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## **A PRELIMINARY SURVEY OF PESTICIDE RESIDUES IN WHITETAIL DEER (*Odocoileus virginianus*)**

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### Abstract

A pesticide analysis was run on 21 deer collected from the Mississippi Delta Region during the winter of 1969-1970.

The primary tissues analyzed were flesh, liver and fat. The residues found were DDT and its metabolites. Average DDT and metabolites concentrations of the tissues were: flesh 0.062 p.p.m.; liver 0.194 p.p.m.; fat 1.210 p.p.m.

### INTRODUCTION

Due to the plethora of pesticide usage in the Mississippi Delta Region, the Mississippi Game and Fish Commission initiated a survey of pesticide residues in whitetail deer of this region.

Several investigators have found pesticide residues in fish flesh, water and bottom sediments of lakes within the Delta Region; Prather and Ferguson (1966), Barthel, et al. (1969), Bingham (1969), Herring and Cotton (1970). Prior to this time no residue analysis of whitetail deer had been made in this region. However, in other areas of the country, residue analyses of whitetail deer, mule deer and elk have been made. In South Dakota 23 whitetail deer were found to contain an average of 0.2 p.p.m. of DDT+metabolites in renal fat; Greenwood, et al. (1967). Jewel (1967) found mule deer fat to range from 0.4-2.8 p.p.m. of endrin. Pillmore and Finley (1963) reported finding 0.05-42.0 p.p.m. of DDT+metabolites in mule deer from Montana, Colorado and New Mexico.

The purpose of this paper is to report the residues found in whitetail deer collected during the winter of 1969-1970 from three areas in the Mississippi Delta Region.

## SAMPLING AREAS

*Leflore-Sunflower Area:* Area is composed of small patches of timberland completely surrounded by some type of agriculture (Figure 1). Cotton and soybeans are the major crops grown in this area. The combined acreage of timberland is approximately 4600 acres that produce an annual harvest of 17.7 adult bucks per square mile of timberland. Area is currently supporting 1 deer per 3-5 acres of timberland. Deer in this area are dependent on agricultural crops for subsistence. Winter browse is substantially depleted by late winter.

*Delta Wildlife:* This area is one 19,000 acre block of 30 to 50 year old bottomland hardwood bordered on one side by the Little Sunflower River with agriculture bordering the remaining sides (Figure 2). Annual kill is about 200 adult bucks a year, which is 6.7 bucks per square mile of timberland. Area is presently carrying 1 deer per 10 acres of timberland. The deer have access to agricultural crops but not to the extent the deer have in the Leflore-Sunflower Area.

*Tennessee Bar and Management Area:* There are 7200 acres of timberland in this area which is located between the main protection levee of the Mississippi River and the River (Figure 3). The annual deer kill is 100 adult bucks, with a density of approximately 1 deer per 10 acres. The deer in this area do not have ready access to browse on agricultural crops.

## METHODS AND PROCEDURES

Samples for pesticide analyses were taken by biologists from deer killed during regular hunting season by hunters. One to two pound samples of liver, fat and flesh were taken immediately and frozen or put on ice in the field. Parts of deer where samples were taken were the lower lobe of the liver, fat around the kidney and flesh from the upper part of the hind quarter. After the samples arrived at the laboratory they were quartered and blended individually in a Waring blender. A 10 gram subsample was taken from the blended sample for each sample of fat, flesh and liver. These 10 gram subsamples were used for pesticide extractions.

Each of the 10 gram samples was then placed in a Waring blender with 175 ml. of hexane and homogenized for 3 minutes. The supernatant liquid was decanted and the remaining tissue reblended with another 175 ml. of hexane for 3 minutes. The extracts were combined and filtered through Whatman #1 and #3 filter paper into a 400 ml. beaker. The extract was then evaporated on a hot water bath to approximately 10 ml. Twenty-five ml. of acetonitrile saturated with hexane was added to a separatory funnel with the 10 ml. extract. Pesticides were extracted into the acetonitrile by gently rocking the separatory funnel back and forth for 30 seconds. The solvent layer was drained into a Kuderna-Danish evaporator. Extract was re-extracted with 3 additional 25 ml. portions of acetonitrile saturated with hexane. All the acetonitrile extracts were collected in Kuderna-Danish evaporators and evaporated to dryness on a hot water bath and under a gentle stream of dry air. The resulting residue was taken up in 10 ml. of hexane.

Required cleanup procedure using florisol was performed.

Analyses of samples were determined on a Micro-Tek 220 gas chromatograph equipped with tritium foil electron capture detector cells. A dual column system was employed to identify and confirm suspected pesticides. The multiple columns used were a 3% DC 200 on 100/120 mesh Gas Chrom Q and 9% QF-1 on 100/120 mesh Gas Chrom Q. Ancillary confirmation techniques were not employed. Operating parameters were as follows:

Temperature: Detector - 185°C

Inlet - 220°C

Column Oven - 175°C

Carrier Gas: Nitrogen

Although all samples were screened for 17 organochlorine pesticides, only p,p'-DDT, p,p'-TDE and p,p'-DDE were routinely found. Trace amounts of toxaphene were found in four liver samples and trace amounts of endrin found in one fat sample. Pesticides identified at concentrations lower than .001 p.p.m. were recorded as trace.

Figure 2. Sketch of Leflore Sunflower Area.

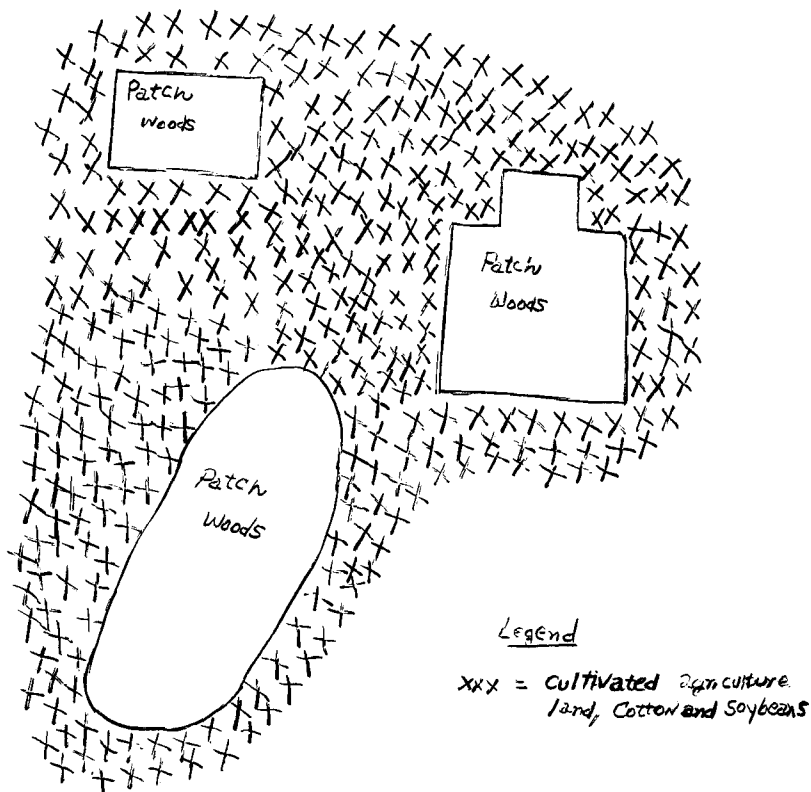


Figure 20. Sketch of Delta Wildlife Area

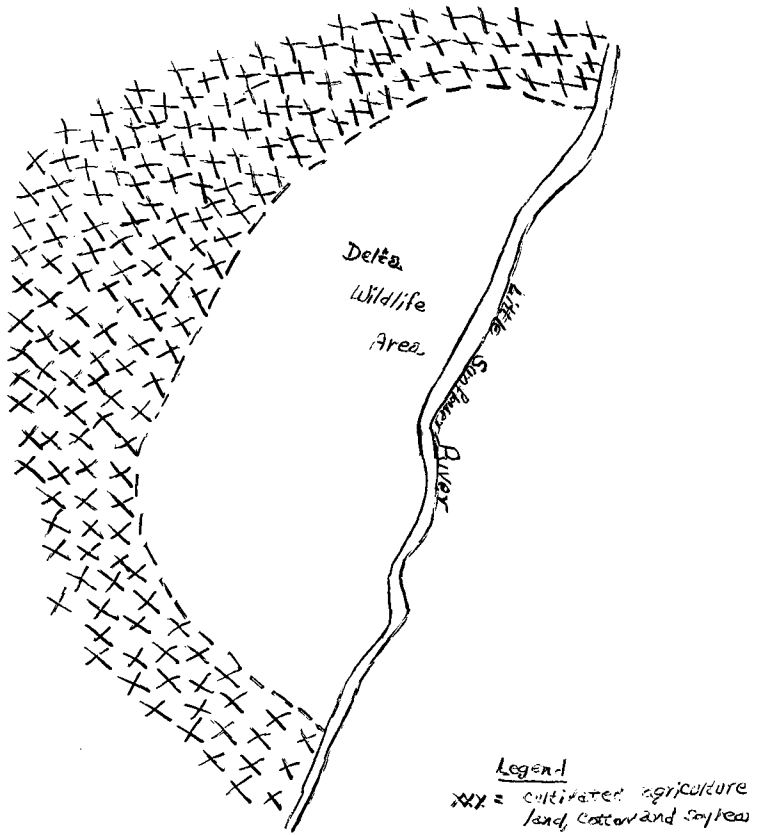
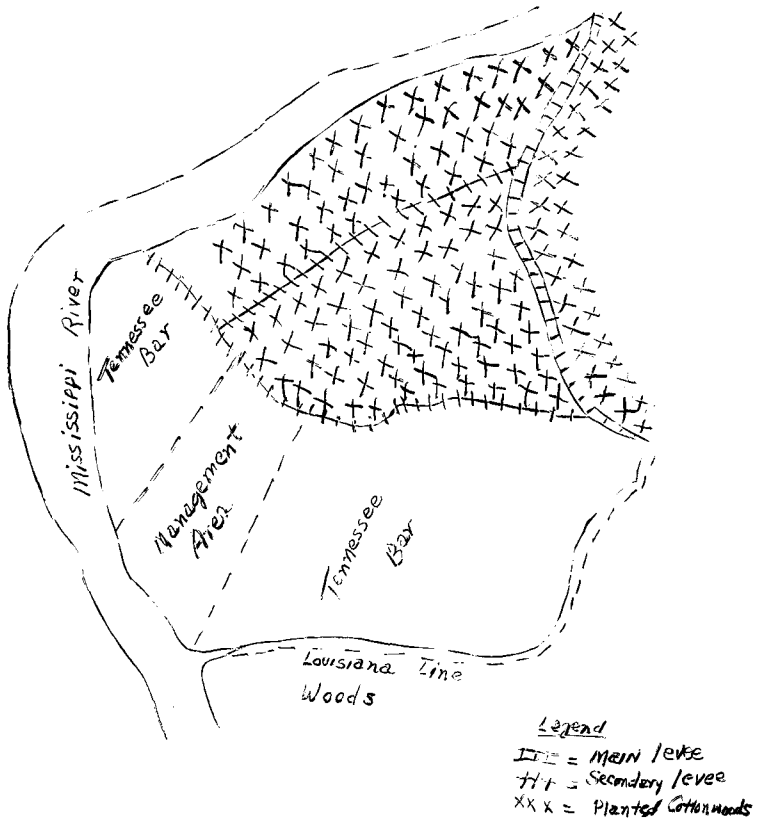


Figure 3. Sketch of the Tennessee Bar and Management Area



## RESULTS AND DISCUSSION

The chlorinated pesticides found in whitetail deer from the three areas surveyed are shown in Tables 1, 2, and 3. All deer samples contained residues of p,p'-DDE, p,p'-TDE and p,p'-DDT with the highest residue found being p,p'-DDT in a fat sample. The concentrations of p,p'-TDE found in liver samples correspond to those reported by Pillmore and Finley (1963).

The highest concentration of DDT+metabolites was found in the fat of deer from the Leflore-Sunflower Area (Table 1). Trace amounts of toxaphene were found in the liver samples of 4 deer and trace amounts of endrin in fat sample of one deer.

Of the 21 deer analyzed, only 4 were does which ranged in age from 2½ years to 5½ years. The bucks ranged from 6 months to 3½ years. There seemed to be a slight increase of pesticide levels as the age of the deer increased.

Due to the variations in residue levels and the small sample size, no comparison could be made between the areas.

It is suspected that the major sources of pesticide residue found in whitetail deer are the contamination of browse by spraying operations and subsequent browsing on pesticide contaminated agricultural crops such as cotton and soybeans.

## CONCLUSIONS

The study was intended as a preliminary survey to determine pesticide residues of whitetail deer in the Mississippi Delta. The study indicates that residues do occur in the areas surveyed. Residue levels found were well below the tolerance allowed in domestic livestock by the Food and Drug Administration, however, no regulations have been specifically adopted relating to harvest of game animals containing residues.

Although no immediate effects have been observed in this particular study of whitetail deer, there may be both short and long term indirect effects on their well being.

## ACKNOWLEDGEMENTS

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Table 1. Pesticide residue in whitetail deer collected from the LeFlore-Sunflower Area, 1969-1970.  
(T= .0001 p.p.m.)

COMPOUND	RESIDUES in p.p.m. <sup>1</sup>											
	FLESH					LIVER					FAT	
	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>
P,p'-DDE	0.004	0.001-0.008	7	0.005	T-0.010	9	0.334	0.015-0.630	7			
P,p'-TDE	0.009	0.005-0.016	7	0.084	T-0.376	9	0.376	0.083-0.700	7			
P,p'-DDT	0.020	0.012-0.030	7	0.012	T-0.040	9	0.948	0.188-1.975	7			
Toxaphene	-	-	7	T	T	9	-	-	7			
TOTAL DDT+metabolites	0.033				0.101			1.658				

1. Calculated on a wet weight basis  
2. Number of samples analyzed

Note: A total of 9 deer were analyzed, however, two samples of flesh and fat were lost from 2 deer.

Table 2. Pesticide residues in whitetail deer collected from the Delta Wildlife Area, 1969-1970.  
(T= .0001 p.p.m.)

COMPOUND	RESIDUES in p.p.m. <sup>1</sup>											
	FLESH					LIVER					FAT	
	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>
P,p'-DDE	0.018	0.002-0.066	6	0.006	T-0.016	6	0.175	0.050-0.350	6			
P,p'-TDE	0.046	0.004-1.163	6	0.098	0.007-0.204	6	0.258	0.075-0.600	6			
P,p'-DDT	0.072	0.014-0.150	6	0.003	T-0.010	6	0.612	0.225-1.025	6			
Endrin	-	-	6	-	-	6	T	T	6			
TOTAL DDT+metabolites	0.136				0.107			1.045				

1. Calculated on a wet weight basis

2. Number of samples analyzed

Table 3. Pesticide residue in whitetail deer collected from Tennessee Bar & Management Area, 1969-1970.  
(T= .0001 p.p.m.)

COMPOUND	RESIDUES in p.p.m. <sup>1</sup>											
	FLESH				LIVER				FAT			
	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>	Mean	Range	N <sup>2</sup>
p,p'-DDE	0.002	0.002-0.003	6	0.005	T-0.009	6	0.175	0.038-0.325	6	0.175	0.038-0.325	5
p,p'-TDE	0.006	T-1.100	6	0.194	0.114-0.375	6	0.175	0.023-0.375	6	0.175	0.023-0.375	5
p,p'-DDT	0.014	0.007-0.018	6	0.041	0.014-0.084	6	0.362	0.175-0.775	6	0.362	0.175-0.775	5
Toxaphene	-	-	6	T	T	6	-	-	6	-	-	5
<b>TOTAL DDT+metabolites</b>		<b>0.022</b>			<b>0.240</b>						<b>0.712</b>	

1. Calculated on a wet weight basis.

2. Number of samples analyzed.

Note: Six deer were analyzed, however, one sample of fat was lost from one deer.