

AGRICULTURAL PESTICIDES IN WILD TURKEYS IN
SOUTHERN ILLINOIS

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Abstract: Adipose tissue from 55 male turkeys, killed during the 1974 hunting season in southern Illinois, was analyzed for pesticide concentrations by gas/liquid chromatography. Twelve pesticides were identified in the samples with only four, total DDT, heptachlor epoxide, toxaphene, and linuron, present in all samples. Concentrations ranged from 0.22 ppm to 0.88 ppm.

The wild turkey (Meleagris gallapavo, Linn.) is an important gamebird for a limited number of Illinois hunters. Management of the turkey requires an understanding of factors that may influence their health and productivity. As in other galliform birds, pesticides may influence behavior and thereby survival (Baxter et. al. 1969, Dahlgren and Linder 1971, Dahlgren and Linder 1974, McEwen and Brown 1966). The probability that turkeys will be exposed to some pesticide is high since the wild turkey has a varied diet which includes mast, fruits, cultivated crops, grasses, and a multitude of invertebrates (Edminster 1954). This is a report of a survey of pesticides in the adipose tissue of wild turkeys harvested in southern Illinois in 1974.

Data in this paper are from an M.S. thesis, Department of Zoology, Eastern Illinois University. The study was supported in part by Illinois Department of Conservation Federal Aid Project W-63-R. Dr. J. Ellis, Chemistry Department, Eastern Illinois University, assisted with the chemical instrumentation and extraction procedures.

MATERIALS AND METHODS

Turkeys were killed by hunters in Jackson, Union, Alexander, and Pope Counties in southern Illinois during two 5-day hunting seasons in April, 1974. At check stations in each county, fat samples were removed from either the interfurcular fat depot or the "breast sponge." Fat samples were pooled by age class and county into ten groups. Extraction procedures described in the Pesticides Analytical Manual, Volume III (U.S. Dept. Health, Education, and Welfare 1970) were followed verbatim except that 15-20 gm of adipose tissue were required to produce 1.5-2.5 gm of fat. The fat obtained was accurately weighed and all was used. A reagent control was prepared after each extraction by following all extraction procedures without the adipose tissue.

Extracts were analyzed with a Varian Aerograph, Series 2800 gas chromatograph with an electron capture detector, and an A-25 recorder. Nitrogen, the carrier gas, was allowed to flow at a column head pressure of 58 psi. The column was 4 x 1830 mm stainless steel, and packed with 3% QF-1 with a solid support of 80/100 mesh Chromosorb W, acid washed and treated with dimethyl dichlorosilane. Injector, column, and detector temperatures were 200°, 200°, and 225° C, respectively.

Pesticide standards were obtained from the U.S. Environmental Protection Agency's Toxic Substances Effects Laboratory, Research Triangle Park, North Carolina. Standard solutions of 1.0 ppm were prepared, injected into the gas chromatograph, and retention times noted. Mixtures of the standard solutions were made to determine retention times of pesticide combinations. Identification of pesticides in fat samples was made by comparing retention times with peaks of standard mixtures. Pesticides were quantified using the disc integrater on the recorder and comparing integrations with those of 1.0 ppm solutions.

RESULTS

The 1974 hunting season resulted in a harvest of 55 male turkeys, 33 adults and 22 juveniles. Adipose tissue was collected from 54 birds. One bird (J-14) was noted to have a noticeably small gizzard and liver, overly large testes for a juvenile, large quantities of yellow unvascularized fat, and brown legs. The bird was believed to be domestic; its fat was analyzed separately from other juveniles from Jackson County.

The turkeys sampled contained 13 identified pesticides (Table 1). No residues of malathion, methoxychlor, alachlor, bromacil, propachlor, 2, 4-D and 2, 4, 5-T were detected. Most pesticides occurred at less than 0.30 ppm and none occurred at greater than 0.88 ppm (simazine). Heptachlor epoxide, toxaphene, linuron, and DDT and its isomers, were present in all samples. Toxaphene (0.12 to 0.82 ppm) and total DDT (0.12 to 0.83 ppm) showed the heaviest concentrations while Heptachlor epoxide and linuron were in trace amounts (< 0.10 ppm) and never occurred in concentrations greater than 0.16 ppm.

TABLE 1. Pesticide concentrations (ppm) in the adipose tissue of wild turkeys harvested in 1974 in southern Illinois

Pesticide	Jackson County		Union County				Alexander County		Pope County	J-ll
	Adult 10 ^a	Juvenile 3 ^a	South Adult 4 ^a	North Adult 8 ^a	South Juvenile 3 ^a	North Juvenile 4 ^a	Adult 8 ^a	Juvenile 8 ^a	5 ^a	1 ^a
Aldrin	--	--	--	--	--	--	--	--	--	.55
Atrazine	--	--	--	--	--	--	.61	.50	.50	--
Chlordane	--	--	--	.19	--	.19	.60	.47	.12	--
Total DDT	.41	.30	.61	.83	.37	.72	.29	.24	.71	.12
Dieldrin	.36	.07	.14	.38	.14	.18	--	--	.23	.05
Endrin	--	--	--	--	--	--	.59	.45	--	--
Heptachlor epoxide	.14	.09	.10	.16	.08	.10	.10	.09	.13	.09
Lindane	.09	.07	.13	.11	.04	.09	.11	.02	--	--
Linuron	.12	.09	.14	.12	.13	.10	.10	.08	.08	.06
Silvex	--	--	.20	.24	.10	.13	.49	.28	.30	--
Simazine	.27	--	--	--	--	--	--	--	--	.88
Toxaphene	.51	.37	.58	.68	.39	.56	.43	.29	.82	.12
Trifluralin	.12	--	--	--	--	--	--	--	--	--
TOTAL	2.22	1.19	2.10	2.91	1.45	2.27	3.52	2.62	3.09	2.07
County Mean	0.26									0.46

^aNumber of birds in sample

Differences in pesticide concentrations were evident between counties and between age groups. Pope County had the heaviest concentration (0.62 ppm) per bird. Atrazine and endrin were noted only in Alexander County and trifluralin and simazine only in Jackson County. Juvenile birds, with few exceptions had the same pesticides as an adult but concentrations were usually less. The sample from J-14 was the only one with aldrin and, it contained more simazine and less total DDT and toxaphene than other birds.

Unidentified pesticides were present in four of the 10 samples. Jackson County juveniles contained 19.2%, unknown, south Union County juveniles 2.4%, Alexander County juveniles 3.8%, and the J-14 sample 23.2%.

The percentage of fat in the adipose tissue, determined during the extraction procedures, ranged from 18.2% in Pope County to 5.8% for the northern Union County juveniles. The J-14 sample was an exception; 65% of the adipose tissue was fat. There was no correlation ($P > 0.10$) between fat concentration or average body weight and the total pesticide concentrations in the groups using Spearman's correlation test (Langley 1971).

DISCUSSION

The pesticides found in fat samples of wild turkeys were within the tolerance levels set for poultry products by the U.S. Environmental Protection Agency with the exception of the dieldrin in adults of Jackson County and north Union County. The concentrations of dieldrin in these two samples slightly exceed the 0.30 ppm tolerance level. According to W. H. Stickel (Patuxent Wildlife Research Center, personal communication) these tolerance levels offer much latitude and no ill effects can be expected from consumption of these birds. Furthermore, pesticides reported for Illinois wild turkeys are from adipose tissue rather than muscle tissue which is usually consumed.

The pesticides found in the Illinois turkeys are indicative of those used in agricultural practices in southern Illinois (Steve Moore III, Illinois Natural History Survey, personal communication, and Dr. R. Hill, Illinois Department of Agriculture, Regional Diagnostic Laboratory, Centralia, Illinois, personal communication). According to Dr. Moore, dieldrin is used in orchards and could result from isomerization of aldrin used to treat row crops. Heptachlor epoxide, chlordane, toxaphene, and methoxychlor are applied to grain crops. Further, he said that although DDT is not now being used, it could be expected from its past usage on orchards and row crops. Dr. Hill has detected atrazine, simazine, alachlor, linuron, 2, 4-D, 2, 4, 5-T, trifluralin, and propachlor in plants and soils from Jackson, Union, Alexander, and Pope Counties. These herbicides are used to control vegetation in agriculture and on road, pipeline and powerline rights-of-way.

Turkeys range into cultivated fields and are exposed to agricultural pesticides directly, or chlorinated hydrocarbons could be transported from farm to forest by runoff. Pesticides applied within the forest might also reach the turkeys directly. Methoxychlor, malathion, lindane, and chlordane are used for control of foliage feeders such as lepidopteran larvae; dieldrin, aldrin and occasionally DDT are applied to control soil larvae such as some coleopteran larvae; and 2, 4-D 2, 4, 5-T, simazine, atrazine, trifluralin, and bromacil are used to control vegetation (K. F. Ford, Commonwealth Associates Inc., personal communication). District rangers report the use of malathion in Jackson County at the rate of 1.25 lbs/acre to control the alfalfa weevil; 2, 4-D was used in Pope, Union, and Jackson Counties at the rate of 4 lbs/acre to retard revegetation; and simazine was used in Jackson County for vegetation control. (R. A. Tucker, J. Newcomb, and G. H. Lyon Jr., District Rangers, Vienna, Jonesboro, and Murphysboro Ranger Districts, respectively, personal communication).

There are no published data on pesticides in wild turkey populations; however, some work has been done with domestic turkeys (Anderson et al. 1951, Marsden and Bird 1947) and other wild galliform birds. Domestic turkeys eating meal containing 0.075% (750 ppm) DDT or more showed depressed growth and even death (Marsden and Bird 1947). This is a concentrated amount of DDT; it is unlikely that wild turkeys would be exposed to similar concentrations. Dieldrin, tested on sharp-tailed grouse in the field, was found to adversely affect the behavior of breeding males receiving 25 mg pesticide/kg of body weight (McEwen and Brown 1966). Nusz et al. (1976) tested bobwhites with dieldrin and found they gained less weight than undosed birds. Toxaphene has been found by Genelly and Rudd (1956) to depress egg production, fertility, and hatchability if given to pheasants in concentrations of 300 ppm or more.

Numerous workers reported that egg production, egg weight, clutch size, number of clutches, fertility, and hatchability of gallinaceous birds was unaffected by most chlorinated hydrocarbons (Dahlgren and Linder 1974, Davison and Sell 1972, Lillie et al. 1973, Messick et al. 1974, and Whitehead et al. 1972). Dahlgren and Linder (1974) noted that the progeny of cock and hen pheasants fed dieldrin showed aberrant behavior through the third generation. We can draw no conclusions about the effects of pesticides in Illinois wild turkeys.

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