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A Preliminary Evaluation of Three Food Flavoring Compounds as Bird Repellents

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ABSTRACT

There is an increasing demand in New Zealand for nonlethal bird repellents to protect food crops and prevent poisonous mammal baits being eaten by native birds. Three food flavorings, dimethyl anthranilate (DMA), methyl anthranilate (MA), and a peppermint extract (Optamint), were applied to wheat as surface coatings at different concentrations and then offered to individually caged house sparrows *(Passer domesticus)*. The birds were given one of four levels of treated wheat (control, 0.25, 0.5, and 1.0% by weight for DMA and MA; 0, 1, 3, and 5% by weight for Optamint). Only Optamint at the 5% level significantly reduced consumption of wheat. All three Optamint-treatment levels were phytotoxic to grass.

KEY WORDS

bird repellents, house sparrow, Passer domesticus, peppermint, dimethyl anthranilate, methyl anthranilate

INTRODUCTION

There is an increasing demand in New Zealand for nonlethal bird repellents to protect food crops and prevent poisonous mammal baits being eaten by native birds. Dimethyl anthranilate (DMA) and methyl anthranilate (MA) have been extensively tested as bird repellents both in cattle feedlots (Glahn et al. 1989, Mason et al. 1983, Rogers 1974) and on fruit (Askham and Fellman 1989, Askham 1992, Avery 1992, Curtis et al. 1994). The third compound, a peppermint extract Optamint® (supplied by Haarmann & Reimer, Australia) has never been tested as a bird repellent, but is similar to another peppermint extract, d–pulegone, evaluated by Mason (1990). The repellents were tested on house sparrows because they were abundant, easily trapped, and caused damage to a greater range of crops in New Zealand than most other species of birds.

METHODS

House sparrows *(Passer domesticus)* were mist-netted and conditioned to cages (cage dimensions 25 × 49 × 34 cm) housed in a shed under a 16:8 hr light/dark cycle. The birds were housed singly in the cages to measure individual food consumption. The cages were arranged in three groups of eight (housing four males and four females). For 4 weeks before testing, the birds were given free access to mixed bird seed (containing canary seed *[Phalaris canariensis]*, and white and pan millet *[Panicum* spp.), plus silverbeet *(Beta vulgaris cicla)*, water, and grit. The birds were trained to feed from a sealed container (750 ml) with a 65-mm diameter hole drilled in the side. These containers were used to reduce food spillage as house sparrows flicked seeds out of open-top feeders during feeding. For 7 days before the repellent compounds were added to the seeds, birds were fed daily with 50 g of wheat. At 0900 hr each day, the remaining seeds (including those spilled) were weighed, and the container was refilled.

Three food flavorings were applied to wheat at different concentrations and then fed to house sparrows to test their potential as bird repellents. All three food additives were dissolved in acetone as they were not soluble in water. The 100-ml solutions were poured over 400 g of wheat and oven-dried overnight at 40 °C. Both MA and DMA strengths were applied at 0.25%, 0.5%, and 1.0% by weight (as recommended by Avery 1992, Mason et al. 1989, and Mason et al. 1991). As no previous work could be used as a guide to the strength of Optamint required, it was arbitrarily applied at 1.0, 3.0, and 5.0% by weight.

Compounds were tested separately at each of the four concentrations (including a control), with a Latin-square design. Individual birds in each group were exposed to a different concentration of the same repellent in their food each day, but no two caged birds within a group were given the concentrations in the same sequence. The individual birds were fed daily at 0900 hr with 50 g (to more than satisfy their daily needs) of either treated or untreated wheat in one container, providing a no-choice trial.

Optamint-treated wheat at three treatment levels (1.0%, 3.0%, and 5.0%) was left in marked plots on mowed grass until at least two treatments were completely eaten by free-ranging birds to test whether Optamint was phytotoxic. The other two food additives were already known to be phytotoxic (Avery 1992).

RESULTS

Individually, the sparrows ate an average of 5.9 g ± 0.4 g of untreated wheat daily in the pretreatment experiment (Figure 1). Consumption varied significantly between birds ($P = 0.014$) and between days ($P = 0.025$), but not between the three groups of eight individually caged birds. While there may be variation between the eight birds within a treatment group, overall there was little difference in the amount of wheat consumed by the groups prior to exposure to the treated wheat.

The amount of treated wheat eaten differed significantly for the levels of Optamint tested ($P < 0.001$) (Figure 2). Birds ate 0.9 g at 5% Optamint, 5.6 g at 1% Optamint, and 6.0 g of untreated wheat. The amounts eaten of wheat treated by MA or DMA did not differ significantly

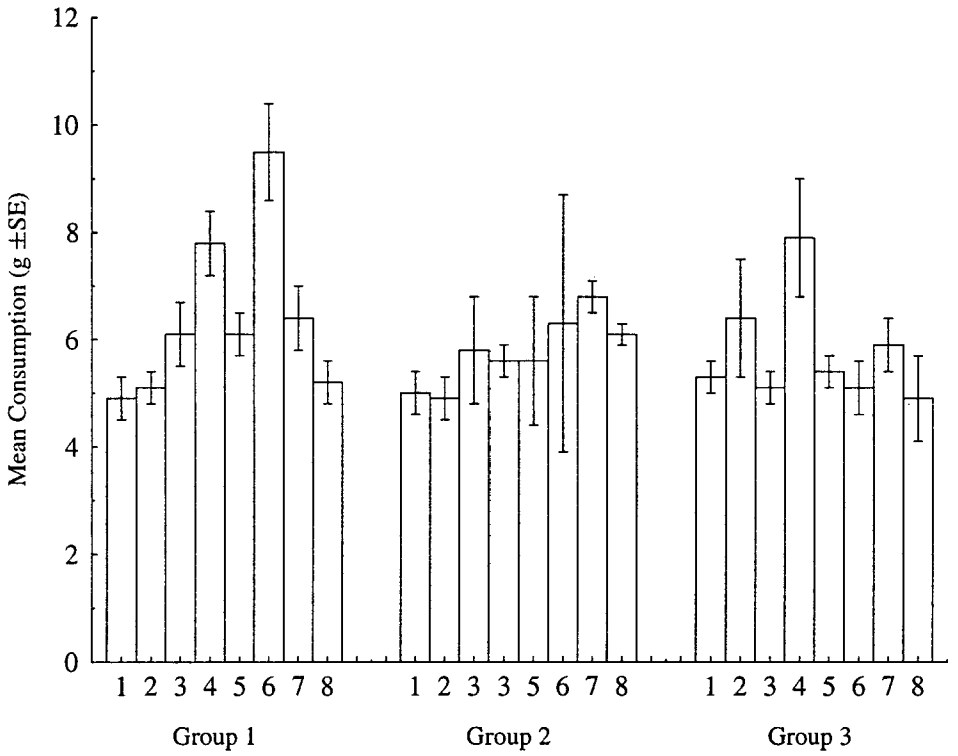

FIGURE 1.

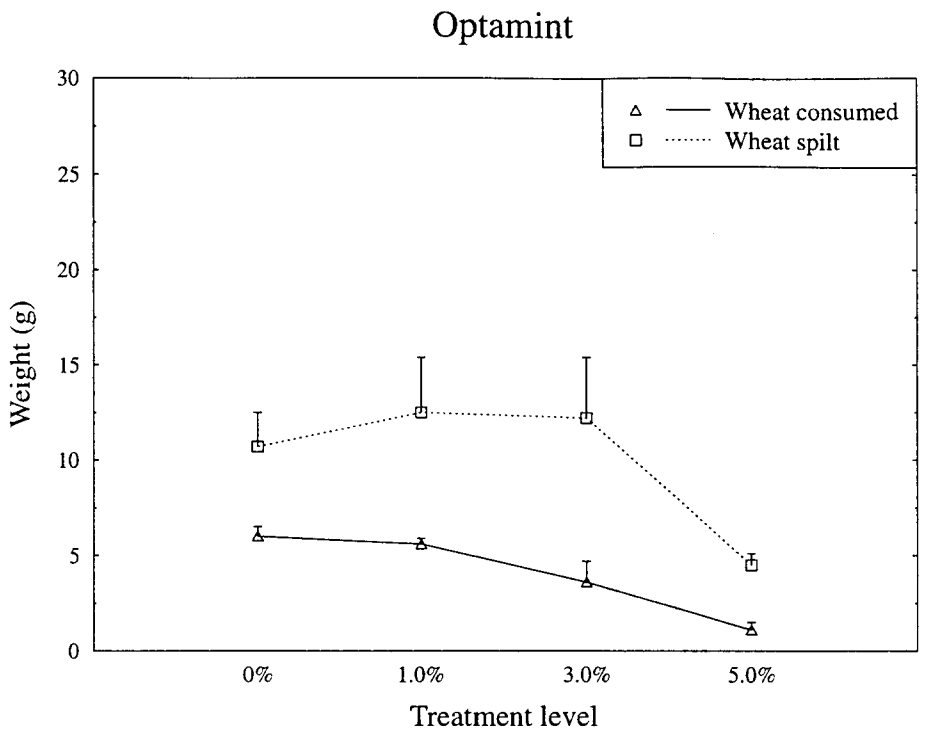

FIGURE 2.

between treatment levels (Figures 3 and 4). The amount of wheat spilled varied significantly with treatment level for DMA (34% of the 1% concentration, 17% of the untreated wheat; $P = 0.048$; Figure 3). No such difference occurred with MA (Figure 3). Little wheat was spilled from the 5% Optamint treatment, confirming that the repellent deterred the birds.

The amount of each repellent eaten differed significantly for individual birds (as in the pretreatment exposures), $P<0.001$ for DMA, $P = 0.011$ for MA, and $P = 0.053$ for Optamint.

A comparison of the repellency of the three food additives is difficult because different treatment levels were used. At the 1% concentration for DMA and MA, the amount of wheat eaten was higher than for a 5% level of Optamint ($P<0.001$). There was no difference between he amount of wheat eaten at lower Optamint concentrations and that eaten for the 1% coating of DMA or MA.

The 1% and 3% levels of Optamint-coated wheat placed on grass were eaten by free-ranging house sparrows within 3 days; however, the 5%-treated wheat remained largely untouched. Grass in all the plots showed some degree of yellowing, indicating that Optamint was phytotoxic to plant material.

DISCUSSION

The Optamint exhibited significant repellency only at the 5% rate. The peppermint (d-pulegone), tested by Mason (1990) against starlings *(Sturnus vulgaris)*, was significantly repellent at lower concentrations (0.01, 0.1, and 1.0%). The two mint-based repellents would need to be directly compared to show whether Optamint is more or less repellent than d-pulegone.

The house sparrows were not repelled by MA and DMA even at the 1% application rate. During Avery's (1992) trials, captive cedar waxwings *(Bombycilla cedrorum)* ate significantly fewer blueberries treated at the same strengths of MA as used in this trial. Cedar waxwings did not eat many of the MA-treated berries, but persisted in testing them. In this trial, the house sparrows tended to spill more seeds at the higher levels of treatments, possibly indicating that they persistently tested and rejected the treated wheat. Mason et al. (1991) mentioned that MA at 0.4 to 0.5% might represent an effective threshold concentration for some bird species and feeding situations. It seems that house sparrows in this experiment failed to satisfy either condition, and higher concentrations will be required for repellency.

All three compounds are phytotoxic and cannot be used on crops without protective formulations (Askham 1992, Vogt 1992). However, in New Zealand, poisons for controlling rats *(Rattus* spp.) and possums *(Trichosurus vulpecula)* are sometimes eaten by native birds, and the addition of some of these compounds may stop birds eating the baits. Possums fed DMA at three rates of 0.5, 1.0, and 1.5% by weight of food were suspicious of the compound at first, but it did not significantly reduce their consumption (Porter et al. 1991). Vogt (1992) also noted that MA has a very strong, persistent odor. Rats tend to avoid novel odors and may not take baits treated with MA.

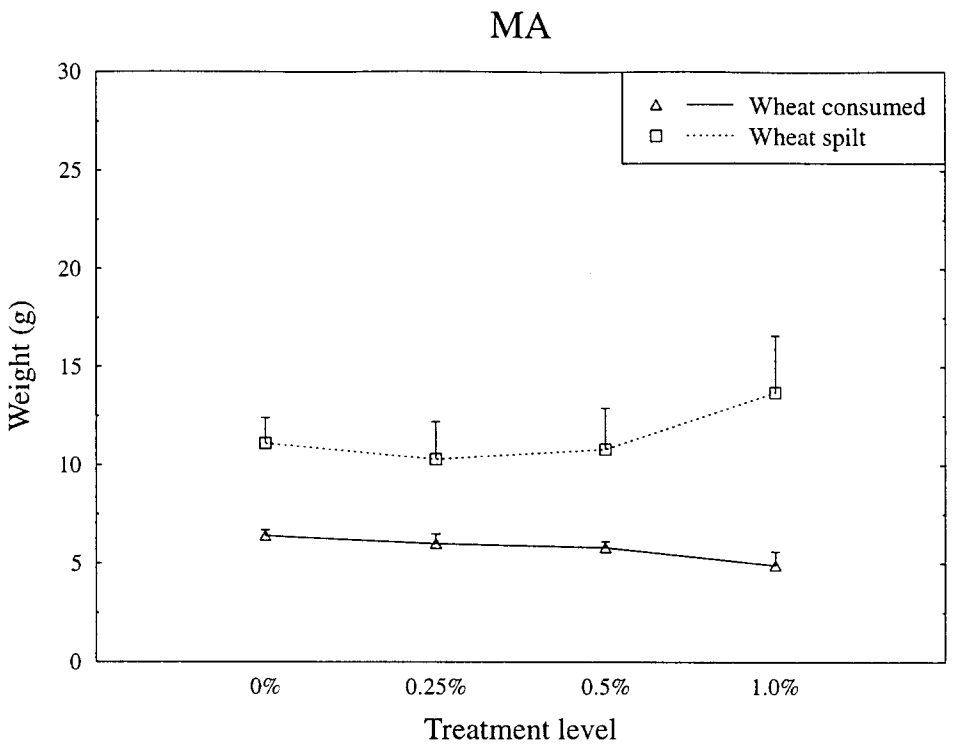

FIGURE 3.

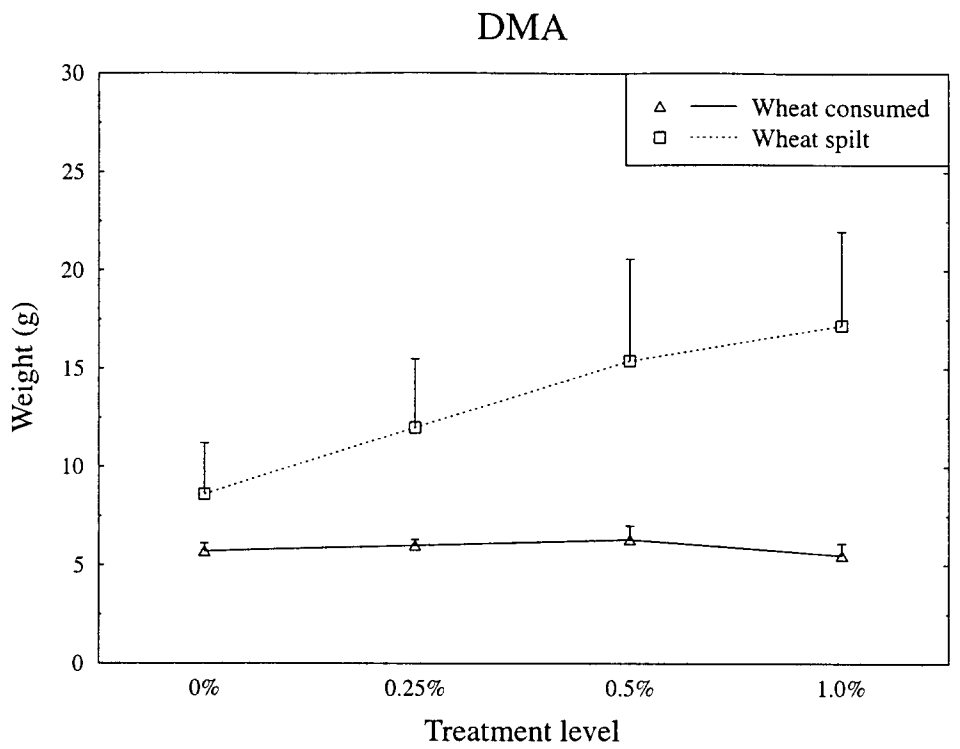

FIGURE 4.

ACKNOWLEDGMENTS

I thank J. Brown for statistical advice, J. D. Coleman and E. B. Spurr for comments on the draft manuscript, and J. Orwin for editorial assistance.

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