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Monitoring of Pesticide Residue in Summer Fruits and Vegetables Growing on the Riverbed Side

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Pesticides use in agriculture is necessary in the production of food. Indeed, they are used widely to control crop pests. The use of high persistent organochlorine insecticides was curtailed since 1989s. A low persistence organophosphate, carbamate, synthetic pyrethroid and other pesticides that have currently been used against pests of most vegetable and fruit crops had replaced them. This usage resulted in the presence of pesticide residues in our fruits and vegetables.

During the last decade, several surveys on fruits and vegetables with pesticides were reported (Dejonckheere et al. 1996; Dogheim et al. 1996 a, b; Neidert and Saschenbrecker, 1996; Papadopoulou, 1991; Roy et al. 1995, 1997;Yoshida et al. 1992).

It is well known that no monitoring study can determine all pesticides in fruits and vegetables. That would be economically unrealistic and practically impossible. So, the objective of the present study was to determine the residues of certain group of pesticides in common fruits and vegetables.

In the present study, a multi-residue method for the determination of carbamates, organophosphorus and some organochlorines in summer fruits and vegetable from different places near river Ganga at Kanpur was established in order to find out the extent and magnitude of these insecticide residues. The data would help in assessing the risk of human exposure to pesticides and in implementing integrated pest management.

MATERIALS AND METHODS

1 kg each of the fruits and vegetables was collected from Ranighat, Jajmau, Magzinghat, Golaghat in Kanpur, Jagatnagar in Unnao and Allahabad. Selection of fruits and vegetables *viz.* Cucumber (kheera, *Cucumis sativus* L.), Snake cucumber (kakdi, *Cucumis melo* var *utilissimus*), Musk melon (kharbooja, *Cucumis melo* L.), Water melon (tarbooja, *Citrullus vulgaris* L.), White gourd (petha, *Benincasa hispida*), Pumpkin (kaddu, *Cucurbita pepo* L.), Bottle gourd (lauki, *Lagenaria siceraria*) and Ribbed gourd (torai ghia, *Luffa acutangula*) was based on their easy availability and relative importance during summer months.

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As soon as the samples were picked up, they were put in polyethylene bags and transferred to the laboratory. Wherever necessary the fruits were separated into pulp and peel. Washed samples were chopped and mixed thoroughly. Out of this three representative sub-samples weighing 25g each were randomly taken up and blended with 100 ml acetone for 3 min. The acetone extract was filtered and the process was repeated three times for complete extraction. The combined filtrate and washings were transferred to a separatory funnels with 25 ml each of saturated saline and hexane and shaken thoroughly. The aqueous phase was again extracted with hexane and the pooled hexane fractions were passed through glass column containing activated charcoal and anhydrous sodium sulphate to clean the pigment contents. The hexane fraction was concentrated to known volume and analysed by gas chromatography (Fytianos et al. 1998, Liapis et al., 1994, Abbassy, 2001).

For carbofuran, the method of Lee and Westcott (1980) was followed with minor modification (Dixit and Banerji 1994).

Standards were obtained from M/s Hindustan Ciba Geigy, Rallis India Ltd and BASF India, Ltd. Recovery studies were performed by spiking the samples with known quantities of different pesticides and subjecting them to similar analytical procedures. The reproducibility of results for all the pesticide was between 89-92%.

RESULTS AND DISCUSSION

The concentration of carbofuran residues in fruits and vegetables are presented in Table 1. Residues of organophosphorus insecticides were below detectable limits in the fruits and vegetables tested. However, a few samples showed residues in very low quantities (Table 2), which were well below the tolerance limits of these insecticides.

No doubt the concentrations of organophosphorus and carbofuran have been on a decline in farm products in the last two decades (Sanghi and Tewari, 2001). Many different pesticide residues may be found on the single serving of vegetables. These multiple residues may be derived from various sources such as applications of more than one pesticide on a crop during a growing season, possible spray drift on persistent environmental residues.

In our earlier experiment (Dixit and Banerji, 1994) we found the residues of carbofuran on the higher side in water chestnuts, which may be due to indiscriminate use of the insecticide by water chestnut growers. Moreover, we (Banerji and Dixit, 2001) could not observe any residue of monocrotophos in water chestnuts even though the insecticide effectively controlled the insect/pest infestation. However, organophosphorus pesticides *viz.* dimethoate, dichlorvos, phosphomidon and monocrotophos, were below detectable limits in most of the fruits and vegetables. It was, therefore, felt safe to use these organophosphorus

Table 1. Carbofuran residue in fruits and vegetables at riverbed side.

Sample	Location	Residue µg/g			
		Pulp		Peel	
		Range	Mean	Range	Mean
Cucumber (*Kheera*)	Allahabad	1.21-1.24	1.23	0.83-1.29	1.06
	Ranighat Kanpur	0.55-0.80	0.62	0.80-1.05	0.93
	Jajmau Kanpur	0.37-0.62	0.49	0.33-0.35	0.34
	Magzinghat Kanpur	0.74-0.77	0.76	0.82-0.87	0.85
Snake cucumber (*Kakdi*)	Magzinghat Kanpur	0.30-0.36	0.33	-	-
	Ranighat Kanpur	0.58-0.64	0.61		
Musk melon (*Kharbooja*)	Allahabad	0.72-0.82	0.77	1.13-1.34	1.24
	Jagat Nagar Unnao	0.23-0.25	0.24	1.0-1.2	1.1
	Golaghat Kanpur	0.24-0.38	0.31	0.43-0.48	0.46
Water melon (*Tarbooja*)	Jagat Nagar Unnao	0.56-1.17	0.87	0.37-0.52	0.45
	Golaghat Kanpur	0.63-0.76	0.69	1.28-1.70	1.49
White gourd melon (*Petha*)	Golaghat Kanpur	0.16-0.26	0.21	0.24-0.35	0.30
Pumpkin (*Kaddu*)	Magzinghat Kanpur	0.51-0.66	0.59	0.17-0.23	0.20
	Ranighat Kanpur	0.70-0.75	0.73	0.74-1.70	1.22
Bottle gourd (*Lauki*)	Jajmau Kanpur	0.55-0.59	0.57	0.07-0.25	0.16
	Ranighat Kanpur	0.27-0.69	0.48	0.52-1.28	0.90
Ribbed gourd (*Torai ghia*)	Magzinghat Kanpur	0.12-0.27	0.20	0.16-0.19	0.18

Table 2. Some Organophosphorus residue in fruits and vegetables at riverbed side.

Sample	Location	Plant Part	Residue µg/g			
			Dichlorvos	Dimethoate	Phosphomidon	Monocrotophos
Guava	Jajmau Kanpur	Pulp	ND	0.001	ND	ND
Cucumber	Allahabad	Pulp	ND	ND	ND	ND
(Kheera)		Peel	ND	ND	ND	0.001
	Ranighat Kanpur	Pulp	ND	ND	ND	ND
		Peel	ND	ND	ND	ND
	Jajmau Kanpur	Pulp	ND	ND	ND	ND
		Peel	ND	0.002	ND	0.001
Snake	Magzinghat Kanpur	Pulp	ND	ND	ND	ND
cucumber	Ranighat Kanpur	Pulp	ND	ND	ND	ND
(Kakdi)						
Musk melon	Allahabad	Pulp	ND	ND	ND	ND
(Kharbooja)		Peel	ND	ND	ND	ND
	Jagat Nagar Unnao	Pulp	ND	ND	ND	ND
		Peel	ND	ND	ND	ND
	Golaghat Kanpur	Pulp	ND	ND	ND	ND
		Peel	ND	ND	ND	ND
Water melon	Jagat Nagar Unnao	Pulp	ND	ND	ND	ND
(Tarbooja)		Peel	ND	ND	ND	ND
	Golaghat Kanpur	Pulp	ND	ND	ND	ND
		Peel	ND	ND	ND	ND
White gourd	Golaghat Kanpur	Pulp	ND	ND	ND	ND
(Petha)		Peel	ND	0.001	0.0012	ND
Pumpkin	Magzinghat Kanpur	Pulp	ND	ND	ND	ND
(Kaddu)		Peel	0.001	ND	ND	ND
	Ranighat Kanpur	Pulp	ND	ND	ND	ND
		Peel	ND	ND	ND	ND
Bottle gourd	Jajmau Kanpur	Pulp	ND	ND	ND	ND
(Lauki)	Ranighat Kanpur	Peel	0.002	0.002	ND	0.001
		Pulp	ND	ND	ND	ND
		Peel	ND	0.001	ND	ND
Ribbed gourd	Magzinghat Kanpur	Pulp	ND	ND	ND	ND
(Torai ghia)		Peel	0.001	ND	ND	ND

Values are the mean of 5 samples. ND=below detectable limits

insecticides for controlling the insect/pest infestation of the crops. These organophosphorus pesticides effectively control insect/pest problem and their residues remain in the crops for days and weeks only. On the safer side, the fruits and vegetables may be harvested after a waiting period of 15 days (Dixit and Banerji 1998).

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