

**Management of fruit fly (*Bactrocera* spp.) in cucumber (*Cucumis sativus* Linn.) grown organically****Surender Kumar Sharma<sup>1</sup>, Punam<sup>2</sup> and R. Kumar<sup>2</sup>****ABSTRACT**

Fruit flies (*Bactrocera* spp.) are the key pests of our potential vegetable and fruit crops. Literally, wide organic options are available but their evaluation studies are scanty and hence study on comparative evaluation of 10 organic formulations and a synthetic insecticide against fruit fly in organically grown cucumber during the years 2011 and 2012 were conducted at certified Model Organic Farm, CSK HPKV, Palampur. The lowest fruit infestation of 7.69 and 9.09% was registered in treatment with cypermethrin 25EC @ 0.5ml/l followed by treatment with neem oil (Nimbecidene) 5ml/l as 12.50 and 13.58% during both respective years of study. Similar trend of fruit yield was observed using cypermethrin 25EC gave highest fruit yield 191.48 and 183.33 q/ha followed by neem oil (Nimbecidene) as 189.01 and 181.48 q/ha during both years of study. However, both these formulations were significantly at par but under organic conditions four sprays of neem oil formulation coinciding with infestation at 10 day interval can be effectively used to manage this pest.

**Key words:** *Bactrocera* spp., fruit fly management, organic inputs, cypermethrin, neem oil

**MS History:** 22.02.2015 (Received)-14.05.2016 (Revised)- 19.05.2016 (Accepted)

**Citation:** Surender Kumar Sharma, Punam, and R. Kumar 2016. Management of fruit fly (*Bactrocera* spp.) in cucumber (*Cucumis sativus* Linn.) grown organically. *Journal of Biopesticides*, 9 (1): 73-79.

**INTRODUCTION**

Cucumber (*Cucumis sativus*) a vegetable crop, its fruits used as pickle or salad in India (Whener and Guner, 2004). Tephritid fruit flies, *Bactrocera* spp. are the most serious and destructive insect pests infesting all cucurbit vegetables worldwide except in Arctic and Antarctic regions (Kapoor *et al.*, 1980). The extent of loss inflicted by these dipteran flies is varying from 30 to 100% depending upon cucurbit species and environmental conditions (Gupta and Verma, 1992; Dhillon *et al.*, 2005; Shooker *et al.*, 2006). Their attack not only reduce yield but also affect fruit quality hence farming enterprises rendered unprofitable. In Himachal Pradesh, *Bactrocera tau*

(Walker), *B. cucurbitae* (Coquillett), *B. scutellaris* (Bezzi) have been reported as the predominant fruit fly species which cause heavy losses in cucurbit and tomato crops in low and mid hill areas (Agarwal *et al.*, 1987, Sunandita and Gupta, 2007; Prabhakar *et al.*, 2007; Singh *et al.*, 2013). Though, strict quarantine measures have been enforced to restrict entry of this insect (Ronald and Jayma, 2011), the consumption and production of plant based formulations is comparatively less compared to synthetic insecticides (Thakore, 2006). During last two decades many evaluation studies on IPM based and ecofriendly management options against key insect pests were adopted among which some were ineffective, unaffordable

and created environmental hazards (Manjunathan, 1997; Singh and Singh, 1998; Nupane, 2000; Dhillon *et al.*, 2005). Similarly, many plant extracts and neem oil were identified as potential botanical insecticides against fruit fly species (Sood and Sharma, 2004; Ingole *et al.*, 2005; Mondal and Ghalak, 2009; Gupta and Dikshit, 2010; Sharma *et al.*, 2011; Khursheed and Raj, 2012; Azad *et al.*, 2013; Haldhar *et al.*, 2014; Bhowmik *et al.*, 2014; Maharjan *et al.*, 2016).

Botanicals have also been regarded safe to ecology, pest management and to counter insect resistance (Yankanchi and Patil, 2009). Increasing acceptance of organic agriculture where chemicals are not permitted has led to a quest to scientific community around the globe to either formulate or suggest the safer alternatives for controlling insect pests. Considering the economic importance of fruit fly pest and economic cucurbit crop of the country the present studies were conducted to evaluate the efficacy of some organic inputs along with a recommended insecticide as standard check in organically grown cucumber crop.

#### **MATERIALS AND METHODS**

Field experiments were conducted at certified Model Organic Farm of CSK Himachal Pradesh Agriculture University, Palampur during the years 2011-12 and 2012-13. Cucumber variety Damini seeds were sown in polythene bags containing the mixture of soil, sand and ash under polyhouse conditions. The transplanting of seedling was done in replicated randomized block design with plot size of 3 x 2.7 m during first week of April, 2011 and 2012. The crop was raised as per the all recommended organic agronomic practices (Anonymous, 2008). The efficacy of eleven treatments consisted of nine organic inputs, one untreated check including a recommended inorganic insecticide was determined during the

study. The treatments were heeng 0.005%+panchgavya10%, cow milk 10%, aqueous extracts of *Melia* 5%, *Eupatorium* 5%, *Lantana* 5%, neem seed kernel (NSKE) 10%, dashparni 5%, *Polygonum hydropiper* 5%, akashvan + fermented butter milk (FBM) 10% each, a biopesticide Nimbecidine (neem oil 5ml/l of T. Stanes and Company Ltd., India), synthetic pyrethroid cypermethrin 25EC (Super Fighter of Insecticide (India) Ltd.) 0.5ml/l and an untreated check. Two Palam traps were additionally installed to monitor the insect population. The first foliar spray application of each treatment was made when either fruit fly infestation noticed or males were trapped. The subsequent spray applications were applied at ten day interval. The observations on five selected vines per plot were recorded. Marketable sized fruits were harvested at week interval in each treatment. The healthy and infested fruits were sorted out separately after each picking. The monitoring of the fruit fly males was also continued using Palam trap during the cropping seasons. The percentage of infested fruits and marketable fruit yield in each treatment was worked out to assess the effect of treatments during the entire cropping seasons. The data was subjected to statistical analysis.

**Details of preparation/ procurement of formulations:** Panchgavya, extracts of dashparni, *Melia*, neem seed kernels, *Polygonum hydropiper* were prepared at Model Organic Farm as per Sharma *et al.*, 2014 while *Lantana* and *Eupatorium* extracts and neem oil as Thakur and Sharma, 2014. The details of other formulations used in study are as under:

**Cow milk:** Fresh milk of *desi* cow breed from Organic Agriculture Department dairy farm of CSKHPKV was used for

spray at desired concentration diluted in water.

**Akashwan+Fermented butter milk:** Poured 400g each of soapnut powder, *Sapindus* sp. and crushed aak leaves *Calotropis* sp. in 4l cow urine. Contents were mixed properly, added 4.2l water and 1l fermented butter milk. Solution after 10 day storage was sieved. FBM was also arranged from farm dairy.

**Cypermethrin:** Synthetic pyrethroid cypermethrin formulation 25% EC (Super Fighter) of Insecticide (India) Ltd. was procured from the local market.

### RESULTS AND DISCUSSION

The monitoring of the fruit flies was conducted installing Palam trap during main cropping seasons of 2011 and 2012 which is a commercial trap developed by the Department of Entomology, Palampur and is very popular among the farmers of the state.

**Table 1.** Weekly trap population of fruit fly by using Palam trap in cucumber crop

Weeks of month	Trap catches/week	
	2011-2012	2012-2013
May 1 <sup>st</sup>	110.50	213.50
2 <sup>nd</sup>	251.00	302.00
3 <sup>rd</sup>	232.00	289.50
4 <sup>th</sup>	227.00	236.50
June 1 <sup>st</sup>	224.00	215.00
2 <sup>nd</sup>	203.50	206.50
3 <sup>rd</sup>	197.50	203.50
4 <sup>th</sup>	190.50	155.00
July 1 <sup>st</sup>	108.50	98.50

The data (Table 1) revealed that peak incidence of trapped males was observed in the 2<sup>nd</sup> week of May which continued till the termination of crop with decreasing trend and the lowest population of 108.50 and 98.50 were recorded during both the years of study, respectively. The observation on the effect of periodical sprays of treatments consisted of aqueous plant extracts, neem oil and cypermethrin on cucumber fruit infestation by fruit flies and their impact on yield were recorded as

per the method Bhatnagar and Yadava (1992) with some modifications. The perusal of data revealed that all the organic formulations had impact on management of fruit fly. Among the treatments tested, the percent fruit infestation ranged between 7.69 to 75% and 9.09 to 77.78% during the years 2011 and 2012, respectively. The lowest fruit infestation was registered in treatment with cypermethrin 25EC @ 0.5ml/l and was followed by treatment Nimbecidene 5ml/l as 12.50 and 13.58% during both respective years under study (Table 2 and 3). It is also apparent from table 2 and 3 that similar trend of fruit yield was observed i.e. highest of 191.48 and 183.33 q/ha was harvested from cypermethrin 25EC treated vines and was significantly at par with second best treatment Nimbecidene 0.3EC during 2011 and 2012, respectively. The present findings are in accordance with Borah (1997) who has reported lowest fruit infestation by *B. cucurbitae* in treatment with cypermethrin. In the present studies, the second better performing treatment of neem oil gets support from reports of various researchers. Chen *et al.* (1996), Ranganath *et al.* (1997), Gupta and Dikshit (2010) advocated safety and use of neem products for fruit fly management. Similarly, Sapkota *et al.* (2010) have documented neem leaf extract as the most effective to manage fruit fly in summer squash with qualitative and quantitative increase in yield attributes. Our results to advocate use of Nimbecidene in organic agriculture are also in conformity with Ragumoorthi *et al.* (1998) reported Nimbecidene as most effective against Moringa fruit fly, *Gotina distigima*. However, Hassan (1998) have advocated neem seed kernel extract as most effective against larvae of Queensland fruit fly but in our studies it

**Table 2.** Effect of different spray treatments at different intervals on cucumber fruit infestation by fruit fly during 2011-12

Treatment	Per cent cucumber fruits' infestation after treatment spray*				Yield in q/ha
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
	% infested	% infested	% infested	% infested	
Asafoetida 0.005%+Panchgavya 10%	33.33	46.15	50.00	56.00	147.16
Cow milk 10%	53.84	57.14	62.50	75.00	129.01
<i>Melia</i> extract 5%	30.77	35.39	40.00	42.86	150.49
<i>Eupatorium</i> extract 5%	22.22	47.62	58.97	62.50	138.27
<i>Lantana</i> extract 5%	21.43	30.00	36.59	40.00	153.95
Nimbecidine 5ml/l	12.50	16.67	24.39	29.09	189.01
NSKE 10 %	13.33	25.00	35.56	37.67	174.2
Dashparni 5%	40.00	41.67	53.33	59.09	140.00
<i>Polygonum hydropiper</i> extract 5%	40.00	40.00	42.86	63.16	138.27
Aksvaan 5% + FBM 10%	33.33	46.67	54.00	64.00	135.80
Cypermethrin 25 EC (Super Fighter) 0.5ml/l	7.69	12.50	18.60	22.22	191.48
Untreated control	60.00	50.00	69.39	66.67	90.49
CD (5%)	8.68	8.92	6.85	6.88	-

was not comparable with cypermethrin and Nimbecidine. Singh and Singh (1985) have reported both cypermethrin and neem oil as the effective treatments among other botanicals for the management of this insect pest. The present findings are in agreement with the above said literature results and confirm that cypermethrin and Nimbecidine out passed all the tested organic formulations against fruit fly and hence it can be advocated to use neem oil formulation (Nimbecidine 5ml/l of water) as a safer alternative to insecticides in organic cucumber agro-ecosystem as well as its suitable menace and better yield.

Under field conditions, amongst the nine plant based organic inputs, one biopesticide, a synthetic pyrethroid and an untreated control tested only one biopesticide i.e. Nimbecidine @5ml/l of water was promising for the menace of fruit fly in cucumber. Cypermethrin was found to be the most effective and significantly at par with neem oil. Four sprays of Nimbecidine coinciding with infestation at 10 day interval can be

effectively used to manage this pest under organic system. In the present scenario, where we have a huge demand and acceptability of organic products and still there is need to have extensive screening for effectiveness of all the available biopesticides, plant extracts and available organic formulations for stringent organic management measure of this serious insect pest.

#### ACKNOWLEDGEMENT

Authors are highly thankful to Indian Council of Agricultural Research, New Delhi (ICAR Adhoc-217-56) for providing facilities and funding as Niche Area of Excellence to Department of Organic Agriculture, CSK HPKV, Palampur to conduct this research work.

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**Table 3.** Effect of different spray treatments at different intervals on cucumber fruit infestation by fruit fly during 2012-13

Treatment and dosage	Per cent cucumber fruits' infestation after treatment spray				Yield in q/ha
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
	% infested	% infested	% infested	% infested	
Asafoetida 0.005%+Panchgavya 10%	38.10	45.00	50.00	54.17	160.49
Cow milk 10%	54.55	57.89	70.00	72.73	137.04
<i>Melia</i> extract 5%	35.71	35.29	42.86	43.75	161.11
<i>Eupatorium</i> extract 5%	26.67	54.55	60.00	66.67	155.56
<i>Lantana</i> extract 5%	25.00	33.33	40.00	41.67	164.2
Neem oil (Nimbecidine) 5ml/l	13.58	18.52	28.57	31.46	181.48
NSKE 10 %	14.29	32.00	33.33	36.11	170.99
Dashparni 5%	41.67	51.61	57.14	59.26	154.32
<i>Polygonum hydropiper</i> extract 5%	40.00	45.83	50.00	66.67	139.51
Aksvaan 5% + FBM 10%	38.46	50.00	60.00	65.22	136.42
Cypermethrin 25 EC (Super Fighter) 0.5ml/l	9.09	17.14	20.00	23.08	183.33
Untreated control	70.00	51.61	83.32	77.78	93.83
CD (5%)	7.02	6.47	9.19	8.43	-

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