Bull. Environ. Contam. Toxicol. (2005) 75:1094–1097

DOI: 10.1007/s00128-005-0861-2

Bulletin of Environmental Contamination and Toxicology

Dissipation of Ethion on Brinjal (*Solanum melongena* L.) Under Subtropical Conditions at Ludhiana, Punjab, India

G. Jyot, S. K. Sahoo, R. S. Battu, B. K. Kang, B. Singh

Department of Entomology, Punjab Agricultural University, Ludhiana 141004, India

Received: 28 March 2005/Accepted: 20 September 2005

Brinjal (***Solanum melongena*** L.) is one of the most important vegetable crop of tropical and subtropical regions of the world. In Punjab, brinjal occupied an area of 3,350 ha with the production of 33,201 tons (Anonymous 2002). The brinjal yield in Punjab is considerably lower because of several factors, the most important being the damage caused by insect pests. Spider mite, *Tetranychus cinnabarinus* is one of the major pest of this crop in Punjab during April to June and again during September to November (Dhooria, 2003). Ethion, a non-systemic insecticide and acaricide with contact action, has been recommended against the management of spider mite on brinjal. Pesticides applied to food crops leave residues which may be hazardous to the consumers. The dissipation of an insecticide varies with the nature of insecticides, dosage applied, number of applications, interval between applications, crop variety and agroclimatic conditions. Since no published information seems to be available on the residues of ethion on brinjal under Punjab climatic conditions, the present studies were, undertaken to determine the residues of ethion on brinjal at different time intervals and suggest suitable waiting periods for the safety of consumers.

MATERIALS AND METHODS

Brinjal crop (var. Nishat Hybrid) was raised at the Entomological Research Farm, Punjab Agricultural University, Ludhiana, during the 2003 following recommended agronomic practices (Anonymous 2002). The technical material of ethion was obtained from Augsburg, Germany and its formulation (Fosmite 50EC) was supplied by Pesticide India Industries Ltd. Udaipur, Rajasthan, India . All the solvents used were of laboratory grade and redistilled. The suitability of solvents and other chemicals was ensured by running reagent blanks before actual analysis. Ethion (Fosmite 50 EC) was sprayed @ 375 and 750 g a.i. ha^{-1} along with control .Two sprays, first at 50 % infestation stage and subsequently second at 15 days interval were found quite effective for the control of the mite. There were three replications for each treatment. Representative samples of brinjal were collected from each treatment at varying intervals after second spray. About one kg samples of marketable size brinjal fruits were taken at 0, 1, 3, 5 and 7 days after the second spray. These samples were extracted, cleaned up and analyzed following method of Sahoo *et al* (2004) with slight modifications.

Correspondence to: B. Singh

A representative sample of chopped fruits (50g) was blended with 50ml of water in a blender for 2 minutes. Acetone (100ml) was added to the blender and shaken gently for 5minutes. The extract was filtered through glass wool plugged in a funnel. The residual pulp was re-extracted with 50 ml of acetone and filtered. Finally, a washing was given to the blender and the funnel containing the residual pulp with acetone and the extracts were combined.

The combined extracts thus obtained were transferred to a separatory funnel of 1 litre capacity, diluted with 500 ml of 2 per cent aqueous solution of sodium chloride and partitioned thrice into 100, 50 and 50 ml of dichloromethane. The combined dichloromethane extracts thus obtained were concentrated to 2–3 ml *in vacuum* using a rotary evaporator at a temperature below 35°C.

The extracts were cleaned up by column chromatography using silica gel (60-120 mesh) as an adsorbent. Before use, the silica gel was activated at 110°C for 2 hours. A glass column (1.5cm dia x 60 cm long) was packed with activated silica gel (20g + 1g charcoal) in between the two small layers of anhydrous sodium sulfate supported on a plug of glass wool. The column was pre washed with dichloromethane following which the concentrated extract was poured over it. The extract was eluted with a freshly prepared solvent mixture of dichloromethane-acetone (1:1, v/v). The eluate was concentrated to near dryness in a rotary evaporator *under vacuum* and then transferred to 5 ml acetone for further analysis.

The estimation of ethion residues was carried out by gas liquid chromatography (GLC) equipped with nitrogen–phosphorus detector (NPD) and a pyrex glass column (1mt x 2mm i.d.) packed with 3 per cent DC 200 on 100–120 mesh gas chrom Q. The operating conditions of GLC were as follows: Detector temperature:270°C, Oven (column) temperature: 210°C, Injector temperature:250°C, Carrier gas (N_2) flow rate:3.5 kg cm^{-2}, Air flow:1.2 kg cm^{-2} and Hydrogen flow: 0.5 kg cm^{-2}. Under these operating conditions, ethion gave a peak with retention time of 4.2 minutes. The average recoveries from brinjal samples spiked with concentration of 0.8 and 1.6 mg kg^{-1} were found to be more than 80 per cent. Therefore the results are reported as such without applying any correction factor. The minimum limit of detection for ethion was found to be 0.05 mg kg^{-1}. The half- life (RL_{50}) as well as time required to reach below the tolerance level (T_{tol}) were calculated by using Hoskins formula (Hoskin,1961).

RESULTS AND DISCUSSION

The overall results of the analysis of brinjal fruits following 2nd spraying of the crop with ethion @ 375 and 750 g a.i. ha^{-1} are presented in Table 1. Immediately after the second spray, the mean initial deposits of ethion were 2.01 and 4.93 mg kg^{-1} on the fruits of brinjal at minimum effective and double the effective dosages respectively. Following application @ 375 a.i.ha^{-1}, the residues of ethion on brinjal were found to be below the MRL after 4 days of application. However, it took 7 days to reach below the MRL when the crop was sprayed @ 750 g a.i.ha^{-1}.

The results are in agreement with the findings of Akashe *et al* (2002) who reported an initial deposit of 2.32 mg kg^{-1} following application of ethion @ 0.1% on the petals of rose flower and also recommended a waiting period of five to six days. The maximum residue limit (MRL) of 1.0 mg kg^{-1} has been prescribed for ethion on brinjal (Anonymous, 1999). These results can be further substantiated with the

Table 1. Mean residues (mg kg^{-1}) of ethion on brinjal

	Residues level (mg kg^{-1})	
Days after Spray	375 g a.i.ha^{-1}	750 g a.i.ha^{-1}
0 (1hr)	2.01 ± .09	4.93 ± 0.17
1	1.35 ± 0.06 (32.83)*	3.23 ± 0.21(34.48)
3	1.01 ± 0.07 (49.75)	2.39 ± 0.16 (51.52)
5	0.81 ± 0.02 (59.70)	1.54 ± 0.07 (68.76)
7	0.63 ± 0.04 (68.66)	0.85 ± 0.09 (82.76)
T_{tol} (days)	3.63	6.53
RL_{50} (days)	4.52	2.95

BDL = Below Detectable Limit (< 0.05 mg kg^{-1})
* Figures in parenthesis indicates % dissipation

help of dissipation parameters calculated in the present investigations. It was found that ethion residues reached below the MRL on 3.63 and 6.53 days (Ttol) at single and double dosages, respectively. The half-life (RL_{50}) values of 4.25 and 2.95 days were calculated following the application of ethion on brinjal at single and double dosages, respectively. The present results are similar to Manjunatha *et al* (1989) who also reported a half- life values of 2.75 days following application of ethion @ 312.5 g a.i. ha^{-1} on sorgham leaves. They used this acaricide against *Tetranychid oligonychus indicus*.

These studies suggest that the use of ethion at the minimum effective dosages does not pose any hazards to consumers if a waiting period of 4 days before harvest is observed.

Acknowledgments. We thank the Indian Council of Agricultural Research, New Delhi for providing the research grant under the scheme "All India Network Project on Pesticide Residues". The authors are also thankful to the Head, Department of Entomology, Punjab Agricultural University, Ludhiana, Punjab, India, for providing the necessary research facilities.

REFERENCES

Akashe VB, Kharbade SB , Dethe MD (2002) Residues of selective miticides on rose. Resources Management in Plant Protection during twenty first century, Hyderabad- India-14-15 Nov 2002, Vol II,47-48.

Anonymous (2002) Package of Practices for Cultivation of Vegetables. pp.22. Punjab Agricultural University, Ludhiana.

Anonymous (1999) Guide to Codex Maximum Limits for Pesticides Residues. Food and Agricultural Organization, Rome, pp 475.

Dhooria MS (2003) Economic status of phytophagous/predaceous mites from different plants in Punjab. J Insect Sci 16(1-2):12-17.

Hoskins WM (1961) Mathematical treatment of the rate of loss of pesticide residues. FAO Pl Prot Bull 9: 163-68.

Manjunatha M, Puttaswamy, Yelshetty SD (1989) Pesticide Residues on Sorgham leaves. Ann Arid Zone 28:3-4,319-322.

Sahoo SK, Kapoor SK, Singh B (2004) Estimation of Residues of Profenofos in/on Tomato *Lycopersicon esculentum* Mill. Bull Environ Contam Toxicol 72:970-974.