

Spring 1983

The dominance hierarchy of the Black-capped Chickadee and it's relation to breeding territory and frequency of visitation to an artificial food source

Craig Thompson

University of Wisconsin - Milwaukee

Follow this and additional works at: https://dc.uwm.edu/fieldstation_bulletins



Part of the [Forest Biology Commons](#), and the [Zoology Commons](#)

Recommended Citation

Thompson, C. 1983. The dominance hierarchy of the Black-capped Chickadee and it's relation to breeding territory and frequency of visitation to an artificial food source. *Field Station Bulletin* 16(1): 14-20.

This Article is brought to you for free and open access by UWM Digital Commons. It has been accepted for inclusion in *Field Station Bulletins* by an authorized administrator of UWM Digital Commons. For more information, please contact open-access@uwm.edu.

THE DOMINANCE HIERARCHY OF THE BLACK-CAPPED CHICKADEE AND ITS RELATION TO BREEDING TERRITORY AND FREQUENCY OF VISITATION TO AN ARTIFICIAL FOOD SOURCE

ABSTRACT

A peck-dominant type of dominance hierarchy was demonstrated in a group of twenty-one Black-capped Chickadees and was consistent with what is expected of this species of Paridae at the interflock level. No significant correlations were found between dominance and frequency of visitation to the study feeder, between dominance and distance from feeder to 1980 breeding territory, and between distance to territory and frequency of visitation.

INTRODUCTION

Vertebrate societies have evolved into many organizational schemes. The advantages afforded an individual by being a member of a social group include detection of and defense against predators, easier access to potential mates, and more efficient location of food and shelter. The advantages of social living are associated with some costs or disadvantages, including greater intraspecific competition for valuable resources. One means of reducing the costs of societal living is through the development of a dominance hierarchy. Two major types of hierarchies occur in flocking birds. In the first type, the birds are organized into a "peck-right" unilateral despotism as first described by Schjelderup-Ebbe (1922) in studies of the domestic chicken (Gallus gallus). In this system the dominant, or alpha male, is never defeated while the second bird is dominated only by the first bird, the third only by the first two, and so on. The second type of hierarchy is a "peck-dominance" system as described by Masure and Allee (1934) in flocks of pigeons (Columba livia). In the peck-dominance hierarchy the dominant bird wins the highest proportion of encounters, but the outcome of any particular encounter is not completely predictable.

The purpose of this study is to determine the dominance hierarchy of free-ranging Black-capped Chickadees (Parus atricapillus) and test for correlations between dominance status, location of breeding territory, and frequency of feeder visitation.

METHODS

The study was done at the UWM Field Station, near Saukville, Ozaukee County, Wisconsin. All data were collected at one (F9) of six chickadee feeders which have been in use at the Field Station each winter since 1969. The feeder was set up in mid-November and observations were made from mid-January, 1980 through the first week in April. Observations took place one day per week with 4-6 hours of observation at each date. The feeders, which are supplied with sunflower seed and suet,

are designed to allow only one bird to feed at any particular instance. Aggressive interactions between birds frequently occur. A canvas observation blind is situated near the feeder to allow the observer to watch the birds as they come to feed. Each bird is individually recognizable by a combination of one Fish and Wildlife Service numbered aluminum band and two colored plastic bands located on the legs. Sex of the birds was determined by wing chord measurements and behavioral observations during the breeding season (Weise 1979).

Two types of interactions were recorded to determine dominance relationships. The first was designated as a displacement, in which one bird displaced another bird from the feeder. The second was designated as waiting, in which a bird approached the feeder, but waited until the feeding bird had finished and left before attempting entry. At the end of the winter a dominance hierarchy was formulated on the basis of wins and losses at the feeder. The number of visits to the feeder by each bird was also recorded.

During the breeding season (April-July) 1980 C. M. Weise located the territories of all breeding chickadees in the Field Station area, including those involved in this study. Distances from the F9 winter feeder to the territories were measured on a large scale map.

Correlations among observations were tested by the Kendall Rank Correlation Coefficient (Siegel 1956).

RESULTS AND DISCUSSION

Dominance hierarchy. Table 1 indicates the presence of a dominance hierarchy. During the study period 41 individuals were recorded at the feeder, but 20 birds were excluded from the analysis for at least one of the following reasons: (1) the bird had 5 or fewer interactions with other birds, (2) the bird disappeared (presumably due to death) before one-half of the study period was completed, or (3) the bird, during the course of the study, moved to a different feeder and no longer used F9.

After these exclusions 21 individuals were ranked according to dominance, with a total of 641 interactions observed for that group. This type of dominance hierarchy is not the intraflock linear peck-right dominance hierarchy that has been demonstrated in several species of North American Paridae such as the Black-capped Chickadee (Odum 1942, Hartzler 1970, Glase 1973, Smith 1976), the Mountain Chickadee (*P. gambeli*) (Dixon 1965), and the Carolina Chickadee (*P. carolinensis*) (Dixon 1963). Rather, the type of dominance hierarchy demonstrated here is the peck-dominance system. The reason for this type of hierarchy is that this group of birds does not represent a single flock. The F9 feeder was situated in such a way that up to three separate flocks of chickadees could be using the feeder simultaneously. Since the exact composition of each flock was not known, the group as a whole was treated as a composite flock and the dominance hierarchy was arranged accordingly. This, then, is an example of interflock dominance and is consistent

with similar findings by Hartzler (1970) in Black-capped Chickadees and by Dixon (1965) in Mountain Chickadees.

Table 1. Black-capped Chickadees at the F9 Feeder from January-April 1980 arranged according to dominance. An individual's sex, age, dominance, visitation rate and distance from feeder to 1980 territory are presented. Rank order is shown in parentheses.

Bird	Sex	Age (Years)	Total No. of Encounters	Total No. of Wins	Percent Wins	Total No. of Visits	Distance in m. to territory
COAY	M	3	31	26	83(1)	143(7)	170(10)
POAW	M	1	32	25	78(2)	52(17)	--
BOAW	M	3	95	73	77(3)	209(3)	485(8)
CAYO	M	1	51	37	73(4)	220(1)	175(9)
BRAO	M	2	22	15	68(5)	114(11)	--
AOTS	M	1	11	7	64(6)	50(18)	135(11)
TOAT	M	3	52	31	60(7.5)	121(9)	1180(1)
AYTO	?	2	10	6	60(7.5)	115(10)	--
RTAO	M	5	31	16	52(9)	106(12)	900(4)
PAPO	F	2	6	3	50(10)	44(19)	--
PJAO	M	1	13	6	46(11)	152(5.5)	930(2.5)
AOGJ	F	1	10	4	40(12)	66(16)	--
COAB	F	3	13	5	38(13)	67(15)	--
AYRO	F	2	65	23	35(14)	196(4)	--
JOAC	F	1	29	10	34(15)	211(2)	--
GOAS	F	3	45	14	31(16)	84(14)	930(2.5)
JSAO	M	1	10	3	30(17)	33(21)	640(7)
CAGO	F	2	12	3	25(18)	88(13)	750(5.5)
YOYA	F	1	59	14	24(19.5)	38(20)	--
ROAB	M	1	17	4	24(19.5)	124(8)	750(5.5)
BCAO	F	1	27	1	4(21)	152(5.5)	--

Determinants of Dominance. Sex, age, body size, and location of breeding territory are all factors that may influence an individual's rank (Tordoff 1954, Brown 1963, Smith 1976, Balph 1977). The dominance of males over females within groups of flocking birds is a relatively common phenomenon and has been demonstrated in Black-capped Chickadees (Weise 1971, Glase 1973, Smith 1976), Mountain Chickadees (Dixon 1965) and Dark-eyed Juncos (*Junco hyemalis*) (Balph 1977, Ketterson 1979).

Also, the rank of the female may be affected by the rank of her mate as was observed by Glase (1973) and Smith (1976) in Black-capped Chickadees and by P. J. Drent (personal communication to C. M. Weise) in the Great Tit (Parus major). With few exceptions, females previously mated with high ranking males ranked high themselves relative to the other females. However, we did not observe this phenomenon in this study, probably due to the restricted sample size and the inability to identify all the pairings among the birds in the hierarchy.

Age. Age had little affect on dominance status (Table 1). Similar results have been found by Weise (1971) in Black-capped Chickadees and by Tordoff (1954) in captive groups of non-breeding Red Crossbills (Loxia curvirostra).

Body size. Body size was not taken into consideration in this study. Smith (1976) and Glase (1973) found that even though male Black-capped Chickadees on an average weighed more than females, there was no indication that rank within either sex group was related to size.

Territory. A major portion of this study involved testing whether there are interrelationships between dominance, frequency of visitation to the feeder, and distance from feeder to breeding territory. The assumption was made that each chickadee had a home-site to which it became psychologically attached at the end of its juvenile dispersal movement, i.e. in the first summer of its life (Weise and Meyer 1979). During the winter it is assumed that each bird commutes once or several times daily between its home-site and the winter feeder. In the spring each bird will attempt to establish its territory on or near its home-site. Thus, distance to territory is taken to represent a commuting distance. The hypothesis is that birds commuting from longer distances will be subordinate to those whose home-sites are close to the feeder location. Long-distance commuters should also have lower visitation rates, if for no other reason than that they have less time to spend at the feeder.

In this data set there was no correlation between dominance and ranked number of visits (Table 1) ($T = .014$, $P = .468$, $N = 21$). Next the distance to breeding territory was investigated. Ten individuals from Table 1 could not be located in the 1980 breeding season. They either failed to obtain territorial space or their territories were beyond the limits of the Field Station chickadee study area. Hence the calculations were based on 11 birds. Of these, four were in two mated pairs, three were males whose mates were not identified, and the remaining four were mated to birds that spent the winter at feeders other than F9. The distance from feeders to territories ranged from 135 to 1180m. The ranked distances did not prove to be correlated with ranked number of visits ($T = .05$, $P = .416$, $N = 11$). The distance ranking and dominance were also not significantly correlated ($T = .27$, $P = .125$, $N = 11$). Furthermore, the positive T value was contrary to expectation. Other investigators have found that the flock whose home range is closest to, or includes, the feeder, is dominant over flocks coming from a distance.

Such interflock site-related dominance has been demonstrated in the Mountain Chickadee by Dixon (1965) and Minock (1971), in the Great Tit by Drent (personal communication to C. M. Weise) and in the Black-capped Chickadee by Hartzler (1970). Balph (1977) has also found a propensity toward site-related dominance in Dark-eyed Juncos.

CONCLUSIONS

The lack of a correlation between dominance, commuting distance, and frequency of visitation has been subjectively observed at the Field Station feeders for some time. Very often the male whose territory eventually includes the feeder site is one of the least frequent visitors (see AOTS in Table 1). Likewise, birds who by all standards of aggressive behavior are at the top of the dominance order are often infrequent visitors (COAY, in the present case). The inconsistency in the present study concerning site-related dominance between flocks is probably due to our lack of knowledge of the precise composition of each flock.

Despite the absence of correlations between dominance and feeder visitation or commuting distance there is no question of the importance of the dominance hierarchy in the daily and annual life of birds. Gauthreaux (1978) in his analysis of the ecological significance of behavioral dominance considered social dominance to be analogous to the evolutionary process of adaptive radiation. Dominance permits maximum utilization of resources by allowing individuals to coexist in an orderly fashion with a minimum of potentially harmful interactions. Smith (1976) suggests that a dominance hierarchy may reduce the incidence of fights among conspecifics, decreasing the chance of injury for each individual. Gauthreaux further suggests that unlike adaptive radiation, social dominance is a more "plastic strategy" since individuals are free to "change their strategy depending on competitive circumstance."

Dominance improved survivorship in Dark-eyed Juncos (Fretwell 1969 ; Baker and Fox 1978; Ketterson 1979). Smith (1976) suggested that dominance acts as a secondary sexual characteristic, augmenting the male's ability to attract potential mates and she demonstrated that high ranking Black-capped Chickadees obtain better quality breeding sites.

Finally, Gauthreaux (1978) states that dominance rank not only influences dispersal, short and long term migration and homing, but also differential habitat utilization, establishment and quality of breeding territory, mating success, and differential mortality rates during the breeding and non-breeding seasons. Thus, the dominance hierarchy has a profound effect on the population dynamics of the group as a whole, but ultimately on the individual's reproductive success and hence its inclusive fitness.

ACKNOWLEDGMENTS

I would like to thank C. M. Weise and Ken Graupmann for assisting in observations and accumulation of data.

LITERATURE CITED

- Baker, M. C. and S. F. Fox. 1978. Dominance, survival and enzyme polymorphism in Dark-eyed Juncos (Junco hyemalis). *Evolution* 32:697-711.
- Balgh, M. H. 1977. Winter social behavior of Dark-eyed Juncos: Communication, social organization, and ecological implications. *Anim. Behav.* 25:895-884.
- Brown, J. L. 1963. Aggressiveness, dominance, and social organization in the Steller Jay. *Condor* 65:460-484.
- Dixon, K. L. 1963. Some aspects of social organization in the Carolina Chickadee. *Proc. XIII Int. Ornith. Congr.* 240-258.
- 1965. Dominance-subordination relationships in Mountain Chickadees. *Condor* 67:291-299.
- Fretwell, S. D. 1969. Dominance behavior and winter habitat distribution in juncos (Junco hyemalis). *Bird Banding* 40:1-25.
- Gauthreaux, S. A. 1978. The ecological significance of behavioral dominance. Pp. 17-54 in *Perspectives in Ethology*, v. 31. (P. P. G. Bateson and P. H. Klopfer, Eds.) New York, Plenum Press.
- Glase, J. C. 1973. Ecology of social organization in the Black-capped Chickadee. *Living Bird* 12:235-267.
- Hartzler, J. E. 1970. Winter dominance relationships in Black-capped Chickadees. *Wilson Bull.* 82:427-434.
- Ketterson, E. D. 1979. Aggressive behavior in wintering Dark-eyed Juncos: determinants of dominance and their possible relationship to geographic variations in sex ratio. *Wilson Bull.* 91:371-383.
- Masure, R. A. and W. C. Allee. 1934. The social order in flocks of the common chicken and the pigeon. *Auk* 51:306-327.
- Minock, M. E. 1971. Social relationships among Mountain Chickadees. *Condor* 73: 119-120.
- Odum, E. P. 1942. Annual cycle of the Black-capped Chickadee - 3. *Auk* 59:499-531.
- Schjelderup-Ebbe, T. 1922. Beitrage zur socialpsychologie des haushuhns. *Z. Psychol.* 88:225-252.
- Siegel, S. 1956. *Nonparametric statistics*. New York, McGraw-Hill.
- Smith, S. M. 1976. Ecological aspects of dominance hierarchies in Black-capped Chickadees. *Auk* 93:95-107.
- Tordoff, H. B. 1954. Social organization and behavior in a flock of captive, non-breeding Red Crossbills. *Condor* 57:346-358.
- Weise, C. M. 1971. Population dynamics of the Black-capped Chickadee. *University of Wisconsin-Milwaukee Field Station Bulletin*. Vol. 4, No. 1. pp. 6-11.

Weise, C. M. and Meyer, J. R. 1979. Juvenile dispersal and development of site-fidelity in the Black-capped Chickadee. *Auk* 96:40-55.

Craig Thompson, Dept. of Zoology, UWM
Present address: Dept. of Zool. & Physiology
University of Wyoming
Laramie, Wyoming 82071