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INTENTIONAL POISONING OF BIRDS WITH PARATHION

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ABSTRACT.—Intentional poisoning of birds by farmers is not uncommon but is rarely documented and given proper attention. Two recent cases from New York are illustrative. In the first, at least 5,120 birds, mostly Red-winged Blackbirds (*Agelaius phoeniceus*), Common Grackles (*Quiscalus quiscula*) and Brown-headed Cowbirds (*Molothrus ater*) were killed by parathion- (an organophosphate insecticide) treated corn, which had been distributed on a truck farm in mid-March. In the second, at least 3,196 birds, mostly Common Grackles, Red-winged Blackbirds and European Starlings (*Sturnus vulgaris*), died after ingesting parathion-treated rye seed spread near unharvested field corn in late March. A Cooper's Hawk (*Accipiter cooperii*), two Red-tailed Hawks (*Buteo jamaicensis*) and an American Kestrel (*Falco sparverius*) were killed in these cases after consuming poisoned icterids. Small numbers of birds in six other species were also killed in these incidents.

Parathion (Phosphorothioc acid *O,O*-diethyl *O*-[4-nitrophenyl] ester), an organophosphate insecticide that has been widely used for many years, is highly toxic to birds. The median lethal oral dose (LD_{50}) of parathion varies from 0.125–0.250 mg/kg for Fulvous Whistling-Ducks (*Dendrocygna bicolor*) to 24.0 mg/kg for Chukar (*Alectoris chukar*; Tucker and Crabtree 1970, Schafer 1972). Accidental deaths of numerous wild birds have resulted from the agricultural use of parathion. White et al. (1982a, b) reported the deaths of over 1,600 waterfowl, mostly Canada Geese (*Branta canadensis*), from applications of parathion to agricultural fields in Texas. More insidious and less appreciated is the use of parathion to deliberately poison wild birds. Carson (1962) described the purposeful killing, by farmers, of an estimated 65,000 birds with parathion. Farmers continue to intentionally kill birds with parathion and this report describes the investigation of two recent cases in New York State.

METHODS

We followed the procedures of Heinz et al. (1979) and Stone (1979) for investigating suspected pesticide-induced bird mortalities. Necropsies were conducted according to van Riper and van Riper (1980) except that alimentary canal tissues and contents rather than fat were collected for analyses of acetylcholinesterase (AChE) inhibitor pesticides. For each case, chemical analyses were performed at two or more of the following: The New York State Department of Environmental Conservation Laboratory at Coxsackie Field Station (C), Coxsackie; the Department's Hale Creek Field Station (H), Gloversville; the U.S. Fish and Wildlife Service Laboratory at Patuxent Wildlife Research Center (P), Laurel, Maryland and Hazelton-Raltech, Inc. (R), Madison, Wisconsin. Parathion levels were determined by either gas chromatography or gas chromatography-mass spectrometry. AChE activity was determined by the method of Ellman et al. (1961). Chlorinated hydrocarbon pesticide, aflatoxin, and nitrite/nitrate levels were determined by the methods of Heath and Hill (1974), AOAC (1975), and AOAC (1975), respectively. All values given are on a wet weight basis.

CASE REPORT—NEWBURGH

On 14 March 1979 approximately 200 birds, mostly Red-winged Blackbirds (*Agelaius phoeniceus*) and Common Grackles (*Quiscalus quiscula*), were found dead on the grounds of an elementary school across from an approximately 12-ha truck farm near Newburgh, New York. Birds reportedly fell from the air or from trees in the school yard and were in tremors before dying. In the next several days, 5,120 dead birds comprising nine species (Table 1) were collected mostly within 100 m of the farm. Numerous other carcasses were not picked up as they had been scavenged and consisted of little more than clumps of feathers. Many of the birds had died on or near a small field of winter rye planted amidst chopped corn stalks and cobs from the previous summer. No spring planting had occurred and no reason for poisoning birds was obvious.

TABLE 1. Species and numbers of birds killed by parathion on Newburgh and Albany, New York farms.

Species	Number killed	
	Newburgh	Albany
Cooper's Hawk (*Accipiter cooperii*)	0	1
Red-tailed Hawk (*Buteo jamaicensis*)	0	2
American Kestrel (*Falco sparverius*)	1	0
Rock Dove (*Columba livia*)	1	0
Mourning Dove (*Zenaida macroura*)	0	23
Blue Jay (*Cyanocitta cristata*)	0	1
European Starling (*Sturnus vulgaris*)	18	229
Eastern Meadowlark (*Sturnella magna*)	1	1
Red-winged Blackbird (*Agelaius phoeniceus*)	4,327	539
Common Grackle (*Quiscalus quiscula*)	515	2,359
Brown-headed Cowbird (*Molothrus ater*)	254	29
Northern Cardinal (*Cardinalis cardinalis*)	1	0
Song Sparrow (*Melospiza melodia*)	2	12
Total	5,120	3,196

The farmer stated that he had not recently used pesticides but had applied a granular fertilizer at the rate of 364 kg per acre to this field a few days before. Investigation of the field revealed numerous yellow-brown serpentine paths on the field surface. The discolorations were caused by an oily material that caused the death of the leaves of rye plants. Cobs of corn, picked free of kernels by birds and irregularly stained brown with a substance smelling like a petroleum-based solvent, were taken for chemical analyses.

Necropsies of representative birds revealed no infectious or parasitic disease that could account for the mortalities. Gizzard contents invariably included fragments of corn. Particles of fertilizer were also frequently found. Pooled samples of alimentary canals and/or contents were submitted for determination of aflatoxin, nitrite/nitrate, and organochlorine and organophosphate pesticides.

Analyses showed no aflatoxin present (R) and low levels of nitrite/nitrate (R) and organochlorine pesticides (C). However, two pooled samples, each made up of the gizzard contents from 50 Red-winged Blackbirds, contained 617 and 1,112 ppm of parathion. A pooled sample of 22 Common Grackle gizzards contained 150 ppm of parathion and two samples of gizzards (25 and 30 gizzards per sample) from Brown-headed Cowbirds (*Molothrus ater*) had 171 and 166 ppm of the pesticide (R). The gizzard contents (feathers, bird tissues, and corn) of an American Kestrel (*Falco sparverius*) contained 8.9 ppm of parathion (R). Stained and unstained regions of a corn cob from the farm field showed 33,457 and 937 ppm (H) of parathion.

The field investigation, necropsies, clinical signs and chemical analyses indicated that the birds had died as a result of eating parathion-treated grain. Subsequent interviews with the farmer disclosed that he wanted to kill blackbirds before he planted so as to prevent the birds from damaging his sweet corn in the summer. The farmer paid a $1,250 fine.

CASE REPORT—ALBANY

On 30 March 1982 birds were reported falling out of trees in a yard next to a farm located south of Albany, New York. Investigation revealed 65 dead birds (mostly Red-winged Blackbirds and Common Grackles) in the yard and many more dead and dying birds in adjacent lawns, fields and woods. Clinical signs exhibited by affected birds included tremors, dyspnea and convulsions. Most birds appeared to die of respiratory failure within a few minutes. We found many dead birds in nearby corn fields and woody areas. Oily-appearing rye grain with a distinct petroleum-solvent odor was found scattered amidst corn stubble in three separate areas totalling approximately 3 ha. The upper alimentary canals of several grackles and blackbirds examined in the field were found to contain one or two rye grains. Samples of the rye were collected and a person was stationed in the area to discourage birds from feeding. Department personnel and volunteers collected dead and sick birds and raked soil over the rye. Despite efforts to cover the grain and intermittent periods of rain, birds continued to die on the farm for several days.

A total of 3,196 carcasses were collected, of which 167 (5.2%) were scavenged to varying degrees (Table 1). Representative birds were frozen and the remainder were refrigerated. Approximately 50 sick birds were collected. Most of these, including a Red-tailed Hawk (*Buteo jamaicensis*), recovered within 48 h and were released.

Necropsy of representative specimens showed them to be in good flesh, with congested lungs, and showing little other gross pathology. Rye grains were found in the esophagus and/or gizzard. The gizzard of one Red-tailed Hawk contained blackbird feathers and several rye grains.

Brain, gastrointestinal content, and rye grain samples were sent to laboratories for chemical analyses. Rye grain samples contained 6.2 ±

1.7% (mean ± SE) or 62,000 ppm parathion by weight (H and P). Analyses of gastrointestinal contents showed 42.6 ± 13.6 ppm parathion for samples of Red-winged Blackbirds (H,P,R), 74.4 ± 10.5 ppm for Common Grackles (H and P), 45.8 ppm for a pooled sample from Song Sparrows (*Melospiza melodia*) (H), and 17 ppm from a Mourning Dove (*Zenaida macroura*) (P). Brain AChE activity was 6.7 ± 0.3 moles acetylthiocholine iodide hydrolyzed/min/g wet weight for five Red-winged Blackbird brains, 6.9 ± 0.3 for five Common Grackles and 5.3 ± 0.8 for three Mourning Doves (P). Based on the AChE levels in brains of non-poisoned controls, these mean values represent 67%, 72% and 64% inhibition of AChE activity in the three species, respectively (E. Hill and W. Reichel, pers. comm.), all within lethal ranges (Ludke et al. 1975).

The farmer initially denied the use of any pesticide on his farm in the recent past. Later, however, he acknowledged responsibility for the incident and paid a $1,000 fine for the purposeful poisoning of birds.

DISCUSSION

The less environmentally persistent organophosphate and carbamate insecticides have largely replaced the organochlorine pesticides. The former are generally more acutely toxic to birds than organochlorine compounds, and numerous cases of bird mortalities from organophosphate and carbamate intoxication have been reported (Mills 1973; Seabloom et al. 1973; Stickel 1974; Nettles 1976; Zinkl et al. 1978, 1981; White et al. 1979, 1982a, b; Stone 1979, 1980, 1982; Fleming 1982; Hill and Fleming 1982). The two cases illustrate the ease with which granivorous birds can be purposely killed with grain heavily treated with compounds such as parathion. In the Albany case, each treated rye grain contained, on the average, approximately 1.9 mg of parathion. As the acute oral LD_{50} of parathion for Red-winged Blackbirds is 2.4 mg/kg (Schafer 1972), the amount of parathion in a single treated grain was theoretically sufficient to kill several birds.

Predators and scavengers may be secondarily poisoned after ingesting alimentary canals of poisoned birds. In the current cases, a Cooper's Hawk (*Accipiter cooperii*), three Red-tailed Hawks (one of which survived), and an American Kestrel were poisoned by eating birds killed by parathion. Secondary toxicity from organophosphate pesticides has been occasionally reported (Mills 1973, Mendelsson and Paz 1977, White et al. 1979, Hill and Mendenhall 1980) but has not been sufficiently studied. Mendelsson and Paz (1977), in particular reported mass mortalities of raptors feeding upon rodents intentionally killed by Israeli farmers with monocritophos (=Azodrin®, (E)-phosphoric acid dimethyl [1-methyl-3-(methyl-amino)-3-oxo-1-propenyl]ester), an organophosphate pesticide.

These mortalities occurred in the spring, as have the majority of intentional bird poisonings investigated by the senior author. In a seven-year study of deliberate wildlife poisonings in Scotland, Hamilton et al. (1981) also found the peak occurrence during spring months. This seasonality is partially due to the reactions of farmers towards large flocks of migrating birds in their fields. These flocks, however, may actually do far less damage to crops than is perceived by farmers (Dolbeer et al. 1978). In the Albany case, areas of unharvested field corn were present but birds concentrated their foraging on corn that had been knocked down by the weather and was no longer mechanically harvestable.

It is difficult to accurately assess the impact of deliberate pesticide poisoning of birds, both in terms of incidence and severity. These poisonings no doubt occur more frequently than is commonly appreciated by biologists (Stone 1979, Hamilton et al. 1981, Fleming 1982). Such incidents may involve many more birds than those found during a superficial investigation. Searches for carcasses tend to underestimate the number of birds killed by a pesticide application (Heinz et al. 1979) because many may remain hidden in vegetation and others may die far from the poison source or succumb days after ingesting poison. In addition to acute lethal poisoning, other effects of organophosphate pesticides on birds have been reported experimentally (Eastin et al. 1982, Grue 1982, Rattner et al. 1982, White et al. 1983) and include impairment of feeding, thermoregulation, salt gland and endocrine gland function, nesting behavior, and reproduction. One or more of these effects may have occurred in the present cases.

Biologists and others should be aware that intentional poisoning of birds does occur and that adequate investigation and reporting is needed. We believe that the incidence of deliberate poisoning of wild birds by farmers could be reduced through education, well-publicized prosecutions, and substantial fines.

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