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AM Bharadiya
Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, Gujarat, India

JB Bhut
Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, Gujarat, India

Correspondence
JB Bhut
Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh, Gujarat, India

Effect of different insecticides against fruit fly, *Bactrocera cucurbitae* Coquillett infesting sponge gourd

AM Bharadiya and JB Bhut

Abstract
Field experiments on effect of different insecticides against fruit fly, *Bactrocera cucurbitae* Coquillett infesting sponge gourd was carried out during consecutive two years 2014 and 2015 at Agronomy Farm, Junagadh Agricultural University, Junagadh. The five different insecticides were evaluated against the fruit fly, *B. cucurbitae* infesting sponge gourd. The insecticides abamectin 0.0025 per cent and emamectin benzoate 0.002 per cent were found most effective and economic and were statistically at par with each other. The significantly minimum fruit infestation 19.35 per cent with 32.01 per cent yield increased and net return Rs. 22695/ha was recorded in the treatment of abamectin. While in emamectin benzoate 20.62 per cent fruit infestation with 29.10 per cent yield increased and Rs. 20625/ha net return was recorded. However, the treatment of dichlorovos 0.07 per cent (22.65% fruit infestation with 26.32% increased yield and Rs. 18660/ha net return) was proved next best insecticide.

Keywords: Effect, Insecticides, Fruit fly, *Bactrocera cucurbitae*, Sponge gourd

Introduction
Cucurbits, a common name given to a number of vegetable crops belonging to botanical family cucurbitaceae which mostly possess trailing habit, are extensively grown all over the tropical and sub tropical countries and include the largest number of summer and rainy season vegetables. The number of insect pest cause damage to this crop among these, melon fruit fly is a serious pest and was first described by Coquillett (1899) [4] as *Dacus cucurbitae* on cucurbit from Hawaii. Later on, it was reported from different parts of the world, *viz.*; Australia, Mayanmar, China, East Africa, Taiwan, Hawaii, Malaysia, Nepal, Pakistan, Phillippines and Sri Lanka (Narayanan and Batra, 1960) [12]. In India, the incidence of the melon fly was first reported by Lefroy (1907) [10] on cucurbits. Melon fruit fly, *B. cucurbitae* damages over 81 plant species, but plants belonging to the family cucurbitaceae are most preferred hosts (Allwood *et al*., 1999) [1]. Depending on the environmental conditions and susceptibility of the crop species, the extent of losses varies between 30 to 100 per cent (Pareek and Kavadia, 1994; Dhillon *et al*., 2005; Shooker *et al*., 2006) [13, 6, 15]. This pest is reported to cause 80 per cent infestation in cucumber and bottle gourd, 60 per cent in bitter gourd and 50 per cent in sponge gourd (Gupta and Verma, 1992) [8]. For controlling this pest, several researchers have worked on the effectiveness of different insecticides for the control of *B. cucurbitae* infesting cucurbits (Borah, 1998; Mishra and Singh, 1999 and Babu *et al*., 2002) [3, 11, 2]. However, very scanty work has been done for the control of *B. cucurbitae* infesting sponge gourd. Hence, the present investigation was carried on effect of different insecticides against fruit fly, *B. cucurbitae* infesting sponge gourd.

Materials and Methods
With a view to find out the efficacy of different insecticides for control of fruit fly in sponge gourd, a field experiments was conducted in randomized block design with four replication at Agronomy Farm, Junagadh Agricultural University, Junagadh during two consecutive year *kharif* 2014 and *kharif* 2015. All the recommended agronomical practices were followed to raise good crop. The insecticidal solutions were sprayed through manually operated hydraulic knapsack sprayer till the whole plant was cover thoroughly. The first application of insecticides was made at the time of fruit formation stage, while the second application was made at 15 days interval after the first spray.

The observations on number of infested fruits and healthy fruits from five randomly selected and tagged plants as well as number of maggots per infested fruits were recorded during fruit picking at 4 to 5 days intervals and continue still last picking (maturity of crop). The fruits which were premature and dropped due to infestation of fruit fly were also considered in the observations. The per cent increase in yield over control as well as net cost benefit ratio (NCBR) was also calculated.

Results and Discussion

The data (Table 1) revealed that all the treatments were found significantly superior over control in reducing the fruit fly infestation. The treatment of abamectin 0.0025 per cent recorded the significantly minimum 19.35 per cent fruit infestation and it was statistically at par with emamectin benzoate 0.002 per cent in which 20.62 per cent fruit infestation was recorded. Further, it was found that treatment of dichlorovos 0.07 per cent was next best insecticide against fruit fly as it recorded 22.65 per cent fruit infestation. Whereas, treatments of lambda-cyhalothrin 0.005 per cent and acephate 0.05 per cent were found superior over control but inferior to dichlorovos 0.07 per cent against fruit fly as they recorded 25.52 and 26.65 per cent fruit infestation, respectively. The fruit infestation in control was recorded as high as 32.78 per cent.

During present study it was found that the descending chronological order of effectiveness of insecticidal treatments based on per cent reduction of fruit infestation due to fruit fly incidence was abamectin 0.0025 per cent > emamectin benzoate 0.002 per cent > dichlorovos 0.07 per cent > lambda-cyhalothrin 0.005 per cent > acephate 0.05 per cent.

Maggot population

The significantly lowest 3.65 maggots/fruit (Table 1) was recorded in the crop treated with abamectin 0.0025 per cent and it was at par with the treatment of emamectin benzoate 0.002 per cent in which 4.31 maggots/fruit was recorded. Further, it was found that the treatments of dichlorovos 0.07 per cent (4.46 maggots/fruit), lambda-cyhalothrin 0.005 per cent (4.82 maggots/fruit) and acephate 0.05 per cent (5.21 maggots/fruit) were found superior over control, but were inferior to rest of the treatments against fruit fly indicating least effective in reducing the maggot population. The maximum maggot population 5.75 was recorded in control plot. The yield data revealed (Table 2) that the sponge gourd yield 6238 kg/h with 32.01% increased over control was received from abamectin 0.0025 per cent treated crop was significantly highest and was at par with the yield 6100 kg/ha with 29.10% increased over control from treatment of emamectin benzoate 0.002 per cent and 5669 kg/ha with 26.32% increased over control from treatment of dichlorovos 0.07 per cent. The data revealed that the gross return of Rs. 93570/ha was highest in the treatment of abamectin 0.0025 per cent followed by emamectin benzoate 0.002 per cent and dichlorovos 0.07 per cent in which gross return were Rs. 91500 and Rs. 89535/ha recorded, respectively.

Looking to the overall two years results, The insecticide abamectin 0.0025 per cent was found most effective against sponge gourd fruit fly with lowest 19.35 per cent fruit infestation with 3.65 maggots/fruit, maximum yield of sponge gourd fruits (6238 kg/ha with 32.01 per cent increase over control) and the highest net return Rs. 22695/ha. The effectiveness of abamectin might be due to its mode of action as it acts mainly by ingestion but also has contact and translaminar activity that continue to kill pests as the feed on the mesopphyll tissue. The same insecticides were found most effective against *B. cucurbitae* infesting cucumber and bitter gourd by Khursheed and Raj (2012) [9] and Sharma and Sinha (2009) [14]. Whereas, the treatment of emamectin benzoate 0.002 per cent (20.62% fruit infestation with 4.31 maggots/fruit, 6100 kg/ha yield with 29.10% increase and Rs. 20625/ha net return) was at par with abamectin 0.0025 per cent. However, the treatment of dichlorovos 0.07 per cent (22.65% fruit infestation with 4.46 maggots/fruit, 5969 kg/ha yield with 26.32% increase and Rs. 18660/ha net return) was proved next best treatment.

Table 1: Efficacy of insecticides against fruit fly, *B. cucurbitae* under field condition during two *kharif* season

Sr. No.	Treatment	Fruit infestation (%) after spray			No. of maggots / damage fruit		
		Pooled*			2014	2015	Pooled
		2014	2015	Overall Pooled			
1	Lambda-cyhalothrin 5% EC 0.005%	30.91** (26.39)	29.78 (24.67)	30.34 (25.52)	2.32*** (4.91)	2.29 (4.74)	2.31 (4.82)
2	Emmamectin benzoate 5% SG 0.002%	26.94 (20.53)	27.08 (20.72)	27.01 (20.62)	2.13 (4.04)	2.26 (4.59)	2.19 (4.31)
3	Abamectin 1.9% EC 0.0025%	26.27 (19.59)	25.92 (19.11)	26.10 (19.35)	2.07 (3.77)	2.01 (3.54)	2.04 (3.65)
4	Dichlorovos 76% EC 0.07%	28.36 (22.56)	28.48 (22.74)	28.42 (22.65)	2.17 (4.20)	2.28 (4.72)	2.23 (4.46)
5	Acephate 75% SP 0.05%	31.86 (27.86)	30.31 (25.47)	31.08 (26.65)	2.35 (5.04)	2.42 (5.37)	2.39 (5.21)
6	Control (water spray)	35.08 (33.03)	34.79 (32.56)	34.93 (32.78)	2.43 (5.41)	2.57 (6.10)	2.50 (5.75)
S.Em.±		0.71	0.65	0.48	0.08	0.10	0.06
C.D. at 5 %		1.99	1.82	1.33	0.24	0.27	0.18
C.V. %		11.56	10.76	11.17	12.88	14.46	13.71
S							
S.Em.±		0.63	0.81	0.67	--	--	0.04
C.D. at 5 %		1.89	2.44	1.94	--	--	NS
SXT							
S.Em.±		1.00	0.91	0.68	--	--	0.09
C.D. at 5 %		NS	NS	NS	--	--	NS

*Pooled of two spray

**Figures in the parentheses are retransformed values while outside are sine^{-1} √(X + 0.5)/100 transformed value.

***Figures in the parentheses are retransformed values while outside square root √(X + 0.5) transformed value

Table: 2: Fruit yield, Increased yield over control and economics different insecticidal treatment for the control of fruit fly, *B. cucurbitae*

Sr. No.	Treatment	Fruit yield (kg/ha) (Pooled)	Increased yield over control (%) (Pooled)	Gross benefit (`/ha)	Net benefit (`/ha)	Net cost benefit ratio (NCBR)
1	Lambda-cyhalothrin 5% EC 0.005%	5263	11.38	78945	8070	1 : 7.02
2	Emmamectin benzoate 5% SG 0.002%	6100	29.10	91500	20625	1 : 6.78
3	Abamectin 1.9% EC 0.0025%	6238	32.01	93570	22695	1 : 3.23
4	Dichlorovos 76% EC 0.07%	5969	26.32	89535	18660	1 : 17.77
5	Acephate 75% SP 0.05%	5106	8.07	76590	5715	1 : 6.42
6	Control (water spray)	4725	--	70875	--	--
S.Em.±		235.13	--	--	--	--
C.D. at 5 %		679.03	--	--	--	--
C.V. %		11.95	--	--	--	--
Y						
S.Em.±		135.75	--	--	--	--
C.D. at 5 %		NS	--	--	--	--
Y X T						
S.Em.±		332.53	--	--	--	--
C.D. at 5 %		NS	--	--	--	--

- Labourer charges @ Rs. 200/ha/spray
- The price of sponge gourd fruit @ Rs. 15/kg
- Quantity of water required for one spray @ 500 l/ha

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