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Comparative efficacy of some biopesticides and a pyrethroid against cucurbit fruit fly, *Bactrocera cucurbitae* (Coquillett) on Bitter gourd

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Abstract
The efficacy of two bacterial fermented bio-pesticides (abamectin and emamectin benzoate), one insect growth regulator (lufenuron) and one newer pyrethroid (lambda-cyhalothrin) against the cucurbit fruit fly, *Bactrocera cucurbitae* (Coquillett) on bitter gourd was evaluated by field experiments. Two concentrations of the selected bio-pesticides were tested. A total of three sprays were applied and data were collected on different parameters viz. percent fruit infestation, number of marketable fruits/m^2, infested and marketable fruit yield (t/ha) etc. Analysis of the results revealed that abamectin (Ambush 1.8EC) was found as the most effective one followed by emamectin benzoate (Suspend 5SG) while the insect growth regulator, lufenuron (Haron 5EC) was found as less effective against the *B. cucurbitae* based on the parameters studied. The efficacy of abamectin was significantly better in comparison with that of the others. Therefore, the abamectin can be suggested for effective management of the *B. cucurbitae*.

Keywords: *Bactrocera cucurbitae,* biopesticides, abamectin, lufenuron, comparative efficacy.

1. Introduction
The Cucurbit fruit fly, *Bactrocera cucurbitae* (Coquillett) **(**Diptera: Tephritidae) is one of the most serious polyphagous insect pests of cucurbits representing 74.5% of the total number of flies infesting different vegetables growing in Bangladesh [1]. More than 125 host plants were reported worldwide while 81 crop plants were reported from Bangladesh [2, 3, 4]. It is a major pest of cucurbitaceous vegetables, especially the bitter gourd, musk melon, snap melon, snake gourd and ridge gourd in Bangladesh [4, 5]. Thus, high prevalence of fruit fly infestation is a major constraint of cucurbit yield and quality of the cucurbitaceous vegetables.

The maggots of *B. cucurbitaei* are responsible for causing damage by feeding internally on fruit pulp and make tunnels in fruits. The infested fruits become rotten and shed up prematurely. If not rotten, the fruits become deformed and market value reduced drastically. Sometimes, female adults make pseudo-puncture on the skin of the young fruits which also reduce market price adversely [6, 7].

It is responsible for causing 30-100% yield losses depending on susceptible varieties, suitable weather condition as well as management practices [4, 6, 7, 8]. Other than fruits, this pest also causes a loss of about 9.7% to female flowers [9]. Among different cucurbitaceous vegetables, bitter gourd (*Momordica charantia* L.) was reported as the most favorable host for *B. cucurbitae* having highest infestation rate (41-89%) and shortest pre-mating, pre-oviposition, incubation, larval and pupal periods [10].

Fruit fly management in the cucurbitaceous vegetable crops including bitter gourd is reasonably difficult because the maggot of *B. cucurbitae* is an internal feeder. Farmers of Bangladesh are exclusively relying on different kinds of broad spectrum chemical insecticides of different groups like organophosphorous, organocarbamate, nicotinoids, older pyrethroids etc. to control *B. cucurbitae* [4, 11, 12, 13]. In some areas of Bangladesh farmers spend about 25% of the cultivation cost in bitter gourd production only to buy toxic pesticides [14]. However, the increasing use of synthetic chemical insecticides has led to a number of problems such as development of resistance to insecticides in insect pests, high insecticide residues in market produce, resurgence or increased infestation by some insect species due to the destruction of natural predators and parasitoids, changing pest status of mites and other minor insect pests to major ones, ecological imbalance and danger to health of the pesticide applicator [13, 15, 16, 17].

Therefore, it is urgent needed to increase the uses of biopesticides and new types of short durational insecticides against *B. cucurbitae* due to their selective mode of action, low residual activity and safety for farmer’s usage [18]. Considering all these facts, the present field investigations were, therefore, undertaken to find out the comparative efficacy of two bacterial fermented biopesticides (abamectin and emamectin benzoate), one insect growth regulator (lufenuron) and one newer pyrethroid (lambda-cyhalothrin) against the cucurbit fruit fly, *B. cucurbitae* on bitter gourd in Bangladesh.

2. Materials and methods
2.1 Experimental layout and location
Field experiments were conducted at Entomology field laboratory, Bangladesh Agricultural University, Mymensingh to elucidate comparative efficacy of selected pesticides/bio-pesticides during the period from March to July, 2014. The experiments were laid out in a Randomized Complete Block Design (RCBD) with three replications for each treatment.

2.2 Variety, land preparation and plant development
Land was ploughed with a power tiller followed by laddering and leveling the surface of soil. Cowdung and other fertilizers were applied as per recommended doses [19]. Seeds of a local popular variety of bitter gourd (Tajkorola - 88) was collected from local market and then soaked in water overnight. After

that the seedlings were raised in well prepared plots. There were 4 pits per plot and single plant per pit. All necessary horticultural practices were done for proper growth and development of the plants. Infestation of the insects like epilachna beetle, red pumpkin beetle was kept low by collecting and destroying the adults.

2.3 Selection of the biopesticides and pyrethroid and their doses

Four insecticides were selected to evaluate their efficacy against *B. cucurbitae* on bitter gourd as follows:

Table 1: Specification of treatments

Treatments	Active ingredients	Group/family
T_1 Suspend 5 SG @ 1.0 g/L water	Emamectin benzoate	Avermectin (Bacterial fermented)
T_2 Suspend 5 SG @ 1.5 g/L water		
T_3 Ambush 1.8 EC @ 2 ml/L water	Abamectin	Avermectin (Bacterial fermented)
T_4 Ambush 1.8 EC @ 3 ml/L water		
T_5 Jubas 2.5 EC @ 1 ml/L water	Lambda-Cyhalothrin	Pyrethroids
T_6 Jubas 2.5 EC @ 2 ml/L water		
T_7 Haron 5 EC @ 1 ml/L water	Lufenuron	Insect Growth Regulator (IGR)
T_8 Haron 5 EC @ 2 ml/L water		
T_9 Control	-	-

2.4 Data collection schedule, parameters and procedures

Data were collected on before and 3, 7 and 10 days after treatment (DAT) application. A total of three sprays were given at ten days interval. Fruits were picked at 10 DAT after each spraying. The following parameters: percentages of infested fruit**,** percent fruit protection over control, number of healthy or marketable fruits/m^2, yield (t/ha) of infested fruits**,** yield (t/ha) of marketable fruits, increase of marketable fruit yield (times) over control were considered for the efficacy evaluation of the selected bio-pesticides.

Data was calculated of the above mentioned parameters as per the formula and procedures described earlier by Khatun *et al*. (2015).

2.5 Statistical analysis

The recorded data were compiled and tabulated for statistical analysis. Analysis of variance (ANOVA) was done by using a computer statistical package MSTAT. The mean differences among the treatments were adjudged with Duncan's Multiple Range Test (DMRT) and Least Significant Difference (LSD) when necessary.

3. Results and discussion

3.1 Comparative efficacy of the selected biopesticides and a pyrethroid insecticide on the percent fruit infestation

The resultant effects of selected biopesticides and a pyrethroid insecticide on the percent fruit infestation caused by the cucurbit fruit fly, *B. cucurbitae* on bitter gourd are presented in Table 2. It is found that all the treatments tested of the selected insecticides were significantly effective in reducing percent fruit infestation compared to the control (P<0.01, Table 2). Although, the efficacy of the tested insecticides varied according to their types as well as concentrations tested.

Table 2: Efficacy of selected biopesticides and a pyrethroid insecticide on percent fruit infestation caused by *B. cucurbitae* at different sprayings

Treatments*	Before Spray	Mean percent fruit infestation at different sprayings									Cumulative mean
		Days after 1st spray			Days after 2nd spray			Days after 3rd spray			
		3 DAT	7 DAT	10 DAT	3 DAT	7 DAT	10 DAT	3 DAT	7 DAT	10 DAT	
T_1	9.29^{bcd}	13.71^{bc}	15.92^{b}	17.48^{c}	18.38^{cd}	20.50d^{e}	22.63^{d}	22.93^{cd}	25.73^{c}	29.05^{d}	20.70^{d}
T_2	8.58^{de}	11.08^{ef}	15.26^{b}	20.71^{b}	18.26^{cd}	21.46^{d}	22.79^{d}	23.24^{cd}	22.74^{d}	25.38^{e}	20.10^{d}
T_3	8.75^{cde}	10.72^{f}	12.53^{c}	15.22^{ef}	16.52^{de}	17.33^{f}	18.14^{e}	19.86^{de}	19.87^{e}	21.71^{f}	16.87^{e}
T_4	9.88^{b}	10.81^{f}	12.07^{c}	12.85^{g}	14.16^{f}	15.03^{g}	18.17^{e}	17.79^{e}	19.53^{e}	20.55^{f}	15.66^{e}
T_5	8.96^{cde}	13.44^{bcd}	15.29^{b}	15.73^{de}	19.36^{c}	19.61^{e}	22.75^{d}	23.60^{c}	24.25^{cd}	27.50^{de}	20.17^{d}
T_6	7.41^{f}	12.23^{de}	13.21^{c}	14.12^{fg}	15.45^{ef}	12.32^{h}	17.78^{e}	21.21^{cd}	23.67^{cd}	25.12^{e}	17.23^{e}
T_7	9.55^{bc}	14.64^{ab}	14.71^{b}	16.78^{cd}	22.87^{b}	30.67^{b}	36.61^{b}	35.42^{b}	36.60^{b}	37.98^{c}	27.36^{b}
T_8	8.33^{e}	13.25^{cd}	15.03^{b}	17.76^{c}	23.74^{b}	26.81^{c}	27.20^{c}	13.95^{f}	26.13^{c}	54.48^{b}	24.26^{c}
T_9	10.71^{a}	15.08^{a}	20.73^{a}	28.04^{a}	35.32^{a}	40.00^{a}	43.14^{a}	48.63^{a}	55.41^{a}	59.26^{a}	38.40^{a}
$LSD_{0.05}$	0.81	1.24	1.23	1.43	1.95	1.72	1.71	3.18	2.69	2.46	2.22
SE (±)	0.27	0.42	0.41	1.51	2.13	2.87	2.95	3.52	3.79	4.75	2.36
CV (%)	5.17	5.65	4.75	4.70	5.50	4.39	3.89	7.29	5.52	4.25	5.76
Level of significance	**	**	**	**	**	**	**	**	**	**	**

In a column, means of similar letter(s) do not differ significantly.

** = Significant at 1% level,

CV = Co-efficient of Variation.

*T1= Suspend 5SG @ 1.0g/L (Emamectin benzoate); T2= Suspend 5SG @ 1.5g/L (Emamectin Benzoate); T3= Ambush 1.8EC @ 2 ml/L (Abamectin); T4= Ambush 1.8EC @ 3 ml/L (Abamectin); T5= Jubas 2.5 EC @ 1ml/L (Lambda-cyhalothrin); T6= Jubas 2.5EC @ 2 ml/L (Lambda-cyhalothrin); T7= Haron 5EC @ 1 ml/L (Lufenuron); T8= Haron 5EC @ 1 ml/L (Lufenuron) and T9=Control.

The highest percentage of fruit infestation was observed in control ranged from 15.08 to 59.26% with the cumulative mean of 38.40%. Fruit infestation level showed rapid and steady continuous increase in bitter gourd when left untreated. On the other hand, infestation level increased slowly when plants were treated with the selected biopesticides and pyrethroid insecticide.

Among the treatments, the lowest fruit infestation of bitter gourd (cumulative mean, 15.66%) was observed in plants treated with Ambush 1.8EC (Abamectin) @ 3 ml/L followed by the same @ 2 ml/L (cumulative mean, 16.87%) which was statistically similar (Table 2). On the other hand, Haron 5EC @ 2 ml/L (Lufenuron) provided the least efficacy regarding the percent fruit infestation where cumulative mean was found about 24.26% (Table 2).

Statistically significant difference was observed in between the doses of Jubas 2.5EC (lambda-Cyhalothrin) on percent fruit infestation. Higher doses of lambda-Cyhalothrin provide significant lower percent fruit infestation level. However, when the plants were treated with suspend 5SG (Emamectin benzoate), statistically insignificant infestation level was observed for both the doses tested (Table 2).

In addition, percent fruit protection over control was also calculated and the results are presented in Figure 1.

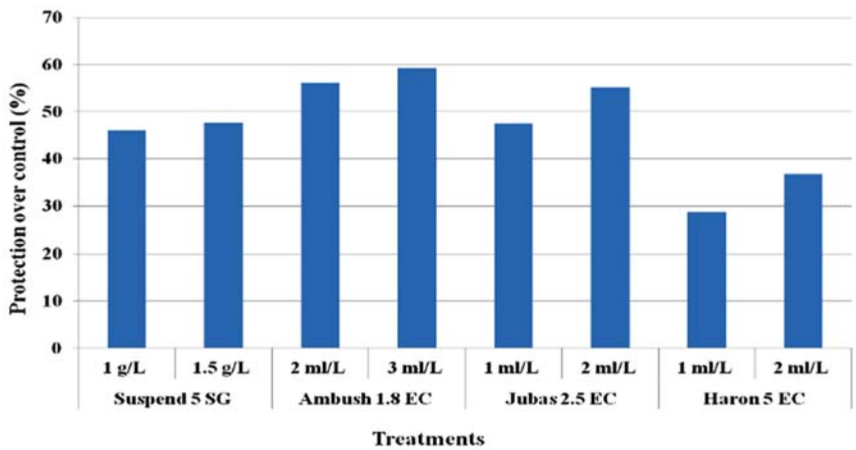

Fig 1: Percent protection of bitter gourd over control when plants were treated with different concentrations of the selected pesticides

It showed that 59.23% fruits were protected from infestation when bitter gourds plants were treated with Ambush (Abamectin) @ 3 ml/L followed by ambush @ 2 ml/L (56.07%), Jubas @ 2 ml/L (55.13%), Jubas @ 1ml/L (47.47%), Suspend @ 1.5 g/L (47.65%), Suspend @ 1 g/L (46.09%), Haron @ 2 ml/L (36.82%), and Haron @ 1 ml/L (28.75%). Thus, abamectin (Ambush @ 3 ml/L) provide the highest protection and the Lufenuron (Haron @ 1 ml/L) provide the lowest protection (Fig.1).

3.2 Comparative efficacy of the selected biopesticides and a pyrethroid insecticide on the number of marketable or healthy fruits/m^2

The selected biopesticides and a pyrethroid insecticide treatments had a significant variable efficacy on the number of marketable or healthy fruits/m^2 (P<0.01) (Table 3). It is found that the Suspend 5SG (Emamectin benzoate), Ambush 1.8EC (Abamectin), Jubas 2.5 EC (lambda-Cyhalothrin), Haron 5EC (IGR, Lufenuron) increased significantly on the number of marketable or healthy fruits/m^2 compared to control.

Table 3: Efficacy of selected biopesticides and pyrethroid insecticide on number of marketable fruits/m^2 of bitter gourd

Treatments*	Number of marketable or healthy fruits/m^2				Increase over control
	1st picking	2nd picking	3rd picking	Cumulative number	
T_1	1.00^{e}	1.33^{c}	1.50^{c}	3.83^{c}	1.39
T_2	1.16^{cde}	1.50^{bc}	1.33^{cd}	4.00^{c}	1.45
T_3	1.83^{b}	1.92^{a}	2.00^{b}	5.75^{a}	2.09
T_4	1.83^{b}	1.75^{ab}	2.25^{a}	5.83^{a}	2.12
T_5	1.42^{c}	1.58^{bc}	1.25^{cd}	4.25^{c}	1.55
T_6	2.92^{a}	1.00^{d}	1.17^{d}	5.08^{b}	1.85
T_7	1.33^{cd}	1.67^{ab}	0.67^{e}	3.67^{c}	1.33
T_8	1.33^{cd}	0.92^{d}	1.50^{c}	3.75^{c}	1.36
T_9	1.08^{de}	1.00^{d}	0.67^{e}	2.75^{d}	1.00
$LSD_{0.05}$	0.299	0.289	0.232	0.668	-
SE (±)	0.099	0.096	0.078	0.223	-
Level of significance	**	**	**	**	-
CV (%)	11.13	11.86	9.87	8.93	-

In a column, means of similar letter (s) do not differ significantly.

** = Significant at 1% level,

CV = Co-efficient of Variation.

*T1= Suspend 5SG @ 1.0g/L (Emamectin benzoate); T2= Suspend 5SG @ 1.5g/L (Emamectin Benzoate); T3= Ambush 1.8EC @ 2 ml/L (Abamectin); T4= Ambush 1.8EC @ 3 ml/L (Abamectin); T5= Jubas 2.5 EC @ 1ml/L (Lambda-cyhalothrin); T6= Jubas 2.5EC @ 2 ml/L (Lambda-cyhalothrin); T7= Haron 5EC @ 1 ml/L (Lufenuron); T8= Haron 5EC @ 1 ml/L (Lufenuron) and T9=Control.

The abamectin (Ambush 1.8EC @ 3 ml/L) produced the highest cumulative number (5.83/m^2) of marketable bitter gourd followed by statistically similar number (5.75/m^2) produced by the same but lower doses (Ambush 1.8EC @ 2 ml/L). Thus, abamectin with the increase of doses did not cause the significant increase of the number of marketable or healthy fruits/m^2. The second highest cumulative number (5.08/m^2) of marketable fruits was recorded from lambda-Cyhalothrin (Jubas @ 2 ml/L). The lowest cumulative number (3.67/m^2) of marketable fruit was obtained from Lufenuron (Haron @1 ml/L). Table 3 also showed significant variation on the number of healthy fruits /m2 among the three different pickings of fruits.

In addition, the increase of marketable or healthy fruits/m^2 over control was also calculated (Table 3). All the treatments showed increased marketable or healthy fruits/m^2. However, abamectin (Ambush 1.8EC) caused increase more than twice in comparison with the control.

3.3 Comparative efficacy of the selected biopesticides and a pyrethroid insecticide on the yield of marketable bitter gourds (t/ha)

Similar to the number of marketable fruits//m^2, the yield of marketable bitter gourds (t/ha) increased significantly (P<0.01) by the treatments of the tested bio-pesticides and pyrethroid insecticide and the results are presented in the Table 4.

The lowest yield of marketable fruits (4.23 t/ha) was obtained from control plots. On the other hand, the highest yield (8.54 t/ha) was recorded from plots treated with Ambush 1.8EC @ 3 ml/L (Abamectin). The second highest marketable yield (7.91 t/ha) was obtained from Jubas @ 2 ml/L (LAMBDA-Cyhalothrin) which was followed by 1 ml/L (7.45 t/ha). The Haron 5EC (Lufenuron) performed least among the treatments in producing minimum yield of marketable bitter gourds (6.33 t/ha).

Table 4: Efficacy of selected biopesticides and insecticide on yield (t/ha) of marketable bitter gourds fruits

Treatments*	Yield (t/ha) of marketable bitter gourds				Yield increase over control
	1st picking	2nd picking	3rd picking	Cumulative yield	
T_1	2.10^{de}	2.38^{de}	1.87^{b}	6.33^{d}	1.50
T_2	2.58^{bc}	2.06^{f}	1.90^{b}	6.57^{d}	1.55
T_3	2.80^{b}	3.90^{a}	1.50^{d}	8.22^{ab}	1.94
T_4	2.80^{b}	3.01^{b}	2.70^{a}	8.54^{a}	2.02
T_5	2.50^{c}	3.10^{b}	1.84^{b}	7.45^{c}	1.76
T_6	4.50^{a}	2.40^{ef}	0.95^{f}	7.91^{bc}	1.87
T_7	2.20^{d}	2.50^{d}	1.64^{cd}	6.31^{d}	1.49
T_8	1.90^{e}	2.74^{c}	1.80^{bc}	6.45^{d}	1.52
T_9	1.40^{f}	1.60^{g}	1.20^{e}	4.23^{e}	1.00
$LSD_{0.05}$	0.218	0.205	0.173	0.715	-
SE (±)	0.270	0.225	0.165	0.428	-
Level of significance	**	**	**	**	-
CV (%)	5.02	4.47	5.79	6.04	-

In a column, means of similar letter (s) do not differ significantly.
** = Significant at 1% level,
CV = Co-efficient of Variation.
*T1= Suspend 5SG @ 1.0g/L (Emamectin benzoate); T2= Suspend 5SG @ 1.5g/L (Emamectin Benzoate); T3= Ambush 1.8EC @ 2 ml/L (Abamectin); T4= Ambush 1.8EC @ 3 ml/L (Abamectin); T5= Jubas 2.5 EC @ 1ml/L (Lambda-cyhalothrin); T6= Jubas 2.5EC @ 2 ml/L (Lambda-cyhalothrin); T7= Haron 5EC @ 1 ml/L (Lufenuron); T8= Haron 5EC @ 1 ml/L (Lufenuron) and T9=Control.

Increase of yield of the marketable bitter gourds over control was also calculated (Table 4). The yield was increased more than twice times over control when plants were treated with ambush @ 3 ml/L followed by Ambush @ 2 ml/L (1.94 times), Jubas @ 2 ml/L (1.87 times), Jubas @ 1 ml/L (1.76 times), Suspend @ 1.5 g/L (1.55 times), Suspend @ 1 g/L (1.5 times), Haron @ 2 ml/L (1.52 times) and Haron @ 1 ml/L (1.49 times).

3.4 Comparative efficacy of the selected biopesticides and pyrethroid insecticide on the infested fruit yield (t/ha) of bitter gourd

All the selected tested insecticides significantly reduced the yield of infested fruits compared to control (Table 5). The highest infested cumulative fruit yield (6.46 t/ha) was recorded from control plots and the lowest cumulative infested yield (3.59 t/ha) was observed when bitter gourd plants were treated with ambush @ 3 ml/L (Abamectin) which was insignificantly followed by ambush 2 ml/L (3.83 t/ha), Jubas @ 2 ml/L (3.70 t/ha), Jubas@ 1 ml/L (4.09 t/ha). Comparatively higher infested yield was obtained from bacterial fermented Suspend @ 1.5 g/L (4.35 t/ha) followed by Suspend @ 1 g/L (4.72 t/ha), Haron @ 2 ml/L (4.77 t/ha) and 1 ml/L (5.23 t/ha) than Ambush or Jubas. There were no statistically significant differences observed between the efficacy of Jubas and Ambush regarding infested fruit yield (Table 5).

Table 5: Yield (t/ha) of infested bitter gourds after application of biopesticides and biopesticide

Treatments*	Yield (t/ha) of infested bitter gourd			
	1st picking	**2nd picking**	**3rd picking**	**Cumulative yield (t/ha)**
T_1	1.74ab	1.80b	1.20d	4.72bc
T_2	0.76e	1.02d	2.60a	4.35cd
T_3	1.07d	1.43c	1.32cd	3.83de
T_4	1.30c	1.17d	1.20d	3.59e
T_5	1.30c	1.46c	1.37c	4.09cde
T_6	1.21c	1.46c	1.03e	3.70de
T_7	1.75a	1.77b	1.70b	5.23b
T_8	1.73ab	1.70b	1.37c	4.77bc
T_9	1.60b	2.30a	2.56a	6.46a
$LSD_{0.05}$	0.134	0.181	0.122	0.650
SE (±)	0.115	0.126	0.196	0.216
Level of significance	**	**	**	**
CV (%)	5.61	6.82	4.42	8.29

In a column, means of similar letter (s) do not differ significantly.
** = Significant at 1% level,
CV = Co-efficient of Variation.
*T1= Suspend 5SG @ 1.0g/L (Emamectin benzoate); T2= Suspend 5SG @ 1.5g/L (Emamectin Benzoate); T3= Ambush 1.8EC @ 2 ml/L (Abamectin); T4= Ambush 1.8EC @ 3 ml/L (Abamectin); T5= Jubas 2.5 EC @ 1ml/L (Lambda-cyhalothrin); T6= Jubas 2.5EC @ 2 ml/L (Lambda-cyhalothrin); T7= Haron 5EC @ 1 ml/L (Lufenuron); T8= Haron 5EC @ 1 ml/L (Lufenuron) and T9=Control.

These observations are in agreement of our previous report [6] where abamectin was applied alone and in combination with the several others insecticides. Abamectin alone and abamectin plus lambda-cyhalothrin significantly reduced the fruit infestation of bitter gourd caused by the cucurbit fruit fly. Similar observations on abamectin and lambda-Cyhalothrin were reported by various other authors also [5, 20, 21]. Our results also revealed that the insect growth regulator, lufenuron (haron 5 EC) showed least efficacy on *B. cucurbitae*. Chang *et al.,* (2012) [22] revealed that the Lufenuron did not affect significantly the fertility of the *B. cucurbitae* adults which could be the reason of least performance of Lufenuron in our study also. Many observations using same group of insecticide and biopesticide were reported by various authors on different vegetables. Oke (2008) [12] evaluated the effectiveness of pyrethroid, Lambda-cyhalothrin against *B. cucurbitae* and found that it increased the quality of harvested make table cucumber fruits in relation to infestation of fruits with oviposition marks. Sawai *et al.,* (2014) [23] reported that the application of Emamectin benzoate moderately increased the marketable yield of ridge gourd.

The abamectin is a new generation type of biopesticide derived the soil bacterium *Streptomyces avermitilis*. The resultant high efficacy of abamectin against the *B. cucurbitae* could be due to its antiovipositional and reproductive inhibitory effect as suggested by our previous observations. Further experimentations are required to determine the exact cause of high efficacy against the cucurbit fruit fly.

4. Conclusions

Four insecticide namely, Suspend 5SG (Emamectin benzoate), Ambush 1.8EC (Abamectin), Jubas 2.5 EC (lambda-Cyhalothrin) and Haron 5EC (IGR, Lufenuron) were tested to evaluate their comparative performance to check the infestation caused by the cucurbit fruit fly, *B. cucurbitae*. It was found that the selected insecticides exerted variable efficacy against *B. cucurbitae* on bitter gourd. The lowest fruit infestation with highest protection over check and therefore, increased number of marketable or healthy fruits/m^2, yield of marketable fruits, yield of infested fruits was obtained by the application of abamectin. Yield of the number of marketable or healthy fruits/m^2 and yield of marketable fruits were increased twice compared to control by abamectin treatment. On the other hand, the IGR, Haron 5 EC (lufenuron) performed least efficacy against *B. cucurbitae*. Thus, Ambush 1.8EC (Abamectin) showed best performance among the tested chemicals. Hence, the abamectin can be could be recommend for the effective management of the *B. cucurbitae*.

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