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ABSTRACT

The chemosterilant ornitrol was tested as a means of reducing egg production in feral pigeons on the central campus of Bowling Green State University. Ornitrol (0.1% by weight), coated on whole-kernel corn, was baited on building rooftops for 10-day periods in 1982 and 1983. Weekly post-treatment nest monitoring indicated that ornitrol does not inhibit egg-laying, but 16-29% of all eggs laid were infertile. This increase in egg infertility over the pre-treatment period was significant. However, because pigeons breed throughout the year on campus, it is estimated that this reduction in productivity would have no major impact on the population.

A limited laboratory trial indicated that pigeons feeding on untreated corn ate significantly more food than did treated birds. Egg-laying was inhibited in two of three pairs treated for 10 days and was nearly complete in three pairs treated for 20 days. However, pigeons in the 20-day group became lethargic, and one bird died after treatment. It appears that the chemical, at an average dosage of 0.3 g chemosterilant per bird, acted more as a debilitating agent than as a sterilant. The present ornitrol formulation cannot be recommended for use in pigeon control.

INTRODUCTION

Chemosterilants have received recent attention as potential means of controlling population levels of bird pests (Davis, 1962; McLean, 1972; Anonymous, 1970; Becker, 1970; Fringer and Granett, 1970; Sturtevant, 1970; Guarino and Shafer, 1973; Shafer et al., 1976; Mitchell et al., 1977). Initial laboratory and field trials indicated that the chemosterilant ornitrol (20,25-diazacholestenol dihydrochloride) could inhibit egg-laying and induce infertility in feral pigeons for up to six months (Elder, 1964; Wofford and Elder, 1967). The chemical interferes with the synthesis of cholesterol, which is necessary for formation of the egg yolk (Woulfe, 1968; 1970). Field trials in Maine and Florida also reported success in reducing pigeon populations by baiting with ornitrol (Schortemeyer and Beckwith, 1970; Woulfe, 1968; 1970), although the reduction in pigeon numbers reported in these trials may have been due to factors other than the effects of the chemosterilant alone (Murton et al., 1972). Other laboratory tests indicated that ornitrol-treated bait may be unacceptable to pigeons if alternative foods are available (Sturtevant and Wentworth, 1970). At present the efficacy of ornitrol on free-ranging pigeon populations is poorly understood.

Pigeons have been a nuisance on the Bowling Green State University campus for years. Lethal control methods effectively eliminated an isolated population roosting at the football stadium (Jackson, 1978), but periodic attempts to reduce pigeon numbers on the central campus have not been productive. The purpose of this paper is to report on the use of ornitrol on the Bowling Green central campus and in a limited laboratory trial. Results of two years of baiting with ornitrol on campus suggest this bait is not an effective tool for population control of feral pigeons.

METHODS

Field

The bait consisted of ornitrol-coated (0.1% by weight) whole-kernel corn supplied by Avitrol Corporation. Treatments were conducted twice (April 21-30 and June 22-July 1) in 1982 and once (March 7-16) in 1983. Two treatment sites were used because there appeared to be two relatively discrete pigeon sub-populations on the central campus. The treatment sites were located on building rooftops (Hayes and Moseley Halls) in order to minimize potential hazards to nontarget species.

Prior to baiting, untreated whole-kernel corn was fed on the rooftops until the pigeons established a regular feeding pattern. Prebait, containing the ornitrol carrier (ethocel) but not the chemosterilant, was then fed for several days to accustom the birds to any possible adverse taste. Once the prebait was accepted, the bait was fed for a 10-day period as recommended on the manufacturer's label. All corn was presented in measured amounts in three food trays at each site, and amounts eaten daily were determined.

Nesting activity levels across campus were monitored pre-and post-treatment in both years. The number of nests active was determined from the ground with binoculars or from windows overlooking nesting ledges. A nest was considered to be active if it was being brooded or if squabs were present in the nest. Additionally, weekly to biweekly roost counts were made at dusk on the central campus to estimate the resident population size both pre- and post-treatment.

The efficacy of treatments was based on monitoring the number of clutches and determining egg fertility for 2-5½ months post-treatment. In 1982 all nests accessible with an extension ladder were monitored for two months after each treatment. In 1983 between 10-17 nests were accessible for monitoring in the cupola on the roof of Hayes Hall, and four other nests were regularly observed through windows at Moseley Hall and at the Life Sciences building. These nests were monitored for two months prior to treatment and for five and one-half months after treatment. Pigeon eggs normally hatch after 17-18 days of incubation (Levi, 1957); any eggs which did not hatch after three weeks of incubation were removed from the nests and examined for fertility, based on the presence or absence of an embryo.

Laboratory

The no-choice feeding trial consisted of two treatment groups and a control group. The birds were housed in three indoor pens at the Fernside Rodent Research Lab. Nesting boxes and nest materials were provided in each pen. The birds were allowed to pair and lay one clutch of eggs prior to treatment; however, only 16 of the 22 birds mated. All eggs laid prior to treatment were fertile. The control group (n = 8; 2 nesting pairs) was fed untreated whole-kernel corn. One treatment group (n = 6; 3 nesting pairs) was fed ornitrol-treated corn for 10 days as recommended on the manufacturer's label. The second treatment group (n = 8; 3 nesting pairs) was fed ornitrol-treated corn until the dosage per bird averaged 0.3 g of chemosterilant, which is the dosage reported necessary to inhibit egg-laying (Elder, 1964). The amount of corn eaten was recorded each day. Water and grit were provided *ad lib.*

Food consumption data in these tests were tested by a two-day ANOVA to determine if significant differences occurred between treatment groups and between treatment periods (days 1-10 and 11-20). Means were compared using Duncan's multiple range test; $p \leqslant .05$ was considered to be significant.

RESULTS

Campus

Ornitrol treatments — A total of 8.9 kg of bait was consumed during the first ornitrol treatment in April and 13.8 kg during the second 10-day treatment in June, 1982. According to the manufacturer's recommended rate of baiting (7½ lbs. per day per 100 pigeons), sufficient bait was eaten to have treated approximately 26 and 40 pigeons, respectively, in the first and second treatments. However, because bait consumption declined sharply after the first few days of treatment (Fig. 1), fewer pigeons probably ingested bait regularly over the 10-day treatment period. Several doves (*Zenaida macroura*), starlings (*Sturnus vulgaris*), grackles (*Quiscalus quiscula*), and house sparrows (*Passer domesticus*) also fed on the bait. Approximately 50-60 pigeons were residing on campus during the treatment and survey periods.

In early March of 1983, 34.2 kg of bait was eaten, which was enough to have treated about 100 pigeons. During treatment time there were an estimated 100-110 pigeons roosting on campus. Another 80-100 pigeons were excluded from the grain elevator nearby campus in early March, just before treatment, and some of these birds also may have been feeding on the campus. A few doves, starlings, and grackles also fed on the bait. The daily pattern of bait consumption differed from that in 1982, however, as feeding increased after the first day and then declined over the final two days of treatment (Fig. 1). Initial bait consumption may have been poor because of rainfall, which wetted the ornitrol coating on the corn.

Efficacy of treatments — The principal effect of the treatments was an increase in the number of infertile eggs which were laid. Forty-five eggs were removed and examined in the two months after the first treatment, and 29% (13/45) were infertile (Table 1). Six of 17 monitored nesting pairs laid infertile clutches. In the two months after the second treatment, 16% (5/32) of all eggs examined were infertile; and four of 11 nesting pairs were laying infertile eggs. One egg removed from a nest in July had no yolk. However, by late August, only two months after the second treatment, all pairs were laying fertile eggs.

In 1983, 20% (21/105) of all eggs removed and examined in the five and one-half months following treatment were infertile (Table 2). In contrast, all 32 eggs examined in the two months prior to treatment were fertile. This difference in egg fertility pre- and post-treatment is highly significant ($\chi^2 = 7.56$, $\underline{p} < .01$). Ten of 19 pairs laid an infertile clutch after treatment, but only two pairs laid more than one infertile clutch. In early August one of these pairs was incubating five eggs, three which were infertile and two which hatched by late August.

There was no major decline in the number of nests which were active after any of the treatments. Although the number of monitored nests decreased from 17 to 11 by the time of the second treatment in 1982, overall nesting levels across campus remained constant. Several pairs changed nesting sites after treatment, either to higher inaccessible ledges or to other buildings, but they continued to nest. Surveys indicated that only one pair actually stopped laying eggs. In 1983, 25 nests were active across campus at treatment time, and 29 were active in the months following treatment. There was no indication that any birds stopped laying in the five and one-half months post-treatment in 1983.

Treatment costs — The cost of treatment in 1983 averaged approximately $1 per campus pigeon, or about $2 if only treated birds are considered. Costs included one-hour-per-day of labor (at $5/hr) for 20 days to prebait and bait the two sites, 22½ kg of corn, and six food trays for presenting the bait. The bait and prebait were supplied without cost by Avitrol Corporation. Costs in 1982 were not calculated but approximated those in 1983.

Laboratory

Bait consumption — Significant differences in bait consumption were found between treatment groups ($p < .001$) and between treatment periods ($p < .01$) in the laboratory trial. In all comparisons, the birds ate significantly more untreated than treated corn (Table 3). Feeding also increased significantly when the 10-day treatment group was switched from a regimen of treated to untreated corn. The average dosage of chemosterilant per bird was 0.17 g and 0.29 g, respectively, in the 10-day and 20-day groups.

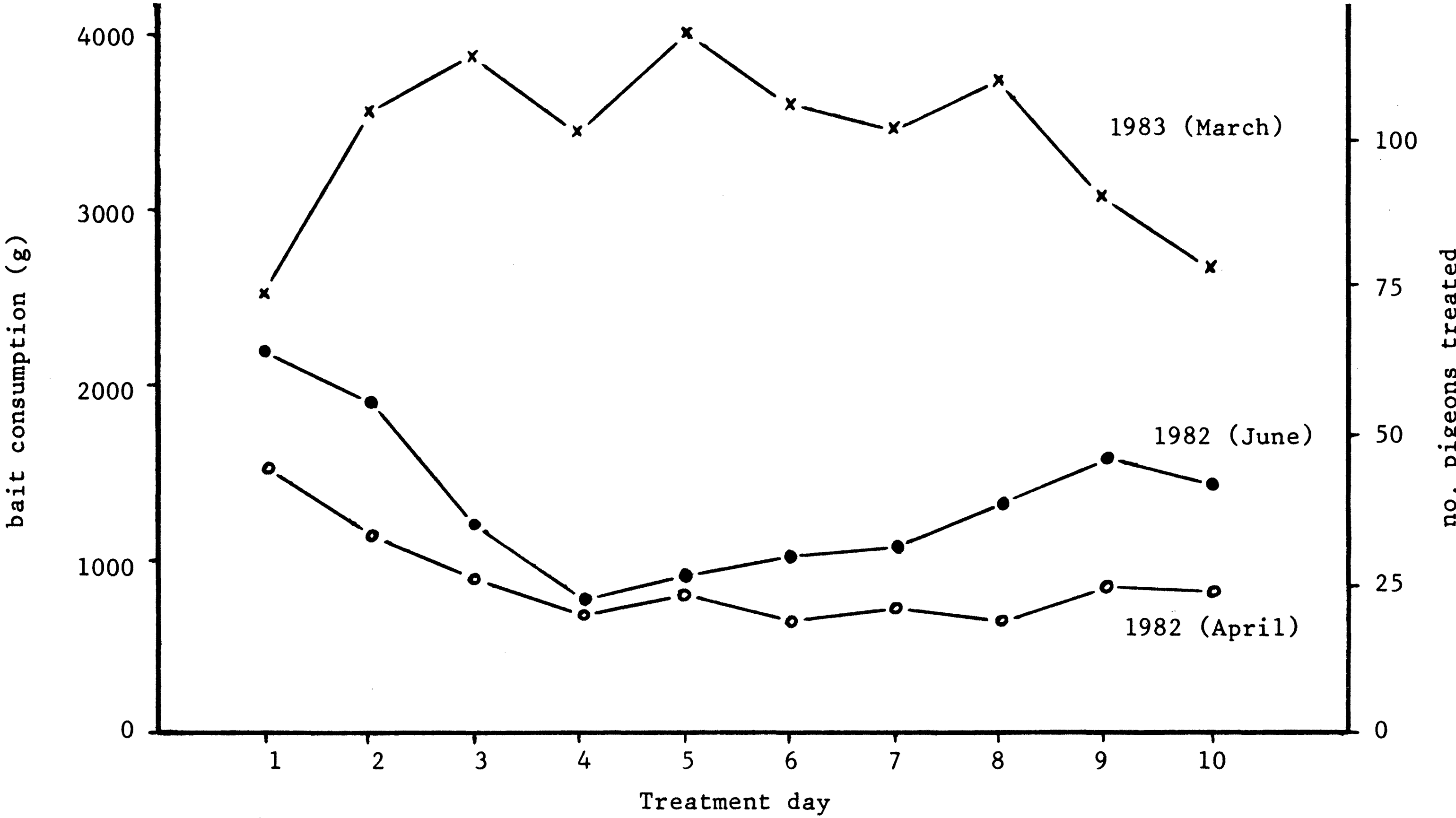

FIGURE 1. Consumption of ornitrol-treated bait in 1982 and 1983.

Efficacy of treatments — The efficacy of the laboratory treatments could not be determined for any extended period, because by late September all birds, including the controls, began molting and ceased egg-laying. However, both control pairs laid fertile eggs 12-15 days after treatment began, while only two of six treated pairs laid eggs. One of three pairs in the 10-day treatment group laid two fertile eggs 37-39 days after treatment and laid a second fertile clutch about two months later. The other two pairs continued extensive courtship activities but produced no eggs. One infertile egg was laid by one of the three pairs in the 20-day group after 40 days, but no other eggs were laid. All birds in the 20-day group became lethargic during the second-half of the trial and courtship activities declined noticeably. Two of the birds were sick, and temporary paralysis of the legs was evident; one bird died about two months post-treatment.

DISCUSSION

The results of the trials in 1982 and 1983 indicate that ornitrol has not been an effective tool for reducing population levels of pigeons on the Bowling Green campus. There was little evidence to suggest that ornitrol inhibits egg-laying, and the number of birds laying infertile eggs was not sufficient to have a major impact on the population.

Elder (1964) reported that ornitrol completely inhibits egg-laying in laboratory pigeons for three months, with 75% inhibition of ovulation for up to six months. Field trials by Wofford and Elder (1967) reported similar results, with reproductive inhibition almost complete for five to seven months in two pigeon colonies and 89% complete for three months in a third colony. Field trials in Maine and Florida also claimed to have reduced pigeon populations by baiting with ornitrol (Woulfe, 1968; 1970; Schortemeyer and Beckwith, 1970). In Maine, for example, pigeon numbers were reportedly reduced from about 2500 to 400 over a three-year period (Woulfe, 1970). However, as noted by Murton et al. (1972), the reduction of pigeon numbers in these trials likely was due to factors other than the action of the chemosterilant alone.

In theory, population reduction would occur as a result of natural mortality, which for pigeons is in the range of 30-35% annually (Murton et al., 1972), if recruitment of young into the population were restricted. Pigeons breed throughout the year (Davis and Schein, 1952; Murton and Clarke, 1968; Preble and Heppner, 1981). Pigeons potentially are capable of raising 9-10 broods per year (Murton et al., 1972), although an average of 5-6 clutches seems more realistic based on observations on campus. The normal clutch size is two, and a second clutch often is laid before the first young have left the nest (Levi, 1957; Murton and Clarke, 1968).

Natural fertility of pigeon eggs may exceed 90-95%, and nearly one-half of all eggs laid give rise to young which leave the nest (Levi, 1957; Murton and Clarke, 1968; Preble and Heppner, 1981). Thus, a single pair of pigeons on campus might produce 5-6 young per year. If natural annual mortality in a population of 100 birds is 30-35%, only 5-7 fertile nesting pairs could produce enough young to replenish the population. For ornitrol to be effective, a minimum of 90% of the breeding birds likely would have to be sterilized for a full six-month period, with treatments to be made twice a year. Under our field conditions, reducing the normal production of fertile eggs by 90% or more does not appear to be possible.

Laboratory trials also have provided conflicting evidence as to ornitrol's effectiveness under controlled conditions. Contrary to Elder's (1964) findings, Sturtevant and Wentworth (1970) found no significant difference in the number of clutches laid by treated and untreated pigeons. There were differences in egg fertility and the number of one-egg clutches which were laid, however. Sparrows fed ornitrol-coated corn for six weeks continued to lay eggs during the extended treatment period; although none of the eggs hatched, fertility was quickly restored within four-five weeks after treatments ended (Mitchell et al., 1977).

One problem with ornitrol in laboratory trials has been bait acceptance. Sturtevant and Wentworth (1970) found that pigeons almost totally ignored ornitrol-coated corn when given a choice between treated or untreated bait. Pigeons forced to eat treated bait ate considerably less food than did those fed untreated corn, and lost up to 28% of their body weight. As in the present trial, depressed feeding over the recommended 10 days of baiting resulted in an average dose of chemosterilant per bird of only 0.16-0.17 g, considerably less than the 0.3 g reported necessary to inhibit ovulation (Elder, 1964). In the present trial, however, birds dosed at 0.3 g of chemosterilant over 20 days showed symptoms of illness. Ornitrol is known to be toxic at high dosages, and at sub-lethal doses birds may become lethargic, exhibit partial paralysis of legs and wings, and greatly reduce feeding (Lofts et al., 1968; Becker, 1970; Sturtevant and Wentworth, 1970). Murton et al. (1972) and Sturtevant and Wentworth (1970) suggest it is the debilitation effects of the drug, including slow starvation, which result in the decline of reproductive activities. Such a management tool would not be considered very efficacious.

One further aspect was not specifically considered. The bait (ornitrol coated on corn) was used directly as it had come from the formulator. It is possible that some of the coating had fallen away during shipping, and the actual dose on the corn was far less than assumed. No chemical analysis of this bait was made, but the biossay provided by these tests and observations suggests it may have been deficient.

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TABLE 1. Number of clutches and fertility of eggs in monitored nests after treatments in 1982.

Building Site	Post-treatment 1 (April - June)				Post-treatment 2 (June - August)			
	no. nests	no. clutches	no. eggs		no. nests	no. clutches	no. eggs	
			fertile	infertile			fertile	infertile
University Hall	6	8	12	4	4	7	11	2
Moseley Hall	4	6	10	2	3	3	4	1
Hayes Hall	2	3	2	4	2	4	6	1
Williams Hall	2	3	4	2	1	2	2	1
McFall Center	2	2	4	0	1	2	4	0
Eppler Center	1	1	0	1	0	0	0	0
Total	17	23	32	13	11	18	27	5

TABLE 2. Egg production and fertility in pre- and post-treatment nests in 1983.

Building Site	Pre-treatment (January - March)				Post-treatment (March - August)			
	no. nests	no. clutches	no. eggs		no. nests	no. clutches	no. eggs	
			fertile	infertile			fertile	infertile
Hayes Hall	10	13	26	0	15	42	60	21
Moseley Hall	2	2	4	0	3	9	18	0
Life Sciences	1	1	2	0	1	3	6	0
Total	13	16	32	0	19	54	84	21

TABLE 3. Consumption of ornitrol-treated and untreated corn by laboratory pigeons. Means connected by lines are not significantly different at the *p* = .05 level.

Treatment group	Treatment period	Treatment	Food consumption (g/bird/day)
10-day	days 11-20	untreated	24.9
control	days 11-20	untreated	20.8
control	days 1-10	untreated	20.0
10-day	days 1-10	treated	17.2
20-day	days 1-10	treated	16.4
20-day	days 11-20	treated	15.3