MANAGEMENT OF APHID, *LIPAPHIS ERYSIMI* (KALTENBACH) (HOMOPTERA: APHIDIDAE) IN CANOLA (*BRASSICA NAPUS* L.) CROP USING NITROGENOUS FERTILIZERS AND SYNTHETIC INSECTICIDES

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ABSTRACT: Field experiment was conducted at the farm of Faculty of Agriculture, Gomal University, Dera Ismail Khan to determine integrated effect of nitrogenous fertilizer and synthetic insecticides on aphid, *Lipaphis erysimi* (Kaltenbach) (Homoptera: Aphididae) population in canola crop during 2010-11. Results showed that tested insecticides significantly reduced aphid population compared to control. Minimum (8.67aphids) were recorded after 3rd week of treatment with karate 2.5 EC (625ml.ha^{-1}) using medium dose (58kg.ha^{-1}) of nitrogen fertilizer. The same treatment also provided maximum (1246.91kg.ha^{-1}) grains yield. It was concluded from the present studies that tested levels of nitrogen fertilizer had no effect on aphid population, while synthetic insecticides significantly reduced pest infestation.

Key words: Canola, aphid, *Lipaphis erysimi*, nitrogen application.

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INTRODUCTION

Canola (*Brassica napus* L.) is an important oil seed crop in Pakistan and a good source of edible oil for human consumption. Its seed contains less than 2% erucic acid and 5-8% saturated fats (Raymer, 2002).

The crop is attacked by various invertebrate pests all over the world. Canola aphid, *Lipaphis erysimi* is a major pest of this crop (Blackman and Aestop, 2000). The pest breeds parthenogenically and complete 4 to 5 generations in a year (Lohar, 2001). Both the nymphs and adults of the pest damage to the crop by sucking cell sap from leaves, inflorescence, pods and cause 70-80% yield losses. During the years of sporadic attack and severe infestation, there may be no grain formation at all **(**Khattak *et al*., 2002; Rana, 2005).

Different control tactics have been practiced for the control of this pest. Application of non-chemical control tactics keeps aphid population below economic injury level. However, in cases of severe infestation, use of pesticides become essential (El-Hag and Zaitoon, 2000). As a vital part of integrated pest management, pesticides play an important role in plant protection (Soomro *et al*., 2008). Organophosphate insecticides, viz. phosphamidon, quinalphos, malathion, dimethoate and diazinon have been successfully used against this pest (Gazi *et al*. 2001). Granular insecticides, viz. thimet 10G and furadan 3G have also been found effective against *Myzus persicae* (Saljoki and Emden, 2003 and Patil *et al.*, 2004). However, indiscriminate use of these insecticides deteriorates agro-ecosystem, public health and environment as well (Ali and Rizvi, 2008). Therefore, it is desirable to integrate environmentally safe control tactics in pest management to minimize the use of synthetic insecticides.

The present study was designed to determine integrated effect of synthetic insecticides and nitrogen fertilizer on aphid population in canola crop.

MATERIALS AND METHODS

Field experiment was conducted at the farm of Faculty of Agriculture, Gomal University, D.I.Khan to establish integrated pest management strategy for the control of aphid in canola crop. The trial was laid out in randomized complete block design (RCBD) with three nitrogen levels and three insecticides along with a control, each having three replications. Seed of Bulbul variety was sown during 1st week of October, keeping plant-to-plant and row-to-row distance 30 and 45cm respectively. Treatment size was 3 × 2.7 meters. An area of one meter between treatments and two meters between replications was maintained as a path. Agronomical practices were performed uniformly in all of the treatments, except for nitrogen fertilizer, which was applied in three different doses, viz. 30, 58 and 93 Kg.ha^{-1}. The insecticides, viz. Ripcord 10EC (625ml.ha^{-1}), Karate 2.5EC (625ml.ha^{-1}) and Furadan 3G (25 kg.ha^{-1}) were applied to the crop when pest density reached at economic threshold level.

To assess aphid population in each treatment, Data was recorded at weekly intervals, starting from initiation of flowering until crop maturity. Aphid population (nymph/adults) was recorded on upper 10cm of inflorescence of six randomly selected plants in central two rows in each treatment. Aphids were dislodged from

the selected portion of inflorescence with the help of a camel hair brush onto a white greasy sheet and were counted using magnifying glass. Mean aphid population was calculated using the following formula.

$$\text{Mean aphid population} = \frac{\Sigma x}{n}$$

Where

Σx = Total number of aphid counted

n = number of samples

At the end of experiment, data of grains yield/plot was recorded and converted into kg/hectare using the following formula.

$$\text{Grain yield per hectare (kg)} = \frac{\text{Yield per plot} \times 10000}{\text{Plot size}}$$

Data was subjected to analysis of variance technique (Steel *et al*., 1997) using statistical analysis software MSTAT-C as two factors randomized complete block design. The significant means were determined by using least significance difference (LSD) test at 0.05 probability level.

RESULTS AND DISCUSSION

Aphid Population after 1st Week of Insecticides Application: Tested nitrogen levels had no significant effect on aphid population. However, synthetic insecticides significantly reduced pest population compared to control (Table-1). Minimum aphid population was recorded in treatment T_2 (21.53), which was statistically at par with T_1 (24.59) and T_3 (27.14) and significantly different from T_4 (64.28). The interaction of nitrogen levels and insecticides showed that minimum aphid population was recorded in D_2T_2 (20.06), which was statistically at par with rest of the treatments, except for control, where maximum (64.28) aphids were observed.

Aphid Population after 2nd Week of Insecticides Application: Data recorded after 2nd week of insecticide application showed that different nitrogen levels, had no significant effect on aphid population (Table-2). However, all the tested insecticides significantly reduced the pest population compared to control. Interaction of nitrogen levels and insecticides showed that significantly lowest (20.39) aphid population was recorded in D_1T_3, while significantly highest (48.26) population was recorded in untreated plot.

Aphid Population after 3rd Week of Insecticides Application: Data recorded after 3rd week of insecticides application revealed that nitrogen levels had no significant effect on aphid population (Table-3). As far as efficacy of synthetic insecticides was concerned, all of the treatments were found to be effective against the pest compared with control. Interaction of nitrogen levels and insecticides showed that significantly lowest aphid population (8.67) was recorded in D_2T_2, while highest population (32.29) was recorded in control.

Grains Yield: Results revealed that maximum (1164.20 $kg.ha^{-1}$) grains yield was produced by the plants treated with karate, which was statistically at par with ripcord (1074.07 $kg.ha^{-1}$). Significantly lowest grains yield (604.94 $kg.ha^{-1}$) was recorded in control. Interaction of nitrogen levels and insecticides showed that maximum (1246.91 $kg.ha^{-1}$) grains yield was recorded in D_2T_2, while minimum (461.73 $kg.ha^{-1}$) was recorded in control (Table-4).

Table-1. Aphid Population after 1st Week of Insecticides Application

Nitrogen Levels	Aphid Population				Mean
	T_1 (Ripcord)	T_2 (Karate)	T_3 (Furadan)	T_4 (Control)	
D_1 (30kg N/ha)	28.39^{b}	24.00^{b}	24.89^{b}	64.28^{a}	35.39^{NS}
D_2 (58kg N/ha)	20.78^{b}	20.06^{b}	28.39^{b}	64.28^{a}	33.38
D_3 (93kg N/ha)	24.59^{b}	20.53^{b}	28.14^{b}	64.28^{a}	34.39
Mean	24.59^{b}	21.53^{b}	27.14^{b}	64.28^{a}	

Means followed by different letter (s) in respective column/rows are statistically different at 5% probability level. NS stands for non-significant

Table-2. Aphid Population after 2nd Week of Insecticides Application

Nitrogen Levels	Aphid Population				Mean
	T_1 (Ripcord)	T_2 (Karate)	T_3 (Furadan)	T_4 (Control)	
D_1 (30kg N/ha)	24.83^{d}	28.61^{c}	20.39^{f}	48.26^{a}	30.52^{NS}
D_2 (58kg N/ha)	24.11^{e}	24.01^{e}	20.39^{f}	48.26^{a}	32.18
D_3 (93kg N/ha)	24.81^{d}	24.81^{d}	24.85^{d}	48.26^{a}	30.68
Mean	24.58^{b}	25.81^{b}	25.85^{b}	48.26^{a}	

Means followed by different letter (s) in respective column/rows are statistically different at 5% probability level. NS stands for non-significant

Table-3. Aphid Population after 3rd Week of Insecticides Application

Nitrogen Levels	Aphid Population				Mean
	T_1 (Ripcord)	T_2 (Karate)	T_3 (Furadan)	T_4 (Control)	
D_1 (30kg N/ha)	16.56^{b}	16.70^{b}	16.10^{bc}	32.29^{a}	20.41^{NS}
D_2 (58kg N/ha)	12.99^{bc}	8.67^{c}	20.14^{b}	32.29^{a}	18.52
D_3 (93kg N/ha)	16.27^{bc}	12.69^{bc}	16.62^{b}	32.29^{a}	19.47
Mean	15.27^{b}	12.69^{b}	17.62^{b}	32.29^{a}	

Means followed by different letter (s) in respective column/rows are statistically different at 5% probability level. NS stands for non-significant

Table-4. Effect of Nitrogen Levels and Insecticides on Grains Yield

Nitrogen Levels	Grains Yield (Kg.ha^{-1})				Mean
	T_1 (Ripcord)	T_2 (Karate)	T_3 (Furadan)	T_4 (Control)	
D_1 (30kg N/ha)	988.89^{bc}	1081.48^{abc}	953.09^{c}	676.54^{d}	925.00^{NS}
D_2 (58kg N/ha)	1159.26^{ab}	1246.91^{a}	1023.47^{bc}	676.54^{d}	1026.55
D_3 (93kg N/ha)	1074.07^{abc}	1164.20^{ab}	988.89^{bc}	461.73^{e}	922.22
Mean	1074.07^{ab}	1164.20^{a}	988.48^{b}	604.94^{c}	

Means followed by different letter (s) in respective column/rows are statistically different at 5% probability level. NS stands for non-significant

It was observed from the results that synthetic insecticides, viz. ripcord, karate and furadan significantly reduced aphid population and increased grains yield of canola plants compared to control. Highly significantly yield was recorded with the application of karate 2.5EC and ripcord 10EC. Our findings are supported by the finding of Gazi *et al*. (2001), who with the application of organophosphate insecticides, viz. phosphamidon, quinalphos, malathion, dimethoate and diazinon obtain similar results against mustard aphid. While Saljoki and Van Emden (2003) also reported efficacy of granular insecticides against *Myzus persicae*. They obtained effective control of the pest using thimet 10G (phorate) and furadan 3G (carbofuran). Phorate 10G @ 2.5 and 3.0 kg a.i.ha^{-1} had been successfully used for the control of sugarcane wooly aphid (Patil *et al.*, 2004). According to Amitava and Santanu (2005), granular insecticides (phorate 10G and carbofuran 3G) were effective against *M. persicae* and *Aphis gossypii* compared to biopesticides. Spray application of lambdacyhalothrin 2.5EC and advantage 20EC caused significant reduction in aphid population (Rana *et al*., 2007). Similarly, Farooq and Tasawar (2009) noted significant reduction in *Brevicryne brassicae* population with treatment of lannate 40SP @ 560 g.ha^{-1}. The present results are supported by the findings of previous workers, who effectively controlled this pest problem by using synthetic insecticides.

It was further observed that nitrogen fertilizer had no significant effect on aphid population. Similar results were also reported by Aslam *et al.* (2004). Who found that nitrogen fertilizer had no adverse effect on biology of *L. erysimi*. While, Khattak *et al.* (1996) reported that aphid population increased with an increase in nitrogen level. However, they noted comparatively less population of the pest when nitrogen was applied in combination with phosphorus. According to Kumar *et al.* (1998), excessive application of nitrogen fertilizer encouraged the development of aphid population. Similar results were also reported by Yadu and Dubey (1999). The present results are also in agreement with findings of Aslam *et al*. (2004), who reported that nitrogen fertilizer had a non-significant effect on aphid population in canola crop.

REFERENCES

Ali, A. and P. Q. Rizvi (2008). Influence of aphid species on the development and predation of *Menochilus sexmaculatus* Fabricius (Coleoptera: Coccinellidae). J. Eco-Friendly Agric. 3: 134-137.

Amitava, K. and P. Santanu (2005). Comparative field efficacy of synthetic insecticides and biopesticides against aphids on potato. Annals of Plant Prot. Sci., 13(1): 34-36.

Aslam, M., M. Razaq and A. Maalik (2004). Effect of nitrogen fertilizer application on population of mustard aphid (*Lipaphis erysimi* Kalt.) on different canola varieties. Pak. Entomol., 26 (1): 115-119.

Blackman, R. I. and V. F. Aestop (2000). Aphid on the world crops: an identification and information guide. John Wiley and Sons, N.Y., 476 p.

El-Hag, E.A. and A. A. Zaitoon (2000). Studies on the integrated control of cereal aphids in the Gassim area, Saudi Arabia. The BCPC Conference:

Pests and diseases proceedings. Entomol. Exper. et Appl. 64(7): 254-261.

Farooq, A. and Z. Tasawar (2009). Comparative efficacy of five different insecticides against *Brevicoryne brassicae* (Linn.) (Homoptera: Aphididae), a pest on canola in Southern Punjab, Pakistan. Pak. J. Zool., 41(1): 75-77.

Gazi, M., A. Hossain, M. Z. Islam, M. A. Hossain and M. Khalequzzaman (2001). Effect of some insecticides on mustard aphid, *Lipaphis erysimi* (Kaltenbach) in field and net house conditions. J. Biol. Sci., 1(11): 1031-1033.

Khattak, S. U., A. S. Khan, M. Shah, Z. Alam and M. Iqbal (1996). Effect of nitrogen and phosphorus fertilization on aphid infestation and crop yield of three rapeseed cultivars. Pak. J. Zool., 28(4): 335-338.

Khattak, S.U., H. Muhammad, A.U. Khan, Z. Aslam and F. Abid (2002). Pesticidal control of rapeseed aphid, *Brevicoryne brassicae* (L.). Pak. J. Zool. 34: 225-228.

Kumar, B., A. Kumar, M. S. Ali and J. Prasad (1998). Effect of different levels of nitrogen on incidence of mustard aphid (*Lipaphis erysimi* Kalt). Shashpa, 5(1): 111-112.

Lohar, M. K. (2001). Appl. Entomol.. 2nd Ed. Deptt. of Entomol. Sindh Agric. Univ. Tandojam. 242 p.

Patil, A. S., V. D. Shinde, S. B. Magar, R. G. Yadav and Y. S. Werkar (2004). Sugarcane woolly aphid (*Ceratovacuna lanigera* Zehtn.), its history and control measures. Proceedings of the 66th Annual Convention of Sugar Technologists Association of India, 133-155.

Rana, J.S. (2005). Performance of *Lipaphis erysimi* (Homoptera: Aphididae) on different brassica species in a tropical environment. J. Pest Sci., 78: 155-160.

Rana, Z. A., M. A. Shahzad, N. A. Malik and A. Saleem (2007). Efficacy of different insecticides and Dc-Tron Plus against mustard aphid, *Lipaphis erysimi* (Kalt). J. Agric. Res., 45(3): 221-224.

Raymer, P. L. (2002). Canola: An emerging oilseed crop. In: *Trends In New Crops And New Uses*. (Eds.) J. Janick and A. Whipkey Ashs Press, Alxenderia, Va. Pp. 122-126

Saljoki, A. U. R. and H. F. V. Emden (2003). Selective toxicity of different granular insecticides to the peach-potato aphid, *Myzus persicae* (Sulzer) (Homoptera: Aphididae) and its parasitoid *Aphidius matricariae* Haliday (Hymenoptera: Aphididae) in two differentially resistant potato cultivars. J. Biol. Sci. 3(2): 215-227.

Soomro, A. M., G. M. Seehar, M. I. Bhangar and N. A. Channa (2008). Insecticides in the blood samples of spray-workers at agriculture environment: The toxicological evaluation. Pak. J. Anal. Environ. Chem., 9(1): 32-37.

Steel, R. G. D., J. H. Torrie and D. A. Dicky (1997). Principles and procedures of statistics, a biological approach. 3rd ed. Mc Graw Hill, Book Co. Inc. NY, USA. Pp.352-358.

Yadu, Y. K. and V. K. Dubey (1999). Effect of nitrogen application and spray time on grains yield, net profit and mustard aphid (*Lipaphis erysimi*) population. Adv. Pl. Sci., 12 (1): 45-48.