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COMPASS ORIENTATION OF AN INCUBATING AND BROODING RUBY-THROATED HUMMINGBIRD (*ARCHILOCHUS COLUBRIS*). — The literature on incubation behavior of hummingbirds is voluminous (Bent, 1940; Schuchmann, 1999) but surprisingly little has been written about the orientation of females on the nest. Hermits (*Phaethornis* and *Glaucis*) that attach their nests under drooping palm leaves invariably incubate with their heads facing the leaf surface (Skutch, 1951; Novaes & de Carvalho, 1957; Skutch, 1964; Oniki, 1970; Snow & Snow, 1973). Comparable data for the 300+ species of non-hermit hummingbirds are limited to scattered observations for a few tropical species. A female *Colibri thalassinus* repeatedly faced the same direction during incubation (Wagner, 1945), whereas *Campylopterus largipennis* faced the supporting stem of a palm leaf (Théry, 1987). In contrast, *Chaetocercus berlepschi* (Juiña et al., 2010) and *Amazilia fimbriata* (Haverschmidt, 1952) were observed making frequent turns on the nest and *Chlorostilbon mellisugus* was observed to incubate in all compass directions but more frequently faced the nest support (Thomas, 1994). The orientation of incubating females appears to be unrecorded for the most intensively studied hummingbird genera in North America (*Archilochus*, *Calypte*, and *Selasphorus*).

On 22 July 2014, I observed a female Ruby-throated Hummingbird (*Archilochus colubris*) gathering spider webs and prizing flakes of lichen from tree bark in my suburban yard in Fairfax County, Virginia (38º 46.3′ N; 77º 5.7′ W). Presumably the same female was observed gathering spider webs more than three dozen times in the same area during the next week. I found the nest and incubating female on 31 July on a sloping branch of a White Oak (*Quercus alba*) about 9 m above the ground. The nest was shaded but received dappled sunlight during the course of the day. I watched the nest daily, but at irregular intervals, from 31 July through 18 August with a 20× spotting scope. The nest contents could not be directly observed.

Incubation sessions were punctuated by brief feeding forays. The returning female invariably approached the nest from the same direction after a series of short hovering flights before settling immediately in the nest cup. However, I noted that the compass direction of the incubating female seemed to shift randomly, or nearly so, in successive incubation bouts (Fig. 1). Photographs taken from the same vantage point revealed that the elastic walls of the nest flexed in the direction faced by the incubating female.

Fig.1. Variation in orientation of an incubating female Ruby-throated Hummingbird (*Archilochus colubris*).

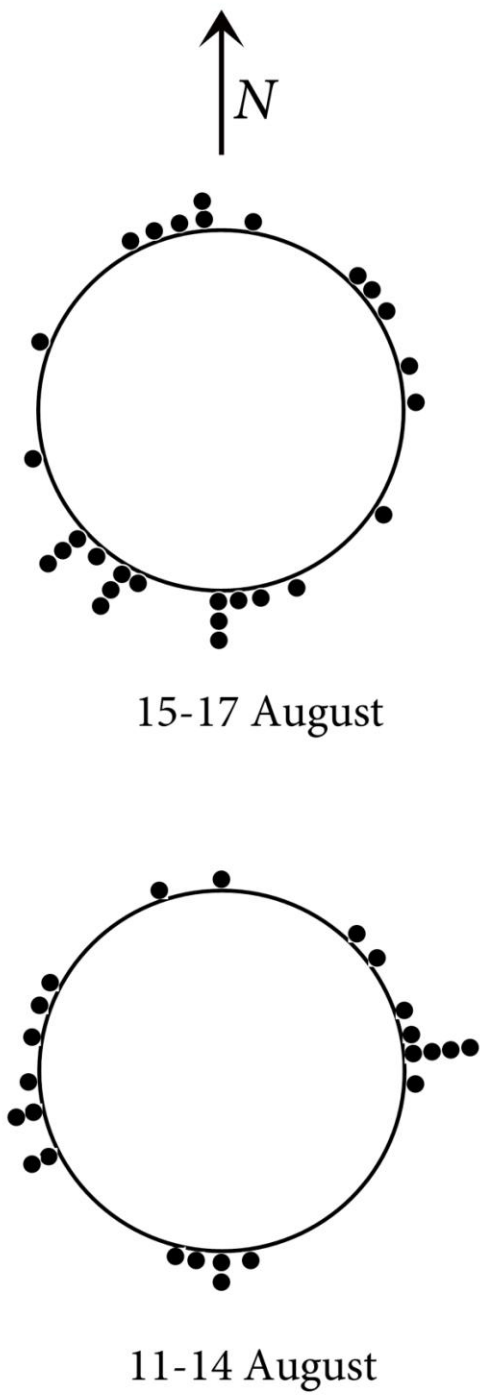

Fig. 2. Orientation of female Ruby-throated Hummingbird (*Archilochus colubris*) during early (11-14 August) and late (15-17 August) brooding periods.

Nest elasticity conferred by spider webs in the nest matrix has rarely been mentioned in the literature (Wueste, 1902).

The first evidence that the eggs had hatched was observed on the morning of 10 August when the female perched on the rim of the nest upon returning and began to feed a nestling. The female's brooding schedule was similar to the incubation schedule for the first four days after hatching but from the fifth day onward the duration of brooding bouts decreased and the length of absences from the nest increased, a pattern that is typical in hummingbirds (Baltosser, 1996). By the seventh day (17 August), the female brooded the nestlings only at night, returning to the nest at dusk. I recorded the direction faced by the female during 52 brooding bouts (11-17 August). The orientation of the brooding female changed frequently from bout to bout and the location of the most favored positions shifted over time, possibly owing to shifts in the postures and orientation of the rapidly growing nestlings. I tested the hypothesis that brooding orientation was uniformly distributed with the Hodges-Ajne test for circular uniformity (Zar, 1996). This relatively straightforward test is based on the total number of observations (*n*) and the smallest number of observations (*m*) that occur within a range of 180°. Under the null hypothesis of circular uniformity, the probability of observing an *m* at least this small is

$$P = 2^{1-n}(n-2m)\binom{n}{m}$$

Observations were divided into early (11-14 August) and late (15-17 August) incubation periods (Fig. 2). Orientations were uniformly distributed in both incubation periods ($P > 0.50$).

A review of egg dates for Virginia indicates that this nest (hatching on 10 August) represents the latest definitive record for the state (Clapp, 1997). A female was reportedly incubating at Mountain Lake Biological Station, Giles County, on 12 August 1946 (Smyth, 1948). However, it is unclear from Smyth's account whether the female was incubating eggs or brooding nestlings.

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