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FORAGING BEHAVIOR OF TWO TYRANT FLYCATCHERS IN TRINIDAD: THE GREAT KISKADEE (*PITANGUS SULPHURATUS*) AND TROPICAL KINGBIRD (*TYRANNUS MELANCHOLICUS*)

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Abstract.—We compared the foraging behavior of two large, sympatric flycatchers, the Great Kiskadee (*Pitangus sulphuratus*) and Tropical Kingbird (*Tyrannus melancholicus*), in Trinidad. For each observation of foraging, we recorded or estimated the type of substrate, height class above ground at which foraging occurred, size class of food item captured, and type of prey. The kiskadee foraged more often on the ground and less often in the air than the kingbird, which rarely foraged on the ground. The kiskadee foraged at significantly lower levels than the kingbird. Both species foraged mostly on animal prey with roughly equal frequency. Although a variety of prey sizes were taken, both species foraged primarily on prey < 1 cm long, with no significant difference between the species.

Key words: foraging behavior, Pitangus sulphuratus*, Trinidad, Tyrannidae,* Tyrannus melancholicus

Resumen.—COMPORTAMIENTO DE FORRAJEO DE DOS TIRÁNIDOS ATRAPAMOSCAS: EL CRISTOFUÉ (*PITANGUS SULPHURATUS*) Y EL PITIRRE CHICHARRERO (*TYRANNUS MELANOCHOLICUS*). Comparamos el comportamiento de forajeo de dos especies grandes de atrapamoscas, el Cristofué (*Pitangus sulphuratus*) y el Pitirre Chicharrero (*Tyrannus melanocholicus*), en Trinidad. Para cada observación de forrajeo, registramos o estimamos el tipo de sustrato, clase de altura por encima del suelo en la cual se alimentó, la clase de tamaño de alimento capturado, y el tipo de alimento. El Crisofué se alimentó más frecuentemente en el suelo y menos frecuentemente en el aire que el Pitirre Chicharrero, el cual raramente se alimentó en el suelo. El Cristofué se alimentó a alturas significativamente más menores que el Pitirre Chicharrero. Ambas especies se alimentaron principalmente de presas animales con frecuencia casi igual. Aunque incluyeron alimentos de tamaño variable, ambas especies consumieron principalmente insectos de < 1 cm de longitud, sin una diferencia significativa entre las especies.

Palabras claves: conducta de forrajeo, Pitangus sulphuratus*, Trinidad, Tyrannidae,* Tyrannus melancholicus

AS A LARGE AND DIVERSE FAMILY of New World birds, flycatchers of the family Tyrannidae exhibit a wide variety of foraging strategies (Fitzpatrick 1980). The Great Kiskadee (*Pitangus sulphuratus*) and Tropical Kingbird (*Tyrannus melancholicus*) are large, ubiquitous inhabitants of relatively open country that occur sympatrically in much of their Neotropical range (Stouffer and Chesser 1998, Brush and Fitzpatrick 2002), including Trinidad, a large island on the continental shelf of northeastern South America (ffrench 1991). The Great Kiskadee is heavier and has a longer bill (body mass, 47.5-68.5 g; bill length, 23-31 mm; wing length, 106-118 mm) than the Tropical Kingbird (body mass, 31.5-44.5 g; bill length, 20-25 mm; wing length, 107-120 mm; data from Trinidad based on ffrench [1991], S. A. White and F. E. Hayes unpubl. data.).

Few studies have quantified the foraging behavior of the Great Kiskadee (Fitzpatrick 1980, 1981, Gorena 1995, 1997, Cintra 1997, Latino and Beltzer 1999, Brush and Fitzpatrick 2002) and Tropical Kingbird (Fitzpatrick 1980, 1981, Pearson 1971, Rosenberg 1990, Cintra 1997). Here we compare the niche partitioning of foraging behavior between the two species in Trinidad. Because interspecific competition generally precludes two similar species from occupying the same niche at the same time in the same place, we predicted that the two species would differ in their foraging behavior, and that the kiskadee would feed upon larger food items because of its larger bill and body mass.

METHODS

From February-May 2002 (dry season), we studied the foraging behavior of unmarked individuals of each species at elevations < 100 m above sea level in Maracas Valley and St. Augustine, north-central Trinidad. The study sites were relatively open urban or campus areas in close proximity to buildings, electrical wires, grass lawns, and trees often exceeding 20 m in height.

Binoculars (7-8×) were used to observe the behavior of focal birds. For each observation of foraging, we attempted to determine or estimate the following variables: type of substrate from which foraging was attempted (ground, vegetation, and air); height above ground at which foraging occurred (< 2 m, 2-4 m, 4-6 m, and > 6 m); size of food item captured (< 0.5 cm, 0.5-1.0 cm, 1.0-1.5 cm, and > 1.5 cm, as estimated against bill length); and type of prey (plant or animal). No more than ten observations were taken from a given individual.

Each foraging attempt was assumed to be an independent event. Two-sample chi-square tests (χ^2 statistic) were used to compare the proportions of foraging attempts on different substrates and food types between the two species. Mann-Whitney *U* tests (*z* statistic) were used to compare the foraging heights above ground and the relative sizes of food between each species. Each statistical test and its assumptions are described by Zar (1984). All tests were computed with Statistix 7 software (Anonymous 2000). Because multiple observations were taken from the same individual bird, caution is warranted in interpreting the results of these statistical tests.

RESULTS

The two species differed significantly in their use of foraging substrate; the kiskadee foraged more often on the ground (44.6%) and less often in the air (21.8%) than the kingbird, which foraged primarily in the air (56.0%) and only rarely on the ground

Table 1. Frequency of foraging attempts by the Great Kiskadee and Tropical Kingbird on prey with respect to substrate type, height of prey capture above ground, size of prey, and type of prey.

Variable	Great Kiskadee	Tropical Kingbird
Substrate[a]		
Ground	45	1
Vegetation	34	36
Air	22	47
Height above ground[b]		
<2 m	67	18
2-4 m	15	29
4-6 m	13	25
>6 m	1	12
Food type[c]		
Animal	68	65
Plant	13	15
Food size[d]		
<0.5 cm	51	37
0.5-1 cm	24	26
1-1.5 cm	9	16
>1.5 cm	16	4

[a] $\chi^2 = 50.06$, df = 2, $P < 0.001$
[b] $z = 6.42$, $P < 0.001$
[c] $\chi^2 = 0.06$, df = 1, $P = 0.81$
[d] $z = 0.21$, $P = 0.83$

(1.2%; Table 1). The kiskadee foraged at significantly lower levels (69.8% of time < 2 m) than the kingbird (78.6% of time > 2 m; Table 1). Both species foraged mostly on animal prey with roughly equal frequency (kiskadee, 84.0%; kingbird, 81.3%; Table 1), but both often foraged on fruits. Although a variety of prey sizes were taken, both species foraged primarily on prey < 1 cm long (kiskadee, 75.7%; kingbird, 75.9%) with no significant differences between the species (Table 1).

DISCUSSION

Fitzpatrick (1980) regarded the Great Kiskadee as a "supreme generalist...uniquely variable in its foraging behavior" (p. 49), and *Tyrannus* kingbirds (including Tropical Kingbird) as "Aerial Hawking specialists" (p. 54). Our results were consistent with these generalizations and were similar to those of previous studies on the foraging behavior of these species.

Although the kiskadee often uses aerial hawking to capture prey, a diversity of foraging methods and substrates have been documented in Texas and Peru, including perch-gleaning, sally-gleaning, hover-gleaning in vegetation, shallow plunge-diving and wading up to belly in water, and scavenging on the ground (Gorena 1997, Brush and Fitzpatrick 2002). In contrast, the kingbird was among the most specialized foragers of flycatchers in Peru and Brazil, where it foraged predominantly (> 75%) by aerial hawking (Fitzpatrick 1980, Rosenberg 1990, Cintra 1997, Stouffer and Chesser 1998); however, aerial hawking in our study was just 56%. Intraspecific kleptoparasitism has been observed in both species (Bentley 1991, Hayes 1992, 2000) but no instances were observed during this study, providing further evidence of its rarity.

The kiskadee forages from any height but usually hunts close to the ground, averaging 2.5 m above the ground in Texas (Gorena 1997), 6.5 m in forest edge and 3.4 m in nearby savanna in Brazil (Cintra 1997), and was 0-2 m above ground 69% of the time (nearly identical to our study) in Peru (Brush and Fitzpatrick 2002). In contrast, the Tropical Kingbird is a canopy specialist that typically hunts from the highest perches available, 76% of the time > 25 m and 24% from 12-25 m high in the canopy of dry forest in Peru (Pearson 1971), averaging 7.3 m in forest edge and 4.6 m in savanna in Brazil (Cintra 1997), and averaging about 6 m in 10 m scrub on Amazonian River islands in Peru (Rosenberg 1990). The kingbird only rarely descends to the ground or into low vegetation (Skutch 1954, 1960).

The kiskadee forages on a variety of fruits, insects, and small vertebrates (see review by Brush and Fitzpatrick 2002). Animal prey were taken more frequently than fruits by kiskadees in Texas (56% of diet; Gorena 1995, 1997) and Peru (63%; Brush and Fitzpatrick 2002), but in lower proportions than in our study (84%); in contrast, animal prey comprised only 40% of items in the stomachs of kiskadees in Argentina (Latino and Beltzer 1999). The kingbird consumes a wide variety of plant and animal prey (see review by Stouffer and Chesser 1998), but the relative contributions of each has not been documented previously.

The relative sizes of food items consumed has not been studied previously in the kiskadee and kingbird (Stouffer and Chesser 1998, Brush and Fitzpatrick 2002). Because the kiskadee possesses a larger bill and body, we predicted it would prey on larger food items on average. However, our data failed to support this prediction. Nevertheless, the kiskadee appears to be more predisposed for attempting to prey upon larger items of food, even if only rarely. In Trinidad, kiskadees have been observed feeding or attempting to feed on a variety of vertebrate prey including fish (Chadee et al. 1991), lizards (ffrench 1991, this study), nestling Bananaquits (*Coereba flaveola*; ffrench 1991, F. E. Hayes and N. A. Trimm pers. obs.), and mice (Bentley 1991, ffrench 1991). In contrast, the kingbird has been reported foraging on vertebrate prey only once, on a small frog in Central America (Skutch 1954, Stouffer and Chesser 1998).

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