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BACTERIA IN OLD HOUSE WREN NESTS

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Abstract.—Little attention has been paid to the presence of bacteria that inhabit old bird nests, some of which may be harmful to nestlings, adults, or both. In this study we documented the presence of three bacteria genera (*Pseudomonas*, *Bacillus*, and *Staphylococcus*) in old House Wren (*Troglodytes aedon*) nests. These bacteria are not usually pathogenic. However, we also documented the presence of *Salmonella*, a known pathogen. We hypothesize that one potential consequence of the removal of old nest material by male House Wrens and other cavity-nesting species before constructing a new nest is reduction of populations of potentially harmful bacteria in the nest cavity.

BACTERIAS EN NIDOS USADOS POR *TROGLODYTES AEDON*

Sinopsis.—Se ha puesto poca atención a la presencia de bacterias que habitan en nidos viejos, algunas de las cuales podrían ser detrimentales para pichones y adultos. En este estudio documentamos la presencia de tres especies de bacterias en los nidos de reyezuelo (*Troglodytes aedon*). Usualmente las bacterias encontradas no son patogénicas. Sin embargo, *Salmonella* fue identificada. Postulamos como hipótesis, que la remoción de material viejo del nido, previo a construir uno nuevo, por aves como el reyezuelo y otras especies que anidan en cavidades, es para reducir la población de bacterias potencialmente dañinas.

Parasites may be a major selective influence on the evolution of life history traits in birds (Hamilton and Zuk 1982, Møller 1993). For example, ectoparasitic mites have been documented to reduce song output and increase the cost of reproduction in Barn Swallows (*Hirundo rustica*) (Møller 1991, 1993). Ectoparasites may also influence the behavior of birds, including the choice and use of roost (Christe et al. 1994) and nest sites. Tree Swallows (*Tachycineta bicolor*) and Cliff Swallows (*Hirundo pyrrhonota*) often avoid previously used nest sites in subsequent years in an attempt to overcome the effects of ectoparasites (Loye and Carroll 1991, Rendell and Verbeek 1996). In some cavity-nesting species in which the same nest sites may be used by different individuals year after year, the old nest is often removed before a new one is constructed (e.g., European Starlings [*Sturnus vulgaris*], Clark and Mason 1985; Pied Flycatchers [*Ficedula hypoleuca*], Merino and Potti 1995; House Wrens [*Troglodytes aedon*], Pacejka and Thompson 1996). Pacejka et al. (1996) have documented that such behavior reduces ectoparasite populations.

Most of the discussion in previous studies on the effects of parasites on nest- and roost-site selection in birds has focused on ectoparasites (e.g., mites, fleas, fly larvae, etc.) in the nest (e.g., Johnson 1996, Møller 1989, Thompson and Neill 1991). Little attention has been paid to the presence of pathogenic bacteria that may also inhabit old nests, and we are aware of no studies addressing this issue. Many species of bacteria (e.g., *Salmonella* spp., *Streptococcus* spp., *Yersinia* spp., etc.) cause diseases that can be fatal to birds (Brittingham et al. 1988, Calnek et al. 1991, Campbell and

Lack 1985, May 1995). A potential adverse effect of bacteria on avian reproductive success is suggested by the fact that European Starlings incorporate into nests green plant material that has been shown to reduce numbers of some pathogenic bacteria (Clark and Mason 1987). However, in this and in other studies, the actual bacterial species inhabiting the nests were not documented. The purpose of this study was to identify bacteria that inhabit old nests of House Wrens, and to isolate known avian pathogens.

METHODS

The study was conducted from January–May 1996, on six nests collected from nestboxes at the East Bay Study area in McLean County, Illinois (40°40′N, 88°53′W). Three nests were collected on 17 Jan. 1996, and three nests were collected on 17 Apr. 1996. The study area, which contained 325 nestboxes that had been in place since 1982 (Harper et al. 1994), consisted of upland deciduous forests surrounded by agricultural lands. Old nests that contained nestlings the previous breeding season were collected from nestboxes by inverting the nestbox and shaking all of its contents into plastic bags that were then sealed. The sealed bags were stored at room temperature to promote bacterial growth.

We mixed 1 g of nest material from each nest with 100 ml of distilled water that had been sterilized in an autoclave. In order to obtain isolated colonies, we diluted the resulting suspensions to various concentrations (10^{-2}–10^{-7}) and mixed them with either Tryptic Soy Agar (TSA) or Glycerol Yeast Extract Agar (GYE). Samples taken from clearly distinguished bacteria colonies were subcultured through streaking to ensure purity of colonies. We then subjected the colonies, which were maintained at room temperature, to the following standard laboratory identification techniques: adonitol fermentation, arabinose fermentation, bacterial morphology, carbohydrate fermentation, catalase activity, citrate utilization, DNAse activity, dulcitol fermentation, endospore staining, Gram staining, hydrogen sulfide production, indole formation, lipid hydrolysis, litmus milk reactions, lysine decarboxylation, methyl red test, motility test, nitrate reduction, ornithine decarboxylase, oxidase test, oxygen requirements, sorbitol fermentation, urease production, and Voges-Proskauer test (Harley and Prescott 1993). Bacteria were identified according to Krieg (1984) and Holt et al. (1994).

Nest suspensions were also screened with Bismuth Sulfate Agar (BSA) for the presence of *Salmonella*, a known pathogenic genus (Campbell and Lack 1985). The presence of *Salmonella* was confirmed with Salmonella-Shigella Agar (SSA), in addition to Gram reaction, citrate utilization, and lysine decarboxylase tests. All tests were conducted in April–May 1996, on plates incubated at 37 C.

RESULTS AND DISCUSSION

We identified three genera (*Pseudomonas*, *Bacillus*, and *Staphylococcus*) from randomly chosen bacterial colonies, while a fourth colony could be

identified only to family (Enterobacteriaceae). Members of all three genera are commonly found in the environment and are not usually pathogenic, while members of Enterobacteriaceae are typically found in the intestinal tract and fecal matter of homeothermic animals (Krieg 1984). The presence of fecal matter from nestlings is the most likely source of Enterobacteriaceae in House Wren nests. Johnson (1996) found that House Wrens avoided nesting in cavities containing heavily soiled nests with large amounts of feces. He suggested this was because male wrens encountered difficulty in removing the lining that was caked with fecal matter. However, as several members of the Enterobacteriaceae can become opportunistic pathogens (Krieg 1984), the avoidance of such heavily soiled nests may also be advantageous in that potentially pathogenic bacteria would be avoided.

Salmonella, a member of Enterobacteriaceae, was found in five of the six House Wren nests. Members of the genus *Salmonella*, which are commonly found in avian fecal matter, can cause Salmonellosis (Weber 1979). This disease, which has been documented in wild birds such as Rock Doves (*Columbia livia*), European Starlings, and House Sparrows (*Passer domesticus*) (Weber 1979), may result in septicemia (Weber 1979) and damage to the lungs, liver, and spleen (Campbell and Lack 1985). While we have not looked for this disease in House Wrens, the presence of *Salmonella* in old nests poses a potential threat to nestlings. The nest removal behavior of male House Wrens could reduce populations of *Salmonella* and other fecal-borne pathogenic bacteria in the nest site. This behavior may also serve a similar function in other cavity-nesting birds. Although removal of old nest material may carry risks of bacterial infection for adult males, such behavior may reduce chances of infection for nestlings, as has been proposed by Thompson and Neill (1991) in relation to infestation by ectoparasitic mites. It is likely that bacterial pathogens may also affect populations of such ectoparasites.

Future studies should test for the presence of other known pathogenic bacteria (e.g., *Clostridium*, etc.), fungi, and viruses. We suggest that the presence of bacteria, fungi, and viruses should be considered as possible influences on the behavior of cavity-nesting birds.

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LITERATURE CITED

BRITTINGHAM, M. C., S. A. TEMPLE, AND R. M. DUNCAN. 1988. A survey of the prevalence of selected bacteria in wild birds. J. Wildl. Diseases 24:299–307.

CALNEK, B. W., H. J. BARNES, C. W. BEARD, W. M. REID, AND H. W. YODER, JR. (eds.). 1991. Diseases of poultry, 9th ed. Iowa State Univ. Press, Ames, Iowa.

CAMPBELL, B., AND E. LACK (eds.). 1985. A dictionary of birds. Calton (Poyser) and Vermillion (Buteo), Vermillion, South Dakota.

CHRISTE, P., A. OPPLIGER, AND H. RICHNER. 1994. Ectoparasite affects choice and use of roost sites in the great tit, *Parus major*. Anim. Behav. 47:895–898.

CLARK, L., AND J. R. MASON. 1985. Use of nest material as insecticidal and anti-pathogenic agents by the European starling. Oecologia (Berlin) 67:169–176.

———, AND ———. 1987. Olfactory discrimination of plant volatiles by the European starling. Anim. Behav. 35:227–235.

HAMILTON, W. D., AND M. ZUK. 1982. Heritable true fitness and bright birds: a role for parasites? Science 218:384–387.

HARLEY, J. P., AND L. M. PRESCOTT. 1993. Laboratory exercises in microbiology, second edition. William C. Brown, Dubuque, Iowa.

HARPER, R. G., S. A. JULIANO, AND C. F. THOMPSON. 1994. Intrapopulation variation in hatching synchrony in house wrens: test of the individual optimization hypothesis. Auk 111: 516–524.

HOLT, J. G., N. R. KRIEG, P. H. A. SNEATH, J. T. STALEY, AND S. T. WILLIAMS (eds.). 1994. Bergey's manual of determinative bacteriology. Ninth ed. Williams and Wilkins, Baltimore, Maryland.

KRIEG, N. R., ed. 1984. Bergey's manual of systematic bacteriology. Vol. 1. Williams and Wilkins, Baltimore, Maryland.

JOHNSON, L. S. 1996. Removal of old nest material from the nesting sites of house wrens: effects on nest site attractiveness and ectoparasite loads. J. Field Ornithol. 67:212–221.

LOYE, J. E., AND S. P. CARROLL. 1991. Nest ectoparasite abundance and cliff swallow colony site selection, nestling development, and departure time. Pp. 222–241, *in* J. E. Loye and M. Zuk, eds. Bird–parasite interactions. Oxford Univ. Press, Oxford, United Kingdom.

MAY, R. M. 1995. Disease and the abundance and distribution of bird populations: a summary. Ibis 137:S85–S86.

MERINO, S., AND J. POTTI. 1995. Mites and blowflies decrease growth and survival in nestling flycatchers. Oikos 73:95–103.

MØLLER, A. P. 1989. Parasites, predators, and nest boxes: facts and artefacts in nest box studies of birds? Oikos 56:421–423.

———. 1991. Parasite load reduces song output in a passerine bird. Anim. Behav. 41:723–730.

———. 1993. Ectoparasites increase the cost of reproduction in their hosts. J. Anim. Ecol. 62:309–322.

PACEJKA, A. J., E. SANTANA, R. G. HARPER, AND C. F. THOMPSON. 1996. House wrens *Troglodytes aedon* and nest-dwelling ectoparasites: mite population growth and feeding patterns. J. Avian Biol. 27:273–278.

———, AND C. F. THOMPSON. 1996. Does removal of old nests from nestboxes by researchers affect mite populations in subsequent nests of house wrens? J. Field Ornithol. 67:558–564.

RENDELL, W. B., AND N. A. M. VERBEEK. 1996. Old nest material in nestboxes of tree swallows: effects on reproductive success. Condor 98:142–152.

THOMPSON, C. F., AND A. J. NEILL. 1991. House wrens do not prefer clean nestboxes. Anim. Behav. 42:1022–1024.

WEBER, W. J., ed. 1979. Health hazards from pigeons, starlings, and English sparrows. Pp. 18–20, *in* Diseases and parasites associated with pigeons, starlings and English sparrows which affect man and domestic animals. Thompson Publications, Fresno, California.

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