

Dissipation Kinetics of Propargite in Brinjal Fruits Under Subtropical Conditions of Punjab, India

B. K. Kang · Gagan Jyot · R. K. Sharma ·
S. K. Sahoo · R. S. Battu · Balwinder Singh

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Abstract Residues of propargite were estimated in brinjal fruits by High Performance Liquid Chromatography (HPLC) following single application of Omite 57 EC @ 570 and 1140 g a.i./ha. The average initial deposits of propargite were observed to be 0.51 and 0.92 mg/kg, respectively, which were below its maximum residue limit (MRL) of 2 mg/kg. The residue levels of propargite dissipated below limit of quantification (LOQ) of 0.02 mg/kg after 10 days at both the dosages. The half-life values ($T_{1/2}$) of propargite were worked out to be 3.07 and 3.54 days, respectively, at recommended and double the recommended dosages. A waiting period of one day has been suggested for the safe consumption of brinjal fruits to avoid any health hazards.

Keywords Brinjal fruits · HPLC · MRL · Propargite · Residues

Brinjal (*Solanum melongena* L.) is one of the most common and popular vegetables grown in India, occupied an area of 2.68 thousands hectares in Punjab with an annual production of 37.96 thousands tonnes per annum. The crop is subjected to high degree of instability in production from year to year, mainly because of losses caused by insect pests, of which brinjal shoot and fruit borer and mites are the most serious. Several insecticides are recommended for the control of these pest (Anonymous 2006).

Propargite, 2-[4-(1,1-Dimethyl ethyl) phenoxy] cyclohexyl 2-propenyl sulphide, is a non-systemic acaricide for controlling variety of phytophagous mites on many crops including cotton, fruit trees, vegetables, hops and nuts, etc. (Royal Society of Chemistry 1987). The compound is recently introduced in India as an effective acaricide on a large number of crops most of which are consumed by human beings directly or after processing. Therefore, it has become important to check the dissipation behaviour of propargite in edible raw commodities, processed products and in the environment. Taking all these points into consideration, an attempt was made to study the residue levels and dissipation kinetics of propargite in brinjal.

Materials and Methods

Brinjal (var. Punjab Jamuni Gola) was raised and transplanted during February 2007 according to recommended agronomic practices at Entomological Research Farm of Punjab Agricultural University, Ludhiana. Application of propargite (Omite 57EC) was made at 50% fruit formation @ 570 and 1140 g a.i./ha using water @ 500 L/ha. Each treatment was replicated thrice and size of each plot was 50 sq.m. In control plots, only water was sprayed.

For residue studies, about 2 kg of marketable size fruit were collected from each treated and control plots from 5 to 6 sites and brought to the laboratory in polyethylene bags and processed immediately for residue analysis. Brinjal fruit samples were collected before and 0 (2 h), 1, 3, 5, 7, 10 and 14 days after application of the insecticide. From the composite samples, a sub sample of 250 g per replicate for all the treatments was drawn after cutting into small pieces. Then a 50 g representative sample of brinjal fruit was selected from each replicate of all the treatments,

B. K. Kang · G. Jyot · R. K. Sharma · S. K. Sahoo ·
R. S. Battu (✉) · B. Singh
Department of Entomology, Pesticide Residue Analysis
Laboratory, Punjab Agricultural University, Ludhiana 141 004,
Punjab, India
e-mail: rsbattu2007@rediffmail.com

for extraction of residues. The residues were determined by using High Performance Liquid Chromatography (HPLC) Shimadzu model SPD-M20A.

A representative 50 g sample of chopped and macerated brinjal fruit was dipped for overnight into 100 mL acetone in an erlenmayer flask. The extract was filtered into 1 L separatory funnel along with rinsings of acetone. The filtrates in the separatory funnel were diluted with 600 mL brine solution and partitioned thrice into 75 mL dichloromethane. The dichloromethane fractions were combined, dried over anhydrous sodium sulphate and treated with 500 mg activated charcoal powder for about 2–3 h at room temperature. The clear extracts so obtained were filtered through Whatman filter paper No.1., concentrated to near dryness and added about 5 mL acetonitrile (HPLC grade) and again concentrated using rotary vacuum evaporator at 30°C. The process was repeated to completely evaporate dichloromethane and final volume was reconstituted to about 5 mL using HPLC grade acetonitrile.

The residues of propargite were estimated on HPLC by employing C₁₈ column at 230 nm wavelength and using acetonitrile as mobile phase @ 1 mL/min. Under these operating conditions the retention time of propargite was found to be 4.19 min. Residues of propargite were quantified by comparison of peak height/peak area of standards with that of unknown or spiked samples run under identical conditions. Half-scale deflection was obtained for 20 ng propargite and limit of quantification (LOQ) was found to be 0.02 mg/kg. The percent recoveries of propargite in

brinjal fruits were found to be consistent and more than 80% (Table 1). Therefore, the results are presented as such without applying any correction factor.

Results and Discussion

The results of dissipation of propargite in brinjal fruits are presented in Table 2. The average initial deposits estimated in brinjal fruits were found to be 0.51 and 0.92 mg/kg, respectively, following single application of Omite 57EC at @ 570 and 1140 g a.i./ha. Three days after application, these residue levels dissipated to the extent of about 45 and 43%, respectively, at single and double the application rate (Fig. 1). Half-life ($T_{1/2}$) of propargite calculated as per Hoskins 1961 was observed to be 3.07 and 3.54 days, respectively, when applied @ 570 and 1140 g a.i./ha. Residues of propargite in brinjal fruits dissipated below limit of quantification (LOQ) of 0.02 mg/kg after 10 days at both the dosages.

Aplada-sarlis et al. (1994) also reported initial deposits of 0.95 and 2.13 mg/kg on green house tomatoes when Omite was applied at 60 and 120 g a.i./ac, respectively. Samples were analysed at 0, 1, 2, 3, 6, 13, 20, 27 and 34 days after application. The residues of Omite ranged from high 0.95 mg/kg at day 0 to a low of 0.42 mg/kg after 34 days at 60 g dose whereas at double the recommended dose, the residue concentrations varied from 2.13 to 1.05 mg/kg at day 0 and 34 days, respectively. The residues of Omite on cotton were also studied by Uniroyal 1976. They had applied Comite® to cotton foliage at the rates of one or two pounds in 25 gallons water per acre. Samples were analysed at 0, 14, 28 and 42 days after application and the average residues of propargite were found to be 55, 9.25, 0.40 and 0.10 mg/kg, respectively. The estimated half-life was found to be 3.69 days on cotton. Kumar et al. (2005) studied the dissipation behaviour of propargite in soil, apple fruit and tea. In soil, the half-life was found to range from 43 to 45 days, while in plant matrices (tea and apple) it ranged from 1.66 to 2.61 days. According to them, the dissipation rate of Omite was found to vary with the nature of crop or sample.

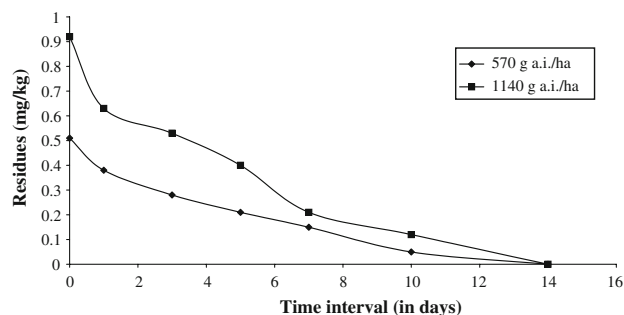


Fig. 1 Dissipation of propargite (mg/kg) in brinjal fruits

Table 1 Recovery of propargite from brinjal fruits

Substrate	Level of fortification (mg/kg)	µg added	µg recovered	^a Recovery (%) (Mean ± SD)
Brinjal fruit	1.0	50	42.50	85.0 ± 4.58
	0.5	25	22.50	90.0 ± 6.00
	0.1	05	4.215	84.3 ± 4.04
	0.02	01	0.80	80.0 ± 5.07

^a Each value is mean ± SD of three replicate determinations

Table 2 Residues of propargite (mg/kg) in brinjal fruits

Days after application	570 g a.i./ha (1000 g/ha)			1140 g a.i./ha (2000 g/ha)		
	Replicates	Mean \pm SD	dissipation (%)	Replicates	Mean \pm SD	dissipation (%)
Before application	BDL	BDL	—	BDL	BDL	—
	BDL			BDL		
	BDL			BDL		
0	0.51	0.51 \pm 0.01	—	0.90	0.92 \pm 0.05	
	0.51			0.88		
	0.52			0.98		
1	0.38	0.38 \pm 0.02	25.50	0.64	0.63 \pm 0.02	31.86
	0.36			0.60		
	0.40			0.65		
3	0.30	0.28 \pm 0.01	45.09	0.58	0.53 \pm 0.04	42.85
	0.27			0.51		
	0.28			0.50		
5	0.22	0.21 \pm 0.01	58.82	0.45	0.40 \pm 0.06	56.52
	0.21			0.42		
	0.22			0.33		
7	0.15	0.15 \pm 0.02	70.58	0.22	0.21 \pm 0.01	77.17
	0.18			0.21		
	0.13			0.22		
10	0.05	0.05 \pm 0.01	90.19	0.10	0.12 \pm 0.02	86.95
	0.04			0.11		
	0.06			0.15		
14	BDL	BDL	—	BDL	BDL	—
	BDL			BDL		
	BDL			BDL		
T _{1/2}	3.07			3.54		

BDL Below detectable limit of 0.02 mg/kg

The maximum residue limit (MRL) of 2 mg/kg has been prescribed for propargite on brinjal fruit (<http://www.faolex.fao.org/docs/texts/mal54650.doc>). Following application of propargite at 570 and 1140 g a.i./ha, the initial deposits of propargite on brinjal were found to be below the MRL. These studies, therefore, suggest that the use of propargite at the recommended and the double the recommended dosages does not seem to pose any hazards to the consumers and a waiting period of one day is suggested to reduce the risk before consumption of brinjal fruits.

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