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The comparative efficacy of different pesticides against aphid (*Brevicoyne brassica* + *Lipaphis erysimi*) on canola crop under arid condition

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Abstract
Experiments were carried out to evaluate the efficacy of different insecticides for the control of aphid in canola crop at Adaptive Research Farm Karor, Distt. Layyah, Punjab. Pakistan and farmer's field i.e. Chak No. 116/TDA Tehsil, Karor, Distt. Layyah Punjab, Pakistan under irrigated condition during Rabi crop season 2022-23. The trials were layout in Randomized Complete Block Design (RCBD) with three replications with plot size of 05 m x 0.9 m along with row spacing 45 cm. Six different pesticides treatments including T_1. Legend (Metrin) @ 740 ml ha^{-1}, T_2. Confidor (Imidacloprid) 25 WP @ 500 g ha^{-1}, T_3. Plenum (Pymetrozine) @ 200 ml ha^{-1}, T_4. Advantage (Carbosulfon) 20 EC @ 1250 ml ha^{-1}, T_5. Talstar (Bifenthrin) @ 370 ml ha^{-1} and T_6. Controls (check plot) were applied at pod formation stage. All insecticides gave effective control of aphid up to nine days after application in both locations (Table 1&11), but Advantage (Carbosulfan) 20 EC @ 1250 ml ha^{-1} proved to be the best because of its consistent effectiveness throughout the experiments. It is thus recommended that advantage (Carbosulfan) 20 EC may be applied @ 1250 ml ha^{-1} for offering control of aphid at pod formation stage.

Keywords: *Brassica napus Brevicoyne brassica Lipaphis erysimi* advantage, aphid, arid zone, Punjab, Pakistan

Introduction
Canola (*Brassica napus* L.) belogs to family is an important oilseed crop of world because seeds of this crop contains less than 2% erucic acid and <30 uMg^{-1} of gulcosinolates in the oil free meal, and canola oil contains 5.8% saturated fats which is low any other vegetable oil. (Raymer, 2002) [16]. Canola has been recently introduced in this country. In Pakistan, during Rabi 2022-23, canola was grown on an area of 509 thousands hectares with an annual total production of 796 thousand tones. (Economic Survey of Pakistan, 2022-2023) [10]. Due to its medicinal value and presence of lesser amount of saturated fats in canola oil has further increased its importance.

There are many reasons of low production but major threats for reduction in yield of *B. napus* are insect pests. Canola is the host of 21 insect pest species in the world (Lamb, 1989) [12]. among which aphid dominates the others (weber, *et al*. 1991) [18]. *B. Brassicae* and *L. erysimi* are also major insect pests in the USA, Australia and India. In Pakistan mostly five insect pests feed upon canola out of which *B. brassica* is the most serious as compared to others (Ali and Munir 1984) [1]. The cabbage aphid, (*Brevicoryne brassicae* L.) and turnip aphid, (*Lipaphis erysimi* Kalt.) are devastating insect pests of canola (*Brassica napus)* in Multan, Bahawlpur and Dera Ghazi Khan Districts of Punjab, Pakistan (Aslam and Razaq, 2007) [2]. Aphids suck the juices from all parts of the plants including leaves and inflorescence and deform them. The depletion of the nutrient in the plant parts adversely affects crop growth and seed yield. In case of severe infestation, yield may be reduced up to 35% (Buntin and Raymer, 1994, Atwal and Dhaliwal 1998.) [6, 3]. *L. erysimi* only can cause 10-90% damage depending upon the severity of the infestation and crop stage (Rana, 2005) [15]. Management tactics for aphid in these countries often rely heavily on insecticides as other methods of control have not been very effective (Buntin and Raymer, 1994; Brown *et al*, 1999; Chattopadhyay *et al*, 2005; Hanain *et al* 2007) [6, 5, 7, 11]. The importance of this pest on canola and other oil seed crops and needs for its management strategy has been emphasized by various workers in Pakistan.

(Chaudhry, 1985 Chaudhry, 1986), [8, 9]. India (Maurya 1998) [13]. and USA (Ramer *et al* 1990) [17]. The present studies were conducted to evaluate the percentage of infestation on canola crop by aphid and to assay the effect of successive application of pesticides on infestation rate.

Materials and Methods

Location

The experiments were conducted during Rabi crop season 2022-23 in Adaptive Research Farm, Karor, District Layyah Punjab Pakistan and at farmer's field i.e. Chak No. 116/TDA, Tehsill Karor, using canola variety super canola with seed rate of 5 kg ha^{-1}. The fertilizer NPK was applied as per recommendation and standard agronomic practices were given at a proper time. The crop was sown in 1st November with Randomized Complete Block Design (RCBD).The plot size was 05 m x 0.9 m along with row spacing of 45 cm and treatments were 1 m apart.

Treatments

The experiments were comprised of 6 treatments *viz*, T_1. Legend (Metrin) @ 740 ml ha^{-1}, T_2. Confidor (Imidacloprid) 25 WP @ 500 g ha^{-1}, T_3. Plenum (Pymetrozine) @ 200 ml ha^{-1}, T_4. Advantage (Carbosulfon) 20 EC @ 1250 ml ha^{-1}, T_5. Talstar (Bifenthrin) @ 370 ml ha^{-1} and T_6. Controls (check plot) were applied after completion the proper pest scouting of conola aphid.

Pest scouting and data recording

Data for canola aphid was counted on five randomly selected plants at their top 10 cm of central shoot when aphid population reached to Economic Threshold Level (ETL). Then application of insecticide was done as per treatment (Khan *et al*, 2017).

Five plants from two central row of each treatment were randomly selected tagged and aphid population was counted on them. For this purpose, the top 10 cm of the central inflorescence of a plant was beaten 10 times with 15 cm stick of pencil thickness. Aphids were collected on a piece of white plastic sheet and counted. This method has also been employed on sampling of aphid in India (Chatto padhyay, *et al*, 2005) [7]. This method is efficient and saves the time, labour, effort and resources. Insect population was recorded 24 hours before and at time intervals of 1, 3, 7 and 9 days after treatments.

Statistical analysis

The data mean aphid population per 10 cm shoot of central shoot was subjected to analysis of variance (ANOVA) by using M STATE, Computer software (MSU, 1982) mean of aphids population of canola were separated by Least Significance Difference Test at P-0.05%

Results and Discussion

The perusal of data exhibits that the both experiments were infested with aphid on canola crop. The data regarding the number of pests before spray indicated non-significant differences among all the treatments at both locations i.e. Adaptive Research Farm Karor and farmer's field (Table I&II). The data regarding mean numbers of aphids per inflorescence at ARF Karor (Table-1) showed non-significantly different in all the treatments before insecticide application (Table1). The percentage mortality in AR Farm Karor, one day after insecticide application mortality in Metrin @ 740 ml ha^{-1}, Imidacloprid 25 WP @ 500 g ha^{-1}. Pymetrozine @ 200 ml ha^{-1} and Carbosulfon 20 EC @ 1250 ml ha^{-1} treated plots were non- significantly different from each other but was significantly higher than that in Imidacloprid 200 SL and Control. On third and seventh day after insecticides application, mortality in all the insecticide treated plots was non significant but was significantly higher than that in control. On ninth day after application mortality of aphids was significantly lower in plots treated with Pymetrozine @ 200 ml ha^{-1} than all other treatments including control (check plot). This may be due to the loss of persistence of Pymetrozine after seven days of application and the pest were reappeared. Quality of food could have been poor for aphids at this stage of the crop, which has pronounced effect on insect population (Price, 1975). Percentage morality in control was also increased due to crop maturity resulting in emigration of aphids from canola.

While data pertaining to average population of aphid up to nine days after spray in farmer's field i.e. Chak No.116/TDA Tehsil. Karor, Distt. Layyah as indicated in table-II showed similar trend of results as that in AR Farm Karor (Table-1)

These results support the recommendations that mid-February were the most crucial time to spray with seven days interval when the population reached 50 aphids per plant (Maurya, 1998) [13]. Our findings are in contrast from different plant species under trial and sowing dates. It is concluded that there is no advantage of using pesticides for the control of canola aphids on pod formation stage of canola because aphid population will decline naturally at this stage. Application of pesticides should not be repeated before seven days. Among the tested different products, carbosulfon 20 EC @ 1250 ml ha^{-1} proved to be the best insecticide for offering control of aphid because of its persistence up to nine days after application.

Table 1: Mortality of aphid on canola with five insecticides at AR Farm Karor (Layyah)

Treatments/Application		1 DAT***	3 DAT	7 DAT	9 DAT
Metrin @ 740 ml ha^{-1}	91a	92a	96a	93a	91a
Imida 25 WP @ 500g ha^{-1}	89a	78a	92a	97a	96a
Pymetrozine) @ 200 ml ha^{-1}	66a	84a	90a	82a	66b
Cabosulfan1235ml	141a	71a	98a	100a	99a
Bifenthrin) @ 370 ml ha^{-1}	94a	33b	84a	100a	98a
Control	135a	33b	62b	73b	90a

Treatments, Aphids/Inflorescence* Percent Mortality of Aphids** Before insecticide

Means followed by same letter in columns are non-significantly different from each other (LSD. P=0.05)

Means followed by the same letter in columns are non-significantly different from each other (LSD. P=0.05)

*Top 10 cm of the central inflorescence

**Calculated on the basis of the number of aphids / inflorescences before insecticide application

***Days after treatment

Table 2: Mortality of aphid on canola with five insecticides at AR Farm Karor (Layyah)

Treatments/ Application		1 DAT***	3 DAT	7 DAT	9 DAT
Metrin @ 740 ml ha^{-1}	88a	89a	93a	90a	88a
Imida 25 WP @ 500g ha^{-1}	86a	75a	89a	97a	93a
(Pymetrozine) @ 200 ml ha^{-1}	63a	81a	87a	79a	63b
Cabosulfan1235ml	138a	68a	95a	97a	96a
Bifenthrin) @ 370 ml ha^{-1}	91a	30b	81a	97a	95a
Control	132a	30b	59b	70b	87a

Treatments, Aphids/Inflorescence*, Percent Mortality of Aphids**, Before insecticide

Means followed by same letter in columns are non-significantly different from each other (LSD. P=0.05).

Conclusion

All insecticides tested effectively controlled aphids in canola crops, with Advantage (Carbosulfon) 20 EC at 1250 ml ha-1 demonstrating the best and most consistent efficacy across both experimental sites. This treatment provided long-lasting control, making it the recommended option for aphid management at the pod formation stage. While other insecticides showed varying levels of effectiveness, their performance was not as consistent or persistent as Carbosulfon. Therefore, applying Advantage at the recommended dose is advised for optimal aphid control in canola.

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