

# Organic chlorine insecticide residues in Goosanders and Red-breasted Mergansers

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## Summary

Appreciable quantities of residues of organic chlorine insecticides or their metabolites were found in eleven Goosanders and nine Red-breasted Mergansers collected in Scotland from March to July, 1964. The levels of contamination with dieldrin, which is very toxic to birds, were in most cases low compared with those reported in other birds feeding on freshwater fish in other areas of Britain.

## Introduction

Organic chlorine insecticide residues were shown by Moore and Walker (1964) to be present in two fish-eating birds, the Heron *Ardea cinerea* and the Great Crested Grebe *Podiceps cristatus*. The average residue concentrations in the breast muscle of these two species were much higher than those occurring in birds of prey such as the Sparrow-Hawk *Accipiter nisus*, the Barn Owl *Tyto alba*, the Tawny Owl *Strix aluco* and the Little Owl *Athene noctua*. Because such high concentrations of residue were found in two fish-eating species it was decided to determine the concentrations present in two fish-eating ducks, the Goosander *Mergus merganser* and Red-breasted Merganser *M. serratus*.

## Methods

Liver samples taken from eleven Goosanders and nine Red-breasted Mergansers were examined (by C. H. Walker) by gas-liquid chromatography (G.L.C.) as described by Goodwin, Goulden and Reynolds (1961) and de Faubert Maunder, Egan and Roburn (1964) and by paper chromatography (Evans, 1962). The extraction and clean-up for these techniques were similar to those described by de Faubert Maunder *et al.* (1964) except that a small layer of active charcoal (0.1g) was included in the alumina column when difficulty was experienced with pigmented material in the extracts. The G.L.C. results were obtained using a Perkin Elmer 452 gas chromatograph with an Apiezon column. Where the amounts of pesticide were large enough, paper chromatography was used to confirm the results obtained by G.L.C. Small amounts of pp<sup>1</sup>DDT and pp<sup>1</sup>TDE could not be measured, as breakdown of pp<sup>1</sup>DDT (sometimes with formation of pp<sup>1</sup>TDE) occurred on the Perkin Elmer instrument. Liver samples were taken in preference to breast muscle samples as higher levels of residues are usually found in the liver and it is becoming standard practice to use this organ in analysis of birds for organic chlorine insecticide residues.

## Results and Discussion

The results of the analyses for organic chlorine insecticide residues in the liver are given in Table I. As in other species of bird (Moore and Walker, 1964), pp<sup>1</sup>DDE was the most common and abundant residue found. This compound is a metabolite of pp<sup>1</sup>DDT and there is no evidence that it is biologically active to birds. On the other hand, dieldrin is very toxic to birds and Turtle *et al.* (1963) found 6.2 to 32.0 parts per million (p.p.m.) dieldrin to be present in the flesh of feral pigeons killed with this chemical. Dieldrin in avian tissues may come from insecticidal dieldrin, and/or from the conversion of aldrin which occurs very rapidly after entry into birds. Heptachlor epoxide is a metabolite of the insecticide heptachlor.

With the exception of two Goosanders from the Tweed, the levels of contamination in both the Goosander and the Red-breasted Merganser are quite low compared with those for other birds feeding on freshwater fish in other areas of Britain. Working with breast muscle, Moore and Walker (1964) found an average level of organic chlorine insecticide residues of 13.3 p.p.m. (wet weight) in seven Herons and 5.8 p.p.m. in four Great Crested Grebes. As pp<sup>1</sup>DDT is used widely outside agriculture, the source of the pp<sup>1</sup>DDE residues given in Table I is open to some doubt. Dieldrin and gamma BHC may have originated from sheep dips.

Samples of Salmon parr, which are frequently eaten by both the Goosander and the Red-breasted Merganser, were taken from two Ross-shire rivers, the Meig and the Bran and from the upper reaches of the Aberdeenshire Dee. They were analysed for organic chlorine insecticide residues by Mr. A. V. Holden of the Freshwater Fisheries Laboratory, Pitlochry, who found that 12 whole parr from the Meig and Bran contained respectively about 0.020 and 0.003 p.p.m. dieldrin (wet weight) and 0.005 and 0.003 p.p.m. pp<sup>1</sup>DDE. The average amount of dieldrin plus pp<sup>1</sup>DDE in 13 fish from the Aberdeenshire Dee was 0.03 p.p.m. (wet weight). In

Table I. Residues of organic chlorine insecticides found in Red-breasted Mergansers and Goosanders in Scotland in 1964.

Locality	Date	Residue (p.p.m. wet weight)			
		pp <sup>1</sup> DDE	Dieldrin	Gamma BHC	Heptachlor epoxide
<b>Red-breasted Merganser</b>					
R. Conon, Ross-shire	29.4.64	0.70		0.10*	
R. Carron, E. Ross-shire	3.7.64	<0.20			
R. Tay, Perthshire	6.7.64	1.1			
"	6.7.64	2.3	0.44		<0.10*
"	6.7.64	0.30	0.04*		
"	6.7.64	0.13			
"	6.7.64	0.56	0.20*	0.28*	
"	6.7.64	2.0	0.20*	0.30*	
"	6.7.64	1.15	0.40*	0.27*	
<b>Goosander</b>					
R. Tweed, Berwickshire	26.3.64	9.3	10.2	<0.10*	
"	15.4.64	43.0	3.4		
R. Orrin, Ross-shire	23.4.64	1.2			
R. Garry, Inverness-shire	9.5.64	3.7	<0.10*		
R. Dee, Aberdeenshire	2.7.64	0.90			
"	2.7.64 <sup>a</sup>	0.20*	0.20		
"	2.7.64 <sup>a</sup>	<0.20*			
"	2.7.64 <sup>a</sup>	0.30*			
"	2.7.64 <sup>a</sup>	0.50			
R. Tummel, Perthshire	6.7.64 <sup>a</sup>	0.23			
"	6.7.64 <sup>a</sup>	0.27			

<sup>a</sup> Fledglings. \* Not confirmed by paper chromatography

the River Clunie, Aberdeenshire, the values for dieldrin and pp<sup>1</sup>DDE in Salmon parr were 0.002 p.p.m. and 0.016 p.p.m. (both unit wet weight) respectively. Though these quantities are small, they may be of

biological significance because of the accumulation of insecticide residues through the food chain which has been demonstrated in the Western Grebe on Clear Lake, California (Hunt and Bischoff, 1960).

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