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To study the infestation level and effective chemical control of pomegranate fruit borer (*Virachola isocrates*)

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Abstract
Keeping in view the importance of pomegranate fruit borer (*Virachola isocrates*) different insecticides, Cypermethrin, Bifenthrin, Lambda-Cyhalothrin and Methomyl were tested against pomegranate fruit borer at Agriculture Research Institute Mingora Swat during summer 2015. The experiment was laid out in Randomized Complete Block Design, with three replications. Each replication was assigned with 5 treatments (Cypermethrin, lambda cyhalothrin, Methomyl, Bifenthrin and Control). Results showed that all the chemical application proved significantly better from control plot. Most effective was Lambda-Cyhalothrin which reduced the infestation level from 6.98 to 1.68 followed by methomyl (1.73), bifenthrin (2.05) and cypermethrin (2.58). Highest average infestation (8.14) was recorded in control plots.

Keywords: Chemical, infestation, borer and pomegranate

1. Introduction
The pomegranate, (*Punica granatum)*, belongs to family Lythraceae. An attractive shrub or small tree, with average height of 20-30 feet, the pomegranate is much-branched, more or less spiny and extremely long-lived. The leaves are evergreen or deciduous, showy flowers are singly or 5 in cluster form [16].

The fruit has leathery skin or rind, basically yellow more or less overlaid with light or deep pink or rich red. The interior is separated by membranous walls and white spongy tissue into compartments packed with transparent sacs filled with tart, flavorful, fleshy, juicy, red, pink or whitish pulp. In each sac, there is one white or red, angular, soft or hard seed. The seeds represent about 52% of the weight of the whole fruit [16].

Pomegranate produce best on deep, heavy loams, but are adapted to many soil types from pure sand to heavy clay. Growth on alkaline soil is poor. Optimum growth is associated with deep fairy heavy, moist soil of pH (5.5-7.0) [18].

It is widely cultivated throughout the Middle East and Caucasus region, North Africa and Tropical Africa, the India subcontinent, Central Asia, and the drier parts of Southeast Asia. In recent years, it has become more common in the commercial markets of Europe and the Western Hemisphere [16].

The pomegranate fruit could be considered a functional food because it has valuable compounds in different parts of the fruit that display functional and medicinal effects. These can act as antioxidant [5], as anti-tumoral [13] or anti-hepatotoxic [6] agents, and improve cardiovascular health [7].

They have been seen to have antimicrobial, anti-inflammatory, antiviral, antidiabetic properties [10, 15, 12, 22] and they can improve oral [8] and skin [3] health. They help prevent Alzheimer's disease [20] and improve sperm quality [21] and erectile dysfunction in male patients [11].

According to the broodier published by Pakistan Agriculture Research, 2015 about the importance of pomegranate among the Muslim countries, Afghanistan, Iran, Indonesia, Malaysia, Turkey, Saudi Arabia and the Gulf States are noted producers and exporters of fresh pomegranates. Other major producers are India, China and USA. In Pakistan, Balochistan is the main producer of pomegranates, although Khyber Pakhtunkhwa and Punjab are also producing pomegranates in isolated areas on a small scale.

In KPK pomegranate are cultivating in swat at its initial phases. Swat lies between 30° to 35° N latitude and 72° to 74° 6' E Longitude and are in Provincially Administrated Tribal Area (PATA) Khyber Pakhtunkhwa, Pakistan. Swat valley is mainly divided in seven different Tehsils namely, i.e. Brikot, Khwazakhela, Charbagh, Babozai, Kabal, Madyan and Matta [1].

Many types of fruits and vegetables are grown in Swat Khyber Pakhtunkhwa area devoted to the cultivation of the fruit was 12465 ha while for vegetable 7245 ha. The total fruit production is 90932 tons and 138818 tons of vegetables.

In Swat valley pomegranate is grown on very small area and does not have regular orchards but now some new orchards established in Chakdara (Kota) and Khwaza Khela (Swat) [2]. Pomegranate growers facing some emerging issues one of which is pomegranate fruit borer (*Virachola isocrates*).

Studies on the bio ecology and behavior of the pomegranate fruit borer, *Virachola isocrates* Fab. Revealed that the insect multiplied primarily on pomegranate crop under orchard agro-ecosystem. Guava also served as host crops to certain extent whenever the main host plant pomegranate is wanting or less suited for development of the larvae. Severe damage was noticed in 30–50 days old fruits of pomegranate and the adults preferred 30–50 days old fruits for egg laying and most of the eggs were laid on the calyx portion of the individual fruits. The severity of damage was noticed between April to August months. Fourth and fifth instar larvae caused maximum damage to fruits and total rejection of fruits is not uncommon on infestation by these insects [17].

2. Material and Method

The experiment was conducted at Agriculture Research Institute Mingora Swat in summer 2015. The experiment was laid out in Randomized Complete Block Design, with three replications. Each replication was assigned with 5 treatments (Cypermethrin, lambda cyhalothrin, Methomyl, Bifenthrin and Control). During the visits basic data before the application of spray was collected and formulation of spray was calculated. The following instruments, chemicals (insecticide) were used during formulation of spray;

1. Knapsack Spray 2. Electric Balance 3. Graduated cylinder

During the entire experiment a total of 3 sprays were applied with 10 days interval. Control was left undisturbed. Details of treatments are as follow;

Table 1: Treatment detail of different chemical insecticides

Treatments	Trade name	Chemical composition	Doses
T_1	Arrive	Cypermethrin 10%	3 ml/liter
T_2	Karate	Lambda Cyhalothrin 25w/v	3 ml/liter
T_3	Lannate	Methomyl 90%	3 gm/liter
T_4	Talstar	Bifenthrin 10%	3 ml/liter
T_5	Control	Spray with water	

2.1 Data Collection

Post treatment infestation data was recorded by observing infested fruits after 10, 20 and 30 days respectively and their average were also calculated.

2.2 Statistical Analysis

Data was analyzed by using Statistics software 8.1 version; Means were separated with L.S.D (Least Significance Difference) Test.

3. Results and Discussion

Data recorded on infestation of pomegranate fruit borer presented in table 2 which revealed that after chemical insecticides application all the chemicals proved very effective against the target pest as all the products significantly reduced the insect pest population. The infestation range was between 2.30-3.33 per plot. Significantly highest infestation 7.99 was recorded in control (sprayed with water).

Data recorded after 20 days of chemical application every chemicals found very effective against the target pest and all the chemical insecticides significantly reduced the insect pest population. The infestation range per plot was between 0.66-1.88. Control plots showed significantly highest infestation 8.22.

After 30 days of treatment application table data revealed that all the insecticides against the target pest found very successful and all the chemical insecticides significantly reduced the insect pest population. Per plot the infestation ranged was between 1.55-2.53. Significantly highest pest infestation 8.22 was recorded in check plot.

Average data showed that the entire chemical perform very effectively against the target pest and reduce the insect population. Statistically all the treatment showed no significant difference but among chemical insecticides treatments most effective was lambda cyhalothrin which reduced the infestation level from 6.98 to 1.68 followed by methomyl 1.73, bifenthrin 2.05 and cypermethrin 2.58. The experiment showed that that pomegranate fruit borer *Virachola Isocrates* could be effectively control by using chemical insecticides but lambda-Cyhalothrin was the most efficient in controlling the pest population. [4] Use different chemical insecticides for controlling pomegranate fruit borer and found phospsamidon the most effective. Our findings are against with [9] they use different insecticides for pomegranate fruit borer and found endosulfan the most effective and methyl least effective. [19] Applied different chemical and bagging for controlling pomegranate butterfly and most effective control was fruit bagging but due to high cost of the fruit bagging he cannot recommended. Methomyl was also found effective against maize stem borer [14].

Table 2: Effect of chemical insecticides on the infestation of pomegranate fruit borer

Treatment	Pre-Spray	10 days	20 days	30 days	Average infestation
Cypermethrin	7.12	3.33 b	1.88 b	2.53 b	2.58
Lambda-Cyhalothrin	6.98	2.30 b	1.21 b	1.55 b	1.68
Methomyl	7.25	2.33 b	0.66 b	2.21 b	1.73
Bifenthrin	7.30	2.63 b	1.88 b	1.66 b	2.05
Control (water)	7.35	7.99 a	8.22 a	8.22 a	8.14
LSD		3.483	2.097	3.32	2.96

4. Conclusion and Recommendation

All the chemical treatments found very effective but show no significant difference from each other. Most effective was Lambda-cyhalothrin which reduced the population from (6.98) to (1.68) followed by methomyl (1.73), bifenthrin (2.05) and Cypermethrin (2.58). Infestation in the control remains increased due to no chemical application. Therefore it is recommended that for effective control of pomegranate

fruit borer chemical application of lambda-cyhalothrin and methomyl would be valuable.

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