Is Razor-wire an Effective Deterrent for Birds Perching on Security Fences at Airports?

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ABSTRACT: Wildlife-aircraft collisions (wildlife strikes) pose a serious risk to aircraft and cost civil aviation in the United States an estimated $957 million annually. Blackbirds and doves in particular have caused some of the most devastating aircraft accidents related to wildlife strikes in the United States and Europe. Birds perching on security fences and other structures are a problem at airports and other locations where birds are not desired. Reduction of available perching sites should make airports less attractive to these species and thus reduce the risk of damaging wildlife strikes. We conducted a series of experiments to determine if 3 species of birds hazardous to aviation [i.e., mourning doves (*Zenaida macroura*), common grackles (*Quiscalus quiscula*), and brown-headed cowbirds (*Molothrus atar*)] were deterred from perching sites at the top of a 3-stranded security fence by the application of Razor–ribbon™ Helical razor-wire. We determined bird use (for perching) of 3-stranded barbed wire security fences, with and without the addition of razor-wire using 6 birds each in 2 3.6- x 8.5- x 2.4-m flight cages. Treatment perches consisted of the top portion of a 3-stranded barbed wire security fence (2.5-m in length) with 2.5-m of razor-wire attached. Control perches consisted of an identical portion of security fence without the razor-wire. During the experimental period, mourning doves were observed on razor-wire protected fences twice as often, brown-headed cowbirds were observed similar amounts of time, and common grackles were observed 4 times as often as they were on unprotected fences. We found no evidence that razor-wire provided any deterrence to birds that perch on security fences.

Key Words airports, anti-perching, bird strikes, brown-headed cowbird, common grackle, mourning dove.

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Wildlife-aircraft collisions (wildlife strikes) pose a serious safety risk to aircraft and the flying public. Wildlife strikes cost civil aviation at least $957 million annually in the United States (Dolbeer et al. 2016). Over 169,850 wildlife strikes with civil aircraft were reported to the U.S. Federal Aviation Administration (FAA) during 1990–2015 (Dolbeer et al. 2016). Aircraft collisions with birds accounted for 97% of the reported strikes, whereas strikes with mammals and reptiles were 3% and <1%, respectively (Dolbeer et al. 2016). Gulls (*Larus* spp.), waterfowl such as Canada geese (*Branta canadensis*), raptors (hawks and owls), and blackbirds (Icterinae)/starlings (*Sturnus vulgaris*) are the species presently of most concern at airports (Dolbeer et al. 2000, Dolbeer and Wright 2009, DeVault et al. 2011). Mourning doves are also a significant hazard and have resulted in damaging strikes to both civil (Dolbeer et al. 2000, Dolbeer et al. 2016) and military aviation (Zakrajsek and Bissonette 2005). Sound management techniques that reduce bird numbers in and

around airports are therefore critical for safe airport operations (DeVault et al. 2013).

Large-scale killing of birds to solve conflicts is often undesirable or impractical (Dolbeer 1986, Dolbeer et al. 1997). Nonlethal frightening techniques to keep birds away from airports are available (Marsh et al. 1991, Cleary 1994) but can be cost-prohibitive or only temporarily effective (Dolbeer et al. 1995). Habitat management within airport environments, including modification of potential perching areas, is the most important long-term component of an integrated wildlife damage management approach to reduce the use of airfields by birds and mammals that pose hazards to aviation (U.S. Department of Agriculture 2005, DeVault et al. 2013).

Effective anti-perching techniques are an important part of an integrated wildlife damage management program at airports (DeVault et al. 2013). Security fences, buildings, signs, light fixtures, and other locations within airport environments provide roosting habitat for many species of birds, most notably many species that pose a hazard to safe aircraft operations. We reviewed the scientific literature found only one study that evaluated anti-perching methods for security fences. The findings of Seamans et al. (2007) suggest that anti-perching devices, such as Bird-wire™, might be useful in deterring birds from using airport security fences as a place to perch or roost.

Following the terrorist attacks that occurred in the USA on September 11, 2001 there has been increased interest, available monies, and implementation of measures to deter humans from entering airfields. Consequently, the use of razor-wire has increased significantly as an anti-personnel security technique and this trend will likely continue into the future. To our knowledge, no information exists in the published literature regarding the efficacy of the razor-wire as a device to reduce the amount of perching by birds on fences within airport environments.

The objective of this study is to determine if the installation of razor-wire onto the barbed wire components of airport security fences will deter birds from perching on the fences. Our null hypothesis is that bird use of 3-stranded barbed-wire security fencing components will not differ with or without razor-wire attached.

METHODS

Our studies were conducted in 2004 and 2005 at the U.S. Department of Agriculture's, Wildlife Services, National Wildlife Research Center, Ohio Field Station at the National Aeronautical Space Administration Plum Brook Station, Erie County, Ohio, USA (41°27' N, 82°42' W). This facility is a 2,200-ha fenced installation with large tracts of fallow fields, interspersed with woodlots, and surrounded by agricultural fields.

Bird Species

We conducted a series of experiments with 3 species of birds that are hazardous to aviation: mourning doves (*Zenaida macroura*), common grackles (*Quiscalus quiscula*), and brown-headed cowbirds (*Molothrus ater*; Dolbeer et al. 2016). The mourning dove experiment was conducted 25 – 29 October 2004 (pre-treatment period) and 1 – 5 November 2004 (experimental period). We conducted the common grackle experiment during 29 November – 17 December 2004 (pre-treatment period) and 6 – 10 December 2004 (experimental period). The brown-headed cowbird experiment was conducted 2 – 6 May 2005 (pre-treatment period) and 9 – 13 May 2005 (experimental period).

Anti-perching Experiments

For each species (independently), bird use (for perching) of 3-stranded barbed wire security fences, with and without the addition

of razor-wire, was evaluated using groups of birds in 2, 3.6- x 8.5- x 2.4-m flight cages. Groups of birds (12 birds/group) were randomly assigned to each of the 2 cages in two-choice tests to determine the effect of mounted razor-wire on bird use of perches. Once a bird group was established, the members stayed in the cage for the entire period.

Observers conducted experimental observations from an observation tower (20 m from the flight cages) with the aid of binoculars. Spot counts of the birds in the cages were conducted every 1 minute for a 1-hour period (beginning at 09:00 each day). The location of each the birds (perched on the control fence, on the ground, cage sides, food or water pan) was recorded. Similar observations were conducted for a second 1-hour period (beginning at 11:00). This series of observations was made for a 5-day period (pre-treatment period); during this time both perches (fences) in each cage were control perches (no razor-wire).

Following the pre-treatment period, razor-wire was attached to 1 of the 2 perches in each cage. Pre-treatment data was examined to determine if the birds exhibited a preference for either perch; the razor-wire was attached to the perch used most frequently. Treatment perches consisted of the top portion of a 3-stranded barbed-wire security fence (2.5-m in length) with 2.5-m of razor-wire attached. Razor–ribbon™ Helical razor-wire (Allied Tube and Conduit Inc., Hebron, Ohio) was attached using a 26-cm (14-inch) spacing between coils. Spacing between coils was set to 26-cm as this distance is slightly narrower than the average wingspan of mourning doves; our intention was to make it difficult for the birds to land and take off on the fence between the razor-wire coils. Control perches consisted of an identical portion of security fence without the razor-wire. A second series of observations (experimental period) was then conducted for a 5-day period.

Statistical Analyses

Our response data (perching rate) was non-normally distributed and we were unable to successfully transform them. Thus, we used Wilcoxon Sign Rank tests to compare the perching rate of birds on the control and razor-wire sections during the experimental period (razor-wire present) for each bird species independently (Zar 1996). In addition, we used Mann–Whitney *U* tests to compare the perching rate of birds on control, razor-wire, the ground, and on other locations between the pre-treatment and experimental treatment periods for each bird species independently (Zar 1996).

RESULTS

Attaching razor-wire did not reduce perch use of 3-stranded barbed-wire security fences by the 3 species of birds. During the experimental period, mourning doves were observed on razor-wire protected fences twice as often ($W = 1.96$; $P = 0.05$) as on unprotected fences (Table 1). Common grackles perched on razor-wire protected fences and unprotected fences with similar ($W = 1.79$; $P = 0.07$) frequency (Table 1). Brown-headed cowbirds perched on razor-wire protected fences 4 times more often ($W = 3.45$; $P = 0.001$) that on unprotected fences (Table 1).

The 3 bird species differed in the specific part of the razor-wire protected fences where they perched (Figure 1). Mourning doves perched on the razor-wire itself the vast majority of the time, common grackles perched on the barbed-wire and the razor-wire equally, and brown-headed cowbirds perched on the barbed-wire twice as often as they perched on the razor-wire itself (Figure 2).

Table 1. Percentage of observations (total of 14,400 per period for each species) that mourning doves, common grackles, and brown-headed cowbirds were perched on control fences, on razor-wire fences, on the ground, and on other places during experiments conducted in Erie County, Ohio, 25 October 2004 to 18 May 2005. Other places consisted of food and water pans and on the side of the flight cages.

	Pre-treatment Period (5 days)		Experimental Period (5 days)	
Species	Location	% of Observations	Location	% of Observations
Mourning doves	Control	21%	Control	8%
	Control (RW)*	29%	Control (RW)	18%
	Ground	47%	Ground	64%
	Other	3%	Other	1%
Common grackles	Control	2%	Control	1%
	Control (RW)*	20%	Control (RW)	1%
	Ground	49%	Ground	80%
	Other	29%	Other	18%
Brown-headed cowbirds	Control	5%	Control	4%
	Control (RW)*	21%	Control (RW)	17%
	Ground	67%	Ground	67%
	Other	7%	Other	12%

* During the pre-treatment period, the fences where the razor-wire was attached (for the post-treatment period) were controls.

Figure 1. Mourning doves (*Zenaida macroura*) perched on the Razor–ribbon™ Helical razor-wire during the experimental period.

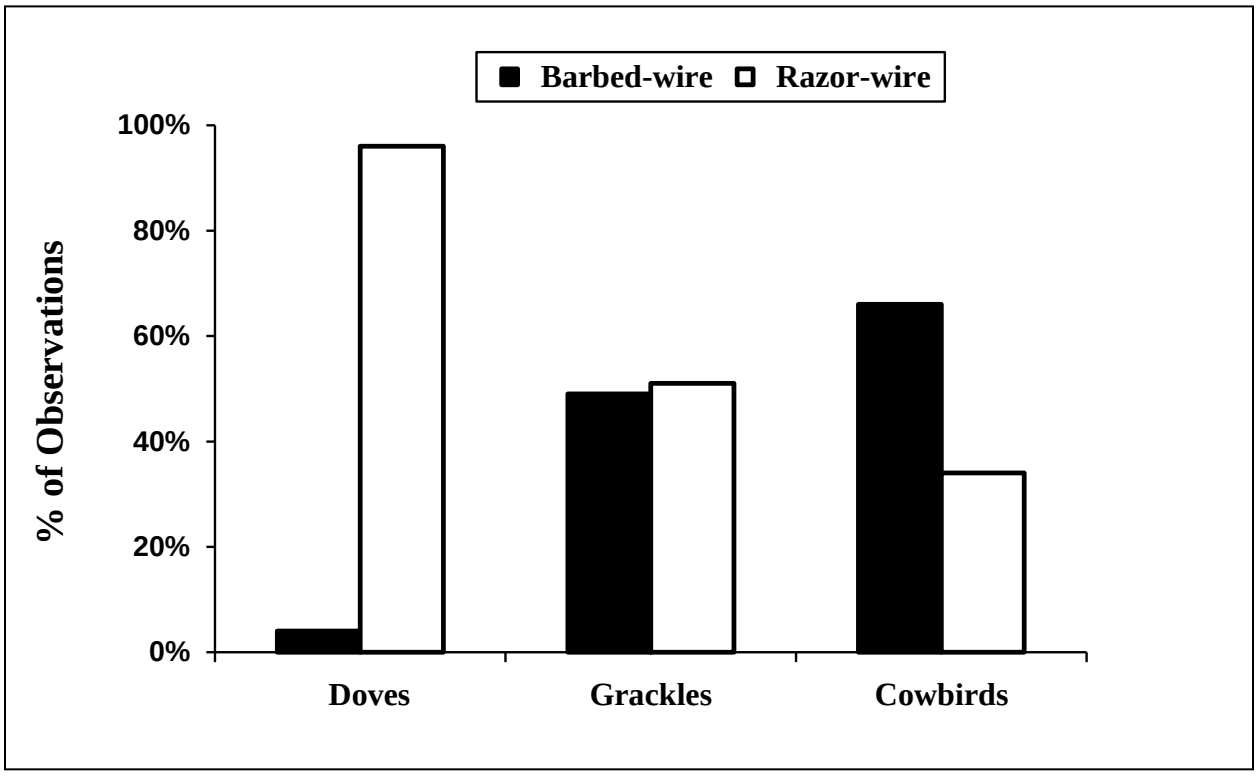

Figure 2. Percentage of observations showing where mourning doves, common grackles, and brown-headed cowbirds were perched within a 3-stranded barbed-wire fence that had razor-wire attached to the fence.

Mourning doves and common grackles spent more time on the ground (doves: $U = 4.57$, $P = 0.03$; grackles: $U = 27.26$, $P < 0.0001$) and less time on the control perches (doves: $U = 7.97$, $P = 0.005$; grackles: $U = 6.70$, $P = 0.01$), razor-wire protected perches (doves: $U = 5.19$, $P = 0.02$; grackles: $U = 29.35$, $P < 0.0001$), and other locations (doves: $U = 11.17$, $P = 0.001$; grackles: $U = 12.00$, $P = 0.0005$) during the experimental treatment period compared to the pre-treatment period. In contrast, brown-headed cowbirds spent similar amounts of time perching on the ground ($U = 0.35$, $P = 0.55$), on control perches ($U = 2.66$, $P = 0.10$), and razor-wire perches ($U = 0.29$, $P = 0.59$) during the pre-treatment and experimental treatment periods. Brown-headed cowbird use of other location perches was higher ($U = 9.02$, $P = 0.003$) during the experiment treatment period compared to the pre-treatment period.

DISCUSSION

Razor–ribbon™ Helical razor-wire was not an effective deterrent for reducing perch use of 3-stranded barbed-wire security fences by birds. Although the razor-wire is sufficiently sharp to inflict wounds to humans and thus acts as an effective anti-personnel barrier, it does not exclude birds from perching on security fences or the razor-wire itself. Mourning doves, common grackles, and brown-headed cowbirds were observed perching on all parts of the razor-wire during the experiments.

Common grackles and mourning doves spent less time perched on the fences with and without razor-wire attached and more time on the ground during the experimental period. Although it is possible that the attachment of the razor-wire might have influenced this response, other factors

are likely to have caused this change in behavior. Acclimating to the flight cages as the experiment progressed, in addition to continual harassment by avian predators [e.g., Cooper's hawks (*Accipiter cooperii*)], likely reduced the amount of time the birds perched on fences and increased the amount of time spent on the ground.

Modification of airfield habitats (e.g., removal of woody vegetation) to reduce perching and roosting opportunities to wildlife hazardous to aviation is an important part of an integrated wildlife damage management program (U.S. Department of Agriculture 2005, DeVault et al. 2013). However, birds commonly perch on a diversity of artificial structures present on airports, including buildings, signs, light structures, and security fences. Exclusion of birds from such man-made structures might be achieved through the placement of specialized perch exclusion products (Avery and Genchi 2004, Seamans et al. 2007, Seamans and Blackwell 2011). However, further research to develop and evaluate the efficacy of anti-perching tools and methods that can be practically implemented to prevent birds from perching on airport security fences and other airport structures are needed. Other types of razor-wire or different attachment methods for the razor-wire might be more effective in deterring birds from perching on security fences.

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