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THE RUFOUS-COLLARED SPARROW AS A HOST OF THE SHINY COWBIRD

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The Rufous-collared Sparrow or Chingolo (*Zonotrichia capensis*) is one of the main hosts of the Shiny Cowbird (*Molothrus bonariensis*) through most of their overlapping range in South America. The most recent study on the interaction between these species was carried out by King (1973) in Horco Molle, province of Tucumán, northwestern Argentina.

In 1970 I began to collect data on all the nests of Rufous-collared Sparrows which I found in my study area near Lobos, province of Buenos Aires, Argentina. Rufous-collared Sparrows are quite abundant here and I have found 45 nests.

The data reported here relating to the interaction between host and brood parasite differ from data collected from Tucuman by King (1973), and also from the data collected near Rio de Janeiro, Brazil, by Sick and Ottow (1958; original not seen: their observations are extensively quoted in the paper of King). My data are also relevant to other studies on the brood parasitism of the Shiny Cowbird which I am carrying out in the same study area. One of these studies, begun in 1972, is centered on the reproductive interactions of the Shiny Cowbird and the Chalk-browed Mockingbird (*Mimus saturninus*). I think that only comparative studies will throw light on some aspects of the breeding biology of the Shiny Cowbird, such as the significance of the polymorphism in egg shell color.

Since 1969 I have also been studying the breeding of the Bay-winged Cowbird or Bay-wing (*Molothrus badius*) and its brood parasite the Screaming Cowbird (*Molothrus rufoaxillaris*). I have already published a short preliminary account on both species (Fraga 1972). Since I began this study I have found an increasing number of nests of Bay-wings parasitized by both the Screaming and the Shiny cowbirds. This situation seems to have been overlooked and was only briefly commented on by Friedmann (1929:119), although among other things it is an additional complication to the problem of the proper identification of the eggs found in the nests of Bay-wings.

STUDY AREA AND METHODS

All the nests of sparrows were studied in the main woodland of Estancia La Candelaria, Lobos, Province of Buenos Aires, Argentina (about 35° 15′ S) and in 2 smaller adjacent wooded areas. Between 1970–1972 I found most nests in a small woodland of about 0.8 ha, fenced off from the surrounding pasture with barbed wire (the fenced area is about 1

ha). The most abundant trees are the North American locusts *Robinia pseudoacacia* and *Gleditsia triacanthos*, and the native tala (*Celtis spinosa*). As this area is protected from grazing cattle and horses, young trees and saplings are quite numerous. From September to early January there is a rich cover of tall grasses, chiefly *Bromus unioloides*. From 1972 onwards most nests were found in the main woodland of La Candelaria, a more complex area which covers about 80 ha. Basically this area includes a central zone of gardens, orchards, and lawns surrounded by a belt of untended dense woodland where several species of trees, shrubs, palms, and vines have become naturalized. In these years I have also studied some nests in a hedgerow of native trees and shrubs (*Celtis spinosa*, *Parkinsonia aculeata*, and *Sambucus australis*) bordering a drainage ditch.

All nests were found along routes or in places which I visited frequently, often daily, for the study of other birds. The sample of 45 nests could be divided into 2 subsamples. The first comprises 40 nests which were found only with eggs of sparrows or cowbirds or of both species. In this subsample only 7 nests were found in or before the egg-laying period of the sparrows, as new sparrow eggs were laid after my first visit. The remaining 33 nests were found during the incubation period of the sparrows. The second subsample comprises 5 nests which were found with at least one nestling sparrow or cowbird. The inclusion of this subsample in the computations of nesting success would overstate success. My experience with both species suggests that non-parasitized nests have a higher chance of reaching the nestling or fledgling stage than parasitized ones. For this reason this subsample will be excluded from computations on the incidence of parasitism.

Once found, all the nests of sparrows were visited either daily or at 2-day intervals. All the eggs and the younger nestlings were marked; older nestlings were banded with colored celluloid bands. Day 0 designates the day in which the nestlings hatched, and day 1 is the following day. Nestlings were usually weighed around noon.

THE LOCAL HOSTS OF THE SHINY COWBIRD

Broadly speaking we have good general information on the species of passerines parasitized by Shiny Cowbirds in this part of Argentina (Friedmann 1929, 1963) though more intensive studies are needed. In 8 years of bird study in La Candelaria I have found eggs of Shiny Cowbirds in the nests of 12 species of passerines. About 33 species of passerines breed regularly here, but my coverage for some species breeding exclusively in open country or in marshes is not good. Most of my nesting records (more than 350 up to 1975) are of the 24 species of passerines that breed in wooded areas. In this group I have found eggs of Shiny Cowbirds in the nests of the following 8 species: Cattle Tyrant (*Machetornis rixosus*), Fork-tailed Flycatcher (*Muscivora tyrannus*), Tropical Kingbird (*Tyrannus melancholicus*), House Wren (*Troglodytes aedon*), Chalk-browed Mockingbird, Rufous-bellied Thrush (*Turdus rufiventris*), Bay-winged Cowbird, and Rufous-collared Sparrows. More than 50% of the nests of the Fork-tailed Flycatchers, mockingbirds, and sparrows were parasitized. I paid particular attention to the local species recorded as effective hosts (rearing fledgling cowbirds) by Friedmann (1963:197), such as the Rufous Hornero (*Furnarius rufus*) and

the Masked Gnatcatcher (*Polioptila dumicola*); for these species I have no local records of parasitism.

Although this list could eventually be enlarged, the important point is that it is unlikely that any of the remaining 16 species could be an important effective host of the Shiny Cowbird. This is also shown by the following list of 6 species of woodland birds that have been recorded rearing fledglings of Shiny Cowbirds in La Candelaria between 1970–1975: Cattle Tyrant (1 record), Fork-tailed Flycatcher (no less than 14 records), Tropical Kingbird (2 records), House Wren (4 records), Chalk-browed Mockingbird (6 records), and Rufous-collared Sparrows (12 records excluding those reported here). The lack of records for the Rufous-bellied Thrush may simply reflect the fact that it is a scarce bird in my study area; the peculiar situation of the Bay-wing needs another explanation.

BREEDING BIOLOGY OF RUFOUS-COLLARED SPARROWS

Rufous-collared sparrows are resident throughout the year in La Candelaria. Some males may show sporadic outbursts of territorial behavior (including singing) in early August in periods of fair weather, but I have not detected nesting activities at such early dates. Sustained territorial behavior can be observed from late August to early February.

My earliest record of a nest-building female is 16 September (1975) in the main woodland. Table 1 shows the number of nests of sparrows by periods of half months. The start of egg-laying was known or could be calculated in 22 nests. The remaining 23 nests are placed in the table in the period in which they were found. In my sample the earliest date for egg-laying was 22 September 1975 (calculated). The latest nest (with eggs) was found on 11 February 1971.

In La Candelaria all the nests of sparrows which I found were built on or near the ground. The highest nest was built 12 cm above ground level in a tangle of the vine *Doxantha unguis-cati* growing over a casuarina tree. Most nests were built in dense cover and near the bases of trees, fallen branches, or protruding roots. Otherwise there was considerable variation in the location and degree of exposure of the nest. In places with a sparse ground cover, such as dense woodland, nests were often found under piles of fallen branches. Some peculiar locations include 2 nests built inside low, open hollow stubs (both parasitized), another built in a cavity at the base of a tree, 2 nests built in deep niches in the slopes of a drainage ditch (1 parasitized), and one nest found under the concave side of the basal sheath of a fallen palm frond (parasitized). Some nests were completely covered from above.

As most local passerines, Rufous-collared Sparrows lay either 3 or 4 eggs. The mean clutch size of 11 non-parasitized nests was 3.18 eggs; there

TABLE 1

TEMPORAL DISTRIBUTION OF NESTS OF RUFOUS-COLLARED SPARROWS, BY PERIODS OF HALF-MONTHS*

Period	Parasitized nests	Non-parasitized nests	Total
15–30 September	1	1	2
1–15 October	3	–	3
16–31 October	4	2	6
1–15 November	5	3	8
16–30 November	8	4	12
1–15 December	3	1	4
16–31 December	1	–	1
1–15 January	5	–	5
16–31 January	1	1	2
1–15 February	–	2	2
TOTAL	31	14	45

* Five nests found in the nestling period are included in the table.

were 9 nests with 3 and 2 nests with 4 eggs. Of the 3 non-parasitized nests found in the nestling stage, 2 contained 3 nestlings and the other 4 nestlings. A comparison with the data assembled by King (1973: Table 1) shows the expected gradual increase in clutch size with latitude (2.69 eggs in Tucuman and 2.31 eggs in Rio de Janeiro).

Measurements of 32 eggs of Rufous-collared Sparrows were as follows: range 16.4–21.8 × 13.5–15.9 mm; mean and standard error: 19.28 ± 0.23 × 14.76 ± 0.09 mm.

The incubation period could only be determined in one nest with 3 eggs, and was 13 days. In this nest the first 2 eggs hatched on day 12, but the spread of hatching was less than 24 h.

Nestlings were fed insects by both parents. By day 2 the nestlings may partially open their eyes when begging food; this becomes more noticeable at day 3. By day 6 pinfeathers begin to emerge. The nestling period of Rufous-collared Sparrows was 9–11 days (7 nestlings). At day 8 nestlings may attempt to leave the nest.

Three banded fledglings remained in the parental territory for at least 19 days. They were fed at first by both parents, later probably chiefly by the male. At this time (15 December 1974) the female was apparently attending a second nest which I was unable to locate.

These observations suggest that Rufous-collared Sparrows may attempt 2 or even 3 broods in a season, but with their low nesting success probably few pairs will succeed in raising more than one brood.

THE BREEDING SEASON AND NEST-SEARCHING BEHAVIOR OF SHINY COWBIRDS

In La Candelaria, Shiny Cowbirds can be seen in variable numbers throughout the year. As I have but a few banded individuals, I know little about their local movements. Outside the breeding season they come to the main woodland only for roosting. The largest flocks can be seen in winter.

In my sample of parasitized sparrow nests the earliest date for eggs of Shiny Cowbirds was 26 September 1975. This is the earliest date I have for cowbird eggs in the nests of any host. The latest parasitized nest of sparrows was found on 27 January 1972; I have 2 unquestionable later records of parasitism by Shiny Cowbirds in 2 nests of Bay-wings: 2 immaculate white eggs were laid on 5 and 7 February 1975. The overlap in the breeding seasons of Rufous-collared Sparrows and Shiny Cowbirds was 87% in my sample but this figure is probably a minimal estimate of the actual overlap.

I have 14 records of female Shiny Cowbirds watching the movements of Sparrows. Twice I had already found a nest of sparrows in the area; one of these nests was parasitized the following day. The female cowbirds were watching the movements of the sparrows from some convenient perch. At times they uttered chattering notes, particularly when they flew away. On 11 October 1970 while I was watching a nest-building female sparrow, I observed a female cowbird that remained no less than 17 min doing the same from a nearby branch. Then she alighted near the nest but soon flew away while the female sparrow was chipping. This nest was never finished. Twice 2 female cowbirds were seen searching in the same area at the same time.

Only twice did I observe male Shiny Cowbirds that followed nest-searching females as they moved away. This does not necessarily mean that they were helping the females in any way. In my opinion most records in the earlier literature, particularly in Hudson (1920 I:75) of male Shiny Cowbirds visiting nests of other birds with females in this part of Argentina were probably caused by confusion with male Screaming Cowbirds. As I will show in my account on the species, pairs of Screaming Cowbirds not only visit nests of their hosts, the Bay-wings, but also nests of other birds. I have no records of Screaming Cowbirds visiting nests of Rufous-collared Sparrows.

INCIDENCE OF PARASITISM

In my sample of 40 nests found either during the egg-laying or the incubation period of the sparrows, 29 (72.5%) nests were parasitized. In the additional sample of 5 nests found in the nestling period, 2 nests were parasitized.

A seemingly significant difference between my observations and those re-

ported by King (1973) from Horco Molle can be observed in the temporal distribution of non-parasitized nests. At Horco Molle both host and parasite have slightly longer breeding seasons with an overlap of 87%. Although the overall incidence of parasitism was perhaps lower than in my study area (66% vs 72.5% in the sample of 40 nests, or vs 69% in the sample of 45 nests but difference not significant), at the peak of the breeding season of the sparrows all their nests (100%) were parasitized. As can be seen in Table 1, in my study area non-parasitized nests were more evenly distributed throughout the breeding season of the sparrows and even at the peak of their breeding season (period 15 October–15 January) only 27 out of 35 nests (77.1%) were parasitized.

SEQUENCE OF EVENTS IN FIVE PARASITIZED NESTS

Of the 7 nests found in or before the egg-laying period, 5 nests were parasitized in the following way:

Nest 11: 27 October 1972, found with sparrow egg; 28 October 1972, this sparrow egg was removed, now one sparrow egg plus 2 cowbird eggs (1 immaculate, 1 spotted); 29 October, now 2 sparrow eggs plus 4 cowbird eggs (2 immaculate, 2 spotted); 30 October, 2 sparrow eggs (number 3 punctured) plus 5 cowbird eggs (3 immaculate, 2 spotted) but nest abandoned, all the eggs were cold. The nest retained all its contents till 2 November, when I collected all the eggs. The nest was apparently parasitized by at least 2 female cowbirds.

Nest 15: 1 October 1973, found with 2 sparrow eggs; 2 October, 3 sparrow eggs; 3 October, 3 sparrow eggs plus 1 immaculate cowbird egg; 5 October, 1 sparrow egg apparently punctured, otherwise no changes; 6, 8, 10 October, no changes; 12 October, all eggs vanished.

Nest 27: 24 September 1975, 1 sparrow egg; 26 September, 2 sparrow eggs plus 1 immaculate cowbird egg stained with yolk; 28 September, all eggs gone.

Nest 34: (the highest nest I found in the creeper *Doxantha*) 11 November 1975, 2 sparrow eggs; 12 November, 3 sparrow eggs; 14 November, no changes; 16 November, 3 sparrow eggs plus 1 spotted cowbird egg; 24–25 November, all sparrow eggs hatched; 28 November, cowbird egg hatched but nestling died.

Nest 36: Found on 23 November 1975 without eggs; 24 November, no eggs; 25 November, 1 immaculate cowbird egg; 26 November, 1 sparrow egg plus the cowbird egg; 27 November, 2 sparrow eggs plus the cowbird egg; 28 November, 1 sparrow egg (number 3, as both 1 and 2 removed) plus 2 cowbird eggs (1 immaculate, 1 spotted); 29 November, 1 sparrow egg (the same) plus 3 cowbird eggs (1 immaculate, 2 spotted) but nest

deserted. This nest retained all its contents till 3 December, then only the cowbird eggs till at least 18 December. The nest was probably parasitized by 2 female cowbirds.

The time of laying of the 11 cowbird eggs was as follows: 1 egg apparently laid before the egg-laying of the sparrows; 7 eggs laid during the egg-laying period; 2 eggs laid on the first day of the incubation period, and 1 egg laid on the fourth day of the incubation period. Sparrow eggs were removed either on the day when a cowbird egg was laid or on the previous or following day.

CONTENTS OF PARASITIZED NESTS

The 29 parasitized nests contained 59 cowbird eggs (average 2.03 eggs per nest) and 71 sparrow eggs which were eventually reduced to 62 (average 2.14 eggs per nest). The average number of cowbird eggs per parasitized nest in my sample was similar to the average of 2.06 cowbird eggs reported by King (1973: Table 1) from Tucuman.

As the mean clutch size in non-parasitized nests of sparrows was 3.18 eggs, this means that cowbirds removed an average of 1.04 sparrow eggs per parasitized nest, apparently a higher number than at Horco Molle or Rio de Janeiro (King, 1973: Table 1). I estimate that 30 eggs of sparrows were removed by cowbirds in my sample. I actually observed the disappearance of 9 sparrow eggs from 7 nests. In addition no fewer than 6 sparrow eggs were punctured but not removed.

I have no definitive records of cowbird eggs removed either by cowbirds or by sparrows. However I have observed 2 punctured cowbird eggs in 2 nests with 4 cowbird eggs each; both nests were abandoned on my next visit.

In my sample 15 parasitized nests (51.7%) contained 1 cowbird egg and 2–4 sparrow eggs (average 2.73 eggs); 4 nests (13.8%) contained 2 cowbird eggs and 2–3 sparrow eggs (average 2.75 eggs); 6 nests (20.7%) contained 3 cowbird eggs and 0–1 sparrow eggs (average 0.66 eggs); 2 nests (6.9%) contained 4 cowbird eggs and 2 sparrow eggs, and 2 nests (6.9%) contained 5 cowbird eggs and 0–2 sparrow eggs (average 1 egg). Thus the highest compound clutch was 7 eggs.

Cowbird eggs.—In my study area the eggs of Shiny Cowbirds are either immaculate or spotted (Fig. 1); this is normal in eastern Argentina, Uruguay, and southeastern Brazil (Friedmann 1929). Most immaculate eggs are white; the ground color of the spotted eggs as well as the number, size, distribution, and color of the spots shows a considerable and probably continuous variation. Intermediates to these basic types rarely occur. A few immaculate eggs may have some extremely faded pale gray spots resembling water marks on a white paper. These eggs were considered immaculate. In

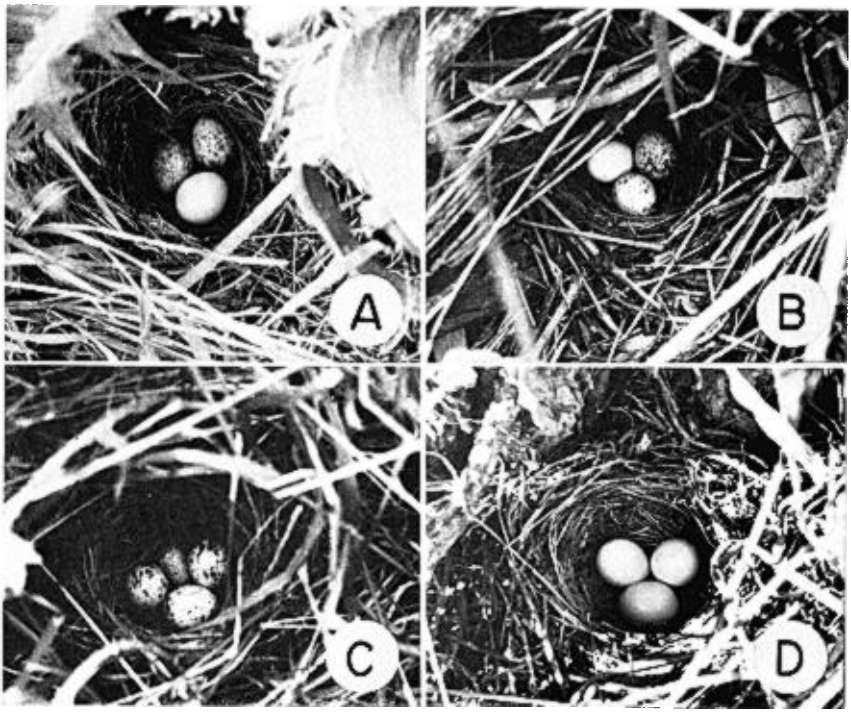

FIG. 1. Parasitized nests of sparrows. A: 2 sparrow eggs, 1 immaculate cowbird egg. B: 2 spotted and 1 immaculate cowbird eggs. C: 1 sparrow egg and 3 rather similar spotted cowbird eggs. D: 3 immaculate cowbird eggs; later 2 spotted cowbird eggs were also laid in this nest.

the nests of Rufous-collared Sparrows, only 1 cowbird egg was considered to be intermediate, having a white ground color with 7 small deep brown spots. In my experience immaculate and spotted eggs are better regarded as discontinuous or quasi-discontinuous forms. This basic variation seems to be a true genetic polymorphism (Ford 1965). The possible selective forces that maintain this polymorphism are unknown. Immaculate eggs are strikingly different from the eggs of the local hosts of the Shiny Cowbird. Hudson (1920 I:124–126) suggested that some host species may selectively reject or eject the immaculate eggs. At least 3 species among the recorded local hosts may eject cowbird eggs and at the present time I am investigating this point in the Chalk-browed Mockingbird. The Rufous-collared Sparrow is a poor subject for such studies, as it accepts eggs of both types.

Of the 59 eggs of Shiny Cowbirds found in nests of sparrows, 32 (54%) were immaculate, 26 (44%) were spotted, and 1 was intermediate. The

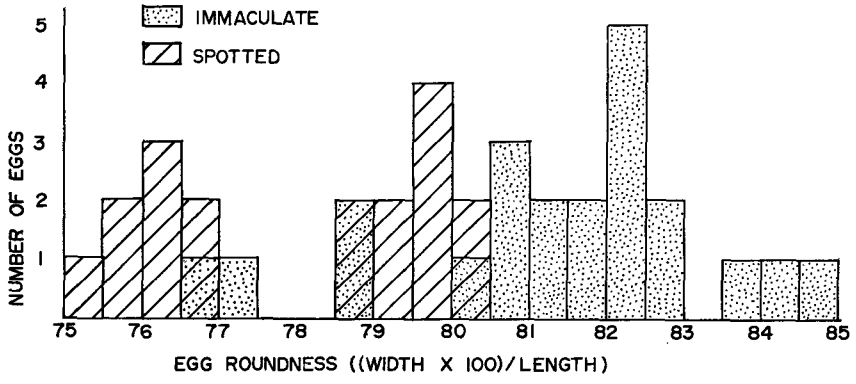

FIG. 2. Roundness (width × 100/length) of immaculate and spotted Shiny Cowbird eggs.

distribution of immaculate and spotted cowbird eggs in the parasitized nests was as follows: 10 nests received only immaculate cowbird eggs (7 with 1 egg, 3 with 2 eggs); 8 nests received only spotted cowbird eggs (7 with 1 egg, 1 with 3 eggs), and 10 nests were parasitized with both egg types in various combinations. One nest was parasitized with 1 intermediate egg. In the whole sample, 21 nests received immaculate eggs and 18 nests received spotted eggs. Available evidence suggests random placement of both egg types.

I measured 41 cowbird eggs (22 immaculate, 18 spotted and 1 intermediate). Average measurements (mean and standard error) are 22.75 ± 0.22 × 18.16 ± 0.18 mm for all the sample. Measurements of immaculate eggs are as follows: range: 20.7–24.3 × 16.8–19.8 mm; mean and standard error 22.56 ± 0.20 × 18.35 ± 0.19 mm. Measurements of spotted eggs are: range: 20.7–24.7 × 16.6–18.9 mm; mean and standard error: 22.91 ± 0.25 × 17.91 ± 0.17 mm. The intermediate egg measured 23.9 × 18.3 mm. As can be observed immaculate eggs are usually more rounded. The index for roundness (width × 100/length) ranges from 76.82 to 84.75 for immaculate eggs and 75.30 to 80.53 for spotted eggs. These values are plotted in Figure 2. The difference in roundness between the immaculate and the spotted eggs found in nests of sparrows is significant ($P < 0.001$, Mann-Whitney U-test and Kolmogorov-Smirnov test).

On the whole spotted eggs of Shiny Cowbirds do not closely resemble those of their hosts. However the spotted eggs are so variable that I have found a few exceptions in the nests of 4 host species. The smallest spotted cowbird egg

in my sample resembled the eggs of sparrows not only in size (20.7 × 16.6 mm) but also in color and pattern.

Incubation period.—In 2 parasitized nests of sparrows, 2 eggs of Shiny Cowbirds hatched in 12 days. Six eggs in nests of other hosts hatched in 11½ (1 egg) and 12 days. Four fresh eggs of cowbirds (2 from deserted nests of sparrows) placed in nests of Eared Doves (*Zenaida auriculata*) hatched in 12 days.

DESERTION OF PARASITIZED NESTS

I did not observe Rufous-collared Sparrows to remove cowbird eggs of any type nor to practice egg-burial, but they may desert parasitized nests. The only possible case of desertion of a non-parasitized nest was attributed to predation. One sparrow egg was gone on the day of the desertion; the following day the destroyed nest cup was empty. I agree with Rothstein (1975) that nest desertion is not necessarily a direct specific response to cowbird eggs. The parasitized nests were perhaps deserted because the female cowbird was discovered by the sparrows, or because of the abnormal size of the clutch, or because some punctured eggs became glued to the nest lining.

As nests of Rufous-collared Sparrows suffer a high rate of predation, it is convenient to have a restricted definition of desertion. In this study I considered that 7 out of 29 parasitized nests were deserted due to cowbirds because: (a) eggs of host and parasite, or of both species, remained in the deserted nest, (b) the remaining eggs were not warmed and no sparrow was seen in or near the nest, (c) the nests retained their final contents for at least 1 day after their abandonment, or (d) I have evidence that cowbirds visited these nests either on the day of their desertion or (in 1 instance) on the previous day because new cowbird eggs were found or sparrow eggs were removed or punctured. The 7 deserted nests contained 20 cowbird eggs (11 immaculate, 9 spotted; average 2.85 eggs) and 13 sparrow eggs (average 1.85 eggs) and included the 2 nests with 4 cowbird eggs and one nest with 5 cowbird eggs.

INTERACTIONS IN THE NESTLING PERIOD

Due to the low nesting success only a limited number of eggs produced fledglings. In this section data from the additional 5 nests found in the nestling period are also included.

Cowbird nestlings.—Nestling Shiny Cowbirds from the nests of 6 host species showed variation in the color of the oral flanges and mouth lining, and in fewer cases in the color of the skin. The color of the flanges varied from pure white to yellow. The color of the mouth lining varied from pale

pink to deep red or orange-red. In at least 3 nestlings (1 from a nest of sparrows) the hue of the skin was yellowish.

These seemingly continuous variations were not obviously correlated with egg shell color. I have not detected correlation between the colors of the flanges and mouth lining. The fledgling cowbirds which were successfully reared by sparrows could be better described by comparison with the nestling sparrows, which have pale yellow flanges and red mouths. In 2 fledglings the flanges were white; 1 had a pale red mouth. The other fledglings had flanges which were at least as yellow as those of the sparrows; their mouth linings were red. The colors of the mouthparts were apparently irrelevant to the parental behavior of the sparrows. My largest sample of nestling Shiny Cowbirds comes from parasitized nests of mockingbirds, in which they often die of starvation; despite this, I have no conclusive evidence relating mouth color to survival value.

By day 3 cowbird nestlings have partially open eyes; by day 7–8 pinfeathers begin to emerge. Nestling cowbirds are less precocial in their behavior than nestling sparrows of the same age and do not attempt to leave the nest until day 11 or 12. The recorded nestling period of Shiny Cowbirds in nests of sparrows was 12–13 days but probably not all the nestlings departed spontaneously. In the safer nests of other hosts, the recorded nestling period was 13–15 days. Nestling Shiny Cowbirds seem to be less well adapted to the hazards of ground nesting than are nestling sparrows.

Table 2 gives the weights of nestling cowbirds and sparrows. King (1973) observed that the weight of a nestling cowbird is approximately equivalent to the weight of 2 nestling sparrows of the same age. In my study area I observed a similar situation. I found a pair of sparrows that fledged 4 young sparrows (in a nest found with nestlings), thus one might expect that 2 cowbirds could also be fledged at times. However in 3 nests in which more than 1 cowbird egg hatched only 1 nestling cowbird survived. Events in these nests were as follows:

Nest 21: found 27 October 1974 with 3 cowbird eggs (2 immaculate, 2 spotted) and 1 sparrow egg; 30 October, the spotted cowbird egg hatched; 31 October, the 2 immaculate cowbird eggs hatched (weights of nestlings—5.4, 3.4, 3.0 g); 1 November (weights 6.9, 4.4, and 3.7 g); 2 November (13, 6.8 and 5.8 g); 3 November, the 2 smaller nestlings were gone (the survivor weighed 18 g); 4 November, the nest was destroyed, the nestling vanished.

Nest 23: found on 8 December 1974 with 3 sparrow eggs and 2 cowbird eggs (1 immaculate, 1 spotted); 18 December, 2 cowbird nestlings (4.0, 3.7 g); 19 December, 2 cowbird nestlings (6.8 and 6.4 g); 20 December, 2 cowbird nestlings (8 and 7.7 g) plus 1 sparrow nestling (1.8 g); 21 December, only 1 cowbird nestling was alive (10.5 g); the other was dead from

TABLE 2

WEIGHTS (G) OF NESTLING SPARROWS AND COWBIRDS*

Day	Sparrows alone	Sparrows with cowbirds	Cowbirds
0	2.3** (1.7–2.6, N = 9)	2.0 (1.9–2.1, N = 4)	3.7 (3–4.4, N = 5)
1	3.4 (3.2–3.8, N = 6)	3.5 (3.2–3.7, N = 5)	6.1 (5.2–7.6, N = 5)
2	5.3 (5.1–5.7, N = 6)	5.1 (5–5.3, N = 4)	9.8 (7.6–10.5, N = 6)
3	7.7 (7.2–8, N = 9)	7.6 (7.4–7.8, N = 4)	12.4 (11–15.5, N = 5)
4	10.1 (9.2–10.5, N = 9)	9.6 (9–10.5, N = 4)	18.8 (14.5–23, N = 5)
5	13 (12.5–13.5, N = 6)	12.2 (12–13, N = 4)	23.0 (20.5–28, N = 5)
6	13.6 (13–14.5, N = 6)	14.5 (14–15, N = 4)	26.2 (23.5–29, N = 4)
7	16.7 (15.5–18, N = 6)	16 (15.5–17, N = 4)	31.2 (27.5–34, N = 4)
8	17 (15.5–18.5, N = 3)	16.4 (16–17, N = 4)	31.8 (28–34.5, N = 4)
9	———	———	32.2 (29.5–35, N = 2)

* Nestlings that died of starvation are excluded.
** Mean with range and sample size in parentheses.

unknown causes. The nestling sparrow was gone. Only 1 cowbird was fledged.

Nest 28 B: found on 12 October 1975 with 2 nestling cowbirds (weights: 12.5, 6 g); 15 October (weights 20 and 13.5 g); 17 October (27 and 16 g); 18 October, only 1 nestling (29.5 g) which was fledged on 22 October.

In 2 parasitized nests, 2 nestling sparrows were raised with 1 nestling cowbird. One nestling sparrow died of starvation in each of these nests. Another fledged cowbird was raised alone (no sparrow egg hatched).

NESTING SUCCESS

Sparrow eggs in non-parasitized nests.—Of the 35 eggs, 26 were taken by predators. Only 9 eggs hatched in 3 nests. Of the 9 nestlings, 3 were taken by predators; 6 were fledged. Only 2 of 11 nests were successful (18.2%), 9 of 35 eggs hatched (25.7%), 6 of 9 nestlings fledged (66.7%), and 6 of 35 eggs produced young which fledged (17.1%).

Sparrow eggs in parasitized nests.—I estimate that 92 eggs were laid in 29 nests; 30 eggs were removed by cowbirds. Another 13 eggs were abandoned in deserted nests, 23 eggs were taken by predators. Only 13 eggs hatched in 5 nests. Of the 13 nestlings 3 died of starvation, 4 were taken by predators, and only 7 were fledged. Only 3 of 29 nests were successful (10.3%), 13 of 92 eggs hatched (14.1%), 7 of 13 nestlings fledged (53.8%), and 7 of 92 eggs produced young which fledged (7.6%).

Sparrow eggs in all nests.—I estimate that only 13 sparrows fledged from 127 eggs laid (10.2%) in 40 nests.

Cowbird eggs.—Of the 59 eggs, 20 were abandoned in deserted nests. Another 27 eggs were taken by predators. Only 10 eggs hatched. Of the 10 nestlings, 3 died of starvation, 1 died from an unknown cause, and 2 were taken by predators. Only 4 cowbirds were fledged. Four of 29 nests were successful (13.8%). Of 59 cowbird eggs laid, only 10 hatched (16.7%), and of these nestlings, only 4 fledged (40%).

The figures for nest success are considerably lower than those reported from Tucuman and Rio de Janeiro (King 1973, Table 1). They are also the lowest figures for nesting success I have observed in local birds, but I have not studied other ground nesters. As most nests of sparrows in my sample were not found before egg-laying, the true nesting success could be even lower. My figures suggest that Shiny Cowbirds probably surpass any nest predator in the amount of harm inflicted to the reproductive efforts of the sparrows.

In my study areas nests built above the ground in trees and shrubs are exposed chiefly to avian predators and to the only abundant climbing mammal, the white-eared opossum (*Didelphis albiventris*). Nests built on or near the ground are probably equally exposed to opossums and to the most abundant avian predators (such as the Chimango, *Milvago chimango*) but in addition they are also exposed to other terrestrial predators, ranging from amphibians (the escuerzo, *Ceratophrys ornata*) to foxes (*Dusicyon gymnocercus*). Some terrestrial predators frequently seen in my study areas were hog-nosed skunks (*Conepatus chinga*) and great tegu lizards (*Tupinambis teguixin*).

The value of the sparrows as hosts of the cowbirds is considerably diminished by their high nesting losses. More extensive comparisons with other host species will be included in future accounts.

SUMMARY

Brood parasitism of Shiny Cowbirds on Rufous-collared Sparrows was studied in 1970–1975 in north Buenos Aires province, Argentina. Summary information on the local hosts of Shiny Cowbirds is reported. The overlap in the breeding seasons of cowbirds and sparrows was at least 87%. Shiny Cowbirds parasitized 72.5% of the nests. Non-parasitized nests were found almost throughout the breeding season of the

sparrows. Observations on the nest-searching behavior of female cowbirds are included. The sequence of egg-laying in 5 parasitized nests is described.

Parasitized nests contained an average of 2.03 cowbird eggs and 2.14 sparrow eggs. Cowbirds removed about 1 sparrow egg per parasitized nest. More than 50% of the nests were parasitized with 1 cowbird egg. Up to 5 cowbird eggs were found in parasitized nests. Cowbird eggs in nests of sparrows were immaculate (about 55%) or spotted (about 45%). Immaculate eggs are more rounded. Rufous-collared Sparrows deserted some parasitized nests.

The sparrows have a low nesting success probably because they are ground nesters. Few nests produced fledglings. Data on weights of nestlings suggest that sparrows cannot rear more than 4 nestling sparrows or 2 nestling cowbirds, but the latter situation was not observed.

SUMARIO

El parasitismo de cría de *Molothrus bonariensis* sobre *Zonotrichia capensis* fué estudiado durante 1970–1975 en una zona de estudio en Buenos Aires, Argentina. La superposición de períodos de postura fué de 87% y el porcentaje de nidos parasitados 72.5%. El promedio de huevos hallados en dichos nidos fue 2.03 para el parásito y 2.14 para el huésped. Los huevos del parásito eran inmaculados o manchados, con diferencias en la forma. Pese al bajo éxito reproductivo los datos sugieren que *Zonotrichia* puede criar hasta 4 pichones propios o 2 del parásito, aunque lo último no fué observado.

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