

NATURAL HISTORY AND DISTRIBUTION OF SELVA CACIQUES (*CACICUS KOEPCKEAE*) IN THE PERUVIAN AMAZON

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Resumen. – Historia natural y distribución del Cacique de Koepcke (*Cacicus koepckeae*) en la Amazonía peruana. – Presentamos nuevos datos sobre distribución, hábitat, conducta social y nidificación del Cacique de Koepcke (*Cacicus koepckeae*) obtenidos durante seis años de trabajo de campo en 37 sitios de los departamentos Cusco y Ucayali, Amazonía de Perú. Nuestras nuevas 10 localidades estaban vecinas a ríos secundarios, a alturas entre 340 y 660 m s.n.m., y contenían parches (pacales) del bambú *Guadua sarcocarpa*. Presentamos sonogramas y descripciones del canto, antes desconocido, y de otras voces. Encontramos dos nidos activos separados por 400 m, ambos colgando sobre un arroyo, bolsas alargadas tejidas mayormente con fibras negras del hongo *Marasmius*. Observamos y oímos hasta tres y cuatro individuos en cada nido, los que compartían conductas parentales como vigilancia y ataques a depredadores, conducta inusual en caciques de nidificación solitaria. Las tres especies de caciques *C. koepckeae*, *C. sclateri* y *C. chrysopterus* construyen nidos solitarios de fibras oscuras fúngicas colgando sobre el agua. Esta similitud apoya la taxonomía tradicional que sugiere una cercana relación filogenética entre las tres especies.

Abstract. – We present new data on the distribution, habitats, social behavior, and nesting of the Selva Cacique (*Cacicus koepckeae*), obtained during six years of surveys at 37 sites in the departamentos Ucayali and Cusco, Amazonian Peru. Our 10 new localities for this cacique were close to smaller rivers, at altitudes of 340–660 m a.s.l., and had patches of *Guadua sarcocarpa* bamboo. Sonograms and descriptions of the song (previously unknown) and other vocalizations are presented. We found two active nests, elongated pendant bags hanging over streams, mostly built with blackish rhizomorphs of the fungus *Marasmius*. We observed from three to four individuals at each nest, sharing some parental duties like nest guarding and attacks to potential predators, an unusual behavior for solitary breeding caciques. The nests of Selva, Golden-winged (*C. chrysopterus*), and Ecuadorian (*C. sclateri*) caciques are similar, all suspended over water. This similarity supports the view of traditional taxonomy in suggesting a close phylogenetic relationship between the three species. *Accepted 4 September 2012.*

Key words: *Cacicus koepckeae*, Selva Cacique, Icteridae, bamboo, fungal nest, social behavior, Peru.

INTRODUCTION

Selva Caciques were discovered in 1963 and described in 1965 (Lowery & O'Neill 1965).

They are known to occur in a restricted area of southeastern Amazonian Peru, being reported from only six localities in the departamentos Cusco and Ucayali (Young *et al.* 2009).

There are few museum specimens, and the female plumage has been undescribed (Jaramillo & Burke 1999). Because of its restricted range, the Selva Cacique is considered vulnerable (BirdLife International 2012). Young *et al.* (2009) used spatial models based on variables like altitude and rainfall to suggest a larger distribution for these caciques, extending their range into nearby Acre State in Brazil. Reports of habitat use by Selva Caciques emphasized their use of riparian habitats with early successional vegetation like *Gynerium* cane (Tobias 2003), and avoidance of upland *terra firme* forest (Collar *et al.* 1992). Minimal first-hand information exists on their foraging behavior, vocalizations and nesting (Gerhardt 2004, Tobias 2003). Our main objective is to provide new information about the distribution, habitat use, nesting behavior, and vocalizations of Selva Caciques.

No DNA data are available for Selva Caciques, but traditional taxonomy based on museum specimens suggests that this species is closely related to Golden-winged (*C. chrysopterus*) and Ecuadorian (*C. sclateri*) caciques (Lowery & O'Neill 1965, Cardiff & Renssen 1994). We use the new information to evaluate this hypothesis.

STUDY AREA AND METHODS

Our observations were made during 284 days of field work from February 2004 to November 2009 while conducting surveys with a team from PMB biodiversity assessment program (Programa de Monitoreo de la Biodiversidad en Camisea). Avian biodiversity was studied at 37 sites (with seven visited twice) in the departamentos Cusco and Ucayali, Peru (Fig. 1). Sites were located within a minimum polygonal area of 15,390 km² along the eastern Andean foothills, with an altitudinal gradient of 200 to 1700 m a.s.l.. The topography was undulating, consisting of ridges intersected by rivers, with some flat alluvial land

along the main rivers (e.g., Camisea, Cashirari, and Urubamba). Sites were selected *a priori* using two criteria: presence of diverse vegetation types and site accessibility to landing helicopters (stony beaches) or boats used for transportation. Vegetation types were studied by analysis of image texture in satellite images, and also by aerial photographs taken during helicopter surveys. This information was afterwards verified by our increasing field experience. A scouting party established campsites and a series of 8 to 15 radiating trails 1 to 5 (mean 2.6) km long, that summed up to 14 km in length. The trails crossed main vegetation types and intersected or bordered topographical features like ridges, rivers and streams. A team of field zoologists and botanists conducted research at each site for a week, during all months excepting January, May, June, and December.

Climate data for our study areas is only available for the airport of Las Malvinas at 390 m a.s.l.. Mean annual temperature for 2001–2010 was 25.1 °C, with low and upper means of 20.4 °C and 29.8 °C. During the Austral winter (May–August), the brief passage of southern fronts (“frijes”) lowered maximum daily temperatures to 16 °C. Mean annual rainfall is 3420 mm, unevenly distributed. Precipitation declines in the Austral winter (mean 43 mm for August) and increases in the Austral summer (mean of 468 mm for February). Satellite images and our field experience suggest that cloud cover and rainfall increase with altitude.

Lower elevations sites were included in reserves set for ethnic groups with Amazonian culture and semi-nomad habits. Vegetation there was mostly humid rain forest with few and small human-made clearings. Sedentary populations with Andean cultural traditions increased towards the highlands, and so did number and size of agricultural clearings. Vegetation types visited included disturbed areas (agricultural fields and abandoned gas

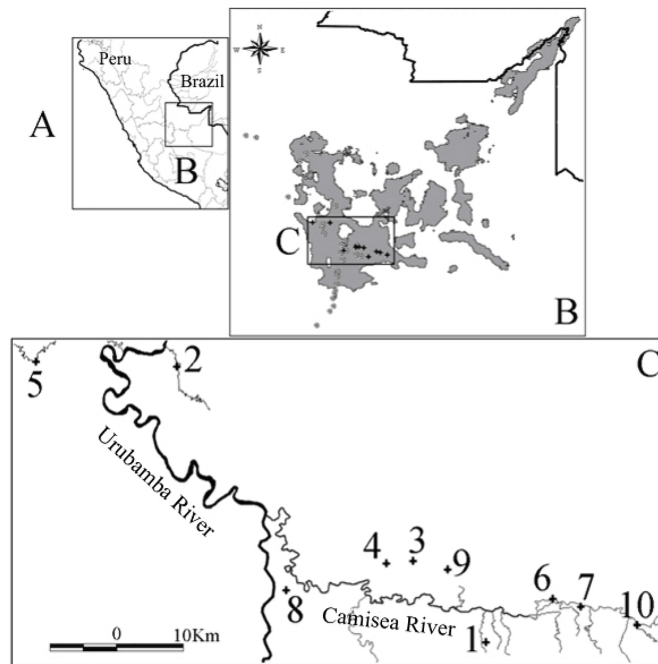


FIG. 1. Map of study localities for Selva Caciques superposed to their hypothetical distribution (in gray) modeled by Young *et al.* (2009). Crosses mark campsites where Selva Caciques were detected, and dotted circles those without caciques. The numbers refer to Appendix 1.

fields), riparian habitats and lakes (cochas), semi-dense forest with an open canopy, and dense forest with abundant emergent trees and a closed canopy.

Selva Caciques were observed with 8 x 30 and 10 x 40 binoculars, and we used playback of the species' calls taken from published sources (Schulenberg *et al.* 2000) and our own recordings to check the species' presence. Habitat use by caciques was estimated by sampling vegetation in a circle of 30 m around each observed individual or group. Nests of Selva Caciques ($N = 2$) were observed at distances of < 12 m from hides built with local plants, for a total of 10 hrs. Plant species were identified by field botanists in our team. We took digital photographs and tape-recorded vocalizations using a Marantz PMD 222 cassette recorder with an AKG C568 EB shot-

gun microphone. Sonograms were prepared by R. Fraga using Avisoft SASLab Pro. Tape recordings by P. Grilli have been deposited at the Macaulay Library of Natural Sounds (Cornell University, Ithaca, NY).

RESULTS

Locations and habitat. Selva Caciques were observed at 10 of 37 research sites (Appendix 1, Fig. 1). We observed the species in undulating terrain along the Andean foothills only at elevations ranging from 340–660 m a.s.l.. Caciques were found only near or along watercourses in semi-dense forest with an open canopy of scattered emergent trees up to 30 m high. The understory vegetation included extensive patches (locally called "pacaes") of the spiny bamboo *Guadua*

sarcocarpa. This bamboo usually grows in dense stands up to 6 m high, but sometimes climbs trees. Other common plants in areas where caciques were observed included riparian trees and shrubs in the genera *Zigga*, *Inga*, and *Erythrina*, and patches of *Gynerium* cane.

General behavior. Groups of non-breeding Selva Caciques consisted of two to seven individuals. The modal range was three to five individuals ($N =$ eight groups), and the mean group size was 3.4 individuals. All individuals observed were similar in plumage and size, with no obvious sexual dimorphism in plumage and size. Selva Caciques were observed foraging ($N = 4$) only on arboreal vegetation and taller understory shrubs, never on the ground, and at heights ranging from 3 m to about 20 m. We placed mist nets 2 m above ground every day to capture understory birds, but no Selva Caciques were netted, even at sites where they were observed.

Selva Caciques were twice seen mandibulating flowers (probably taking nectar) of the tree *Erythrina ulei* (Papilionaceae) and (once) flower buds of a *Bellucia* sp. (Melastomataceae) shrub. Once a group inspected seed pods of an unidentified legume tree, probably searching for insects. Roosting behavior was observed five times, when up to five individuals entered dense bamboo patches at sunset and remained vocalizing up to 40 min after dark.

Vocal behavior. Selva Caciques were rather noisy, usually betraying their presence by persistently calling. We recorded three different calls and the species song, the latter given by individuals performing displays near nests. The most frequent call consisted of a series of alternating high-pitched and low-pitched staccato notes, “feet-cheow”, commonly produced in groups of two or three equal notes, “feet-feet-feet...cheow-cheow.” Bouts of repeated calling sometimes took up to one

min or more. Observations of the birds and note overlaps in sonograms suggest that this call is sometimes a well-coordinated duet (Fig. 2). This call was heard in all our observations, including foraging episodes, nesting activities and in roosts. Playbacks of this call only once attracted a single Selva Cacique. A grating rattle lasting 0.4 s with a fundamental pitch at 2800 Hz was heard three times from nesting individuals.

At both nesting groups, single individuals (possibly males) performed a bow display above nests (see below) while producing songs that lasted < 2 s and consisted of two to four brief low-pitched introductory notes with frequency range of 786–1140 Hz (mean = 852 Hz), a brief clicking sound, plus one to three whistles ascending or descending on the scale with frequency ranges of 1762–1950 Hz (mean = 1856 Hz), sometimes with complex harmonics (Fig. 3). Songs at each nest were homogeneous but of different types (A and B, Fig. 3). Song frequencies exceeded one per minute when two individuals were near the nest.

Nesting behavior. Two nests were found at the Sepriato-2 campsite (Appendix 1, Fig. 1), located between the Río Camisea and the permanent tributary Arroyo (or Quebrada) Sepriato. The nests were attached to branches or vines hanging over the waters of the Sepriato, a fast-flowing stream 6 to 10 m wide and up to 1.6 m deep. The Sepriato has its source at 1140 m a.s.l. in Serranía Cashiriari, and flows along a well excavated bed over sandy or rocky soil, with boulders up to 5 m long. Vegetation above the stream bed was open, and the caciques were easily observed. Debris accumulated from past floods was visible in branches up to 2 m above both nests.

The first nest was found on 21 July 2007. It was a pensile bag attached to a slender branch of a *Zygia* sp. tree and suspended 6 m over water. The *Zygia* tree was growing at the

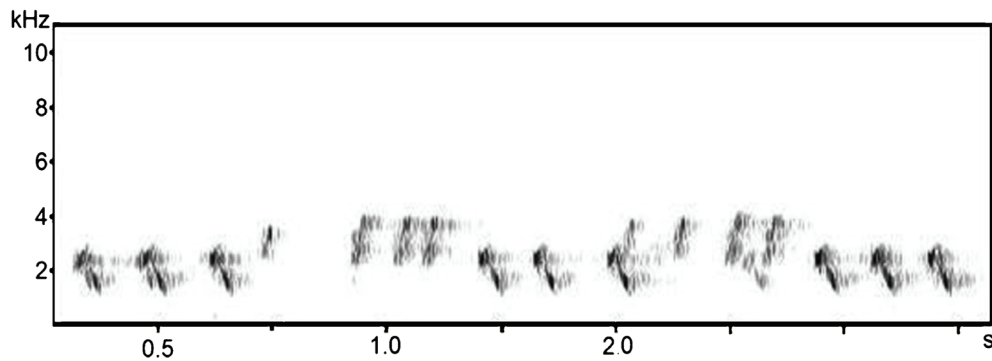


FIG. 2. Calls of up to three individuals of Selva Caciques, one more distant from the microphone, recorded at nest 1 in Sepriato 2.

downstream tip of a small island. The nest was entirely black, with an entrance at the top, and the main nest materials were fungal hyphae of the fungus *Marasmius* (“vegetal horsehair”). We saw caciques incorporating thin dark fibers into the nest four times. By 23 July, the nest was nearly finished and the bottom of the nest was closed. On 27 July, we found that the nest had been neatly cut with a machete and removed by a semi-nomadic group of natives camping along the Río Camisea. Our Machiguenga guide interviewed the native hunters, who indicated that they found the nest empty of eggs on 27 July and tossed it to the water. Based on photographs we estimated the total height of the nest was 60–80 cm.

On 27 July, we found a second nest under construction 400 m upstream from the first. Only a roughly circular nest attachment was built, 10 m above water, in a thorny *Mimosa* sp. vine growing over a small unidentified tree. Nest materials were mostly or exclusively black *Marasmius* fibers. Only the attachment ring of the nest was built when we left the area on 29 July. This second nest was probably built by another cacique group.

The first nest was visited by Selva Caciques 11 times during six hours of observations (10:00–16:00 h). The number of

caciques observed at each visit were one (five times), two (twice), three (four times), and four (once). Single visiting caciques seemed to perform nest guarding from an elevated perch. This individual chased and attacked other bird species near the nest tree, mostly other icterids like Crested Oropendolas (*Psarocolius decumanus*) and Yellow-rumped Caciques (*Cacicus cela*). We saw six times one or two further individuals joining the attacks. During each nest visit, only one cacique brought black fibers, and that cacique was escorted by a second cacique that displayed and sang from a perch less than one m above the nest. Twice fast “feet-cheow” vocalizations were produced by this individual while flying above the stream with an exaggerated wing-quivering movement. When three or four individuals were present, one or two of them perched 6–10 m across the river in front of the nest tree.

The second nest was visited by Selva Caciques six times during three hours of observations (11:30–14:30 h). The number of individuals per visit was one (twice), two (three times), or three (once). Their behavior followed a more stereotyped pattern. When two or three individuals visited the nest, one perched for periods of 4–20 min on the opposite shore in front of the nest producing fast

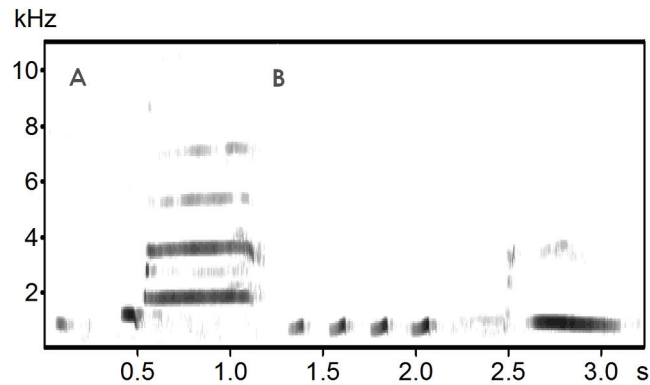


FIG. 3. Two songs types (A and B) of displaying individuals at two nests of Selva Caciques at Sepriato 2.

“feet-cheow” vocalizations, and then arrived and perched less than 50 cm above the nest. The calling bouts were heard in apparent response to similar voices and/or the arrival of other individuals. When a second cacique arrived with nesting material, and added it to the nest, its presumed mate vocalized and performed the bowing display (see below) around the nest. When this second individual departed, it was followed by the first. Even when the nest was not visited we heard and tape recorded up to three caciques along a 30 m stretch of the river that included the nest tree.

At nests, displaying caciques assumed a horizontal posture and performed a deep bow with fast wing-quivering movements while raising the crown feathers and exposing their yellow rump. Bowing displays were performed above the nest (Fig. 4) while other individuals were present (building or not), and included the species song. Song and displays were never continuous and occurred in discrete bouts.

DISCUSSION

The altitudinal range where we detected Selva Caciques is similar to that reported by Gerhart (2004). Only one locality (Kinteroni 1X,

Appendix 1) was slightly outside the theoretical range predicted by the model of Young *et al.* (2009), so our data validate the model on a large scale. On a smaller scale, we found that small water courses near bamboo patches were also good predictors of the presence of Selva Caciques. The riparian habitat frequented by Selva Caciques, although in hilly terrain, included patches of early successional plants, such as *Gynerium* cane, *Cecropia* sp., and balsa *Ochroma pyramidale*, like the “river edge forests” of the Amazonian lowlands (Remsen & Parker 1983). Gerhart (2004) described the habitat of Selva Caciques as a patchwork of successional habitats of varying ages and structures located along dry river courses, side branches, and braids of narrow, high-gradient rivers. The local people called this habitat “otségoa” (Gerhart 2004). This description is similar to ours, but no authors mention bamboo stands as a component of Selva Cacique habitat. We did not observe Selva Caciques foraging on bamboo. Selva Caciques used bamboo patches for roosting, but numerous icterid species throughout the Americas also do so (Fraga 2011) and yet are not considered bamboo specialists. Perhaps Selva Caciques prefer the semi-open forest canopy associated with *Guadua sarcoarpa* bamboo stands (Griscom & Ashton 2003).

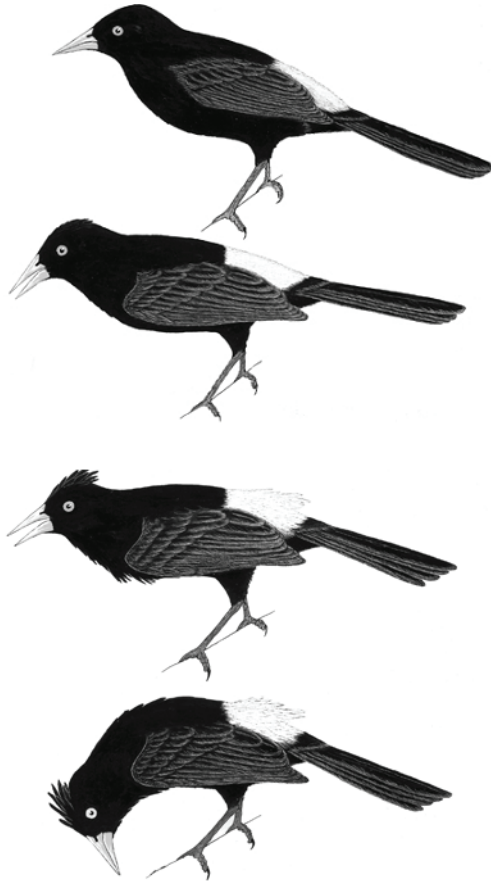


FIG. 4. Display sequence of nesting Selva Caciques (drawing by Luis Pagano).

Neither Ecuadorian (*C. sclateri*) nor Golden-winged (*C. chrysopterus*) caciques show a particular association with bamboo patches (Ridgely & Greenfield 2001, Bodrati & Fraga 2010).

The close relationship of Selva Caciques with smaller streams may be due to their choice of nest sites. Ecuadorian and Golden-winged caciques also nest over water (Botero 2001, Bodrati & Fraga 2010). Our findings on group sizes of Selva Cacique agree with previous reports of maximum groups of six (Collar *et al.* 1992, Tobias 2003).

The “feet-cheow” calls of Selva Caciques we recorded were identical to those described or depicted previously (Tobias 2003, Gerhart 2004), and closely resembled calls reported for the Ecuadorian Caciques (Krabbe & Nilsson 2003). Golden-winged Caciques lack similar calls (pers. observ.) The Selva Cacique songs we recorded share some resemblance (brief introductory notes followed by whistles) with those of both Ecuadorian and Golden-winged caciques, but whistles of the last species have an overall higher pitch.

The nests of Selva Caciques in our study were similar to those Ecuadorian and Golden-winged caciques, i.e., located on branches over water and built of blackish fungal materials (Botero 2001, Bodrati & Fraga 2010). Nests of the smaller-sized Golden-winged Caciques are, however, narrower and shorter than in the preceding species. Gerhart (2004) saw no breeding activity around his putative nests, only one of which was visited by a single Selva Cacique for about 1 h. Based on his own descriptions, we believe that unidentified oropendolas built those nests.

Our observations indicate that Selva Caciques nest during the dry Austral winter season. During the rainy season the two observed nests would have been destroyed by the Sepriato's sudden floods. In subtropical northern Argentina and Paraguay, the Golden-winged Cacique breeds only during the Austral rainy season from October to January (Bodrati & Fraga 2010, Di Giacomo 2005). North of the Equator in Colombia, active nests of the Ecuadorian Cacique have been found in January (dry season) and April (wet season) (Cadena *et al.* 2000, Botero 2001).

Although further data on nestling provisioning are needed, our observations of nesting groups suggest the possibility of cooperative breeding habits in Selva Caciques. Botero (2001) briefly reported a trio of Ecuadorian Caciques attending one nest, so perhaps both caciques share a similar breeding system. Although Golden-winged Caciques commonly occur in small family groups when not breeding, available information (Di Giacomo 2005, Bodrati & Fraga 2010) indicates standard non-cooperative breeding behavior.

This study demonstrates that Selva, Ecuadorian, and Golden-winged caciques share similarities in vocalizations and weave a fungal *Marasmius* nest, unique within the genus *Cacicus*. Our field data support the traditional taxonomic view (Lowery & O'Neill 1965,

Cardiff & Remsen 1994) of a close phylogenetic relationship between these three caciques.

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APPENDIX 1. Localities (numbered as in Fig. 1) of observations of Selva Cacicques made by the authors in departamentos Cusco and Ucayali, with coordinates, altitudes in m a.s.l., months, and years.

- 1) Cashiriari 3 (11°52'56.53"S/072°42'05.03"W), 660 m, July 2005.
- 2) Yamihua (11°30'56.04"S/073°03'51.13"W), 340 m, October 2005.
- 3) Tzonkiriari (11°46'27.02"S/072°44'53.07"W), 430 m, July 2006.
- 4) Potogoshiari (11°46'37.46"S/072°47'02.97"W), 430 m, July 2006.
- 5) Kinteroni 1X (11°30'30.43"S/073° 15'15.55"W), 420 m, November 2006.
- 6) Sepriato 1 (11°49'27.36"S/072°33'40.54"W), 440 m, February and July 2007.
- 7) Sepriato 2 (11°49'52.07"S/072°31'56.70"W), 450 m, July 2007.
- 8) Toteiroki (11°48'48.16"S/072°55'2.71"W), 470 m, March 2008.
- 9) San Martín 3 (11°47'8.64"S/072°42'4.27"W), 490 m, January 2009.
- 10) Alto Camisea (11°51'33.73"S/072°26'47.95"W), 480 m, September 2009.

