

Lindane, Chlorpyrifos, and Quinalphos Residues in Mustard Seed and Oil

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Mustard is an extensively cultivated oil seed crop in India. It is only second in area and production to the prime crop of groundnut (Agnihotri 1999). Its seeds contain about 40% edible oil and the oil cake left after extraction of oil is valued as animal feed and concentrated organic manure (Gupta & Bhatnagar, 1990). The crop is infested with several insect pests, particularly mustard sawfly and aphids. Many insecticides, including lindane, chlorpyrifos and quinalphos, are recommended to control these insect pests but only a few of these have been tested for their persistence behaviour in the crop. Such information about lindane, chlorpyrifos and quinalphos is lacking. Therefore it was considered necessary to study the persistence of these insecticides in seeds and oil of mustard to find out if they persisted in above MRL (maximum residue limit) amounts and thus rendered the produce unsafe for human and animal consumption.

MATERIALS AND METHODS

The persistence studies of lindane, chlorpyrifos, and quinalphos were carried out in winter season of 1995-96 at ARS, Durgapura, Jaipur. Mustard var. T-59 was raised in 4mx5m plots. The doses of the insecticides tested were identical i.e., 500 and 1000g ai/ha. Each insecticide was applied to the crop twice as foliar spray. First application of the insecticide was made four weeks after germination of the crop and second three weeks later. The two treatments of each insecticide, alongwith one untreated control, were replicated three times. At crop maturity the samples of mustard seeds were collected from different treatments of each replication.

Twenty g of finely ground samples were extracted with n-hexane in a soxhlet for 8 hours and the extract was partitioned with acetonitrile.

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The acetonitrile layer was diluted with saturated solution of sodium chloride and again partitioned with 3x50 ml portions of n-hexane. The combined n-hexane layer was concentrated and cleaned up with concentrated sulphuric acid. The n-hexane layer was then washed with distilled water till the washings were neutral to litmus. The n-hexane layer was then dried over anhydrous sodium sulphate and concentrated to 5 ml.

Twenty g of powdered samples were extracted with acetonitrile and partitioned with n-hexane. The n-hexane layer was dried over anhydrous sodium sulphate, concentrated and chromatographed over silica gel (60-120 mesh). The column was eluted with n-hexane. The elute was concentrated to 5 ml.

Ground mustard seed samples were extracted with acetonitrile and then partitioned with chloroform : hexane (5:1). The extract after passing through anhydrous sodium sulfate, concentrated and chromatographed over florisil and the column was eluted with chloroform. The elute was evaporated to dryness. The residue was then dissolved in 5 ml of ethyl acetate.

To estimate the residues of lindane, chlorpyrifos and quinalphos in the oil of mustard seeds, oil was extracted from the seeds with hexane. A known weight of the oil was processed as above for residue estimation.

The residues of lindane, chlorpyrifos and quinalphos were analysed with Gas Liquid chromatograph (Tracor model 565) equipped with electron capture detector. For the estimation of lindane residues OV-210 column was used. The temperature of oven was kept at 190°C and detector 300°C. The residues of chlorpyrifos and quinalphos were analysed using OV-17 column, keeping the oven temperature at 230°C, injection port 250°C and detector 300°C.

RESULTS AND DISCUSSION

The analytical data pertaining to lindane, chlorpyrifos and quinalphos are given in Table 1. Perusal of the data showed that only lindane persisted in seed and oil at the time of crop maturity. Chlorpyrifos and quinalphos did not persist either in mustard seed or its oil. Similar results were reported for sunflower (Parihar & Gupta,

1998), groundnut (Bhatnagar & Gupta, 1992) and safflower (Bhatnagar and Gupta, 1998). In mustard at the lower dose of 500 g ai/ha, the average lindane residues were found to be 0.43 mg kg⁻¹ in seed and 1.0 mg kg⁻¹ in oil while at the higher dose of 1000 g ai/ha the residues were 0.52 mg kg⁻¹ in seed and 1.18 mg kg⁻¹ in oil. In all cases the residues were above maximum residue limit of lindane (0.05 ppm).

It was concluded from the above studies that no waiting period was required for safe consumption of mustard seeds and mustard oil when the crop was treated with chlorpyrifos and quinalphos at even higher test dose of 1000g ai/ha. But when lindane was sprayed on mustard crop, its seeds as well as oil were contaminated with insecticide residues at both the test doses of 500 and 1000g ai/ha in quantities above MRL (maximum residue limit). This made the use of lindane in mustard unsafe for human consumption of its seeds and oil.

Table 1. Residues Of Lindane, Chlorphriphos And Quinalphos In Mustard Seed And Oil

S.No.	Insecticide	Dose (g ai/ha)	Average Residues (mg kg ⁻¹)	
			Seed	Oil
1	Lindane 25 EC	500	0.43	1.0
		1000	0.52	1.18
2	Chlorpyrifos 20EC	500	BDL	BDL
		1000	BDL	BDL
3	Quinalphos 25 EC	500	BDL	BDL
		1000	BDL	BDL

MRL of lindane = 0.05 mg kg⁻¹

BDL = Below detectable limit

REFERENCES

- Agnihotri NP (1999) Pesticide safety evaluation and monitoring. Indian Agricultural Research Institute, New Delhi, p 173
- Bhatnagar A, Gupta A (1992) Persistence of Chlorpyrifos Residues in soil and groundnut seed. International Arachis News Letter 11:16-17

- Bhatnagar A, Gupta A (1998) Lindane, chlorpyrifos and quinalphos residues in safflower seeds and oil. *Pestic Res J* 10 : 127-128
- Gupta A, Bhatnagar A (1990) Persistence pattern and safety evaluation of oxydemeton methyl in mustard. *Pestology* vol 14:23
- Gupta A, Bhatnagar A (1998) A study on the dissipation of quinalphos in groundnut and loamy sand soil. *Adv Bios* 17:67-74
- Parihar NS, Gupta A (1998) Persistence of lindane and endosulfan residues in sunflower seeds and oil. *Pestology* vol 22 : 31-33