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# Comparative efficacy of insecticides against mustard aphid in *Brassica juncea*

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**Abstract**
Rapeseed/Mustard crop is being widely promoted as a matter of crop diversification and significant emphasis is being laid on saving the crop from insect pests as scientists are continuously striving their best for the betterment of the quality of the produce of the crop. This research was conducted to determine the efficacy of different insecticides against the mustard aphid which causes significant yield losses in *Brassica juncea*. Study was conducted during crop season 2016-17 using RCBD design with 3 replications, data were recorded at different recommended time intervals. Maximum mortality of mustard aphid was caused by Advantage (98.70%) followed by Plenum (96.60%), Oshin (87.10%), and Pirate (49.60%). Advantage and Plenum represented least differentiated mortality percentages while results of Pirate treatment showed a possible indication of resistance development in insects against this particular insecticide.

**Keywords:** *Brassica juncea*, advantage, plenum, oshin, pirate, aphid

## Introduction
Brassica crop plants belong to the Brassicaceae family. Members of this genus are informally known as cruciferous plants (Frank, 1990) [12]. Most common species of this crop are *B. compestris*, *B. napus* and *B. juncea* (khan and Begum, 2005) [14]. This crop is grown in Rabi growing season in both irrigated and rain fed areas of Pakistan (Beversdrof and Hume, 1990) [9]. Pakistan produces 25 % of the domestic edible oil, cotton contribute 60% and brassica contribute 17% of the total requirement of Pakistan (Mohammad *et al.,* 2008). The area and production of rapeseed and mustard in Pakistan is about 522000 acres along with production of 206000 Tonnes seed and 66000 Tonnes Oil (Pakistan Economic survey, 2017-2018) [19]. Many insect pest play a limiting factor in yield of Brassica crop, which include Cabbage butterfly, Pea leaf miner, Shield bug and Mustard aphid. Mustard aphid *(Lipaphis erysimi*) can attain a status of key pest and cause severe losses in terms of decrease in quality and quantity of the produce. These losses may vary up to 96% (Bakhetia & Arora 1986; Rohilla *et al.*,. 1987; Bakhetia & Sekhon 1989; Singh & Sachan 1994; Singh & Prem-chand 1995; Sharma & Kashyap 1998; Singh & Sharma 2002) [6, 21, 7]. Mustard aphid may cause 66 to 99% losses in *Brassica campestris* L. and 27-28 percent in *Brassica juncea* L. (Bakhetia 1979) [7] along with decrease of about 15% in oil contents (Verma & Singh 1987) [28]. Incidence of Mustard Aphid *(Lipaphis erysimi)* has been reported all over the world where Brassica crops are grown on significant area (Yue and Liu, 2000). Mustard Aphid *(Lipaphis erysimi)* is reported to be present in Pakistan, India, Bangladesh, and USA (Verma and Sing 1987, Atwal and Dhaliwal, 2007, Biswas, 2008) [28, 5, 10]. The damage is caused by both nymph and adult stages as these suck the cell sap from leaves and leaves turn yellow from green and growth of plants is stunted. It found on all parts of plant; leaves, stem, blooming flowers and silique forming inflorescence, while in condition of severe attack, the plants may even die off (Aslam and ahmad, 2001) [4]. Mustard aphid has a very short time to complete its life cycle and ultimately can cause severe yield losses which are eventually losses in terms of money (Lane and Walter, 1991 Blackman and Aestop 2000) [16, 11]. More efforts are done to keep the insect pest population below than economic threshold level to have healthy crop and more yield by using different control measures. Chemical control is more accurate as it controls about 90% of the aphid population but due to its high rate of reproduction, in a period of 2-3 weeks after treatment of insecticide, the aphid population reaches around the same number as was before treatment (Singh *et al.*, 1983 Amer *et al.*,., 2009) [24, 3]. That's why it is mandatory for insecticides to have an effective control over Mustard aphid population for a longer period of time. Objective of the present study was to identify most suitable insecticide among the commonly used insecticides to control the population of Mustard aphid.

## Materials and Method
This study was carried out at farm area of Oilseeds Research Institute, Faisalabad, Pakistan in crop growing season 2016-17. Khanpur Raya; a cultivar extensively sown in the field area was used as test crop and germplasm was obtained from the Oilseeds Research Institute, Faisalabad. Crop was sown in

mid-November 2016 with RCBD design. Plot size was 5 m x 0.9 m along with row spacing of 45 cm and fertilizer was used at ratio of 90:85:60 NPK (kg/ha). Data for mustard aphid was recorded on five randomly selected plants at their top 10 cm of central shoot. When aphid population reached to economic threshold level, then treatment of insecticides was done (Khan *et al.*, 2017). Advantage 20EC@500ml/acre, Plenum 50%WG @0.16 kg/acre, Oshin 200SG@100mg/acre, Pirate 36SC@ 333ml/acre and control were applied in three replicates (Table 1). Five plants from each treatment were randomly selected, tagged and Mustard aphid population was recorded on them. Insect population was recorded 24 hours before application. Besides this, the insect pest population was recorded at time intervals of 24 hour, 48 hour, 72 hour and 168 hours after treatment. The experiment was repeated thrice to minimize possible error. Percentage mortality of mustard aphid was calculated by using the formula:

$$\% \text{ Mortality} = \frac{\text{Pre Treatment Population} - \text{Post Treatment Population}}{\text{Pre Treatment Population}} \times 100$$

The relevant data was tabulated and analyzed by using Statistix 8.1 software, Analysis of Variance was constructed and mean wise comparisons were made.

**Table 1:** Information about insecticide used in this experiment

| Sr. No. | Brand Name | Common Name | Formulation | Dose/acre |
|---|---|---|---|---|
| 1 | Advantage | Carbosulfan | 20 EC | 500 ml |
| 2 | Plenum | Pymetrozine | 50 WG | 0.16kg |
| 3 | Oshin | Dinotefuran | 20 SG | 100 mg |
| 4 | Pirate | Chlorphenapyar | 360 SC | 333 ml |
| 5 | Control | Untreated | | |

## Results and Discussion

**Table 2:** Analysis of variance for population of mustard aphid before treatment

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 2 | 2.39121 | 1.19561 | | |
| Insecticides | 4 | 10156.7 | 2539.18 | 641748 | 0.0000 |
| Error | 8 | 0.03165 | 0.00396 | | |
| Total | 14 | 10159.2 | | | |

**Table 3:** Analysis of variance for population of mustard aphid after 24 hour application

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 2 | 0.9 | 0.45 | | |
| Insecticides | 4 | 20448.4 | 5112.11 | 37867.5 | 0.0000 |
| Error | 8 | 1.1 | 0.13 | | |
| Total | 14 | 20450.4 | | | |

**Table 4:** Analysis of variance for mustard Aphid population after 48 hour application

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 2 | 0.6 | 0.31 | | |
| Insecticides | 4 | 20315.8 | 5078.96 | 47173.0 | 0.0000 |
| Error | 8 | 0.9 | 0.11 | | |
| Total | 14 | 20317.3 | | | |

**Table 5:** Analysis of variance for Mustard Aphid population after 72 hour application

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 2 | 9.8 | 4.90 | | |
| Insecticides | 4 | 20848.6 | 5212.14 | 1146.91 | 0.0000 |
| Error | 8 | 36.4 | 4.54 | | |
| Total | 14 | 20894.7 | | | |

**Table 6:** Analysis of variance Mustard Aphid population after 168 hour application

| Source | DF | SS | MS | F | P |
|---|---|---|---|---|---|
| Replication | 2 | 0.3 | 0.16 | | |
| Insecticides | 4 | 21706.6 | 5426.65 | 484520.2 | 0.0000 |
| Error | 8 | 0.9 | 0.11 | | |
| Total | 14 | 21707.8 | | | |

**Table 7:** Toxicity of different insecticides on mortality of aphid population at various intervals

| Brand name | Common name | Dose (Per Acre) | Population before treatment | Mortality Percentage | | | |
|---|---|---|---|---|---|---|---|
| | | | | 24 hours after treatment | 48 hours after treatment | 72 hours after treatment | 168 hours after treatment |
| Advantage | Carbosulfan | 500ml | 251.00b | 91.800a | 94.300a | 98.800a | 98.700a |
| Plenum | Pymetrozine | 0.16kg | 230.29d | 92.000a | 91.600b | 87.200b | 96.600b |
| Oshin | Dinotefuran | 100 mg | 239.26c | 81.500b | 77.933d | 81.800b | 87.100c |
| Pirate | Chlorphenapyr | 333ml | 190.80e | 46.500c | 89.900c | 31.800c | 49.600d |
| Control | untreated | 0 ml | 268.78a | -4.400d | -2.500e | 1.400d | -1.200e |

Results of Analysis of Variance (ANOVA) for this study represent that significant results were obtained and P value was found to be zero (Table 2-6). Insecticidal efficacy results of the present study reveal that after 24 hours of treatment relative efficacy of insecticides was comparatively higher in case of Plenum followed by Advantage, Oshin and Pirate respectively (Table 7). Advantage gave highest mortality of aphid population when population was counted 48 hours after treatment followed by Plenum, Pirate and Oshin (Table 7). After 72 hours of treatment Advantage gave highest mortality followed by Plenum, Oshin and Pirate (Table 7). Population of Mustard aphid was also counted 168 hours after treatment and the results represented that Advantage gave highest mortality percentage (98.7%) followed by Plenum (96.6%), Oshin

(87.1%) and Pirate (49.6%) respectively (Table 7).

Mortality percentage after 168 hours of treatment of Carbosulfan (98.7%) is much higher than reported by Ahmed *et al.,* (2017) which was 74.18%. Possible reason for the fluctuation can be the difference in dose as in present study 500ml/acre dose was evaluated while Ahmed *et al.,* (2017) evaluated the dose @ 300ml/acre.

Mortality caused by Pymetrozine (96.6%) is very close to the mortality caused by Carbosulfan (98.7%) after 168 hours of treatment (Table 7). Foug *et al.,* (1998) [13] claimed that pymetrozine has no significant knockdown effect rather it is slow poison as it kills the aphid and whiteflies by cessation of feeding. They are also accepting that in previous reports it is evident that during Laboratory studies, 90% aphid population was controlled within three hours after treatment however 100% mortality was not achieved even after 48 hours of treatment. Possible difference between their claim and results of the present study might be due to difference in species of Aphid as they targeted *Aphis gossypii* while in the present study *Lipaphis erysimi*; Mustard Aphid was the target.

Dinotefuran caused 87.1% mortality (Table 7) and Mohamed *et al.,* (2015) [17] claimed that after 168 hours of treatment it caused 86.77% mortality of Cabbage aphid on canola plants. The difference in mortality percentages in both the cases is almost negligible.

Mortality caused by Chlorfenapyr (49.6%) after 168 hours of treatment (Table 7) is near to the efficacy claimed by Sharma *et al.,* (2017) [23] on diamond back moth (51.66%) on its larval population. Patil (2015) claimed the mortality percentage of 51.49% in case of cowpea aphid. Previous studies provide significant evidence of low efficacy of chlorfenapyr which has been reconfirmed by the present study.

## Conclusion

The present study represents that maximum mortality one week after treatment (168 hours) was caused by Advantage followed by Plenum, Oshin and Pirate. It is evident from Table 7 that mortality percentages were almost equivalent to each other in case of advantage and Plenum. Oshin represented significant mortality in insect population but was less than Advantage and Plenum. Least mortality was caused by Pirate which can be a symbol of resistance development in insects against this particular insecticide.

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