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## Potential of selected plant based bio-insecticides for managing insect pests infestation in brinjal at Dehradun, Uttarakhand

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### Abstract

Among twenty six different insect pests species infesting brinjal, the shoot and fruit borer, *Leucinodes orbonalis*, White fly, *Bemisia tabaci* and leaf hopper, *Amrasca biguttula biguttula* noticed to cause heavy damage. The brinjal shoot and fruit borer is a regular pest damaging the crop throughout the year. The yield loss due to the pest is to the extent of 70-92 per cent. T-4 (Turmeric + Chilli + Garlic) provided significantly high control followed by T2 (Turmeric + Chilli) and T3 (Turmeric + Garlic). Efficacy of T1 was better against leaf hopper in comparison to *L. orbonalis* and whitefly.

**Keywords:** botanicals, shoot and fruit borer, white fly, turmeric, biopesticides

### Introduction

Brinjal is a popular and important vegetable crop grown in the subtropical and tropical region of world (Degri *et al.*, 2012) [3]. This crop is grown throughout the year under irrigated condition, hence, subjected to attack by a number of insect pests, from seedling stage till maturity (Regupathy *et al.* 1997) [7]. Brinjal is attacked by nearly twenty six different pest species out of which, The white fly, *Bemisia tabaci*, leaf hopper, *Amrasca biguttula biguttula* and brinjal shoot and fruit borer, *Leucinodes orbonalis* are some important pest species found throughout Asia (Mochiah *et al.*, 2011,) [6].

Biopesticides are a form of pesticide based on micro-organisms or natural products. There is an increasing number of non-chemical methods that can be used to complement the use of chemical pesticides as part of IPM. Biopesticides, such as naturally occurring fungi, bacteria and other microorganisms as well as some naturally occurring chemicals, such as plant extracts and pheromones, can be applied to crops in much the same way as conventional chemical pesticides to target insect pests and diseases. They generally have little impact on other organisms, as well as reduces negative effects on biodiversity (Harish *et al.*, 2011, Adalbert *et al.* 2013,) [4, 1].

With increasing concern for environmentally sound strategies in the control of pests, the development of alternative natural pesticides has now become an imperative need. Turmeric (*Curcuma longa*) along with Garlic, *Allium sativum* and Chilli pepper, *Capsicum annum* are some important medicinal & spice plant with reported insecticidal activity (Angelica *et al.*, 2017, Meng *et al.*, 2020, Sajjad *et al.*, 2014) [2, 5, 8]. It is important to report that very limited information on efficacy of these plant extracts is available in published literature against brinjal insect pests. This research work therefore focused at investigating the efficacy of turmeric along with garlic and Chilli pepper against main insect pests of brinjal.

### Materials and Methods

The study was carried out at the Entomological Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand, India (latitudes 30°01' N and 31°2' N and longitudes 77°34' E, elevation of 640 metres above sea level & situated in humid subtropical climatic region. The experimental field was designed in a randomized complete block design and consist of five treatments including one untreated control (table.1). Each plot size was of 2.5 m x 2.5 m dimensions. Thus a total of 15 plots were prepared and divided into three separate blocks. The brinjal seeds of local susceptible variety was sown on raised nursery beds. After twenty five days brinjal seedlings were transplanted in the main experimental block with spacing of 40 x 50 cm to give a plant population of 28 plants per plot.

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Manual weeding was carried out at three weeks interval throughout the experiment.

### Land preparation & sowing

To prepare the land the hard pan of the experimental soil was

removed by disc harrow and left for 15 days. Later second ploughing and leveling was performed. After that plots were finally prepared by giving separation strips and irrigation channels.

**Table 1:** Details of different treatment and combinations of botanicals

Treatment	Composition	Rate of application
T1	Turmeric	Turmeric (30 ml stock solution /litre of water)
T2	Turmeric + Chilli	Turmeric (15 ml) + Chilli (15 ml)
T3	Turmeric + Garlic	Turmeric (15 ml) + Garlic (15 ml)
T4	Turmeric + Chilli + Garlic	Turmeric (10 ml)+Chilli (10ml)+Garlic (10ml)
T5	Untreated control	-

### Preparation of aqueous spray solution of different botanicals

#### A. Turmeric, *Curcuma longa*

200 g powder of Turmeric was taken and dissolved in 1000 ml of purified water and mixed thoroughly. There after it was left for 24 hours. After that solution was boiled for 60 minutes, filtered with a muslin cloth and cooled. The filtrate was kept in the refrigerator as stock solution. This stock solution was used to make different concentrations during application in field.

#### B. Garlic, *Allium sativum*

200 g Garlic bulbs were peeled off and converted to paste with a mixture grinder. This paste was mixed with 1 litre of purified water. The mixture was then filtered with a muslin cloth to get stock solution.

#### C. Chilli pepper, *Capsicum annum*

200 g matured chilli fruits of pungent variety was used to make stock solution. For this purpose chilli fruits were converted to paste form by mixture grinder and diluted with 1 L of purified water. The paste was then filtered to obtain a uniform stock solution.

### Application of the treatments

The foliar application of different botanical mixtures and combinations was done using pneumatic hand sprayers of one litre capacity. The treatments were given in the morning to prevent photodecomposition of botanicals.

### Data Collection

The efficacy of different treatments was worked out by visual

counting of pest number on five randomly selected plants from each plot for leaf hopper and whitefly. For shoot and fruit borer drooped down shoots and damaged fruits having fruit borer entry holes with excreta were counted. The counting was carefully done in the morning hours by observing the leaves for leaf hopper and whitefly & damaged shoots and fruits for shoot and fruit borer. This data was collected once before treatment and subsequently one and two weeks after application of biopesticides.

### Yield attributes

The total weight of brinjal fruits harvested from each plots at three different pickings after three weeks of treatment was taken using digital balance.

### Statistical Analysis

The data were analysed statistically using Randomized Block Design (RBD). The treatments were compared by means of critical differences (CD) at 5 per cent level of significance.

### Results and Discussion

Three species of insects, viz., The white fly, *Bemisia tabaci*, leaf hopper, *Amsasca biguttula biguttula* and brinjal shoot and fruit borer, *Leucinodes orbonalis* have been found causing significant damage to brinjal crop at our experimental site.

Performance of three botanicals viz. turmeric, chilli & garlic alone and in different combinations against three important pests of brinjal was tested.

Mean change in insect infestation and average fruit yield (t/ha) of three pickings from different treatments is given in Table 1, 2 and 3 respectively.

**Table 2:** Efficacy of different botanical combinations against leaf hopper infestation on Brinjal

Treatments	Mean no. of insects/plant before treatment	Mean no. of insects /plant after treatment		Mean increase or decrease in infestation	Mean yield (t/ha)
		After one week	After two weeks		
T1	27.95	23.10	21.12	-6.83	9.46
T2	32.63	28.73	16.56	-16.07	12.96
T3	35.90	25.84	20.14	-15.80	13.57
T4	29.13	20.63	9.12	-20.01	16.30
T5	32.18	34.72	38.14	+5.96	8.96
S.E.±	2.5197	0.8533	0.9502	-	0.163
CD at 5% level	-	-	-	1.60	2.59

\*Fruit yield of only three pickings

Mean reduction in infestation after treatment with T4(Turmeric + Chilli + Garlic) in term of pest number or no. of damaged shoot/fruits was 20.01,8.45 and 5.07 for leaf hopper, whitefly and shoot and fruit borer, respectively. Accordingly crop yield in T4 was 16.30,15.35 and 15.30 t/ha

for all the three pests respectively.

Treatment-4 (Turmeric + Chilli + Garlic) provided significantly high control of leaf hopper, in comparison to all other treatments followed by T-2 (Turmeric + Chilli) and T-3 (Turmeric + Garlic). However, T4 was found to be the most

effective against leaf hopper with crop yield of 16.30 t/ha. Treatment-1 (Turmeric only) was at par with untreated control. T-2 (Turmeric + Chilli) and T-3 (Turmeric + Garlic) were significantly superior over control but they were significantly inferior when compared with T4. Thus three

botanical combinations viz. Turmeric + Chilli + Garlic, Turmeric + Chilli, Turmeric + Garlic significantly reduced no. of leaf hopper, white fly and fruit borer incidence after two weeks of biopesticide spray. Increasing order of biopesticides efficacy is T4>T3=T2>T1>T5.

**Table 3:** Efficacy of botanical combinations against whitefly infestation on Brinjal

Treatments	Mean no. of Insects/plant before treatment	Mean no. of insects/plant after treatment		Mean increase or decrease in infestation	Mean yield (t/ha)
		After one week	After two weeks		
T1	16.34	15.46	14.03	-2.31	9.30
T2	14.93	13.62	9.72	-5.21	11.52
T3	16.40	13.58	10.59	-5.81	12.22
T4	13.35	10.91	4.90	-8.45	15.35
T5	15.40	19.07	23.19	+7.79	7.25
S.E.±	0.2762	0.1845	0.1598	-	0.388
CD at 5% level	-	-	-	1.30	2.49

\*Fruit yield of only three pickings

**Table 4:** Efficacy of botanical combinations against brinjal shoot and fruit borer infestation on Brinjal

Treatments	Mean no. of damaged shoots and fruits /plant before treatment	Mean no. of damaged shoots and fruits /plant after treatment		Mean increase or decrease in infestation	Mean yield (t/ha)
		After one week	After two weeks		
T1	9.02	9.03	8.50	-0.52	10.27
T2	6.77	5.70	4.95	-1.82	12.30
T3	5.84	5.03	4.22	-1.62	13.47
T4	8.53	7.60	3.46	-5.07	15.30
T5	7.11	8.77	10.73	3.62	8.96
S.E.±	0.89	0.38	0.55	-	0.388
CD at 5% level	-	-	-	1.03	1.40

\*Fruit yield of only three pickings

## Conclusions

The study revealed that botanical combination, Turmeric + Chilli + Garlic was most effective in minimizing infestation of leaf hopper, white fly and brinjal shoot and fruit borer. If we compare effect of this treatment against all the three pests then it is concluded that it was most effective against leaf hopper. Other combinations such as Turmeric + Chilli and Turmeric + garlic were also good in efficacy but provided only moderate level of control. Turmeric alone was not as much as effective as reported by different studies.

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