Pesticide Levels in the Omental Fat of Urban Gray Squirrels

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During 1974, the Health Program Office, Florida Department of Health and Rehabilitative Services, conducted an assessment study of the urban gray squirrel, Sciurus carolinensis, as an environmental indicator of selected disease agents and chemical pollutants (LEWIS et.al., 1975; MCKINNON et.al., 1976; WHITE et.al., 1975). The squirrels were from the city of Jacksonville and were shown to have potential as indicators of heavy metals (MCKINNON et.al., 1976), mercury and cesium-135 (JENKINS, 1976). In conjunction, pesticide residue levels were determined for 22 gray squirrels, the results of which are given in this report.

Methods and Materials

The squirrels were live-trapped in five city parks and six residential areas of the city of Jacksonville. The techniques of capture, subsequent handling and aging have been described elsewhere (LEWIS et.al., 1975). Each squirrel was immobilized with ketamine hydrochloride and exsanguinated. All omental fat was collected, wrapped in aluminum foil and frozen. Fat samples were extracted with petroleum ether and partitioned against acetonitrile. The extract was then subjected to fractionation on a florosil column (MILLS, 1961; MILLS et.al., 1963). Analysis was by Ni-63 electron capture gas chromatography, using a Tracor MT-220 instrument with two differing columns. Thin layer chromography (ultraviolet light/AgNO-3) was used as a confirmatory procedure. The following parameters were observed:

Columns: 1.3% SP-2250, 5.7% SP-2401 on Chromosorb W-HP, 100-120 mesh., 5% SP-2401 on Chromosorb W-HP, 100-120 mesh.
Temperatures: Columns 200°c; Injection Chamber 225°c; Dectector 310°c
Carrier Gas Flow: (nitrogen) SP-2250, SP-2401, 70ml/min. SP-2401, 50ml/min.

The fat samples from several squirrels were of insufficient quantity for analysis by the above procedure. Consequently, these samples were assayed by a micro-method (HUTCHINSON et.al., 1977). The specimens were ground with methyl-alcohol and a small portion of 2% NaCl. The resultant mixture was then extracted with petroleum

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TABLE 1
Pesticide Residues (ppm) in Fat Samples from Park Squirrels[1]

Pesticide	Squirrels										
	Female 1yr[2]	Female 1yr	Female[3] 1yr	Female 1yr	Female 1yr	Female 2yr	Female 3yr	Female 3yr	Male[3] <1yr	Male 1yr	Male 1yr
Alpha-BHC	--	.006	.057	--	--	.002	--	--	--	--	.002
Gamma-BHC	.003	.014	.022	.006	.005	.004	--	.005	--	.003	.005
Beta-BHC	.024	.052	.159	.035	.041	.028	.029	.042	.020	.026	.042
Aldrin	.004	.015	--	.009	.014	.007	--	.008	--	.004	.007
Dieldrin	.005	.016	.023	.043	.040	--	.076	--	--	.039	--
Heptachlor	--	.017	--	.016	--	.005	.004	.007	--	.008	--
Heptachlor epoxide	.013	.019	--	.022	.057	.019	.023	.006	--	.004	.032
Oxychlordane	.028	.034	--	.025	.062	.016	--	--	--	--	.021
Nonachlor	.042	.065	--	.088	.050	.050	.042	.047	--	.025	.047
o,p' - DDT	.009	.035	--	.050	.071	.015	--	.022	--	--	.017
p,p' - DDT	.020	.076	.032	.138	.035	.038	.051	.036	.117	.023	.029
o,p' - DDE	.034	.033	--	.061	.066	.040	.043	.035	--	--	.043
p,p' - DDE	.013	.029	.021	.029	.092	.017	.025	.011	.111	.007	.022
o,p' - DDD	--	--	--	--	--	--	--	--	--	.067	--
p,p' - DDD	--	.030	--	.015	--	--	--	--	--	--	--
PCB	--	--	--	<4	--	<2	--	--	--	--	--

1. All values adjusted to 100% extractable lipid content.
2. Ages determined by eye-lens weight.
3. Determinations by micro-method.

TABLE 2
Pesticide Residues (ppm) in Fat Samples from Residential Squirrels

Pesticide	Squirrels										
	Female 1yr[2]	Female 1yr	Female 1yr	Female[3] 2yr	Female 2yr	Female[3] 2yr	Female 4yr	Female[3] 4yr	Female[3] 4yr	Male[3] 1yr	Male[3] 1yr
Alpha-BHC	--	.002	.004	--	.004	--	--	.055	--	.086	--
Gamma-BHC	.005	.006	.006	.034	.006	--	--	.024	--	.077	--
Beta-BHC	.035	.064	.063	--	.051	.012	.017	.056	.016	.120	.031
Aldrin	.007	.015	.008	--	.009	--	--	--	--	--	--
Dieldrin	--	.014	.053	--	.022	.068	.061	.023	--	--	.025
Heptachlor	.014	.021	.028	--	.015	--	--	--	--	--	--
Heptachlor epoxide	.010	.010	.058	--	.007	.024	.022	.019	--	.057	--
Oxychlordane	.035	.008	.028	--	.025	--	.030	--	--	--	--
Nonachlor	.069	.111	.084	--	.055	--	.040	--	--	--	--
o,p' - DDT	.015	.046	.020	.078	.023	--	.022	.155	--	--	--
p,p' - DDT	.027	.089	.048	--	.132	.040	.069	.091	.085	.623	.046
o,p' - DDE	.057	.070	.079	.057	.044	.060	.041	--	--	--	--
p,p' - DDE	.011	.028	.048	.017	.057	.068	.016	.040	.131	.154	.103
o,p' - DDD	--	.024	--	--	--	--	--	--	--	--	--
p,p' - DDD	--	.021	.013	--	.015	--	--	--	--	--	--
PCB	--	<5	--	--	<4	--	--	--	--	--	--

1. All values adjusted to 100% extractable lipid content.
2. Ages determined by eye-lens weight.
3. Determinations by micro-method.

ether and centrifuged to effect separation. Direct injection was then made into the gas chromatograph and analysis was as described above. This method has proved suitable for tissues of 100 to 500 mg or blood up to 5 ml.

Results and Discussion

While omental fat samples from squirrels in city parks (Table 1) and residential areas (Table 2) contained residues to the same compounds, the mean number of compounds per squirrel was slightly less in the residential group. This most likely is a result of laboratory technique since fat samples prepared by the micro-method revealed residues to fewer compounds. Despite which procedure was used, however, residue levels were low and comparable for both groups. Age and sex of the squirrels did not influence the results nor did the land usage patterns of the different parks. The residue levels in the squirrels were lower than those reported for raccoons, Procyon lotor, from Jacksonville (NALLEY et.al., 1975), although the squirrels did have residues to more compounds than the raccoons. The PCB compounds detected in the squirrels were not identified as to specific chlorine content.

The low level of pesticide residues in squirrels tested is in agreement with observations made on other Florida wildlife, (THOMPSON, 1973). FLYGER (1974) stated that because of their food habits, urban squirrels were probably not good indicators of pesticides and other contaminants. Based on the data presented in this report, we must agree with Flyger concerning pesticides, however, concomitant studies indicate that this probably is not correct for heavy metals, mercury and cesium-135 (JENKINS, 1976; MCKINNON et. al., 1976). Whether squirrels are the most sensitive wildlife indicators of these environmental contaminants in urban environments remains a matter of conjecture.

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