

The results show that Penfluron disrupts the growth and development of 4th instar larvae of *C. quinquefasciatus*. The significant observations are prolongation of larval period and complete suppression of pupation. All the concentrations tested blocked development; with higher concentrations the effect was quicker.

Prolongation of larval period and suppression of pupation may be due to imbalance caused by the insecticide in growth-stimulation and growth-inhibition hormone levels as suggested by Novak<sup>4</sup>. The juvenilizing activity of chitin inhibitor compounds against mosquito larvae has been reported earlier<sup>5-8</sup>. Gujar and Mehrotra<sup>9</sup> recorded the juvenilizing effect of plant extracts on the last larval instar of *Spodoptera litura* and related the juvenilizing action to disruption in the insect's endocrine system. It is quite possible that complete arrest of development induced by Penfluron in *C. quinquefasciatus* is a juvenilizing effect of a disrupted neuroendocrine system. Whether such an effect is insect-specific is to be investigated.

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## EFFECT OF VARIOUS INSECTICIDES ON HONEY BEE, *APIS FLOREA* FABRICIUS IN 'BER' (*ZIZYPHUS MAURITIANA* LAMK)

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'BER' (*Zizyphus mauritiana* Lamk) is a cross-pollinated fruit crop, where pollinators play a vital role in fruit setting. It is reported that 85% of the cross pollinated flowers depend on insect pollinators<sup>1</sup>. In India, the activities of honey bees on different crops were reported earlier<sup>2,3</sup>. Ber is an important fruit crop in the semi-arid zones of North Gujarat, where *Apis florea* is an important pollinator. However, scanty information is available on the adverse effects of various insecticides (to *A. florea*) which are commonly used in 'ber' for insect pest management. The present study was carried out to determine the effect of insecticidal spraying on the population of *A. florea*.

The popular ber variety 'Umran' was used for this study and the experiment was set in a split-plot design with nine insecticidal treatments and one untreated control. The details of insecticides used are given in table 1. Spraying was done with a knapsack sprayer using 5 l mixture per tree. The first spraying was immediately after flowering and subsequent sprayings were done at a three week interval. Initial observations on the honey bees were recorded 24 h before each spraying and there after observations were taken at 24, 48, 72 h and one week after spraying. For recording the honey bee population, four branches (50 cm each) each from south, north, east and west direction were tagged. The observations on honey bee population were recorded by four persons at a time standing in four different directions, observing the tagged branches at 5 min interval. The results subjected to statistical analysis are presented in table 1.

The data on the population of the honey bee recorded before and after spraying (table 1) revealed a significant difference in the honey bee population due to insecticide, spray, period, insecticide  $\times$  period and spray period. The control recorded the highest bee population (3.17/0.5 m branch) which was statistically at par with 0.07% endosulfan (3.05/0.5 m branch), 0.03% thiometon (2.82/0.5 m branch) and 0.03% demeton-*o*-methyl (2.81/0.5 m branch) whereas the rest of the insecticidal treatment remained at par and showed lower

**Table 1** Effect of different insecticides on honey bee (*A. florea* Fab.) population before and after spraying

Mean, honey bees population/0.5 m branch length							
Insecticides	Concen- tration	Before spraying	After spraying				Mean
		24 h	24 h	48 h	72 h	One week	
Control		5.17	0.92	1.33	3.50	4.92	3.17
Endosulfan	0.07	5.42	0.50	0.67	4.25	4.42	3.05
Thiometon	0.03	5.42	0.25	0.75	3.58	4.08	2.82
Demeton- <i>o</i> -methyl	0.03	4.83	0.33	0.92	2.08	5.33	2.81
M. parathion	0.03	4.83	0.42	1.17	2.50	4.67	2.72
Quinalphos	0.05	4.92	0.17	0.50	1.67	5.08	2.70
Monocrotophos	0.04	4.83	0.42	0.58	2.00	4.67	2.50
Fenthion	0.1	4.58	0.08	0.83	3.83	4.75	2.46
Malathion	0.04	4.50	0.42	0.42	1.58	4.67	2.32
Dimethoate	0.03	4.58	0.33	0.67	1.50	4.50	2.32
Mean for period	—	4.91	0.39	0.79	2.65	4.71	—
Mean for = 1st spraying		5.30	0.38	1.28	2.78	5.63	2.07
2nd spraying		6.85	0.48	0.50	3.03	6.05	3.38
3rd spraying		2.58	0.30	0.58	2.15	2.45	1.61
		S		Em ±		C.D. at 5% level	
Period				0.08		0.27	
Spraying				0.08		0.22	
Insecticides				0.14		0.40	
Insecticides × period				0.31		0.85	

honey bee population and higher toxicity. The effect of time on honey bee population indicated that the bee population was highest 24 h before (4.91) and 7 days after spraying (4.71) of the insecticides. The observation recorded after 24 h of spraying showed a significantly low bee population (0.39/0.5 m branch) which increased steadily after 48 h (0.79/0.5 m branch) and 72 h of spraying (2.65/0.5 m branch).

A similar trend was observed during all the three sprayings. The bee population was seen to be lowest after 24 h of spraying in all the three cases and this increased steadily. Fifty per cent of the initial activity was restored after 72 h of spraying.

The results show that 0.07% endosulphan, 0.03% thiometon and 0.03% demeton-*o*-methyl are safe insecticides and this does not reduce the honey bee population significantly as compared to control. Patel<sup>4</sup> reported that 0.07% endosulphan was comparatively a safe insecticide for bee population in fennel crop. Upadhyay *et al*<sup>5</sup> reported that 0.07% endosulphan and 0.03% thiometon were the safe insecticides for bees in coriander crop. The present findings thus agree with the results reported earlier.

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