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Bird/ant/acacia symbioses in a mature Neotropical forest.—A variety of avian species nest in swollen-thorn acacias (*Acacia* spp.), presumably because ants symbiotic with the tree afford the birds protection against predators (Janzen 1969, Young et al. 1990). In the ant/acacia obligate symbiosis, ants of the genus *Pseudomyrmex* defend the acacia tree from herbivores and other plants, and the tree produces proteins, lipids, carbohydrates, and specialized thorns for the ants (Janzen 1966).

Parque Nacional Tikal (625 km^2) in northern Guatemala (17°13'N, 89°39'W) is dominated by semi-deciduous tropical dry forest (Smithe and Trimm 1966), which has remained largely undisturbed since ca 900 A.D. White-bellied Wrens (*Uropsila leucogastra*) and Yellow-olive Flycatchers (*Tolmomyias sulphurescens*) are common insectivores in Tikal, both building similar retort-type nests in the understory (Sutton 1948, Skutch 1960), often in swollen-thorn acacias (*Acacia collinsii, A. cornigera,* and *A. gentlei*; Janzen 1974). While both have been noted nesting in acacias (Sutton and Pettingill 1942, Smithe and Trimm 1966, Stiles et al. 1989) this study addresses the selective nature of the nesting association by both the wrens and flycatchers.

To explore the question of nest-site selection, we tested the null hypothesis that the birds nested in acacia trees in proportion to the tree's representation in the forest. During the dry season (February–June 1988), nests were counted and the tree containing the nest noted as acacia or non-acacia. As we were collecting data on a variety of bird and tree species, it is unlikely that our searches were biased for acacias. To estimate the relative density of acacias, circular plots 20 m in diameter were established around four nests (two of each species). Although these plots were chosen for their logistical convenience, they occurred in habitat that appeared representative of the study area. All trees in the plots with at least as many potential nesting sites as the tree chosen by the bird were counted as suitable nesting trees and identified as acacia or non-acacia. We defined suitable nesting trees by the minimum and maximum height of the nests (1.5–15 m) and the range of branch diameters (0.3–2 cm) actually used by the birds. The average relative density of acacias was thereby calculated to be 5.1 ± 1.4% (SD) of the trees available; that is, roughly one suitable nesting tree in twenty was an acacia. Although this method is admittedly inexact, we found it highly conservative; suitable nesting trees often contained many times the number of potential nesting sites as the acacia, but were only counted as one tree.

Based upon this expected frequency, both the White-bellied Wren and the Yellow-olive Flycatcher nested in swollen-thorn acacias more often than would be expected by chance (White-bellied wrens: 55 nests in acacias and four in non-acacias, $\chi^2 = 949.6$, df = 1, $P < 0.001$; Yellow-olive Flycatchers: 27 nests in acacias and 20 in non-acacias, $\chi^2 = 273.5$, df = 1, $P < 0.001$).

The relationship between the birds and the ant/acacia system is likely a commensal one. By protecting the host tree, the ants may inadvertently reduce the bird's risk of nest predation (Janzen 1983:763). The ants could benefit from access to the birds' feces and/or ectoparasites as noted in other bird/insect relationships (Moreau 1942, Chisholm 1952). However, due to the brevity of the bird's nesting periods and their small size, this would appear to be an unlikely source of significant nutrition to the ant colony. Also, we found no evidence of predation on ants by these birds (Janzen 1969). Thus, it seems that the relationship is commensal; the birds receive protection from the ants, whereas the ants and tree are not affected significantly by the birds.

Interestingly, 11 of the 20 Yellow-olive flycatcher nests in non-acacias were within 1 m of a wasp nest (*Polybia*), an association noted by Stiles et al. (1989; see also Wunderle and Pollock 1985). Furthermore, there were three cases in which both flycatcher and wasp nests occurred in the same acacia. This suggests that nest-site selection in Yellow-olive Flycatchers might be flexible (i.e., in acacias, with wasps, or both) and/or may vary between individuals.

Finally, none of the non-acacia nests of either bird species were located in trees containing thorns. As such trees were common, their non-use could be an indication that the pairs that nest in acacias were selecting for the presence of the ants, not the thorns.

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LITERATURE CITED

Chisholm, A. H. 1952. Bird-insect nesting associations in Australia. Ibis 94:395–405.

Janzen, D. H. 1966. Coevolution of mutualism between ants and acacias in Central America. Evolution 20:249–275.

———. 1969. Birds and the ant × acacia interaction in Central America, with notes on birds and other myrmecophytes. Condor 71:240–256.

———. 1974. Swollen-thorn acacias of Central America. Smith. Cont. to Botany 13:1–131.

———. 1983. Costa Rican natural history. Univ. of Chicago Press, Chicago, Illinois.

Moreau, R. E. 1942. The nesting of African birds in association with other living things. Ibis 84:240–263.

Skutch, A. F. 1960. Life histories of Central American birds. Pac. Coast Avifauna 34: 496–507.

Smithe, F. B. and H. W. Trimm. 1966. The birds of Tikal. The Natural History Press, Garden City, New York.

Stiles, F. G., A. F. Skutch, and D. Gardner. 1989. A guide to the birds of Costa Rica. Cornell Univ. Press, Ithaca, New York.

Sutton, G. M. 1948. The nest and eggs of the White-bellied wren. Condor 50:101–112.

——— and O. S. Pettingill. 1942. Birds of the Gomez Farias region, southwestern Tamaulipas. Auk 59:1–34.

Wunderle, J. M. and K. H. Pollock. 1985. The Bananaquit-wasp nesting association and a random choice model. Ornithol. Monogr. 36:595–603.

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Vocal responsiveness to chilling in embryonic and neonatal American Coots.—Although neonates of many avian species rapidly develop an ability to thermoregulate physiologically, heat provided by a brooding parent commonly augments the young bird's imperfectly developed endothermic capacity (Theberge and West 1973). Brooding contact between parents and young is stimulated by loud "distress" calls of the young (Gullion 1954, Kirkley and Gessaman 1990). Distress calls, a common response to social isolation, are also stimulated by chilling (Kaufman and Hinde 1961) and may play a role in neonatal temperature control by maintaining parental brooding (Kirkley and Gessaman 1990). Distress calls are also given in response to chilling by late-stage embryos of some species, and so could have a thermoregulatory function before hatching (Evans 1990a). Despite the apparent relevance