

Note

Sora (*Porzana carolina*) Parasitism of Red-winged Blackbird (*Agelaius phoeniceus*) Nests

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Sora (*Porzana carolina*) is a conspecific brood parasite that also occasionally parasitizes nests of other species. Sora parasitism in nests of passerines is rare. Of 129 Red-winged Blackbird (*Agelaius phoeniceus*) nests found in North Dakota in 2009 and 2010, two (1.6%) were parasitized by Soras. The conditions favouring this rare parasitic behaviour may include competition for nest sites and high Sora density.

Key Words: Sora; *Porzana carolina*; Red-winged Blackbird; *Agelaius phoeniceus*; brood parasitism; North Dakota

Introduction

Conspecific brood parasitism has been reported in various bird taxa and over 230 bird species (Davies 2000; Yom-Tov 2001; Lyon and Eadie 2008). This behaviour is more prevalent among avian species with precocial young than in species with altricial young (Rohwer and Freeman 1989; Lyon and Eadie 2008). Conspecific parasitism has been described in territorial rails, including Sora (*Porzana carolina*; Allen 1939; Sorenson 1995) and several species of moorhens (*Gallinula angulata*, *G. chloropus*, *G. galeata*; Gibbons 1986; Ueda *et al.* 1993; McRae 1996; Jamieson *et al.* 2000; Post and Seals 2000) and coots (*Fulica americana*, *F. armillata*, *F. atra*, *F. cristata*, *F. rufifrons*; Arnold 1987; Lyon 1993; Jamieson *et al.* 2000; Lyon and Eadie 2004; Samraoui and Samraoui 2007).

Although the extent of this reproductive behaviour in Soras is poorly known, Sora hosts are known to exhibit conspecific egg discrimination and rejection (Sorenson 1995), a rare defensive tactic to mitigate the costs of conspecific brood parasitism (Davies 2000; Lyon 2003). There are also reports of heterospecific brood parasitism in Soras, including Soras laying eggs in nests of other rail species, e.g., Virginia Rail (*Rallus limicola*; Tanner and Hendrickson 1954), King Rail (*R. elegans*; Swales 1896), and other rail species laying eggs in Sora nests, e.g., Virginia Rail (Miller 1928). Sora parasitism in nests of non-rallid taxa has been reported once (Gollop 1949). Here, I report the second and third records of Soras parasitizing nests of a passerine, Red-winged Blackbird (*Agelaius phoeniceus*).

Observations

In 2009 and 2010, during a study of the immune system of the brood-parasitic Brown-headed Cowbird (*Molothrus ater*), observers located nests of a common cowbird host, the Red-winged Blackbird (hereafter redwing), at an experimental wetland facility maintained by the United States Geological Survey's Northern Prairie Wildlife Research Center, about 3 km east of

Jamestown (46°53'N, 98°38'W) in south-central North Dakota.

The facility consisted of 20 constructed earthen wetlands arranged in a four by five array covering an upland and wetland area of 2.66 ha. Individual wetland cells were approximately 22 × 22 m (0.05 ha) in flooded surface area, 1.2 m in maximum depth, and contoured to a 1:4 basin slope. Wetland plant communities were well established in the experimental wetlands, and the dominant emergent was cattails (*Typha* spp.), which occurred mainly in dense monospecific stands. These wetlands were functioning much like natural semi-permanent prairie wetlands.

Between late May and early July in both 2009 and 2010, observers visited the experimental wetlands at 1–4 day intervals to locate active redwing nests. Nests were located by flushing females from nests while walking along the adjacent upland berms or wading into the flooded cattails of each wetland cell. Each cell was occupied by one or two territorial male redwings and one to four female redwings. Knowledge of behavioural cues of nesting redwings and the small size of the wetland cells allowed observers to find a large number of redwing nests: 129 total nests (56 in 2009 and 73 in 2010). Redwing nests were built 5–65 cm (average 34.3 cm) above the water in cattails. Water depth beneath redwing nests was 10–94 cm (average 38.2 cm). Cowbird parasitism in redwing nests was moderate (25%) in 2009 and low (< 5%) in 2010; such variation between years is not unusual (Igl and Johnson 2007).

Observers found 26 active Sora nests (14 in 2009 and 12 in 2010; up to three per wetland cell) incidentally while searching for redwing nests. Sora nests were crudely woven platforms constructed of cattail stalks and leaves and attached at the base of live and senescent cattails; the lips of the nest platforms were 3–12 cm (average 6.6 cm) above the standing water (nest cup depth was not measured). Water depth beneath Sora nests was 0–70 cm (average 26.1 cm). Sora nests contained 6–16 Sora eggs (average 8.3 eggs per clutch),

although individual clutch sizes may have been underestimated if incomplete or partly hatched clutches were mistaken for full clutches. Most Sora nests were not systematically monitored after initial discovery.

Two (1.6%) of the 129 redwing nests contained the equivalent of full redwing clutches and a single Sora egg. During the morning of 7 June 2009, a female redwing was flushed from a nest containing five redwing eggs and one Sora egg (Figure 1). The Sora egg was not present six days earlier when this nest was first located with a single redwing egg. No Sora nests were located in this wetland cell in 2009, but Sora nests were found in three adjacent wetland cells that year. The nearest known Sora nest was about 27 m from the parasitized redwing nest and contained 16 Sora eggs, which is a large clutch for this species and may reflect conspecific parasitism by one or more Sora females. The parasitized redwing nest was 61 cm above the water, and the water depth beneath the nest was 94 cm. Cattail density in the vicinity of the nest was sparse. Both redwing eggs and the Sora egg were candled to determine viability and incubation stage and to estimate hatching dates (Weller 1956; Lokemoen and Koford 1996). Embryo development suggested that the redwing eggs and the

Sora egg had been incubated for about three days, indicating that the Sora egg had been deposited before the host's clutch was completed. Using published estimates of incubation stages for the redwing (11–13 days; Yasukawa and Searcy 1995) and Sora (16–20 days; Melvin and Gibbs 2012), the hatching dates were estimated to be 14–16 June and 19–23 June for the redwing eggs and the Sora egg, respectively. These estimates were based on the assumption that the Sora's larger egg (Figure 1) would not interfere with the length of the incubation period for the redwing eggs or their hatchability.

After discovery of the Sora egg in this nest, the redwing nest was visited almost daily until its fate was known. By mid-morning on 15 June, three of the five redwing eggs had hatched. On 16 June, the nest contained four redwing nestlings, a redwing egg, and the Sora egg; candling on that day indicated that the Sora embryo was in an advanced stage of development. On 18 June, the remaining redwing egg was missing, but the Sora egg remained. On 22 June, the nest contained three redwing nestlings and half of a Sora eggshell with a slightly detached membrane, suggesting that the Sora egg had hatched. A dead Sora hatchling and a dead red-



FIGURE 1. Red-winged Blackbird (*Agelaius phoeniceus*) nest parasitized by a Sora (*Porzana carolina*) in June 2009 in south-central North Dakota. Photo: L. D. Igl.

wing nestling were found floating in the water beneath the nest. Neither had visible injuries, and it is uncertain why they were dispelled from the nest. The three remaining redwing nestlings fledged from the nest on 25 or 26 June.

On 19 June 2010, a redwing nest was found with one redwing egg, one Sora egg, and three redwing nestlings that were approximately nine days old. Both eggs were heavily encrusted with bird excrement. The nest was 46 cm above the water, and the water depth beneath it was about 70 cm. Candling revealed no evidence of embryo development in the redwing egg; the Sora egg appeared to be addled (fertile but decomposing). A Sora nest with eight eggs was located in the same wetland cell, about 2.5 m east of the parasitized redwing nest. On 21 June, three newly fledged redwing young were perched near the redwing nest. The redwing egg disappeared from the nest between 26 and 28 June, and the Sora egg disappeared on 29 or 30 June. This nest was about 150 m from the parasitized redwing nest found in 2009; there was no evidence (e.g., egg size, shape, maculation) to suggest that the two Sora eggs found in the redwing nests in 2009 and 2010 were laid by the same female Sora.

Discussion

Reports of precocial species of rails laying eggs in nests of altricial or semi-altricial species are rare, e.g., American Coots (*F. americana*) parasitizing Least Bittern (*Ixobrychus exilis*) nests (Peer 2006); and Common Moorhen (*G. chloropus*) parasitizing Yellow Bittern (*I. sinensis*) nests (Ueda and Narui 2004). Reports of rails laying eggs in passerine nests are even rarer, with only two known cases previously reported in the literature. In South Carolina, Post and Seals (1989) found a Common Moorhen egg in a Boat-tailed Grackle (*Quiscalus major*) nest containing three host eggs. Gollop (1949) found a redwing nest with three host eggs and a Sora egg in southern Quebec. Given the numerous studies of redwing nesting biology in North America and the scarcity of similar parasitism records in the literature, Sora parasitism of redwing nests is undoubtedly rare.

Although Soras and redwings occupy the same marsh habitats during the breeding season, the two species have strikingly different nesting biologies and life history strategies, with little or no overlap in clutch size, nest type and location, nest dimensions and height, egg colour and size, onset and length of incubation, parental care, and discrimination of foreign eggs (Walkinshaw 1940, 1957; Yasukawa and Searcy 1995; Melvin and Gibbs 2012). The differences between the two species highlight the unusualness of these cases of heterospecific parasitism. Sora is a monogamous, solitary-nesting rail, and the redwing is a polygynous, colonial-nesting passerine. Redwings build open, cup-shaped nests 20–80 cm above the water surface in wetland emergent vegetation, and Soras build loosely woven nest plat-

forms over shallow water. Soras typically lay 8–11 buff-coloured eggs (average length 32.0 mm, average breadth 22.8 mm) that are irregularly spotted with brown or russet (Figure 1). Redwings lay four or five pale blue-green to grey eggs (average length 24.7 cm, average breadth 17.8 cm) that are irregularly (sometimes heavily) marked with black or brown streaks, blotches, or spots (Figure 1). Sora eggs are incubated by both sexes for 16–20 days; incubation begins any time from the laying of the first egg to the ninth egg but at least three days before the last egg is laid, and hatching occurs asynchronously. Redwing eggs are incubated by the female only, usually beginning after the penultimate egg is laid, and eggs hatch asynchronously within 11–13 days after the onset of incubation. Newly hatched Sora chicks are precocial but semi-nidifugous, i.e., chicks may leave the nest within 24 h of hatching but generally do not leave the nest until 3–4 days after hatching unless disturbed. Redwing nestlings are altricial: chicks depart the nest 10–12 days after hatching.

Despite these differences, an observation of a female redwing accepting a Sora egg is not surprising. Although differences in egg appearance (i.e., shape, size, maculation, ultraviolet reflectance, brightness, colour) are used by many avian species to identify and remove heterospecific eggs from their nests (Rothstein 1974; Jackson 1998; Croston and Hauber 2014), previous experiments have shown that redwings invariably accept foreign and artificial eggs (Rothstein 1975; Røskaft *et al.* 1990), although they are capable of removing them (Ortega and Cruz 1988). In the northern Great Plains, redwing nests are moderately to heavily parasitized by Brown-headed Cowbirds, and the species is considered a preferred cowbird host in this region (Igl and Johnson 2007).

It is much easier to understand how a female redwing would accept a Sora egg in its nest than to explain why a female Sora would lay its egg in an elevated and dissimilar nest of a seemingly unsuitable non-rallid host. Several hypotheses have been proposed to explain parasitic egg-laying by conspecific parasites (Lyon 1993) and may be important to understanding these rare cases of heterospecific parasitism in the Sora. These hypotheses include: (1) floater females without nests or territories of their own may depend entirely on nesting females to raise their offspring; (2) nesting females who lose their nests during laying and have eggs ready to lay but no nest to lay them in may be forced to lay their eggs in nests of other females; (3) nesting females may delay their own nest initiation because of some constraint (e.g., condition of their mate or territory) and lay parasitically until conditions improve; or (4) nesting females can increase their immediate or lifetime reproduction and spread the risk of predation by laying surplus eggs in the nests of other females (Lyon 1993). These hypotheses overlap with the motivations proposed by Wiens (1971) to explain egg dumping, i.e., incidental laying of eggs in other species' nests. These

hypotheses also reflect Sealy's (2015) interpretation of egg laying in nests of inappropriate, non-passerine hosts by Brown-headed Cowbirds.

Each of these hypotheses predicts a different pattern to the distribution and timing of parasitic or inappropriate egg laying. For Soras at this study site, observers did not record information on abundance, the presence of floater females, nest fate, constraints, or lifetime reproduction, and, thus, we lack a full understanding of these key hypotheses. However, high densities of Soras in these experimental ponds and competition for nest sites may have contributed to these rare cases of parasitism. The experimental ponds supported one of the highest nest densities of Soras reported in the literature: 14 and 12 nests/ha of wetland surface area in 2009 and 2010, respectively. Local density estimates for Sora pairs elsewhere range from 0.1 pairs/ha in central North Dakota (Kantrud and Stewart 1984) to 2.5 pairs/ha in northwest Iowa (Griese *et al.* 1980). In some waterfowl and colonial waterbird species, the probability of being parasitized by a conspecific increases with nest density (Rohwer and Freeman 1989; Petrie and Møller 1991; Fournier 2000). Competition for or limited availability of nest sites has been implicated in some parasitic laying by waterfowl (Saylor 1992).

Finally, although it is unlikely that redwings would provide the type of parental care needed to raise precocial Sora young successfully, these observations represent the first report of successful hatching of a Sora egg found in a redwing nest. In one of the parasitized redwing nests in this study, the Sora egg hatched six or seven days after the redwing eggs hatched. This is within the known incubation period for Sora (Melvin and Gibbs 2012). Previous experiments have shown that redwings are capable of prolonged incubation up to 13–14 days beyond their typical incubation period (Holcomb 1970, 1974). Other studies have reported icterid species hatching non-passerine eggs several days after the host eggs hatched. In Post and Seals' (1989) report of a Common Moorhen egg in a Boat-tailed Grackle nest, the moorhen egg hatched 10 days after the last grackle egg, and the moorhen chick jumped from the nest and swam away. Yasukawa (2010) reported a case of a female redwing hatching and feeding a Yellow-billed Cuckoo (*Coccyzus americanus*) chick, despite a 3- to 4-day delay in hatching of the cuckoo egg compared with the host eggs. Craik (2010) argued that, although mixed clutches of altricial and precocial eggs might seem incompatible, it is imprudent to assume that all unsuitable combinations are doomed to fail. Had the Sora chick survived in the above nest, it could have parasitized parental care from neighbouring conspecifics or its own biological parents (*sensu* Davies 2000). Conspecific parasitism is not particularly well studied in Sora, and the observations of heterospecific parasitism reported here raise additional questions and highlight the need for more studies regarding the factors influencing brood parasitism in this species.

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