population on oilseed rape (*Brassica napus* L.). A perusal of data, based on the overall performance of the test compounds, reflected that newer insecticides were superior in reducing the population of aphids and yield enhancement as compared to conventional insecticides. The best results were achieved with the application of Imidacloprid by recording the lowest number of aphids (2.2 per plant) than obtained with Thiomethoxam and Acetamiprid (3.22 and 4.66, respectively). Other insecticides, viz., Chlorpyrifos and Dimethoate were also found to be effective in maintaining the aphids' population at lower levels per plant (16.2 and 17.5, respectively) over untreated control (227.7). Imidacloprid was responsible for increasing the grain yield to 3722.85 Kg per Hectare, approached by Thiomethoxam, Acetamiprid, Chlorpyrifos and Dimethoate as against unsprayed control (2980.0, 2542.85, 1542.85, 540.0 and 604.85 Kg per Hectare, respectively). Study indicated that selective use of newer insecticides would seem a reasonable strategy in aphids controlling and integration of such chemicals in insects' management package could help to reduce pest densities.

Keywords: Aphids, *Brassica,* Infestation, Insecticide, Chemical control.

1. Introduction

Among oleiferous brassicas, rape and mustard are important oilseed crops, which play a key role in our economy. These crops are damaged by a number of insect pests at different stages of their growth. According to Sarwar [1], the aphids constitute one of the key pests and main phyto-sanitary problems in rapeseed and mustard crops. About 43 insect species have been recorded attacking these plants, but the most important being mustard aphid *Lipaphis erysimi* (Kaltenbak), as it can inflict losses upto 100% in case of severe infestation. It sucks sap from the plant and attacked plants wither resulting in drastic losses in seed yield and oil content as stated by Bakhetia [2]. Phadke [3] and Prasad [4] reported aphids as most important pest of these plants that make them weak and reduce the yield. Aphids usually feed on growing points, inflorescence besides the foliage, and severe infestations result in stunted growth and poor pod formation. The yield loss due to the aphids has been reported to be 30-70 percent on mustard. This sucking insect is currently the most important pest and has imposed a severe constraint on oilseed crops production. The poor return from rape and mustard can be attributed to a wide variety of factors. Out of them, non-availability of suitable production technology and lack of proper insect pests' management practices are the most important. In the later case, optimal plant protection plays a vital role in determining higher yield.

In Pakistan, like other oilseed producing countries, pest control has largely relied on chemical control. Because of indiscriminate use of insecticides, aphids have appeared as primary pest on rape and mustard and their control system needs special attention. Therefore, there is a dire need to examine more chemicals for better management of this pest. For controlling of this pest, wide range of insecticides have been recommended, which are being used by the

* Corresponding author : drmsarwar64@yahoo.com

farmers against the devastation of this notorious insect. This severity of problem necessitates in selecting the suitable newer insecticides for the control of this pest. Now a day, more emphasis is given on the use of specific, safer and effective insecticides helpful at low doses. Therefore, newer insecticides are slowly replacing the conventional insecticides. Devi et al. [5] indicated that by new insecticides treatment, not only the aphid population is reduced but also the populations of the predatory insects were not much affected. Although the efficacy of plant extracts against aphid *L. erysimi* has been evaluated by certain researchers, yet, chemical insecticides were more effective than botanical insecticides. Vekaria and Patel [6]; Dutta et al. [7] and Singh [8] conducted field trials to test the efficacy of different indigenous plants and chemical pest control agents as foliar sprays against the mustard aphid *L. erysimi*. Pooled data indicated that the chemical insecticides were the most effective, reduced the aphid population and recorded highest yield, while the botanical insecticides showed moderate level of efficacy. Hence, in the present study, the efficacies of some recently introduced insecticides have been evaluated and compared with conventional chemicals. Observing the economic importance of the pest and host plant, the present research work deals with an attempt to find out possible ways to control the aphids. The trial was carried out with two main goals; firstly to determine effectiveness of insecticides' against aphids' mortality, and simultaneously to trace their resulting effects on seed yield.

2. Materials and Methods

Present field trial was laid on oilseed rape (*B. napus*) variety "Rainbow" during winter season 2003-2004 (November 2003 to March 2004) in Randomized Complete Block Design replicated three times at Nuclear Institute of Agriculture, Tandojam. The plot size was 3.5 m^2, and all recommended package of agricultural practices were followed at the experimental site. Crop was spaced at the distance of 15 cm from plant to plant and 30 cm between rows. The trial consisted of 6 treatments viz., newer insecticides like Imidacloprid (Confidor 200 EC), Thiomethoxam (Actara 25 WG) and Acetamipirid (Megamas 20 SL) along with conventional insecticides such as Chlorpyrifos (Lorsban 40 EC) and Dimethoate (Systoate 40 EC) including untreated check. The recommended dosage of the insecticides was used alongwith the recommended amount of water as a base. The solutions of all the insecticides were prepared in water and sprayings done in the morning during the clear day. To avoid the mixing up of the insecticides, the sprayer was washed thoroughly after spraying with each chemical. The insecticides were sprayed on the crop 95 days after sowing for the control of aphids when their populations reached above economic threshold level. Untreated check plots were maintained without spraying any insecticide, and kept for comparison.

Spray applications were made with handheld knapsack sprayer fitted with a plastic hollow cone nozzle by covering single row of crop each time. A total of 2 chemical applications were made, the first on 22-2-2004 and the second after 18 days on 12-3-2004, after conducting pest scouting. To avoid drifting of the insecticide and to reduce the chances of chemicals mixing, non-experimental area was left as buffer zone between different treatments. Assessments of insecticides controlling efficiency were made by visual counts on the number of alate and apterous aphids per plant after the application of insecticides. Observations on the incidence of aphids were recorded in each plot from 5 randomly selected plants one day/ two days after each spraying and data pooled to show efficacy of different insecticides. The population of the aphid was counted visually on top, middle and bottom portion of each plant to determine their mean population on per plant basis. All parts of plants were thoroughly examined for aphids' counts. Similarly, the crop yield was determined on per plot basis, after the crop was harvested and threshed. The insect count and yield data, thus obtained were averaged and subjected to statistical analysis for the test of significance by adopting procedure projected by Steel and Torrie [9] to analyze different parameters using analysis of variance techniques.

3. Results and Discussion

Aphids appeared at the vegetative stage of the crop and their activity continued till pods fully ripened. However, their peak activity was observed between flowering and pods formation periods. After these periods aphid's incidence started to decline and reached to the tune of zero when crop fully matured. Pre treatment aphids' population ranged 30.66-33.33 per plant. Results depicted that all insecticides had higher initial killing effects on pest, as the time after each treatment lapsed,

Table 1. Pooled data (average) showing efficacy of different insecticides for the control of aphids.

No.	Treatment (Insecticides)	Dose/ Hectare	Aphids population / plant		Yield/ plot ($3.5\ m^2$) (gm)	Yield Kg/ Hectare
			Pre treatment	Post treatment		
1.	Imidacloprid (Confidor 200 EC)	0.625 L	32.66 a	2.21 c	1303.0 a	3722.85
2.	Thiomethoxam (Actara 25 WG)	75 gm	30.66 a	3.22 c	1043.0 b	2980.0
3.	Acetamiprid (Megamos 20 SL)	0.625 L	31.33 a	4.66 c	890.0 c	2542.85
4.	Chlorpyrifos (Lorsban 40 EC)	2 L	30.66 a	49.89 b	661.70 d	1890.57
5.	Dimethoate (Systoate 40 EC)	1 L	31.33 a	54.89 b	540.0 e	1542.85
6.	Control		33.33 a	161.1 a	211.70 f	604.85
LSD value			8.61	23.14	55.43	

Data means sharing the same letter in a column are not significantly different at *P*= 0.05.

the appearance of pest started again. Further, the results reflected that all the insecticide treatments significantly reduced the alate and apterous aphids' population and increased grain yield as compared to untreated units (Table 1). However, the newer insecticides proved significantly superior in controlling aphids' population and produced considerably higher yield than the treatments of conventional insecticides. After chemical applications, the data on mean aphids' population showed that a significant reduction of aphids in the treated plots was achieved as compared to untreated one.

Among the newer insecticides, Imidacloprid (Confidor) treated plots showed the least density of aphids (2.21 per plant). Other treatments in order of their economic effectiveness were Thiomethoxam followed by Acetamiprid, where the reduction in aphid's population was recorded as 3.22 and 4.66 per plant, respectively. Other insecticides (conventional), viz., Chlorpyrifos and Dimethoate were found to be effective in maintaining the aphids' population at lower levels of 49.89, 54.89 per plant, respectively, over untreated control (161.1 for each plant).

From the mean yields of the trial presented in Table 1, significant variations were observed between newer and conventional insecticide treatments as compared to untreated plots. Among them, the maximum yield was recorded from the plots treated with Imidacloprid (3722.85 Kg per Hectare) followed by Thiomethoxam (2980.0 Kg) and Acetamiprid (2542.85 Kg). Out of other treatments Chlorpyrifos and Dimethoate gave significantly higher yield (1890.57 and 1542.85 Kg, respectively) than the control plot, where the yield was 604.85 Kg only. From the unsprayed plots, almost minimum yield was obtained, as the pest intensity was the highest in these plots. From the results of trial presented in terms of both the parameters under consideration, it was observed that all chemical treatments were superior in controlling aphids and they produced more seed than the control plot. The effectiveness of the treatments was in order of Imidacloprid> Thiomethoxam> Acetamiprid> Chlorpyrifos> Dimethoate. These differences in relative efficiency of different test insecticides in controlling the pest might be attributed to varying chemical nature and controlling abilities of their active ingredients.

During this experimentation, appreciable effects of insecticides were observed on plant growth, and crop attained a good stand. Contrary to that, aphid's population was so severe in control plots that some plants dried prematurely without bearing any siliqua. Consequently, the least yield was obtained in the control plots due to higher pest density. The data from this study indicated that the use of insecticides to control aphid insect pest is currently vital to have a high yield as shown in the recent observations. These findings will be considered essential, if due attention is paid further to the best choice of chemicals. Many workers during the past have tried different insecticides against the aphids and gave different findings, Prasad [10] when conducted research with some conventional insecticides; it was observed that Chlorpyrifos was the most effective and economical than the other tested insecticides like

Dimethoate. Pareek and Noor [11] conducted the trial against *Myzus persicae* (Sulzer) under field conditions and found that Dimethoate insecticide gave the least control than other tested insecticides. Flanders et al. [12] concluded that Dimethoate was the most promising for developing insect management programme. Bodhade et al. [13] also reported the effectiveness of Dimethoate in controlling aphids' population in crop field. Cornale et al. [14] reported that the use of an insecticide with a wide spectrum of activity such as Dimethoate against aphids besides being unnecessary caused the collapse of populations of beneficial insects.

Newer chemicals tended to be more effective when their efficacy was determined with the number of aphids observed in connection with yield out put as compared to already existing chemicals. The varying efficacy in these treatments may lead us to consider these chemicals as pest management tools. The mode of action of newer chemicals was unique as comparable to that of other chemicals of present studies. After their entering in the insect body either through the cuticle or by ingestion, their rapid absorption and lethal action contributed to enhance pest mortality. Similarly, their mode of action resulted in severity of paralysis and finally the death of aphid. Inhibiting of feeding by insect with newer chemical treatments was rapid and pest knockdown occurred within few hours. Further, different mode of action of newer chemicals may not show cross-resistance in aphid, and also the existing insecticides has a low use rate for pest mortality as compared to conventional insecticides (organophosphate), which are the additional advantages of newer insecticides. Similar studies on the efficacy of different insecticides against mustard aphid on mustard and rape were carried out by Sarwar et al. [15]; Anil et al. [16] and Rana et al. [17]. All these earlier studies revealed that most of sprays, proved to be effective against aphid incidence.

A few earlier researchers have also reported the superfluous effectiveness of newer chemicals; Fanti and Fanti [18] focused their studies on testing the efficacy of new formulations of insecticides including Imidacloprid and Acetamiprid, and compared with that of traditionally used insecticides. The effectiveness of all new insecticide formulations was greater than 95% and they were significantly more effective against the aphid. Sreelatha and Divakar [19] reported the effectiveness of Imidacloprid as seed treatment against aphids. Bragg and Burns [20] recommended Imidacloprid as seed treatment that provided season-long (throughout pod ripening) aphid control. Similarly, Misra [21] reported the parallel results and revealed that newer insecticides like Imidacloprid and Thiomethoxam proved quite superior to conventional insecticide like Dimethoate etc. in controlling aphids. Gesraha [22] investigated that newer insecticides were found much more toxic to the pest than predator. It may be suggested from these results that the selected newer insecticides could be incorporated into the integrated aphid management system in rape and mustard cultivations.

4. Conclusions

The results of this study reflected that newer insecticides were superior in reducing the population of aphids and yield enhancement as compared to conventional insecticides. So, one of the most quick and effective insect control methods is the use of newer chemicals, which might be based upon proper selection of insecticide, its dose and application technique. Integration of such chemicals in insects' management package would help to reduce the need for conventional chemical uses. This revealed that new chemical insecticides used in transition could reduce the need for complete reliance on chemicals, and can lead towards reliance on non-chemical tactics for the control of aphid. The new insecticides with novel modes of action and other benefits would provide the necessary additional tools for successful implementation of IPM programme.

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