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Effect of different synthetic chemical insecticides on potato aphid (*Macrosiphum Euphorbiae*, Thomas) and their inauspicious effects on lace wing in Skardu Baltistan, Pakistan

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Abstract
The present investigation was carried out at Skardu Baltistan region during summer 2015 to find out the efficacy of different synthetic chemical insecticides on Potato aphid (*M. euphorbiae*) and their inauspicious effects on Lacewing in potato field. The field investigation were carried out with seven treatments with different level of Insecticide concentration, Movento ® (low) @ 80ml/100 lit water, Movento ® (medium) @ 100/100 lit water, Movento ® (high) @ 120ml/100 lit water, Difenthuron (low) @ 80ml/100ml lit water, Difenthuron (medium) @100ml/100 lit water, Difenthuron (high) @ 120ml/100 lit water. Results showed that Movento ® (high) was more toxic against potato aphid followed by Movento ® (medium) and Movento ® (low), respectively. While on other hand Difenthuron was found most lethal for the lace wing population followed by Difenthuron (high), Difenthuron (medium), and Difenthuron (low). The study recommends the use of Movento ®for the safe and effective control of potato aphid (*M. euphorbiae*). Farmers should use Movento ® for the control of Aphids (*M. euphorbiae*) in the field as it is the least toxic to lace wing population.

Keywords: Movento®, Difenthuron, insecticides, Lace wing, Aphid

Introduction
Potato (*Solanum tuberosum* L.) is the fourth major food crop of the world. Potato is one of the cash crop of Pakistan, total production 3.55 million tons (Food and Agriculture Division, 2012) [4]. In Gilgit Baltistan, agriculture is the key source of income about 90 percent of population involved in agriculture sector (Khan and Akhtar, 2006) [6]. Climate is ideally suited for the cultivation of vegetables and fruits including potato, its productivity are very low. Potato production in Gilgit Baltistan region is (17.17 ton) per hectare. Potato is now gaining status of cash crop in Gilgit Baltistan after Apricot Food and Agriculture Division, 2012) [4].

Potato crop is seriously attacked and damaged by a number of insect pests i.e. wireworms, aphids, cutworm and others which cause reduction of yield of the crop. Potato aphid is included one of the devastating insect pest of potato crop Ahmed *et al*. (2007) [1]. Green lacewing, *Chrysoperla carnea* (Stephens) commonly known as "aphid lion" is predominately important and widely distributed in Pakistan (Afzal and Khan, 2008) [3] and other parts of the world (Geetha and Swamiappan, 1998) [5]. It is considered a prominent general predator that feeds on a variety of insect pests of field crops, vegetables and fruit orchards. Because of its voracious feeding on soft bodied insects *e.g.*, aphids, caterpillars, leafhoppers, psyllids, mealybugs, white flies, thrips, insect eggs, spiders and mites, it is considered as an important component of IPM program (Rashid *et al.*, 2012) [7].

Larvae are "alligator" shaped with long forceps-like curved tubular mandibles and have colorations ranging from grey to brown. The tubular mandibles inserted into insect body and suck the insect contents (blood) and probably for that nature it is known as "aphid lion". Ahmed *et al*. (2007) [1] noticed that as prey densities increased, *C. carnea* larvae increased its food consumption. It shows higher predation on older larval stages than younger ones. During development, each larva of *C. carnea* consumed an average of 732.35 eggs of

Corcyra cephalonica, 662.53 eggs of *Heliothis armigera*, 419.18 *Aphis gossypii*, 409.55 neonates of *H. armigera*, 329.70 pupae of *Bemisiatabaci* and 288.45 nymphs of *Amrasca biguttula and M. Euphorbiae* (Balasubramani and Swamiappan, 1994) [3].

Work on potato aphid is limited in the Gilgit Baltistan region as potato aphid is most emerging pests according to the survey of PARC Pakistan (Khan and Akhtar, 2006) [6]. Potato is one of the most growing and cash crop of Gilgit Baltistan but in recent years potato aphid cause great reduction in the yield of potato. For minimizing the economic loss the research work was programmed.

Materials and Methods

The experiment was carried out in Randomized Complete Block (RCB) design having seven treatments with different concentrations of Insecticides (80,100 and 120ml) against mites on potato crop and their inauspicious effects on lace wing at Skardu Baltistan during 2015.The field investigation took about three month from sowing to data collection. Plot size was 15m X 3.75m, plant to plant distance was 0.30-m and row to row distance measured 0.75-m.

Table 1: Insecticides were sprayed with their respective concentrations

Treatments	Active ingredient	Rate/100 litwater
1. Movento ® (240SC)	Spirotetramate +Imidaclopride	80.00 ml
2. Movento ® (240SC)	-	100.00 ml
3. Movento ® (240 SC)	-	120.00 ml
4. Difenthuron G/L	Difenthuron	80.00 ml
5. Difenthuron G/L	-	100.00 ml
6. DifenthuronG/L	-	120.00 ml
7. Control	…….	…….

Population Density of Aphid

Population density of aphid was recorded on linear colony dimension after spray. Data were collected from three different parts of plant i.e. top, middle and lower parts of five randomly selected potato plants. The column length of aphid colony was scaled and the number of aphids was counted in the colony. Population density of aphid/cm^2 was determined by the following formula.

$$\text{Population density of aphid/cm}^2 = \frac{\text{Number of aphid in colony}}{\text{Column length of colony}}$$

From the above data the mean aphid density was calculated.

Population Density of Ladybird Beetle

Number of ladybird beetles was counted in five randomly selected potato plants for each treatment and mean population density was determined. Data was analysed statistically and evaluated through LSD test (Steel and Torrie, 1980) [8].

Results and Discussion

Effect of different synthetic chemical insecticides on potato Aphid

After spraying the insecticides in the plots data were collected after one day result indicated that the lowest population of aphid was recorded in the plot treated with Difenthuron (low) 4.32 aphids/cm^2 followed by Movento ® (high) 4.34 aphids/cm^2, Movento® (medium)5.17 aphids/cm^2,Movento ®(low) 6.01 aphids/cm^2, Difenthuron (medium) 6.06 aphids/cm^2 and highest population was recorded on Difenthuron (high) 6.60 aphids/cm^2 while in control plot the population density of potato aphid was recorded 18.54 aphids/cm^2 (Table I).

Data recorded three days after spraying revealed the lowest population of aphids on Movento ® (high) 2.34 aphids/cm^2 followed by Difenthuron (high) 3.44 aphids/cm^2, Movento® (medium) 3.55aphids/cm^2, Difenthuron (medium) 4.26 aphids/cm^2, Movento ®(low) 4.87 aphids/cm^2 and highest population was recorded on plot treated with Difenthuron (low)7.06aphids/cm^2.Whilein control plot population density of potato aphid was recorded 7.10 aphids/cm^2 (Table I).

Over all mean of the data indicated a significant difference among the treatments and control. The lowest population of 5.701 aphids/cm2 was recorded on Movento ® (high) which was followed by Movento® (medium) 6.897 aphids/cm^2, Difenthuron (high) 7.053 aphids/cm^2, Movento ® (low) 7.081 aphids/cm^2, Difenthuron (medium) 8.331 aphids/cm^2 and highest on Difenthuron (low) 9.068 aphids/cm^2. While in control plot population density of potato aphid recorded 14.34 was aphids/cm^2. These results are coinciding with Ahmad *et al*. (2007) [1] found that synthetic insecticide highly reduced potato aphid population (Table I).

Effect of different synthetic chemical insecticides on Lace wing

Observation recorded 12 days after spraying indicated lowest population density of lace wing on Difenthuron (high), Difenthuron (low) and Difenthuron (medium) *i.e.* 1.77, 2.44 and 3.60/5 plants. While in plot treated with Movento® showed less effect on Lace wing as Movento® (high), Movento® (Low) and Movento® (medium) *i.e.*4.8, 4.01 and 3.87/5 A highest population density (7.00 lace wing/5 plants) was recorded in control. All the treatments were significantly different with the control Table II.

Data in Table II fifteen days after spraying indicated the lowest population density of lace wing on Difenthuron (high), Difenthuron (medium) and Difenthuron (low) *i.e.* 1.10, 1.87 and 2.10lace wing/5 plants which was at par with all the treatments as compared to the control where the highest number of lace wing/5 plants was recorded *i.e.* 6.10. All the treatments were significantly different from control. No significant difference was recorded in all the treatment after eighteen, twenty one and twenty four days after spraying (Table II).

Results concluded from overall mean showed the lowest population lowest population density of lace wing on Difenthuron (high), Difenthuron (medium) and Difenthuron (low) *i.e.* 1.56, 1.97 and 2.709 lace wing/5 plants while highest number of population density of lace wing on Movento® (Low), Movento® (medium) and Movento® (high) *i.e.* 4.08, 3/07 and 2.91 lace wing/5 plants while in the control plot highest population density of lace wing was recorded.

5.93. (Table II). These findings are similar to the findings of Youn *et al.* (2003) [9] who stated that Difenthuron was very effective against aphids but highly toxic to lace wing population.

Table 1: Population density of M. euphorbiae following spray of the insecticides in potato field Mean density/sq cm in days

Treatments	Rate (a.i) 100 lit of H_2O					Days						
	1	3	5	7	9	12	15	18	21	24	Mean	
Difenthuron (low)	80ml	4.32d	7.06ab	20.10	6.0	7.13	7.60	12.3	11.10	11.3	3.77	9.068d
Difenthuron (medium)	100ml	6.60d	4.26bc	7.54	11.90	12.33	12.44	8.66	8.87	6.53	3.87	8.331e
Difenthuron (high)	120ml	6.11cd	3.44c	10.77	6.88	8.56	9.77	10.11	7.80	5.54	1.55	7.053f
Movento ® (low)	80ml	6.01ab	4.87a	10.50	6.17	8.33	9.40	9.86	7.98	6.89	3.00	7.081b
Movento ® (medium)	100ml	5.17bc	3.55bc	4.83	9.53	10.11	9.91	10.33	6.80	5.73	3.01	6.897c
Movento ® (high)	120ml	4.34cd	2.34bc	3.87	9.02	7.01	8.80	9.44	5.12	4.30	2.80	5.704g
Control	…….	18.54a	7.10a	17.96	21.18	15.36	14.23	19.10	12.19	7.89	9.90	14.34a
LSD Value	4.90	2.98										2.684

Note: Within a column means followed by different letters are significantly different at 0.05 probability level.

Table 2: Population density of Lace wing following spray of the insecticides in Potato field Mean density/5 plants in days

Treatments	Rate (a.i) 100 lit of H_2O						Days					
		1	3	5	7	9	12	15	18	21	24	Mean
Difenthuron (low)	80ml	0.23	1.30	1.10	2.10	5.13ab	3.60bcd	5.53b	2.10	3.23	2.77	2.709c
Difenthuron(medium)	100ml	0.17d	1.17	1.06	1.90	4.33b	2.44ab	4.66b	1.87	2.53	2.10	1.97 c
Difenthuron (high)	120ml	0.9	0.99	1.00	1.11	3.56	1.77	2.11	1.10	1.54	1.55	1.56e
Movento ® (low)	80ml	0.36	2.44	1.45	3.55	3.04ab	4.01bcd	4.08b	6.98	7.13	7.09	4.085d
Movento ® (medium)	100ml	0.87b	2.18bc	1.33	3.01	2.01ab	3.91abc	3.87b	5.80	4.73	2.98	3.071c
Movento ® (high)	120ml	0.13c	1.34bc	1.17	2.87	5.01b	4.80ab	6.44b	3.12	2.30	1.80	2.91b
Control	…….	4.54a	5.10a	6.96	6.18	6.36	7.23	6.10	7.19	7.89	7.90	5.93a
LSD Value	2.46	8.97	5.79									1.977

Note: Within a column means followed by different letters are significantly different at 0.05 probability level

Conclusion and Recommendations

According to the findings of experiment lowest population of *M. euphorbiae* was recorded in the plot treated with Movento ® and Difenthuron but between them Movento ® was more effective against Potato aphid. While on the other hand highest population of lace wing was recorded in the plot treated with Movento ®. While the plot treated with Difenthuron showed lace wing population was the lowest and turned out to be more toxic for natural enemies.

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