Indian Journal of Applied Entomology **24**(1) : 20-26 (2010)

BIOEFFICACY OF NEWER INSECTICIDES AGAINST RED PUMPKIN BEETLE, *RAPHIDOPALPA FOVEICOLLIS* (LUCAS) ON MAJOR CUCURBITACEOUS VEGETABLES IN SOUTH EAST RAJASTHAN

S.L. GATHALA, N.K. BAJPAI AND BHUPENDRA UPADHYAY*

Department of Entomology, Rajasthan College of Agriculture (MPUAT) Udaipur, Rajasthan
*Associate Professor, Department of Agricultural Statistics and Computer Application, RCA, Udaipur

ABSTRACT

A study was conducted to test the bioefficacy of newer insecticides against red pumpkin beetle, *Raphidopalpa foveicollis* (Lucas) on major cucurbitaceous vegetables in south east Rajasthan. The summer squash, pumpkin and ridge gourd crops were sprayed with different insecticides thrice at 30, 45 and 60 days after germination. All tested insecticides were found superior to control and provided protection to the crops against red pumpkin beetle. The maximum pest population reduction was observed on seventh day after treatments in all three crops in all three sprays. The beta-cyfluthrin gave maximum reduction (99.41%) of beetle population followed by carbaryl (85.79%) in summer squash white minimum reduction (57.45%) was observed in neemazol after seven day of first spray. Similar trend of efficacy was observed after second and third spray. Beta-cyfluthrin gave 100 per cent reduction of pest after seven days in all three spray in pumpkin and ridge gourd.

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

Cucurbits are important group of vegetables and are very good source of minerals and water, which are easily supplied to the body preferably in the summer season when they are in more need by the body. In Rajasthan, ridge gourd and bottle gourd are cultivated in 1151 and 2248 ha, respectively with annual production of 2769 and 8288 tonnes, while cucumber is grown in 3233 ha area with a production of 12273 tonnes (Anonymous, 2002-03). The productivity per unit area of these crops is low as compared to their inbuilt potential. The production of these crops can be increased by minimizing the damage caused by insect pests. Red pumpkin beetle, *Raphidopalpa foveicollis* has been observed as a major constraint for successful cultivation of these crops in Rajasthan (Kavadia *et al.*, 1975).

Chemical insecticides are being used as an effective control strategy for minimizing the losses caused by red pumpkin beetles, but the residues on fruits have necessitated the development of ecofriendly technologies. Therefore, it was felt important to test the newer insecticides 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 Zaid 2007. Udaipur is located at 23.4°N longitude and 75°E latitude at an elevation of 579.5 MSL in state of Rajasthan. The maximum and minimum temperature during Zaid season was 40.6°C and 15°C respectively with an average temperature of 29.8°C. Besides, the maximum, minimum and average relative humidity during the season was 54, 10 and 24.3 per cent respectively.

Summer squash, pumpkin, ridge gourd and bitter gourd were 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 agronomic 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.

To find out the efficacy (1.5 ml/l) of spinosad (1.5 ml/l), carbaryl (2g/l), neemazol (1ml/l), beta-cyfluthrins and endosulfan (2ml/l), at their recommended doses of each treatment was sprayed in the field at 15 days interval. Each treatment was replicated four times. In all three sprays were given and the first, second and third spray were given at 30, 45 and 60 days after sowing respectively.

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

RESULTS AND DISCUSSION

Different insecticides were sprayed at recommended doses on different cucurbits to know their efficacy against red pumpkin beetle and data observed have been presented here under:

Summer squash

First spray : Data presented in the Table 1 show that three days after first spray beta-cyfluthrin (1.5ml/l) was significantly superior over other treatments by reducing 82.68 per cent of red pumpkin beetle population followed by 75.66 and 63.50 per cent in carbaryl and endosulfan, respectively. The reduction in beetle population in spinosad was 51.60 per cent and was at par with neemazol with 50.48 per cent.

The data recorded after seven days of spray show that all the treatments were significantly superior over control. Beta-cyfluthrin was the best treatment, which gave 99.41 per cent reduction of the beetle population, followed by 85.79 and 74.62 per cent in carbaryl and endosulfan, respectively. The lowest population reduction (57.45%) was obtained with neemazol, which was at par with spinosad (60.17%).

Second spray : All the treatments were significantly superior over control after three days of second spraying. Application of beta-cyfluthrin gave the best results with 85.99 per cent reduction, followed by carbaryl (78.50%) and endosulfan (71.25%). Further, the per cent reduction in population in spinosad (63.02%) was at par with that of neemazol (61.42%) (Table 1).

The similar trend in pest population reduction was observed after seven days of treatments. The reduction in pest population ranged from 68.67 to 99.41 per cent, being maximum in beta-cyfluthrin (99.41%) and minimum in neemazol (68.67%). Efficasy of spinosad (69.73%) was at par with neemazol (68.67%).

Third spray : It is apparent from the Table 1 that maximum reduction in beetle population was obtained with beta-cyfluthrin (88.87%), whereas, Spinosad (56.70%) and neemazol (51.93%) were equally effective. The order to bioefficacy of these insecticides was in a descending order as:

Beta-cyfluthrin (88.87%) > carbarly (80.91%) > endosulfan (69.69%) > spinosad (56.70%) > neemazol (51.93%).

A similar trend of reduction of beetle population was observed seven days after spraying. Beta-cyfluthrin performed best with cent percent reduction followed by carbaryl (96.67%), endosulfan (83.33%) and spinosad (69.97%). The least population reduction, 67.98 per cent, was observed in neemazol which was at par with spinosad (69.97%).

Pumpkin

First spray : It is evident from Table 2 that all treatments were significantly superior over control right from third day after spraying. Application of beta-cyfluthrin gave the maximum population reduction 87.80 per cent, followed by carbaryl (78.33%) and endosulfan (69.76%). The application of beta-cyfluthrin significantly reduced the red pumpkin beetle than other treatments. Minimum reduction (58.69%) in red pumpkin beetle population was observed with neemazol, which was statistically at par with spinosad (59.73%).

The data recorded after seven days of spray had a similar trend. The highest reduction (95.12%), was obtained in beta-cyfluthrin, followed by carbaryl (85.12%) and endosulfan (74.43%). The least reduction in beetle population (59.89%), was observed in neemazol, which was statistically at par with spinosad (61.72%).

Second spray : The data presented in Table 2 reveal that all treatments were significantly superior over control. Beta-cyfluthrin proved superior by reducing 87.77 per cent red pumpkin beetle population followed by carbaryl (78.35%), endosulfan (71.90%), spinosad (62.92%) and neemazol (61.68%).

The efficacy of these treatments, after seven days of spraying indicated that beta-cyfluthrin resulted in maximum reduction of beetle population (98.24%), followed by carbaryl, endosulfan, spinosad and neemazol with a reduction of 92.89, 84.81, 73.45 and 68.59 per cent, respectively.

Third spray : The data presented in the Table 2 show significant reduction in beetle population ranging from 63.77 to 94.88 per cent, in the various treatments as compared to control after third day of spray. The maximum reduction (94.88%) was observed in beta-cyfluthrin followed by 86.62, 76.37, 64.84 and 63.77 per cent in carbaryl, endosulfan, spinosad and neemazol. It is also visible from the data that beta-cyfluthrin, carbaryl and endosulfan were significantly different than spinosad and neemazol.

A similar trend of results was obtained after 7th day of 3rd spray where no beetle was recorded in beta-cyfluthrin which was statistically superior over carbaryl, 95.14 per cent also. The minimum reduction in population, (70.12 per cent) was found in neemazol, which was at par with spinosad (73.90%).

Table 1. Bio-efficacy of newer insecticides against red pumpkin beetle on summer squash crop (*Zaid*, 2007)

Treatment	Dosage	Effects of insecticides on beetle population														
		First spray					Second spray					Third spray				
		Mean number of beetle population			Per cent reduction in population		Mean number of beetle population			Per cent reduction in population		Mean number of beetle population			Per cent reduction in population	
		PTP	3 DAS	7 DAS	3 DAS	7 DAS	PTP	3 DAS	7 DAS	3 DAS	7 DAS	PTP	3 DAS	7 DAS	3 DAS	7 DAS
Spinosad (T_1)	1.5 ml/lit	6.50	3.25	3.00	45.92* (51.60)	50.87* (60.17)	9.25	4.00	3.25	52.55* (63.02)	56.62* (69.73)	7.50	3.75	2.75	48.85* (56.70)	56.71* (69.67)
Carbaryl (T_2)	2.0 g/lit	6.75	1.75	1.00	60.44 (75.66)	67.86 (85.79)	9.75	2.50	1.00	62.37 (78.50)	72.69 91.15	5.50	1.25	0.50	64.09 (80.91)	79.48) (96.67
Endosulfan (T_3)	2.0 ml/lit	7.25	2.75	2.25	52.83 (63.50)	59.75 (74.62)	9.25	3.25	2.25	57.58 (71.25)	63.94 80.69	7.25	2.50	1.50	56.60 (69.69)	65.79 (83.33)
Neemazol (T_4)	1.0 ml/lit	8.75	4.50	4.25	45.48 (50.84)	49.28 (57.45)	11.00	5.00	4.00	51.60 (61.42)	55.96 68.67	6.75	3.75	2.75	46.10 (51.93)	55.54 (67.98)
Beta-cyfluthrin (T_5)	1.5 ml/lit	8.00	1.50	0.25	65.41 (82.68)	85.61 (99.41)	10.50	1.75	0.25	68.02 (85.99)	85.59 99.41	9.50	1.25	0.00	70.51 (88.87)	90.00 (100.00)
Untreated control (T_6)	–	9.50	10.00	11.00	–	–	11.00	13.00	12.75	–	–	8.00	9.25	9.75	–	–
SEm ±		–			1.23	2.62	–			1.38	2.29	–			1.66	2.97
CD at 5%		–			3.72	7.88	–			4.16	6.89	–			5.00	8.95

* Angular transformed per cent values, Figures in parentheses are retransformed per cent values.

PTP = Pre treatment population, DAS = Days after spray

Table 2. Bio-efficacy of newer insecticides against red pumpkin beetle on pumpkin crop (*Zaid*, 2007)

Treatment	Dosage	Effects of insecticides on beetle population														
		First spray					Second spray					Third spray				
		Mean number of beetle population			Per cent reduction in population		Mean number of beetle population			Per cent reduction in population		Mean number of beetle population			Per cent reduction in population	
		PTP	3 DAS	7 DAS	3 DAS	7 DAS	PTP	3 DAS	7 DAS	3 DAS	7 DAS	PTP	3 DAS	7 DAS	3 DAS	7 DAS
Spinosad (T_1)	1.5 ml/lit	10.75	4.50	4.25	50.61* (59.73)	51.78* (61.72)	12.75	5.00	3.75	52.49* (62.92)	58.98* (73.45)	11.75	4.50	3.25	53.63 (64.84)	59.28* (73.90)
Carbaryl (T_2)	2.0 g/lit	13.25	3.00	2.00	62.26 (78.33)	67.31 (85.12)	13.00	3.00	1.00	62.27 (78.35)	74.54 (92.89)	11.75	1.75	0.75	68.54 (86.62)	77.27 (95.14)
Endosulfan (T_3)	2.0 ml/lit	10.50	3.25	2.75	56.64 (69.76)	59.63 (74.43)	13.50	4.00	2.25	57.99 (71.90)	67.06 (84.81)	11.75	3.00	1.75	60.92 (76.37)	67.96 (85.92)
Neemazol (T_4)	1.0 ml/lit	11.00	4.75	4.50	50.01 (58.69)	50.71 (59.89)	13.00	5.25	4.50	51.76 (61.68)	55.91 (68.59)	12.75	5.00	4.00	52.99 (63.77)	56.86 (70.12)
Beta-cyfluthrin (T_5)	1.5 ml/lit	11.75	1.50	0.75	69.56 (87.80)	77.23 (95.12)	13.50	1.75	0.50	69.53 (87.77)	82.37 (98.24)	10.00	0.75	0.00	76.93 (94.88)	90.00 (100.00)
Untreated control (T_6)	–	11.75	12.00	12.75	–	–	14.25	15.00	15.75	–	–	15.00	16.75	16.25	–	–
SEm ±					1.26	2.47				1.15	2.19				2.14	2.18
CD at 5%					3.79	7.44				3.48	6.59				6.45	6.58

* Angular transformed per cent values, Figures in parentheses are retransformed per cent values.

PTP = Pre treatment population, DAS = Days after spray

Table 3. Bio-efficacy of newer insecticides against red pumpkin beetle on ridge gourd crop (*Zaid*, 2007)

Treatment	Dosage	Effects of insecticides on beetle population														
		First spray					Second spray					Third spray				
		Mean number of beetle population			Per cent reduction in population		Mean number of beetle population			Per cent reduction in population		Mean number of beetle population			Per cent reduction in population	
		PTP	3 DAS	7 DAS	3 DAS	7 DAS	PTP	3 DAS	7 DAS	3 DAS	7 DAS	PTP	3 DAS	7 DAS	3 DAS	7 DAS
Spinosad (T_1)	1.5 ml/lit	9.25	3.75	3.00	50.29* (59.17)	54.44* (66.18)	11.75	3.75	3.50	55.57* (68.03)	56.89* (70.17)	12.25	4.00	3.00	55.13* (67.32)	58.53* (72.75)
Carbaryl (T_2)	2.0 g/lit	9.00	2.50	1.00	58.17 (72.19)	69.82 (88.10)	12.25	2.75	1.25	62.25 (78.32)	71.68 (90.12)	12.75	2.50	1.00	63.79 (80.49)	72.67 (91.13)
Endosulfan (T_3)	2.0 ml/lit	8.25	2.75	1.75	54.71 (66.62)	62.10 (78.11)	12.50	3.25	2.50	58.85 (74.77)	64.51 (81.48)	13.25	3.50	2.00	59.07 (73.58)	65.52 (82.83)
Neemazol (T_4)	1.0 ml/lit	8.50	3.75	3.00	48.00 (55.23)	53.03 (63.84)	12.00	4.00	3.75	55.23 (67.47)	55.90 (68.57)	11.75	4.00	3.25	54.49 (66.26)	56.36 (69.31)
Beta-cyfluthrin (T_5)	1.5 ml/lit	9.25	1.25	0.00	68.83 (86.96)	90.00 (100.00)	11.50	1.75	0.25	67.30 (85.11)	85.97 (99.51)	13.00	1.75	0.00	68.73 (86.84)	90.00 (100.00)
Untreated control (T_6)	–	8.00	8.00	7.75	–	–	12.00	12.00	12.00	–	–	13.50	13.50	12.00	–	–
SEm ±					1.03	1.52				1.01	2.26				1.27	1.27
CD at 5%					3.10	4.59				3.05	6.80				3.82	3.828

* Angular transformed per cent values, Figures in parentheses are retransformed per cent values.

PTP = Pre treatment population, DAS = Days after spray

Ridge gourd

First spray : The efficacy of different tested insecticides against red pumpkin beetle in ridge gourd after 3rd day of first spray showed that beta-cyfluthrin was very effective by reducing 86.96 per cent beetle followed by 72.19, 66.62, 59.17 and 55.23 per cent in carbaryl, endosulfan, spinosad and neemazol, respectively (Table 4).

Similar results were obtained after 7 days of spray of insecticides. No beetle was found in the crop treated with beta-cyfluthrin whereas in other treatments reduction varied from 63.84 to 88.10 per cent as was in 3rd day after first spray. All treatments were significantly superior over control (Table 2).

Second spray : The reduction in the beetle population after spray of various treatments indicated that beta-cyfluthrin gave maximum per cent reduction (85.11%), which was followed by carbaryl (78.32%) and endosulfan (74.77%), whereas the efficacy of spinosad (68.03%) and neemazol (67.47) was at par (Table 3).

The observations recorded seven days after spray showed a similar trend. Beta-cyfluthrin with 99.51 per cent reduction in beetle population proved to be significantly superior over other treatments followed by 90.12, 81.48, 70.17 and 68.57 per cent in carbaryl, endosulfan, spinosad and neemazol respectively. The efficacy of spinosad and neemazol was statistically at par.

Third spray : It is evident from Table 3 that all treatments were significantly superior over control. Application of beta-cyfluthrin gave highest reduction of 86.84 per cent followed by 80.49 and 73.58 per cent in carbaryl and endosulfan respectively. Minimum reduction (66.26%) in red pumpkin beetle population was observed in the treatment with neemazol, which was at par with that for spinosad (67.32%).

Even, seven days after spray, the treatments show a similar trend of efficacy. Beta-cyfluthrin gave complete control with 100.00 per cent reduction in population, whereas the population reduction in carbaryl, endosulfan, spinosad and neemazol was 91.13, 82.83, 72.75 and 69.31 per cent, respectively.

The reduction in beetle population after third and seventh day after spray indicated that maximum reduction was observed on seventh day after treatment in all three sprays. All treatments were significantly superior over control in reducing red pumpkin beetle population. Among different insecticides evaluated, beta-cyfluthrin @ 1.5 ml/lit gave maximum reduction, 82.68 to 100.00 per cent of red pumpkin beetle population. The present results are in conformity with the results of Babu *et al.* (2002) who reported 6.86 per cent damaged leaves only in watermelon after spray of beta-cyfluthrin. Similarly, Dikshit *et al.* (2001) and Satpathy *et al.* (2002) observed that beta-cyfluthrin had highest efficacy against red pumpkin beetle in sponge gourd and brinjal respectively. Dangi (2006) also reported that beta-cyfluthrin was most effective against red pumpkin beetle in long melon, bottle gourd and ridge gourd crops.

Carbaryl was second to beta-cyfluthrin and gave effective and significant control of red pumpkin beetle on all three crops *viz*., summer squash, pumpkin and ridge gourd and proved significantly superior to standard check endosulfan. These findings are in close conformity with the findings of Sharma *et al.* (1999) who reported that carbaryl (0.1%) was more effective against the red pumpkin beetle.

Standard check endosulfan and spinosad gave moderate control of red pumpkin beetle population. The findings are well in accordance with the findings of Dikshit *et al.* (2001) who reported moderate efficacy of endosulfan in sponge gourd. Dangi (2006) found that spinosad @ 1 ml/lit, 1.5 ml/lit and 2.5 ml/lit gave moderate efficacy against red pumpkin beetle in long melon, ridge gourd and bottle gourd crops.

Neemazol was the least effective among all the treatments in controlling the red pumpkin beetle. Dikshit *et al.* (2001) reported the same in sponge gourd. Lakshmi *et al.* (2001) found that a neem product nimbicidine (0.2%) was least effectives with a 28.66 per cent reduction of red pumpkin beetle population only on pumpkin crop.

REFERENCES

Anonymous. (2002-03). Rajasthan Horticulture Statistics. Director of Horticulture, Pant Krishi Bhawan, Jaipur, pp. **44**:53-66.

Babu, P.G., Reddy, D.J., Jadhav, D.R., Chiranjeevi, C. and Khan, M.A.M. (2002). Comparative efficacy of selected insecticides against pest of water melon. *Pesticide Research Journal,* **14**:57-62.

Dangi, N.L. (2006). Investigations on population dynamics of red pumpkin beetle. *A. Foveicollis* (Lucas) and its ecosafe management. Ph.D. Thesis submitted to Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan.

Dikshit, A.K. and Pachauri, D.C. (2002). Bioefficacy of beta-cyfluthrin and imidacloprid in okra and sponge gourd. *Journal of Entomological Research,* **25**:131-136.

Kavadia, V.S., Noor, A., Doval, S.L. and Gupta, H.C.L. (1975). Laboratory and field evaluation of insecticides for the control of pests of cucurbits. *Indian Journal of Plant Protection,* **2**:93-102.

Lakshmi, M.V., Rao, G.R. and Rao, P.A. (2005). Efficacy of different insecticides against red pumpkin beetle, *R. foveicollis* (Lucas) on pumpkin. *Journal of Applied Zoological Research,* **16**:73-74.

Satpathy, S., Kumar, A. and Ram, D. (2002). Preference for bottle gourd flowers by red pumpkin beetle. *Insect Environment* , **8**:99-100.

Sharma, S.S., Bhanot, S.P. and Kalra, V.K. (1999). Host preference, extent of damage and control of red pumpkin beetle, *R. foveicollis* (Lucas). *Journal of Insect Science,* **12**:168-170.