Effect Of Different Botanical And Synthetic Insecticides Against Tomato Fruit Worm (*Helicoverpa Armigera)*

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ABSTRACT

Tobacco extract, Volium flexci sc, Coragen, chili pepper and Chinaberry leaves extract were used for the treatment of tomato fruit borer *Helicoverpa armigera* at Malakander from The University Agriculture during 2021. Chemical insecticides and botanical extracts gave significant result in control of tomato fruit borer. However, lowest number of larval population per plant of tomato fruit worm was noted in plot treated with Coragin (24302kgha^{-1}) followed by (22172kgha^{-1}) while highest was observed in untreated plot. Highest yield was recorded in Coragin followed by (18333kgha^{-1}) while lowest was recorded in untreated plot. Minimum percent fruit damage was recorded in Coragin (7.783%) while maximum fruit damage was recorded in untreated plot. (33.217%) Maximum CBR was also recorded in Coragin (1:9.60) treated plot, followed by Volium flexci sc (1:6.12) was recorded, while minimum was recorded in Chili Pepper (1:2.29). Based on high-cost benefit ratio for yield and less percent fruit damage, Coragin is most effective management of tomato fruit worms at the rest of other treatments.

Key words: Tomato, Fruit borer, Synthetic insecticides and Plant extracts,

INTRODUCTION

Tomato was originated from Andean region and brought to Europe during renaissance; it is now a widespread cultivated crop. It stands at 7th most important crop; its cultivated area has also doubled during the last 20 years while China is leading its production worldwide. Tomato has been used in fresh condition as well as in processed form in food industry. It contains certain secondary metabolite which possess anti-oxidant activity as well as positive impact on human's health. These include and not limited to lycopene, beta carotene, vitamin C etc. (Bergougnoux, 2014)

Tomatoes are useful in tackling different types of cancer diseases such as s lung, prostate, stomach, cervical, breast, oral, colorectal, esophageal, pancreatic, and many other types of cancer. Secondary metabolites such as lycopene and bioflavonoids are claimed to be the cause of anticancer activity possessed by tomato. Tomato has also detoxification property which is due to sulfur and chlorine. Moreover, tomatoes are also said to prevent LDL accumulation as well as cardiovascular diseases. (Bhowmik *et al.,* 2012)

Tomatoes are the third important source of vitamin C and fourth important source of vitamin A in our diet. It also contains phytosterols that keep in check the cholesterol level of our body and folic acid as well. It also contains lycopene which has shown antioxidant properties, having double the potency of another well-known antioxidant, Beta carotene. Moreover, it contains GABA which is known to lower the blood pressure of an individual. (Bhowmik *et al.,* 2012)

Tomato crops often get attacked by various pests. These pests include *Helicoverpa armigera* (Hubner) and sucking insect pests viz. whitefly, *Bemesia tabaci* Genn., Jassids, *Amrasca biguttulla* (Ishida), thrips, *Thrips tabaci* Lind., Serpentine leaf miner, *Liriomyza trifolii* (Burgess). All of these pests are a serious threat to the overall yield and quality of tomato (Sharma *et al.,* 2013). Morevoer, Pest management of tomato especially for lepidopteran pests is both unsuccessful and expensive because both of the pests have developed resistance against insecticides. These pests could be controlled using integrated pest management approach as well as new studies related to development of new insecticides and bio-pesticides. (Bhonwong *et al.,* 2009)

The yield of tomato in Pakistan is low as compared to other countries. One of the major cause is the attack of insect pests on this crop in which Tomato fruit worm is notorious for its destruction of tomato crop. Insecticides can control this pest but it leaves toxic residues on vegetable as well

as increasing the resistance of pests against insecticides. To control pest damage in tomato crop, organic amendments and bio-pesticides should be used and promoted. (Shah *et al.*, 2013)

Melia azedarach L., commonly known as china berry is a deciduous tree known to be native to India and China but it is also spread to some other parts of the world (Orhan *et al.*, 2012). This plant is known to exhibit insecticidal activity and is used in many research studies to evaluate its study as a bio insecticide. It is also known to inhibit fungus and bacteria in an appreciable amount. Overall it has a wider range of application. It is also known to control cotton leaf worm which is a menace for many crops as it has acquired certain immunity against commonly used insecticides. (Perry *et al.*, 2013)

Fatty acids and their esters are main components of extracts of fruit of M. azedarach and due to the presence of these compounds, M. azedarach exhibits such insecticidal and anti phytopathogenic activity. (Farag *et al.*, 2011)

Chilies peppers are regarded both as vegetable and a spice. Many investigations lead to the conclusion that they have a high level of antioxidants. Their extracts contain phenolic content, beta- carotene content, vitamin c and antioxidant activity. Green chilli in particular is reported to have a high concentration of vitamin C. (Sharma *et al.* 2017).

MATERIALS AND METHODS

Current experiment "effect of different botanical and synthetic pesticides on tomato worm (*Helicoverpa armigera)* at Distract Peshawar 2021" was carried out at research field Malakander agriculture university Peshawar during Kharif season 2021 by using Shimla Varity.

Experimental design

Trial was carried out by using Randomized Complete Block design (RCBD) with 5 treatments and all treatment was repeated 3 times. Plant-plant distance was 0.60 cm and row to row distance was 1 m. Plot size was $5*1m^2$ and total plant in each plot was 16 and total plot size was $360m^2$.

Insecticides Preparation

Coragen & Volium flexci pesticide 20 SC was purchased from local market.

Extracts

Chili pepper extract

50 grams of green fresh fruits of chilli pepper was crushed and then added to 1 liter of water for 24hrs. And then this solution was filtered with a fine cloth and make 1 liter of solution. These insecticidal formulations are widely available. The main compound present in chili pepper is Capsaicin which has disgusting and insecticidal properties against hemipterans pests (Bergmann and Raupp 2014; Dayan *et al*. 2009). Antonious *et al*., 2006, 2007) showed that other compounds of chili pepper extract preparation may contribute to the insecticidal activity.

Tobacco extract

20 grams of tobacco dried leaves was crushed and kept in 1 litre of tape water for 24hrs and then they was filtered with muslin cloth (Sohail *et al.* 2012).

Chinaberry

China berry: 4 grams of fresh leaves of china berry was crushed and added 1 litre of water for 3 hrs and then they was filtered with a fine cloth. These aqueous extract was used to control serpentine leaf minor chard (Abou-Fakhr Hammad *et al.* 2000) and (Kibrom *et al.* 2012) cabbage aphids. Both leaves and fresh fruits of aqueous extract was controlled of lepidopteran pest (Singh *et al.*, 2013; McKenna *et al.* 2013) and mites (Attia *et al.* 2011) although effectiveness was positive to controls in the field codition.

Following parameters was investigate during the present study.

No of larvae of fruit worm.

For recording the population levels of fruits borer larvae in five plant was selected randomly. A total of five plants per plot were determined for each replication. The pre-treatment count of number of larvae present in each plant was recorded on weekly basis. Quality of the fruit. The fruit quality was categorized into damaged and sound fruit.

POD BORER (*Etiella zinckenella* and *Helicoverpa armigera*)

The first data of fruits borer (*Etiella zinckenella* Tr. and *Helicoverpa armigera* Hub.), was recorded before 24hrs of pesticides applied and then after larval population were recorded at weekly

interval. Then larval population of fruits borer complex was recorded at weekly interval on five randomly selected plants per plots .Starting with 50% flowering till to harvest.

Percent fruit damage = Total number of damaged fruits by pod borer /plot X100

Total number of fruits in plants

Yield kg/ha

After each picking of fruits weight (kg) in each treatment was noted. Each treatment yield was than transformed into kg per hectare with formula:

Yield kg per ha = fruits weight (kg) x 10000

Area harvested

Statistical Analysis

Data observed and noted on various parameters was analyzed through statistical software (Statistix 8.1) by Analysis of Variance (ANOVA) and through LSD Test at 5% Probability Level means for check their significance level and differences.

RESULTS

The effect of different botanical and synthetic insecticides against tomato fruit borer *Helicoverpa armigera* was evaluated under field condition at The university of agriculture Peshawar research Farm from first week of May to July last week. The recorded was noted on different weeks are given in Table.1.

Number of larvae *(H. armigera)*

The number of *H. armigera* larvae were recorded by randomly selected five plants/ plot on different week interval and the results are given below.

Number of larvae *(H. armigera)* recorded on first week after spray application.

The result showed that the mean number of larvae (*H. armigera*) / plant in plots treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 0.94, 0.89, 0.56, 0.93, 0.76 and 2.46 respectively, which were significantly different from one another. Result indicated that the lowest number of larvae of *H. armigera* was noted in plot

treated with Coragen was significantly minimum than other of all treatments and followed by plot treated with Chinaberry extract leaves while in control plot highest number of larvae was observed.

Number of larvae *(H. armigera)* recorded on second week after spray application.

The result indicated that the mean number of larvae (*H. armigera*) / plant in plots treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 1.24b, 0.99, 0.66, 0.99, 1.02 and 2.53 , respectively, which were significantly different from one another. Result indicated that the lowest number of larvae of *H. armigera* was noted in plot treated with Coragen was significantly minimum than other of all treatments and followed by plot treated Chinaberry extract leaves, Volium flexci sc and Chilli pepper, while in control plot maximam number of larvae was noted.

Number of larvae *(H. armigera)* recorded on third week after spray application.

Result showed that the mean number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 1.55, 1.15, 0.68, 1.02, 1.67 and 2.56 respectively, which were significantly different from one another. Result indicated that the lowest number of larvae of *H. armigera* was noted in plot treated with Coragen was significantly minimum than other of all treatments and followed by plot treated Chinaberry extract leaves and Volium flexci sc, while in control plot highest number of larvae was noted.

Number of larvae *(H. armigera)* recorded on fourth week after spray application.

Result revealed that the mean number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 1.63, 1.22, 0.96, 1.17, 1.74 and 2.64 respectively, which were significantly different from one another. Result indicated that the lowest number of larvae of *H. armigera* was noted in plot treated with Coragen was significantly minimum than other of all treatments and followed by plot treated Volium flexci sc, while highest number of larvae was noted in control plot.

Number of larvae *(H. armigera)* recorded on fiveth week after spray application.

The mean number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 1.27, 1.09, 1.12, 1.02, 1.26

and 2.64 respectively, which were significantly similar to one another. Result indicated that the same number of larvae of *H. armigera* was noted in all treated plots, while highest number of larvae was recorded in control plot.

Number of larvae *(H. armigera)* recorded on sixth week after spray application.

The data revealed that the mean number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 1.05, 0.88, 0.76, 0.92, 0.98 and 2.69 respectively, which were significantly different from one another. Result showed that minimum number of larvae of *H. armigera* was noted in Coragen treated plot, followed by Volium flexci sc, while highest number of larvae was observed in control plot.

Number of larvae *(H. armigera)* recorded on seventh week after spray application.

The data showed that the mean number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 0.68, 0.63, 0.44, 0.84, 0.93and 2.74 respectively, which were significantly different from one another. Result showed that minimum number of larvae of *H. armigera* was noted in Coragen treated plot, followed by Volium flexci sc, while highest number of larvae was observed in control plot.

Number of larvae *(H. armigera)* recorded on eighth week after spray application.

The data showed that the mean number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 0.54, 0.52, 0.31, 0.56, 0.83 and 2.78 respectively, which were significantly different from one another. Result showed that minimum number of larvae of *H. armigera* was noted in Coragen treated plot, followed by Volium flexci sc, Tobacco extract and Chinaberry leaves extract, while control plot was observed highest number of larvae.

Means of all weeks of number of larvae *(H. armigera)/plant.*

The result indicates that the means number of larvae (*H. armigera*) / plant plot treated with Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 1.11, 0.92, 0.69, 0.93, 1.15 and 2.63 respectively, which were significantly different from one another. Result showed that less number of larvae of *H. armigera* was noted in Coragen treated plot, followed by Volium flexci sc, while control plot was noted highest number of larvae.

Table 1. Mean number of H. armigera larvae per plant recorded at different week interval

Treatment	1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	means
Tobacco extract	0.94b	1.24b	1.55b	1.63b	1.27b	1.05b	0.68cd	0.54c	1.11b
Volium flexci sc	0.89b	0.99c	1.15c	1.22c	1.09b	0.88cd	0.63de	0.52c	0.92c
Coragen	0.56d	0.66d	0.68d	0.96c	1.12b	0.76d	0.44e	0.31d	0.69d
Chilli pepper	0.93b	0.99c	1.02c	1.17c	1.02b	0.92bc	0.84bc	0.56c	0.93c
Chinaberry extract	0.76c	1.02c	1.67b	1.74b	1.26b	0.98bc	0.93b	0.83b	1.15b
Controll	2.46a	2.53a	2.56a	2.64a	2.64a	2.69a	2.74a	2.78a	2.63a
LSD	0.0597	0.0694	0.1182	0.1242	0.1189	0.0584	0.0924	0.0872	0.0718

Means followed by the different letter in each column are statistically significant from each other at 5% level of significance ANOVA followed by LSD Test

Yield Kg/ha: The yield obtained from different treated plots of botanical extracts and synthetic insecticides (Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 21700, 22172, 24302, 20000, 21667 and 18333 respectively were significantly different result from each other. However maximum marketable yield was recorded in plot treated with Coragen (24302) followed by Volium flexci sc (22172), while minimum marketable yield was observed in control (18333).

Percent Fruit Damage: The percent fruit damage indicates that infestation was significantly affected the yield on different treated with (Tobacco extract, Volium flexci sc, Coragen, Chilli pepper, Chinaberry leaves extract and Control were 16.860, 11.547,7.783, 13.093, 17.710 and 33.217 respectively which were significantly different from one another. Result revealed that minimum percent fruit damage was noted in plot treated with Coragen (7.783), followed by, Volium flexci sc(11.547) and Chilli pepper (13.093), while maximum percent damage was recorded in control plot (33.217).

Table 3. Yield and Percent damage of fruit Kg/ha

Treatments	Yield kg/ha	weight loss
Tobacco extract	21700b	16.860b
Volium flexci sc	22172b	11.547c
Coragen	24302a	7.783d
Chilli pepper	20000bc	13.093c
Chinaberry leaves extrac	21667b	17.710b
Control	18333c	33.217a

Means followed by the different letter in each column are statistically significant from each other at 5% level of significance ANOVA followed by LSD Test.

Table. 3. Economic analysis of different management practices used against fruit borer on tomato crops during 2021

Treatments	Marketable yield kg/ha A	Gross income Rs B	Cost of control /ha C	Return over control Rs. per ha D	Estimated net benefit Rs. per ha E=(D-C)	C: B F=(D/C)
Tobacco extract	21700	520800	12945	80808	67863	5.24
Volium flexci sc	22172	532128	12943	92136	79193	6.12
Coragen	24302	583248	13520	143256	129736	9.60
Chilli pepper	20000	480000	12150	40008	27858	2.29
Chinaberry leaves extract	21667	520008	12650	80016	67366	5.33
Control	18333	439992	-	-	-	-

Price of tomato crop 24 PKR

Cost benefit ratio: It is evident from the study that highest CBR value was recorded in plot treated with coragen (1:9.60) followed by Volium flexci sc (1:6.12) while lowest was recorded in Tobacco extract (1:5.24).

DISCUSSION

Most serious insect pest of tomato is fruit borer all over the world. It causes significant losses in the quality and quantity of the product. The fruit borer larvae damage the crop and to control this pest the grower apply chemical insecticides and botanical extracts of different plants. Botanical insecticides are environmentally friendly while chemical insecticides effect the environment, there we should apply alternate of botanical insecticides.

Larval population of tomato fruit borer (*H. armigera*).

All the synthetic and botanical insecticides reduce the larval population of *Helicoverpa armigera* as compared to untreated plot. The plots treated with chinaberry extract leaves, tobacco extract and chilli pepper extracts indicate comparatively poor performance as the rest of chemical insecticides. Due to poor performance of botanical extracts the grower go back to synthetic insecticides because synthetic insecticides give quick result as compared to botanicals extracts result agree with (Sunitha *et al.,* 2006) who study the efficacy of insecticides against gram pod borer. Poor result of botanical extracts may also due slowly and gradually work on different insect's pest of crops.

Result shows that different experimental block shows different efficacy which gives a significant reducing the larval population of tomato fruit borer.as compared to control plot.

Generally chemical insecticides i.e Coragen and Volium flexci sc gave significant result to minimizing the larval population of *Helicoverpa armigera* (Khorsheduzzaman *et al.,* 1998) reported a remarkable decrease in tomato fruit infestation. When chemical insecticides with other bio pesticides approaches for the control of tomato fruit borer. The chemical insecticides Coragen revealed better result than other applied insecticides. This result is agreed with the result of Wakil *et al.,* (2012).

Yield of tomato fruit

In all the treatments yield of tomato was significantly different from untreated plots. Maximum yield of tomato crop was observed in plot treated with Coragen (24302 kg/hac) because Coragen did best result against the control of Helicoverpa armigera larvae and less attack was observed therefore maximum yield was obtained. This result is similar to Sujayanand *et al.,* (2020). The

larval infestation gives significant decrease the yield to tomato crop. The chemical insecticides show quick result and also significant increase in the yield of tomato. These results are in line of Sunitha *et al.*, (2006) was observed that chemical insecticides significantly higher yield.

Percent fruit damage

Person fruit damage results clearly revealed that fruit borer of tomato was significantly decreased by all the treatment as compared to untreated plot. The effect of chemical insecticides coragin show significance result as compared to all other treatments. Less percent losses were recorded in coragin treated because of quick action of insecticides on tomato fruit borer (7.783%) H. armigera population was less and therefore less percent damage was noted. These results are in line with Sujayanand *et al* (2020) while the highest percent infestation was recorded in untreated plot. Therefore, highest percent loss was observed in untreated plot.

Cost benefit ratio

In all treatments CBR is very important because its show real image of the treatment that how much is gain by applying different control practices. However application of coragin was found best and also highest value of CBR was noted (1:90.60) followed by Volium flexci sc while minimum value of CBR (1:6.12) was recorded in chilli paper although coragin was expensive than other treatment but better result in performance and maximum yield with maximum net returned then Volium flexci sc the present result are similar to the result of (1:2.29)

CONCLUSION AND RECOMMENDATIONS

1. All the chemicals insecticide and botanical extracts have potential to manage tomato fruit borer as compared to untreated plot
2. All chemicals' insecticides perform better results as compared to botanical extracts
3. Coragin and V is the most effective in reducing the larval population of tomato fruit borer
4. Chemical insecticides and botanical extracts show positive outcomes bears CBR values

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