PESTICIDE SECTION

CANADIAN WILDLIFE SERVICE

MANUSCRIPT REPORTS

Dieldrin and Heptachlor Epoxide in Alberta and Saskatchewan Wildlife

No. 27

R.W. Fyfe

1973

CANADIAN WILDLIFE SERVICE

PESTICIDE SECTION
MANUSCRIPT REPORTS

C.W.S. Manuscript Reports are compilations of research data reflecting the activities of Toxic Chemicals (formerly Pesticide) Section personnel and contractors and are not intended for general distribution. Some of the material in this report will eventually appear in published form, and prior right to publication is reserved. Enquiries concerning the content of this report should be addressed to the author; requests for copies should be made to the author or to the Toxic Chemicals Section, Canadian Wildlife Service, Department of the Environment, Ottawa, Ontario, K1A 0H3.

Dieldrin and Heptachlor Epoxide in Alberta and Saskatchewan Wildlife

A Report to the Western Committee on Crop Pesticides, Saskatoon, 25 October, 1971 amended July, 1973

by

R.W. Fyfe
Canadian Wildlife Service
Edmonton

Initial and subsequent samples collected by the Canadian Wildlife Service in the 1960's of prairie predatory birds and their prey clearly indicated that the primary toxic chemical residues in western Canada wildlife were DDT and its metabolites, mercury, dieldrin, and heptachlor epoxide. These substances were found in samples throughout the prairie region with residue levels in the flesh of seed-eating game birds frequently above actionable levels based on human food standards and residues in the tissues of predatory birds and seed-eaters occasionally at lethal or near-lethal levels.

Having once identified the principal contaminants, it was then necessary to identify the sources of contamination and to determine the effects of the residues on wildlife. Much of CWS toxic chemical work in western Canada has therefore been based on these two primary objectives, with the result simply that for the most part we have been able to identify the sources of the four contaminants and have also identified some of the effects of these chemicals on predatory birds and seed-eaters. The data on DDT and mercury were used by CWS in discussions leading to restricting the use of DDT in 1969 and withdrawing mercury registrations in 1970.

We were then faced with the problems of 1) identifying the primary source of the other two contaminants, dieldrin and heptachlor epoxide, in western Canada, and, 2) the potential need for a suitable alternative for wireworm control, should aldrin and heptachlor cereal seed treatments be shown as the primary source. We therefore undertook a cooperative study with Dr. R. Burgess of the Saskatoon Research Station of the Canada Department of Agriculture and the two provincial (Alberta and Saskatchewan) wildlife agencies. Dr. Burgess agreed to carry out tests

with the current alternate seed treatment (Lindane) on pheasants and to conduct field checks on the amount of grain left exposed on fields following normal seeding procedures. CWS agreed to carry out the bulk of the field sampling of seed-eaters and their predators, and the provincial wildlife agencies agreed to assist, to collect samples where possible, and to report on the residues in upland game species.

Eight sample areas were designated where cereal grain seed treated with aldrin or heptachlor was being used, and samples of seed-eating birds and mammals were collected prior to, during, and following seeding in 1970 and 1971. In addition a corresponding series of samples were collected from untreated areas. Samples of the eggs of predatory birds were collected in conjunction with continuing CWS studies on Merlins (Falco columbarius)and Prairie Falcons (Falco mexicanus). (Fimreite et al., 1970; Fyfe, 1969; Fyfe et al., 1969; Keith and Gruchy, 1972). Analysis methods are described in Reynolds, 1971.

The results of this cooperative study were summarized (Tables 1 to 10) and presented to the Western Committee on Crop Pesticides on October 25, 1971, in Saskatoon.

Tables 1-4 show that dieldrin and heptachlor epoxide residues were elevated in seed-eaters on all treated areas during and after seeding but did not increase in untreated control areas. The differences between treated and untreated areas are highly significant. The species of seed-eating birds and mammals sampled are listed in the Appendix. As indicated in Tables 5 and 8, mean dieldrin or heptachlor epoxide residues range from 0.33 to 0.78 in the eggs of two predatory species whose main

diet is seed-eating birds and mammals. Residue levels by area are shown in Tables 6, 7, 9, and 10. Field studies show both species declining and exhibiting low productivity in Alberta and Saskatchewan.

Following a lengthy discussion of these data at the 1971 WCCP meeting, the recommendations for aldrin and heptachlor seed treatment for wireworms in cereal crops were dropped by the committee. These uses of aldrin and heptachlor then dropped sharply in the 1972 and 1973 sowing, and at the time of writing, July 1973, the Canada Department of Agriculture is proposing to registrants that registration of these uses be suspended as of January 1, 1974, on the grounds that the uses have caused residue problems and suitable alternatives are available.

References

FIMREITE, N., R.W. FYFE and J.A. KEITH. 1970. Mercury contamination of prairie seed eaters and their avian predators. Can. Field-Natur. 84: 269-276.

FYFE, R.W. 1969. Population and pesticide levels in western birds of prey. Western Region Pesticide Section Progress Report No. 3, Canadian Wildlife Service. 44 p.

FYFE, R.W., J. CAMPBELL, B. HAYSON and K. HODSON. 1969. Regional population declines and organochlorine insecticides in Canadian Prairie Falcons. Can. Field-Natur. 83: 191-200.

KEITH, J.A. and I.M. GRUCHY. 1972. Residue levels of chemical pollutants in North American birdlife. pp. 437-454. Proc. XV Int. Ornithol. Congress, The Hague, 30 Aug. - 5 Sept. 1970. K.H. Voous (ed.). E.J. Brill publishers, Leiden.

REYNOLDS, L.M. 1971. Pesticide residues analysis in the presence of polychlorobiphenyls (PCB's). Residue Rev. 34: 27-57.

ALDRIN SEED TREATMENT

Table 1. Comparison of dieldrin levels (ppm wet weight) in whole bodies of seed-eating birds and mammals.

	Dieldrin Residues from Treated Areas		Dieldrin Residues from Untreated Areas		Significance of Difference Between Groups
	(n)	$\bar{x}$ ± SE	(n)	$\bar{x}$ ± SE	
Seed-eating mammals	10	0.87 ± 0.57	12	0.00 ± 0.00	
Seed-eating birds	33	0.68 ± 0.12	53	0.04 ± 0.01	P<0.001
All seed eaters	43	0.72 ± 0.16	65	0.03 ± 0.01	P<0.001

Note - all (n) values are pools of 5 specimens

Table 2. Comparison by collection area of dieldrin levels (ppm) wet weight in whole bodies of seed eaters.

	Dieldrin Residues from Treated Areas		Dieldrin Residues from Untreated Areas		Significance of Difference Between Groups
	(n)	$\bar{x}$ ± SE	(n)	$\bar{x}$ ± SE	
Area #1 (1970) Drumheller	17	1.41 ± 0.31	23	0.08 ± 0.03	P<0.001
Area #2 (1971) Hilda	9	0.15 ± 0.07	18	0.00 ± 0.00	P<0.005
Area #3 (1971) Hanna	9	0.20 ± 0.06	13	0.00 ± 0.00	P<0.001

Note - all (n) values are pools of 5 specimens

Table 3. Comparison of heptachlor epoxide levels (ppm wet weight) in whole bodies of seed-eating birds and mammals.

	Heptachlor Epoxide Residues from Treated Areas		Heptachlor Epoxide Residues from Untreated Areas		Significance of Difference Between Groups
	(n)	$\bar{x}$ ± SE	(n)	$\bar{x}$ ± SE	
Seed-eating mammals	5	0.63 ± 0.48	4	0.02 ± 0.02	
Seed-eating birds	32	0.40 ± 0.14	25	0.01 ± 0.00	P<0.01
All seed eaters	37	0.43 ± 0.13	29	0.01 ± 0.00	P<0.005

Note - all (n) values are pools of 5 specimens

Table 4. Comparison by collection areas of heptachlor epoxide levels (ppm wet weight) in whole bodies of seed eaters.

	Heptachlor Epoxide Residues from Treated Areas		Heptachlor Epoxide Residues from Untreated Areas		Significance of Difference Between Groups
	(n)	$\bar{x}$ ± SE	(n)	$\bar{x}$ ± SE	
Area #4 Kindersley	15	0.46 ± 0.22	16	0.12 ± 0.00	P<0.025
Area #5 Scotfield	17	0.47 ± 0.21	13	0.01 ± 0.00	P<0.05

Note - all (n) values are pools of 5 specimens

Table 5. Dieldrin levels (ppm wet weight) in the eggs of predatory birds in Alberta and Saskatchewan, 1967 to 1970.

Species	(n)*	$\bar{x}$ ± SE	Range
Prairie Falcon	135	0.33 ± 0.08	(0.00 - 8.94)
Merlin	61	0.53 ± 0.07	(0.03 - 2.25)

Table 6. Dieldrin levels (ppm wet weight) by area in the eggs of Alberta and Saskatchewan Prairie Falcons, 1967 to 1970.

Area	(n)*	$\bar{x}$ ± SE	Range
Big Muddy Valley	23	0.08 ± 0.06	(0.02 - 0.77)
South Sask. River	26	0.23 ± 0.05	(0.02 - 1.01)
Bow River	24	0.82 ± 0.44	(0.00 - 8.94)
Old Man River	19	0.23 ± 0.05	(0.03 - 0.94)
Red Deer River	14	0.13 ± 0.03	(0.03 - 0.42)
Bassano	22	0.14 ± 0.03	(0.03 - 0.77)

Table 7. Dieldrin levels (ppm wet weight) by area in the eggs of Alberta Merlins, 1969 to 1970.

Area	(n)*	$\bar{x}$ ± SE	Range
Hanna	31	0.54 ± 0.11	(0.03 - 1.93)
South Sask. River	27	0.56 ± 0.11	(0.05 - 2.25)

* - All (n) values are of individual eggs.

Table 8. Heptachlor epoxide levels (ppm wet weight) in the eggs of predatory birds in Alberta and Saskatchewan 1967 to 1970.

Species	(n)*	$\bar{x}$ ± SE	Range
Prairie Falcon	134	0.59 ± 0.07	(0.02 - 7.04)
Merlin	61	0.78 ± 0.11	(0.08 - 4.63)

Table 9. Heptachlor epoxide levels (ppm wet weight) by area in the eggs of Alberta and Saskatchewan Prairie Falcons 1967 to 1970.

Area	(n)*	$\bar{x}$ ± SE	Range
Big Muddy Valley	22	0.51 ± 0.09	(0.02 - 1.75)
South Sask. River	26	0.73 ± 0.13	(0.10 - 2.77)
Bow River	24	0.75 ± 0.30	(0.08 - 7.04)
Old Man River	20	0.50 ± 0.07	(0.05 - 1.06)
Red Deer River	14	0.66 ± 0.17	(0.19 - 2.26)
Bassano	22	0.30 ± 0.04	(0.07 - 0.78)

Table 10. Heptachlor epoxide levels (ppm wet weight) by area in the eggs of Alberta Merlins 1969 to 1970.

Area	(n)*	$\bar{x}$ ± SE	Range
Hanna	31	0.51 ± 0.09	(0.08 - 1.78)
South Sask. River	29	1.15 ± 0.21	(0.17 - 4.63)

* - All (n) values are of individual eggs.

Appendix

Seed-eating mammals

Richardson's ground squirrel	*Spermophilus richardsonii*
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
white-footed mouse	*Peromyscus leucopus*

Seed-eatings birds

Sharp-tailed Grouse	*Pedioecetes phasianellus*
Horned Lark	*Eremophila alpestris*
English Sparrow	*Passer domesticus*
Western Meadowlark	*Sturnella neglecta*
Redwinged Blackbird	*Agelaius phoeniceus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Savannah Sparrow	*Passerculus sandwichensis*
Vesper Sparrow	*Pooecetes gramineus*
Chipping Sparrow	*Spizella passerina*
McCown's Longspur	*Rhynchophanes mccownii*
Chestnut-collared Longspur	*Calcarius ornatus*