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RESEARCH ARTICLE

Evaluation of wires as deterrents for preventing house martin nesting on buildings

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We tested the effectiveness of wires in preventing house martins (*Delichon urbica*) from constructing nests on buildings. Their nests were removed after each of two breeding seasons, wires were installed, and nest relocation was monitored during the following breeding season. Deterrents were considered as successful if the nests were displaced to new sites and as a failure if the nests were relocated in their original places, even if these were constructed on the wires. In the control, martins relocated 89.3% of their nests within the same location rather than in new locations. In the treatment there was a 45% decrease in colony size, a failure rate of 77.7% and a displacement rate of 22.2% in the first year. During the second year, there was an 82.5% increase in colony size, a 45.5% failure rate and a 54.5% displacement rate. The wires did not have a significant effect on displacements during the first year but did have such an effect during the second year. We conclude that wires are not an effective method for preventing house martins from nesting.

Keywords: *Delichon urbica*; house martin; nesting; deterrents; wires; urban wildlife control

1. Introduction

Damage caused by birds is a common problem in urban environments, buildings and homes, crops, aquaculture facilities and airports (Godin 1994; Gorenzel et al. 1994; Sol et al. 1997; Harding et al. 2007). Some of the bird species most frequently involved in causing such damage are native ones such as starlings (Johnson and Glahn 1994; Belant et al. 1998), sparrows (Agüero et al. 1991; Fitzwater 1994), pigeons (Sol and Senar 1992; Williams and Corrigan 1994) or gulls (Solman 1994), although exotic bird species are a growing concern in many places (Bucher and Martin 1987; Temple 1992). Wildlife control operations are similar to sustainable yield harvesting (Sinclair et al. 2006) where the main aim is to remove a fraction of the population. This is usually achieved by manipulating population mortality and fertility, and indirect by manipulate the pest using methods such as exclusion, deterrents or habitat and food availability. Many of the species targeted are not protected, and control techniques may include shooting or live trapping for relocation (Craven et al. 1998). However, legally protected or endangered species present a particular challenge. Controlling the problems caused by protected bird species is difficult due to legal and ethical restrictions. In these cases, shooting or other fatal methods have to be avoided. Controlling fertility is also difficult or restricted, and trapping and relocation is not a realistic and effective solution due to the risk of some birds returning to their old home range. Thus, habitat modification and management, exclusion and sonic devices, hawks, repellents or perch deterrents are the only options available (Mason 1990; Werner et al. 2005; Baxter and Robinson 2007; Fiedler et al. 2007; Lammers and Collopy 2007).

Swallows and house martins family (Hirundinae) are insectivore passerines that are protected in many countries. Control problems with these species arise due to the birds breeding biology (Gorenzel and Salmon 1994). House martins (*Delichon urbica*) are migratory and highly colonial nesting birds which show a high rate of nest reoccupation every year (De Lope and Da Silva 1988). Breeding pairs attach their nests under the eaves of buildings, windows, cornices or roofs in urban environments (Antón and Santos 1985) causing dirt and damage problems. House martin droppings tend to build up beneath nests (Royal Society for the Protection of Birds website); consequently financial costs are incurred in cleaning and repainting window frames or building structures. Bird nests also can be a source habitat of ectoparasites (Heeb et al. 2000). The parasite fauna living in house martins' nests (Kimito 1970) affects the breeding success (Christie et al. 1998; Marzal et al. 2005) and immune response (De Lope et al. 1998) of these birds, and they can also be disease vectors. Also, McNeill (1977) and Yamauchi (2005) reported health risks and infestation among humans. It is inappropriate to use exclusion methods for house martins while the nests are in active use. However, preventing the birds from

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nesting can be done when the birds are overwintering and the nests are unoccupied. The Royal Society for the Protection of Birds (RSPB) of the UK recommends the use of pieces of wood or other materials (plastic or PVC) to block the angles under the eaves where the nests are built. They also suggest using fine-mesh chicken wire installations or parallel wires, stretching from the outer edges of the soffit board to further down the wall, to prevent the martins from reaching the corners. The main problem with these exclusion methods is the lack of experimental evidence for their efficacy. Rigorously conducted studies are scarce (but see Belant et al. 1998; Haag-Wackerhagel 2000; Seamans et al. 2007 for testing some deterrent devices among other bird species). The aim of this study was therefore to evaluate the effectiveness of wires as deterrents for house martin nesting.

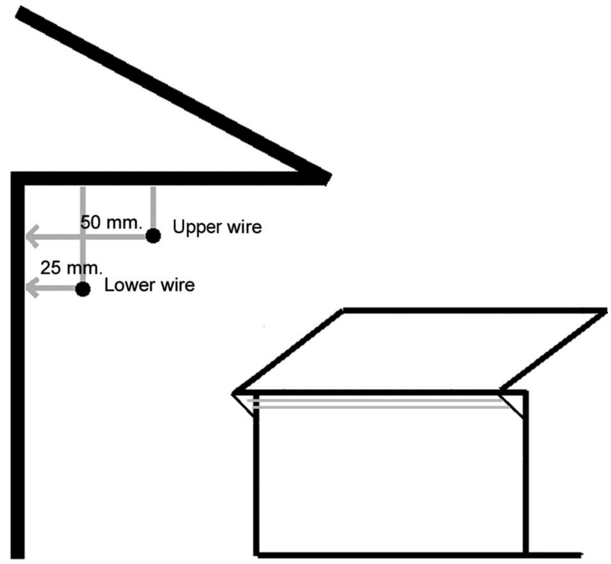

Figure 1. Wire installation scheme beneath building eaves

2. Materials and methods

The study was carried out at Los Arqueros Golf and Country Club, a residential housing development located on the Costa del Sol (Málaga, Andalucía, southern Spain), which consists of 140 buildings, most of which bear house martin nests. We selected a group of 13 buildings called 'El Lago' (36° 33' N 5° 00' W); in which house martin nests were abundant. The buildings are surrounded by gardens, semi-natural Mediterranean scrubland and golf courses.

We assume, *a priori*, that a deterrent device has to displace its target to an alternative site lacking deterrents, and secondly, lead to a decrease in the numbers of its target species. In this study, the targets were house martin nests. We experimentally removed nests during each of two consecutive winters with the permission of the environmental authorities, installed wires, and then tested for nest reinstallation during the following two breeding seasons. Both removals were performed after the end of the breeding season, when post-nuptial migration had just ended, during November 2006 and November 2007. The deterrents were installed during December 2006, and were fitted to all the eaves of the buildings. The deterrents consisted of two parallel steel wires (1.5 mm diameter) and blocked the angles where nests had originally been placed. The first wire (the higher) was 50 mm away from the wall and 25 mm away from the roof cornice. The second (the lower) was 25 mm away from the wall and 50 mm from the roof cornice. The wires formed a structure that obstructed the right angle between the wall and roof cornice (Figure 1). We installed a total of 391.72 m of wires. The wires were only slightly tensed, thus leaving them unsteady and difficult to use as nest fixing points or to roost on, as well as to prevent house martins from approaching the eaves. We checked the status of the wires as deterrents after the first breeding season. The house martins began their pre-nuptial migration during mid-March and a new breeding season began in the area in April. We monitored nest relocation from April to August, in both 2007 and 2008. We also performed a control experiment in other nearby buildings with house martin nests. These were also removed but deterrents were not installed, and nest relocation was monitored for one breeding season only.

A complete photographic report allowed us to count and locate each nest before removing it during both breeding seasons. We compared removed and relocated nests in the places where deterrents were installed. Deterrents were considered as failures when the nests were relocated and installed in the same places, and considered as successful when the nest was displaced and relocated to a new site with no deterrents. In addition, we tested changes in the average number of nests in the buildings each breeding season to determine whether deterrents reduced the nesting colony size. We also investigated differences in colony size in the control buildings before and after nest removal, and compared old and new nest relocation sites. A matched pairs design, where variations in treatment are conducted during the same year, would have been useful. However, since house martins are a legally protected species in Spain, it was not possible to employ this experimental set-up. We studied the potential effect of the year on the results, and the relocation of nests in places with and without wires. Finally, we assume that the method was an overall success if comparisons showed that there were more nest displacements in the experimental group than in the control group. We used a one-way ANOVA test for statistical comparisons and contingency tables for testing the association of variables (Fowler and Cohen 1992). Means are given with their standard error.

3. Results

Five buildings were used as controls, and there were a total of 28 nests before removal (5.6 $\pm$ 0.22 nests per building);. A total of 25 nests were relocated after removal (89.3% of the total removed), 88% being in the same place and 22% in new places. The average number of nests relocated per building was 5.0 $\pm$ 0.2. The average number of nests per building was not significantly different (ANOVA, $F_{1,9} = 0.782$; $P > 0.05$) before and after removing the nests. The frequency of relocated nesting was not significantly different from the previously observed frequency ($X^2 = 1.635$; df = 4; $P > 0.05$) and relocated nests were not significantly associated with new places ($X^2 = 2.115$; df = 4; $P > 0.05$).

During the first year (winter 2006, before the first removal), we found a total of 40 nests. There were nests in 9 of the 13 buildings considered. The average number of nests per building was 4.44 $\pm$ 0.6. In the 2007 breeding season, after the first removal and deterrent installation, we found a total of 18 nests, i.e. a 45% decrease in colony size, and there were nests in 8 of the 13 buildings. The average number of nests per building was 2 $\pm$ 0.75. In the 2008 breeding season, after the second removal, a total of 33 nests were found, representing an 83% increase in colony size compared to the previous year. The decrease compared to the original size was 82.5%. Once again, there were nests in 8 of the 13 buildings. The average number of nests per building was 4.13 $\pm$ 0.5. The average number of nests per building was not significantly different (ANOVA, $F_{2,26} = 0.126$; $P > 0.05$) between years, i.e. before installing deterrents and after 2 years of treatment.

In 2007, there were 14 deterrent failures (77.7% of all relocated nests were in their original places, even with wires installed), and 4 nests (22.2%) were displaced to new places without wires. In 2008, there were 15 deterrent failures (45.5%) and 18 displacements (54.5%). Thus, over the 2 study years, 29 nests (56.9%) were deterrent failures and 22 (43.1%) were displaced. In 2007, the wires had no significant effect on nest displacement ($X^2 = 0.802$; df = 1; $P > 0.05$) compared to control, whereas in 2008 the wires significantly enforced the displacement of nests to new places without wires (X^2 11.147; df = 1; $P < 0.001$). The frequency of failures and displacements was significantly associated by year ($X^2 = 1.635$; df = 4; $P < 0.05$) of treatment.

The martins made successive attempts to evade and surmount the wires by attaching mud to the wall at the original site of the nest until a sufficient amount of mud had accumulated to cover the wires (see Figure 2 for details).

Figure 2. House martin's nest installed on the wires

4. Discussion

The overall results show that, despite removing nests and fitting wires as deterrents, house martins try to rebuild their nests in the same location, as observed in the control. The average number of nests per building did not decrease in relation to the number existing prior to installation of wires. Furthermore, despite an initial decrease in the size of the colony during the first year of treatment, it grew back to its original size after the second year. We observed that some new nests had been built in areas where there were no wires, but also found nests built on the wires.

The reproductive characteristics of house martins may partly explain the results. These birds are very loyal to their nesting places, especially if they have successfully reared chicks during a previous season. After migrating they return to the same nesting place as the previous spring and their offspring build their nests nearby (Shields 1984). Cooperative rearing and help from other pairs of martins with nests nearby is common among these birds (Brown 1987). They are very colonial (Lahlah et al. 2006) and philopatric (de Lope and Da Silva 1988) and try to use the same nests every year leading to growth in the colony which is usually made up of members of the same family. In fact, their reproductive success depends on this behaviour (Greenwood 1980) and on the nests (Lifjeld and Marstein 1994; Riley et al. 1995). It has been suggested that nest site fidelity and the growth of the colonies year after year minimises the risk of being preyed on, and increases the lifetime reproductive success (Blancher and Roberston 1985). Thus, house martins will attempt to re-use the colony location even in the most precarious conditions.

In our experiment the wires had two functions. On the one hand, they formed a barrier, preventing the birds from reaching the corners of the cornices where they could attach mud and build their nests. On the other hand, the wires broke the 90° angle needed for the nest to be stable. In both instances the wires failed to achieve the desired result as many birds were observed sitting – and even sleeping – on the them, and many nests were built on them. In fact, it is likely that in some cases the wires helped to stabilize the nests or were useful to the birds when they were attaching mud during nest-building. However, there have also been cases where nests have been moved to new locations where there were no wires. Slagsvol (1984) observed that when nests were removed, the parent birds made considerable efforts to build new nests, had lower reproductive success, and more of them gave up after a number of unsuccessful attempts to build a new nest. This process affected the young inexperienced female birds more than the older ones. This would explain the initial decrease in the size of the colony during the first year, and suggests that the re-located nests belonged to young birds which were trying to breed for the first time, although this was not been demonstrated here.

The reproductive success of house martins, and therefore the dynamics of their colonies, may also be limited by other factors such as scarcity of food, leading to weight loss among them (Newton 1998). However, this species is associated with grasslands and areas that have undergone significant alterations, such as golf courses and urban developments (Woodhouse et al. 2005). It has been shown that arthropods are abundant and diverse in these areas (Robinson 2005; Yasuda and Koike 2006), especially on golf courses and the artificial ponds associated with them. Thus, a population of flying insects is available for the martins to feed on during spring and summer. This line of reasoning has led us to highlight food as a limiting factor, as well as the fact that during the study period no special measures were taken (such as phytosanitary measures) in relation to the previous study on vegetation in the area. In the case of house martins, Bryant (1979) suggested that reproductive failure is highest when problems occur during nest-building or when time is lost, for example, by the birds being forced to rebuild them.

Therefore, working on the assumption that the only limiting factor in the colony studied was nest removal, we believe that the latter constituted a stress factor in the colony and led to increased efforts to rebuild nests. Some of the birds, probably the youngest and least experienced, abandoned attempts to reproduce after a few failed attempts, or moved the nest to an area without deterrents. We saw evidence of failed attempts to build nests during the first year. Other birds, which may have had more experience, used the wires to strengthen their nests. The decrease in colony size during the first year was followed by an increase during the second year when as many nests were built on the wires as in the first year. Therefore, this increase was due to building nests in locations without wires; that is, in the nests built by chicks born in the previous year or to birds that failed to build a nest in the previous season.

In conclusion, although installing wires led to nests being relocated, there was a high number of deterrent failures (nests were built on wires) and thus the wires did not work as an exclusion system. Other wire-installation designs are possible and other kinds of deterrents and solutions are available (nets, spikes or other materials that change the architecture of the eaves). Seamans et al. (2007) also found that wires were less effective than other methods to prevent perching. The aesthetic aspect of the solution is also important. The use of nets and plastics to break the angle at the eaves has the disadvantage of being too noticeable to the human eye. Wires have the advantage of being relatively unnoticeable to people inhabiting the building, which solves the aesthetic problem. The use of some kind of low-voltage electric pulse device could be a way to increase the effectiveness of wires. However, electrical systems may not be appropriate, as nest building could lead to short-circuits or increase the risk of bird mortality. Furthermore, these systems are expensive and difficult to install. The use of some kinds of spikes as deterrents may be a better solution, as they have been shown to reduce avian perching sites (Avery and Genchi 2007; Seamans et al. 2007). However, their usefulness in reducing nesting sites remains untested. In any case, the displacement of nests to locations without deterrents has to be assumed.

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