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NEST STRUCTURE AND PLACEMENT OF ORCHARD ORIOLE (*Icterus spurius*) NESTS IN TALLGRASS PRAIRIE IN OKLAHOMA

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Abstract—The structure and placement of nests were studied for Orchard Orioles (*Icterus spurius*) nesting in upland tallgrass prairie habitat in Osage County, Oklahoma. Nests were generally located within woody thickets or shrubs at heights ranging from 50 to 330 cm. Nest mass decreased linearly with placement height, as did the mass of the outer nest shell. However, the mass of inner, insulating nest liners were similar across all nest heights. Individual nest fibers as long as those previously recorded for this species were found. Patterns of nest structure are discussed in conjunction with habitat management practices in the tallgrass prairie region and how these practices might affect the nesting biology of this species.

INTRODUCTION

The Orchard Oriole (*Icterus spurius*) is the smallest oriole species in North America. A Nearctic-Neotropical migrant, this species visits Oklahoma from May to July for nesting and raising young (Reinking 2004). Although widespread across eastern North America and Oklahoma, analysis of population trends from the Breeding Bird Survey have shown the species has declined significantly in Oklahoma (Reinking 2004). Specific causes for Orchard Oriole decline in Oklahoma are unknown, although many populations of Nearctic-Neotropical migrants have long been in decline (Robbins *et al.* 1989). Some attribute declines to factors associated with overwintering areas (Rappole and McDonald 1994). Conversely, others have shown that predation during breeding is strongly linked to population declines in neotropical species (Bohning-Gaese *et al.* 1993). Regardless of the cause, the Orchard Oriole is listed as a species of conservation concern by groups such as Partners in Flight (Donovan *et al.* 2002), who recommend more study of "habitat requirements and management needs" for all declining species that nest within North American habitats.

Orchard Orioles have long attracted the interest of ornithologists due to their unique nest construction. The nest architecture is based on the intricate weaving of long grass or plant fibers together to form the nest body, which is incorporated into the branches of trees or shrubs and contains dense, soft inner liner for insulation (Schaefer 1976). Bent (1958) reported a single fiber 33 cm long hooked and wound 34 times into a nest. Other observations report nest fibers greater than 14 cm in length (Shufeldt 1903, Scharf and Kren 2010). While green grasses are often used by orioles to weave nests (Scharf and Kren 2010), other fibrous materials from yucca (*Yucca* spp.), cacti, and prickly pear (*Opuntia* spp.) also have been used (Tate 1925). A variety of materials including catkins, feathers, plant down, animal hair, and fine grasses are used for nest linings (Bent 1958, Coppedge 2009).

METHODS

An opportunity to study Orchard Oriole nest structure resulted from nests incidentally discovered during two previous field studies of bird nesting ecology at the Joseph H. Williams Tallgrass Prairie Preserve (TGPP), a 15,700 ha site in Osage County (36°50'N, 96°25'W) owned by The Nature Conservancy. The first study documented use of bison (*Bison bison*) hair by nesting birds from 2002 through 2004 (Coppedge 2009). The second study examined Red-winged Blackbird (*Agelaius phoeniceus*) nesting patterns from 2007 to 2008 (Coppedge 2010). Once

Figure 1. Partially dissected Orchard Oriole (*Icterus spurius*) nest from the Tallgrass Prairie Preserve, Oklahoma, showing the outer nest shell (left), and the inner insulating liner (right). Photograph by the author.

an Orchard Oriole nest was discovered, detailed nest location was noted but the nest was left undisturbed during the nesting season. Following protocol (Coppedge 2009), nest vertical height in the supporting substrate was measured and nests were collected once no longer in use, usually in late July or early August. When necessary, supporting branches were removed with pruning shears along with nests to avoid disturbing structural integrity.

Supporting branches were carefully removed and nests disassembled in the lab into their two primary structural components, the inner insulating liner and outer nest shell (Figure 1). The length of ten randomly selected fibers from each outer shell were extracted and measured to the nearest cm. Both nest components were dried separately for 24-48 h at 38°C, then weighed to the nearest 0.001 g on an analytical balance. The relationships between nest component mass (liner mass, shell mass, and total mass), fiber length, and vertical nest location height was analyzed with linear regression.

RESULTS

Twenty-seven Orchard Oriole nests collected from the TGPP were

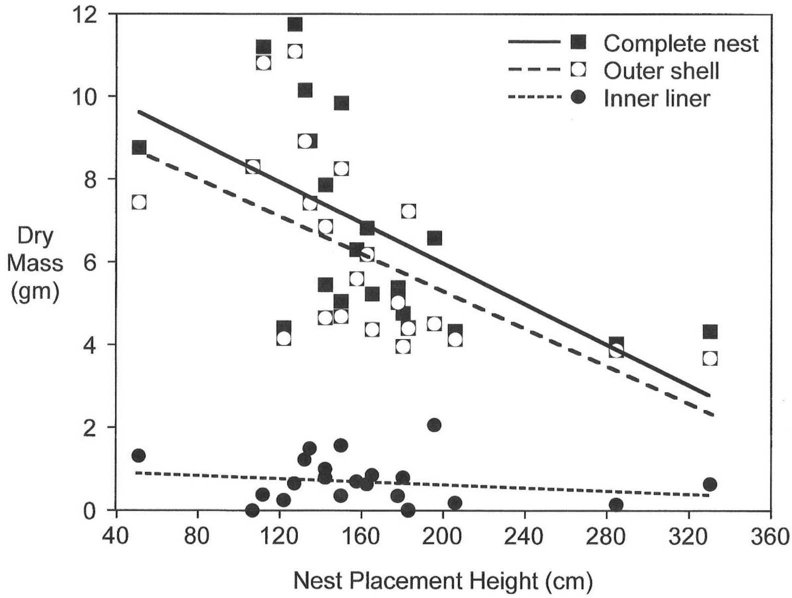

Figure 2. Relationship between Orchard Oriole (*Icterus spurius*) nest mass parameters and nest placement height, Tallgrass Prairie Preserve, Oklahoma.

analyzed for this study. Total nest mass after drying ranged from 4.03 to 11.75 g, with a mean mass of 6.58 g. Nest heights ranged from 51 to 330 cm, with a mean height of 163 cm (*n = 22*). Nest height data for five nests was lost during transport in the field, so those nests were excluded from regression analysis. Total nest mass was significantly but negatively related to nest height (R^2 = 0.35; P = 0.0036; Figure 2). The outer nest shell comprised the bulk of nest mass, ranging from 3.13 to 11.09 g, with a mean mass of 5.79 g. Nest shell mass also varied negatively with nest height (R^2 = 0.34; P = 0.0043; Figure 2). Inner nest liners had relatively low mass compared with nest shells, ranging from 0.024 to 2.064 g, with a mean mass of 0.79 g. Two nests had no notable insulating liner. Unlike nest shell and total nest mass, liner mass did not relate significantly to nest height (R^2 = 0.04; P = 0.3911; Figure 2).

Nest fiber lengths ranged from 9 to 33 cm, with an overall mean length of 15 cm. Three nests were inadvertently dried prior to fiber extraction, rendering fibers in those nests too brittle for measurement. There was no statistical relationship between mean fiber length and nest height (R^2 = 0.03; P = 0.4548) or total nest mass (R^2 = 0.14; P = 0.0711).

DISCUSSION

Orchard Orioles nesting in Great Plains grasslands are known to prefer to nest in lower, denser woody vegetation as compared to open canopy trees in riparian zones (Scharf and Kren 2010). The mean nest height of 163 cm observed for these nests at the TGPP is notably lower than that reported from other sites, but this is likely a function of the specific areas surveyed, which focused on areas allocated to bison grazing where trees and extensive riparian zones are somewhat limited (Coppedge 2009, 2010). Earlier studies in the TGPP area reported an average Orchard Oriole nest height of 441 cm based on data from six nests (Reinking *et al.* 2009) and 204 cm based on nine nests (Coppedge 2009). Nests used in this study occurred primarily in one of four types of shrubby vegetation – buttonbush (*Cephalanthus occidentalis*), wild sand plum (*Prunus angustifolia*), sumac (*Rhus glabra*), or black willow (*Salix nigra*) thickets resulting from stump sprouting after beaver (*Castor canadensis*) cutting.

Orchard Orioles nesting in upland tallgrass prairie habitat with limited trees but plentiful shrubs built larger nests at lower nesting heights. This vertical variability in nest size has not been previously reported. Larger nest mass was achieved by increasing the size of the outer nest shell rather than by changing the size of inner liners, which were consistent in size regardless of vertical nest location (Figure 2). This variability in outer nest structure may result from physical circumstances, whereby more branches and attachment points in lower substrate locations leads to the construction of larger nests. Unfortunately, nest substrate characteristics were not specifically evaluated for such variables as the number of attachment points or supporting branches at each nest. The influence of nest site substrate on oriole nest size might make an interesting question for future studies on this species, especially as it relates to nest survival. As for the two nests with no nest liner, it is possible these nests were abandoned before completion. Orchard oriole abandonment of incomplete nests has been observed at this site in response to Brown-headed Cowbird (*Molothrus ater*) nest parasitism (Coppedge and Coppedge 2010).

Another hypothesis for nest size variability originates from nesting orioles gaining thermal efficiency by building larger nests in the cooler (earlier) portion of the breeding season. Early nests may need to be larger for better insulation, and grass is a fair insulating material for exposed nests, even when wet (Hilton *et al.* 2004). However, exact laying and fledgling dates and nest fates were unknown for these oriole nests, leaving this hypothesis unaddressed here but available for future research. Patterns derived from Red-winged Blackbirds nesting in the same habitat may be insightful. Both early-initiated and vertically lower nests of Red-winged Blackbirds experienced higher predation rates than later (temporal) or higher (vertical) nests (Coppedge 2010). Thus, building larger nests early and/or closer to the ground in this habitat would likely result in higher nest predation for orioles as well, a futile effort for a mostly single-brooded species with limited time on the breeding grounds (Reinking 2004). As nests are built primarily by the female, nest size (mass) variation could simply be plasticity in individual nest-site preferences (Mennerat *et al.* 2009). There remains much to be learned about the nesting ecology of Orchard Orioles in tallgrass prairie, and how nesting in this habitat impacts reproductive success and local populations of this species.

Mean fiber lengths in Orchard Oriole nests from the TGPP did not vary by nest height or mass, but maximum fiber sizes were equal in length to those previously reported at 33 cm (Scharf and Kren 2010). Relative to grassland specialists, Orchard Orioles are not particularly abundant in upland grassland habitat at the TGPP based on point counts (Coppedge *et al.* 2008, Reinking *et al.* 2009). However, the need for long, green plant fibers and grasses by nesting Orioles does have implications for grassland habitat management. Regionally, tallgrass prairie is typically managed with annual spring prescribed burns followed by intensive summer grazing. These actions would inherently limit the availability of longer grass fibers preferred by nesting Orchard Orioles. However, a management technique implemented in specific areas of the TGPP leaves patches of unburned and generally ungrazed prairie each year to benefit litter-dependent grassland species such as Henslow's Sparrow (*Ammodramus henslowii*) (Coppedge *et al.* 2008). It appears that "patch-burn" management (Fuhlendorf and Engle 2004) might also benefit other birds of conservation concern like the Orchard Oriole that require long plant fibers for nest construction, material unlikely to occur in annually burned and heavily grazed prairie environments.

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