

**Management of major insect pest of bitter gourd (*Momordica charantia*) through different pesticides**

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**Abstract:** The present study is carried out at Agriculture Research Institute Swat during the year 2018 to study the Integrating Management of fruit flies on Bitter gourd with indigenous plant extract i.e (Garlic extract and Neem extract) and a product chemical (Mythomyl) 90Sp. The experiment was randomized complete block design with replications. The chemical were applied three times at the rate of 3ml/litre of water. The lowest mean percent infestation and highest percent reduction in the population of fruit fly was recorded in plot treated with (Mythomyl) 90Sp was (1.36, 64.38), trailed by Neem oil extract (1.52, 58.29) and Garlic extract (1.57, 59.36) which were nonsignificant. While highest mean population of fruit fly was observed in control plot (3.76). The highest yield and lowest percent damage (1845kg/ha, 15.3%) was observed in plot treated with Mythomyl 90Sp. Which were followed by Neem oil extract (1610kg/ha, 35.3%) and Gralic extract (1345kg/ha, 55.5%). While lowest yield and highest percent damage (1112kg/ha, 75.5%) was observed in control plot. The highest CBR was recorded in plot treated with (Mythomyl) 90Sp 1:5.41 followed by Neem oil extract 1:4.64, while lowest CBR was observed in Garlic extract 1:3.64 respectively. So it is concluded that the Chemical insecticide (Mythomyl) showed best results as compared to botanical extracts in controlling against fruit flies infestation and in production of Bitter gourd. It is recommended that Chemical insecticide (Mythomyl) is superior for controlling against fruit fly.

**Key words.** Bitter gourd, chemical, extracts, fruit fly

### Introduction

Bitter gourd (*Momordica charantia*) gets its name from the Latin word “momordica”, which means “to bite”, referring to the grooved edges of its seed which looks as if it has been chewed. It is a member of the gourd family (e.g., squash, cucumbers). Actually, bitter gourd looks somewhat like a cucumber with lots of warts. Despite its rather unflattering appearance and bitter flavor, it is one of the most nutritious gourds. Moreover, it is one of the most versatile vegetables that have multiple and integral uses. In Southeast Asia, bitter gourd is mostly grown for the local market (AURDC 2005).

Bitter gourd, or karela in Hindi, is relished for its benefits and despised for its bitter taste. It is an excellent source of vitamins B1, B2, and B3, C, magnesium, folate, zinc, phosphorus, manganese, and has high dietary fibre. It is rich in iron, and contains twice the beta-carotene of broccoli, twice the calcium of spinach, and twice the potassium of a banana, according to Health.com. Even drinking raw karela juice is full of advantages as it contains essential vitamins as well as antioxidants that all of us need. Fruit flies are a serious pest in Pakistan, causing losses, at the farm level, of an estimated \$200 million annually, with added losses to traders, retailer and exporters. Small farmers suffer in particular, being the main growers of highly susceptible guava and being unable to afford protection measures. The use of cover insecticide sprays against fruit fly is widespread and increasing (Stonehouse et al., 1997). Fruit flies are most serious pest of fruits and vegetables at global level distributed throughout Asia, Europe, Africa and Australia (Khattak et al., 2009). Fruit flies play havoc with horticulture industries as it attacks more than 250 different kinds of fruits and vegetables. Citrus, mango, guava, pomegranate, peach, plum, persimmon, loquat, pear, jujube, melon, watermelon, bitter melon, bottle gourd, pumpkin, cucumber, tomato, bottle gourd and sponge gourd suffer losses of about 7.5, 15, 35, 15, 20, 30, 35, 30, 7.5, 15, 30, 35, 7.5, 30, 20, 20, 30, 2.5 and 12.5% respectively with annual financial loss of nearly seven billion rupees (Irshad and Jilani, 2003). However many disadvantages are associated with the use of insecticides e.g. expensiveness, difficult application, environmental and health hazards, rapid resurgence of pest and non pest species, and resistant development in pest against insecticides. An alternative management method is the use of sex pheromones that attracts fruit flies. Balochistan melon fly (*Myiopardalis paradalina*) they are the major cash crop in the region and damage caused by pest is seriously reducing the incomes of farmers. In some areas, 90% of fruits are being lost Aziz et al., (2018).

#### ***Bactrocera cucurbitae***

Adults of this fly are reddish brown with 3 longitudinal lemon yellow colored strips on the thorax. The ovipositor of female is short is brown, wings have distinctive marking particularly finger like dark marking going forward and outwards from near the middle from trailing edge. It is comparatively less important than the species (Irshad and jilani, 2003). *B. cucurbitae* is distributed widely in temperate, tropical, and sub-tropical and sub-tropical regions of the world (Dhillon et al., 2005).

#### ***Bactrocera dorsalis***

The oriental fruit fly, *Bactrocera dorsalis* (Hendel), is a major pest throughout South East Asia and in a number of Pacific Islands (Stephens et al; 2007). Body colour of the adult is reddish brown with 2 longitudinal yellow striped at thorax, the ovipositor of the female is the short and brown. Adult have black T shaped marking on the abdomen with the bar of T always separated from the post (Irshad and jilani, 2003).

#### ***Bactrocera zonata***

*B. zonata* have longitudinal white/grey/yellow strips marking on the upper surface of the thorax above the wings; either no dark patch (stigma) on the wing tip, or if there is one, it is faint and not connected by a dark band to the colouring on the rest of the wings. It is the most common and wide spread species in Pakistan

as well as other fruit growing areas of the world. As such it has attained the attention of economic entomologist (Irshad and Jillani, 2003).

Employing homemade pesticides would cut food production losses and allow us to utilize environmentally acceptable pest control approaches (Hussain *et al.*, 2022), Keeping in view the above facts, the present study were conducted to know the effect of indigenous plant extract and chemical Mythomyl against fruit fly.

## MATERIALS AND METHODS

The Current study were carried out to integrate management of Fruit fly with product chemicals (mythomyl), Garlic Extract, Neem oil Extract in farmer field of Bitter Gourd at ARI(Agriculture Research Institute) Swat, in the month of June 2018 to August 2018, in Swat valley.

### Experiment

The experiment was laid out at Randomized complete block design (RCBD) to integrate management of fruit fly through indigenous plant extracts, such as Garlic extract, Neem oil extract, and chemical (mythomyl) in bitter gourd at Swat valley. Four treatments were used in the experiment i.e (T1, T2, T3, T4,) and it is replicated 3 times with some distance to avoid the effect of treatment on each other. The plots were regularly monitored and data were summed up on weekly basis from June 2018 to August 2018. The Treatments were as follows: T1= Garlic extract, T2= (Mythomyl) 90Sp, T3= Neem oil extract, T4= Control. The pesticides were applied at two week intervals at the rate of 3ml/litre of water to each treatment except control plot with the help of spraying pump in the presence of field officer ARI (Agriculture Research Institute) Swat.

### Extract Preparation

The garlic extract were prepared by rinse garlic twice with distilled water to remove dirt,extract were prepared with the help of juicer grinder by adding 20ml of water to garlic, later shaken thoroughly and shifted to clean beaker with the help of muslin cloth. Neem oil extract is available at local market, which is in liquid form.

### Yield kg plot<sup>-1</sup> and percent damage

The weight of bitter gourd collected from each treatment was recorded separately when it was picked from each plot. Total yield was calculated by combining all picking yields from each treatment. Total fruits was collected from each treatments and separate infested fruits from them and converted into percent damage.

$$\text{Percent damage} = \frac{\text{Total number of damaged fruit /plot} \times 100}{\text{Total number of fruit in plot}}$$

$$\text{Yield kg per ha} = \frac{\text{Fruit weight (kg)}}{\text{Total area harvested (m}^2\text{)}} \times 10000$$

### Percent infestation

Three plants were chosen randomly from each experimental plot. From each plant three leaves were collected for examination of pest arrival. Data were recorded at interval of before 24hr and after weekly interval.

### Percent reduction

The following formula was used to calculate the percent reduction.

$$\% \text{ reduction} = \frac{\text{No of insect in control} - \text{No of insects in treatment}}{\text{Number of insects in control}} \times 100$$

### CBR

Cost benefit ratios of different treatments were find out by the formula used by Hussain *et al.*, (2022).

### Statistical Analysis

The data was statistically analyzed by using computer based software Statistix 8.1 and LSD test were used for mean comparison.

### Results

#### Mean population and mean percent reduction of fruit fly

Fruit fly is the major insect pest of bitter gourd and farmer used different types of pesticides for their management. The current experiment was conducted to find out the efficacy of different pesticides against fruit fly. Before spray application the mean population of fruit fly was nonsignificant (Table.1). After first week the lowest mean population highest percent reduction of fruit fly was recorded in neem oil extract (1.02, 70.91%), followed by garlic extract (1.58, 55.36%) and Mythomyl 90Sp (1.66, 58.62%) respectively. The highest poplution (3.53) was recorded in control plot. After second week the mean population highest percent reduction of fruit fly was recorded Mythomyl 90Sp (1.15, 67.50%), followed by garlic extract (1.55, 56.31%) and neem oil extract (1.67, 53.03%) respectively. While highest mean population of fruit fly (3.56) was recorded in control plot. After third week the mean population highest percent reduction of fruit fly was recorded Mythomyl 90Sp (1.39, 61.88 %), followed by Garlic extract (1.63, 55.23 %) and neem oil extract (1.74, 52.20%) respectively. While highest mean population of fruit fly (3.64) was recorded in control plot. After fourth week the mean population highest percent reduction of fruit fly was recorded Mythomyl 90Sp (1.09, 69.84 %), followed by neem oil extract (1.26, 65.25 %) and gralic extract (1.54, 57.97%) respectively. While highest mean population of fruit fly (3.64) was recorded in control plot. After fifth week the mean population highest percent reduction of fruit fly was recorded Mythomyl 90Sp (0.92, 75.09%), followed by neem oil extract (0.98, 73.29 %) and gralic extract (1.08, 70.69%) respectively. While highest mean population of fruit fly (3.69) was recorded in control plot. After sixth week the mean population highest percent reduction of fruit fly was recorded Mythomyl 90Sp (0.63, 83.30 %), followed by garlic extract (0.67, 81.89%) and neem oil extract (0.93, 74.92 %) respectively. While highest mean population of fruit fly (3.74) was recorded in control plot. After seventh week the mean population highest percent reduction of fruit fly was recorded Mythomyl 90Sp (0.15, 96.79 %), followed by garlic extract (0.54, 88.54 %) and neem oil extract (0.83, 82.65 %) respectively. While highest mean population of fruit fly (4.78) was recorded in control plot. The lowest mean percent infestation and highest percent reduction in the population was recorded in plot treated with (Mythomyl) 90Sp was (1.36, 64.38), trailed by Neem

oil extract (1.52, 58.29) and Garlic extract (1.57, 59.36) which were nonsignificant. While highest mean population of fruit fly was observed in control plot (3.76). The highest yield and lowest percent damage (fig.1) was (1845kg/ha, 15.3%) observed in plot treated with Mythomyl 90Sp. Which were followed by Neem oil extract (1610kg/ha, 35.3%) and Gralic extract (1345kg/ha, 55.5%). While lowest yield and highest percent damage (1112kg/ha, 75.5%) was observed in control plot. The highest CBR was recorded (Table.2) in plot treated with (Mythomyl) 90Sp 1:5.41 followed by Neem oil extract 1:4.64, while lowest CBR was observed in Garlic extract 1:3.64 respectively.

### Discussion

The present study was carried out to evaluate the efficacy of three insecticides *viz.*, Garlic extract, methomyl, Neem oil extracts against populations of fruit fly. Before spray applications the population of fruit fly were nonsignificant in all the treatments. This results was similar to the result of Hussain *et al.* (2022). The chemical insecticides Mythomyl showed best results in the reduction of fruit fly infestation. Our findings are similar with the findings of Lamba *et al.* (2021) and Hussain *et al.* (2022) who reported that good control with garlic extract was attained in an integrated pest management (IPM) programmed. Shivangi *et al.* (2017) also studied that, garlic and neem oil extract is recognized as an integral component of IPM in horticultural crop, result it reduces pesticides level, with resulting beneficial result for predators, parasitoids and pollinators. Extract type organic insecticides are also less money consuming and less dangerous to enviroiment and human health. Pinnacle and Thai effectively control infestation of *B. cucurbitae* which was damaging to angled luffa and bitter gourd. It is likely that these extract and insecticide could also be effective in managing in infestation of fruit flies in other tropical crop. Khatun, *et al.*, (2002) also studied that Neem oil extract also control fruit flies i.e *Bactrocera cucurbitae*, *B. dorsalis* and *B. zonata*. Khursheed *et al.* (2012) studied that Mythomyl is useful choice of insecticides for fruit flies control and this is usually combined with protein hydrolysate to form a bait spray. Mehmood *et al.*, (1995) and Sawai *et al.* (2004) tested the efficacy of Mythomyl insecticide bait against fruit flies and repoted that Diptrix was the most effective tested insecticides based bait. Hsu and Feng (2000) was also reported methomyl and Hsu and Feng (2002) reported methomyl showed best results against *B. cucurbitae*. Our results are partially in agreement with Ahmad *et al.* (2010) who evaluated the insecticides resistance in two strains of *B. zonata* in Punjab, Pakistan. Nadeem *et al.* (2010) reported the susceptibility of *B. zonata*. Our results also showed that three populations of *B. zonata*. Effectively there is no analogous study against methomyl in Pakistan, however, our work is contradictory to the results reported by El-Aw *et al.* (2008) who paralleled the toxicity of different pesticides against peach fruit fly (*B. zonata*) and found that methomyl was more operative than the other insecticides. Hsu and Feng (2002) compared the resistance level in different insecticides against population of *B. dorsalis* (Hendel) and *B. cucurbitae* and got the highest resistance ratio recorded to methomyl against *B. dorsalis* among the tested strains which also vary in our study. Marketable fruits were picked at 6-day intervals and brought to the laboratory for observations on fruit fly infestation and larval density per fruit. The pesticides directly affected the yield of the crops. This results was similar to the results of Hussain *et al.* (2022).

### CONCLUSION AND RECOMMENDATION

It is concluded that chemical insecticide (Mythomyl) 90Sp showed best results in control of fruit fly on bitter gourd. Therefore, Garlic and neem oil extract is recommended for used in fruit fly management because it is environmentally safe and it has no residual effect.

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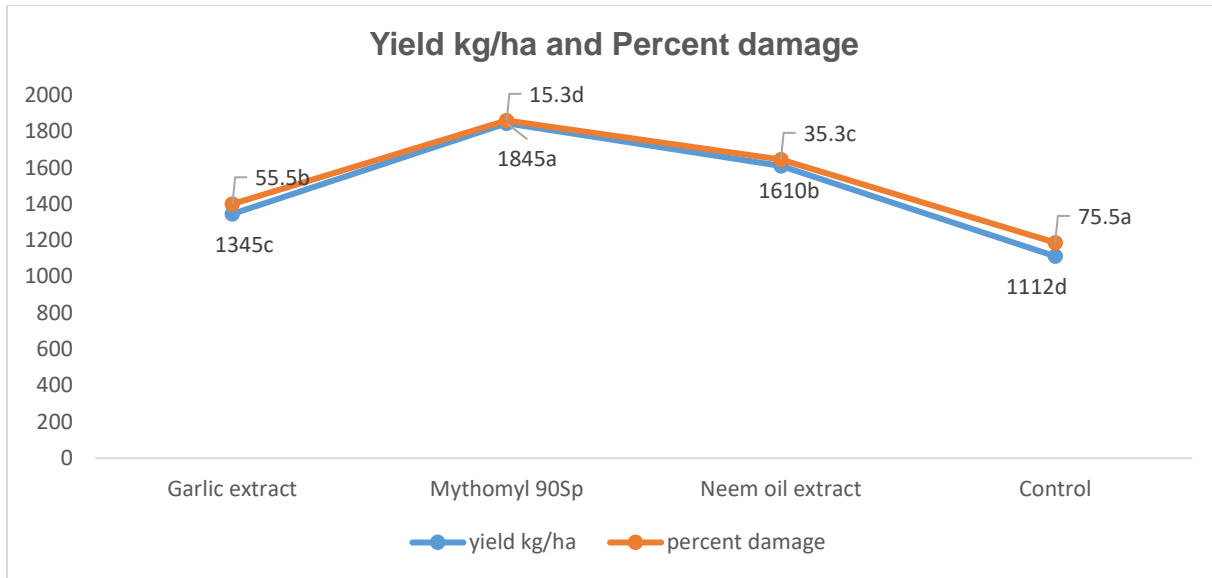
**Conflicts of Interest:** The authors declare no conflict of interest.

**Table 1. Mean population and mean percent reduction of fruit fly in bitter gourd at field in Swat valley.**

Treatment	BSA	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Mean
<b>Garlic extract</b>	3.94 <sup>a</sup>	1.58 <sup>bc</sup> 55.36 <sup>a</sup>	1.55 <sup>b</sup> 56.31 <sup>ab</sup>	1.63 <sup>bc</sup> 55.23 <sup>a</sup>	1.54 <sup>b</sup> 57.97 <sup>a</sup>	1.08 <sup>b</sup> 70.69 <sup>b</sup>	0.67 <sup>bc</sup> 81.89 <sup>a</sup>	0.54 <sup>c</sup> 88.54 <sup>b</sup>	1.57 <sup>b</sup> 58.29 <sup>b</sup>
<b>(Mythomyl) 90Sp</b>	3.89 <sup>a</sup>	1.66 <sup>b</sup> 58.62 <sup>a</sup>	1.15 <sup>c</sup> 67.50 <sup>a</sup>	1.39 <sup>c</sup> 61.88 <sup>a</sup>	1.09 <sup>b</sup> 69.84 <sup>a</sup>	0.92 <sup>c</sup> 75.09 <sup>a</sup>	0.63 <sup>c</sup> 83.30 <sup>a</sup>	0.15 <sup>d</sup> 96.79 <sup>a</sup>	1.36 <sup>c</sup> 64.38 <sup>a</sup>
<b>Neem oil extract</b>	3.76 <sup>a</sup>	1.02 <sup>c</sup> 70.91 <sup>a</sup>	1.67 <sup>b</sup> 53.03 <sup>b</sup>	1.74 <sup>b</sup> 52.20 <sup>a</sup>	1.26 <sup>b</sup> 65.25 <sup>a</sup>	0.98 <sup>bc</sup> 73.29 <sup>a</sup>	0.93 <sup>b</sup> 74.92 <sup>b</sup>	0.83 <sup>b</sup> 82.65 <sup>c</sup>	1.52 <sup>b</sup> 59.36 <sup>b</sup>
<b>Control</b>	3.46 <sup>b</sup>	3.53 <sup>a</sup>	3.56 <sup>a</sup>	3.64 <sup>a</sup>	3.64 <sup>a</sup>	3.69 <sup>a</sup>	3.74 <sup>a</sup>	4.78 <sup>a</sup>	3.76 <sup>a</sup>
<b>CV</b>	2.42	15.43 12.82	8.88 9.47	7.75 8.97	12.83 10.80	5.86 5.34	9.09 5.93	7.51 5.57	5.42 5.38

Means followed by same letters within a column are not significantly different at 5% level of significance (LSD test)

**Fig. 1. Mean yield kg/ha and mean Percent damage in fruit fly at different treatments**



**Table 2. Cost benefit ratio of different botanical insecticides and Chemical against Fruit fly of bitter gourd**

Treatments	Yield kg/ha	Grass income	Cost over control	Return over control	Increase over control	C:B
Garlic extract	1345	47075	12945.5	47075	34129.5	3.64
Mythomyl 90Sp	1845	64575	11943.6	64575	52631.4	5.41
Neem oil extract	1610	56350	12150.8	56350	44199.2	4.64
Control	1112	38920	-----	-----	-----	-----

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