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Efficacy of bio- and synthetic pesticides against pea leaf miner, *Phytomyza atricornis* Goureau (Diptera: Agromyzidae), on pea in Peshawar

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Abstract
Pea leaf miner *Phytomyza atricornis* Goureau (Diptera: Agromyzidae) 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 leaf miner on 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 *P. atricornis* of pea during 2005. The results revealed that overall mean density of *P. atricornis* after 1st and 2nd chemical treatment was significantly lower in megamos (1.08, 1.59 individuals leaf^{-1}) and larsban (1.47, 2.07 individuals leaf^{-1}). In control overall mean density and mean density after each chemical treatment of *P. atricornis* remained significantly higher than all the insecticidal treatments. Pea yield was significantly higher in lorsban (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: Biopesticide, *P. atricornis*, pea, synthetic insecticides

1. Introduction
Pea (*Pisum sativum* L.) is an important Rabi vegetable of Pakistan. The major reasons for its low yield are cultivation on marginal land and imbalanced fertilizer application and attack of diseases and insect pests [1]. Despite large number of cultivars in the field, pea yield per unit in Pakistan is lower than international standard due to many factors like poor cultural practices, poor weed control, disease incidence, pest attack, etc. Amongst these insect pests and diseases are major causes of low yield [2].
Pea leaf miner (*Phytomyza horticola* Goureau (Diptera: Agromyzidae) is a serious hinder in cultivation of peas (*Pisum sativum* L.) and cause 90% damage to the crop by mining young leaves which results in stunting and low flower production [3].
Leaf miners could influence crops in at least 6 ways, among which the most significant 2 ways are causing reductions in crop yields and reducing the aesthetic value of ornamental plants [4]. The female leaf miner cut the epidermis of the host plant leaves with its ovipositor and feed on the wounded part [5].
Keeping in view the importance of the pea crop and the damages caused by *P. atricornis* to it, the present study aimed to compare efficacy of one biopesticide and two synthetic pesticides against this pest.

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. The plants in each treatment were regularly observed at weekly intervals for leaf miner infestation. Stacking was used to support the succulent plant stems. In each row, excluding the two border rows, five plants were selected randomly for observation. The total numbers of infested leaflets per two branches per five plants were counted in each 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 tape 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	Imidacloprid	0.6m/L
Trend	Methamidophos	4ml/L
Megamos	Acetamiprid	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 $P < 0.05$ [6].

3. Results and Discussion
3.1 First application against *P. atricornis*
Mean density of *P. atricornis* was significantly lower in megamos 24h (0.55 individuals leaf^{-1}) and 48h (0.73 individuals leaf^{-1}) after treatment (Table 2). The pest density was significantly lower in megamos and lorsban treatments after 72h (1.03, 1.40 individuals leaf^{-1}) and one week (1.35, 1.75 individuals leaf^{-1}) and megamos, lorsban and trend after two weeks (1.78, 2.05, 2.15 individuals leaf^{-1}). Overall mean density of the pest was significantly lower in megamos (1.08 individuals leaf^{-1}), lorsban (1.47 individuals leaf^{-1}) and trend (1.62 individuals leaf^{-1}). Density of the pest in control increased from 2.48 to 5.46 individuals leaf^{-1} during the 25 days experimental period.

Table 2: Mean density of *P. atricornis* leaf^{-1} after 1st application during 2005.

	Mean density of *P. atricornis* leaf^{-1}						
		Post-treatment after					
Treatment	**Pre -treatment**	**24h**	**48h**	**72h**	**1 week**	**2 week**	**Overall mean density**
BtA	2.30	1.48b	1.75b	1.95b	2.18ab	2.28bc	1.92b
Trend	2.28	1.15bc	1.35c	1.58bc	1.90b	2.15bc	1.62bc
Megamos	2.65	0.55d	0.73d	1.03d	1.35c	1.78c	1.08c
Larsban	2.38	1.00c	1.18c	1.40cd	1.75bc	2.05bc	1.47c
Control	2.48	2.48a	2.51a	2.52a	3.45a	5.46a	3.28a
LSD Value	N.S.	0.3356	0.3514	0.36254	0.4125	0.4125	0.412

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

3.2 Second application against *P. atricornis*
Mean density of *P. atricornis* 24h after treatment was significantly lower in megamos (0.85 individuals leaf^{-1}) and larsban (1.35 individuals leaf^{-1}) treatments (Table 3). Forty eight hours after treatment it was significantly lower in megamos with 1.13 individuals/leaf. Megamos and lorsban yielded lower pest density after 72h (1.58, 2.13 individuals leaf^{-1}), one week (1.58, 2.13 individuals leaf^{-1}) and two weeks (2.83, 3.05 individuals leaf^{-1}). Overall mean density of the pest was significantly lower in megamos (1.59 individuals leaf^{-1}) and lorsban (2.07 individuals leaf^{-1}) treatments. The pest density in control increased from 4.58 to 7.87 individuals leaf^{-1} during the 25 days experimental period.

Table 3: Mean density of *P. atricornis* leaf^{-1} after 2nd application during 2005.

	Mean density of pea leaf miner leaf^{-1}						
		Post treatment after					
Treatment	**Pre -treatment**	**24h**	**48h**	**72h**	**1 week**	**2 weeks**	**Overall mean density**
BtA	4.10ab	2.65b	3.00b	3.40b	3.40b	4.03b	2.69b
Trend	3.53b	1.75c	2.05c	2.53c	2.53c	3.30c	2.43b
Megamos	3.88ab	0.85d	1.13d	1.58c	1.58d	2.83cd	1.59c
Larsban	3.58b	1.35cd	1.73cd	2.13c	2.13cd	3.05c	2.07bc
Control	4.58a	4.60a	4.62a	4.62a	6.58a	7.87a	4.58a
LSD Value	0.7703	0.8154	0.5482	0.9842	0.8124	0.5642	0.8324

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 higher in lorsban treatment (3323 kg ha^{-1}) and lower in control (2352 kg ha^{-1}). Pea was significantly higher in all the treatments than in control.

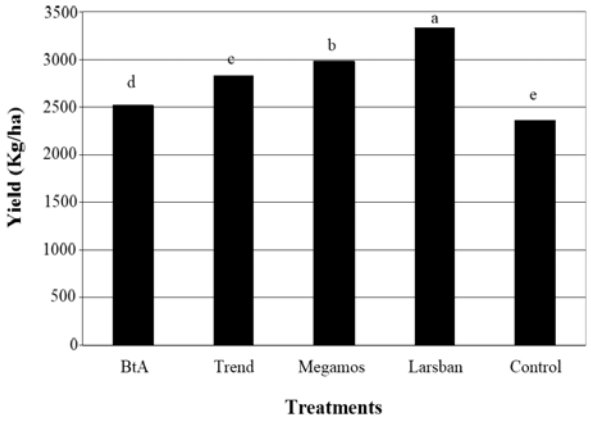

Fig 1: Mean yield of pea ha^{-1} after chemical treatment of the crop during 2005. Bar heads with different letters are significantly different at 5% level of significance (LSD test).

In our study the synthetic insecticides megamos, lorsban and trend resulted in significantly higher mortalities of *P. atricornis* than BtA and control. The pest density in BtA treatment was significantly lower than control. The present results are comparable to those of some earlier researchers. They also found synthetic insecticides highly effective against *P. atricornis* on pea crop, e.g., Pea leaf minor can be controlled by using different group of insecticides [7]; Synthetic insecticides significantly reduced pea leaf miner on pea crop [8]; Spinosad significantly reduced leaf miner larvae under laboratory conditions [9]; High pea yield can be obtained from resistant varieties and chemical treated plots [10].

In our study pea yield was significantly higher in megamos, trend and lorsban treatments than in BtA and control. The present results are comparable to those of some earlier researchers. Leaf miner infestation affect pea yield. Different varieties have different infestation levels, which significantly affects pea yield [11]. Among the five pea varieties minimum mean leaf miner infestation (4.3 infested leaflets /branch) were recorded in Climax, while maximum mean infestation (9.6 infested leaflets /branch) in Green Feast. After 1st and 2nd spray minimum infestation was recorded in Climax followed by Azad. There was significant difference among the pea yield. Highest mean yield was recorded in Climax (4.283 Kg/ plot), while minimum (2.53 kg/plot) in Azad variety. Among the five varieties Climax was more resistant to Pea leaf miner and also high yielding [12].

4. Conclusion

The synthetic insecticides megamos, trend and lorsban yielded significantly higher mortalities of *P. atricornis* and higher pea yield than in BtA and control. The results might help in better control of pea leaf miner on pea crop in Peshawar.

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