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POISONING OF CANADA GEESE IN TEXAS BY PARATHION SPRAYED FOR CONTROL OF RUSSIAN WHEAT APHID

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ABSTRACT: Approximately 200 Canada geese (*Branta canadensis*) died at a playa lake in the Texas Panhandle shortly after a winter wheat field in the basin adjacent to the lake was treated with parathion to control newly invading Russian wheat aphids (*Diuraphis noxia*). No evidence of infectious disease was diagnosed during necropsies of geese. Brain ChE activities were depressed up to 77% below normal. Parathion residues in GI tract contents of geese ranged from 4 to 34 ppm. Based on this evidence, parathion was responsible for the goose mortalities. Parathion applications to winter wheat will undoubtedly increase if parathion is applied for control of both Russian wheat aphids and greenbugs (*Schizaphis graminum*). Geese may potentially be exposed to widespread applications of parathion from fall to spring, essentially their entire wintering period.

Key words: Anticholinesterase poisoning, brain cholinesterase activity, *Branta canadensis*, Canada geese, mortality, organophosphorus insecticide, parathion, playa lakes, Russian wheat aphid.

INTRODUCTION

Russian wheat aphids (*Diuraphis noxia*) are indigenous to the southern Soviet Union and have been a pest there since 1900. They were found in central Mexico in 1980 (Gilchrist et al., 1984), spread to northern Mexico by 1983, and are believed to have entered the United States in Texas in 1985 (Morrison *in* Stoetzel, 1987). They were first identified near the Texas Panhandle in 1986 (Stoetzel, 1987). Since then, they have invaded most Great Plains and northwestern states. The appearance of Russian wheat aphids and early stages of damage it causes to wheat are similar to those of the greenbug aphid (*Schizaphis graminum*). Greenbugs have been considered a pest to winter wheat crops during midwinter and cool springs for many years which has resulted in annual treatments primarily of parathion (ethyl parathion, *O*, *O*-diethyl *O*-*p*-nitrophenyl phosphorothioate) for their control in northern Texas. Russian wheat aphids attack newly growing seedling wheat in fall and wheat plants during warm springs. At least five organophosphorus (OP) insecticides, essentially the same as those for controlling greenbugs, are suggested for controlling this new insect in wheat crops (G. J. Michels, Jr., pers. comm.). Mortality of wildlife may worsen if intensive spraying of OP's on crops is expanded to control the newly invading Russian wheat aphid (Blus et al., 1989). Lethal toxicity levels to Canada geese (*Branta canadensis*) of OP insecticides applied to winter wheat for control of aphids are unknown.

On 14 November 1988, a local wheat grower reported geese dying at a playa lake near Tulia, Swisher County, in the southern part of the Texas Panhandle (34°32′N, 101°46′W). The following day personnel of the U.S. Fish and Wildlife Service counted approximately 200 dead adult and immature Canada geese at the playa lake. According to reports, on 12 November 1988 one of two winter wheat fields in the playa basin 15 m from the playa lake had been aerially sprayed once with parathion at the rate of 0.57 kg active ingredient/ha for control of Russian wheat aphids. Mortality of geese occurred within 48 hr after the field was treated.

We present evidence here that parathion when applied to a winter wheat field for control of Russian wheat aphids in the Texas Panhandle caused mortality of 200 Canada geese in November 1988. This is the first reported kill of wildlife from an insecticide used for control of Russian wheat aphids.

MATERIALS AND METHODS

Four fresh carcasses of Canada geese were collected from the playa lake on 15 November 1988. One live goose, listless and withdrawn from the flock, was collected by shooting at the playa lake to determine if it had been exposed. No geese were found dead in the treated wheat field. No samples were analyzed from the treated wheat field to document the exposure level to geese.

Necropsies of three fresh carcasses were conducted at the National Wildlife Health Research Center (Madison, Wisconsin 53711, USA) on 17 November 1988 to determine cause of death. Necropsies included epidemiology, clinical symptomatology and pathology sufficient to arrive at a diagnostic conclusion without testing for botulism. Brain cholinesterase (ChE) activity was measured by using the method of Ellman et al. (1961) as modified by Hill and Fleming (1982) in one goose that died and in the one that was shot. For controls, normal ChE activity was determined in six Canada geese (see also Hill 1988) which died of causes of mortality known not to inhibit brain ChE activity at the National Wildlife Health Research Center.

Proventriculus and ventriculus were removed and frozen on 17 November 1988 and shipped to Patuxent Wildlife Research Center (Laurel, Maryland 20708, USA) for insecticide residue analyses. Contents were extracted from proventriculus and ventriculus of five specimens and analyzed for 25 OP insecticide residues using gas chromatography (White et al., 1982a; Patuxent Wildlife Research Center, Analytical Chemistry SOP-OP scanning method 0-25.00, 28 April 1989). The presence of parathion was confirmed in two specimens by gas chromatography/mass spectrometry. The lower limit of reportable residues was 0.5 ppm wet weight. No analyses were conducted for carbamate insecticides.

RESULTS AND DISCUSSION

All geese examined at necropsy had abundant subcutaneous and visceral fat deposits. The only significant gross finding was a slight reddening of intestinal mucosa, although villi were normal. Histopathological examination was non-contributory. Lesions consistent with infectious disease, such as acute avian cholera, were absent in viscera. Bacteriological culturing revealed only *E. coli* from the liver and no significant growth from cloacal contents. Incidental traumatic pathology (pectoral muscles, heart, lungs, blood filled abdomen, presence of shot pellets) was observed in the goose collected by shooting. The presence of recently consumed green vegetation, abundant food material throughout the gastrointestinal tracts and good body conditions indicated acute deaths consistent with toxicosis.

Brain ChE activity was depressed 62% and 77% below normal in the two geese collected at the mortality site compared to that in controls; a finding consistent with death due to an anticholinesterase insecticide (Ludke et al., 1975). Incubation for 18 hr at 37 C produced only minimal ChE regeneration raising the index of suspicion for an OP poison such as parathion. Parathion (the only residue) was detected in proventricular/ventricular contents in levels ranging from 4 to 34 ppm in all geese analyzed (Table 1).

Based on the above evidence and the proximity of dead geese at the playa lake to the wheat field recently treated with parathion, parathion application was considered responsible for the mortality. Apparently, the geese were exposed to parathion in the treated wheat field and may also have been exposed to parathion from aerial drift at the lake and in playa lake water near the wheat field. The mortality of Canada geese in November 1988 is the earliest seasonal kill of wintering waterfowl known to occur from insecticide poisoning in northern Texas.

From 1980 to 1988, extensive losses of

TABLE 1. Brain ChE inhibition and parathion residues in contents of ventriculus and proventriculus from adult Canada geese collected dead at a playa lake in the Texas Panhandle, Tulia, Swisher County and of controls (apparently normal specimens) November 1988.

Tested	n	ChE			Parathion residues (ppm wet weight)
		Activity[a]		Inhibition	
		Mean	SD	%	
Adult female	1[b]	3.0	0.2	77	34[c]
Adult female	1	—	—	—	22[c]
Adult female	1	—	—	—	18
Adult male[d]	1[b]	4.9	0.0	62	6
Adult male	1	—	—	—	4
Controls	6[e]	13.0	1.5	0	—

[a] ChE activity expressed as micromoles acetylthiocholine hydrolyzed/min/g brain tissue.
[b] Mean and standard deviation of duplicate samples.
[c] Residues confirmed by gas chromatography/mass spectrometry.
[d] Shot.
[e] Mean and standard deviation of six individuals.

Canada geese occurred from parathion poisoning in northern Texas, in addition to the present kill in Swisher County, when parathion or a parathion/methyl parathion compound was applied to winter wheat at rates of 0.57 to 0.85 kg/ha to control greenbugs. In four incidents, 2,110 wintering Canada geese (2,050 at playa lakes), 37 other geese and, in one incident, 100 ducks were killed by parathion or parathion/methyl parathion (White et al., 1982a, b) or were suspected to have been killed by parathion (Texas Parks and Wildlife Department, unpubl. rep.). Wintering bald eagles (*Haliaeetus leucocephalus*) have been observed feeding on geeese thought to have died from parathion poisoning (Texas Parks and Wildlife Department, unpubl. rep.). Two golden eagles (*Aquila chrysaetos*) were observed feeding on carcasses of geese killed in Swisher County.

The playa lakes of the Texas Panhandle provide winter wetland habitat for approximately 50,000 Canada geese (White et al., 1982a). This area is also one of the most intensively cultivated regions in the Western hemisphere (Bolen and Guthery, 1982). Much of the wheat in this area is treated annually from mid-winter to spring with parathion to control greenbugs. Spraying of insecticides, largely parathion, in fall for control of Russian wheat aphids was not frequent but became widespread in 1988. Therefore, Canada geese may be exposed to parathion from fall to spring, essentially their entire wintering period. Wintering eagles that feed on parathion-killed geese may also be affected by secondary poisoning as described by Henny et al. (1987).

In this study, a large winter wheat field abutting the playa lake where goose mortality occurred received no insecticide treatment because the lease contract for this land stipulated that no insecticides were to be applied. This wheat field produced a satisfactory yield (J. Stockett, pers. comm.). Thus, some parathion applications to winter wheat may be unnecessary. However, applications of parathion to winter wheat crops planted in playa basins next to playa lakes where geese congregate will undoubtedly increase if parathion is applied from fall to spring for control of both the Russian wheat aphid and the greenbug. Russian wheat aphids are more difficult to control than greenbugs and require application rates of up to 1.13 kg/ha of parathion. Multiple applications of parathion to single wheat crops, currently done for control of greenbugs in some areas, will most likely occur for control of Russian wheat aphids.

Because of the extreme toxicity of parathion to waterfowl (White et al., 1982a) and the importance of protecting waterfowl and habitat in this critical wetlands region, alternatives to parathion should be used for pest control in crops planted near playa lakes. Health hazards to waterfowl and other wildlife, including potential exposures by air, water, and food sources, should be minimized when considering alternatives.

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