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## Divorce in the Canary Islands Stonechat (*Saxicola dacotiae*)

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**ABSTRACT.**—I report the first case of divorce for the Canary Islands Stonechat (*Saxicola dacotiae*), an endemic bird species of the semiarid island of Fuerteventura (Canary Islands, Spain). I studied 72 pairs during three breeding seasons (2000–2001, 2001–2002, and 2002–2003). In 2001–2002, a female divorced after a successful first nesting. This female settled in a neighboring territory where the owner was unpaired, built a new nest, and laid four eggs. The low rate of divorce (1.4%) suggests that unforced mate changes by Canary Islands Stonechats are rare. *Received 22 July 2004, accepted 31 May 2005.*

The Canary Islands Stonechat (*Saxicola dacotiae*) is an island endemic restricted to Fuerteventura Island, Canary Islands, Spain. Bibby and Hill (1987) estimated the population size of the species as 650–850 pairs. Although there are no recent estimates of the abundance of the species, its status has been modified recently by the Spanish Ornithological Society (SEO/BirdLife) from “Near Threatened” to “Endangered” on the basis of increasing destruction and alteration of its habitats (Illera 2004a). In spite of its critical status, very little is known about the biology of this species. Here, I describe the first case of divorce in the Canary Islands Stonechat.

The Canary Islands archipelago is located in the Atlantic Ocean, 100–460 km off the northwest coast of Africa, and comprises seven main volcanic islands and several islets. Fuerteventura is the easternmost (28° 46' N, 14° 31' W), second largest (1,660 km<sup>2</sup>), and oldest island (approximately 22 million years old; Carracedo and Day 2002). The climate is semiarid with dry summers and scarce rainfall in autumn and winter (mean annual precipitation = 117 mm; Marzol-Jaén 1984). The vegetation is mainly sparse xerophytic shrubland. Canary Islands Stonechats are largely re-

stricted to slopes of stony fields and ravines covered by medium to large shrubs and large boulders; they avoid lava and sandy habitats (Illera 2001). Stonechats are thought to be monogamous, sedentary, and territorial (Martín and Lorenzo 2001, Urquhart 2002, Illera 2004b). Territory boundaries usually abut those of neighboring pairs (JCI pers. obs.). After settling, individual birds are extremely faithful to their sites all year long, i.e., they do not move after the breeding season, although territory boundaries may shift between successive breeding seasons (Illera 2004b; JCI unpubl. data). The breeding period extends from December to April (Martín and Lorenzo 2001, Urquhart 2002, Illera 2004b; JCI unpubl. data). Reproductive effort and the duration of the breeding period depend proximately on rainfall and ultimately on food (arthropod) availability (Illera 2004b; JCI unpubl. data). Pairs breed over more extended periods and lay two clutches in wet years, whereas in dry years they breed only once or not at all. Clutches are also larger in wet than in dry years (Illera 2004b; JCI unpubl. data).

Results presented here were obtained during studies of stonechat breeding success and site fidelity. Birds were trapped, banded, and monitored (Illera 2004b; JCI unpubl. data). I monitored 72 pairs over three breeding seasons (2000–2001, 2001–2002, and 2002–2003) at 12 study sites in which 1–10 pairs bred at least once in the 3 years. Of 72 pairs, I color-banded 114 individuals: 32/42 (2000–2001), 39/47 (2001–2002), and 43/54 (2002–2003). Due to sexual dimorphism and individual variability in phenotypic traits, I was also able to identify unbanded individuals. However, because sexual dimorphism traits shift after the molt period (Illera and Atienza 2002), they were only used to identify individuals within each breeding season. The number of banded pairs studied during two or more breeding periods was seven. I monitored pairs at least weekly from late October to ear-

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ly November (pre-breeding period) until a month after the last fledgling left the nest (post-breeding period). The time spent monitoring each pair during each visit varied between 30 min and 2 hr. Stonechats nested once or not at all in the dry (27.3 mm rainfall) breeding season of 2000–2001, and laid two clutches in the two wet years (124.5 and 125.1 mm rainfall in 2002 and 2003, respectively; Illera 2004b; JCI unpubl. data).

Of 72 pairs monitored, only one divorced within a breeding season (2001–2002). Divorce was not recorded for pairs monitored ( $n = 7$ ) in successive breeding seasons. The case of divorce reported here was the result of desertion by a female that subsequently settled in a neighboring territory where the owner was unpaired. Desertion occurred after the original pair successfully reared a brood (three fledglings). In the first brood (about 15 days previous to divorce), during 90 min of observation, 9 and 10 feeding visits were performed by the female and the male, respectively. In six visits to this territory, I did not observe the second male assisting with feeding young or encounters between the female and the second male. All three adults were color-banded. Fifteen days after the first brood fledged, the female built a new nest and laid four eggs. Both members of the new pair fed nestlings of the second brood, with no assistance from the divorced male. The nest was depredated, but the new pair did not attempt to breed again, and 2 weeks later the female disappeared from the territory. The female's original mate continued singing and feeding its three chicks alone during the 4 weeks after fledging. The divorced female never returned to her former territory even though the territories were adjacent. The deserted male did not mate with another female during the remainder of the 2001–2002 breeding period, and he finally moved to a new territory 5 months later.

Limited information is available on divorce in the genus *Saxicola* (Urquhart 2002). Johnson (1961, 1971) recorded several cases of mate exchanges, polygyny, and polyandry in a population of Common Stonechat (*S. torquata*), both within a given breeding season and between successive breeding seasons. H. Flinks (*in* Urquhart 2002) reported that male Common Stonechats might be vulnerable to

mate loss while feeding fledglings. Bibby and Hill (1987) reported that some unpaired male Canary Islands Stonechats assist with feeding young of established pairs. However, during 238.5 hr of observation of feeding (23 pairs), I did not record males or females assisting with feeding young.

The low rate of within-season divorce (1.4%,  $n = 72$  pairs; three breeding seasons) and the lack of between-season divorce (0/7) suggests that unforced mate changes by Canary Islands Stonechats are rare. Strong site fidelity reported for this species (Illera 2004b; JCI unpubl. data.) also suggests that occurrences of between-season divorce are rare. Divorce did not appear to have been triggered by poor breeding success, as mean fecundity of all pairs monitored over 3 years was  $2.25 \pm 0.15$  SE ( $n = 68$ ). The biotic and abiotic homogeneity of Fuerteventura and the likely costs associated with territory switching (e.g., increased probability of predation after a move, aggression of adjacent territory holders, and less efficient foraging in unfamiliar territories; Jakob et al. 2001, Yoder et al. 2004) probably makes divorce maladaptive in this species.

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## Regurgitated Mistletoe Seeds in the Nest of the Yellow-crowned Tyrannulet (*Tyrannulus elatus*)

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**ABSTRACT.**—I describe a Yellow-crowned Tyrannulet (*Tyrannulus elatus*) nest built largely of mistletoe seeds, which differs from the cup of plant matter typically constructed by this species. Mistletoe seeds have been observed in the nests of at least two other bird species, but this observation is the first where the nest appeared to be purposely constructed from seeds, possibly to take advantage of their adhesive properties. *Received 20 September 2004, accepted 31 May 2005.*

Adhesive substances, such as the saliva of *Aerodramus* and *Collocalia* swiftlets (Smythies 1999, Hansell 2000), and regurgitated materials, such as fruits and seeds ingested by Oilbirds (*Steatornis caripensis*; Hilty and Brown 1986), are regularly used for nest construction by these and a few other bird species. However, the use of adhesive mistletoe fruit seeds in nest construction is almost unknown. There have been only two other reports of mistletoe seeds used in nest construction, both in nests of unrelated flycatcher spe-

cies (Tyrannidae: Traylor 1977; Lanyon 1984, 1988; Mobley 2002; Fitzpatrick 2004). A single atypical nest of Fork-tailed Flycatcher (*Tyrannus savana*) in Brazil contained mistletoe seeds regurgitated by an adult into the nest cup during incubation, apparently to help keep the loosely structured nest from falling apart (Sick 1985). Other descriptions of *T. savana* nests make no mention of mistletoe seeds (Hilty and Brown 1986, Stiles and Skutch 1989, Howell and Webb 1995, Hilty 2003, Fitzpatrick 2004). In Venezuela, a single globular nest of the Great Kiskadee (*Pitangus sulphuratus*) was observed to contain a few regurgitated mistletoe seeds about the lower rim and below the side entrance to the nest (J. A. Mobley pers. obs.). No published descriptions of *P. sulphuratus* nests mention mistletoe seeds (Hilty and Brown 1986, Stiles and Skutch 1989, Howell and Webb 1995, Hilty 2003, Fitzpatrick 2004). Here, I provide the first report of a nest covered almost entirely with mistletoe seeds, by the Yellow-crowned Tyrannulet (*Tyrannulus elatus*).

Birds, including *T. elatus* (Hilty and Brown

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1986, Stiles and Skutch 1989, Hilty 2003, Fitzpatrick 2004), are well-known consumers and dispersers of mistletoes (Viscaceae, Loranthaceae) in the Neotropics (e.g., Calder and Bernhardt 1983, Sargent 1994, Restrepo et al. 2002). However, other uses of these plants by birds are poorly known. The seeds of some mistletoe species contain an extremely adhesive layer of viscin tissue under the fruit flesh; once digested, viscin can sometimes elongate to form a thread 3–4 cm long that is attached to one end of the seed. During regurgitation or defecation of the seed, the loose end of this thread will stay in the stomach or cloaca until it is wiped on a substrate, usually a branch. Leverage is then used to remove the strand entirely from the body (Kuijt 1969, Calder and Bernhardt 1983). This is an effective dispersal strategy for mistletoes, as the seeds are occasionally placed on a branch in a location suitable for germination.

The *T. elatus* nest was found on 20 March 2004, on Barro Colorado Island, Panama (9° 9' 49" N, 79° 50' 16" W; 80 m in elevation) in a clearing in humid, lowland evergreen forest. When found, the nest was complete and contained a single egg. The nest was placed approximately 7 m above ground on a small horizontal branch—about 2 cm in diameter—in a 20-m broadleaf evergreen tree parasitized by several mistletoe plants, on which the flycatcher pair fed. The cup-shaped nest was small, approximately 5 cm in diameter (outside rim to outside rim), and was built of undetermined plant material. Regurgitated seeds covered the entire exterior of the nest, and there was a band of regurgitated seeds that wrapped beneath the branch on which the nest was built. Seeds were also worked into the plant material in the nest's interior.

The mistletoe seeds were probably of the genus *Struthanthus* or *Oryctanthus*, with *Struthanthus* more likely based on the round (as opposed to more ovoid) seed shape (S. Sargent pers. comm.) Upon regurgitation, the seeds were a whitish color, but seeds already placed on the nest had dried and turned a crimson-red to orange-red color. The single egg was white with small, evenly dispersed blotches of pale cinnamon to raw umber. The color appeared to be from pigment in the eggshell rather than from stains from the mistletoe seeds, as the colors were different. The

nest did not appear large enough to accommodate a second egg. Nest-construction materials and the pattern of egg markings differed from those described in other published accounts (Penard and Penard 1910, Sneath 1935, Hilty and Brown 1986, Stiles and Skutch 1989, Hilty 2003, Fitzpatrick 2004); these authors described the nest as a shallow cup built of small twigs, mosses, spiderwebs, grasses, tree bark, feathers, and other fine material, and containing a clutch of two unmarked white or cream-colored eggs. A nest of *T. elatus* found in the same clearing on Barro Colorado in 2003 (R. Moore pers. obs.) was similar to the published descriptions; therefore, the nest built of mistletoe seeds was not likely to have been a local adaptation.

On 20 March 2004, the bird attending the egg (distinguishable from its mate by awkwardly arranged feathers on the crown) left for short foraging bouts that lasted ~5 min. Upon returning to the nest, it would resume incubation, and then regurgitate three to four additional seeds on the nest. The bird then used its bill to move the seeds to a location on the nest's exterior, or work them into the plant material in the cup wall, thus continuing to construct the nest after the egg was laid. Placement of each seed took a short period of time—between 5 and 15 sec in 3 hr of observation. I observed four such foraging bouts followed by seed regurgitation and placement. Both the attending bird and its mate also wiped regurgitated seeds on branches in the nest tree. Both adults actively defended the territory against Palm Tanagers (*Thraupis palmarum*) and Social Flycatchers (*Myiozetetes similis*), two other species that may consume mistletoe fruits.

Two hypotheses might explain wiping mistletoe seeds on nests: either the adhesive properties of the seeds were used intentionally to aid in nest construction, or the nest was simply the most convenient object on which the incubating bird could wipe seeds. The careful placement of regurgitated seeds by *T. elatus* on the nest exterior, however, suggests that the seeds were being intentionally used for their adhesive properties to hold the small nest together and to adhere it to the branch. Placing seeds underneath the supporting branch and working seeds into the nest cup takes more concentrated effort and care compared to wip-

ing them on the side of the nest or a nearby branch. Because mistletoe seeds are adhesive and viscin strands are strong, it seems possible that the seeds were used to strengthen the nest, perhaps allowing the overall size of the nest to be smaller than previously described nests, which would decrease the effort needed to build a nest. Because the bright, red-orange color of the seeds contrasted strongly with the surroundings, it seems unlikely that the seeds were used as camouflage.

Conversely, Sick's (1985) description of the *T. savana* nest and J. A. Mobley's (pers. comm.) observations of *P. sulphuratus* nests indicate that the addition of mistletoe seeds to the nest may be only a convenient means of wiping seeds while incubating, with no intent to alter nest structure. Sick (1985) suggested the seeds were inadvertently voided in the nest; neither he nor J. A. Mobley (pers. comm.) observed active placement of, or nest building with, mistletoe seeds, and the few seeds present were not enough to affect nest construction.

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