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## On the incubation behavior of Evening Grosbeaks (*Coccothraustes vespertinus*)

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**ABSTRACT**—Knowledge of the breeding behavior of Evening Grosbeaks (*Coccothraustes vespertinus*) is based largely on a multiyear study in Colorado during the 1980s. In Colorado, the duration of full incubation bouts by female grosbeaks had a mean of 26.6 min, a value repeated since then in the literature. For one nesting pair of grosbeaks I studied in Montana, full incubation bouts ( $n = 5$ ) by the undisturbed female during 22 h of direct nest watches on 7 d in June 2018 had a mean of 112.6 min (range = 45–202 min), much longer than the value reported in the Colorado study. Incomplete incubation bouts (female already

incubating on my arrival or at my departure) by the undisturbed Montana female ( $n = 11$ ) during the same observation period had a mean of 56.2 min, 4 of which were a minimum of 94–146 min, further suggesting that longer duration incubation bouts may be the norm for this species. Duration of incubation bouts for Evening Grosbeak in the Colorado study appear to be brief relative to other North American fringillids, but my limited data suggest that Evening Grosbeaks are typical in this regard. Mean duration of 10 nest absences by the undisturbed Montana incubating female was  $9.7 \pm 7.6$  min (range = 3–26 min), similar to the Colorado study ( $10.1 \pm 10.7$  min). Male behavior during incubation also appeared similar to results from Colorado (no attending the eggs, frequent exchange of vocalizations

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with the nesting female, escorting and feeding the female only when off the nest). I conclude that the duration of nest watches (60–80 min) in the Colorado study was inadequate to determine the length of many longer incubation bouts by female Evening Grosbeaks. Received 30 March 2019. Accepted 22 July 2021.

Key words: breeding biology, Fringillidae, Montana, nest attendance, nesting behavior.

### Sobre el comportamiento de incubación del picogordo *Coccothraustes vespertinus*

RESUMEN (Spanish)—El conocimiento sobre el comportamiento reproductivo del picogordo *Coccothraustes vespertinus* se basa principalmente en un estudio de múltiples años en Colorado durante la década de 1980. En Colorado, la duración de los periodos de incubación por las hembras de este picogordo tuvo una media de 26.6 min, un valor que ha sido repetido desde entonces en la literatura. En una pareja de picogordos anidantes que estudié en Montana, los periodos de incubación ( $n = 5$ ) por una hembra sin perturbar durante 22 h de observaciones del nido a lo largo de 7 d tuvieron una media de 112.6 min (rango = 45–202 min), mucho más largos que el valor reportado en el estudio de Colorado. Los periodos incompletos de incubación (cuando encontré a la hembra incubando desde mi llegada o a mi partida) por la hembra de Montana ( $n = 11$ ) durante el mismo periodo de observación tuvieron una media de 56.2 min, 4 de los cuales tuvieron un mínimo de 94–146 min, lo que sugiere los periodos más largos de incubación podrían ser la norma en esta especie. La duración de los periodos de incubación del picogordo en Colorado parece ser breves en relación con los de otros fringílicos, aunque mis limitados datos sugieren que los *C. vespertinus* son típicos a este respecto. La duración media de 10 ausencias en el nido por la hembra que incubaba sin perturbación en Montana fue de  $9.7 \pm 7.6$  min (rango = 3–26 min), similar al estudio de Colorado ( $10.1 \pm 10.7$  min). El comportamiento de los machos parece tener resultados similares a los de Colorado (no participa en el cuidado de los huevos, intercambios de vocalizaciones frecuentes con la hembra en el nido, acompañando a la hembra y alimentándola únicamente cuando no estaba en el nido). Concluyo que la duración de las observaciones en el nido (60–80 min) en el estudio de Colorado fue inadecuado para determinar la longitud de muchos de los periodos de incubación de mayor duración por parte de las hembras de este picogordo.

Palabras clave: biología de la reproducción, comportamiento en el nido, cuidado del nido, Fringillidae.

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Behaviors performed by adult birds during incubation, such as nest attentiveness and mate guarding, are forms of parental investment contributing to overall reproductive effort that may also affect the evolution of other life-history traits (Conway and Martin 2000, Fedy and Martin 2009). Large variation among species in incubation behavior, especially incubation constancy (Skutch 1962, 1976), presumably results as a response to a suite of intrinsic and ecological factors (e.g., body size, food requirements, ambi-

ent temperature, predation risk, nest type, time of day) to which birds are exposed, although underlying causes of variation in incubation behavior often remain unclear (Conway and Martin 2000). Information on incubation constancy and related behavior is surprisingly limited for many North American passerines, including the Fringillidae (Conway and Martin 2000). Thus, there is need for additional data, within and among species, on the incubation behavior of many North American finches, which will enable more complete understanding of the process of incubation and its significance to reproductive effort.

The Evening Grosbeak (*Coccothraustes vespertinus*) is a relatively common fringillid widespread through coniferous forests of the western United States and across southern Canada, reaching its southern distribution limit in western Mexico (Gillihan and Byers 2001). However, because the species is secretive during the nesting season, and tends to build flimsy nests high in tall trees, many aspects of its life history remained poorly documented (Speirs 1968a, 1968b) until the breeding ecology and behavior were studied in some detail in Colorado during the 1980s (Fee and Bekoff 1986; Bekoff et al. 1987, 1989; Scott 1990; Scott and Bekoff 1991).

In this paper, I document adult behavior during incubation by a pair of Evening Grosbeaks nesting in western Montana, which supplements and expands on results of the studies in Colorado. My initial impetus for observing this nest was to document more fully the nesting biology of Evening Grosbeaks in Montana, as very few nests have been reported in the state (Davis 1953, Marks et al. 2016), let alone watched at length. However, once incubation began it was evident that some of the adult behavior associated with this nesting was inconsistent with published descriptions, and these differences warranted to be highlighted (Gillihan and Byers 2001).

### Methods

I followed the activities of one nesting pair of Evening Grosbeaks in Pattee Canyon, Missoula County, Montana ( $46^{\circ}50'N$ ,  $113^{\circ}56'W$ ; 1,310 m elevation) during 30 May–17 June 2018. My observations began in the last few days of nest construction through the first day that at least 1 egg hatched; the observations I report here for

incubation were made during 7–15 June. The nest, located ~22 m above ground in a ~26 m tall (42.5 cm diameter breast height) Douglas-fir (*Pseudotsuga menziesii*), was a loosely woven cup of thin sticks lined with rootlets built on top of a limb and abutting the SW side of the tree trunk. I estimated tree canopy cover in the vicinity of the nest at 30%, composed of mature Douglas-fir and ponderosa pine (*Pinus ponderosa*) with a sparse and patchy shrub understory of ninebark (*Physocarpus malvaceus*), serviceberry (*Amelanchier alnifolia*), and snowberry (*Symphoricarpos* sp.).

I observed nesting activities using a 10× binocular and a 20× spotting scope from a position ~40 m from the nest tree. Total time I spent observing the grosbeak pair during the incubation phase was 22 h over 7 separate days. All observations were made during 0745–1300 h MST; 6 of 7 nest watches during incubation lasted 3 or 4 continuous h (180 or 240 min), the first watch (7 June) lasted 60 min. Full incubation bouts were those of known duration, incomplete incubation bouts were those where the female was already on the nest when I began a nest watch or she remained on the nest for an undetermined length of time after I departed.

I considered nest attendance as the percentage of time that the female was on the nest during each nest watch. Nonparametric statistical analyses comparing the duration of undisturbed and disturbed female incubation bouts and nest absences, and the correlation between nest attendance and ambient temperature at the beginning of nest watches, were conducted using Statistix 8 (Analytical Software, Tallahassee, Florida, USA). Where provided, values are given as mean  $\pm$  SD.

To examine nest attendance patterns of female North American fringillids, including Evening Grosbeak, I compiled information primarily from *Birds of North America* species accounts and web searches for appropriate papers. Several species lacked the information I sought and are not included in my review. I used mean nest attendance values given in Conway and Martin (2000) for the fringillid species they included in their analyses but first reviewed their original sources to corroborate the values.

## Results

Only the female attended the nest during incubation. Mean duration of full incubation bouts

by the undisturbed female was  $112.6 \pm 62.0$  min ( $n = 5$ , range = 45–202 min). Two additional full incubation bouts of 6 min and 4 min occurred on 14 June during 22 min of a 4 h nest watch (and between incomplete incubation bouts of at least 124 min and 94 min), when a male–female pair of grosbeaks was present <20 m from the nest tree. The incubating female attacked the second female once at the beginning of the 22 min period. Mean duration of full incubation bouts when including the 2 exceptionally short ones was  $81.9 \pm 72.9$  min. The difference in mean duration of full undisturbed and full disturbed incubation bouts was statistically significant (Wilcoxon rank sums; 2-tailed exact permutation test,  $P = 0.048$ ). Mean duration of incomplete incubation bouts was  $56.2 \pm 56.9$  min ( $n = 11$ ), 4 of which lasted at least 94–146 min. Mean number of min/h the nest was attended by the female during incubation was 55.3 min ( $n = 22$ , range = 34–60 min), or 92.2% female nest attendance (1,217 min of 1,320 min total observation time). Duration of female nest attendance during a nest watch ( $n = 7$ ) was not significantly correlated with ambient temperature at the start of the watch (Spearman Rank Correlation:  $r_s = -0.321$ ,  $P = 0.495$ ).

Mean duration of full nest absences by the undisturbed female was  $9.7 \pm 7.6$  min ( $n = 10$ , range = 3–26 min). Duration of 3 additional full nest absences on 14 June when the intruding pair of grosbeaks was near the nest were 8, 3, and 1 min. Mean duration of all 13 full nest absences was  $8.4 \pm 7.2$  min. The difference in duration of full absences by the undisturbed and disturbed incubating female was not statistically significant (Wilcoxon rank sums; 2-tailed exact permutation test,  $P = 0.10$ ), perhaps a result of small sample size, but absences by the incubating female averaged more than twice as long when the second female was not in the nest area.

The male did not directly help build the nest, incubate the eggs, or feed the incubating female at the nest, although he often accompanied her when she was off the nest and sometimes fed her when she was at least 25 m from the nest in an adjacent tree or shrub. During nest building and early incubation, he accompanied the female to the nest tree when she returned to the nest ( $n = 11$ ), but he remained 0.5–8.0 m from the nest proper. Both adults often exchanged calls when in the nest tree or separate trees, the female also calling from the

nest. The female and male exchanged calls on 54% of 13 nest departures shortly before the female terminated an incubation bout or when she was in the air; the male also called from the nest area on 60% of 15 female returns to the nest.

It is worth noting that the male of the pair of Evening Grosbeaks appearing near the nest on 14 June, 3 d before hatch day, may have been the male already paired to the incubating female. The incubating female vocalized repeatedly before attacking the second female shortly after the pair copulated 20 m from the nest tree, and attempted unsuccessfully to displace the second female while the male remained passive. The 3 birds then moved more or less together 4–6 m apart to 3 trees during the next 8 min, including into the nest tree <10 m from the nest, before the nesting female resumed incubation. The incubating female did not vocalize during the lengthy (at least 124 and 94 min) uninterrupted incubation sessions before and after the appearance and departure of the pair. I did not hear the male vocalize during the entire 4 h nest watch, unlike nest watches of the same length on 12 and 15 June, and on hatch day (17 June), when the female and male frequently exchanged calls as she incubated, foraged, or brooded. Although the male was not marked, the behavior of the nesting pair that day was exceptional for the incubation phase of nesting.

## Discussion

Evening Grosbeak nests are difficult to find and observe (Speirs 1968a, 1968b; Bekoff et al. 1989; Gillihan and Byers 2001), and relatively few have been watched extensively, so it is not surprising that gaps remain in knowledge of the species' breeding biology. My results from a single nest in Montana are a case in point. Especially striking is the difference of 86 min in mean duration of full nest incubation bouts by the undisturbed female at the Montana nest (112.6 min) and the value reported in the Colorado study (26.6 min) by Scott (1990) and Scott and Bekoff (1991), and repeated since then in the literature (Conway and Martin 2000, Gillihan and Byers 2001). The difference remains large (55.3 min) even when including the 2 short full incubation bouts for the Montana female when she was obviously dis-

turbed by the presence of a second female in the nest area.

The disparity is unlikely due to effects of ambient temperature at the time of my observations, which showed no significant correlation among nest watches, nor differences between the 2 study sites, which showed considerable overlap in temperatures at the times of study: 10–27 °C in Montana for the incubation phase alone, 15–22 °C in Colorado for nestling as well as incubation phases (Scott and Bekoff 1991).

I suspect the disparity in duration of incubation bouts is unlikely a result of major underlying genetic differences between the 2 populations. Evening Grosbeaks in both localities are members of the same subspecies (*C. v. brooksi*), the mean duration of nest absences by incubating females was quite similar in both localities ( $9.7 \pm 7.6$  min in Montana and  $10.1 \pm 10.7$  min in Colorado), and most other adult behaviors during incubation were similar, including male guarding and feeding the female when she was away from the nest. That said, nest attendance behavior by the single Montana female reported here could be anomalous for Montana as well as for Evening Grosbeaks in general, but without observations from additional Montana nests it is impossible to know if that is the case.

Data for other species of North American fringillids, however, indicate that female nest attendance of the Montana Evening Grosbeak nest was relatively typical for the family (Table 1), and that the value reported in the Colorado study (Scott 1990, Scott and Bekoff 1991) is the outlier. Mean duration of complete incubation bouts exceeded 60 min for 8 of 9 other North American species with data, and 90 min for 5 of those species. As Newton (1973: p. 177) noted, "In all carduelines studied, daytime incubation stints of two hours are common."

The most likely explanation for the disparity in mean duration of nest attendance bouts between the 2 localities is that the sampling methodology in Colorado was inadequate for documenting longer incubation bouts. There, nest watches were 60–80 min long (Scott 1990, Scott and Bekoff 1991), in contrast to my watches from Montana, which were mostly 180–240 min. A 60 min nest watch would have failed to detect the full duration of most of the incubation bouts by the undisturbed female at the Montana nest. An additional 4 partial bouts

**Table 1.** Nest attendance during incubation by some female North American fringillid species. ON: mean duration (min) of complete incubation bouts, OFF: mean duration (min) of complete absences, %: mean nest attentiveness (ON ÷ ON + OFF). ON value for House Finch calculated from OFF and % values provided in source.

Common name	Scientific name	ON	OFF	%	Source
Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>	48	15	76	Conway and Martin (2000)
Brown-capped Rosy-Finch	<i>Leucosticte australis</i>	85	14	86	Johnson et al. (2000)
House Finch	<i>Haemorhous mexicanus</i>	80	24	77	Stein et al. (2010)
Red Crossbill	<i>Loxia curvirostra</i>	148	7	95	Conway and Martin (2000)
White-winged Crossbill	<i>Loxia leucoptera</i>	150	–	–	Conway and Martin (2000)
American Goldfinch	<i>Spinus tristis</i>	152	9	94	Conway and Martin (2000)
Lesser Goldfinch	<i>Spinus psaltria</i>	99	42	70	Conway and Martin (2000)
Lawrence's Goldfinch	<i>Spinus lawrencei</i>	119	4	97	Conway and Martin (2000)
Common Redpoll	<i>Acanthis flammea</i>	68	3	97	Knox and Lowther (2000)
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	27	10	73	Scott (1990), Scott and Bekoff (1991), Conway and Martin (2000), Gillihan and Byers (2001)
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	113	10	92	This paper

exceeded 90 min, further indicating that longer nest watches are required to determine the full duration of many incubation bouts for this species, some of which can exceed 3 h.

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