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NOTES ON THE BEHAVIOR OF THE OLIVE OROPENDOLA (*PSAROCOLIUS YURACARES*) DURING THE BREEDING SEASON

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Resumen. – Notas sobre el comportamiento del Conoto Pico Encarnado (*Psarocolius yuracares*) durante la época reproductiva. – Se observaron dos colonias activas del Conoto Pico Encarnado (*Psarocolius yuracares*) en el sur de Venezuela para describir la estructura de las colonias, los roles de los individuos de ambos sexos durante el período de anidación, y las interacciones intra- e interespecíficas. Ambas colonias (con 14 y 17 nidos, respectivamente) estaban en árboles de *Erythrina* sp. aislados del dosel circundante, y presentaban un alto grado de agregación de nidos (93% y 76%, respectivamente). Las hembras invirtieron su tiempo dentro de los nidos o fuera de la colonia (colectando material para el nido o alimentándose). Los machos reposaban o realizaban despliegues la mayor parte del tiempo. Se identificaron dos diferentes períodos en las colonias, el primero en el cual los nidos eran construídos y el segundo, donde se produjo la puesta e incubación de los huevos. El comportamiento de los machos y de las hembras fue diferente en ambos períodos. Hubo una disminución en la actividad de la colonia y en el número de aves volando durante el segundo período. Las interacciones agonísticas intraespecíficas sólo se observaron entre machos. Estas generalmente consistieron en combates de desplazamiento donde un macho desplazaba a otro que se encontraba en un lugar preferencial de despliegue. También se observaron interacciones agresivas entre conotos y otras especies de aves que anidaban en los mismos árboles donde estaban las colonias, tales como Guacamayas Bandera (*Ara macao*), Maracanás (*Ara severa*) y Arrendajos Rabadilla Encarnada (*Cacicus haemorrhous*).

Abstract. – Two active colonies of Olive Oropendola (*Psarocolius yuracares*) were observed in southern Venezuela to describe the colony structure, sex roles during the nesting period, as well as intra- and interspecific interactions. Both colonies (with 14 and 17 nests, respectively) were located on *Erythrina* trees isolated from the surrounding canopy, and had high degrees of nest clustering (93% and 76% of nests, respectively). Females spent their time either inside the nests or outside the colony (collecting nest material or feeding). Males rested or displayed most of the time. I observed nests during two different colony stages: building of nests and egg-laying and incubation. The behavior of males differed from that of females between stages. There was a decrease in colony activity and in the number of bird flights during the second stage. Intraspecific agonistic interactions were observed only among oropendola males. They usually consisted of one male supplanting another that was in a preferred display site. Aggressive interactions were also observed between oropendolas and other bird species that nested in the same trees where colonies were located, such as Scarlet Macaws (*Ara macao*), Chestnut-fronted Macaws (*Ara severa*) and Red-rumped Caciques (*Cacicus haemorrhous*). *Accepted 26 October 2005*.

Key words: Behavior, breeding season, Olive Oropendola, *Psarocolius yuracares,* Venezuela.

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INTRODUCTION

The family Icteridae is particularly interesting for studies of mating systems because it contains species that are solitary or colonial breeders, monogamous, polygamous, and brood parasites. Caciques (*Cacicus* spp.) and oropendolas (*Psarocolius* spp.) are polygynous and nest colonially (Schäfer 1953, Robinson 1985a, Leak & Robinson 1989, Jaramillo & Burke 1999). The typical nest of oropendolas is a long hanging basket with an entrance on the top, measuring between 75–125 cm in length (Jaramillo & Burke 1999). Orians (1985) stated that the limits of colony size depend on resources and quality of nest sites. Colony size varies among oropendola species (Jaramillo & Burke 1999). Some reported ranges of colony sizes are 5–10 nests for the Russet-backed Oropendola (*P. angustifrons*) (Schäfer 1953), 15–25 nests for the Casqued Oropendola (*P. oseryi*) (Leak & Robinson 1989), 3–172 nests for the Montezuma Oropendola (*P. montezuma*) (Fraga 1989), and 4–100, but an average of 30–40 nests, for the Chestnut-headed Oropendola (*P. wagleri*) (Smith 1991). Oropendolas are considered harem polygynous birds (Leak & Robinson 1989, Webster 1994a) because males control access to females directly, usually by virtue of female gregariousness (Emlen & Oring 1977). Males play no role in building nests or in feeding nestlings, but attack predators and brood parasites (Orians 1985, Robinson 1985a).

Olive Oropendolas (*Psarocolius yuracares*) are found in Amazonian lowland forests from southern Venezuela to northern Bolivia (Meyer de Schauensee & Phelps 1978, Jaramillo & Burke 1999). Their habits and breeding behavior are considered similar to those of other oropendolas (Jaramillo & Burke 1999), but there are no studies regarding their mating system and social behavior. I observed the behavior of Olive Oropendolas in southern Venezuela during the breeding season, and here I describe the structure of the colony, the roles of individuals of both sexes during the nesting period, the activity budget of male oropendolas, as well as intra- and interspecific interactions at colony trees.

METHODS

This study was carried out in southern Venezuela along the Tabaro River (06º21'N, 64º59'W), in El Caura Forest Reserve, Bolívar State. The study area is an undisturbed tropical rainforest in the Nichare River basin, a main tributary of the lower Caura River. Rainfall averages 3250 mm annually, with a relative dry season between January and April. The mean annual temperature is 25.7ºC (Ewel & Madriz 1968).

I observed the nesting behavior of Olive Oropendolas during one week in January 1995, at two colonies, for a total of 23.5 h of observation. I observed each colony daily (3–3.5 h/day at each colony). To describe the structure of the colonies, I recorded the number of nests and the position of each nest with respect to other nests. Nest clusters consisted of more than two nests as far as 50 cm between each other. The degree of clustering in a colony was measured as the proportion of total nests that were in clusters.

Birds were observed with 10 x 25 binoculars. The sex of individuals was distinguished easily because males are larger than females. The number of females in a colony was assumed to be equal to the number of nests, since each female builds one nest, but the number of males was difficult to estimate because I could not identify them individually. I considered the minimum number of males in the colony to be the maximum number of males that I observed at one particular time. While scanning the entire colony, I recorded all activities of males and females in order to describe their roles within the colony. The

males' time budget data were collected at 30-s intervals during 15-min blocks. Males' activities were grouped in four categories: (1) rest: sitting or standing; (2) display; (3) preening; and (4) agonistic interactions: aggressive interactions involving other oropendolas or other species. When a male was displaying, I recorded his position within the colony, counted the number of displays I saw at different time intervals, and calculated the number of displays per time unit. Female activities were classified according to only two categories: (1) inside the nest and (2) away from the colony. The time that females spent inside nests and out of the colony was also recorded.

Agonistic interactions among oropendolas were recorded. I considered an agonistic interaction as an encounter between two individuals when at least one of them acted aggressively. Aggressive interactions could be vocal face-offs, grappling and chasing in the air, or supplantations of another individual from a site. I also recorded oropendolas interactions with other bird species that nested in the same trees where colonies were located.

RESULTS AND DISCUSSION

Colony structure. Both colonies were located on *Erythrina* trees, isolated from the surrounding canopy. This is consistent with the characteristics of nest trees of other oropendola species (Fraga 1989, Leak & Robinson 1989). Trees selected by oropendolas are usually isolated, have an umbrella shape, lack lower limbs or branches, and range in height from 12–30 m (Hilty & Brown 1986, Fraga 1989, Smith 1991). *Erythrina* trees have all these characteristics. Isolation from surrounding canopy, also observed in cacique colonies, is a factor that might reduce mammalian predation, mainly from primates (Robinson 1985b).

One colony was composed of 14 nests distributed in three different clusters (2, 3, and 7 nests, respectively), with two isolated nests, while the other colony had 17 nests distributed in four clusters (2, 2, 3, and 7 nests, respectively), with three isolated nests. The degree of clustering for the two colonies (93% and 76% of nests, respectively) was high. The pattern of nest distribution in cacique colonies is considered a strategy to avoid predation (Robinson 1985b). By nesting together in clusters within the colony, caciques may reduce their vulnerability to avian predators, because more birds defend clustered than isolated nests. The high degree of clustering observed differs from Robinson's (1985c) observations that oropendolas often do not clump their nests within colonies because lone birds are capable of deterring avian predators such as Black Caracaras (*Daptrius ater*) and Cuvier's Toucans (*Ramphastos cuvieri*). However, the Great Black-Hawk (*Buteogallus urubitinga*) was abundant at the study site, and has been considered as an important predator of oropendola eggs (Robinson 1985a, P. Desenne pers. com.). Studies on the Montezuma Oropendola, however, suggest that nest clustering in this species may increase protection from interspecific nest parasitism by Giant Cowbirds (*Molothrus oryzivorus*) (Webster 1994b) and also allows high-ranking males to defend more females against harassment by low-ranking males (Webster 1994c).

Nesting behavior and sex roles. The 14-nest colony had at least 2 males and 14 females. At the 17-nest colony, corresponding to 17 females, the minimum number of males present at one time was 4. Females spent their time either inside the nests or away from the colony (collecting nest material or feeding). I frequently saw females flying into the colony with nest material in their bills.

When in the colony, males rested or displayed most of the day (28.6% and 41.4% of their time, respectively). The display was similar to that described for other oropendola species. Males squatted and deeply bent their

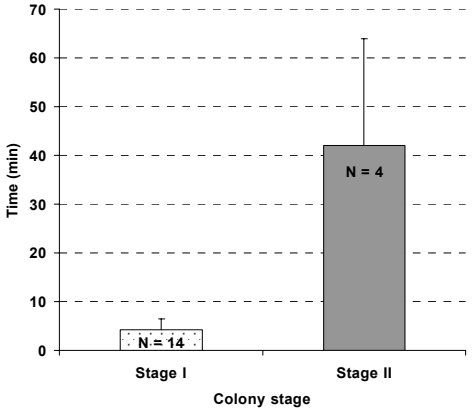

FIG. 1. Average time-periods that female Olive Oropendolas spent inside the nests during the two stages of colony activity.

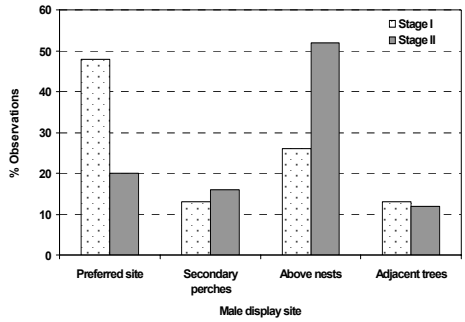

FIG. 2. Differences in display sites used by male Olive Oropendolas during two different stages of colony activity.

head down, dropped their rapidly vibrating wings alongside the body, erected the feathers of their rump, exposing its contrasting yellow coloration, and raised the tail up. At the same time, they produced a vocalization that resembles "liquid gurgling". Males mainly displayed at a "preferred site", on a central branch of the supporting tree, near the nests. However, males also displayed on other branches, above the nests, and in other trees, nearby to the colony. The rest of the time, males were preening themselves (18.0%) or interacting with other individuals (12.0%). This behavior is typical of polygynous species and is similar to that of other colonial icterids, such as Yellow-rumped (*Cacicus cela*) and Red-rumped (*C. haemorrhous*) caciques (Feekes 1981, Robinson 1985a), Crested (*Psarocolius decumanus*), Russet-backed (Schäfer 1953, Robinson 1985a), and Chesnut-headed (Smith 1991) oropendolas.

I identified two different stages of colony activity. The first one (Stage I) involved building of nests and, during this stage, females were frequently observed carrying nest materials in their bills. The second one (Stage II, observed only in the 14-nest colony) included egg laying and incubation. The main difference between these two stages was a decrease in the number of bird flights during the second stage. Feekes (1981) also noted that in cacique colonies, during the nesting period, there is a lot of noise and movement, but during incubation the colony seems almost deserted. Females spent on average more time inside the nests during stage II than during stage I ($t = -6.85$, $df = 16$, $P = 0.001$) (Fig. 1).

The display frequency of males increased significantly during stage II (from 0.95 ± 0.34 displays/min in stage I to 2.49 ± 1.32 displays/min in stage II; $t = -3.57$, $df = 18$, $P = 0.002$). Similar behavior has been reported for Yellow-rumped Caciques (Robinson 1986a), and it seems to be correlated with male dominance. As males were not marked individually, these results should be carefully interpreted, because I do not know for certain that the same males were displaying during both stages. In the stage I, one male mainly displayed in the colony's "preferred site" while the others sang and displayed from more peripheral positions (secondary perches or other trees). However, during the stage II, there was only one male in the colony and it displayed mainly above the nests (Fig. 2). The use of display site did not differ significantly

between the two stages ($\chi^2 = 4.90$, df = 3, $P = 0.18$).

It has been suggested that, for most colonial icterids, copulation rarely takes place in the nest tree because males follow females away from the colony either after precopulatory displays, or on foraging trips (Schäfer 1953, Feekes 1981, Leak & Robinson 1989, Smith 1991). In fact, I did not observe copulations in the colonies. However, oropendola copulations at the colony have been reported for the Montezuma, Russet-backed, and Crested oropendolas (Robinson 1986b, Webster 1994a).

Intraspecific interactions. Aggressive interactions (N = 18) were observed only among male oropendolas. They usually involved supplanting bouts in which one male supplanted another that was on the "preferred site". There was a constant rivalry between males to occupy display sites. Males threatened and chased each other mainly from the "preferred site" and around the nests (N = 13). Other interactions (N = 5) occurred when a male chased another that was displaying on a *Cecropia* tree close to the colony. In all of the observed interactions, when an occupant left a display site, another male occupied it and immediately began displaying. I also observed two aerial fights among males. Intrasexual competition between males has also been described in caciques and other oropendola species, and is related to the male linear dominance hierarchy that may determine priority of access to breeding females (Feekes 1981, Robinson 1985b, Robinson 1986a, Leak & Robinson 1989, Webster 1994a).

Interspecific interactions. Nests of Olive Oropendolas were located on trees where other bird species were also nesting. In the tree where the 14-nest colony was located, a pair of Scarlet Macaws (*Ara macao*) was nesting in a cavity, whereas the 17-nest colony was located in a tree which also supported a colony (28 nests) of Red-rumped Caciques and one nest of Chestnut-fronted Macaws (*Ara severa*). Several behaviors indicative of interspecific interaction were observed. A male oropendola pecked and chased a pair of Scarlet Macaws trying to enter their nest. When macaws were near oropendola colonies, male calls were higher pitched than in other displays. Male oropendolas also aggressively exclude all caciques from the area around their colony. Nests of each species were built in separate groups located on opposite sides of the tree.

I observed Red-rumped Caciques chasing male Olive Oropendolas out of the tree in six instances. Caciques were very aggressive and vocalized loudly during these interactions. Robinson (1985a) indicated that Russet-backed Oropendolas sometimes destroy the eggs and kill the young in cacique nests surrounding their own nest. He postulates that by destroying cacique eggs and young, oropendolas may be reducing the number of food competitors in the area around the colony. Perhaps Olive Oropendolas are cacique nest pirates, as I observed clear defensive behavior by the caciques.

In conclusion, the behavior of the Olive Oropendola seems to be similar to other related species, such as the Montezuma Oropendola, but a long-term study involved banded individuals is required to disentangle relevant questions related to the extent of the female-defense polygyny in this species.

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