DISSIPATION AND DECONTAMINATION OF CYPERMETHRIN AND DELTAMETHRIN RESIDUES IN/ON BRINJAL FRUITS DURING SUMMER AND RABI SEASON UNDER SOUTH GUJARAT CONDITION

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ABSTRACT

Dissipation and decontamination of deltamethrin and cypermethrin have been studied in/on brinjal fruits. Initial deposits of deltamethrin were 0.25 and 0.31 µg g-1 and cypermethrin were 0.56 and 0.62 µg g-1 during summer and rabi season, respectively at zero day. The deltamethrin residue reached to BDL at 10th days of application whereas cypermethrin residue reduced to 91.93 per cent at 10th days of application. The half life values were of 1.76 and 2.10 days for deltamethrin residues and 2.00 and 2.89 days for cypermethrin residues on/in brinjal fruits during summer and rabi season, respectively. Washing the fruit with tap water as well as cooking for 10 minute found to the best process in which greater level of insecticides residue was dislodged from brinjal fruits. This process resulted as BDL of both insecticides residues in brinjal fruits.

Key words: Residue, deltamethrin, cypermethrin, dissipation, decontamination

No: of Tables : 3 **No: of References : 5**

INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous crop of sub-tropics and tropics regions of India. In India, it is one of the most common, popular and principal vegetable crops grown throughout the country except higher altitudes. Brinjal crop is attacked by number of insect pests, during different growth stages which reduced its yield and quality of fruits. Among them, shoot and fruit borer (*Leucinodes orbonalis* Guenee), white fly (*Bemisia tabaci* Gennadius), jassid (*Amrasca biguttula biguttula* Ishida) and aphid (*Aphis gossypii* Glover) are the major pests. Cypermethrin and deltamethrin are broad spectrum synthetic pyrethroids insecticides which have been found effective for controlling insect pests in brinjal. Brinjal fruit (unripe) is primarily consumed as cooked vegetable in various ways and dried shoots are used as fuel in rural areas. However, the use of insecticides creates a problem of three "R" *i.e.* resistance, resurgence and residues. Among these, the residue problem is one of the most important debating issues for human health. Due to lack of education, the farmers of our country do not follow the prescribed dosages and use of pesticides at only stage of the crop without any awareness of the residues and their ill effect on human health. Brinjal fruits are often consumed by human being while it is unripe, green and raw state. Therefore, to generate information about insecticides and their residues, present investigation was carried out.

Materials and Methods:

Brinjal (var. *Surati Ravaiya*) was raised and transplanted during summer 2011and rabi 2011-12 according to standard agronomic practices at Navsari Agricultural University, Navsari, Gujarat using randomized block design (RBD). Insecticides were applied in the form of foliar spray with the help of knapsack sprayer. The first spray of insecticides was given at the appearance of major pests on brinjal while second spray was given at one month after first spray in both seasons. Each treatment was replicated thrice and control plots, only water was sprayed.

Field sampling:

The marketable size brinjal fruits were collect form each treated and control plots at 0 (1 hr. after spray), 1, 4, 7 and 10 days after last sprays of the insecticides. Samples were extracted immediately after sampling.

Extraction:

The extraction and cleanup of brinjal samples for residues of deltamentrin and cypermethrin were carried out as per procedure of California Department of Food and Agriculture (CDFA). A representive sample of brinjal fruits was cut into small pieces, homogenized and 25 g sub-sample was subjected to extraction with 50 ml acetonitrile. The samples were blended at high speed for 3 minutes. Then the samples were filtered through Buchner funnel in a 250 ml capacity conical flask. Then the filtrate was transfered in 100 ml glass stopper cylinder and 10 g NaCl was added followed by vigorous shaking. The layer was allowed to separate and 20 ml

aliquot from the upper acetonitrile layer was collected separately in 150 ml capacity conical flask. Acetonitrile (Contain insecticides) from the conical flask was evaporated to near dryness by vacuum rotary evaporator and residues were reconstituted in 3 ml acetone : hexane (1:1 v/v) in 15 ml graduated test tube. The supernatant was injected to Gas Chrometograph equipped with Ni^{63} electron capture detector (ECD).

Cleanup:

A glass column (1 cm X 30 cm) was filled up with 0.5 g of Na_2So_4 (anhydrous), 1 g Florisil and 0.5 g Na_2S0_4 (anhydrous) as bottom upward. The column was washed with 5 ml acetone-hexane (1:9 v/v) followed by 5 ml hexane. When the solvent front reached the top of the column, the sample extract (2 ml) was transferred and the test tube was rinsed with twice with 5 ml hexane and the rinsed was transfer to the column. The insecticide from the column was eluted by 15 ml acetone: hexane (1:9 v/v) and it was subject to nitrogen concentrator to reached the final volume to 2 ml.

GC parameters for deltamethrin/cypermethrin:

Column : Capillary, TR-1 30m X 0.25mm (ID)X 0.25µm (film thickness)

Temperature : Injector (SSL- Split less) - 230^{0}C

Detector - 300^{0}C

Oven

80^0C (1 min.) —— 10 ^{0}C /min ——▶ 280^0C (2 min.)

Make up Gas : N_2 – 45 ml/min.

Carrier Gas : He – 1 ml/min.

Recovery studies:

Brinjal fruits samples were fortified at 0.01, 0.05 and 0.1 ppm levels to work out the recovery per cent of analytical methodology. The instrumental detection limit (IDL) and instrumental quantification limit (IQL) of deltamethrin and cypermethrin was 0.003 and 0.009ppm, respectively.

Quantitative analysis:

Quantitative estimation of insecticides residue was performed on Gas Chromatograph with capillary column. Qunatitation was carried out by external standard method using different concentration of working standards of insecticides. The concentration of the

insecticidal residue was worked out by the following formulae.

$$ppm = \frac{\text{Height/area of sample}}{\text{Height/area of standard}} \times \frac{\text{µl standard injected}}{\text{µl sample injected}} \times \frac{\text{Final volume (ml)}}{\text{Weight of sample (gm)}} \times \text{concentration of standard}$$

Decontamination of insecticides residues

A representative sample of 1 kg brinjal fruits from each replicate was collected 24 hours after insecticides application and sample was divided in three equal parts. Each part of the sample was used for determining the effect of different culinary processes such as washing the fruits with tap water for 10 min, cooking of brinjal fruits for 10 min and washing the fruits with tap water as well as cooking for 10 min.

Result and Discussion:

The results of dissipation of deltamethrin and cypermethrin in/on brinjal fruits are presented in Table1.

Table-1: Dissipation pattern of insecticides in/on brinjal fruit during summer 2011 and *rabi* 2011-12.

Concentration	Season	Residue (µg g^{-1}) after						Regression equation	R^2	DT_{50} (Day)
		Control	0	1	4	7	10			
Deltamethrin @ 0.00125 %	Summer	ND	0.25±0.01	0.15±0.001 (40.00)*	0.04±0.01 (84.00)	BDL	BDL	y= -0.197x + 1.387	0.999	1.76
	Rabi	ND	0.32±0.02	0.24±0.01 (25.00)	0.13±0.01 (59.37)	0.04±0.01 (87.50)	BDL	y = -0.165x + 1.570	0.932	2.10
Cypermethrin @ 0.009 %	Summer	ND	0.56 ± 0.02	0.38 ± 0.02 (32.14)	0.19 ± 0.02 (66.07)	0.03 ± 0.02 (94.64)	BDL	y = -0.173x + 1.792	0.951	2.00
	Rabi	ND	0.62 ±0.01	0.51±0.01 (17.74)	0.33±0.04 (46.77)	0.06±0.01 (90.32)	0.05± 0.01 (91.93)	y = -0.120x + 1.830	0.927	2.89

BDL = Blow Determination Limit < IQL ND = Not detected

* Figures in parenthesis are per cent dissipation

Table-2 : Per cent mean recovery of insecticides in brinjal fruits at three fortification levels.

Insecticides	Fortification levels (ppm)			Instrumental Determination Limit (IDL)	Instrumental Quantification Limit (IQL)
	0.01	0.05	0.1		
	Mean ± SD	Mean ± SD	Mean ±SD		
Deltamethrin @ 0.0125%	98.24 ± 6.41	89.58 ± 2.86	91.21 ± 1.95	0.003	0.009
Cypermethrin @ 0.009 %	97.73 ± 6.96	104.04 ± 6.59	92.68 ± 3.17	0.003	0.009

Table-3: Extent of removal of deltamethrin and cypermethrin residue from brinjal fruits through various culinary processes.

Insecticides	Season	Decontamination processes			
		T_1	T_2	T_3	T_4
Deltamethrin @ 0.0125%	Summer2011	0.15 ± 0.01	0.13 ± 0.02 (13.33)*	0.08 ± 0.05 (46.67)	BDL
	Rabi 2011-12	0.24±0.01	0.19±0.03 (20.83) *	0.05±0.01 (76.17)	BDL
Cypermethrin @ 0.009 %	Summer2011	0.38 ± 0.02	0.35 ± 0.04 (7.89)	0.09 ± 0.06 (76.32)	BDL
	Rabi 2011-12	0.51±0.01	0.43±0.04 (15.69)	0.04±0.01 (92.16)	BDL

T_1 : Without any process

T_2 : Washing the fruits with tap water for 10 min

T_3 : Cooking of brinjal fruits for 10 min

T_4 : Washing the fruits with tap water as well as cooking for 10 min

BDL = Blow Determination Limit < IQL

* Figures in parenthesis are per cent degradation

Deltamethrin

Average initial deposits of deltamethrin residues in/on brinjal fruits was 0.25 µg g^{-1} recorded at 0 day (2 hours after application), which was reduced to 0.15 and 0.04 µg g^{-1} at 1st and 4th days after treatments, respectively during summer 2011. The corresponding losses in

insecticidal residues were 40.00 and 84.00 per cent, respectively. Deltamethrin residue reached to below determination limit (BDL) at seventh days after application. The half life of 1.76 days for deltamethrin residues on/in brinjal fruits revealed in the present study corroborate with reports of earlier worker[1] Awasthi (1987) determined 1.6 to 3.0 days half-life for determination on cabbage. The result showed fairly rapid degradation of deltamethrin in/on brinjal fruits in summer season.During *rabi* 2011-12, initial deposits of deltamethrin 0.32 µg g^{-1} was recorded at zero day, which was reduced to 0.24, 0.13 and 0.04 µg g^{-1} at 1st, 4th and 7th days after application, respectively. The corresponding losses in insecticidal residues were 25.00, 59.37and 87.50 per cent, respectively. The deltamethrin residue reached to BDL at 10th days of application. The half-life of deltamethrin in brinjal was found to be 2.10 days. The half-life of deltamethrin was observed by earlier workers to be 2.83 days in okra[2] Shah *et al*. (1999).

Cypermethrin

During summer 2011, initial deposit of cypermethrin in/on brinjal fruits was 0.56 µg g^{-1} and reached to BDL after 10th days of application. half-life of cypermethrin was calculated as 2.00 days, which is comparable with earlier reported[3] Duara *et al.* (2003) 3.16 to 3.39 days on brinjal.The initial residue (0.62 µg g^{-1}) of cypermethrin in/on brinjal dissipatel to 0.05 µg g^{-1} after 10th days of the last spray amounting to loss of 91.93 per cent during *rabi* 2011-12. Half-life value was observed 2.89 days.

Decontamination of insecticides residues in brinjal fruits by culinary processes

Among the different culinary processes, deltamethrin and cypermethrin recorded 13.33 to 20.83 and 7.89 to 15.69 per cent removal of residues in brinjal when washing the fruits with tap water for 10 minutes during both season, respectively (Table 3). Cooking of brinjal fruits resulted in more than 46 to 75 per cent reduction of all the insecticides. Washing the fruit with tap water as well as cooking for 10 minute found to the best process in which greater level of insecticides residue was dislodged from brinjal fruits. This process resulted as BDL of both insecticides residues in brinjal fruits.

Jadhav and Ashtaputre (1989) The tap water washing of brinjal fruits did not reduce the residues of cypermethrin while cooking of brinjal fruit could completely reduce the insecticide residues and make the vegetable safe for consumption within a day. Dikshit *et al.* (2001), Washing followed by cooking brought down the deltamethrin residues by 61.8 per cent in okra fruits[5].

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