

Organochlorine Pesticide Levels in Barn Owls Collected in León, Spain

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Several studies have demonstrated that organochlorine pesticides have been the cause of the decline in population of several bird species. Birds of prey are very sensitive to poisoning by organochlorine pesticides due to its trophic position. As it is indicated by Joiris *et al.*, 1977, the study of the contamination of birds of prey by persistent pollutants, such as organochlorine residues, reflects both the use of these substances and their concentration along the food chains. Birds of prey can thus be used as a measure of the contamination of the ecosystems by persistent pesticides, and because of that reason they are frequently included in monitoring programs in spite of their reduced populations.

The purpose of the present study is to give some data on the levels of organochlorine pesticides in organs and tissues of barn owls (*Tyto alba*, Scop.) collected in the province of Leon, in the North-West of Spain. Barn owl is a nocturnal predator whose diet is primarily small rodents, occasionally feebly flying birds, mostly immatures, and insects. This bird is resident in the named province of Leon, therefore, a study of organochlorine pesticide levels will give us a degree of contamination in the area by this persistent pollutants.

MATERIALS AND METHODS

Organochlorine pesticide residues were determined in 23 barn owls obtained in Leon, Spain. They were measured in muscle, liver, fat, brain and kidney, by using a total of 91 samples.

The whole of the brain was removed for insecticide analysis. Portions of about 4 grams were taken from kidney, muscle and liver samples. It was only possible to obtain the perivisceral fat in six individuals, and its weight was variable depending on the bird body fat reserves. All the samples were frozen after collection until analytical treatment was performed.

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TABLE 1.- Average, range (in ppm/wet weight) and incidence percent of organochlorine pesticides in barn owls.

| | α -HCH | LINDANE | HEPTACHLOR EPOXIDE | ALDRIN | ENDRIN | DIELDRIN |
|-----------|---------------|-------------|-----------------------|-------------|-------------|-------------|
| KIDNEY | | | | | | |
| AVERAGE | 0.710 | 0.081 | 0.319 | 0.114 | 0.034 | 0.050 |
| RANGE | 0.051-2.381 | 0.005-0.343 | 0.010-1.326 | 0.027-0.304 | 0.007-0.086 | 0.050 |
| INCIDENCE | 95.65 | 69.57 | 91.30 | 82.60 | 30.43 | 4.35 |
| LIVER | | | | | | |
| AVERAGE | 0.323 | 0.036 | 0.161 | 0.059 | 0.036 | 0.009 |
| RANGE | 0.009-0.830 | 0.002-0.208 | 0.012-0.632 | 0.011-0.279 | 0.005-0.162 | 0.005-0.012 |
| INCIDENCE | 95.45 | 59.09 | 90.91 | 81.82 | 27.27 | 27.27 |
| BRAIN | | | | | | |
| AVERAGE | 0.238 | 0.012 | 0.072 | 0.034 | 0.052 | 0.221 |
| RANGE | 0.007-0.676 | 0.002-0.031 | 0.003-0.456 | 0.005-0.082 | 0.001-0.220 | 0.221 |
| INCIDENCE | 86.96 | 56.52 | 73.91 | 78.26 | 26.09 | 4.35 |
| FAT | | | | | | |
| AVERAGE | 1.073 | 0.051 | 0.134 | 0.090 | 0.014 | — |
| RANGE | 0.691-1.499 | 0.009-0.144 | 0.046-0.393 | 0.042-0.147 | 0.013-0.014 | — |
| INCIDENCE | 66.67 | 83.33 | 83.33 | 83.33 | 33.33 | — |
| MUSCLE | | | | | | |
| AVERAGE | 0.242 | 0.030 | 0.080 | 0.041 | 0.020 | 0.035 |
| RANGE | 0.019-0.591 | 0.003-0.083 | 0.009-0.163 | 0.013-0.122 | 0.006-0.034 | 0.010-0.059 |
| INCIDENCE | 94.12 | 70.60 | 76.47 | 76.47 | 11.76 | 11.76 |

TABLE 2.- Average, range (in ppm/wet weight) and incidence percent of organochlorine pesticides in barn owls.

| | o,p'-TDE | p,p'-TDE | p,p'-DDE | p,p'-DDT |
|-----------|-------------|-------------|-------------|-------------|
| KIDNEY | | | | |
| AVERAGE | 0.348 | 0.006 | 0.201 | 0.164 |
| RANGE | 0.017-0.743 | 0.006 | 0.009-1.606 | 0.013-1.158 |
| INCIDENCE | 21.74 | 4.35 | 86.96 | 56.52 |
| LIVER | | | | |
| AVERAGE | 0.052 | 0.031 | 0.090 | 0.050 |
| RANGE | 0.009-0.127 | 0.016-0.052 | 0.003-0.463 | 0.004-0.158 |
| INCIDENCE | 22.73 | 13.64 | 90.91 | 59.09 |
| BRAIN | | | | |
| AVERAGE | 0.032 | 0.032 | 0.043 | 0.044 |
| RANGE | 0.003-0.082 | 0.008-0.080 | 0.001-0.136 | 0.006-0.193 |
| INCIDENCE | 17.39 | 13.04 | 78.26 | 56.52 |
| FAT | | | | |
| AVERAGE | — | — | 0.482 | 0.134 |
| RANGE | — | — | 0.141-1.029 | 0.008-0.267 |
| INCIDENCE | — | — | 100.00 | 83.33 |
| MUSCLE | | | | |
| AVERAGE | — | 0.056 | 0.107 | 0.041 |
| RANGE | — | 0.023-0.077 | 0.004-0.700 | 0.008-0.138 |
| INCIDENCE | — | 17.65 | 94.12 | 76.47 |

The analytical treatment basically consists in the homogenization of each sample (Ahmad, 1979), extraction of homogenates and clean-up according to the method provided by Richardson *et al.*, 1971. All extracts were eluted through an activated florisil column to separate the pesticides in two fractions. The florisil column was conditioned for 24 h at 130°C.

Cleaned-up hexane extracts of tissues were examined qualitatively and quantitatively by gas-chromatography using a Hewlett Packard gas-chromatograph fitted with a nickel 63 electron capture detector.

The samples were analyzed on two gas chromatographic columns 6 feet long and 1/4 inch inside diameter, containing (a) a 1.5% coating of OV-17/1.95% of QF-1 on 100-200 mesh Chromsorb W (AW/DMCS) and (b) 3.8% of SE-30 on 80-100 mesh Chromsorb W (AW/DMCS).

The operating temperatures were: inlet 250°C; detector 300°C; column (a) 200°C and column (b) 180°C. The carrier gas was 5% argon-methane at a flow rate of 25 ml/min.

Extracts were analyzed for α -HCH, lindane, heptachlor epoxide, aldrin, dieldrin, endrin, o,p'-TDE, p,p'-TDE, p,p'-DDE and p,p'-DDT and were quantified by using a standard.

RESULTS AND DISCUSSION

The mean residue levels and ranges of organochlorine pesticides are summarized in Table 1 and Table 2, expressed in parts per million (ppm) by weight of wet sample. In the same tables is also summarized the incidence percent of organochlorine pesticides in the five types of samples.

α -HCH was found in most analyzed liver, kidney, brain and muscle samples. In a previous paper (Sierra *et al.*, 1984) we have obtained similar results in buzzards (*Buteo buteo*, L.).

The highest mean residue level of α -HCH was found in fat, 1.073 ppm, and this also represented the highest mean concentration for any organochlorine pesticide detected in this species.

p,p'-DDE was detected in all the fat samples, and its mean concentration was 0.482, the highest for this pesticide.

The residual levels that have been detected are lower than those reported by other authors. Peakall and Kemp, 1980, report a p,p'-DDE concentration of 0.05 ppm in muscle of barn owls collected in Canada. The average we have found in similar samples, 0.107 ppm, is higher than this one; nevertheless, these authors reported at the same time in Pretoria a 3.22 ppm and 0.8 ppm of p,p'-DDE in muscle and brain respectively, which are 30 and 20 times higher than our data.

On the other hand, Juillard et al., 1978, found 0.1 ppm of dieldrin in liver of two individuals collected in Switzerland. We have obtained dieldrin only in 6 of the 23 analyzed samples, and at lower concentrations than the cited authors.

This study shows that contamination of barn owls by organochlorine pesticides is low in Leon, Spain.

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Received February 10, 1986; accepted July 25, 1986