

RESIDUAL PERSISTENCE OF CHLORPYRIFOS, IMIDACLOPRID AND ACEPHATE IN BRINJAL FRUIT

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ABSTRACT

Residual persistence of chlorpyrifos, imidachloprid and acephate was investigated by adopting HPTLC with acetylcholine esterase inhibition method. These insecticides were sprayed on the brinjal crop during May, 2004 and residues on brinjal fruit were assessed 3 hours, 3 days and 7 days after application. The residues of the aforesaid insecticides on the three sampling periods (max-min) ranged from 0.075-0.039, 0.030-0.015 and 0.067-0.040 ppm, respectively. The quantity of insecticide residues was negligible in the brinjal fruit. This leads to conclusion that it is safe to recommend brinjal fruit for human consumption after three days of spraying the above said insecticides.

Key words: chlorpyrifos, imidacloprid, acephate, brinjal, residues.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the most important vegetables which has serious insect pest problems in the field. For the control of insect pests of this crop the farmers commonly use insecticides such as acephate, chlorpyrifos, carbofuran and imidachloprid (Khandekar *et al.*, 1982). Dogheim *et al.*, (2002) analyzed 2318 fruit and vegetable sample collected from eight Egyptian markets for possible detection of organic contaminants. They showed that 81.5% of the samples were free of organic contaminants and 18.5% of the samples contained various concentrations of organic contaminants. Only 1.9% of the contaminated samples had concentrations exceeding MRLs.

International Trade in food and agricultural commodities is governed by agreement of the World Trade Organization (WTO). The overall objective of the WTO agreement is to permit countries to undertake legitimate measures to protect the life and health of consumers. Present study is an attempt in the context of WTO scenario to determine the residual persistence of most commonly used insecticides on brinjal fruit in order to determine safety of brinjal fruit for human consumption.

MATERIALS AND METHODS

Brinjal Sampling

For studies on the residual persistence of chlorpyrifos, imidacloprid and acephate on brinjal fruit, an experiment was laid out in the Research Area of Department of Agri-Entomology in University of Agriculture Faisalabad following Randomized Block Design. The previously mentioned insecticides were broadcasted and sprayed on the crop in the concentration of 700ml, 700ml and 300ml

per acre respectively during May, 2004. For assessment of residues the brinjal fruit samples each weighing 1 Kg from each treatment was collected. All the samples were stored at -4°C for residues analysis. The extraction, cleanup and analytical work was followed by Asi *et al.* (2002).

Extraction and Clean up of Brinjal Samples

Brinjal fruit samples taken from each treatment were chopped and mixed thoroughly and out of every sample, a sub sample weighing 50g was taken. Each sub sample was blended for 2-3 minutes in 20 ml of ethyl acetate solution. Thereafter, 20g anhydrous sodium sulphate was added to it to get the remaining water absorbed. The solvent layer was decanted, filtered with Whatman flute filter paper no. 42. Then this extract was cleaned up by activated charcoal. The charcoal was activated at 105°C for about four hours. The cleaned material was transferred in the round bottom flask and reduced the volume upto 1 ml using Rotary Evaporator (Buchi 011, Switzerland). The final volume was evaporated in water bath (40°C) with nitrogen stream for dryness and reconstituted it for analysis on TLC plates.

High Performance Thin Layer Chromatographic Analysis (HPTLC)

Pre-coated silica gel 60 glass plates (each measuring 20 x 20 cm with 0.25 mm layer thickness) were activated at 105°C for 30 minutes. The plates were spotted with samples along with marker compounds and developed in pre-saturated tank of ethyl acetate. After developing the plates, the extra solvent was evaporated in fume hood, and again developed the plate in another pre-saturated tank with bromine vapours (8 g KMnO₄ + 10 mL HCl/HBr) for 30 seconds. The excess chlorine/bromine

was removed in fume hood for about 45 minutes and the plates were sprayed with solution of horse blood serum. Blue spots with white background appeared. The distance traveled by solvent and eluted compounds was noted. R_f values of each compound was calculated and compared with the standard. The concentration of each compound was calculated by comparing the average spot area (horizontal and vertical area) (Asi *et al.*, 2002)

RESULT

Residual Analysis with the help of TLC method

The results of the present studies regarding residues of chlorpyrifos, imidachloprid and acephate analyzed 3 hours, 3 days and 7 days after spray are given in Table 1 and presented graphically in Fig.1.

The residues of chlorpyrifos in brinjal fruit, 3 hours after spraying, were maximum found to be 0.075 ppm which dissipated to 0.050 ppm and 0.039 ppm at 3 and 7 days, respectively. Imidachloprid residues in brinjal fruit at 3 hours after spraying were 0.038 ppm, which degraded to 0.020 ppm at 3 days and 0.015 ppm after 7 days spraying. The residues of acephate at 3 hours after spraying were 0.067 ppm, which dissipated to 0.051 ppm after 3 days and 0.04 ppm after 7 days.

DISSCUSSION

Results of the present study indicated that residues of all the three test insecticides were present in all the samples of brinjal fruits at 7 day after insecticides application. It was further revealed that there was negligible change in chlorpyrifos and acephate residues in brinjal fruit but substantial change occurred in the residues of imida-

cloprid within 7 days. According to Smith, (1968) chlorpyrifos when exposed to sunlight, underwent hydrolysis in the presence of water to liberate 3, 5, 6-trichloro-2-pyridinol, which underwent further decomposition to diols and triols and ultimately cleavage of the ring to fragmentary products. Relative flow value (R_f) of HPTLC method was not effected with time period as shown in Table 1. The horse blood serum method was adopted in the present study following IAEA, which validated various HPTLC methods including this biological method as adopt in the present study for insecticide residues analysis in vegetables (Asi, *et al.*, 2002). The biological methods because of being faster, less laborious, friendly to environment and less expensive was also adopted by Kadenczki *et al.*, (1992). They used Gel Permeable Chromatography (GPC) for removing oil from the grain. This step was eliminated in the present method, as there was no oil in brinjal fruit. In this study, the ethyl acetate was used in this study for the extraction of pesticide residues from vegetables. The methodology involving the use of the HPTLC for the estimation of pesticide residues in food grains, vegetables, fruits, water and soil have also been used by workers like Ohlin (1986), Dekok and Hiemstra (1992), Pang-Goufang *et al.* (1996), Pasha *et al.* (1996) and Takatsuki *et al.* (1999).

The results showed that at 3 hours after spraying, the quantity of residues of test insecticides was maximum followed by that at 3 days and minimum amount of insecticide residue was detected at 7th day. Imidachloprid, chlorpyrifos and acephate residues were negligible in the brinjal fruit at 7 days of spraying. This leads to conclusion that the brinjal fruit is fit for the consumption of public even after 3 days without any hazard to human health as MRL adopted by different countries for eggplant range from 0.2 to 1 ppm.

Table 1: Insecticide residues in brinjal fruit determined by HPTLC method

Insecticide	Insecticide residues in brinjal (ppm)			
	Sampling periods			
	3 hrs*	3 days	7 days	R_f
Chlorpyrifos	0.075	0.050	0.039	0.05
Imidachloprid	0.038	0.020	0.015	0.230
Acephate	0.067	0.051	0.040	0.05

Values are mean of 5 samples taken from each treatment

* 3 hours show 0 day sample

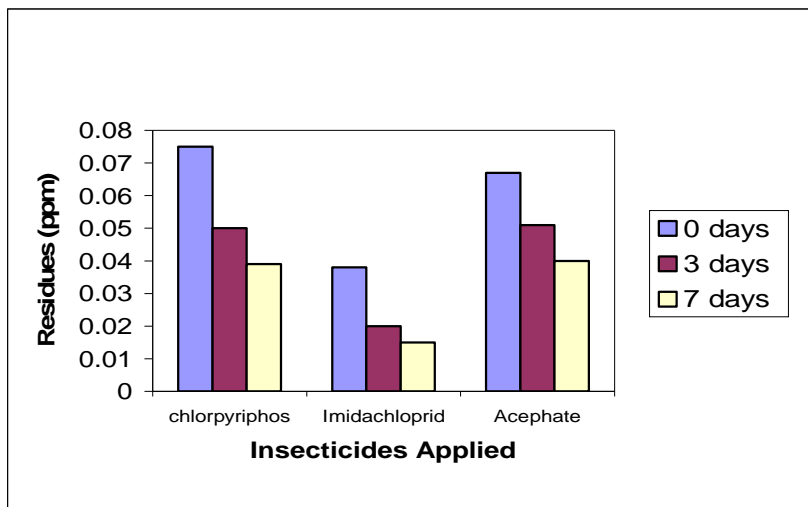


Fig. 1: Residual persistence of, chlorpyrifos, imidachloprid and acephate in brinjal fruits

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