EFFECT OF COWBIRD PARASITISM ON AMERICAN GOLDFINCH NESTING

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ABSTRACT.—In a breeding study of a marked goldfinch population, 22 nests (9.4%) were parasitized by the cowbird. Although 4 cowbird eggs hatched from the 26 laid, no cowbirds fledged from a goldfinch nest. The clutch size of parasitized goldfinches was significantly smaller than those of unparasitized birds, and the mean number of nestlings hatched and fledged was also smaller. By contrast the percentage of goldfinch eggs that hatched and fledged was higher in parasitized nests. Some 55% of the parasitized nests produced fledglings while 36% were lost to predation. Eleven of the parasitized nests belonged to adult female goldfinches, and it is suggested that adult birds are most likely to be affected by cowbird parasitism.

The implications of cowbird parasitism on the goldfinch are discussed. Although the cowbird gained little advantage from the association its parasitism largely offset the advantages of early nesting by the adult goldfinches. The goldfinch has not developed any apparent defense against cowbird parasitism, but those individuals that nested in man-made habitats were largely free from its influence.—*Department of Zoology, University of Guelph, Guelph, Ontario N1G 2W1.* Accepted 13 December 1976. (This paper was subsidized by the author.)

As the breeding seasons of the Brown-headed Cowbird, *Molothrus ater,* and the American Goldfinch, *Carduelis tristis*, barely overlap throughout much of the range of the latter (Friedmann 1963, Scott and Middleton 1968, Mundinger 1972), the goldfinch is not considered to be a major host of the cowbird. However, some early nests of the goldfinch are parasitized (Stokes 1950, Nickell 1951, Sutton 1959, Berger 1968, Holcomb 1969), and in California the goldfinch is apparently a frequent cowbird fosterer (Friedmann 1963). Nevertheless, most of the cowbird eggs laid in goldfinch nests fail to hatch (Berger 1968, Holcomb 1969), and few cowbirds have been successfully raised by goldfinches (Friedmann 1963). Thus the effect of cowbird parasitism on the goldfinch has been largely ignored.

In a study of the breeding biology of a marked population of goldfinches in 3 habitats, 22 nests were found with cowbird eggs. This paper reports the results of this parasitism and discusses its effect on reproduction by the goldfinch.

MATERIALS AND METHODS

During the summers of 1968–1975 I studied goldfinch nesting in natural, nursery, and city habitats in Guelph, Ontario, Canada. Observations began in June and were intensified following the discovery of the first nests in late June—early July. Once located, nests were visited regularly; most were visited daily. Disturbance was kept to a minimum, the female being flushed from the nest only when it was essential to check the nest contents at vital stages of nesting. An attempt was made to trap and color-band as many of the nesting birds as possible.

As clutch size in the goldfinch decreases with the season (Middleton MS) and as cowbird parasitism of goldfinch nests can only occur in the Guelph area in early July (see below) the clutch sizes reported here were recorded only for those nests in which eggs were laid and that were found during building or egg-laying. In parasitized nests clutch size was calculated for goldfinch eggs that were incubated, and cowbird eggs were excluded from the calculations. Nesting success for nests with clutches begun in July was calculated by dividing the number of fledglings leaving the nest by the total number of eggs laid, and from the proportion of successful nests. Means ± 2 SE were used to test confidence at the 95% level, otherwise the tests used are given in the text.

RESULTS

During the study 234 goldfinch nests were found of which 22 (9.4%) contained cowbird eggs. Of the parasitized nests 21 were in the natural habitat (N = 171), one

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TABLE 1

COMPARISON BETWEEN CLUTCH-SIZE AND NESTING SUCCESS OF PARASITIZED VS UNPARASITIZED AND PARASITIZED ADULT GOLDFINCHES

Parameter	Parasitized nests	All parasitized nests	Nests of parasitized adults
Total eggs laid	66	501	178
Total eggs hatched	50	312	128
% eggs hatched	75.8 ± 5.27	62.3 ± 2.17	71.9 ± 3.37
Total young fledged	41	278	123
% eggs fledged	62.1 ± 5.97	55.5 ± 2.00	69.1 ± 3.46
Mean ± SE clutch size	4.4 ± 0.32[1] (N = 18)	5.2 ± 0.08[1] (N = 77)	5.3 ± 0.13 (N = 32)
Mean ± SE eggs hatched/nest	2.8 ± 0.52[2]	3.3 ± 0.26[2]	3.7 ± 0.40
Mean ± SE eggs fledged/nest	2.3 ± 0.50[3]	2.9 ± 0.27[3]	3.4 ± 0.43

[1] $t = 3.829$; $P < 0.01$.
[2] $t = 0.831$; $P > 0.05$.
[3] $t = 1.064$; $P > 0.05$.

in the nursery (N = 29), and none in the city (N = 34). Thus a significantly ($P < 0.05$) greater incidence of parasitism occurred in the natural habitat (12.3 ± 2.51%) than in the man-made habitats (1.6 ± 1.58%). In all, 26 cowbird eggs were laid in the 22 parasitized nests. Four cowbird eggs hatched, but none produced a fledgling. During the 8 years of the study, the mean laying date of the last cowbird egg in a goldfinch nest was 14.1 ± 1.91 July, about 8 days later than the mean laying date for first goldfinch egg, which was 6.5 ± 0.91 July. In each of the 8 years of the study the first nest with eggs was parasitized, and 55% of the clutches started in the July 1–15 period in the natural (N = 33) and nursery (N = 7) habitats contained cowbird eggs.

The goldfinch clutch size in parasitized nests was significantly ($t = 3.829$; $P < 0.01$) smaller than in unparasitized nests (Table 1). Likewise the number of chicks that hatched and fledged was also smaller, but the differences were insignificant ($P > 0.05$). By contrast the percentage of goldfinch eggs that hatched and fledged was higher in parasitized than in unparasitized nests (Table 1).

The fate of all parasitized nests is shown in Table 2. Slightly over half the parasitized nests were successful, but 36% were lost to predation. The remaining nest losses were split equally between abandonment and weather.

Of the parasitized nests 11 were those of adult females (birds in their second or additional breeding season) and 11 were nests of females of unknown age.

DISCUSSION

Because of the short overlap between the breeding seasons of the Brown-headed Cowbird and the American Goldfinch, only those goldfinch nests built early in the season are affected by cowbird parasitism. As most of the early nests are built by adult goldfinches, and as the latter are known to produce the largest clutches and

TABLE 2

FATE OF GOLDFINCH NESTS PARASITIZED BY THE BROWN-HEADED COWBIRD

	Success[1]	Predation of eggs	Predation of nestlings	Abandoned with eggs or young	Failed due to weather
No. of nests	12	5	3	1	1
% of nests	54.6	22.8	13.6	4.5	4.5

[1] No cowbirds fledged from successful nests.

have the highest degree of nesting success (Middleton MS), cowbird parasitism may have a more dramatic influence on goldfinch reproduction than previously anticipated.

Generally cowbird parasitism results in lowered host reproductive output (Rothstein 1975). This was true at Guelph where cowbird parasitism effectively reduced the clutch size of parasitized goldfinches by one egg (Table 1). Additionally, the number of young hatched and fledged per nest was lower than in unparasitized nests and was the lowest calculated for the entire study (Middleton MS). The hatching and fledging success of goldfinch eggs in the parasitized nests was higher than in the unparasitized nests and was similar to that calculated for adult birds (Table 1), suggesting that the nests of adult birds were most often parasitized. Thus although cowbird parasitism initially reduced the reproductive output of the parasitized birds, it apparently had little influence on the subsequent success of the surviving goldfinch eggs. When compared with nesting success in the different habitats, the proportion of successful nests of parasitized goldfinches (Table 2) was higher, though not significantly ($P > 0.05$), than calculated for the natural (44.8%) and nursery (34.4%) habitats. As adult birds are known to have the highest degree of nesting success, these data further support the suggestion that it was mainly the adult birds that were subject to cowbird parasitism.

Only 11 of the 22 parasitized nests were known to have been those of adult females. But as adult females cannot be accurately aged in the field (Middleton 1974), some of the birds trapped for the first time and classed as being of unknown age, were probably adult. In addition four parasitized nests were destroyed before the identity (and thus the age of the female) could be established. Therefore the proportion of parasitized nests belonging to adult females was probably higher than stated.

Use of the goldfinch as a host was a poor strategy from the cowbird's standpoint as only four eggs hatched and no cowbird fledged. Of the four cowbird eggs that hatched three nestlings died in the first day of life and one died in the third day. Meanwhile their goldfinch nestmates fledged successfully. The failure of so many of the cowbird eggs to hatch may have been due to a low fertility coincident with the end of the cowbird's breeding season, while the failure to fledge may be related to the highly granivorous diet of the goldfinch. Nevertheless the current optimum strategy for the cowbird may be to parasitize all nests found, even those of poor hosts (Rothstein 1976).

For the goldfinch, cowbird parasitism had a marked effect upon reproduction as it affected 55% of the birds that nested in the first half of July, most of which were adults. Here it effectively reduced their clutch size by one egg, which led to the lowest reproductive output calculated for the study. Thus the advantages of early nesting with its likelihood of a large clutch size and high degree of success was largely offset by cowbird parasitism.

The incidence of cowbird parasitism calculated at Guelph was higher than given for most other goldfinch studies (Friedmann 1963, Berger 1968, Holcomb 1969, Rothstein 1975), although the nonquantitative data given by Friedmann (1963) imply that the goldfinch is commonly parasitized in parts of New York State and California. The Guelph data suggest that either the incidence of parasitism on the goldfinch is increasing, or that it reflects local variation (Friedmann 1963). With the clearing of the eastern forest, followed by the introduction of agriculture, the cowbird has expanded its range eastward and is now in contact with species that were formerly

free from its parasitism (Friedmann ibid.). In Ontario, therefore, the goldfinch may be experiencing an increase in parasitism, but local variation cannot be ruled out.

Compared with parasitism by the European Cuckoo (*Cuculus canorus*) the host-parasite interactions of the Brown-headed Cowbird are of recent vintage (Rothstein 1975). Thus most north American birds lack host defenses. This is true of the goldfinch, which Rothstein (ibid.) classed as an accepter of cowbird's eggs. In view of the harmful effects of cowbird parasitism on its productivity, the goldfinch may now be facing a new selection pressure that operates against early nesting.

Postponement of nesting by about a week would free most goldfinches from cowbird parasitism, but this in turn would lead to an even shorter breeding season than at present, and would reduce the competitive advantages gained by experienced adult birds.

Finally, as the incidence of parasitism was significantly greater in the natural habitat than in the city and nursery habitats combined, such man-made habitats are still relatively free from cowbird parasitism, a fact also noted by Emlen (1974). Thus by nesting in man-made habitats, particularly the city, goldfinches may have a defense against brood parasitism that would confer an advantage on urban-nesting populations.

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