

E. W. Schafer, Jr.  
Wildlife Research Center  
Building 16, Federal Center  
Denver, Colorado 80225

## SECONDARY HAZARDS TO ANIMALS FEEDING ON RED-WINGED BLACKBIRDS KILLED WITH 4-AMINOPYRIDINE BAITS

E. W. SCHAFFER, JR., U. S. Bureau of Sport Fisheries and Wildlife, Wildlife Research Center, Denver, Colorado

R. D. BRUNTON, U.S. Bureau Sport Fisheries and Wildlife, Wildlife Research Center, Denver Colorado

N F. LOCKYER, U.S. Bureau Sport Fisheries and Wildlife, Wildlife Research Center, Denver Colorado

**Abstract:** Red-winged blackbirds (*Agelaius phoeniceus*) killed by investing cracked corn baits treated with 3 percent 4-aminopyridine, or by oral doses of 4-aminopyridine, were fed to canines, rats, magpies (*pica pica*), and three species, of hawks. The test animals consumed the equivalent of up to 3.4 LD 50 doses of 4-aminopyridine in single feedings and up to 2.4 LD doses a day for 20 days in repeated feedings. None showed any symptoms of intoxication or gross abnormalities at necropsy.

4-aminopyridine (4AP) is a chemical frightening agent that has been registered for protecting ripening field corn from blackbird damage (EPA Registration No. 11649-12). In use, cracked corn baits are treated with 3 percent 4AP, diluted 1 to 99 with untreated corn, and broadcast in fields being damaged. Blackbirds (primarily redwings) that ingest treated particles give distress reactions that frighten away the rest of the flock (De Grazio et al. 1972, Stickley et al. 1972). The acute, sub-acute, and chronic toxicity of 4AP to birds and other animals have been summarized (Schafer et al. 1973; Schafer and Marking 1973). However, since redwings affected or killed by 4AP may be eaten by flesh-eating birds or mammals, the following studies were conducted to determine if 4AP would be likely to present secondary hazards to these animals.

### METHODS

Orally treated redwings were fed to all test animals. To achieve high doses of 4AP, some redwings were gavaged with 4AP in propylene glycol and after death; the carcasses were immediately frozen at -20 C until fed to the test animals. All other

redwings were killed by using simulated baiting conditions in which 20-40 birds of mixed ages and, eyes were released in a 6-ft holding cage and offered a cracked corn mixture containing 99 parts of untreated particles and 1 part of particles treated with 3.0 percent by weight 4AP (a total of 300 ppm 4AP). No other food was present; water was available ad libitum. Individual redwings died 15 minutes to 12 hours after ingesting one or more particles containing 4AP and were immediately frozen at -20 C. For calculating the minimum amount of 4AP available to test animals, we assumed that each dead redwing consumed one treated particle of average weight (22 mg), or 0.66 mg 4AP.

For canines and rats, partially thawed redwing carcasses, minus skin, beak, and feet, were minced in a food chopper. For canines, the minced redwings were then mixed with one-third by weight of Wayne's "bite-size" dry dog food and passed twice through a meat grinder to reduce bone fragments to minimal size. For rats, oatmeal was substituted for dog food. Foods were prepared less than 4 hours before consumption and were refrigerated until use. For flesh-eating birds, whole, frozen redwing carcasses were offered daily.

## RESULTS

### Canines

One individually caged adult female beagle-coyote hybrid (Canis familiaris X Canis latrans) and one individually caged adult male beagle were each fed 175 g of the redwing-dog food mixture twice daily for 8 days. Both animals received additional food and water between test feedings. They consumed an average of 4.8 birds per day, the equivalent of 0.4 mg/kg of 4AP per day, or a total of 3.2 mg/kg. Although the rate of 4AP in redwings is not known, all data are expressed as equivalent amounts of 4AP as if no metabolism had taken place.) Two weeks later the beagle consumed, within 3 minutes, food containing 10 redwings killed by oral administration of 40 mg/kg (26.8 mg) of 4AP. For the beagle, this was equivalent to 2.7 mg/kg of 4AP, or 50 redwings each killed with one 3 percent bait. Two weeks later, the beagle consumed food containing 10 redwings killed by oral administration of 100 mg/kg (equivalent to 5.8 mg/kg for the beagle). At the same time, the female hybrid consumed food containing 10 redwings killed by oral administration of 150 mg/kg. This was equivalent to a dose of 8.2 mg/kg of 4AP, or 150 redwings each killed with one 3 percent bait. Neither canine showed any detectable effects from eating 4AP-killed redwings, and gross pathological examination of both animals 2 weeks after the last feeding revealed no abnormalities.

### Rats

Ten individually caged white laboratory rats (Rattus norvegicus) were offered food-containing 4AP killed redwings for 21 days. Ten other rats were given food containing untreated redwings. Average daily food consumption for the treated rats was 45.8 g, or 0.5 mg/kg of 4AP. Since the acute oral LD 50 of 4AP to rats is 20 mg/kg (Schafer et al. 1973), each rat received an average of 1.3 LD 50 doses during the 21-day test. None showed symptoms of intoxication, and gross pathological

examination at the end of the test showed no differences between treated and control rats.

Five individually caged rats were fasted for 18 hours and then offered food containing one redwing that had been orally dosed with 100, 150, 200, 250, or 300 mg/kg of 4AP. The 300-mg/kg bird was equivalent to an acute dose of 6.5 mg/kg for the rat, or 3.4 LD 50 doses. All the rats consumed the food within 3 hours and none exhibited symptoms of intoxication.

## Magpies

Two individually caged black-billed magpies (pica pica) were fed 4AP-killed redwings for 20 days; one was given one bird per day and the other two. A third magpie was fed untreated redwings. All birds also had water and a weighed amount of Purina Eggena CF "checkers" available ad libitum. The magpie that ate one redwing daily consumed the equivalent of 3.9 mg/kg per day, and the magpie that ate two birds daily consumed the equivalent of 7.5 mg/kg per day, or 3.2 times the acute oral LD50 of 2.4 mg/kg (Schafer et al. 1973); neither showed intoxication symptoms.

## Hawks

A female sharp-shinned hawk (Accipiter striatus) was fed 37 4AP-killed redwings over 21 days, the equivalent of 6.4 mg/kg per day. She showed no intoxication symptoms and a gross pathological examination indicated no abnormalities. A sub-adult male red-tailed hawk (Buteo jamaicensis) was similarly fed 39 4AP-killed redwings over 14 days, without symptoms of intoxication.

Three individually caged sparrow hawks (Falco sparverius) were fed 4AP-killed redwings for 7, 21, and 45 days. Three individually caged controls were fed the same number of untreated 'redwings. The hawks fed 4AP-killed redwings consumed 7, 21, and 58 birds, respectively, or the equivalent of 5.5-6.1 mg/kg 4AP per day. The acute oral LD50 of 4AP to sparrow hawks is 5.6 mg/kg (Schafer et al. 1973). The treated birds showed no symptoms of intoxication, and gross pathological examination revealed no unusual differences between them and the controls.

## DISCUSSION

Although most of these tests were conducted with limited numbers of animals, they suggest that secondary hazards to flesh-eating birds and mammals will not be a problem with 4AP baits when used as described by De Grazio et al. (1972) and Stickley et al. (1972). Apparently, when the compound is consumed by redwings, it is rapidly metabolized or otherwise physiologically inactivated in the body so that what would theoretically be a multiple LD 50 dose is not toxic to an animal eating the bird. In our studies, this was particularly evident in canines and rats, which consumed the equivalent of 1.5 to 3 LD 50 doses within minutes or hours with no apparent effects, and with magpies, which consumed the equivalent of 1.5 to 3 LD 50 doses a day for

20 days, again with no apparent effects. Judging from the results of the longer-term feedings, all the flesh-eating species tested could live unharmed on an exclusive diet of redwings killed with 3 percent 4AP baits.

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