

Insecticide Residues in Pronghorn Antelope of South Dakota¹

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Widespread use of insecticides in recent years has caused increasing concern that insecticide residues may be building up in the natural environment and in wild animals used as food by humans. There is little information on insecticide residues in pronghorn antelope, Antilocapra americana. Pesticide residue surveys of big game mammals have been made in Montana, Idaho, Washington and South Dakota, but few pronghorn antelope were included (1, 2, 3, 4).

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The purpose of this study was to measure the residues of aldrin, dieldrin, DDT, DDD, DDE, endrin, heptachlor, heptachlor epoxide, and lindane in a representative sample of pronghorn antelope of South Dakota.

Methods and Materials

Analysis was made on renal fat of 45 pronghorn antelope collected from five counties during the hunting season from September through December, 1966. The samples were frozen until analysis.

Extraction and cleanup

Due to limitations of the methods used, only values above 0.03 ppm for aldrin, dieldrin, DDE, endrin, heptachlor, heptachlor epoxide, and lindane and above 0.05 ppm for combined levels of DDT and DDD were reported. A control, consisting of a fat sample with known amounts of insecticide added, was included with each group of seven samples to determine the efficiency of the analytical procedure. All values were corrected for the percentage of recovery.

Insecticide residues were extracted and purified using the florisil column method of Stemp et al. (5). A one gram portion was taken from the center of each fat sample and finely ground in ten to fifteen grams of activated florisil. This sample was poured onto a 20 x 400 mm chromatography column containing approximately 40 g of activated florisil. The insecticides were eluted with 700 ml. of a mixture of 20 percent (v/v) dichloromethane in petroleum ether. The effluent was collected in a one liter round-bottom flask, evaporated to near dryness and transferred to a 10 ml. graduated

centrifuge tube. Samples were brought to 5 ml. with hexane and stored in a refrigerator.

Analysis

Gas liquid chromatography was used for the identification and quantitative analysis of the residues. The instrument employed was a Wilkens Aerograph Hy-Fi Model 600 equipped with an electron capture detector cell with a 250 millicurie tritium source. The 1/8 inch OD x 5 ft. Pyrex column was packed with 5.0 percent Dow-11 silicone on 60/80 mesh (HMDS) treated Chromosorb W and operated at 185°C with a nitrogen carrier gas flow rate of approximately 40 ml/min. A similar column with a liquid phase of 2 percent QF-1 Silicone (fluoro) was also used. Several of the samples were subjected to thin-layer chromatography as described by Breidenbach et al. (6) and modified by Greenwood et al. (4) to further verify identification of insecticide residues.

Results and Discussion

Table 1 shows the levels of chlorinated hydrocarbon insecticides in pronghorn antelope of South Dakota. Of the 45 samples analyzed for residues of DDT and DDD, 28 had quantities above the experimental limits of detection; three had DDE residues. Four animals had lindane levels of 0.04 to 0.05 ppm. Heptachlor was not found above the limits of detection in any of the samples but its convert form, heptachlor epoxide, was found in 25 of the 45 samples analyzed. No samples had endrin, aldrin or dieldrin above the detection limits.

TABLE I

Chlorinated hydrocarbon insecticides in pronghorn antelope

Insecticide	Insecticide levels in ppm			highest value
	<0.03	0.04-0.10	>0.11	
	%*	%	%	ppm
Dieldrin	100	0	0	<0.03
Endrin	100	0	0	<0.03
Lindane	91	9	0	0.05
Heptachlor epoxide	45	53	2	0.12
	<0.05	0.06-0.10	>0.11	
DDT, DDD, DDE	38	49	13	0.17

* Values represent percentage of animals analyzed

The average amount of the combined chlorinated insecticides per animal was 0.08 ppm. In 1964 Greenwood et al. (4) analyzed 9 pronghorn antelope in South Dakota and found the same average amount. It appears that in the limited number of pronghorn antelope sampled, there has been no change in the total amount of chlorinated insecticides present from 1964 to 1966. However, five animals had from 0.02 to 0.08 ppm of dieldrin, whereas dieldrin was not found above 0.03 ppm in any of the animals in the 1966 study. This may reflect the federal governments restriction on the use of dieldrin (7).

The average residues concentrations found in this study were well below the tolerances allowed in domestic livestock by

Federal regulations. It would appear that the residue levels reported here are of little significance with regard to human consumption of pronghorn antelope.

Literature Cited

- (1) Pillmore, R. E., and R. B. Finley. 1963. No. Amer. Wildl. and Nat'l. Resources Conf., Trans. 28:409-422.
- (2) Walker, K. C., D. A. George and J. C. Maitlen. 1965. U. S. Dept. Agr., Agr., Res. Ser. 33-105, 21 pp.
- (3) Casebeer, R. L. 1965. U. S. Dept. Agri., For. Serv. Pub. Ogden, Utah. 132 pp.
- (4) Greenwood, R. J., Y. A. Greichus, and E. J. Huggins. 1967. J. Wildl. Mgmt. 31 (2):288-292.
- (5) Stemp, A. R., B. J. Liska, B. E. Langlois, and W. J. Stadelman. 1964. Poultry Sci. 43(1):273-275.
- (6) Breidenbach, A. W., J. J. Lichtenberg, C. F. Henke, D. J. Smith, J. W. Eichelberger, Jr., and H. Stierle. 1964. Rev. ed. U. S. Dept. Health, Education and Welfare, Public Health Ser. Pub. 1241:63-69.
- (7) USDA, ARS, Pesticides Regulation Division. 1965. USDA summary of registered agricultural pesticide chemical uses.