Evaluation of Caffeine and Garlic Oil as Bird Repellents

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Introduction

Ripening sunflower fields in the northern Great Plains provide blackbirds with easily accessible sources of high-energy food. Blackbirds can be nearly impossible to discourage from foraging in favored fields. Repellents sometimes can be effective feeding deterrents, especially if alternative foraging sites are readily available. Currently, there is one bird repellent (BirdShield®, a.i., methyl anthranilate) registered for use on ripening sunflower. The cost-benefits of BirdShield are being questioned after recent field trails showed no reduction in damage levels (Werner et al. 2005).

Both caffeine and garlic are potential taste repellents that have some promise of reducing blackbird damage to field crops. Avery et al. (2005) conducted cage feeding trials with red-winged blackbirds (RWBL) and brown-headed cowbirds and found that caffeine used at a rate of 2,500 ppm on rice seed significantly reduced food consumption. Trials with mixed species blackbird flocks in a flight pen and field trials in Louisiana showed that caffeine reduced blackbird feeding to <10%. The authors suggested, however, that changes in the formulation were needed to facilitate agricultural spray applications. Mason and Linz (1997) and Hile et al. (2004) showed that garlic-treated food consistently repels European starlings under laboratory conditions. Field trials are still needed to test garlic on ripening grain.

In 2005, we tested the repellent properties of garlic oil and caffeine on caged RWBL. We found that sunflower achenes treated with 4% and 12% w/w garlic oil reduced feeding by 58% and 97%, respectively, compared to untreated achenes. Buoyed by these results, we further explored garlic oil in a second series of experiments at reduced concentrations. Treatments of 2%, 1%, and 0.5% w/w garlic oil reduced feeding by 80%, 40%, and 22%, respectively. In the experiments with caffeine, we found that feeding was reduced by 17% at 0.25% w/w. No other tests were done with caffeine in 2005.

In the cage trials conducted in 2005, we used achenes that were fully coated with repellent. Our current report explores the repellency effects of caffeine and garlic oil when they are sprayed only on the exposed tips of the achenes on intact sunflower heads. Additionally, we report the results of applying liquids to sunflower heads with a helicopter.

Methods

Male RWBL were trapped and held in captivity in a roofed outdoor aviary at least 2 weeks prior to testing. During this time, they had free access to water and a mix of grains. The feeding trials were conducted in cages (61 x 36 x 41 cm) that held single individuals, visually isolated from the other test subjects. The birds were placed in cages for a 4-day pretreatment period during which time maintenance food was removed every morning before sunrise and a head of untreated sunflower supplied 1 hour later.

After the pretreatment period, each bird was assigned to a treatment group or the reference group. The bird with the highest average sunflower consumption during the pretreatment period was randomly assigned a test group. The bird with the next highest rate of consumption was assigned to the next group. This systematic process was repeated until all birds had been assigned to a treatment group or to the reference group.

Each day during the 4-day treatment phase, maintenance food was removed before sunrise and a treated sunflower head was placed in the cage 1 hour later. The exact same conditions were held for the reference birds, except they received untreated heads. The heads were withdrawn after 3 hours and maintenance food was provided for the rest of the day and removed the following morning before light. Each day fresh heads were used. Sunflower consumption was measured with a plastic template consisting of 5-cm^2 frames.

Caffeine concentrations were analyzed at the National Wildlife Research Center, Fort Collins, CO.

Three helicopter sprays with water and a caffeine solution were done on ~0.81 ha of sunflower in September 2006.

Results and Discussion

Cage Trials –The caffeine-treated heads had less damage (cm^2/bird) than reference (untreated) heads; whereas, no difference in consumption was detected between garlic-treated heads and untreated heads (Fig. 1). Average consumption of sunflower was less for the caffeine solution (2826 ug/ml) than the garlic oil (0.02 g/ml, P = 0.02). We also directly compared 2 different concentrations of caffeine, 2 ml (2212 ug/ml) and 3 ml (4747 ug/ml) per head. Overall, mean consumption (cm^2/bird) differed among treatments (P = 0.10), with the birds fed the highest concentration (3 ml/head) eating less than the other two treatment groups (Fig. 2).

Figure 1. Consumption of sunflower (cm^2) by individually caged male (n=5) red-winged blackbirds after treatment with garlic oil or caffeine. Each bird was given 1 sunflower head for 3 h on each of 4 treatment days. Capped vertical bars denote 1 SE.

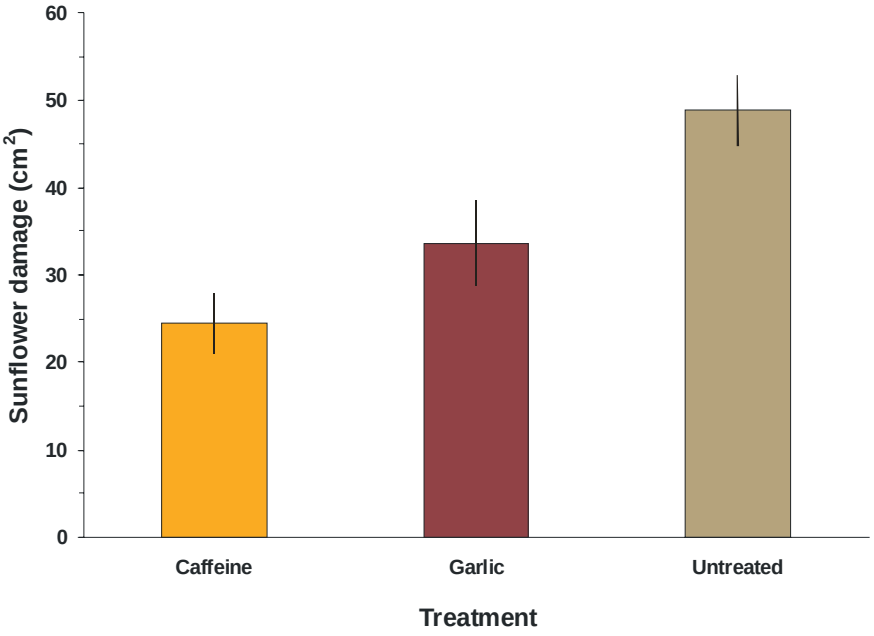
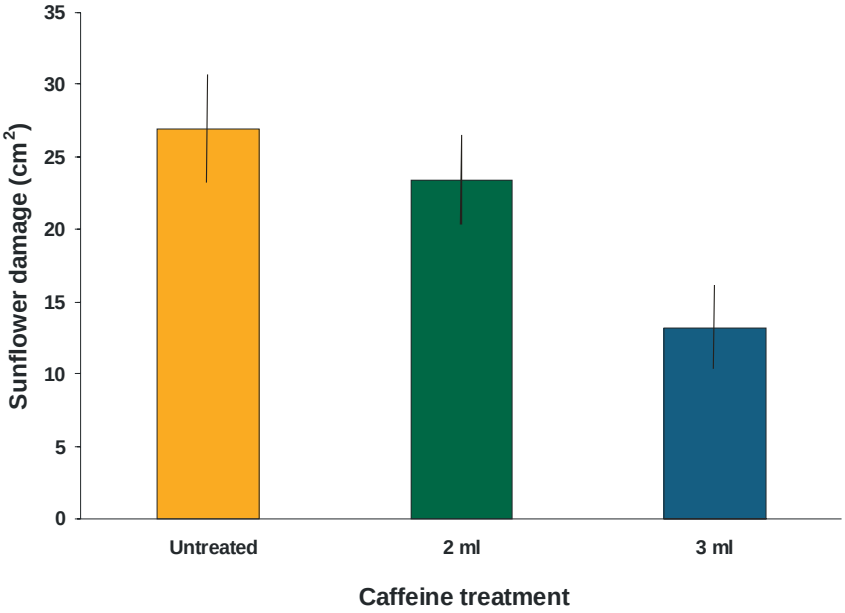


Figure 2. Consumption of sunflower (cm^2) by individually caged male (n=5) red-winged blackbirds after treatment with 2 ml or 3 ml of an aqueous caffeine solution. Each bird was given 1 sunflower head for 3 h on each of 4 treatment days. Capped vertical bars denote 1 SE.



In this study, garlic oil had no effect on sunflower consumption. In tests conducted in 2005, where the entire achenes were coated with 2%, 1%, and 0.5% w/w, feeding was reduced 80%, 40%, and 22%, respectively, compared to consumption of untreated sunflower heads. Perhaps treating only the exposed portion of the achenes was not sufficient to deter feeding, particularly when the birds no access to alternate foods. On the other hand, free-ranging birds might be deterred by low levels of garlic oil if alternative foods are available.

Helicopter Trial – Under the conditions of our experiment, the aerial application by helicopter was not capable of contacting the achenes with the spray. Despite 3 flights that involved flying at different altitudes and speeds, very little spray contacted the face of the heads (i.e., achene surface) because of the heads' horizontal position to the ground. The problem of applying repellent treatments that will reach the achene surface of horizontally orientated heads remains a vexing problem.

Our study adds to the growing body of evidence that caffeine treatment can reduce blackbird feeding (Avery et al. 2005). In comparison, it appears higher concentrations of garlic will be needed to repel blackbirds from sunflower. If achieving adequate spray coverage on the achenes is overcome in field settings, caffeine and perhaps other bird repellents might be an effective management option.

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