PREDATOR URINES AS CHEMICAL BARRIERS TO WHITE-TAILED DEER

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ABSTRACT: The authors assessed whether bobcat (*Lynx rufus*) or coyote (*Canis latrans*) urine could reduce white-tailed deer (*Odocoileus virginianus*) use of established feeding areas or trails. A four-week experiment evaluating deer use of eight feeding stations, four each with coyote or bobcat urine was conducted at a 2,200 ha fenced facility in northern Ohio with high deer densities (38/km^2). At this same facility, the authors also monitored deer use of four trails where coyote urine was applied. For both experiments, urine was placed in holders positioned at ground level within 2 m of the area being protected. The number of deer entering feeding stations after two weeks exposure to predator urines was 15 to 24% less ($P < 0.05$) than the number of deer entering feeding stations during pretreatment. Deer use of trails did not decrease in response to presence of coyote urine. It was concluded that predator urines used as a chemical barrier were of limited effectiveness in deterring high concentrations of white-tailed deer from areas with established sources of food and ineffective in deterring deer from trails.

KEY WORDS: *Odocoileus virginianus*, predator urines, repellents, white-tailed deer, wildlife damage management

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INTRODUCTION

Deer (*Odocoileus* spp.) cause substantial economic loss to agricultural crops (Scott and Townsend 1985; Dudderar et al. 1990; Sayre and Decker 1990). Agricultural and wildlife agencies have ranked deer as causing more crop damage overall than any other group of wildlife (Conover and Decker 1991). Deer residing at airport facilities also pose a direct threat to aviation safety. For example, in 1993 to 1995, deer represented 66% of reported civilian aircraft collisions with mammals (Cleary et al. 1996).

Numerous techniques including fences, frightening devices, and repellents have been evaluated or used to reduce deer use of crops and airfields (Craven and Hygnstrom 1994; Belant et al. 1996a). Predator urines have also been evaluated as feeding repellents for mammals (Sullivan et al. 1988; Epple et al. 1993; Nolte et al. 1993, 1994), including deer (Sullivan et al. 1985; Swihart et al. 1991). However, previous studies typically have evaluated the repellency of urine applied directly on or adjacent to the food being protected. Application of urines to forage is undesirable in some situations such as livestock feed or crops for human consumption. To the authors' knowledge, no study has evaluated the effectiveness of predator urines to reduce deer use of specific areas.

The objective of this study was to determine whether predator urines could be used as chemical barriers to reduce white-tailed deer use of established sources of food and trails. The goal was to develop a technique to reduce deer depredation of agricultural crops and livestock food supplies (e.g., stacked hay or silage) and to reduce their presence near airport runways.

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STUDY AREA

This study was conducted during April to June 1996 at the National Aeronautic and Space Administration Plum Brook Station (PBS), Erie County, Ohio. This 2,200 ha facility is enclosed by a 2.4 m high chain-link fence with barbed-wire outriggers. Habitat within PBS differed from the surrounding agricultural area and consisted of canopy-dogwood (*Cornus* spp.) (39%), grasslands (31%), open woodlands (15%), and mixed hardwood forests (11%) (Rose and Harder 1985). During this study, PBS had an estimated minimum white-tailed deer population of 825 ((38/km^2) (P. Ruble, Ohio Div. Wildl., unpubl. data). The deer population was estimated from a helicopter survey which was conducted over the entire facility. Coyotes (*Canis latrans*) are present on PBS; bobcats (*Felis rufus*) are not.

METHODS

Test Materials

The authors obtained coyote and bobcat urine and scent darts from Johnson and Company (Bangor, Maine). Scent darts consisted of six foam strips attached to a 5 cm wood stake and were manufactured specifically to hold urine. Manufacturer recommended use for both urines was to saturate the foam strips of the scent darts and space them at 10 to 12 ft (3.0 to 3.7 m) intervals near the area to be protected. The manufacturer recommended reapplying urine to the scent darts at 10-day intervals. The coyote urine was marketed as effective in moving deer to or away from specific areas; bobcat urine was similarly marketed for small mammals.

Feeding Experiment

Eight deer feeding stations were established, located >1 km apart using whole-kernel corn placed in two adjacent 1.2 m long cattle feed troughs. A 1.5 m high plastic snow fence was erected on three sides of a 5 x 5 m area such that feed troughs were located inside the

fenced areas about 1 m from the back. Corn was added to feed troughs as necessary to maintain a constant food supply and the amount of corn added was recorded. An infrared monitoring device (TrailMaster®, Goodson and Assoc., Inc., Lenexa, Kansas was installed 60 cm above ground at each opening to record the number of deer intrusions and to avoid recording nontarget species (e.g., raccoons [*Procyon lotor*], fox squirrels [*Sciurus niger*]).

To condition deer to use feeding stations the authors monitored each station five to seven times per week for one month prior to the experiment, recording the number of intrusions and providing corn as needed. The experiment consisted of a 1-week pretreatment, 2-week treatment, and 1-week posttreatment period beginning April 26, 1996. Feeding stations were identical among periods except that urine was applied to scent darts during the treatment period.

Four sites were selected at random to receive coyote urine; the remaining four sites received bobcat urine. At each site, two scent darts each were saturated with 6 to 8 ml of the respective urine and placed the darts 1 m in front of, and 1.5 m either side of the center of the entrance. During treatment, urine was reapplied every seven days and whenever precipitation exceeded 5 mm within a 24 hr period.

The authors initially divided the daily number of intrusions recorded by the monitoring devices by 2 to determine the number of times deer entered each feeding station. The mean daily number of intrusions/week for each station was then calculated. Analysis of variance (ANOVA) was used with repeated measures (weeks) (SAS Inst. Inc. 1988) on log-transformed data to compare the number of deer intrusions and amount of corn consumed among periods for each type of urine. If main effects were significant ($P < 0.05$), Tukey tests were used to determine which means differed.

Trail Experiment

A TrailMaster was positioned to record deer crossings along each of four trails separated by >1 km. At each trail on May 16, the authors then placed a scent dart 2 m on either side of the monitoring device and <1 m from the trail. The experimental design and statistical analyses were conducted identically to those described for the feeding experiment except that the daily number of deer crossing were not divided by 2.

RESULTS

Feeding Experiment

The mean (± SE) daily number of deer intrusions differed among treatment periods at sites with bobcat urine ($F=4.67$; 3,9 df; $P=0.03$) and coyote urine ($F=28.19$; 3,9 df; $P < 0.01$) (Figure 1). For both urines, the number of deer intrusions was greatest during pretreatment and lowest during posttreatment. For both urines, the mean daily number of intrusions during week 2 treatment was 15 to 24% less than the mean daily number of intrusions during pretreatment.

Mean daily corn consumption also differed at feeding stations with bobcat urine ($F = 5.80$; 3,9 df; $P = 0.02$) and coyote urine ($F = 16.22$; 3,9 df; $P < 0.01$). For both urines, corn consumption was greatest during week 1 treatment.

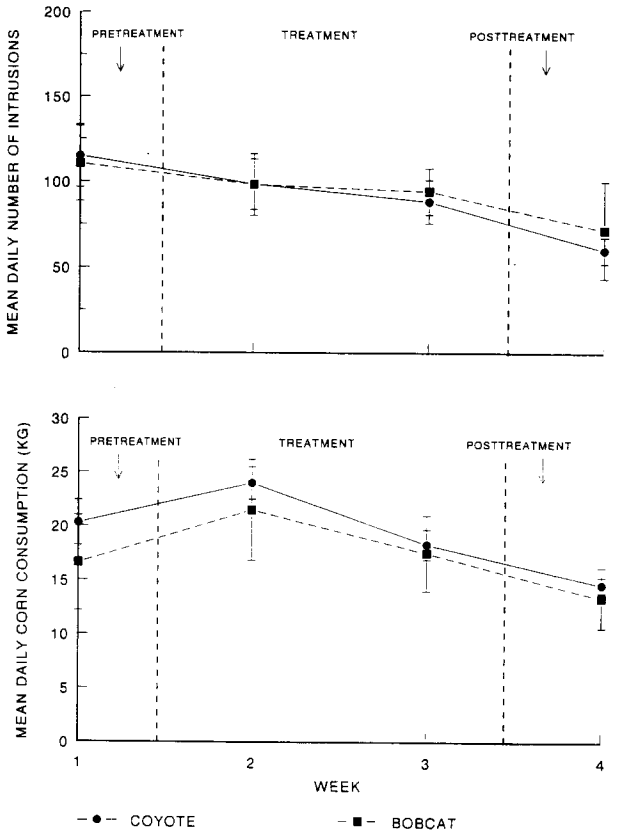

Figure 1. Mean daily number of white-tailed deer intrusions and mean daily corn consumption at sites with coyote or bobcat urine by week, Plum Brook Station, Erie County, Ohio, April to May 1996. Capped vertical lines represent 1 standard error.

Trail Experiment

The mean daily number of deer crossings increased ($F=9.78$; 3,9 df; $P < 0.01$) during the four-week experiment with more ($P < 0.05$) deer crossings during posttreatment (41.3 ± 5.1) than during pretreatment (4.7 ± 1.5) and treatment (7.7 ± 2.0 to 18.6 ± 8.9) (Figure 2). The number of crossings during pretreatment and treatment was similar ($P > 0.05$).

DISCUSSION

The slight (15 to 24%) decline in deer use of feeding stations after two weeks of exposure to bobcat and coyote urine suggests limited effectiveness as a chemical barrier. That deer use continued to decline during posttreatment suggests deer may have learned to avoid the feeding stations. Alternatively, the observed decline in use during April to May may be attributed to increased availability of highly nutritive grass and forbs. Also, decreased use of feeding stations could be in response to decreased movements of female deer during parturition.

Bobcat and coyote urines were marginally effective in deterring white-tailed deer from entering feeding areas and ineffective in reducing deer use of established trails. Sullivan et al. (1985) and Swihart et al. (1991) found that bobcat and coyote urines applied directly on or adjacent

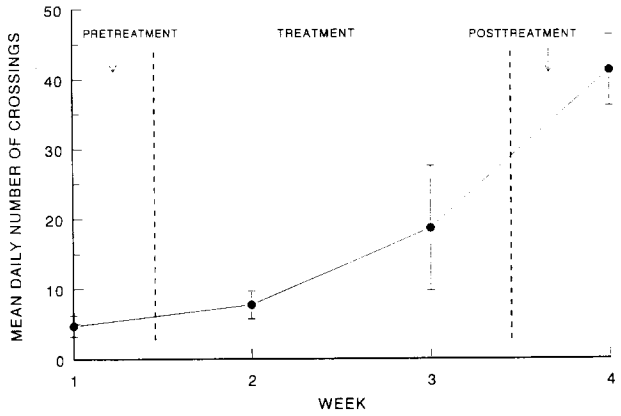

Figure 2. Mean daily number of white-tailed deer crossings on trails at sites with coyote urine, Plum Brook Station, Erie County, Ohio, April to May 1996. Capped vertical lines represent 1 standard error.

to food suppressed consumption by white-tailed deer and black-tailed (*O. hemionus*) deer. In these studies, urine applied directly on food suppressed feeding more than did urine placed adjacent to food. In this study, urine was applied about 5 m from the food. Thus, effectiveness of predator urines increases as the distance between the urine and food source decreases, and effectiveness is maximized when urine is applied directly to food.

The inability of urines to substantially reduce deer intrusions at feeding areas in this study may be related to higher deer densities than observed in other studies; however, the lack of reduction in deer use of trails was likely not. The authors are uncertain why deer use of trails during week 2 treatment and posttreatment increased. One possible explanation is increased movement of female deer to forage post-parturition. Also, the ineffectiveness of using predator odors, such as urine, to deter white-tailed deer from specific areas, such as trails, may not be applicable to mammals in general. For example, Sullivan et al. (1988) documented avoidance by rodents of burrows treated with predator odors. Effectiveness of repellents appears related to the relative attractiveness of the material or area being protected (see Belant et al. 1996b).

Effectiveness of predator urines may also be related to the relative threat perceived by the prey (Swihart et al. 1991). Swihart et al. (1991) suggested that white-tailed deer are more alarmed by the presence of bobcats than coyotes. Aversion to predator odors may be innate, suggesting that habituation should not occur (Muller-Schwarze 1972, 1974). However, habituation to learned avoidance of predator odors may occur if reinforcement is lacking. Bobcats have not been present in northern Ohio for >50 years (Gottschang 1981). Thus, white-tailed deer on PBS may have overcome their innate aversive response to bobcat urine because reinforcement does not occur. The authors have observed coyotes chasing white-tailed deer and carcasses of deer apparently killed by coyotes on PBS; however, the relative importance of deer in the diet of coyotes on PBS is unknown.

Although direct application of predator urines to food can suppress feeding by deer (Sullivan et al. 1988; Swihart et al. 1991), predator urines were only marginally effective in excluding a high-density population of white-tailed deer from establishing feeding areas and were ineffective in reducing deer use of trails. It is concluded that predator urines used as a chemical barrier would be only of limited value in deterring deer from areas containing desired food and from using airport runway areas.

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