Indian Journal of Applied Entomology **27**(2) : 110–113 (2013)

BIO–EFFICACY OF NOVEL INSECTICIDES AGAINST RED PUMPKIN BEETLE

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ABSTRACT

A field trial was conducted to study the bioefficacy of different insecticides *viz.*, Flubendiamide (480 SC), Deltamethrin (10EC), Dichlorovos (76 EC), Quinalphos (25 EC) and Flubendiamide + Deltamethrin (90+60 = 150 SC) against the red pumpkin beetle in cucumber. Among different treatments, three sprays of flubendiamide+deltamethrin 90+60=150 SC @ 200 ml a.i./ha at 15 days interval were significantly superior over all the treatment in terms of mean reduction of red pumpkin beetle as it accounted 88.67 per cent reduction in beetle population. It recorded marketable yield of 505.25 q/ha which was significantly higher than all the treatments. Flubendiamide (480 SC), Deltamethrin (10EC) Dichlorovos (76 EC) and Quinalphos (25 EC) followed the above treatment in terms of efficacy.

Key words: Red pumpkin beetle, *Aulacophora foveicollis,* bioefficacy, insecticides

INTRODUCTION

India is the second largest producer of vegetables in the world, next to China with an annual production of 146.55 million tons from 8.49 million hectares the productivity of 17.3 metric tons (Annon., 2012). In India, the total area under this crop is 40,000 hectares with an average production of about 6,07,000 metric tons (Annon., 2012). In Rajasthan the total area under cucumber is 492 hectares with an average production of 2519 metric tons. (Annon., 2012). Cucumber (*Cucumis sativa* L. 2n = 14) is one of the important vegetable crops from nutrition as well as economic point of view. Various factors that are attributed for low yield of cucumber include poor quality seeds, incidence of insect pests and diseases and adverse climatic conditions. Among these the major insect pests are red pumpkin beetle, *Aulacophora foveicollis* (Lucas), fruit fly, *Dacus cucurbitae* and *Bactrocera* spp. (Dhandapani *et al* ., 2003) and *Aphis gossypii* (Glover) (Brown, 2003). Chemical insecticides have been used as an effective control strategy for major insect pests of cucumber, but the residual insecticidal problem has necessitated the development of ecofriendly technologies. Several new insecticides like flubendiamide, deltamethrin and quinolphos have been introduced having unique chemical structure and have been reported effective against insect pests in many crops (Ameta *et al*., 2010a, Patel *et al*., 1989 and Yadav, 2004). Therefore, it was felt important to test the newer insecticides to replace as safer and effective insecticides in integrated pest management.

MATERIALS AND METHODS

The present investigation was carried out at the Horticulture Farm of Rajasthan College of Agriculture, Udaipur during summer 2012. Cucumber was grown on one meter wide raised beds with a bed to bed distance of three meters. The seeds were sown at about 2 cm depth and 60 cm apart on both edges of the bed. All horticultural practices were followed as per recommendations given in package of practices for raising a good and healthy crop. The experiment was laid down in randomized block design with four replications. The test concentrations of Flubendiamide (480 SC), Deltamethrin (10EC), Dichlorovos (76 EC), Quinalphos (25 EC) and Flubendiamide + Deltamethrin (90+60 = 150 SC) were sprayed in the field at 12 days interval. In all three sprays were given. The first, second and third spray was given at 30, 42 and 54 days after sowing respectively. The details of different treatments are given below in Table 1.

Table 1. Detail of the treatments

S.No.	Treatments for bioefficacy evaluation	Dosage/ha formulation (ml)
T_1	Flubendiamide 480 SC	50
T_2	Deltamethrin 10 EC	150
T_3	Dichlorovos 76 EC	650
T_4	Quinalphos 25 EC	1250
T_5	Flubendiamide + Deltamethrin 90+60=150 SC	200
T_6	Untreated control	

The pre treatment population of *A. foveicollis* was recorded 24 hours before the spray and the post treatment population was recorded at1st, 3rd, 5th and 7th day after spraying on five tagged plants in each replication to observe the mortality. The observations were recorded through visual counting during early hours of the day.

RESULTS AND DISCUSSION

First spray. It is apparent from the Table 2 that the maximum reduction in the beetle population at one day after application was in case of flubendiamide +deltamethrin at spray 90+60= 150 ml/ha with 60.84 per cent reduction. It was followed by flubendiamide 480 SC @ 50 ml/ha (57.11%), deltamethrin 10EC @ 150 ml/ha (45.03%) and dichlorovos 76 EC @ 650 ml/ha and (39.59%). Among all the treatment quinalphos 25 EC @ 1250 ml/ha was least effective (36.71%) population reduction.

The data on efficacy of the treatment three days after spraying showed that flubendiamide + deltamethrin spray at 90+60= 150 ml/ha and flubendiamide 480 SC@ 50 ml/ha performed best with mean reduction of 64.23 and 61.36 per cent in beetle population. It was followed by deltamethrin 10EC @ 150 ml/ha (50.52%). quinalphos 25 EC @ 1250 ml/ha (41.66%) and dichlorovos 76 EC @ 650 ml/ha (43.03%) were statistically at par with each other.

Five days after application, flubendiamide + deltamethrin at 90+60= 150 ml/ha was most effective as it caused the maximum reduction of 71.98 per cent. It was followed by flubendiamide 480 SC@ 50 ml/ha with mean reduction of 67.56 per cent. However, deltamethrin 10EC @ 150 ml/ha and dichlorovos 76 EC @ 650 ml/ha were also equally effective which recorded reduction of 60.41 and 52.04 per cent, respectively. The minimum reduction was observed in quinalphos 25 EC @ 1250 ml/ha treatment 45.12 per cent.

The reduction in beetle population brought about by various treatment at seven days after their application indicated that flubendiamide +deltamethrin spray at 90+60= 150 ml/ha caused maximum reduction of 69.07 per cent followed by flubendiamide 480 SC@ 50 ml/ha (64.07%), which was at par with deltamethrin 10EC @ 150 ml/ha (57.49%). Remaining treatments *viz,* quinalphos 25 EC @ 1250 ml/ha and dichlorovos 76 EC @ 650 ml/ha could reduce the population to 45.12 and 48.60 per cent, respectively.

Second spray. The perusal of the Table 2 clearly revealed that one day after application of treatment flubendiamide + deltamethrin spray at 90+60= 150 ml/ha and flubendiamide 480 SC @ 50 ml/ha performed best. Both the treatment were found statistically at par to each other and resulted into 65.49 and 62.28 per cent reduction in beetle population. Likewise, Deltamethrin 10EC @ 150 ml/ha and dichlorovos 76 EC @ 650 ml/ha were also statistically similar with 48.25 and 45.29 per cent reduction, respectively. quinalphos 25 EC @ 1250 ml/ha offered least protection against red pumpkin beetle 43.47 per cent.

Three days after application, all the treatments showed good results and the mean population reduction ranged from 70.67 to 48.51 per cent. flubendiamide + deltamethrin spray at 90+60= 150 ml/ha gave maximum pest control (70.67%), followed by flubendiamide 480 SC@ 50 ml/ha (67.48%).Spray of dichlorovos 76 EC @ 650 ml/ha and deltamethrin 10EC@150 ml/ha were found moderately effective as it resulted into 50.52 and 53.58 per cent reduction in beetle population, respectively. The minimum reduction was observed in quinalphos 25 EC @ 1250 ml/ha 48.51 per cent.

The data on efficacy of these treatments after five days of spraying indicated that flubendiamide + deltamethrin spray at 90+60= 150 ml/ha resulted in highest reduction (86.38%) of beetle population. While, the lowest reduction (59.04%) was observed in quinalphos 25 EC @ 1250 ml/ha, and dichlorovos 76 EC @ 650 ml/ha (60.42%), which in turn was at par with deltamethrin 10EC@150 ml/ha (65.98%). Application of flubendiamide 480 SC@ 50 ml/ha dose caused about 82.55 per cent reduction in beetle population.

After seven days of spray, flubendiamide +deltamethrin spray at 90+60= 150 ml/ha was the most effective treatment with highest reduction of 83.21 per cent. Flubendiamide 480 SC@ 50 ml/h followed the above treatment with 78.10 per cent reduction. After that deltamethrin 10EC@ 150 ml/ha was effective with mean reduction of 62.29 per cent. quinalphos 25 EC @ 1250 ml/ha found next treatment which caused about 55.67 per cent reduction in beetle population and was at par with dichlorovos 76 EC @ 650 ml/ha that caused 55.41 per cent reduction.

Third spray. One day after third spray, application of flubendiamide + deltamethrin at 90+60= 150 ml/ha gave maximum reduction 70.55 per cent which was followed by flubendiamide 480 SC@ 50 ml/h with 65.52 per cent. Deltamethrin 10EC@150 ml/ha and quinalphos 25 EC @ 1250 ml/ha were moderately effective as they brought 53.84 and 48.60 per cent reduction of red pumpkin beetle population, respectively. The lowest mean reduction in red pumpkin beetle population (48.57) was observed in dichlorovos 76 EC @ 650 ml/ha.

The data recorded after three days of spray revealed that the highest reduction was obtained in flubendiamide + deltamethrin spray at 90+60= 150 ml/ha (76.60%) followed by flubendiamide 480 SC@ 50 ml/h which gave 73.87 per cent reduction in population of red pumpkin beetle.

Table 2. Bio–efficacy of different insecticides against red pumpkin beetle on cucumber

Treatments	Formulation	PPT/ 5plant	Mean reduction (%) in red pumpkin beetle days after spray											
			First spray				Second spray				Third spray			
			1DAS	3DAS	5DAS	7DAS	1DAS	3DAS	5DAS	7DAS	1DAS	3DAS	5DAS	7DAS
Flubendiamide 480SC	50	3.53 (12.00)	49.09 (57.11)	51.56 (61.36)	55.28 (67.56)	53.17 (64.07)	52.11 (62.28)	55.23 (67.48)	65.31 (82.55)	62.09 (78.10)	54.04 (65.52)	59.26 (73.87)	67.43 (85.27)	65.16 (82.35)
Deltamethrin 10EC	150	3.43 (11.25)	42.15 (45.03)	45.30 (50.52)	51.01 (60.41)	49.31 (57.49)	44.15 (48.52)	47.05 (53.58)	54.32 (65.98)	52.11 (62.29)	47.20 (53.84)	51.01 (60.41)	59.20 (73.78)	57.04 (70.39)
Dichlorovos 76EC	650	3.39 (11.00)	38.99 (39.59)	41.00 (43.03)	46.15 (52.01)	44.20 (48.60)	42.30 (45.29)	45.30 (50.52)	51.01 (60.42)	48.11 (55.41)	44.18 (48.57)	47.20 (53.84)	56.04 (56.04)	54.03 (65.50)
Quinalphos 25EC	1250	3.46 (11.50)	37.30 (36.71)	40.20 (41.66)	44.25 (48.69)	42.20 (45.12)	41.25 (43.47)	44.15 (48.51)	50.21 (59.04)	48.25 (55.67)	44.20 (48.60)	47.15 (53.75)	53.21 (64.14)	50.01 (58.69)
Flubendiamide + Deltamethrin 90+60 = 150 SC	200	3.53 (12.00)	51.26 (60.84)	53.27 (64.23)	58.04 (71.98)	56.21 (69.07)	54.02 (65.49)	57.21 (70.67)	68.34 (86.38)	66.28 (83.21)	57.14 (70.55)	61.07 (76.60)	70.33 (88.67)	67.34 (85.15)
Untreated Control	–	3.57 (12.25)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
SEm±	–	0.058	0.779	0.849	1.002	0.934	0.866	0.902	1.414	1.266	1.103	1.108	1.598	1.415
C.D. at 5 %	–	0.175	2.349	2.558	3.021	2.816	2.609	2.720	4.263	3.817	3.103	3.341	4.817	5.898

Figure in parenthesis are retransformed values.

Deltamethrin 10EC @150 ml/ha was the next best treatment which caused about 60.41 per cent reduction in beetle population. Among all the treatments the lowest mean reduction in red pumpkin beetle population 53.84 and 53.75 per cent were observed in dichlorovos 76 EC @ 650 ml/ha, and quinalphos 25 EC @ 1250 ml/ha.

The result obtained after five days of spraying showed significant reduction in beetle population 56.04 to 88.67 per cent. Among all the treatment, highest reduction in red pumpkin beetle population was observed in flubendiamide + deltamethrin spray at 90+60= 150 ml/ha (88.67%). It was followed by flubendiamide 480 SC@ 50 ml/ha (85.27%). The next significant reduction 64.14 per cent and 73.78 per cent were observed in quinalphos 25 EC @ 1250 ml/ha and deltamethrin 10EC @150 ml/ha. The least effective was dichlorovos 76 EC @ 650 ml/ha with mean reduction (56.04%)

The reduction in the beetle population caused by various treatments following seven days after their application indicated that flubendiamide + deltamethrin spray at 200 ml/ha brought maximum reduction of (85.15%), which was followed by flubendiamide 480 SC@ 50 ml/h (82.35%). Deltamethrin 10EC@150 ml/ha and dichlorovos 76 EC @ 650 ml/ha caused (70.39%) and (65.50%) reduction in beetle population and were moderately effective. The least reduction in population of red pumpkin beetle was obtained from quinalphos 25 EC @ 1250 ml/ha (58.69%).

Flubendiamide + deltamethrin (90+60 = 150 SC) 200ml/ha caused maximum reduction of 88.67 per cent in population of red pumpkin beetle, which was significantly superior over other treatments followed by flubendiamide 480 SC 50 ml/ha (85.27%). Since no work could be traced on the bioefficacy of flubendiamide and flubendiamide + deltamethrin against red pumpkin beetle infesting cucumber crop, dose could not be compared. Some studies on other pests are available. On the basis of results, the present findings are in agreement with the earlier reports of Ameta and Bunker (2007) who reported that flubendiamide 480 SC at 50 ml/ha was most effective and caused higher reduction of larval population of diamond back moth. Ameta *et al*. (2010[a]) observed that flubendiamide 480 SC at 100 ml/ha was significantly superior to other insecticide with maximum reduction in the population of pod borer in chickpea. Flubendiamide 480 SC 125 ml/ha against brinjal shoot and fruit borer during summer and *kharif* season was reported to be most effective by Ameta *et al.* (2010[b]).

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