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DOES REMOVAL OF OLD NESTS FROM NESTBOXES BY RESEARCHERS AFFECT MITE POPULATIONS IN SUBSEQUENT NESTS OF HOUSE WRENS?

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Abstract.—Periodic cleaning of nestboxes by researchers may benefit birds by reducing the numbers of ectoparasites in the nestboxes. If so, birds should prefer cleaned nestboxes to nestboxes containing old nest material. House Wrens (*Troglodytes aedon*), however, prefer nestboxes that contain old nests to nestboxes from which old nests have been removed. We compared levels of mite infestation in subsequent House Wren nests built in nestboxes from which we removed old nests with levels in unmanipulated nestboxes that still contained old nests. Nests built in nestboxes containing old nests had similar numbers of mites to nests in nestboxes from which we removed old nests. As House Wrens at least partially, if not entirely, remove old nests from nestboxes prior to use, this result is not surprising. We propose that removal of old nests by House Wrens reduces initial mite population size. As a result, numbers of mites in subsequent nests built in unmanipulated nestboxes do not differ significantly from those in nestboxes cleaned by researchers.

AFECTA LA REMOCIÓN DE NIDOS VIEJOS, EN CAJAS DE ANIDAMIENTO, LA POBLACIÓN DE ACAROS EN ANIDAMIENTOS SUBSIGUIENTES POR PARTE DE *TROGLODYTES AEDON*?

Sinopsis.—La limpieza periódica de cajas de anidamiento (remoción de nidos viejos), podría beneficiar a las aves al reducirse el número de ectoparasitos en estas. De esto ser cierto, las aves deberían preferir cajas limpias a otras que aún contengan nidos viejos. Sin embargo, el reyezuelo común (*Troglodytes aedon*), cuando tiene la opción, prefiere utilizar para anidar cajas con nidos viejos. En este trabajo, comparamos los niveles de infección de ácaros en cajas con nidos viejos y cajas limpias luego de ser utilizada (nuevamente) para anidar por parte de reyezuelos. Se encontraron niveles similares de infección de ácaros tanto en cajas limpias como en cajas en las cuales no se removieron los nidos viejos. Dado el caso de que los reyezuelos remueven de forma parcial, o en su totalidad los nidos viejos, los resultados de este trabajo no son sorpresivos. Proponemos que la remoción del nido viejo por parte del reyezuelo reduce inicialmente el tamaño de la población de ácaros. Como resultado el número de ácaros en anidadas subsiguientes no difiere significativamente en cajas limpias de cajas en donde se dejaron los nidos previamente utilizados.

Perrins (1979:155) and Møller (1989, 1992) suggested that removal of old nests from nestboxes reduces ectoparasite populations. As nest-site selection can be influenced by the presence of ectoparasites (Brown and Brown 1986, 1992; Christe et al. 1994; Feare 1976; Møller 1987; Oppliger et al. 1994), birds might be expected to prefer nestboxes from which old nests have been removed to boxes from which old nests have not been removed (Thompson and Neill 1991). Merino and Potti (1995) found that Pied Flycatchers (*Ficedula hypoleuca*) prefer to nest in empty nestboxes in southern Europe where fleas decrease their reproductive success. In other areas of Europe, Pied Flycatchers reportedly prefer nestboxes containing old nests over empty nestboxes (Mappes et al. 1994, Orell et al. 1993). In the latter two studies, ectoparasitic fleas did not harm flycatchers, suggesting that birds may base choice of nestboxes in some populations on criteria other than flea infestation. Similarly, Eastern Bluebirds (*Sialia sialis*) prefer nestboxes that contain old nests, apparently because they house larvae of a parasitoid wasp (*Nasonia vitripennis*) that may reduce the numbers of parasitic blowfly larvae (*Protocalliphora sialis*) (Davis et al. 1994). Thompson and Neill (1991) also found a preference, subsequently confirmed as statistically significant (Thompson, unpubl. data; this study), by House Wrens (*Troglodytes aedon*) for nestboxes that contain old nests to boxes from which old nests have been removed. Thompson and Neill (1991) offered two explanations for why boxes containing old nests are not avoided: (1) effects of the parasitic mites *Dermanyssus hirundinis* and *Androlaelaps casalis* on House Wrens are inconsequential (e.g., Johnson and Albrecht 1993; Pacejka et al., unpubl. data) and, therefore, the presence of mites does not play an important role in nest-site selection, or (2) the detrimental effects of exposure to mites is offset by the benefits of a good nesting site, as indicated by the presence of an old nest. Another possible explanation for why nestboxes with old nests are not avoided is that the number of mites in subsequent nests built in nestboxes from which old nests are removed are similar to those still containing old nests (Christe et al. 1994).

The hypothesis of Christe et al. (1994) may apply to House Wrens because males routinely remove some or all of the old nest material that they find in a nestbox (Kendeigh 1952). We tested the hypothesis that removal of old nests from nestboxes by researchers has no effect on mite numbers in subsequent nests of House Wrens. We did this by making available nestboxes from which old nests had been removed and nestboxes containing undisturbed old nests at sites where House Wrens had nested the previous breeding season.

METHODS

Study area and study subjects.—We carried out this study in 1993 on the Mackinaw and East Bay study areas in northern McLean County, Illinois (40°40′N, 88°53′W), where nestboxes have been in place on the floodplain of the Mackinaw River and in the surrounding upland forests since the early 1980s (see Drilling and Thompson 1988). Nestboxes used in the study were 30 m from their nearest neighbor, except for one at East Bay (15 m).

House Wrens are small (10–13 g), secondary cavity-nesting, migratory passerines. They are typically double-brooded on the study area, with two distinct laying peaks (early season, May–early June; late season, late June–early August) each summer (Finke et al. 1987). Prior to each nesting attempt, males usually remove the lining and sometimes much of the base cup of sticks from the nestbox (Kendeigh 1952:14ff.; Pacejka and Thompson, pers. obs.), presumably removing many mites at that time. Females lay from 5–10 eggs (early season mode = 7, late season mode = 6) in a clutch, and incubate the eggs for about 13 d. Nestlings spend 14–18 d in the nest, reaching their maximum mass about 12 d after the first nestling hatches (Finke et al. 1987).

The fowl mite, *Dermanyssus hirundinis,* is a blood-feeding, nest-dwelling ectoparasite with a cosmopolitan distribution. Fowl mites infest both domestic and wild birds. When active, fowl mites live for about 10 d, although this varies from 7–21 d depending upon the climate. *D. hirundinis* breeds only during the host's nesting period (Moss 1978), and fowl mites are capable of overwintering in old nests as adult females and eggs (Moss 1978; Pacejka et al., unpubl. data).

The life cycle of fowl mites consists of five stages: egg, larva, protonymph, deutonymph, and adult (Krantz 1978). With the exception of the egg and larva stages, at least one blood meal is necessary to develop from one stage to the next. Females require a blood meal before ovipositing a clutch of approximately 20 eggs (Griffiths 1978, Krantz 1978).

In addition to *D. hirundinis,* a scavenger mite, *Androlaelaps casalis,* was also present in the samples taken from the nesting material. This mite typically resides in nests of birds and mammals, eating feces, egg yolk, and dried blood within the nesting material (Men 1959). However, *A. casalis* is also an opportunistic feeder capable of preying on other mites and on their eggs (Barker 1968), as well as of feeding on the blood of birds and mammals (Men 1959; Radovsky 1985, 1994). The life cycle of *A. casalis* is similar to that of *D. hirundinis*; however, its nutritional requirements for development are unknown.

Procedures.—Before the breeding season began, boxes containing old nests in which nestlings had been successfully raised the previous summer were identified. Old nests in alternating boxes in each row (see Fig. 1 in Drilling and Thompson [1988]) were either left undisturbed ($n = 107$) or removed ($n = 111$), as described by Thompson and Neill (1991). Nests built in the boxes were checked at least twice weekly to determine when egg laying began and to determine clutch size. After hatching, nestlings were weighed to determine the day the first nestling hatched (designated brood-day 0; see Harper et al. 1992). On brood-day 4 nestlings and unhatched eggs were counted to determine brood size. We counted the nestlings again on brood-day 12, and after brood-day 13 checked the boxes daily to determine when the nestlings left the nest.

Mite counts.—Fourteen nests from each nestbox type were randomly selected for extraction of nest associates. Within 24 h after the last nestling had departed, nests were collected, sealed in small plastic bags, and returned within 3–4 h to the laboratory. We placed nests in Tullgren funnels to extract nest associates (see Krantz 1978). Each nest remained in a funnel for at least 48 h until thoroughly dried and no arthropods were moving in the nest material. Funnels were equipped with 50- or 60-Watt light bulbs and the inside top of the funnel just below the light bulb and the outside lip of the bottom were coated with petroleum jelly to prevent escape of arthropods. Nest associates were collected in jars containing about 150 ml of 70% ethanol.

We estimated numbers of mites in each nest by agitating the contents of the jars with a stirring bar. We took four 5-ml samples from the solution, and counted the mites in each sample under a dissecting microscope (10×). The mean number of mites per sample was extrapolated to estimate the total number of mites of both species in the solution.

After counting, we again agitated the solutions with a stirring bar, and took approximately 100 mites from each jar. These mites were placed in 85% lactic acid to clear them for identification (C. Welbourne, pers. comm.) using morphological characteristics described by Krantz (1978) and McDaniel (1979). We estimated the proportion of each mite species in the jars and extrapolated to estimate total number of mites of each species.

Total numbers of each mite species were compared between treatments using *t*-tests (SAS Institute 1988). A test for equal variances of mite numbers between treatments was also performed. We used a *G*-test to compare the frequency of settlement in nestboxes from which we removed old nests with that in boxes in which we left old nests undisturbed. Mite population size may be affected by many factors other than nest removal, thereby confounding detection of a treatment effect. We therefore compared date of clutch initiation, clutch size, brood-day 0, brood size, and number of nestlings on brood-day 12 between nests subsequently built in undisturbed boxes and in boxes from which old nests had been removed.

RESULTS

Fifty-four nestboxes from which the old nest had been removed (48.6%) and 66 undisturbed boxes containing an old nest (61.7%) were used by House Wrens during the early season ($G = 3.75$, df $= 1$, $P = 0.05$). We compared nests assigned to the two treatments and found that they did not differ significantly in date of clutch initiation, clutch size, brood-day 0, brood size, or number of nestlings on brood-day 12 (Table 1).

There was no significant difference in the number of either mite species or in total number of mites between nests built in nestboxes from which we had removed old nests and undisturbed boxes containing old nests (Table 1). Variances in mite numbers also did not differ between manipulated or undisturbed nests (*D. hirundinis:* $F_{1,13} = 2.51$, $P = 0.11$; *A. casalis:* $F_{1,13} = 2.54$, $P = 0.11$; Total mites: $F_{1,13} = 1.81$, $P = 0.30$).

DISCUSSION

Removal of old nests from nestboxes by researchers prior to the beginning of the breeding season did not decrease mite loads in subsequent House Wren nests below those built in boxes from which old nests were not removed. Nests in the two treatments did not differ significantly in number of nestlings or the date in which the broods were started, factors that could potentially affect mite population size (Burtt et al. 1991, Maurya et al. 1984, Phillis 1972).

We propose that the lack of a significant difference in mite numbers between investigator-cleaned and undisturbed nestboxes is attributable to

TABLE 1. Comparison of estimated total numbers of mites of each species, day the first egg was laid, clutch size, brood-day 0, brood size, and number of nestlings on brood-day 12 between subsequent nests built in nestboxes from which the old nests had been removed and nests built in unmanipulated nestboxes containing old nests in 1993. Clutch size and date of first egg are from all nests used in the nest-site-selection experiment (n = 120). Other variables are from a subset of nests from which mites were extracted (n = 28).

	Old nest removed			Old nest not removed				
Variable	No. nests	Mean	SE	No. nests	Mean	SE	t	P
No. mites	14	21,939	6666	14	16,542	4181	0.69	0.50
No. *D. hirundinis*	14	20,321	6252	14	15,233	3944	0.69	0.50
No. *A. casalis*	14	1618	474	14	1309	352	0.52	0.61
Date of first egg	54	146.5	1.6	66	146.7	1.6	0.07	0.94
Clutch size	54	6.9	0.7	66	6.7	0.9	1.41	0.16
Brood-day 0	14	168.1	2.9	14	168.1	2.7	0.09	0.93
Brood size	14	5.6	0.5	14	5.7	0.5	0.21	0.84
No. nestlings on brood-day 12	13	5.5	0.5	11	5.2	0.6	0.47	0.64

the nest-building behavior of the male. Male House Wrens remove old nest material from their nestboxes prior to initiation of nest building (Kendeigh 1952:14ff.). By removing old nests, males likely remove many mites, presumably as many as do researchers when they remove nests from nestboxes. Thus, there are at least two reasons that House Wrens should not be deterred from selecting nestboxes containing old nests. First, mite numbers do not differ significantly between nests built in investigator-cleaned and undisturbed nestboxes. Second, removal of old nest material by male wrens does not appear to delay the onset of a nesting attempt.

Clark (1991) estimates that 19.7% of 137 species of passerines breeding in North America reuse old nests. Species that reuse old nests usually have higher parasite loads than species that use nests only once (Rothschild and Clay 1952). Exposure to parasites in the nest may be especially detrimental to threatened or endangered species because they may be more susceptible to parasitic infection as a result of reduced genetic variation associated with small population size (Loye and Carroll 1995). This is especially true if the parasite is a generalist (Dobson and May 1991), as are most nest-dwelling ectoparasites. It is, therefore, important, particularly with endangered cavity-nesting species of birds, to determine whether they remove old nests from cavities and whether they are adversely affected by nest-dwelling ectoparasites. If, as with the House Wren, these species are not usually adversely affected by ectoparasites and exhibit a preference for nestboxes that contain old nests, it would behoove investigators not to remove old nests from nestboxes. Inclusion of old nests in nestboxes under such circumstances may enhance the attractiveness of artificial nest sites.

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