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Imtiaz Ali Khan
Department of Entomology, The University of Agriculture, Peshawar, Pakistan.

Sajjad Hussain
Department of Entomology, The University of Agriculture, Peshawar, Pakistan.

Rasheed Akbar
Department of Entomology, The University of Agriculture, Peshawar, Pakistan.

Muhammad Saeed
Department of Agricultural Sciences, University of Haripur, Pakistan.

Abid Farid
Department of Agricultural Sciences, University of Haripur, Pakistan.

Ijaz Ali
Department of Agricultural Sciences, University of Haripur, Pakistan.

Mukhtar Alam
Faculty of Agriculture, University of Swabi, Pakistan.

Bismillah Shah
Department of Entomology, The University of Agriculture, Peshawar, Pakistan.

Correspondence:
Imtiaz Ali Khan
Department of Entomology, The University of Agriculture, Peshawar, Pakistan.

Comparison of a biopesticide with three synthetic pesticides against pea aphid, *Acyrthosiphon pisum* Harris (Aphididae: Homoptera), on pea in Peshawar

Imtiaz Ali Khan, Sajjad Hussain, Rasheed Akbar, Muhammad Saeed, Abid Farid, Ijaz Ali, Mukhtar Alam, Bismillah Shah

Abstract
Pea aphid *Acyrthosiphon pisum* (Harris) (Hemiptera: Aphididae) is a major insect pest of pea in Peshawar, causing heavy losses to it each year. Synthetic insecticides have been routinely used for the control of insect pests of pea, but there are many side effects with the regular use of synthetics on pea crop. In the present study, efficacy of a biopesticide and three synthetic insecticides were compared against *A. pisum* on pea during 2005. The experiment was laid out in Randomized Complete Block Design (RCBD) at the New Developmental Farm (NDF) of the University of Agriculture Peshawar (UAP) in 2005 -2006. The results revealed that after 1st and 2nd chemical application overall mean density of *A. pisum* was significantly lower in larsban (2.01, 5.11 aphids leaf^{-1}) and megamos (2.32, 5.94 aphids leaf^{-1}). In control mean density of *A. pisum* remained significantly higher than all the treatments after each chemical application. Pea yield was significantly higher in larsban (3323 kg ha^{-1}) and lower in control (2352 kg ha^{-1}). The findings of the present research might help in better control of insect pest of pea crop in Peshawar.

Keywords: *A. pisum*, Biopesticide, pea, synthetic insecticides

1. Introduction
Pea, *Pisum sativum* L. is an annual plant, belongs to the family; *Leguminosae* and is a popular winter vegetable cultivated in various parts of the world. The major reasons for its low yield are cultivation on marginal land and imbalanced fertilizer application and attack of diseases and insect pests [1]. Pea crop is infested by a number of insect pests throughout its vegetative and production phases. The major insect pests attacking pea crop are thrips, aphids, leaf beetle, Mexican bean beetle, vegetable leaf miner, leafhopper, spider mite, corn earworm, European corn borer, stink bugs, lima bean vine borer and seed corn maggot [2].
P. sativum was attacked by pea thrips, *Caliothrips indicus* (Thripidae: Thysanoptera), pea aphid, *Acyrthosiphon pisum* Harris (Aphididae: Homoptera), leaf miner, *Phytomyza* sp. (Agromyzidae: Diptera) and gram pod borer, *Helicoverpa armigera* Hubner (Noctuidae: Lepidoptera) [3].
One of the major pests with economic impact on field pea crops in Bulgaria is *A. pisum*. The damage that aphids cause can be direct by phloem sap extraction, which may cause a reduction in photoassimilates and crop yield, or indirect by transmitting plant viruses [4]. Staggering 50% of insect-borne plant viruses are transmitted by aphids [5]. Additionally, aphids can cause damage to crops by their sucrose-rich excreta, termed honeydew, which can attract other pest species [6] and provide an ideal medium for sooty moulds that cover host-plant foliage and hinder the photosynthetic capacity of plants [7].
Keeping in view the importance of the pea crop and the damages caused *A. pisum* to it, the present experiments aimed to compare efficacy of one biopesticide and two synthetic pesticides against *A. pisum* on pea crop.

2. Materials and Methods
2.1 Experimental layout and data recording
For the experiments, pea variety "Climax" was grown at the NDF, UAP in 2005. The experiment was laid out in RCBD and replicated three times. There were four treatments and a control. The treatment size was 6 x 4 m^2. Ten plants were randomly selected per row of each

treatment and control for data recording. Number of aphids was recorded per three randomly selected leaves of the ten randomly selected plants per treatment. Data was recorded 24h pre-spray and 24h, 48h, 72h and then at weekly intervals after each chemical application in each treatment. In control, blank spray of tap water was applied. Uniform cultural practices were given to all treatments. The pesticides applied are given in table 1.

2.2 List of insecticides applied against *A. pisum*

Table 1: List of insecticides applied against *A. pisum* on pea crop during 2005.

Trade Name	Common Name	Recommended dose concentration concentration
Confidor	Imidachloride	0.6m/L
Trend	Methamidophos	4ml/L
Megamos	Acetamprid	1.25ml/L
BtA	Biopesticide cicide	1gm/L

2.3 Data analysis
The data were statistically analyzed by One-way ANOVA and the significance of mean differences was determined by Fisher's LSD test at $P < 0.05$ [8].

3. Results and Discussion
3.1 First spray against *A. pisum*
The results showed that density of the pest after 1st treatment was significantly lower in megamos and larsban treatments after 24h (0.53, 0.85 aphids leaf^{-1}), 48h (0.83, 1.15 aphids leaf^{-1}), 72h (1.28, 1.53 aphids leaf^{-1}), one week (3.05, 3.45 aphids leaf^{-1}) and two weeks (4.38, 4.63 aphids leaf^{-1}) (Table 2). In control density of the pest increased from 6.80 to 13.28 aphids leaf^{-1} during the crop growing season. Overall mean density of the pest was significantly lower in larsban (2.01 aphids leaf^{-1}) and megamos (2.32 aphids leaf^{-1}) whereas it was higher in control (9.31 aphids leaf^{-1}).

Table 2: Mean density of *A. pisum* leaf^{-1} on pea after 1st chemical spray in 2005.

	Mean density of pea aphids leaf^{-1}						
		Post-treatment					
Treatment	Pre -treatment	24h	48h	72h	1 week	2 weeks	Overall mean density
BtA	6.40	2.05b	2.55b	3.75b	5.73b	6.40b	4.09b
Trend	6.45	1.23c	1.53c	2.10c	4.33c	5.63bc	2.96c
Megamos	5.68	0.85d	1.15d	1.53cd	3.45cd	4.63c	2.32cd
Larsban	5.33	0.53d	0.83d	1.28d	3.05d	4.38c	2.01d
Control	6.80	6.93a	7.56a	8.45a	10.34a	13.28a	9.31a
LSD Value	N.S	0.4152	0.3254	0.8054	1.1654	1.5214	0.934

Means in columns followed by different letters are significantly different at 5% level of significance (LSD test).

3.2 Second spray against *A. pisum*
The results of the second spray against aphids on pea are presented in Table 3. Mean density of aphids leaf^{-1} was significantly lower in larsban and megamos treatments after 24h (1.68, 2.20), 48h (1.68, 2.38), 72h (2.35, 2.98) and one week (8.70, 9.50). After two weeks pest density was significantly lower in larsban (11.13 aphids leaf^{-1}). Overall mean density of the pest was significantly lower in larsban (5.11 aphids leaf^{-1}) and megamos (5.94 aphids leaf^{-1}). In control density of the pest gradually increased from 21.55 to 29.23 aphids leaf^{-1} during the experimental period.

Table 3: Mean density of aphids leaf^{-1} on pea after 2nd chemical during 2005.

	Mean density of aphids leaf^{-1}						
	Pre -treatment	Post-treatment					
Treatment		24h	48h	72h	1 week	2 week	Overall mean density
BtA	19.95	4.33b	5.20b	6.50b	14.55b	17.65b	9.64b
Trend	18.70	2.48c	3.05c	3.70c	9.95c	13.38c	6.51c
Megamos	19.03	2.20c	2.38cd	2.98cd	9.50cd	12.63c	5.94d
Larsban	18.40	1.68c	1.68d	2.35d	8.70d	11.13d	5.11d
Control	21.55	22.15a	24.62a	25.34a	27.30a	29.23a	25.73a
LSD value	N.S	1.214	1.094	1.009	1.201	1.411	1.201

Means in columns followed by different letters are significantly different at 5% level of significance (LSD test).

3.3 Yield of pea crop
The yield of pea was found significantly different among the treatments, and treatments and control (Fig 1). Pea yield was significantly higher in larsban (3323 kg ha^{-1}) and lower in control (2352 kg ha^{-1}).

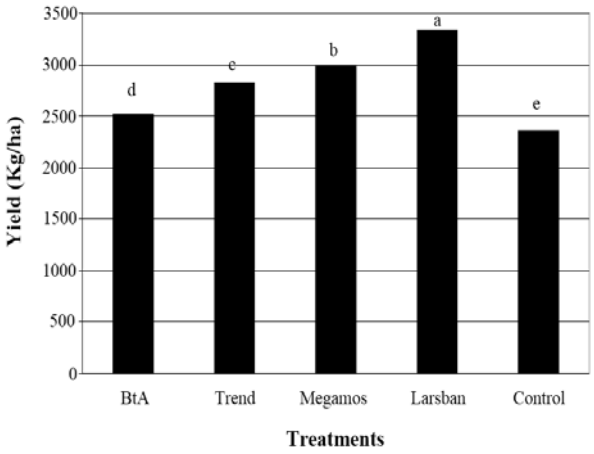

Fig 1: Mean yield of pea ha^{-1} in 2005. Bar heads with different letters are significantly different at 5% level of significance (LSD test).

In our results the synthetic insecticides lorsban, trend and megamos yielded significantly higher mortalities of *A. pisum* than the biopesticide BtA. All the chemicals resulted in significantly higher mortalities of the pest than control. Our results are comparable to those of some earlier researchers. The efficacy and effects of two biological insecticides, NeemAzal T/SR and Pyrethrum FS EC, applied individually and in combination with Polyversum (a biological growth regulator and fungicide) and Biofa (an organic foliar fertilizer), in controlling *Acyrthosiphon pisum* population density were studied. The interaction of Pyrethrum with Biofa was the most efficient variant of the biological products, causing a reduction in aphid density that reached 48.2% after double treatment, while Pyrethrum+Polyversum (42.5%) was the second most successful treatment. The combination of Pyrethrum with Biofa achieved the highest efficacy and synergism and their efficacy approached that of the synthetic insecticide [9].

Since biological products with the active substance azadirachtin are unstable under illumination, have rapid photo degradation under UV radiation, and are susceptible to low temperatures and rainfall [10, 11], NeemAzal exhibited a lower efficacy than Pyrethrum. Comparative analysis of individual application of these biological insecticides showed that Pyrethrum had a better protective effect. Pyrethrum applied at budding, and at budding and flowering stages resulted in a more substantial aphid density reduction of 6.3 and 16.3%, respectively, compared to NeemAzal. The mortality of pea aphids over the seven-day period was 6.9% (2011), 6.1% (2012) and 8.4% (2013) higher on the average than it was after treatment with NeemAzal [9].

Phytopesticides Piros and Pyrethrum exhibited high effectiveness against peach leaf aphid up to five days after treatment, while the efficacy of NeemAzal was significantly lower. However, NeemAzal showed a very good effectiveness in the study against cotton bollworms that reached 77% seven days after treatment [12]. Differences were observed in susceptibility between rosy apple aphids (*Dysaphis plantaginea* Pass.) and spiraea aphids (*Aphis spiraecola* Patch.) in relation to insecticides. NeemAzal and Pyrethrum were ineffective against spiraea aphids, while Pyrethrum showed flash action and resulted in a better control than NeemAzal and other botanical insecticides tested against rosy apple aphids as its efficacy was 100% on the first day after treatment. The action of NeemAzal was delayed and a good effect was reached three days after treatment [13]. Some authors have recommended that azadirachtin and Pyrethrum should be combined with plant oils in order to be more effective [14, 15].

A. pisum infestation of pea resulted in significant reduction in pea yield in our studies. Reduction in pea yield with aphid infestation has also been reported by some earlier researchers. Different pea varieties have different aphid infestation level and different yield can be obtained [16]. High pea yield can be obtained from resistant varieties and chemical treated plots [17].

4. Conclusion

A. pisum heavily infested pea variety Climax. All the insecticides resulted in significantly higher mortalities of the aphid than the control. The synthetic insecticides larsban, trend and megamos gave significantly higher mortalities of aphid than the biopesticide BtA. Pea yield was significantly higher in lorsban treatment. The findings of the present research might help in better control of *A. pisum* on pea crop in Peshawar.

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