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USE OF A TRIGEMINAL IRRITANT FOR WILDLIFE MANAGEMENT

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Aversive chemicals have been used for many years to manage wildlife in certain problem situations. A group of compounds that hold particular promise for the management of wild bird species is composed of derivatives of anthranilic acid. These esters, especially methyl anthranilate and dimethyl anthranilate, are very effective avian feeding deterrents and appear to act primarily through nasal trigeminal irritation (Mason et al. 1989). Methyl anthranilate (MA) is attractive as a wildlife management tool because (1) it is relatively inexpensive, (2) it is generally regarded as safe (GRAS-listed) for humans by the U. S. Food and Drug Administration (MA is used as a fruit flavoring in many foods and cosmetics), and (3) birds do not seem to habituate to it. The use of MA and related compounds represents a humane, nonlethal approach to the control of problem bird species.

In this paper, we briefly describe experiments with MA using captive wild birds to evaluate the potential usefulness of MA as a bird repellent in 3 diverse applications: (1) reducing damage to small fruit crops, (2) discouraging use of small bodies of water, and (3) protecting eggs of endangered species from avian predators.

MA AS A FEEDING DETERRENT TO FRUGIVOROUS BIRDS

Introduction

Each year, cedar waxwings (Bombycilla cedrorum) and other frugivorous bird species cause considerable damage to blueberry, cherry, and other fruit crops in North America. To evaluate the potential of MA as a bird repellent for fruit crops, we tested the repellency of technical grade MA to caged cedar waxwings.

Methods

We captured cedar waxwings in mistnets in blueberry fields near Gainesville, FL and transported them to the Florida Field Station of the Denver Wildlife Research Center. Birds were maintained and tested in 1.4 x 1.4 x 1.8-m cages within a roofed outdoor aviary. Banana mash (Denslow et al. 1987), whole bananas, and water were available ad libitum.

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During the 5-day trials maintenance food was removed at 0800 and trials began at 0900. Each day, we offered the birds 4 berries dipped in propylene glycol and 4 berries dipped in a mixture of MA and propylene glycol. We tested 3 treatment levels: 0.25%, 0.5%, and 1.0% MA (g/g). Each berry was dipped immediately prior to placement on a metal feeder next to a perch readily accessible to the birds. We recorded when each berry was picked up, eaten, or dropped. Berries remaining in the feeders were removed after 10 min. The number of berries eaten and the number of berries dropped were compared among treatment levels with 1-way ANOVAs.

Results

The total number of MA-treated berries eaten (out of 80 presented) was 8, 10 and 25 for the 1.0%, 0.5%, and 0.25% groups, respectively. The totals for berries without MA were 56, 40, and 44. Thus, berry consumption was reduced 86%, 75%, and 43% for the 3 treatments. Significantly ($P = 0.05$) more treated berries were consumed by the 0.25% MA group than by higher treatment level groups. Also, significantly ($P = 0.03$) more treated berries were dropped at the 1.0% MA level than at the lower MA levels. There were no differences ($P > 0.4$) among groups in their responses to propylene glycol berries.

Two birds regurgitated MA-treated berries on each of 2 separate occasions. In the 0.5% group, an individual regurgitated a berry 125 sec after ingestion on test day 2 and regurgitated another berry 2 sec after eating it on test day 4. On each day, the bird ate untreated berries. In the 1.0% group, a bird regurgitated MA-treated berries 90 sec after ingestion on test day 3, and 128 sec after ingestion on day 4. Six minutes after regurgitation on day 4, this bird ate another MA-treated berry and kept it down.

Discussion

The persistence of the cedar waxwings in trying to eat MA-treated berries suggests either that birds were unable to detect MA on the berries without picking them up or that the MA was not sufficiently aversive. The latter possibility seems remote because (1) MA did reduce berry consumption, and (2) at least 2 birds regurgitated treated berries. Thus, repeated sampling of MA-treated berries was probably due to the birds' inability to detect the MA distally. This contention is supported by anatomy of the avian olfactory system. The external nostrils and outer nasal chambers contain no olfactory receptors. In contrast, the epithelium of the relatively large inner chamber is lined with olfactory receptor cells, and the chamber is connected to the mouth by a pair of large ducts, or choanae. The choanae probably carry odors from the mouth directly to the olfactory receptors enabling a bird to smell the food while holding it in the mouth (Welty 1975). Thus, the waxwings had to pick up the berries in order to detect the MA.

DISCOURAGING BIRD USE OF SMALL BODIES OF WATER BY MA TREATMENT

Introduction

The use of certain small bodies of water creates problems for birds as well as for humans. Examples of the former include agricultural drainwater evaporation ponds and gold mine tailing ponds each of which contain toxins detrimental to birds. Human safety is endangered when birds are attracted to temporary puddles on airport runways. Nuisance problems develop when waterfowl are attracted to the ponds in parks, lawns, and golf courses. In this study, we investigated the feasibility of applying MA to discourage birds use of small bodies of water.

Methods

Seven American coots (Fulica americana) were captured near Gainesville, Florida, and maintained in the 0.2 ha flight pen at the field station. The birds were allowed to forage freely within the flight pen, and we provided them with free access to water, except during the MA trial. After several weeks of acclimation to the flight pen, we presented the coots with 2 20-l pans of water. To one pan we added 100 ml of MA plus 50 ml of isopropyl alcohol as a dispersant. The other pan received just the alcohol. The behavior of the coots were monitored from an observation blind, approximately 25 m from the water pans.

We recorded the birds' behavior on video tape to determine the number of times the birds dipped their bills in the pans to drink and the number of times they entered the pans to bathe. We also measured the water level in the pans each morning and afternoon. After 7 days we removed the untreated pan and monitored activity and water levels as before. We placed a pan of untreated water under bird-proof netting to record moisture gained or lost to the environment. During the 1-pan test the coots' only source of untreated water was seepage from the concrete bases of an irrigation pipe.

Results

During the taped observation periods, the coots used the MA-treated pan on the initial test day but not thereafter (Table 1). Water loss from the MA-treated pan averaged 0.5 cm/day compared to 4.8 cm/day from the untreated pan. The coots continued to avoid the MA-treated water during the 1-pan test. Video-taped observations on days 1, 2, and 4 (total time = 376 min) showed no bill dips or entries into the MA-treated water. Daily water loss from the treated pan averaged 0.3 cm compared to 0.2 cm from the control water pan.

When added to water, the MA quickly separated and sank to the bottom of the pan. Initially clear, the water in the treated pan soon acquired an orange tinge and became progressively darker. Eventually, the treated water was dark reddish-brown and murky. After 2 wks, the MA odor was very noticeable several m from the pan.

Table 1. Coot use of MA-treated and plain water pans.

Test day	Observation period (min)	Bill dips		Entries	
		MA	Plain	MA	Plain
1	95	16	62	7	25
2	120	0	63	0	19
5	109	0	50	0	15
6	122	0	82	0	5
7	120	0	83	0	24

Discussion

This limited evaluation indicates that MA can greatly reduce bird use of small bodies of water. The coots in this study were not immediately deterred by the treated water, but after limited use on the first day of exposure, they avoided it completely. Eventual application of this method to actual management situations requires additional tests with different dose rates, species, water depths, and MA formulations.

PROTECTION OF EGGS FROM AVIAN PREDATORS

Introduction

Crows and ravens regularly prey on the eggs of other species (e.g., Post 1990). Control of such depredations usually has involved lethal means -- shooting, poisoning, trapping. Egg predation control methods based on food avoidance learning have been tested (Nicolaus 1987), and here we present results of feeding experiments using MA to help produce a conditioned avoidance response in captive crows.

Methods

Fish crows (Corvus ossifragus) were trapped locally and housed individually in 1.3 x 9.3 x 1.8 m test enclosures. For 5 consecutive days, during 0800-1200, each bird was offered 2 treated quail eggs. We evaluated 2 treatments: methiocarb only and methiocarb-MA combined. Water and commercial dry dog food were available throughout. An egg was considered lost if after 4 h it had been moved from its original location even if the crow did not eat it.

To prepare the treated eggs, we injected an emetic dose (30 mg/egg) of methiocarb into raw quail eggs, then boiled them and sealed the openings with glue. Technical grade MA was mixed 1:1 with propylene glycol, and 0.15 ml of this mixture was applied with a syringe to each egg immediately prior to the daily trial.

Results and Discussion

Crows were not deterred from removing the quail eggs by the methiocarb treatment. Virtually every egg was taken on each of the test days ($\bar{x}$ = 1.7 egg/day, SD = 0.7). In contrast, methiocarb-MA-treated eggs were mostly avoided ($\bar{x}$ = 0.4, SD = 0.7). Some birds sampled the eggs throughout the test, so total deterrence was not achieved.

Protection of eggs is an all-or-nothing proposition. Eggs taken from a nest are lost whether they are eaten or not. Thus, to be effective, the repellent must cause total avoidance of the eggs. It appears from our preliminary results that an emetic compound inside the egg will not by itself produce an avoidance reponse. Rather, a topical treatment using MA or a similarly irritating compound paired with the emetic is more likely to elicit the desired response by the egg predator.

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