Yellow Warbler nests: building materials and cowbird parasitism

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Introduction

Nests are traditionally defined as receptacles in which to house eggs and chicks; however, for the Yellow Warbler (*Dendroica petechia*), nests may have additional biological significance, especially with respect to Brown-headed Cowbird (*Molothrus ater*) parasitism.

Yellow warblers are small, passerine birds that are frequently parasitized by the brown-headed cowbird (Bent 1953; Friedmann 1963). Cowbird parasitism results in a reduction of nesting success in yellow warblers and many other host species (Schrantz 1943; McGeen 1972; Goossen and Sealy 1982; Weatherhead 1989; Sealy 1992). As brown-headed cowbird eggs have an 83% chance of hatching if the egg is accepted (Clark and Robertson 1981) and cowbird incubation takes 10-11 days (Friedmann 1963), compared to 11-12 days in yellow warblers (Clark and Robertson 1981; Goossen and Sealy 1982), it is to the cowbird's advantage to lay in synchrony with the yellow warbler (Norris 1947; also see Briskie and Sealy 1990).

When parasitism occurs, there are two options open to breeding yellow warblers. The first is to accept the cowbird egg, which would likely result in a reduction of hatching success and nestling survival (Clark and Robertson 1981; Weatherhead 1989). Acceptance is most frequently observed when the nest contains 2 or more warbler eggs upon parasitism (Sealy 1992). Egg rejection is the second option, which is achieved by deserting the nest or by burying nest contents. Nest desertion is considered a very costly option because there is a 6- to 9-day delay of rebuilding (Rothstein 1975b), whereas burial is believed to be the less costly because it creates only an estimated 3.1- day delay until laying is resumed (Clark and Robertson 1981).

Burial is defined as the female adding additional material onto the inner wall of the nest and over the parasitic egg, as well as any of her own eggs that might be present (Clark and Robertson 1981; Sealy 1995). Burial is more likely to occur when nests contain 0 or 1 yellow warbler egg at the time of parasitism (Clark and Robertson 1981; Sealy 1995).

Yellow warblers are the only cowbird host that frequently respond to parasitism by burial. Due to this unique behaviour, it is thought that burial is an anti-parasitic adaptation (Friedmann 1929; Clark and Robertson 1981; Burgham & Picman 1989; but see Sealy 1995) because it is a regular rejection activity and the female warbler sometimes sacrifices some of her own eggs (Rothstein 1975a; Sealy 1995). In describing burial as a possible anti-parasitic adaptation, Rothstein (1975a: 256) wrote:

> "Possibly some hosts use nesting materials that make it difficult for cowbirds to determine when a nest is nearly completed and this, rather than a direct response to cowbird eggs, may represent an actual antiparasitic adaptation. It may be no coincidence that the yellow warbler, the species most noted for burying cowbird eggs, often builds an unusual nest with similar material used for both the nest frame and the nest lining."

Rothstein's suggestion has never been quantitatively supported or disproved, although Clark and Robertson (1981) observed that the materials used for the lining and cup were distinctly different. It is hypothesized that the female yellow warbler creates visual homogeneity throughout the nest so that a cowbird cannot correctly determine when a nest is nearly completed and, hence, may parasitize the nest prematurely. I tested this hypothesis by determining if the female selects similar materials for all phases of nest building to achieve visual homogeneity throughout the nest.

Methods

In 1995, searches for yellow warbler nests were conducted daily on the forested dune ridge. All nests were located in the willow community (south side of ridge) to ensure that the vegetation used in nest building was similar.

Over 50 nests were collected after use during the 1995 field season. Nests were dried (at 80˚C) in a brown paper bag and dry mass was recorded. Dry mass is defined as no change in weight occurring after two consecutive measurements, 24 hours apart.

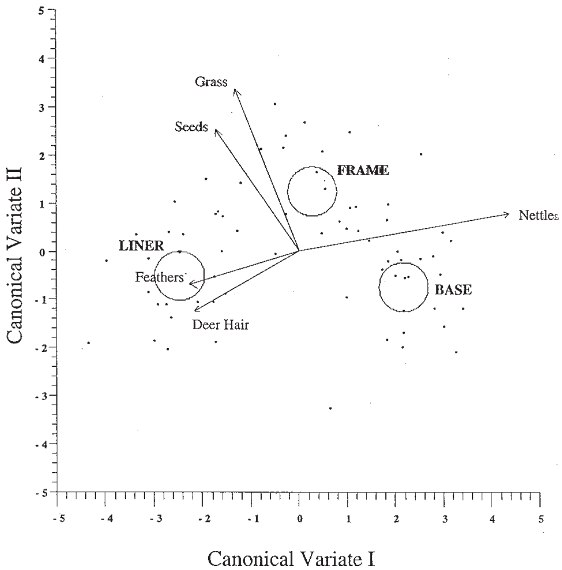

Figure 1. Canonical variate analysis diagram of 24 Yellow Warbler nests displaying the separation of nest layers (liner, frame, base) attributable to the five different nesting materials (represented by arrows). Circles represent a 95% confidence interval around each nest layer.

liner then in the frame or base (Table 1).

Canonical Variate Analysis (Fig. 1) illustrates the material composition of each layer. The liner is characterized by the relative heavier mass of feathers and deer hair, when compared to the frame and base. The frame is represented by relative greater mass of grass and seeds, whereas the base consists mostly of nettles. Eighty-two percent of the variation in these data can be explained by the trend observed in the first axis (Eigenvalue % = 82, Table 2).

Discussion

The color and the texture (animal versus plant material) were the main components that identified the layers in Yellow Warbler nests. Each layer was readily identifiable by this, with exception of the four nests that only had two observable layers (liner and base). Because cowbirds visually select nests to parasitize (Norman and Robertson 1975), the visual differentiation of layers according to color and texture could suffice.

Nettles, grass, deer hair, fruits and feathers were found in 80-100% of all the nests dissected (Table 1). Also, these materials, with the exception of feathers, occurred in over 80% of the nests in every layer (Table 1). The separation of layers within the nest can be accounted to the relative amount (mass) of each material and not the presence/absence of a material within a layer (Fig. 1, Table 1 & 2).

Because the same materials are used throughout the whole nest, yet the relative mass within each layer differs (resulting in heterogeneity throughout the nest), the uniqueness of the yellow warbler nest does not function as my hypothesis suggested. The cowbird is not tricked, due to an inability to detect when a nest is completed, because the frame and liner have a similar appearance. However, the cowbird may still be tricked into laying early, but by another function. Sealy (1995) reported that nearly half (41%) of the cowbird eggs at this site are laid during nest building (termination of nest building being defined as the day the first yellow warbler egg is laid). Because it is not in the cowbird's best interest to lay during this time, due to the high risk of burial (Clark and Robertson 1981; Sealy 1995), it appears that cowbirds lay earlier than what could be presumed to be optimal.

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Table 2. Canonical Variate Analysis: eigenvalue, canonical correlation and chi square values of the two axis of Canonical Variate Analysis for 24 yellow warbler nests with 5 variables (nesting material) and 3 groups (nest layer)

Axis	Eigenvalue	E.V.[a] as %	Can. Coor.[b]	chi square	df	P
1	3.8	82.19	0.89	138.81	10	<0.001
2	0.82	17.81	0.672	38.43	4	<0.001

[a] Eigenvalue
[b] Canonical Correlation

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