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Monitoring of chlorinated hydrocarbon insecticide and chlorpyriphos residues in market samples of chicken

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Abstract: Chlorinated hydrocarbon insecticide and chlorpyriphos residues were monitored in various parts of chicken sampled from Coimbatore, Tamil Nadu at the Department of Entomology, Tamil Nadu Agricultural University, Coimbatore. The results revealed that the liver and gizzard samples of chicken were contaminated with all the four HCH isomers. While, fat and flesh samples were contaminated only with a and y isomers of HCH. Heart was the least contaminated part with the residues of only y isomers of HCH and chlorpyriphos. The maximum level of HCH, endosulfan, DDT and chlorpyriphos residues in chicken was 0.227, 0.375, 0.119 and 0.469 µg/g respectively. Gizzard followed by liver was the most contaminated parts as against the heart, which was the least contaminated organ. None of the parts of chicken were contaminated with any of the organochlorine and chlorpyriphos residues above the maximum tolerance limit.

Key words: Chlorinated hydrocarbon insecticides, chlorpyriphos, residues, chicken

Introduction

The environmental and toxicological impacts of pesticides are highly dependent not only on the parent compound, but also on their metabolites (Kulkarni and Mitra, 1990). Albeit more than 1000 pesticides are in common use around the world and at least around 142 pesticides are registered for use in India. The chlorinated hydrocarbon insecticides, a group of very popular and fascinating insecticides, created awareness regarding their use for pest control in agricultural and public health programmes.

Among the various classes of pesticides, chlorinated hydrocarbons are regarded as having low acute toxicity. but possess a greater potential for chronic toxicity due to their, lipophilic nature. In view of their propensity to accumulate in biological systems, the use of several chlorinated hydrocarbon pesticides is either restricted or banned in several developed countries. The fear that the pesticide residues in some way may endanger plant and animal communities has encouraged a demand for systems of monitoring, which can measure pollutant levels and detect changes in these levels. Among the food commodities, mutton and chicken being rich in fat, contamination by the persistent and liphophilic chlorinated hydrocarbons is more likely, when compared with other pesticides like organophosphates, carbamates *etc.* Considering these, the present study on monitoring of chlorinated hydrocarbon insecticide and chlorpyriphos residues in different parts of chicken was carried out as an attempt to assess the current level of pesticides contamination

Materials and Methods

Monitoring of chlorinated hydrocarbon insecticides and chlorpyriphos residues in

Table 1. Residues (μg g^{-1}, fresh weight basis) of chlorinated hydrocarbon insecticides and chlorpyriphos in various parts of chicken

Residues	Heart n=5	Flesh n=5	Liver n=10	Gizzard n=10	Fat n=15
α - HCH	BDL	BDL-0.026 c=1	BDL-0.052 c=1	BDL-0.052 c=5	BDL-0.038 c=7
γ - HCH	BDL-0.077 c=3	BDL-0.039 c=2	BDL-0.019 c=8	BDL-0.019 c=6	BDL-0.019 c=6
β - HCH	BDL	BDL	BDL-0.227 c=2	BDL-0:227 c=2	BDL
δ – HCH	BDL	BDL	BDL-0.074 c=4	BDL-0.148 c=4	BDL
α - Endosulfan	BDL	BDL	BDL	BDL	BDL
β - Endosulfan	BDL	BDL	BDL	BDL	BDL
Endosulfan sulphate	BDL	BDL-0.250 c=1	BDL	BDL-0.375 c=1	BDL-0.125 c=1
o,p' DDE	BDL	BDL	BDL	BDL	BDL
o,p' DDT	BDL	BDL	BDL	BDL-0.119 c=1	BDL
p,p' DDD	BDL	BDL	BDL	BDL	BDL
p.p' DDT	BDL	BDL	BDL-0.022	BDL	BDL
Chlorpyriphos	BDL-0.469 c=3	BDL-0.078 c=1	BDL-0.0117 c=3	BDL-0.039 c=1	BDL

n - Number of samples analysed
c - Number of samples contaminated
BDL - Below Detectable Level

chicken were carried out in the Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore during 2000-2001. Market samples of fresh chicken were collected at weekly intervals at Coimbatore. Every time 200 gram of chicken flesh, chicken fat, chicken heart, chicken liver and gizzard were purchased and minced to small pieces and mixed thoroughly. From the well-mixed samples, a sub sample of 20 g was taken for analysis. Regarding heart samples 5 g was taken for analysis.

The samples drawn were extracted as far as possible immediately after being received. When the processing could not be done immediately, the samples were stored under refrigerated conditions at - 4°C. However, the storing was not prolonged beyond one week. Sub samples equivalent to 20 g or 5 g fresh weight were churned with 3 x 50 ml acetonitrile in a waring blender for 5 minutes. The combined extract was, filtered through Buchner funnel under mild suction and condensed. The acetonilrile extract was transferred to a 1 litre separating funnel. It was then diluted with 400 ml of saturated sodium chloride solution and partitioned with n-hexane by shaking thrice (3x50). The n-hexane portions were combined in a clean dry flask through a funnel having cotton plugged with 10-15 g of anhydrous sodium sulphate and condensed.

The concentrated n-hexane extracts were transferred to a glass separating funnel, Then 50 ml of concentrated sulphuric acid taken in another separating funnel held above this was added drop wise @ 4 ml/min, till the n-hexane layer became clear. The spent up sulphuric acid was discarded and the n-hexane layer was washed with 20 ml portions of distilled water repeatedly, till neutral to litmus. Then, the hexane layer was dried by passing through anhydrous sodium sulphate and concentrated to a suitable volume of 1-5 ml (Kapoor *et al.,* 1981).

HCH isomers, α and β endosulfan, endosulfan sulphate. DDT-R and chlorpyriphos residues in animal tissues were estimated by Chemito model 3800 gas chromatograph equipped with ^{63}Ni electron capture detector. The operating conditions were as follows:

Column : Chromato pack (6' long x 0.25' dia) packed with 1.5% OV 17 + 1.95% QF 1 on 80-100 mesh chw/HP.

Temperature (°C) : Oven - 200; injector - 220; detector base - 240; detector source – 260

Carrier gas flow rate : 60 ml/min

Attenuation : 8-32

Aliquot injected : 1 µl

The amount of residue is measured by comparing the sample response with the response of the standard using the formula:

$$\text{Residues in ppm} = \frac{Hs}{Hstd} \times \frac{M}{M1} \times \frac{V}{V1}$$

Where,

Hs - Peak height of the sample
Hstd - Peak height of the standard
M - Weight of the standard in ng
M1 - Weight of the sample in g/ml
V - Volume of the final extract in ml
V1 - Quantity of the sample injected in µl

Results and Discussion

The results of analysis revealed that liver and gizzard samples of chicken were contaminated with four HCH isomers (α, γ, β and δ). While, fat and flesh samples were contaminated only with α and γ isomers of HCH. Heart samples were contaminated only with γ isomer of HCH and chlorpyriphos residues. Apart from these, endosulfan sulphate-residues were detected in chicken flesh, gizzard and fat samples. Residues of p,p'-DDT was detected only in liver samples. Except fat samples, all other four parts analysed were detected for the residues of chlorpyriphos

(Table 1). The maximum level of HCH, endosulfan, DDT and chlorpyriphos residues detected in chicken was 0.227, 0.375. 0.119 and 0.469 μg/g, respectively. The results revealed that none of the parts of chicken sampled from Coirnbatore were contaminated with any of the organochlorine and chlorpyriphos residues above the maximum tolerance limit. Tripathi (1966) reported that 61 of the 63 samples of mutton from Pantnagar (U.P.) were contaminated with DDT residues at a mean level of 0.538 ppm. According to Lakshminarayana (1980), 15 of the 22 samples from Hyderabad (Andhra Pradesh) contained DDT residues with a maximum level of 0.15 ppm. In Delhi, all the 10 samples of goat fat were contaminated with DDT residues ranging from 0.5 to 1.6 ppm (Sharma *et al.,* 1979). Recently, Kaphalia and Scth (1981) also reported the presence of both DDT and BHC in various body tissues of goat, buffalo and chicken collected from slaughter houses situated in and around the city of Lucknow (Uttar Pradesh). Battu *et al.* (1984) reported that almost all the samples of meat of pig. chicken, sheep and goat were contaminated with residues of DDT and BHC. The present as well as the earlier studies suggest that the chicken sources in India in general, are contaminated with organochlorine insecticide residues at levels lower than those reported from western countries (Duggan and Duggan, 1973).

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