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短 報 (Note)

Photographic evidence of probable mouse predation on a red-billed leiothrix nest

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Abstract

In order to identify nest predators, we monitored active nests of the introduced red-billed leiothrix *Leiothrix lutea* using camera traps on Mt. Tsukuba, in central Japan. In two of the three monitored nests that were built in bamboo thickets, the cameras recorded that mice had visited them. In one case, a leiothrix carried an eggshell out of the nest the next morning, strongly suggesting that the egg had been destroyed at night by the mouse. In another case, however, the mouse did not destroy the eggs during its visit to the nest, implying that small mice may have difficulty in destroying leiothrix eggs. In both cases, the small Japanese wood mouse *Apodemus argenteus* was assigned as the most probable species. These results indicate that mice can easily access leiothrix nests built in bamboo thickets and may be important nest predators.

Key words : camera trap, mouse, nest predation, red-billed leiothrix

Introduction

Exotic red-billed leiothrix *Leiothrix lutea* has increased in population and has expanded its range in Japan over recent decades (Eguchi and Amano, 2004). Despite its success in invasion, leiothrix seems to suffer a relatively high nest predation rate in Japan (Amano and Eguchi, 2002; Tojo and Nakamura, 2004). Although the nest predators of leiothrix have not yet been explored, occasional field observations showed that jays *Garrulus glandarius* and snakes prey on leiothrix nests (Amano and Eguchi, 2002; Tojo and Nakamura, personal observation). For rodents, such direct observation is absent, but circumstantial evidence suggests they are also responsible for nest predation. For instance, eggshells with serrated edges that seem to have been bitten by rodents are sometimes left in the depredated nests of leiothrix or sympatric native passerines (Eguchi and Amano, 2008), and nestling victims have also been found bitten or partly eaten in a way hardly expected from reptilian or avian predators (Tojo and Nakamura, personal observation). Although recent studies have suggested that rodents are important nest predators of forest birds (e.g., Schmidt and Ostfeld, 2003a, b), little is known about this aspect in Japan. Additional evidence of rodent predation on leiothrix nests would be important for exploring interactions between forest birds and their nest predators in Japanese forest areas.

The camera-trap system is effective for identifying avian nest predators, including nocturnal rodents (Major, 1991; Pietz and Granfors, 2000; Schaefer, 2004). Using a simple camera-trap system, we monitored leiothrix nests and took pictures of mice visiting them. Here, we document this as evidence of mouse predation on leiothrix nests.

Study site and methods

The study was performed in a deciduous forest on Mt. Tsukuba (877 m a.s.l., 36°13′N, 140°06′E), a major breeding area of leiothrix in central Japan (Tojo and Nakamura, 2004). In the breeding season of 2002, we searched and monitored leiothrix nests in our study plot (400m × 200m, about 700 - 800 m a.s.l.). Active nests were generally visited at intervals of a few days to determine their status. Most leiothrix nests were built in dwarf bamboo *Sasamorpha borealis* thickets that cover the bulk of the undergrowth of the study plot.

We made camera traps by combining commercially available infrared censor units (Kyohritsu Electronic

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Industry, Wonder Kit SY-85) and compact 35-mm film cameras with a built-in flash and a time-stamp function (Ricoh MZ-320PS) (Photo 1). The censor consists of two components, the transmitter and receiver, and both are connected to a circuit board with electric cords. The circuit board and batteries were set in a water-resistant plastic box. The camera takes photographs when an object blocks the infrared light between the two components. When set in the field, the transmitter and receiver were attached to green plastic poles (1200 × 9 mm) planted in the ground, so that the infrared light passed through just above the leiothrix nest. The cameras on tripods were covered with clear plastic bags to avoid humidity and were camouflaged with green mosquito nets.

Results

On April 30, 2002, we set the first camera-trap system at a leiothrix nest that contained four eggs. The nest had only two eggs on April 27, and the increase of two eggs during the last three days indicated that the nest was active and the clutch had been completed. On May 2, we found that the film in the camera had finished and we set a new film. Thirty-seven photographs were taken on the film, however, it did not record any parent birds or nest predators, indicating that it had been mis-triggered by wind or rain, through bamboo leaves blocking the infrared light between the censor components. As the four eggs remained in the nest, we suggested that the nest had been abandoned just after the camera setting. After all, the first camera system was removed on May 21 from the nest that still retained the four abandoned eggs, and by then, an additional four films had taken 105 photographs without recording any predators or leiothrix.

The second camera was also set on April 30 at a nest containing an egg, which had been empty on April 27. On May 2, the nest had again become empty and the camera was removed. Fourteen photographs were taken on the film, including two shots of a mouse visiting the nest in the middle of the night following the camera setting (May 1, 02:58 and 03:02, Photo 2a, 2b). It also included eight shots of leiothrix visiting the nest the next morning (May 1, 06:02 - 06:07). Seven shots recorded a leiothrix sitting on the ridge of the nest, which was continually probing the bottom from 06:02 to 06:03. In the last two shots of the seven photographs, another leiothrix appeared below the nest (06:03), then perched on the ridge of the nest (06:03, Photo 2c), followed by a shot where both birds had disappeared (06:03). The last shot showed a leiothrix leaving the nest with an eggshell between its bills at 06:07 (Photo 2d). We did not monitor the nest with camera traps afterwards. When we revisited the site on May 28, the nest had fallen to the ground.

The third camera was set on May 15 at a nest that contained four eggs. As the parent birds were making alarm calls during the camera setting, it was clear that the nest was active. On May 21, we found that the nest had been abandoned with the four eggs getting wet. Thirty-six photographs had been taken on the film in the removed camera, including 6 shots of a mouse visiting the nest. Five of the six shots showed a mouse on the nest (Photo 3) and the remaining shot showed the mouse leaving the nest through a bamboo stem. Unfortunately, as the date and time were not recorded, the time and duration of the visit were unknown, though the darkness showed that the mouse visited at night. No leiothrix were recorded in the photographs, indicating that the nest had been abandoned just after the camera setting. As the camera was set in the morning, it seems unlikely that the mouse' s visit at night caused the abandonment of the nest. On May 31, a juvenile Japanese rat snake *Elaphe climacophora* was sitting on the nest and all the eggs had disappeared, suggesting that the snake had eaten the abandoned eggs. As two of the camera-monitored nests out of the three had been abandoned, we stopped using this camera system.

Discussion

Two wood mouse species were recorded at our study site on Mt. Tsukuba: the large Japanese field mouse *Apodemus speciosus* and the small Japanese field mouse *A. argenteus* (Ibaraki Animal Study Group, 1998). Though the harvest mouse *Micromys minus* and the house mouse *Mus musculus* are also recorded along the riverbed and residential areas in the surrounding lowlands, respectively, they had not been captured in the forest areas of Mt. Tsukuba (Ibaraki Animal Study Group, 1998). Although discriminating juvenile *A. speciosus* from *A. argenteus* depending solely on photographs is difficult, the ability to access the leiothrix nests that were built in the bamboo thickets suggests that the mice in the photographs were most likely *A. argenteus*, as arboreal activity is common in this species but negligible for *A. speciosus* (Sekijima, 1997, 2004). *Apodemus* mouse is known to prey on shrub-nesting blackcap *Sylvia atricapilla* nests in Germany (Schaefer, 2004).

Photo 1. A compact film camera with an infrared censor unit. The circuit board and batteries are in the plastic box.

Photo 2a. A mouse entering a leiothrix nest. The white arrow indicates the tail (02:58, May 1, 2002).

Photo 2b. A mouse on the same nest as 2a. (03:02, May 1, 2002)

Photo 2c.Leothrix visiting the nest the next morning after the mouse-visit (06:03, May 1, 2002). The left bird continued probing the nest from 06:02 and the right one joined at 06:03.

Photo 2d. Leiothrix carrying an eggshell out of the nest (06:07, May 1, 2002).

Photo 3. A mouse visiting an abandoned leiothrix nest (May, 2002). The date and time were not recorded. The mouse did not destroy the leiothrix eggs in the nest.

As the second nest contained only one egg, the parents had not yet started incubation, and had no chance to meet the intruding mouse at night. Instead, the female would have found the first egg destroyed when she came to the nest to lay the second egg the next morning. The leiothrix probing the nest (Photo 2c) may have been eating the contents of the remaining egg, as parental eating or disposal of damaged eggs has been reported in some bird species (e.g., Ratcliffe, 1970; Trail et al., 1981). Unfortunately, there was no direct evidence that the mouse destroyed the egg when it visited the nest and, therefore, egg predation by leiothrix itself could be an alternative explanation for the photographic records. Although filial cannibalism of undamaged eggs never appears to be common in birds, the eating of eggs or young by unrelated adults is widespread and sometimes common, especially among colonially nesting seabirds (Stanback and Koenig, 1992). However, these alternatives do not seem to fit this situation. If the leiothrix probing the nest were an unrelated cannibal, the parent birds should have defended their nest. Another leiothrix which appeared in the two photographs (Photo 2c) did not seem to show any sign of parental defending behavior (e.g., Trail et al., 1981), nor did it join in feeding on the egg as an accomplice. Furthermore, recorded duration time of probing by the leiothrix at the nest seemed too short (06:02 - 06:03) to destroy and consume the egg, while the mouse spent at least 3 minutes on the nest (02:58 - 03:02). We, therefore, suggest that egg predation by the mouse at night would be a more adequate interpretation of the photographic records from the second nest.

The case of the third nest showed that the mice visiting the leiothrix nests did not always destroy the eggs. This may depend on their ability to destroy eggs in relation to their body size. DeGraaf and Maier (1996) experimentally showed that white-footed mice *Peromyscus leucopus* (11.7 - 27.4 g in body weight) did not prey on Japanese quail *Coturnix coturnix* eggs (33 × 23 mm in size) but destroyed most zebra finch *Poephila guttata* eggs (16 × 12 mm) when both eggs were served at the same time. As leoiothrix eggs are between these two species in size (21 × 16 mm, Tojo & Nakamura unpublished data), *A. argenteus* (10 - 20 g in adult body weight, Ohdachi et al., 2009) could have difficulty in breaking them, especially for small individuals. The ability to destroy eggs, however, could change with different levels of experience to the egg. Haskell (1995) suggested a local variation among chipmunk *Tamias striatus* populations in the ability to break quail eggs. Furthermore, at the seabird colony on Triangle Island, British Colombia, Keen' s mouse *Peromyscus keeni* (43.8 ± 5.1 g) commonly eat rhinoceros auklet *Cerorhinca monocerata* eggs of nearly twice their mass (69 × 47 mm, 79 ± 5.4g), by spending approximately 17 minutes to chew through the eggshell (Blight et al., 1999). Therefore, the ability of the mice on Mt. Tsukuba to break bird eggs might have, more or less, improved with increasing "leiothrix-egg experience" during the decades since leiothrix invasion.

These results showed that the camera-trap system we used here was effective for detecting nest-predators at night. However, since two out of the three camera-monitored nests were abandoned, the camera system might have harmful effects on breeding. We suggest that putting sensor components with plastic poles just beside the nests might possibly have a negative psychological effect on breeding pairs. However, putting sensors away from the leiothrix nests is difficult, as dense bamboo thickets are easily deformed by wind or by rain and cause mis-triggering. A video motion detection (VMD) system (Bolton et al., 2007) does not have external censor components and would be advantageous over the infrared sensor system, though the VMD system still seems too heavy to use in steep forest areas, such as our study plot.

Recent camera-trap studies have shown that circumstantial evidence based on field signs remaining in the nest may not be reliable for identifying predators (Major, 1991; Pietz and Granfors, 2000; Bolton et al., 2007). Our results proved that mice visit active leiothrix nests that are built in bamboo thickets and further strengthen existing evidence of mouse predation on leiothrix nests. In most areas of the Japanese islands, *Apodemus* mice are distributed as common wild mice in various types of forests (Ohdachi et al., 2009). Mice would also prey on native shrub-nesting songbirds and, given their ubiquity and abundance, they may play an important role as a bird nest predator in Japanese forests.

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ネズミによるソウシチョウの巣の捕食記録

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要 旨

茨城県筑波山において自動撮影装置によってソウシチョウの巣を観察し、3 巣中 2 巣で夜間のネズミの侵入を記録した。うち一例では、翌朝にソウシチョウが卵の殻を運び出す様子も記録され、侵入したネズミに卵が捕食されたと考えられた。この例は、日本の森林において、ネズミが薮に営巣する鳥の巣の捕食者となっている有力な証拠となる。

キーワード：巣の捕食、ソウシチョウ，自動撮影装置、ネズミ

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