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Original Research Article

Eco-Friendly Pest Management Practices for the Management of Fruit fly in Cucumber

Saurav Gupta*, Vinod Gupta, Abhay Kumar Sinha and Neerja Sharma

Krishi Vigyan Kendra, Samba, SKUAST-J, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (J&K), India
**Corresponding author*

A B S T R A C T

The experiment was conducted at Regional Agricultural Research Station, Rajouri during *Kharif* 2016-17 and *Kharif* 2017-18 with an objective to study the major insect pest of cucumber (*Cucumis sativus*) and their control by eco-friendly pest management practices. During *Kharif*2016-17 and 2017-18, the major insect pest attacking cucumber at RARS, Rajouri were identified and recorded and also evaluated the extent of damage. The results revealed that significantly lowest number of ovipositional punctures (0.77 and 0.96 /fruit), lowest number of maggots (8.10 and 8.97 /fruit), lowest percent fruit infestation (14.96 and 17.98 %) and highest marketable fruit yield (15.53 and 16.47 t/ha.) was recorded in the treatment with spinosad 45 SC (0.15 ml/l) during 2016-17 &2017-18, respectively and it was on par with the treatment Gur poison bait in which 1.02 and 1.11 mean number of ovipositional punctures, 9.33 and 9.57 mean number of maggots per fruit, 18.21 and 21.68 mean percent of fruit infestation, 13.91 and 14.68 tonnes/ ha. of fruit yield was recorded during 2016-17 and 2017-18, respectively. However, highest number of ovipositional punctures (2.74 and 3.06 /fruit), highest number of maggots (19.11 and 19.69 /fruit), highest percent of fruit infestation (46.87 and 56.77 %) and lowest marketable fruit yield (10.82 and 9.54 t/ha.) was obtained in the control during 2016-17 & 2017-18, respectively. These insects have been managed by applying various insecticides reported by several workers but there is a need to explore alternative methods for control and to develop an integrated control strategy for effective management of fruit fly. The general goal of this study is to develop a complete eco-friendly pest management practices by proper identification of the pest and ensure optimal use of chemical pesticides and minimum environmental contamination to maintain crop production.

Keywords

Cucumber, Fruit fly, insecticides, ecofriendly pest management practices

Introduction

Cucurbits consist of wide range of vegetables belong to family Cucurbitaceae, commonly known as guard family. Cucurbitaceae family has about 110 genera and between 650 to 850 species distributed throughout the world. Cucurbits exclusively include various species viz. *Cucumis* (cucumber, muskmelon), *Cucurbita* (pumpkin, gourd, squash), *Lagenaria* (bottle gourd), *Luffa*(sponge gourd) and *Momordica* (bitter gourd). The fruits of cucurbits are beneficial for human health which help in purification of blood, improve digestion, boost energy level in the body and remove constipation. Cucumber,

(*Cucumis sativus*) is a most popular and extensively cultivated cucurbitaceous vegetable crop of district Rajouri of Jammu and Kashmir. Among the biotic constraints, cucumber is attacked by different insect and non-insect pests during different growth stages. Various attacks done to the crops are in the form of defoliation of leaves, damage to roots and flowers, reduction in quality of crop stand and ultimately decrease in commercial yield of the crop. A number of insect pests are infesting cucumber but among them major one are fruit flies (*Bactrocera cucurbitae*) (Alam,1969; Butani and Jotwani, 1984).It has been estimated that a single insect pest fauna of fruit fly, *Bactrocera cucurbitae* can cause a broad range of crop loss in cucumber. Generally, the female fruit flies puncture the soft and tender fruits by their sharp ovipositor and lay the eggs under fruit tissues and gummy fluid oozes from the puncture. The fruit flies also oviposit in the tender plant tissues such as terminals, unopened flowers, young stems and seedlings which may result in the death of the plant (Kate *et al.*, 2009). After hatching, the maggots feed on the pulp of the fruits by making galleries and simultaneously the secondary infection also arises, resulting in rotting of fruits (Gupta and Verma, 1995). The extent of losses caused by *B. cucurbitae* varies from 30 to 100 percent depending on the cucurbit species and season (Dhillon *et al.*, 2005).

The control measures are as difficult as in the Tephritidae family of insects. Some weak link in the life history of the pest is exploited by the economic entomologists. Several management techniques are being applied against this pest because three of its life stages are hidden and the only adult stage is the usual target for its management. Mostly chemically-based insecticides are used for their control without knowing the ill effects of these chemicals on the environment. The residues of pesticide affected the export potential of gourd because of serious concern of the importing countries (Quasem, 2003). Moreover, repeated use of toxic insecticides is not only hazardous to the environment but also directly affects the health of the farmers and consumers. Therefore, it is necessary to explore economically sustainable and environment-friendly methods for control and to develop an integrated control strategy for effective management of fruit fly.

Materials and Methods

The experiment was conducted at Regional Agricultural Research Station, Rajouri during *Kharif* 2016-17 and 2017-18 with an objective to study the major insect of cucumber and their control by ecofriendly Pest Management practices. Fruit fly was recorded as the major pest caused damage to the fruits in the field. The field experiment was laid out with three replications and six treatments. During 2016-17 and 2017-18, the seeds of hybrid Cucumber variety *Malini* (seminis) were sown in the third week of May in plastic bags filled with soil & cow dung manure in the nursery. The cucumber seedlings were transplanted in the field after 20-25 days in both years. The recommended agronomical practices were followed to raise the good crop. The treatment for the management of fruit fly, are as follows: Table 1. Six treatments were (a) T_1 – Spinosad 45 SC@0.30 ml/lt. of water(b) T_2 – Banana poison bait(1Kg rotten banana + 10g carbofuran 3 G + 5g yeast + 5g citric acid) (c)T_3 – Gur poison bait (50ml malathion + 200g gur + 2 litre of water) (d) T_4 – Azadirachtin 10000 ppm @1ml/lt. of water(e) T_5 –Azadirachtin 300 ppm @5ml/lt. of water and T_6- Control (water).

The treatments for the management of fruit fly were imposed at 5th and 8th week after sowing by using Knapsack sprayer after

taking the pre-treatment count of fruit fly damage. The first foliar spray was taken at the fruit setting stage when oviposition marks were noticed on cucumber fruits and when the fruit flies crossed the economic threshold level per day. From each treatment, five plants were selected (randomly during *kharif* season and tagged plants during summer season) and the observations on the number of ovipositional punctures per fruit, number of maggots per fruit and percent fruit infestation due to fruit fly before treatment and three, five and ten days after treatment was recorded. Percent fruit damage was worked out by using formula.

$$\text{Per cent fruit damage} = \frac{\text{Number of fruits infested}}{\text{Total number of fruits observed}} \times 100$$

Furthermore, five infested fruits from each treatment were randomly selected, plucked and brought to the laboratory to count the number of maggots.

These infested fruits were cut open near the damaged part of the fruit and the numbers of maggots in the pulp of the infested fruit were recorded. In each plot, irrespective of healthy and infested, marketable sized cucumber fruits were harvested. At each fruit picking, the healthy and infested fruits were sorted out separately, weighed and noted. The weight of the healthy fruits from all the fruit pickings in each plot was pooled to get yield per plot (kg) and was converted to yield per hectare (tonnes).

Results and Discussion

The results of the present investigation on the efficacy of different ecofriendly methods against fruit fly in cucumber crop exhibited variable efficacy in reducing the number of ovipositional punctures, number of maggots as well as a fruit infestation over untreated control and jaggery alone treatment during *kharif* 2016-17 and 2017-18 at RARS, Rajouri (Table 2). The data revealed that the treatment spinosad 45 SC was found significantly more effective in reducing the fruit fly infestation at three, five and ten days after spraying at first and second spray during both the seasons. The treatment, spinosad 45 SC recorded significantly lowest mean number of ovipositional punctures (0.77 and 0.96 /fruit), lowest mean number of maggots (8.10 and 8.97 /fruit), lowest mean percent of fruit infestation (14.96 and 17.98 %) and fetched significantly higher fruit yield (15.53 and 16.47 t/ha.) as compared to the other treatments during 2016-17 & 2017-18, respectively (Table 1).

The present results were in close agreement with the earlier report of Shivangi *et al.*, (2017) opined that spinosad (200 ml/ha.) was the most effective treatment module against fruit fly in cucumber with the least mean number of ovipositor marks, mean number of pupae formed from damaged fruits, mean percent fruit infestation and avoiding maximum losses with highest fruit yield. Vinutha and Kotikal (2018) also found that spinosad 45 SC @ 0.3 ml/l of water were found very effective in minimizing the fly population, *B. cucurbitae* on oriental pickling melon and were superior in reducing the fruit damage (4.83 %) and also fetched higher yield (18.16 t/ha). The effectiveness of spinosad was mainly due to its toxicity by rapid contact and ingestion activity which is unusual for a biological product.

The treatment spinosad was statistically on par with Gur poison bait in which 1.02 and 1.11 mean number of ovipositional punctures, 9.33 and 9.57 mean number of maggots per fruit, 18.21 and 21.68 mean percent of fruit infestation, 13.91 and 14.68 tonnes/ ha. of fruit yield was recorded during 2016-17 & 2017-18, respectively (Table 2).

Table.1 Efficacy of different ecofriendly methods against fruit fly in cucumber

S.No.	Treatments	Technology Assessed
1	Treatment 1	T_1 – Spinosad 45 SC @0.3 ml/lt. of water
2	Treatment 2	Banana poison bait (1Kg rotten banana + 10g carbofuran 3 G + 5g yeast + 5g citric acid)
3	Treatment 3	Gur poison bait (50ml malathion + 200g gur + 2 litre of water)
4	Treatment 4	Azadirachtin10000 ppm @1ml/lt. of water
5	Treatment 5	Azadirachtin 300 ppm @5ml/lt. of water
6	Treatment 6	Control (water).

Table.2 Efficacy of different treatments against fruit flyin cucumber

T.No.	Treatments	Mean no. of ovipositional punctures /fruit*		Mean no. of maggots /fruit*		Mean % fruit infestation**		Yield (t/ha.)	
		Kharif 2016-2017	*Kharif*2017-18	*Kharif* 2016-2017	*Kharif* 2017-18	*Kharif* 2016-2017	*Kharif*2017-18	*Kharif* 2016-2017	*Kharif* 2017-18
T_1	Spinosad 45 SC @ 0.3 ml/lt.	0.77 (1.15)a	0.96 (1.19)a	8.10 (2.98)a	8.97 (3.05)a	14.96 (22.75)a	17.98 (25.08)a	15.53	16.47
T_2	Banana poison bait (1Kg rotten banana + 10g carbofuran 3 G + 5g yeast + 5g citric acid)	1.16 (1.27)bc	1.20 (1.31)bc	10.10 (3.26)bc	10.09 (3.28)bc	19.95 (26.43)bc	24.24 (29.45)bc	13.51	13.75
T_3	Gur poison bait (50ml malathion + 200g gur + 2 litre of water)	1.02 (1.22)b	1.11 (1.26)ab	9.33 (3.11)b	9.57 (3.09)ab	18.21 (25.15)ab	21.68 (27.70)ab	13.91	14.68
T_4	Azadirachtin 10000 ppm @1ml/lt.	1.29 (1.33)cd	1.30 (1.34)bc	10.53 (3.30)cd	10.35 (3.28)bc	22.56 (28.30)cd	26.61 (31.05) c	12.62	12.86
T_5	Azadirachtin 300 ppm @5ml/lt.	1.32 (1.36)cd	1.33 (1.35)bc	10.71 (3.34)cd	10.39 (3.27)bc	23.15 (28.69)cd	26.83 (31.18)c	12.37	12.25
T_6	Control (water).	2.74 (1.57)e	3.06 (1.66)d	19.11 (4.24)e	19.69 (4.41)e	46.87 (43.12)e	56.77 (48.75)d	10.82	9.54

*Figures in the parentheses are square root transformed values;
**Figures in the parentheses are angular transformed values

Further, Banana poison bait was the next better insecticide against fruit fly as it recorded 1.16 and 1.20 mean number of ovipositional punctures, 10.10 and 10.07 mean number of maggots, 19.95 and 24.24 mean percent fruit infestation, 13.51 and 13.75tonnes/ha. of fruit yield during 2016-17 &2017-18, respectively and it was

statistically on par with azadirachtin 10000 ppm and azadirachtin 300 ppm (Table 2).Treatments of azadirachtin 10000 ppm and azadirachtin300 ppm were found superior over control during both years. Further, the highest number of ovipositional punctures (2.74 and 3.06 /fruit), highest number of maggots (19.11 and 19.69 /fruit), highest percent of fruit infestation (46.87 and 56.77 %) and lowest yield (10.82 and 9.54 t/ha.) was recorded in control treatment during both years respectively (Table 2). Hence, the order of efficacy of different treatments against fruit fly is spinosad 45 SC >Gur poison bait>Banana poison bait >azadirachtin 10000 ppm >azadirachtin 300 ppm.

The bio-efficacy of the different ecofriendly treatments revealed that, significantly lowest number of ovipositional punctures, lowest number of maggots, lowest percent fruit infestation and highest marketable fruit yield was recorded in the treatment with spinosad 45 SC (0.15 ml/l) during both years, respectively and it was on par with the treatment Gur poison bait (50ml malathion + 200g gur + 2 litre of water).

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