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Carbofuran Residue in Water Chestnut

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Water chestnut [*Trapa natans* L. var. *bispinosa* (Roxb.) Makino (Trapaceae)] is cultivated extensively for its fruits in tanks, lakes, ponds etc. throughout the country particularly in Uttar Pradesh, Madhya Pradesh, Bihar, Orissa and Karnataka. The fruits are eaten raw at tender and sometimes after boiling and roasting. The kernel flour is used as a substitute for cereal flour (Anonymous 1976). Due to their habitat the plants are more prone to various pest attacks, like *Galerucella birmanica* (Pradhan et al. 1964).

Carbofuran (2,3-dihydro 2,2-dimethyl-7-benzofuranyl methyl carbamate) is one of the carbamate pesticides used by water chestnut growers. Several studies for environmental impact of carbofuran have been conducted (Rajukkannu et al. 1976, 1978 a, b; Misra and Agarwal, 1989; Patnaik et al. 1989). However, there is much information of carbofuran application on various crop but lacks residue data in water chestnut accept in our earlier reports (Dixit and Banerji 1994; Banerji et al 2000; Banerji and Dixit 2001). However, in this paper we report the results of a survey and monitoring of carbofuran residues in water chestnut procured from the markets of different districts of Uttar Pradesh, Madhya Pradesh, Bihar and Maharashtra. The study would help in assessing the risk of human exposure to pesticides and in implementing integrated pest management.

MATERIALS AND METHODS

Water chestnuts were procured from the market at various localities of different districts of Uttar Pradesh, Madhya Pradesh, Bihar and Maharashtra (India) *viz.* Lakhimpur, Baharaich, Hardoi, Lucknow (village Purahiya) Kanpur, Lucknow (City), Basti, Jalesher, Bhopal, Gwalior, Ujjain, Indore, Patna, Vaishali, Bidupur, Hazipur, Jandaha and Bhusawal. The fruits were separated into kernel and peels prior to analysis. 50 gm each of kernel and peel were taken up for analysis. All the samples were analysed in triplicate according to the methods described earlier (Lee and Westcott, 1980; Dixit and Banerji, 1994).

RESULTS AND DISCUSSION

Survey and analysis of market samples from different districts of Uttar Pradesh, Madhya Pradesh, Bihar and Maharashtra during the period October to December 2001 showed carbofuran residues in the kernel of water chestnut ranging from

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Table 1. Carbofuran residue in Water chestnuts from different regions.

Location	Residue µg/g			
	Kernel		Peel	
	Range	Mean	Range	Mean
Uttar Pradesh				
Lakhimpur	0.33-0.35	0.34	0.40-0.49	0.45
Baharaich	0.17-0.30	0.23	0.23-0.25	0.24
Hardoi	0.54-0.56	0.55	0.46-0.51	0.49
Lucknow (village Purahiya)	0.14-0.17	0.16	0.13-0.15	0.14
Kanpur	0.13-0.15	0.14	0.13-0.15	0.14
Lucknow (City)	0.37-0.42	0.39	0.77-0.87	0.82
Basti	0.37-0.59	0.47	0.63-0.65	0.65
Jaleshar	0.32-0.62	0.49	0.89-0.93	0.91
Madhya Pradesh				
Bhopal	0.15-0.16	0.16	0.13-0.14	0.14
Gwalior	0.31-0.33	0.32	0.16-0.21	0.18
Ujjain	0.80-0.88	0.84	1.03-1.17	1.10
Indore	0.30-1.91	1.1	0.73-0.80	0.76
Bihar				
Patna	0.38-0.39	0.39	0.77-0.78	0.78
Vaishali	0.62-0.87	0.75	0.89-0.90	0.90
Bidupur	0.98-1.16	1.07	0.99-1.14	1.06
Hazipur	0.11-0.13	0.12	0.22-0.25	0.24
Jandaha	0.52-0.57	0.55	0.81-0.89	0.85
Maharashtra				
Bhusawal	ND	ND	0.12-0.28	0.20

ND= not detected

below detectable levels to 1.91 µg/g whereas the corresponding values for peels ranged from 0.12 to 1.17 µg/g. Amongst the eight places in Uttar Pradesh, residues of carbofuran ranged between 0.13-0.62 µg/g in kernels as compared to peels which showed residues in the range 0.13-0.93 µg/g. In Madhya Pradesh, residues of carbofuran were found to vary from 0.15-1.91 µg/g in kernels and 0.13-1.17 µg/g in peels from the four places *viz.* Bhopal, Gwalior, Ujjain and Indore. However, at five places in Bihar, the residue ranged from 0.11-0.87 µg/g and 0.22-0.90 µg/g respectively in kernel and peels while water chestnut from Bhusawal (Maharashtra) showed residue 0.12-0.28 µg/g in peels and below detectable limits in kernels. We found carbofuran residues below tolerance limits in most of the samples (Table 1) except Hardoi (0.54-0.56 µg/g) Basti (0.59-0.65 µg/g), Jaleshar (0.62-0.93) and Lucknow (0.77-0.87 µg/g) from Uttar Pradesh, Ujjain (0.80-1.17 µg/g) and Indore (0.73-1.91 µg/g) from Madhya Pradesh and most of the samples (0.52-1.16 µg/g) from Bihar region, in agreement to our findings (Dixit and Banerji 1994). All these samples showed

residues above tolerance limit of 0.5 μg/g (Anonymous 1985). This study calls for periodical monitoring program for water chestnut at different places of the country to understand the national scenario with particular reference to carbofuran.

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