INCUBATION AT LOW TEMPERATURES BY THE ZEBRA FINCH

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El-Wailly (Condor 68:582, 1966) estimated that Zebra Finches (*Taeniopygia castanotis*) should be able to incubate their eggs successfully at air temperatures as low as 6.8°C when the daily photoperiod was 12 hours (LD 12:12). However, none of the 16 eggs in his four clutches hatched at 14.5°C. The following year I repeated the experiment using the same cages and cold cabinet but with six new pairs of Zebra Finches obtained from a commercial source.

The six pairs were first placed at 22.3°C in LD 12:12, and three of the pairs successfully completed incubation. These three pairs were then placed at 14.1°C. The birds made no attempt at nesting for two months until, in December, the photoperiod was increased to LD 15:9. Nesting began within two weeks and all three pairs successfully hatched eggs (table 1).

Factors that may be involved in the success of my birds include the longer photoperiod, the use of finch seed instead of chick-starter mash, less disturbance of the birds, and of course the use of different birds. Oksche *et al.* (Z. Zellforsch. 58:846, 1963), however, found in their experiments that Zebra Finches did not respond sexually to long photoperiods.

TABLE 1. Record of laying and hatching.

Room temperature	Pair	Clutch size	Number hatched
22.3°C.	A	4	1
	B	4	3
	C	3	2
14.1°C.	A	3	1
	B	7[a]	3
	C	3	2

[a] Laid 3, skipped 2 days, then laid 4 more.

An unusual trait observed only at the lower air temperature was that both the male and the female bird sat on the nest side by side, although only one bird was actually on the eggs. This behavior has been reported for Canada Jays (*Perisoreus canadensis*) where one bird sat on top of the other while incubating during cold weather (Lawrence, Canadian Field Naturalist 61:1, 1947).

Nest temperature was measured with copper-constantan thermocouples and recorded automatically every 24 minutes on a potentiometer. Temperatures were also measured manually by observing the birds from behind a screen and taking temperatures only when the birds were actually sitting on the eggs. The thermocouple wires were inserted through the nest material from both sides so that the warm junction rested on top of the eggs. In the course of a day the incubating birds forced the wires down under the eggs, and once a day it was necessary to move the thermocouples back to the top of the eggs.

TABLE 2. Average temperatures (± SE) recorded automatically.

Room temperature	Temperature above eggs	Temperature below eggs
22.3 ± 0.1°C. (N = 325)	34.9 ± 0.2°C. (N = 101)	30.4 ± 0.2°C. (N = 76)
14.1 ± 0.1°C. (N = 300)	36.3 ± 0.3°C. (N = 56)	28.8 ± 0.2°C. (N = 142)

When the birds were actually incubating, the mean temperature (± SE) on top of the eggs was 37.0 ± 0.25°C. At 22.3°C air temperature the birds left the nest unoccupied for several minutes at a time, which accounts for the lower average temperature above the eggs (table 2). At 14.1°C the birds incubated constantly, even while the cage was being cleaned.

This study was financed in part by a National Science Foundation Grant to Dr. S. Charles Kendeigh.

Accepted for publication 20 April 1967.

PREDATION BY CATBIRDS ON DRAGONFLIES

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As part of an ecological study of a large dragonfly, it was necessary to observe adult emergence at a natural pond (90 by 55 feet) in Tinley Park, Illinois, during July 1966. Beside this pond there was a small, dense growth of *Typha* on a flat stretch of moist mud, constituting the only emergent vegetation. The dragonfly studied almost always utilizes vegetation for emergence, and this process was observed daily from 05:00 to 07:30 for three weeks. Most dragonflies emerge during these hours at temperate latitudes. It is generally accepted by students of dragonfly ecology that, while adult mortality is very small, the most likely time for mortality is at emergence when nymphs and newly emerged adults are exposed to a threat of predation by spiders, frogs, and birds. However, for 10 successive days, I observed that Catbirds (*Dumetella carolinensis*) preyed rather heavily on newly emerged adults clinging to the reeds about one to five inches above the mud. Nymphs and newly emerged adults were seldom found above this height, and the birds (between 9 and 13 each morning) walked between reeds plucking off the insects very rapidly. Nymphs, although plucked off the reeds by *D. carolinensis*, were then quickly rejected, while newly emerged adults were consumed rapidly. On any given day, *D. carolinensis* did not eat all of the newly emerged adults present, and from the numbers of survivors, exuviae, and partially eaten remains (usually wing sheaths), it was possible to obtain an approximation of the mortality resulting from this predation. For the 10-day period, the mean mortality was 68 per cent based on a mean sample size of 74 newly emerged adults. Since most of the dragonflies emerged during the 10-day period as compared with the days preceding and following it, it was evident that predation by *D. carolinensis* reduced the abundance of this insect drastically at the pond. Furthermore, newly emerged adult dragonflies were a important food source of this bird. The noticeable discrimination by *D. carolinensis* between nymphs and newly emerged adults is interesting and warrants further study.

Accepted for publication 16 March 1967.