NEST TREE SELECTION BY RUFOUS-NAPED WRENS IN PALO VERDE NATIONAL PARK, COSTA RICA

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Abstract: Tree-nesting birds may enhance their fitness by nesting near colonies of aggressive social insects as a strategy to protect their offspring from predators; however, little is known about which tree characteristics might influence bird nest site selection. Nest placement by the rufous-naped wren, *Campylorhynchus rufinucha*, may be complicated by the fact that the wren shares its nest tree with acacia ants, which do not have visually conspicuous nests. To explore the question of what tree traits are associated with rufous-naped wren nests, we measured *Acacia collinsii* tree height, diameter at breast height (DBH), number of major branches from the main stem, and number of leaves, and thorns on a 30 cm segment of a canopy branch. We found that birds nested in taller, leafier trees. Because taller, leafier trees are likely to be well-defended by their ant mutualists, the wrens may receive the benefits of distancing their nests from ground predators and from the associations of an effective ant population that may defend the tree and their nests.

Key Words: Acacia collinsii, Campylorhybchus rufinucha, Pseudomyrmex spinicola, *mutualism*

INTRODUCTION

Many bird species nest near aggressive social insects as a fitness-enhancing strategy, utilizing the insects' swarming and stinging behaviors to protect their offspring from predators (Beier and Tungbani 2006). Even though the insects often do not receive any benefit from this interaction, they inadvertently protect the birds' nests (Wiley 1983). Some aggressive wasps and ants have conspicuous nests (Beier and Tungbani 2006), which would allow nesting bird species to choose trees that harbor these swarming insects. However, other aggressive insects. such as *Pseudomyrmex spinicola*, which nest inside the thorns of acacia trees, do not have conspicuous nests (Collins et al., *personal observation*).

Nevertheless, the rufous-naped wren, *Campylorhynchus rufinucha*, nests in acacias and receive protection from predators, such as monkeys and snakes, by the acacia ant *P. spinicola* (Janzen 1969, Young et al. 1990). It is unlikely that the birds are able to learn specific locations of aggressive ant colonies because the birds build new nests every year (Wiley 1983). Therefore, we hypothesized that wrens would use visual cues on the trees as a

proxy for healthy ant populations. We measured visually detectable traits of the acacia tree *Acacia collinsii* (Fabaceae; hereafter referred to simply as acacias) with intact nests of rufous-naped wrens and surrounding acacia trees without nests. We predicted that trees containing nests would be larger and healthier.

METHODS

We conducted our study on 8 January, 2007 along the access road to the east of the Organization for Tropical Studies field station in Palo Verde National Park, Costa Rica. We haphazardly chose twelve acacia trees containing intact rufous-naped wren nests. For each nest tree, we also sampled the three nearest acacia neighbors without nests. We chose near neighbors without nests with a minimum trunk diameter at breast height (DBH) of 1 cm because smaller trees would be incapable of supporting nests.

For each tree, we measured DBH, number of leaves and thorns per 30 cm of a randomly selected canopy branch, number of major branchings off the main trunk, and tree height using a clinometer and distance from the tree. We measured these variables because they are visual traits that a bird might use as indicators of ant activity when choosing a nest site. Because plants in tropical dry forests experience high rates of herbivory (Coley and Barone 1996), tree leafiness should be a reliable indicator of effective defense by ant mutualists. Thorniness is also a strong indicator of effective ant defense, according to the nest space limitation hypothesis (Fonesca 1999). The hypothesis states that living space is the most limiting resource in myrmecophytes, and therefore, the trees with more thorns are associated with larger ant populations.

We first performed pair-wise correlation analyses on the five indicators (DBH, tree height, thorniness, leafiness, and number of branchings) to prevent the use of multiple t-tests on correlated response variables, reducing Type I error rate. We excluded DBH and major branchings because they were correlated with height (height and DBH: $r = 0.85$, $N = 24$, $P < 0.0001$; branching and DBH: $r = 0.67$, $N = 24$, $P = 0.0003$; height and branching: $r = 0.49$, $N = 24$, $P = 0.0003$). For the three trees we measured without a nest per tree with a nest, we averaged the response variables across those trees. We performed paired two-sample t-tests on tree height, leafiness, and thorniness between trees with and without nests using JMP 6.0. We paired nest and no nest samples in identical habitats to eliminate biases among microhabitats.

RESULTS

Nest trees had higher thorn density than no nest trees (mean ± SE, nest: 12.83±0.94, no nest: 11.33±0.75, paired two-sample $t_{11} = -1.76$, $P = 0.053$). Nest trees were 43.7% leafier than no-nest trees (paired two-sample $t_{11} = -2.98$, $P = 0.0062$, Figure 1A). Moreover, nest trees were 70.3% taller than no-nest trees (paired two-sample $t_{11} = -5.55$, $P < 0.0001$, Figure 1B).

DISCUSSION

The location of rufous-naped wren nests suggests the birds use indirect and direct associations of certain physical parameters in their selection of acacia trees. Directly, wrens may select nest sites using height and leafiness as indicators of good tree health and stability. Greater height might also be important for distancing the nest from terrestrial predators, such as rats and coatis.

In addition to these direct physical benefits, the wrens' selectivity among acacia trees may indirectly involve the unique mutualism between these trees and resident ants. Nest trees had a higher thorn density, which may be associated with a larger ant population because myrmecophyte-inhabiting ant colonies are generally space limited (Fonesca 1999). The strength of a resident ant population's protection against grazing herbivores and competing plants has also been shown to promote the tree's overall health (Janzen 1969); therefore, an effective ant colony may indirectly increase the probability that a wren nests in that given tree. Moreover, the ant population may enter into a mutualistic relationship with the wrens (Janzen 1969, Young et al 1990), thereby causing wrens to seek out trees with strong health indicators both for their inherent benefits and for their association with effective ants. Acacia ants may adjust to the nests' presence and actually defend the nests from predators, such as white faced capuchins (Joyce 1992), while the wrens may benefit these ants by consuming or deterring ant predators (Janzen 1969).

Further observation is required to link resident ant activity, nest site selectivity, and the physical parameters of a given acacia tree emphasized in this study. Future work should address the fitness benefits and costs of nesting wrens, cohabitating ant species, and acacia trees as they coexist in the lowlands of Costa Rica's Pacific plain.

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