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EFFICACY OF INSECTICIDES AGAINST FRUIT FLY *BACTROCERA CUCURBITAE* (COQUILLETT) ON CUCUMBER

C B Solanki*, J R Patel[1], A R Mohapatra[2], Anu Thomas[3], M K Katesiya, S M Patel and N J Chaudhari

Department of Entomology, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar 385506, Gujarat, India
[1]Polytechnic in Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Khedbrahma 383255, Gujarat, India
[2]Department of Entomology, Anand Agricultural University, Anand 388110, Gujarat, India
[3]Department of Entomology, Kerala Agricultural University, Thrissur 680656, Kerala, India
*Email: solankichandresh3181996@gmail.com (corresponding author)

ABSTRACT

The field experiment undertaken during 2018 at Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar evaluated the efficacy of insecticides by foliar application against fruit fly *Bactrocera cucurbitae* (Coquillet) in cucumber. Among the treatments evaluated, the least fruit damage at 10 and 14 days after second spray was observed with flubendiamide 480SC @ 0.3 l+ jaggery 5 kg/ ha followed by flubendiamide 480SC @ 0.3 l/ ha. The maximum fruit yield (48.29 q/ ha) was obtained with foliar application of flubendiamide 480SC @ 0.3 l/ ha+ jaggery, and maximum benefit in terms of protection cost benefit ratio (PCBR- 1:12.84) was observed with profenophos 50EC @ 1 l + jaggery 5 kg/ ha.

Key words: *Bactrocera cucurbitae*, cucumber, flubendiamide, profenophos, jaggery, field efficacy, foliar application, fruit damage, yield, cost benefits

Cucumber (*Cucumis sativus* L.) is popular amongst the Cucurbitaceae, and occupies an area of 82 thousand ha with production of 1260 thousand mt in India (Anon., 2018). Insect pests and diseases are the major biotic constraints in cucumber. Insect pests cause damage of 20 to 100% (Gupta, 2004), and around 50% of loss. Fruit fly and red pumpkin beetle cause 100% fruit damage, mainly in the pumpkin, cucumber and bitter gourd (Jyoti and Rajbhandari, 2015), and yield loss of 20-39% was observed with fruit fly attack in cucumber (Hill, 2007). Two species viz*., Bactrocera cucurbitae* (Coquillett) and *B. tau* (Walker) commonly called as melon fruit flies are the major species infesting cucurbits (Kapoor and Agarwal, 1983). Insecticides are the best for their management because of its rapid action and easy availability (Rai et al., 2014). In order to avoid the adverse effects of these insecticides, it is necessary to evaluate more new insecticides that are not only safe to natural enemies and environment but also effective at very smaller doses. The present study evaluates some insecticides along with jaggery as foliar application in cucumber for their efficacy against *B. cucurbitae*.

MATERIALS AND METHODS

The study was carried at the Horticultural Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat), during 2018. The treatments consist of insecticides and jaggery with both alone and combinations viz., flubendiamide 480SC, chlorantraniliprole 18.5SC, chlorfenapyr 10SC, profenophos 50EC, lambda cyhalothrin 5EC, flubendiamide 480SC+ jaggery, chlorantraniliprole 18.5SC+ jaggery, chlorfenapyr 10SC+ jaggery, profenophos 50EC + jaggery, lambda cyhalothrin 5EC+ jaggery and untreated control. Two foliar sprays were given at 15 days interval with the first at flowering stage and second at 15 days after, with a manually operated knapsack sprayer. Fruits infested and total number of fruits were counted with pre-count and post-count data from the net plot and % damage worked out. At the time of harvest, the number and weight of marketable fruits was recorded separately from each plot. The data on fruit infestation was statistically analyzed, and along with the yield, economics of treatments were evaluated with protection cost benefit ratio (PCBR) was worked out. The treatment details are as follows.

RESULTS AND DISCUSSION

The results on fruit damage by *B. cucurbitae* before spraying of insecticides indicated that the difference in % infestation before spray was non-significant, and it remained so after first day after spray; at 5th day after differences were significant; with flubendiamide+ jaggery (20.42% fruit damage) proved to be the most effective; it was followed by the treatment with flubendiamide (21.34%), chlorfenapyr+ jaggery (21.97%), chlorfenapyr (22.11%), profenophos+ jaggery (23.04%), profenophos (23.39%), chlorantraniliprole+ jaggery (24.02%), chlorantraniliprole (24.58%), lambda cyhalothrin+ jaggery (30.35%) and lambda cyhalothrin (31.26%); however, these treatments are comparable with each other but significantly superior to untreated control (39.36%). At ten days after the first spray significantly less fruit damage was observed with flubendiamide+ jaggery (12.66%), the most effective one. Flubendiamide (14.15%), chlorfenapyr+ jaggery (18.11%) and chlorfenapyr (18.79%) followed these, and were at par but significantly superior. Similarly, after 14 days after first spray flubendiamide+ jaggery (14.18%) was superior again followed by the treatment of flubendiamide (15.60%) and chlorfenapyr+ jaggery (20.05%) (Table 1).

At first day after the second spray, again flubendiamide+ jaggery, flubendiamide, chlorfenapyr + jaggery and chlorfenapyr (12.21, 13.51, 16.96 and 17.33%, respectively) were found superior and being at par with each other; profenophos+ jaggery, profenophos, chlorantraniliprole+ jaggery and chlorantraniliprole followed next. At five days after second spray again efficacy of flubendiamide+ jaggery and flubendiamide (10.96 and 11.97%, respectively), remained so. Similar trend was observed at 10 days after second spray. At 14 days after second spray again, the least fruit damage was observed with flubendiamide + jaggery (12.20%) which however was at par with flubendiamide and chlorfenapyr+ jaggery. Thus, overall, the treatment of flubendiamide+ jaggery was the most effective followed by flubendiamide, chlorfenapyr+ jaggery, chlorfenapyr, profenophos+ jaggery and profenophos. The data also indicated that second spray at 10 days interval was

Table 1. Efficacy of insecticides alone and with jaggery against *B. cucurbitae* in cucumber

Treatments	Fruit fly (%) damage on fruit									Yield (q/ ha)
	Pre-count	Post treatment								
		1st Spray				2nd Spray				
		1 DAS	5 DAS	10 DAS	14 DAS	1 DAS	5 DAS	10 DAS	14 DAS	
Flubendiamide 480SC	31.36* (27.09)	31.36 (27.09)	27.51 (21.34)	22.10 (14.15)	23.27 (15.60)	21.56 (13.51)	20.24 (11.97)	18.11 (9.66)	20.85 (12.66)	47.05
Chlorantraniliprole 18.5SC	34.25 (31.68)	34.25 (31.68)	29.72 (24.58)	31.43 (27.19)	32.29 (28.54)	30.68 (26.04)	29.86 (24.79)	28.37 (22.58)	30.37 (25.56)	34.75
Chlorfenapyr 10SC	31.70 (27.61)	31.70 (27.61)	28.05 (22.11)	25.69 (18.79)	26.95 (20.54)	24.60 (17.33)	24.29 (16.92)	23.24 (15.57)	25.50 (18.54)	45.22
Profenophos 50EC	33.07 (29.78)	33.07 (29.78)	28.93 (23.39)	29.68 (24.52)	30.17 (25.26)	28.77 (23.16)	27.85 (21.82)	26.73 (20.23)	28.80 (23.20)	42.16
Lambda cyhalothrin 5EC	35.65 (33.97)	35.65 (33.97)	34.00 (31.26)	31.89 (27.91)	33.52 (30.49)	34.96 (32.83)	33.03 (29.71)	30.93 (26.41)	32.85 (29.42)	33.60
Flubendiamide 480SC+ jaggery	30.68 (26.04)	30.68 (26.04)	26.86 (20.42)	20.84 (12.66)	22.12 (14.18)	20.45 (12.21)	19.33 (10.96)	17.70 (9.24)	20.44 (12.20)	48.29
Chlorantraniliprole 18.5SC + jaggery	33.12 (29.86)	33.12 (29.86)	29.35 (24.02)	30.48 (25.74)	32.18 (28.37)	29.21 (23.82)	28.63 (22.95)	27.85 (21.82)	29.90 (24.85)	40.89
Chlorfenapyr 10SC+ jaggery	31.61 (27.48)	31.61 (27.48)	27.95 (21.97)	25.19 (18.11)	26.60 (20.05)	24.32 (16.96)	23.82 (16.31)	21.93 (13.95)	24.31 (16.95)	46.42
Profenophos 50EC+ jaggery	31.90 (27.93)	31.90 (27.93)	28.69 (23.04)	26.79 (20.32)	28.66 (23.00)	27.84 (21.80)	25.83 (18.98)	24.99 (17.84)	27.17 (20.86)	44.05
Lambda cyhalothrin 5EC+ jaggery	35.29 (33.38)	35.29 (33.38)	33.43 (30.35)	31.76 (27.71)	33.27 (30.09)	33.37 (30.25)	31.22 (26.87)	30.76 (26.15)	32.69 (29.17)	33.75
Untreated control	35.72 (34.09)	35.72 (34.09)	38.86 (39.36)	40.03 (41.37)	41.38 (43.70)	40.22 (41.69)	41.00 (43.05)	41.84 (44.49)	43.18 (46.83)	31.24
S. Em. ±	3.03	3.03	1.81	1.61	1.40	1.51	1.49	1.27	1.39	2.50
CD (p=0.05)	N.S.	N.S.	5.34	4.74	4.12	4.47	4.39	3.76	4.10	7.37
C V %	15.83	15.83	10.34	9.70	8.06	9.13	9.30	8.30	8.39	10.65

*Arc sin transformed values; Figures in parentheses retransformed values; DAS= Days after spraying

Table 2. Economics of application of insecticides against *B. cucurbitae* in cucumber

Treatments	Qty. of insecticides (l or kg/ ha)	Price of insecticides (Rs/ ha)	Labour cost (Rs/ ha)	Total cost of treatment (Rs/ ha)	Yield (q/ ha)	Gross realization (Rs/ ha)	Net realization over control (Rs/ ha)	Net gain (Rs/ ha)	PCBR
Flubendiamide 480SC	0.3	5280	800	6080	47.05	94100	31620	25540	1:4.20
Chlorantraniliprole 18.5SC	0.3	780	800	1580	34.75	69500	7020	5440	1:3.44
Chlorfenapyr 10SC	1.0	3090	800	3890	45.22	90440	27960	24070	1:6.19
Profenophos 50EC	1.0	800	800	1600	42.16	84320	21840	20240	1:12.65
Lambda cyhalothrin 5EC	1.0	524	800	1324	33.60	67200	4720	3396	1:2.56
Flubendiamide 480SC+ jaggery	0.3+5.0	5530	800	6330	48.29	96580	34100	27770	1:4.39
Chlorantraniliprole 18.5SC+ jaggery	0.3+5.0	1030	800	1830	40.89	81780	19300	17470	1:9.55
Chlorfenapyr 10SC+ jaggery	1.0 +5.0	3340	800	4140	46.42	92840	30360	26220	1:6.33
Profenophos 50EC+ jaggery	1.0 +5.0	1050	800	1850	44.05	88100	25620	23770	1:12.84
Lambda cyhalothrin 5EC+ jaggery	1.0 +5.0	774	800	1574	33.75	67500	5020	3446	1:2.19
Untreated control	-	-	-	-	31.24	62480	-	-	-

Number of sprays: Two; Cucumber: Rs. 2000/ q; Flubendiamide 480SC: Rs 17600/ l; Chlorantraniliprole 18.5SC: Rs 2600/l; Chlorfenapyr 10SC: Rs 3090/ l; Profenophos 50EC: Rs 800/ l; Lambda cyhalothrin 5EC: Rs 524/ l; jaggery: Rs 50/ kg; Labour charges: Rs. 200/ day; PCBR: Protection cost benefit ratio

the most effective (Table 1). The net realization was maximum with flubendiamide 480SC+ jaggery (34100 Rs/ ha) followed by chlorfenapyr 10SC+ jaggery (31620 Rs/ ha) and flubendiamide 480SC (25540 Rs/ ha) (Table 2). The highest PCBR was realized with profenophos 50EC+ jaggery (1: 12.84) followed by profenophos 50EC (1: 12.65), chlorantraniliprole 18.5SC+ jaggery (1: 9.55) (Table 2).

Lekha (2016) reported that flubendiamide 90+ deltamethrin 60-150SC led to least fruit damage due to fruit fly in cucumber. Khursheed and Desh (2012) observed lambda cyhalothrin (0.004%) as the second-best treatment after abamectin (0.0015%) in cucumber. In bitter gourd, Sunil et al. (2016) found that deltamethrin 2.8EC+ jaggery bait (0.0028+ 0.015%) was the most effective. In ridge gourd, Hirekurubar et al. (2018) found that spinosad 45SC @ 0.3 ml/ l was the most effective treatment followed by chlorantraniliprole 18.5SC @ 0.2 ml/l at par with deltamethrin 2.8EC @ 0.5 ml/ l. All the insecticides treatments increased the yield of marketable cucumber fruits significantly, with maximum yield being with the treatment of flubendiamide+ jaggery (48.29 q/ ha) followed by others as in Table 1. In cucumber the maximum yield was observed with malathion (0.1%) which was at par with fenthion (0.1%) according to Kate et al. (2010); Sharma et al. (2016) found that cypermethrin 25EC gave maximum fruit yield followed by neem oil (Nimbecidine), and Hirekurubar et al. (2018) with spinosad which was at par with chlorantraniliprole and significantly superior to deltamethrin in ridge gourd. Thus, spray application of flubendiamide 480SC @ 0.14%+ jaggery and flubendiamide 480SC @ 0.14% were the most effective in protecting cucumber crop from *B. cucurbitae*.

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