MANAGEMENT OF FRUIT FLY, *BACTROCERACUCURBITAE* (COQUILLET) IN RIDGE GOURD THROUGH BOTANICALS AND NEWER INSECTICIDES

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ABSTRACT

Field experiment was conducted at Kittur Rani Channamma College of Horticulture Arabhavi, Karnataka during kharif season of 2016 and 2017 to evaluate the bioefficacy of botanicals and insecticides viz., NSKE 5%, azadirachtin 1500ppm, profenophos 50 EC, buprofezin 25 SC, spinosad 45 SC, deltamethrin 2.8 EC, chlorantraniliprole 18.5 SC, difenthiuron 50 WP, and malathion 50 EC mixed with 1 percent jiggery against fruit fly, *Bactroceracucurbitae*(Coquillett)in Ridge gourd. The results of pooled data on percent fruit damage revealed that the minimum percent fruit damage of 14.27 was recorded in spinosad 45 SC @ 0.3 ml/l treated plot, making it most effective treatment followed by chlorantraniliprole 18.5 SC @0.2ml/l (16.97%) which was at par with deltamethrin 2.8 EC@ 0.5ml/l (20.35%). Spinosad 45 SC @ 0.3 ml/l treated plot registered highest fruit yield (22.08 t/ha) which was at par with chlorantraniliprole 18.5 SC @0.2ml/l (20.16 t/ha) and significantly superior than deltamethrin 2.8 EC@ 0.5ml/l (18.86 t/ha). The yield obtained from NSKE 5 % (16.86 t/ha) and azadirachtin 1500 ppm @5 ml/l (16.95 t/ha) were also found at par with deltamethrin 2.8 EC@ 0.5ml/l and significantly higher than the untreated control (13.51t/ha). The highest cost-benefit ratio of 1: 2.64 was obtained in spinosad 45 SC treated plot.

KEYWORDS: Fruit Fly, Insecticides, NSKE, Azadirachtin & Ridge Gourd

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INTRODUCTION

Ridge gourd (*Luffa acutangula*) is a very famous vegetable in the south and east India. It contains various antioxidants, minerals, vitamins, nutrients, and lipids. It is an excellent source of Vitamin A and carbohydrates. It is also a very good source of Vitamin B5, Manganese, Potassium, Copper, total dietary fiber, Vitamin B6, Vitamin C, and Magnesium. It is extremely fibrous to consume and may serve as a highly effective alleviation towards the constipation problems.

Ridge gourd is being subjected to damage by a wide array of insect pests, major being melon fruit fly (*Bactroceracucurbitae*Coq.).The extent of losses caused by *B. Cucurbitae* varies from 30to 100 per cent depending

on the cucurbit species and season (Dhillon *et al.*, 2005). Singh *et al.* (2000), however, reported fruit infestation of 31.27 per cent infestation on the bitter gourd and 28.55 per cent on watermelon. The melon fruit flies have more than 80 hosts and their economic importance cannot be evaluated entirely from the standpoint of the direct damage to the various crops affected. Quarantine laws aimed at preventing the entry and establishment of melon flies and hence reduce the export potential of crop produce (Ronald and Jayma, 2011). Generally, the female fruit flies puncture the soft and tender fruits by their sharp ovipositor and lay the eggs under fruit tissues and watery fluid oozes from the puncture. Sometimes pseudo-punctures (punctures without eggs) have also been reported on fruit skin, which reduces the market value of the produce. The eggs are also reported to be laid into unopened flowers and the maggots successfully develop in the taproots, stems and leaf stalks (Weems and Heppner, 2001). Though different conventional insecticides were tried for the control of this pest the conventional insecticides recommended against this pest gave low to moderate control. Hence there is a need to test newer insecticide to manage this pest.

MATERIAL AND METHODS

The present field experiment was carried out during Kharif season of 2016 and 2017 at Kittur Rani Channamma College of Horticulture Arabhavi, Karnataka in medium deep black soil under irrigated conditions. The experiment was laid out in a Randomized block design with ten treatments replicated thrice. The plot size was 5x4 sq.m for each treatment with a spacing of 120 cm x 60 cm. The crop was raised with “Naga” hybrid by adopting all recommended agronomical practices except plant protection measures. The first spray of insecticides mixed with 1 percent jiggery was applied as soon as the ovipositor marks of fruit fly were observed on the flowers and fruits and the second spray was given at 15 days after the first spray. The fruit damage was recorded at weekly interval picking wise by counting the total number of fruits and fruit fly affected fruits and cumulative fruit damage (%) was calculated for each treatment. The fruit yield obtained from individual plots picking wise, pooled and converted to a ton per hectare. The data on fruit damage was analyzed statistically after doing arcsine transformation. However, the data on yield was analyzed without any transformation.

Economics of application of various insecticides with respect to yield under each treatment was calculated to determine the cost-benefit ratio.

RESULTS

The results revealed that cumulative fruit infestation in all the treatments during *Kharif* 2016, was significantly lower than the untreated control (Table 1). The treatment spinosad 45 SC @ 0.3 ml/l was found effective which recorded least percent fruit damage (12.97%) and it found at par with chlorantraniliprole 18.5 SC @ 0.2ml/l (15.11%) followed by deltamethrin 2.8 EC @ 0.5ml/l (18.55%). The highest percent fruit damage was noticed in untreated control (38.14%). The data on percent reduction of fruit damage over untreated control indicated that highest percent reduction of percent fruit damage (66.07%) was noticed in treatment spinosad 45 SC @ 0.3 ml/l followed by chlorantraniliprole 18.5 SC @ 0.2ml/l (60.46%) and deltamethrin 2.8 EC @ 0.5ml/l (51.46%).

A similar trend was observed during 2017 also, the treatment spinosad 45 SC @ 0.3 ml/l remained effective and significantly superior by recording least percent fruit damage (15.58%) over deltamethrin 2.8 EC @ 0.5ml/l (22.15%). However, it was found at par with chlorantraniliprole 18.5 SC @ 0.2ml/l (18.83%). The highest percent fruit damage of 42.05 was found in untreated control. The highest reduction of percent fruit damage over untreated control was recorded in the treatment spinosad 45 SC @ 0.3 ml/l (62.96%). Chlorantraniliprole 18.5 SC @ 0.2ml/l (55.22%) was next best

treatment.

The pooled data of both years on percent fruit damage revealed that the minimum percent fruit damage of 14.27 was recorded in spinosad 45 SC @ 0.3 ml/l treated plot, making it most effective treatment followed by chlorantraniliprole 18.5 SC @ 0.2ml/l (16.97%) which was at par with deltamethrin 2.8 EC@ 0.5ml/l (20.35%). The same insecticides found effective by recording the highest percent reduction of fruit damage over untreated control to the extent of 64.52, 57.84 and 49.39 respectively.

During both, the seasons significantly higher population of coccinellids (adults and grubs) was observed after 15 days of the second spray in untreated control and the population was at par with each other in rest of the treatments (Table 2). The yield data presented in table 2, indicated that the highest fruit yield was obtained from the plot treated with spinosad 45 SC @ 0.3 ml/l (23.19 t/ha) followed by chlorantraniliprole 18.5 SC @ 0.2ml/l (20.66 t/ha) and deltamethrin 2.8 EC@ 0.5ml/l (20.09 t/ha) and rest of the treatments were at par with each other except untreated control (2016). A similar trend was observed during 2017 also, spinosad 45 SC @ 0.3 ml/l was found excellent chemical and recorded highest fruit yield (20.98 t/ha). Chlorantraniliprole 18.5 SC @ 0.2ml/l (19.65 t/ha) and deltamethrin 2.8 EC@ 0.5ml/l (17.63 t/ha) were next best treatments, the lowest yield of 12.91 ton per hectare was obtained from untreated control.

The pooled observations of both years revealed the same trend. spinosad 45 SC @ 0.3 ml/l treated plot registered highest fruit yield (22.08 t/ha) which was at par with chlorantraniliprole 18.5 SC @ 0.2ml/l (20.16 t/ha) and significantly superior than deltamethrin 2.8 EC@ 0.5ml/l (18.86 t/ha). The yield obtained from NSKE 5 % (16.86 t/ha) and azadirachtin 1500 ppm @ 5 ml/l (16.95 t/ha) were also found at par with deltamethrin 2.8 EC@ 0.5ml/l and significantly higher than the untreated control (13.51 t/ha). The highest cost-benefit ratio of 1:2.64 was obtained from spinosad 45 SC treated plot

DISCUSSIONS

The present findings are in accordance with the reports of Shivangi, Lekha and He mant Swami (2017) who reported the effectiveness of spinosad against *Bactrocera. Cucurbitae* and record of highest fruit yield in cucumber. Sawai et al (2014) reported that deltamethrin (0.0016%) was most effective insecticide against this pest in ridge gourd. Mehta et al. (2000) also recorded minimum fruit infestation and highest fruit yield of cucumber in deltamethrin + molasses treatment. Further Sheikh Khursheed and Desh Raj (2017) study revealed the effectiveness of azadirachtin (0.0045%) in cucumber and bitter gourd. Thus, the above reports have drawn by various research workers for the bio-efficacy of spinosad, deltamethrin and azadirachtin are in close agreement with the present findings.

CONCLUSIONS

In present findings, spinosad, chlorantraniliprole, deltamethrin were found to be effective insecticide and NSKE and azadirachtin can also be included in the management of fruit fly in general and IPM in particular as a novel mode of insecticides in ridge gourd.

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Table 1: Efficacy of Botanicals and Insecticides Against Fruit Fly Infestation in Ridge Gourd

Tr. No	Treatments	Dose	2016		2017		Pooled	
			Fruit Damage (%)	Percent Reduction Over Control	Fruit damage (%)	Percent Reduction Over Control	Fruit Damage (%)	Percent Reduction Over Control
T1	NSKE	5%	22.94 (28.60)	39.98	25.23 (30.11)	40.00	24.09 (29.35)	39.99
T2	Azadirachtin 1500 ppm	5 ml/l	22.21 (28.09)	41.89	24.34 (29.50)	42.12	23.28 (28.75)	42.00
T3	Profenophos 50EC	2 ml/l	19.06 (25.83)	50.12	22.14 (27.96)	47.34	20.60 (26.86)	48.73
T4	Buprofezin 25 SC	0.2 ml/lit	26.09 (30.68)	31.73	29.09 (32.61)	30.81	27.59 (31.65)	31.27
T5	Spinosad 2.5 SC	0.3 ml/l	12.97 (21.07)	66.07	15.58 (23.20)	62.96	14.27 (22.18)	64.52
T6	Deltamethrin 2.8 EC	0.5 ml/l	18.55 (25.38)	51.46	22.15 (28.01)	47.32	20.35 (26.73)	49.39
T7	Chlorantraniliprole 18.5 SC	0.2 ml/l	15.11 (22.83)	60.46	18.83 (25.63)	55.22	16.97 (24.29)	57.84
T8	Difenthiuron 50 WP	0.75 g/l	19.51 (26.16)	48.96	23.87 (29.20)	43.24	21.69 (27.74)	46.10
T9	Malathion 50 EC	1 ml/l	24.95 (29.89)	34.73	25.61 (30.37)	39.09	25.28 (30.12)	36.91
T10	UTC	--	38.22 (38.14)	--	42.05 (40.40)	--	40.13 (39.28)	--
CD @ 5%			4.1		4.2		4.3	
SEm ±			1.4		1.4		1.5	
CV (%)			8.7		8.3		8.8	

Note:- Treatments + 1% jaggery, Figures in the parenthesis are Arc sine transformed values

Table 2: Impact of Botanicals and Insecticides on Natural Enemies and Fruit Yield of Ridge Gourd

Tr. No	Treatment Detail	Dose	No. of Predators/Plant* (15 DAS II Spray)			Fruit Yield (t/ha)		
			2016	2017	Pooled	2016	2017	Pooled
T1	NSKE	5%	3.83 (2.19)	2.57 (1.88)	3.20 (2.05)	17.16	16.56	16.86
T2	Azadirachtin 1500 ppm	5 ml/l	3.17 (2.04)	1.93 (1.71)	2.52 (1.87)	17.20	16.69	16.95
T3	Profenophos 50EC	2 ml/l	1.93 (1.69)	0.87 (1.36)	1.40 (1.54)	17.48	17.15	17.32
T4	Fipronil 5 SC	1 ml/lit	2.10 (1.76)	1.15 (1.46)	1.63 (1.61)	16.67	15.92	16.29
T5	Spinosad 2.5 SC	0.3 ml/l	1.83 (1.67)	0.97 (1.40)	1.40 (1.54)	23.19	20.98	22.08
T6	Deltamethrin 2.8EC	0.5 ml/l	1.57 (1.60)	0.83 (1.35)	1.20 (1.48)	20.09	17.63	18.86
T7	Chlorantraniliprole 18.5 SC	0.2 ml/l	1.33 (1.52)	0.78 (1.32)	1.06 (1.43)	20.66	19.65	20.16
T8	Difenthiuron 50WP	0.75 g/l	2.30 (1.81)	2.01 (1.72)	2.15 (1.77)	17.32	17.01	17.17
T9	Malathion 50 EC	1 ml/l	2.33 (1.82)	2.07 (1.74)	2.20 (1.78)	17.26	16.34	16.80
T10	UTC	--	4.67 (2.38)	3.58 (2.13)	3.79 (2.16)	14.11	12.91	13.51
CD @ 5%			0.3	0.4	0.4	3	2.8	2.7
SEm ±			0.1	0.1	0.1	1.0	0.9	0.9
CV (%)			10.2	12.8	12.0	9.9	9.6	9.0

Note- Treatments + 1% jaggery, *(Coccinellids grubs and adults)

DAS- Days after spray and Figures in the parenthesis are SQRT values

Table 3: Economics of Different Treatments for the Control of Fruit Fly Infesting Ridge Gourd

SL. No.	Treatments	Dose ml or g/l	Formulation /ha	Price of Insecticide (Rs/ Kg or l)	Cost of Application of 2sprays (Rs)	Total Cost of cultivation (Rs)	Fruit Yield t/ha	Gross Income Rs	Net Returns	Cost benefit ratio
T1	NSKE	5%	20kg seeds	10	1600	87600	16.86	252900	165300	1:1.89
T2	Azadirachtin 1500 ppm	5	2000ml	220	2080	88080	16.95	254250	166170	1:1.89
T3	Profenophos 50EC	2	800ml	717	2348	88348	17.32	259800	171452	1:1.94
T4	Buprofezin 25 SC	0.2	80ml	1300	1408	87408	16.29	244350	156942	1:1.80
T5	Spinosad 2.5 SC	0.3	120ml	16000	5040	91040	22.08	331200	240160	1:2.64
T6	Deltamethrin 2.8 EC	0.5	200ml	560	1424	87424	18.86	282900	195476	1:2.24
T7	Chlorantraniliprole 18.5 SC	0.2	80ml	13500	3360	89360	20.16	302400	213040	1:2.38
T8	Difenthiuron 50 WP	0.75	300g	5000	4200	90200	17.17	257550	167350	1:1.86
T9	Malathion 50 EC	1	400ml	300	1440	87440	16.8	252000	164560	1:1.88
T10	UTC	--	0	0	0	86000	13.51	202650	116650	1:1.36

Market value of ridge gourd Rs 15000/ton, Labour charge: 3 Labours/ spray/ha @ Rs 200/-