SEED-SIZE PREFERENCE IN CHICKADEES AND TITMICE IN RELATION TO AMBIENT TEMPERATURE

BECKY A. MYTON AND ROBERT W. FICKEN

COMPETITION for food between two closely related, sympatric species can be assayed in four ways—differences in feeding habits, feeding locations, nature of food, and size of food (Hinde, 1959).

The original object of this study was to test the seed-size preference of two sympatric species, the Carolina Chickadee (*Parus carolinensis*) and the Tufted Titmouse (*P. bicolor*). A direct correlation has often been observed between the size of food taken and the size of the bill of the bird (Lack, 1947; Snow, 1954; Betts, 1955; Morris, 1955); hence, we hypothesized that chickadees would prefer smaller seeds while the larger-billed titmice would prefer larger ones. Further, we predicted that both species would be most efficient at husking and eating the size they preferred. It became apparent soon after observations began that the chickadees took more of the larger seeds on colder days. The objective was therefore expanded to test for correlation between temperature and seed-size preference.

MATERIALS AND METHODS

Feeders were attached four feet up on large trees at four well-separated locations in deciduous woods near College Park, Maryland. The feeders were flat plastic trays measuring 12 × 30 inches with a 1 inch rim. Observations were begun on 17 November 1964, and continued through 22 February 1965.

Two size groups of sunflower seeds, dyed black with India Ink, were placed on one or the other side of each feeder; the large-seed group was 0.12–0.17 g and the small-seed group was 0.03–0.07 g. The two size groups were shifted randomly in order to minimize the effect of position. To test for randomness of choice on each side of the feeder, observations were obtained on mixtures of both sizes.

Data taken included seed size (large or small) chosen, the amount of time spent husking and eating, and ambient temperature.

RESULTS

Control for position effect.—Virtually the same number of seeds of mixed size was chosen from the right side of the feeder (78) as from the left (75) by a flock including several birds of both species, thus indicating no preference for a particular side.

Time spent husking and eating.—The relative efficiency of the two species in dealing with each seed size is presented in Table 1. Chickadees ate the

TABLE 1
MEAN TIMES FOR CHICKADEES AND TITMICE TO HUSK AND EAT LARGE AND SMALL SUNFLOWER SEEDS (IN SECONDS)

Species	Seed size	Husk	Eat	Husk plus Eat
Chickadees	large	14.6	69.0	76.4
Chickadees	small	10.1	29.6	39.7
Titmice	large	5.3	28.5	33.8
Titmice	small	3.3	23.3	26.9

smaller seeds faster than the larger ($P < 0.05$, Student's "t" test) and titmice husked the smaller seeds faster than the larger ($P < 0.05$, Student's "t" test). A comparison of husking, eating, and husking plus eating in both species shows that titmice were significantly faster with both seed types, except in eating the small seeds.

Effect of temperature on size preference.—The observations on size choice were divided into two periods based on temperature (32 F and below, "cold," and above 32 F, "warm").

Chickadees showed a very strong preference for small seeds on warm days and a marked shift in preference toward large seeds on cold days ($P < 0.0001$, Chi Square for contingency). The titmice always preferred large seeds and chose a slightly greater proportion of them on the warm days than on the cold days ($P < 0.05$, Chi Square for contingency) (Table 2).

DISCUSSION

In general, the titmice preferred larger seeds than the chickadees. This supports the original hypothesis; namely, that the larger-billed titmice would prefer larger seeds and the smaller-billed chickadees would prefer smaller seeds. The titmice were more efficient than the chickadees as judged by the time spent husking plus eating both seed sizes, indicating an absolute advantage to a larger bill in utilizing sunflower seeds.

TABLE 2
THE NUMBER OF LARGE AND SMALL SUNFLOWER SEEDS TAKEN BY CHICKADEES AND TITMICE ON WARM AND COLD DAYS

	Chickadees		Titmice	
Temperature	Large	Small	Large	Small
Above 32 F	98	346	301	83
32 F and below	333	352	785	331
Total	431	698	1,086	414

The change in size preference by the chickadees on cold days might be explained by the increased amount of food obtained per unit effort when large seeds were taken. Although there was slightly more than twice as much endoplasm in a large sunflower seed as in a small one, it also took the chickadee approximately twice as long to husk and eat a large seed as a small one (Table 1). However, the chickadee had to make two trips to the feeder to obtain the same amount of food when it chose small seeds, and it would be more efficient for the chickadees to take the large seeds. Because of the stress of cold placed on the chickadees in the cold weather (Brewer, 1963) and the need for greater energy on cold days, it follows that chickadees would benefit by being more efficient on cold days. Thus, it seems that there are two mechanisms in operation. First the chickadee shows a natural preference for smaller seeds; and, second, this preference is modified under conditions of cold stress when efficiency is of overriding importance.

SUMMARY

Field experiments on seed-size choice revealed that Tufted Titmice preferred larger sunflower seeds and Carolina Chickadees preferred smaller sunflower seeds as predicted from their difference in bill size. However, the chickadees showed a marked shift toward large seeds when the temperature was 32 F or below. Two mechanisms seemed to operate in this species: 1) a natural preference for small seeds, and 2) the modification of this preference toward one of increased efficiency under cold stress.

ACKNOWLEDGMENTS

We are grateful to Edward C. Keller for his help with the statistical analyses, and to him and Millicent S. Ficken for their critical reading of the manuscript. This research was supported by the National Science Foundation (GB-891 and GB-3226).

LITERATURE CITED

BETTS, M. M.
1955 The food of titmice in an oak woodland. *J. Animal Ecol.*, 24:282–323.

BREWER, R.
1963 Ecological and reproductive relationships of Black-capped and Carolina Chickadees. *Auk*, 80:9–47.

HINDE, R. A.
1959 Behaviour and speciation in birds and lower vertebrates. *Biol. Rev.*, 34:85–128.

LACK, D.
1947 Darwin's finches. Cambridge Univ. Press, Cambridge.

MORRIS, D.
1955 The seed preferences of certain finches under controlled conditions. *Avicultural Mag.*, 61:271–287.

SNOW, D. W.
1954 The habitats of Eurasian tits (Parus spp.). *Ibis*, 96:565–585.

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF MARYLAND, COLLEGE PARK, MARYLAND (PRESENT ADDRESS (R.W.F.), UNIVERSITY OF WISCONSIN-MILWAUKEE, MILWAUKEE, WISCONSIN), 3 MARCH 1966.