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Evaluation of insecticides and botanicals in the management of fruit flies infesting ridge gourd

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Abstract

The field experiment was carried out on efficacy of insecticides and botanicals in the management of fruit flies infesting ridge gourd during *kharif* season of 2018 and 2019 at Post Graduate Research Farm, Department of Agricultural Entomology, MPKV, Rahuri. During this study evaluate seven insecticides and botanicals. The results regarding pooled of both years on the efficacy of insecticides and botanicals indicated that Spinosad 45 SC was the most effective treatment which recorded minimum (19.38%) mean fruit infestation and was at par with Deltamethrin 2.8 EC (20.34%) continued its superiority over rest of the treatments under study. The next best treatments were Azadirachtin 10000 ppm (25.21%), Emamectin Benzoate 5 SG (27.48), Dichlorvos 76 EC (26.14%), Dashparni ark (31.67%) and Lantana extract (34.03%) were statistically at par with each other.

Keywords: efficacy, fruit flies, ridge gourd, insecticides, botanicals, *Bactrocera* Spp

Introduction

Ridge gourd (*Luffa acutangula* L.) is considered to be the native of tropical Africa and South East Asian region including India. It is generally widely grown in tropical and subtropical parts of the country. It belongs to the family Cucurbitaceae and genus *Luffa*. Ridge gourd is one of the important vegetable crops belonging to cucurbits and locally called as Shiral, Dodka (Marathi), Turai (Gujrat) and Koshataki (Sanskrit). It is rich source of various antioxidants, vitamins, minerals, lipids and other nutrients. It provides us good amount 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. As it contains higher quantity of fibrous material very good to solve the constipation problems also. The family Tephritidae (true fruit flies) is one of the largest, most diversified and fascinating acalypterate families of Diptera which includes more than 4200 known species in 471 genera (Norrbon *et al.*, 1998). Tephritids are distributed throughout the tropical, subtropical and temperate regions of the world. In India about 392 species have been recorded (Kapoor, 1993) [7]. Fruit flies exhibit a diverse array of host use patterns that ranges from strict monophagy to extreme polyphagy. Larvae of some tephritid species, especially those of the sub families Dacinae and Trypetinae, are frugivorous and feed on fruit pulp of both wild and cultivated plants, hence, bearing the name 'fruit flies'. Larvae of remaining species feed on stems, shoots and flowers (Christenson and Foote, 1960) [4]. The control measures are very difficult in the Tephritidae family being internal feeder. The economist studied the detail life history of fruit flies to exploit the weak link. Several management practices are being used against this pest as there of its life stages are hidden and the only adult stage is usual target for its management. Majority of the times synthetic chemical insecticides are used for their control by the growers as they are readily available in the market. the residues of insecticides affect the export potential of gourd because of serious concern of the importing countries. The repeated use of toxic insecticide is hazardous to the environment and also directly affects the health of the farmers and consumers. Therefore, it is necessary to explore economically sustainable and environment friendly insecticides for management of fruit files.

Materials and Methods

The experiment was conducted during *Kharif* 2018 and *Kharif* 2019 at Post Graduate Research Farm, Department of Agricultural Entomology, MPKV, Rahuri, Maharashtra, India. In a randomised block design with eight treatments and three replications, using a variety Pusa Nasdar in a total plot size of (235 m²) at spacing (120x90cm) with recommended package of practices excluding plant protection.

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Six different insecticides and botanicals viz., Dichlorvos 76 EC, Deltamethrin 2.8 EC, Spinosad 45 SC, Emamectin benzoate 5 SG, Lantana extract, Dashparni ark and Azadirachtin 10000 ppm were assessed for its efficacy against melon fruit fly on ridge gourd and a control was also maintained.

Spraying

Desired concentrations of insecticides were prepared on the basis of percentage of active ingredient present in their respective trade product. The actual quantity of spray volume required per treatment per plot was calibrated by using water alone. The insecticides were sprayed thrice. First spray of each insecticide was applied when incidence was noticed on fruits, while the second and third spray was given at an interval of 15 days with manually operated knapsack sprayer.

Method of recording observations

To find out the efficacy of different insecticides and botanicals, infested fruits per plot was recorded at the harvesting. The observations were recorded 3, 7 and 10 days after spray. The pre-count observations were recorded one day before application of insecticides. Percent fruit damage due to fruit fly (*B. cucurbitae*) was recorded at harvest by observing fruits per plot. The observations per cent fruit infestation was computed on the basis of number of infested fruits out of total number of fruits per plot. Number of healthy and infested fruits per plot was recorded separately added at the end of harvesting. The data thus obtained were converted into arcsine transformation and then statistically analysed. The percent infestation was worked out by using the following formula:

$$\% \text{ Fruit infestation} = \frac{\text{No. of damaged fruits}}{\text{Total no. of fruits}} \times 100$$

Results and Discussion

Percent fruit infestation during kharif, 2018

The per cent fruit damage by fruit fly was found to be relatively homogenous that varied from 38.43 to 43.49 per

cent and the data was observed to be non-significant during *Kharif* 2018 season before application of insecticides (Table 1). All the treatments had significant control of fruit fly from 3 days after first spray and onwards. Lowest mean per cent of fruit infestation per plot after 3, 7 and 10 days of first spray was found in Spinosad 45 SC. The data on first spray overall mean percent infestation indicated that, spinosad recorded minimum (22.46%) fruit infestation and followed by deltamethrin (26.76%) and Azadirachtin (25.83%). The highest mean percent fruit infestation was recorded in Lantana extract ad Dashparni ark (37.38% and 34.77%). The highest effective insecticide was spinosad (20.14%) after overall mean of second spray followed by followed by deltamethrin (21.19%) and Azadirachtin (30.00%). After overall mean of third spray the lowest mean per cent of fruit infestation per plot was observed in spinosad (15.60%) and followed by deltamethrin (18.64%) and Azadirachtin (22.36%). The highest mean percent fruit infestation was recorded in Lantana extract and Dashparni ark (32.99% and 30.67%) respectively.

Percent fruit infestation during kharif, 2019

In *Kharif* season 2019, per cent fruit damage by fruit fly was found to be relatively homogenous that varied from 35.73 to 40.71 per cent and the data was observed to be non-significant before application of insecticides and botanicals (Table 2). All the treatments had significant control of fruit fly from 3 days after first spray and onwards. The data on overall mean after first spray percent infestation indicated that among all the treatments, spinosad recorded minimum (23.89%) fruit infestation followed by deltamethrin (28.97%) and Azadirachtin (30.12%). Whereas, highest mean percent fruit infestation was recorded in Lantana extract ad Dashparni ark (37.76% and 34.97) respectively. Overall mean after second spray, spinosad recorded minimum (18.38%) fruit infestation and followed by deltamethrin (21.95%) and Azadirachtin (23.77%). Whereas, Lantana extract ad Dashparni ark (33.15% and 30.42% respectively), recorded highest mean percent fruit infestation. Overall mean after third spray, spinosad recorded minimum (15.99%) fruit infestation and followed by deltamethrin.

Table 1: Efficacy of insecticides and botanicals against fruit flies infesting ridge gourd during *Kharif*, 2018

Tr. No.	Treatments	Conc. (%)	% Fruit infestation	Per cent fruit infestation at											
				first spray			Overall mean	Second spray			Overall mean	Third spray			Overall mean
				Precount	3 DAS	7 DAS		10 DAS	3 DAS	7 DAS		10 DAS	3 DAS	7 DAS	
1	Dichlorvos 76 EC	0.152	40.95 (39.78)*	37.62 (37.78)	29.44 (32.82)	32.86 (34.92)	33.31	31.75 (34.28)	26.93 (31.22)	28.33 (32.14)	29.00	26.56 (30.99)	21.48 (27.61)	26.36 (30.88)	24.80
2	Deltamethrin 2.8 EC	0.0028	40.28 (39.34)	31.31 (34.00)	21.67 (27.71)	27.30 (31.38)	26.76	22.73 (28.41)	18.23 (25.19)	22.62 (28.17)	21.19	17.80 (24.95)	18.79 (25.68)	19.33 (26.04)	18.64
3	Spinosad 45 SC	0.	39.81 (39.11)	24.83 (29.87)	19.39 (26.13)	23.15 (28.76)	22.46	21.30 (27.41)	17.86 (24.81)	21.26 (27.27)	20.14	14.28 (22.12)	15.78 (23.34)	16.74 (24.14)	15.60
4	Emamectin benzoate 5 SG	0.003	38.43 (38.28)	34.92 (36.15)	28.33 (32.14)	31.11 (33.85)	31.45	30.36 (33.36)	28.04 (31.90)	26.46 (30.92)	28.29	28.70 (32.35)	27.30 (31.38)	27.75 (31.78)	27.92
5	Lantana extract	5	42.43 (40.64)	42.06 (40.38)	34.52 (35.94)	35.56 (36.58)	37.38	38.10 (38.03)	31.94 (34.34)	33.33 (35.17)	34.46	33.65 (35.45)	35.36 (36.43)	29.97 (33.16)	32.99
6	Dashparni ark	5	41.90 (40.34)	39.68 (39.01)	31.02 (33.72)	33.61 (35.41)	34.77	36.79 (37.29)	30.63 (33.59)	32.22 (34.58)	33.21	30.17 (33.24)	33.61 (35.41)	28.22 (32.06)	30.67
7	Azadirachtin 10000 ppm	0.03	43.49 (41.20)	34.62 (36.02)	24.83 (29.87)	30.56 (33.51)	30.00	27.78 (31.75)	25.19 (29.99)	24.52 (29.63)	25.83	21.76 (27.76)	24.07 (29.16)	21.26 (27.43)	22.36
8	Untreated control	-	40.95 (39.78)	48.15 (43.94)	50.07 (45.02)	49.62 (44.78)	49.28	52.38 (46.37)	54.23 (47.43)	55.75 (48.30)	54.12	50.23 (45.13)	57.57 (49.36)	49.86 (44.92)	52.55
F test			NS	Sig	Sig	Sig		Sig	Sig		Sig	Sig	Sig	Sig	
SE (M) ±			2.13	1.94	1.95	2.01		1.94	2.02		2.01	1.63	1.81	1.50	
CD at 5%			6.45	5.88	5.92	6.11		5.90	6.14		6.10	4.96	5.50	4.56	

*Figures in parenthesis are arcsine transformed

DAS – Days After Spray

Table 2: Efficacy of insecticides and botanicals against fruit flies infesting ridge gourd during *Kharif*, 2019

Tr. No.	Treatments	Conc. (%)	(%) Fruit infestation Precount	Per cent fruit infestation at											
				first spray			Overall mean	Second spray			Third spray			Overall mean	
				3 DAS	7 DAS	10 DAS		3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS		
1	Dichlorvos 76 EC	0.152	38.62 (38.34)*	37.78 (37.91)	31.11 (33.85)	31.75 (34.28)	33.55	28.97 (32.52)	26.19 (30.77)	29.73 (33.02)	28.30	26.11 (30.61)	21.69 (27.55)	20.50 (26.78)	22.77
2	Deltamethrin 2.8 EC	0.0028	37.90 (37.97)	32.14 (34.40)	27.38 (31.54)	27.39 (31.50)	28.97	24.52 (29.63)	19.58 (26.16)	21.75 (27.66)	21.95	17.49 (24.67)	16.38 (23.85)	18.84 (25.64)	17.57
3	Spinosad 45 SC	0.015	39.81 (39.11)	26.95 (31.26)	21.54 (27.61)	23.19 (28.66)	23.89	20.13 (26.65)	16.74 (24.86)	18.28 (25.30)	18.38	15.82 (23.32)	14.48 (22.33)	17.68 (24.86)	15.99
4	Emamectin benzoate 5 SG	0.003	35.73 (36.70)	35.56 (36.58)	27.38 (31.54)	28.52 (32.20)	30.49	29.44 (32.82)	20.56 (26.89)	25.74 (30.45)	25.25	23.56 (29.04)	24.07 (29.16)	21.48 (27.61)	23.04
5	Lantana extract	5	40.65 (39.60)	40.65 (39.60)	36.11 (36.93)	36.51 (37.14)	37.76	32.78 (34.83)	31.94 (34.34)	34.72 (36.09)	33.15	31.94 (34.34)	30.16 (33.29)	28.97 (32.52)	30.36
6	Dashparni ark	5	38.73 (38.46)	37.78 (37.91)	34.92 (36.15)	32.22 (34.58)	34.97	31.75 (34.28)	28.89 (32.36)	30.63 (33.59)	30.42	28.54 (32.25)	26.19 (30.77)	26.85 (31.13)	27.19
7	Azadirachtin (10000 ppm)	0.03	40.71 (39.45)	32.70 (34.83)	28.87 (32.44)	28.78 (32.39)	30.12	25.92 (30.61)	21.80 (27.79)	23.60 (29.00)	23.77	21.02 (27.29)	19.78 (26.41)	20.13 (26.65)	20.31
8	Untreated control	-	37.78 (37.91)	48.15 (43.94)	51.32 (45.76)	51.85 (46.06)	50.44	46.67 (43.08)	54.23 (47.43)	55.71 (48.29)	52.20	53.33 (46.92)	58.10 (49.66)	52.38 (46.37)	54.60
F test			NS	Sig	Sig	Sig		Sig	Sig	Sig		Sig	Sig	Sig	
SE (M) ±			2.2	1.86	1.72	1.67		1.72	1.67	1.68		1.87	1.51	1.86	
CD at 5%			6.77	5.66	5.21	5.09		5.21	5.09	5.11		5.67	4.57	5.63	

Figures in parenthesis are arcsine transformed
DAS – Days After Spray*

Table 3: Effect of various insecticides and botanicals against fruit flies infesting ridge gourd during *Kharif*, 2018 and *Kharif*, 2019 (Pooled)

Tr. No.	Treatments	Conc. (%)	Per cent fruit infestation (Pooled mean)			Overall mean
			3 DAS	7 DAS	10 DAS	
1	Dichlorvos 76 EC	0.152	31.46 (34.06)*	26.14 (30.75)	26.72 (31.06)	28.11
2	Deltamethrin 2.8 EC	0.0028	24.33 (29.40)	20.34 (26.81)	22.3 (28.17)	22.32
3	Spinosad 45 SC	0.015	20.55 (26.83)	17.63 (24.83)	19.95 (26.49)	19.38
4	Emamectin benzoate 5 SG	0.003	30.42 (33.43)	25.95 (30.62)	26.08 (30.68)	27.48
5	Lantana extract	5	36.53 (37.1)	33.34 (35.27)	32.22 (34.57)	34.03
6	Dashparni ark	5	34.12 (35.71)	30.88 (33.76)	30.00 (33.19)	31.67
7	Azadirachtin 10000 ppm	0.03	27.30 (31.41)	24.09 (29.39)	24.23 (29.42)	25.21
8	Untreated control	-	49.82 (44.90)	54.25 (47.44)	51.97 (46.13)	52.01
F test			Sig	Sig	Sig	
SE (M) ±			1.02	0.91	0.72	
CD at 5%			3.09	2.77	2.20	

Figure in parenthesis are arcsine transformed
DAS- Days After Spray*

(17.57%) and Azadirachtin (20.31%). The highest mean percent fruit infestation was recorded in Lantana extract and Dashparni ark (30.36% and 27.19%) respectively.

Percent fruit infestation during *Kharif*, 2018 and *Kharif*, 2019 (Pooled)

At 3 DAS

The pooled data on the effect of various insecticides and botanicals against per cent fruit infestation per plot during *Kharif*, 2018 and *Kharif*, 2019 are presented in Table 4. 3. The mean per cent fruit infestation computed on 3 DAS indicates that all the insecticidal treatments were significantly superior over untreated control in reducing the Per cent fruit infestation per plot. The results indicated that the Spinosad 45 SC (20.55%) and Deltamethrin 2.8 EC (24.33%) continued its superiority over rest of the treatments under study. The next best treatments in the ascending order were Azadirachtin 10000 ppm (27.30%), Emamectin Benzoate 5 SG (30.42%), Dichlorvos 76 EC (31.46%), Dashparni ark (34.12%) and Lantana extract (36.53%) were statistically at par with each other.

At 7 DAS

The results indicated that the Spinosad 45 SC (17.63%) and Deltamethrin 2.8 EC (22.32%) continued its superiority over rest of the treatments under study. The next best treatments in the ascending order were Azadirachtin 10000 ppm (24.09%), Emamectin Benzoate 5 SG (25.95%), Dichlorvos 76 EC (26.14%), Dashparni ark (30.88%) and Lantana extract (33.34%) were statistically at par with each other.

At 10 DAS

The results indicated that the Spinosad 45 SC (19.95%) and Deltamethrin 2.8 EC (22.3%) continued its superiority over rest of the treatments under study. The next best treatments in the ascending order were Azadirachtin 10000 ppm (24.23%), Emamectin Benzoate 5 SG (26.08%), Dichlorvos 76 EC (28.11%), Dashparni ark (30.00%) and Lantana extract (32.22%) were statistically at par with each other. However, all these treatments were significantly superior over untreated control (51.97%).

Overall mean indicated that the Spinosad 45 SC (19.38%) and Deltamethrin 2.8 EC (20.34%) continued its superiority over

rest of the treatments under study. The next best treatments in the ascending order were Azadirachtin 10000 ppm (25.21%), Emamectin Benzoate 5 SG (27.48), Dichlorvos 76 EC (26.14%), Dashparni ark (31.67%) and Lantana extract (34.03%) were statistically at par with each other.

It can be inferred from the results of present investigation that the field evaluation of insecticides and botanicals against fruit flies on ridge gourd exerted variable efficacy in reducing the fruit infestation over untreated check during both the study years. Among all the treatments, Spinosad a class of biopesticides derived from the from the soil bacterium *Saccharopolyspora spinosa* (fermented product), proved highly effective against fruit flies infestation in terms of lower per cent fruit infestation on ridge gourd during both the years. The effectiveness of Spinosad was mainly due to its toxicity by rapid contact and ingestion activity which is unusual for a biological product. Deltamethrin being a pure cis_isomer rapidly paralyze the insect giving a quick knock down effect. Bio-efficacy of the, Spinosad 45 SC and Deltamethrin 2.8 EC was reported to be effective against *B. cucurbitae* on ridge gourd by Sawai *et al.* (2014) ^[10], Dubale *et al.* (2018c) ^[5] and Hirekurubar *et al.* (2018) ^[6]. Similar findings have been reported by Sharma and Gupta (2019) ^[11, 13] on cucumber. Spinosad has been reported to be effective by Bhowmik *et al.* (2014a) ^[2] and Bhowmik *et al.* (2014b) ^[3] against *B. cucurbitae* on pointed gourd and bitter gourd, respectively. Also, reported by Nehra *et al.* (2019) ^[8] on round gourd. Shivangi *et al.* (2017) ^[15] observed Spinosad and Azadirachtin effective against fruit infestation by *B. cucurbitae* on cucumber. Emamectin benzoate has been reported to be effective against *B. cucurbitae* on cucumber and bitter gourd (Sharma and Gupta (2019) ^[11, 13] and Sharma and Sinha (2009) ^[14], respectively. Dichlorvos and abamectin benzoate has been reported (Bharadiya and Bhut (2017) ^[1]) moderately effective against *B. cucurbitae* on sponge gourd. Present findings are in agreement with the findings reported by the earlier workers.

Conclusion

From the present study, it can be concluded that the efficacy of insecticides on the basis of pooled of both years against fruit flies infesting ridge gourd were found to be treatments Spinosad 45 SC (19.38%) and Deltamethrin 2.8 EC (20.34%) continued its superiority over rest of the treatments under study. The next best treatments in the ascending order were Azadirachtin 10000 ppm (25.21%), Emamectin Benzoate 5 SG (27.48), Dichlorvos 76 EC (26.14%), Dashparni ark (31.67%) and Lantana extract (34.03%) were statistically at par with each other.

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