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PERSISTENT TOXICITY OF IMIDACLOPRID 17.8 SL TO APHID, *Aphis gossypii* Glover AND LEAFHOPPER, *Amrasca biguttula biguttula* Ishida IN BHENDI

G. PREETHA, T. MANOHARAN, J. STANLEY and S. KUTTALAM
Department of Agricultural Entomology, Tamil Nadu Agricultural University
Coimbatore - 641 003, India
E-mail : gpreetha@gmail.com

ABSTRACT : The persistent toxicity of commercial formulations of imidacloprid 17.8 SL, thiamethoxam 25 WG and methyl demeton 25 EC was estimated against *Aphis gossypii* and *Amrasca biguttula biguttula* on bhendi crop. The insecticidal treatments differed considerably in their persistence, period of efficacy and index of persistent toxicity (PT value) against both the insects. Of different treatments, the higher dose of imidacloprid showed longest persistence up to 27 days for aphids and 29 days for leaf hoppers. This was followed by recommended dose of imidacloprid and thiamethoxam irrespective of the insect species. The conventional insecticide, methyl demeton showed shorter persistence for a period of 13 and 17 days against aphids and leafhoppers, respectively.

Key Words : Aphids, bhendi, imidacloprid, leafhoppers, toxicity

INTRODUCTION

Bhendi, *Abelmoschus esculentus* (L.) Moench, is an annual vegetable crop of tropical and subtropical parts of the world usually grown during *kharif* and summer seasons. Bhendi is infested by two major sucking pests *viz.*, aphids, *Aphis gossypii* Glover and leafhoppers, *Amrasca biguttula biguttula* (Ishida) which considerably affect fruit yield. Aphids suck the sap from the young leaves resulting in distorted and twisted foliage and reduced growth. Jassids *(Amrasca* spp.) feed mostly on lower surface of okra leaves, leading to hopper burn symptoms (Bindra and Mahal, 1979). Several insecticides of organophosphate and carbamate group were recommended earlier for the management of the sucking pests. Neonicotinoids are the new group of crop protection agents highly effective against sucking pests with a new mode of action. Hence, the present study was undertaken to investigate the persistent toxicity of imidacloprid, the major neonicotinoid molecule, in comparison with thiamethoxam and a conventional insecticide, methyl demeton.

MATERIALS AND METHODS

The potted plants of 'Parbhani Kranti' bhendi (25 days old) were used for assessing the effect of imidacloprid 17.8 SL on aphids and leafhoppers. The insecticides were diluted with distilled water to make desired concentrations (Table 1) and used for foliar application. The experiment was conducted in a completely randomized block design with three replications at the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore

(South India). The prepared doses of insecticides were sprayed using a hand operated sprayer on the 25 days old potted plants grown in a glass house. Untreated check was maintained by spraying with distilled water. The persistent toxicity of foliar treatments against aphids and leafhoppers was studied using clip-on cages and microcages, respectively.

Aphids (Clip-on cage)

Transparent bliser pack covers of pharmaceutical tablets were used as clip-on cage to confine the aphids. The insecticides were applied on the potted plants and after a day, ten apterous adult aphids cultured in the laboratory were released into the blister packs of 2.5 cm length, 1.0 cm breadth and 0.5 cm height. Ventilation was provided to the aphids by making tiny holes using pin at the top of the blister pack. The clip-on cages were fixed by inserting the bhendi leaf in between the cage and a transparent mylar film sheet which were held in position by using paper clips. Observations were made on the mortality of aphids at 48 h interval. After 48 h, already released aphids were discarded and a fresh batch of aphids was released and the experiment was continued till there was zero mortality.

Leafhoppers (Microcage)

The persistent toxicity of insecticides against leafhoppers was studied using the clip-on microcages of 3.5 cm height and 2.5 cm diameter, made up of transparent mylar film sheets of 175µ thickness for confining the leafhoppers on leaves after treating them with insecticides. Untreated check was sprayed with distilled water. The treatments were replicated thrice with ten insects per replication. The potted plants after insecticide application were left for one day and then ten leafhoppers of uniform size were released into the microcages and fixed by inserting the bhendi leaf in between the cage and a transparent mylar film sheet which were held in position by means of thin iron string. Mortality was recorded at 48 h interval and then fresh batch of insects were released. Observations were recorded continuously until no mortality was observed. Corrected mortality was carried out using Abbott's formula (Abbot, 1925). The corrected mortality data were used for computing PT index (Saini, 1959) expressing the persistent toxicity of insecticides. Based on that, the order of relative efficacy (ORE) was assigned to the various concentrations of the insecticides.

RESULTS AND DISCUSSION

Aphids

There was a hundred per cent mortality of aphids up to 7 days in the higher dose of imidacloprid *i.e.* 50 g a.i. ha^{-1} (0.56 ml 1^{-1}) and 5 days in 15 (0.17 ml 1^{-1}) and 25 g a.i. ha^{-1} (0.28 ml 1^{-1}) of imidacloprid, Tatamida® and thiamethoxam at 25 g a.i. ha^{-1} (0.20 g 1^{-1}). The persistence of the chemical was up to 27 days in imidacloprid at 50 g a.i. ha^{-1} and 25 days in imidacloprid at 25 g a.i. ha^{-1}, Tatamida® at 25 g a.i ha^{-1} and thiamethoxam of 25 g a.i. ha^{-1}. The lower dose of imidacloprid at 15 g a.i. ha^{-1} and methyl demeton at 125 g a.i. ha^{-1} persisted for 21 and 13 days, respectively. The order of relative efficacy of the insecticides based on the persistent toxicity index was as follows: imidacloprid at 50 g a.i. ha^{-1} > imidacloprid at 25 g a.i ha^{-1} > imidacloprid (Tatamida®) at 25 g a.i. ha^{-1} > thiamethoxam at 25 g a.i. ha^{-1} > imidacloprid at 15 g a.i. ha^{-1} > methyl demeton at 125 g a.i. ha^{-1} (Table 1).

Leafhoppers

Cent per cent mortality of leafhoppers was observed up to 9 DAT was the higher dose of imidacloprid at 50 g a.i. ha^{-1} and up to 7 DAT in the recommended dose of imidacloprid, standard check Tatamida® and thiamethoxam at 25 g a.i. ha^{-1}, 5 DAT with imidacloprid at 15 g a.i. ha^{-1} and 3 DAT in methyl demeton at 125 g a.i. ha^{-1}. The persistence of imidacloprid was observed for 29

Table 1. Persistent toxicity of imidacloprid 17.8 SL to aphids, *A. gossypii* on bhendi

S. No.	Treatments	Dose g a.i. ha^{-1}	Corrected per cent mortality at different intervals (days)									
			1	3	5	7	9	11	13	15	17	19
1.	Imidacloprid 17.8 SL	15	100	100	100	89.66	79.39	68.97	51.72	42.86	27.59	13.39
2.	Imidacloprid 17.8 SL	25	100	100	100	96.56	89.64	80.00	72.41	60.00	51.72	37.93
3.	Imidacloprid 17.8 SL	50	100	100	100	100	96.55	86.67	75.86	65.52	60.71	44.83
4.	Imidacloprid 17.8 SL (Tatamida®)	25	100	10	100	96.43	92.85	83.33	73.33	58.62	48.28	34.48
5.	Thiamethoxam 25 WG	25	100	100	100	93.10	89.29	82.76	68.97	55.17	44.33	35.71
6.	Methyl demeton 25 EC	125	100	100	82.76	62.07	48.28	20.69	13.79	0	0	0

S. No.	Treatments	Dose g a.i. ha^{-1}	Corrected per cent mortality at different intervals (days)								
			21	23	25	27	29	P	T	PTI	ORE
1.	Imidacloprid 17.8 SL	15	3.45	0	0	0	0	21	61.58	1293.18	5
2.	Imidacloprid 17.8 SL	25	27.59	17.24	6.90	0	0	25	64.61	1615.25	2
3.	Imidacloprid 17.8 SL	50	34.478								
4.	Imidacloprid 17.8 SL (Tatamida®)	25	100	10	100	96.43	92.85	83.33	73.33	58.62	48.28
5.	Thiamethoxam 25 WG	25	100	100	100	93.10	89.29	82.76	68.97	55.17	44.33
6.	Methyl demeton 25 EC	125	100	100	82.76	62.07	48.28	20.69	13.79	0	0

P - Peirod of persistence (days) T - Mean per cent mortality PTI - Persistent toxicity index ORE - Order of relative efficacy

Table 2. Persistent toxicity of imidacloprid 17.8 SL to leafhoppers, *A. biguttula biguttula* on bhendi

S. No.	Treatments	Dose	Corrected per cent mortality at different intervals (days)									
		g a.i. ha^{-1}	1	3	5	7	9	11	13	15	17	19
1.	Imidacloprid 17.8 SL	15	100	100	100	96.43	82.76	68.97	58.62	41.31	32.22	23.33
2.	Imidacloprid 17.8 SL	25	100	100	100	100	93.33	86.21	79.31	71.42	60.76	46.67
3.	Imidacloprid 17.8 SL	50	100	100	100	100	100	96.43	85.73	78.57	67.90	57.19
4.	Imidacloprid 17.8 SL	25	100	100	100	100	93.10	86.21	78.60	68.93	58.62	42.86
5.	Thiamethoxam 25 WG	25	100	100	100	100	96.55	89.30	75.87	67.86	57.19	41.37
6.	Methyl demeton 25 EC	125	100	100	82.21	72.38	58.62	46.43	39.36	14.28	3.57	0

S. No.	Treatments	Dose	Corrected per cent mortality at different intervals (days)									
		g a.i. ha^{-1}	21	23	25	27	29	31	P	T	PTI	ORE
1.	Imidacloprid 17.8 SL	15	10.71	3.57	0	0	0	0	23	59.83	1376.09	5
2.	Imidacloprid 17.8 SL	25	34.41	21.33	10.71	3.33	0	0	27	64.82	1750.14	3
3.	Imidacloprid 17.8 SL	50	39.29	24.91	20.00	10.34	3.45	0	29	65.59	1902.11	1
4.	Imidacloprid 17.8 SL (Tatamida®)	25	36.67	20.49	17.24	6.67	0	0	27	64.96	1753.92	2
5.	Thiamethoxam 25 WG	25	27.59	13.79	6.90	3.45	0	0	27	62.85	1696.95	4
6.	Methyl demeton 25 EC	125	0	0	0	0	0	0	17	57.87	983.79	6

P - Peirod of persistence (days) T - Mean per cent mortality PTI - Persistent toxicity index ORE - Order of relative efficacy

days at 50 g a.i. ha^{-1} and 27 days at 25 g a.i. ha^{-1}, compared to 17 days in case of methyl demeton (125 g a.i. ha^{-1}) for leafhoppers (Table 2).

The present findings are in agreement with those of Sivaveerapandian (2000) who reported that foliar applied imidacloprid persisted for 23 days against aphids in bhendi. Imidacloprid was reported to be a short persistent chemical against *Plutella xylostella* and its parasitoid, *Oomyzus sokolowskii* (Jain *et al.*, 2003). But persistent toxicity of imidacloprid at 0.09 a.i. L^{-1} was reported to be very high up to 161 days, in tomato plants against *Bemisia argentifolli* (Bethke and Redak, 1997). The persistent toxicity studies on bhendi revealed that the recommended dose of imidacloprid (25 g a.i. ha^{-1}) persisted for a period of 25 days against aphids and 27 days against leafhoppers, keeping the sucking pest population under check and is advantageous over conventional insecticides which may retain efficacy only for 10 or 15 days.

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