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VARIATION IN LOGGERHEAD SHRIKE NEST COMPOSITION BETWEEN TWO SHRUB SPECIES IN SOUTHWEST IDAHO

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Abstract.—Loggerhead Shrike (*Lanius ludovicianus*) nests constructed in sagebrush (*Artemisia tridentata*) and greasewood (*Sarcobatus vermiculatus*) shrubs contained different proportions (by weight) of nest material of different thicknesses. Nests constructed in dense greasewood shrubs contained fewer medium and large sticks, typically used in construction of the nest substructure, than nests built in relatively open sagebrush. In contrast, there was no difference in quantity of lining-fibers, twigs, and small sticks used in nests constructed in these shrubs. These differences can be attributed to different nest-stabilization requirements imposed on breeding shrikes by structurally dissimilar nesting substrates and imply plasticity in shrike nest-building behavior.

VARIACIÓN EN LA COMPOSICIÓN DE LOS NIDOS DE *LANIUS LUDOVICIANUS* CONSTRUIDOS EN DOS ESPECIES DE ARBUSTOS EN SUROESTE DE IDAHO

Sinopsis.—Nidos de alcaudón *Lanius ludovicianus* construidos en arbustos de artemisa (*Artemisia tridentata*) y de barrilla (*Sarcobatus vermiculatus*) estuvieron formados por varillitas de diferente grosor y en una proporción diferente (por peso) en los materiales de construcción. Los nidos construidos en arbustos densos de barrilla contuvieron una cantidad menor de palitos largos y de tamaño mediano, los cuales se usan típicamente en la construcción de la subestructura, que los nidos colocados en artemisa abierta. En contraste, no hubo diferencia cuantitativa en las fibras utilizadas para forrar el nido en su interior, ramitas y palitos pequeños utilizados en la construcción en ambos tipos de arbustos. Estas diferencias pueden ser atribuidas a diferentes requerimientos impuesto a las aves para la estabilidad de los nidos, causado por la diferencia en sustrato entre los arbustos. Las diferencias entre los nidos implica plasticidad en los patrones de construcción por parte de estas aves.

The Loggerhead Shrike (*Lanius ludovicianus*) constructs an open nest cup, typically upon a twig substructure, in dense shrubs and trees that are generally 1–8 m high (Miller 1931). During 1991 and 1992 I found 44 and 75 Loggerhead Shrike nests, respectively, in the cold desert ecosystem of southwest Idaho. Shrikes in this region nested primarily in three different shrub species: sagebrush (*Artemisia tridentata*), bitterbrush (*Pursia tridentata*) and greasewood (*Sarcobatus vermiculatus*). While making routine nest checks during the 1991 breeding season, I noticed that shrike nests appeared different in the different shrub species. The openly branching sagebrush and bitterbrush shrubs used by the nesting shrikes were structurally similar, and nests found in these shrubs appeared similar. Greasewood branches, however, are more densely interwoven than those of the former two shrubs, with thorns lining most branches. Shrike nests found in the greasewood appeared to lack the twig substructure typical of nests found in the sagebrush or bitterbrush.

The proportions of materials of different sizes that birds use in nest construction should vary with both availability and requirements of the particular substrate and habitat situations (Collias and Collias 1984). There is little literature, however, quantitatively documenting intra-specific differences in nest composition between structurally dissimilar nesting substrates. Wide variation is known to occur in Loggerhead Shrike nests from the same vicinity, and although most nests commonly have an ample twig substructure, occasionally nests are more or less homogeneous and lack a stick base (Miller 1931). Miller did not comment, however, on the possibility of a relationship between the nests lacking a stick base and the supporting substructure provided by the nest shrub itself. To determine whether shrikes in Idaho consistently constructed quantifiably different nests in different shrub species, I removed nests from sagebrush and greasewood shrubs, disassembled them with an assistant, and compared relative amounts of the various materials.

METHODS

I randomly selected and removed 10 shrike nests from sites in Owyhee County, Idaho following the 1991 breeding season: five from sagebrush, and five from greasewood. Nests were dried indoors for several days. All nesting materials were then visually separated into five categories: lining-fibers, twigs, small sticks, medium sticks and large sticks. The categories reflect a gradient of nest material thicknesses, with lining-fibers including primarily grasses and rootlets, twigs being very thin and fragile, to large sticks, which were nearly of pencil thickness.

All categories were separated and viewed for all nests at the same time in order to insure that nesting materials from all nests were categorized equally. I categorized materials solely with respect to maximum thickness; neither length nor mean thickness of a particular item were considered. In order to verify the accuracy of this visual separation, five sticks from each category (twigs to large sticks) were then randomly selected from each nest, and the maximum thickness of each measured to the nearest 0.1 mm with a Mitutoyo dial caliper. The lining-fiber category was excluded from this measurement, as meaningful measures of these materials were difficult to obtain and ambiguous. ANOVA and Tukey's tests were used to test for distinct size separation in each category.

All materials in each category from each nest were then weighed using an Ohaus Galaxy 400 digital scale. The weights from each category were compared between nest shrub species with t-tests. When variances within categories were significantly different ($P < 0.05$), comparisons between groups were made using a Mann-Whitney U-test. All computations were done using the SAS statistical package (SAS Institute 1985).

RESULTS

Mean thicknesses of the four categories of nest-building materials were significantly different ($P < 0.005$). Means were separated by approxi-

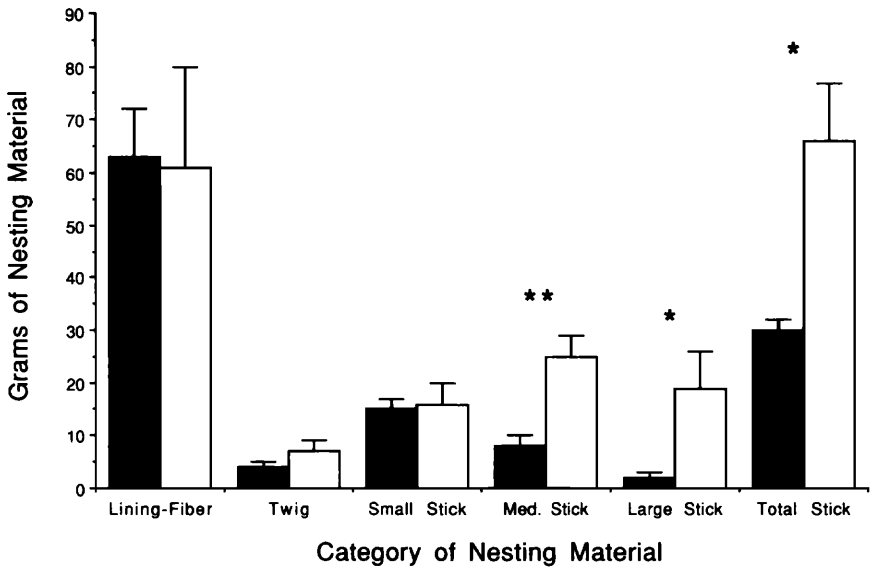

FIGURE 1. Nest composition by mean weight (±SE) of nest-building materials found in Loggerhead Shrike nests in greasewood (dark bars) and sagebrush (open bars) in southwest Idaho (n = 5 for each shrub species). A single asterisk identifies nesting material categories which were significantly different ($P < 0.05$), a double asterisk indicates a highly significant difference ($P < 0.01$).

mately 1 mm per category, and ranged from 1.4 mm for twigs to 4.5 mm for large sticks.

Weights of lining-fibers, twigs and small sticks did not differ between greasewood and sagebrush nests (Fig. 1). There were significantly fewer medium sticks ($P = 0.005$) and large sticks ($P = 0.036$) in the nests built in greasewood than sagebrush, however. In addition, the total stick weight (combination of the twig and three stick weights) was higher in the sagebrush than greasewood nests ($P = 0.022$), although there was no significant difference in total nest weight (all five categories combined) between nests in these two shrub species.

DISCUSSION

Consistent intra-specific differences in proportions of nesting materials in nests from different substrates may reflect both different nest stability requirements imposed by those substrates, and the ability of the species to alter its nest-building behavior in response to those requirements (cf. Collias and Collias 1984). Though variation in lining material composition in bird nests is well known (e.g., Collias and Collias 1984, Skutch 1976), variation in proportion of outer wall and/or platform substructure has been less well documented.

In my study, greasewood is a densely interwoven and thorny shrub that appears to provide sufficient structure to support a nest without initial construction of a larger nest platform or framework. Shrike nests in greasewood seldom incorporated sticks with maximum thicknesses greater than 3 mm. Nests constructed in the more sparsely branched sagebrush were constructed using significantly more thick sticks (Fig. 1). Sagebrush is typically an open shrub that provides only limited nest support, consequently shrikes nesting in sagebrush may need to build a substructure or framework upon or within which to construct the nest. Results of the disassembly of nests support this conclusion, because nest composition between sagebrush and greasewood differs only in proportion of the larger nest-building materials typically used to construct the substructure.

Alternatively, the dense structure of the greasewood may limit the shrike's ability to bring larger sticks into the shrub interior. Although this could explain the lack of these sticks in greasewood nests, the lack of additional finer materials suggests these losses do not need compensation, implying the larger sticks may only be necessary as stabilizing support for nests built in sagebrush. In either case, shrike nest-building behavior must be sufficiently plastic to permit these variations.

Of the 10 nests used in this comparison, mean clutch size was 6.0 and 6.6 eggs for the sagebrush and greasewood nests respectively. Although there was no brood reduction in these 10 nests, three of five sagebrush nests failed altogether, compared to only one of five greasewood nests. I do not believe, however, that this is an indication of superior nest success in greasewood nests. Rather, these four failures occurred coincident with a severe late spring storm, which missed the four successful greasewood nests and one of the two successful sagebrush nests. Data in preparation (from all nests in both 1991 and 1992) appears to indicate there is little or no distinction in nesting success between these nest shrubs. Nonetheless, consistent differences in shrike nest construction in greasewood and sagebrush, as well as other related findings from 1991 and 1992, shed further light on Loggerhead Shrike nest site selection.

Although most passerines may be rather rigid in their nest-construction behavior (Nickell 1958), the maintenance of sufficient plasticity in nest-building to permit nesting on a variety of substrates is essential to take advantage of a wide range of potential breeding sites. Porter et al. (1975) found shrikes constructed nests within the interior of abandoned Black-billed Magpie (*Pica pica*) nests in Colorado, and four shrike nests found in the two years of my study occurred in magpie nests also. In addition, I found one shrike pair nesting in a mound of wind-blown "tumbleweeds," or Russian thistle (*Salsola kali*); Siegel (1980) found a nest constructed "in a pile of hardwood debris" in Alabama as well. I also found two nests constructed on old shrike nests, a habit which has been reported for shrikes elsewhere (Miller 1931, Siegel 1980). Interestingly, in 1992 one pair in my study built a nest in the identical location in a greasewood where I removed a nest for this comparison study following the 1991 breeding season.

Although the degree of cover provided by a nest tree or shrub has been identified as an important component of shrike nest site selection (Luukkonen 1987, Porter et al. 1975), factors in addition to cover must determine the nest shrub selected by shrikes in Idaho. Greasewood shrubs clearly provide superior cover to sagebrush, yet only four of seven nests occurring in stands of mixed sagebrush and greasewood were constructed in the greasewood. In addition, shrike nests in sagebrush and bitterbrush were sometimes plainly visible 15 m or more from the shrub, although shrubs offering increased cover were readily available.

Nest site selection in birds may be influenced by natal nest site (Glück 1984), but four shrikes I uniquely color-banded as nestlings in 1991 and located in 1992 do not support this hypothesis for shrikes. Although all four (three males and one female) successfully nested in sagebrush in 1992, sagebrush was the natal nest shrub in only one case, the others being greasewood, bitterbrush and Russian thistle.

These findings imply several factors must influence nest site selection in shrikes. This study has touched on one factor in the nesting behavior of these birds. Consistent differences in shrike nests constructed in greasewood and sagebrush indicate that structurally dissimilar nesting substrates impose different nest-stabilization requirements on breeding shrikes. Variations in Village Weaver (*Textor cucullatus*) and Northern Oriole (*Icterus galbula*) nest construction have been attributed in part to environmental differences (Collias and Collias 1971, Schaeffer 1976 respectively). Results such as these suggest quantifiable variation in nesting material and microhabitat may occur in other passerine species as well. Identifying the range of nest-construction behaviors in shrikes and other birds should expand our understanding of avian nest site limitations.

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