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SPIDER WEBS AND WINDOWS AS POTENTIALLY IMPORTANT SOURCES OF HUMMINGBIRD MORTALITY

DEVON L. GRAHAM
Department of Biology
University of Miami
P.O. Box 249118
Coral Gables, Florida, 33124 USA

Abstract.—Sources of mortality for adult hummingbirds are varied, but most reports are of starvation and predation by vertebrates. This paper reports two potentially important sources of mortality for tropical hermit hummingbirds, entanglement in spider webs and impacts with windows. Three instances of hermit hummingbirds (*Phaethornis* spp.) tangled in webs of the spider *Nephila clavipes* in Costa Rica are reported. The placement of webs of these spiders in sites favored by hermit hummingbirds suggests that entanglement may occur regularly. Observations at buildings also suggest that traplining hermit hummingbirds may be more likely to die from striking windows than other hummingbirds. Window kills may need to be considered for studies of populations of hummingbirds located near buildings.

TELAS DE ARAÑA Y VENTANAS COMO FUENTES POTENCIALES DE MORTALIDAD PARA ZUMBADORES

Sinopsis.—Las fuentes de mortalidad para zumbadores son variadas. Pero la mayoría de los informes se circunscriben a inanición y a depredación por parte de vertebrados. En este trabajo se informan dos importantes fuentes de mortalidad para zumbadores tropicales (*Phaethornis* spp.) como los impactos contra ventanas y el enredarse con tela de araña. Se informan tres casos de zumbadores enredados con tela de la araña *Nephila clavipes* en Costa Rica. La construcción de las telas de araña en lugares frecuentados por los zumbadores sugiere que el enredarse en la tela de los arácnidos pudiera ocurrir regularmente. Observaciones en edificios también sugieren que las especies de *Phaethornis* pudieran estar más propensas a morir como resultado de impacto a ventanas que otras especies de zumbadores. Se debe considerar la mortalidad causada por coliciones contra ventanas cuando se hagan estudios poblacionales de zumbadores en lugares cercanos a edificios.

Documented sources of adult hummingbird (Trochilidae) mortality include starvation (Stiles 1992) and predation by raptors (Beebe 1950, Lowery 1938, Mayr 1966, Peeters 1963, Sick 1993, Sprot 1927, Stiles 1978), other birds (Sick 1993, Wright 1962), frogs (Monroe 1957, Norris-Elye 1944), snakes (Sick 1993), mantids (Butler 1949, Hildebrand 1949, Murray 1958), fish (Lockwood 1922), and mammals (Bent 1964, Sick 1993). Most predators appear to be opportunistic. However, the Tiny Hawk (*Accipiter superciliosus*) may specialize in hunting hummingbirds (Stiles 1978).

I report two additional sources of mortality, entanglement in spider webs and window kills, from observations during field work (June–July 1990; June 1991–December 1992; March–June 1993) at the La Selva Biological Station, Costa Rica. I suggest that both sources of mortality may be important for some species or populations of hummingbirds.

Spider webs.—Many hummingbirds regularly use spider webs for nesting material, and forage for insects trapped in spider webs (Remsen et al. 1986, Stiles 1995, Wagner 1946, Young 1971). In primary forest understory at La Selva, two species of hermit hummingbirds, Long-tailed Hermits (*Phaethornis superciliosus*) and Little Hermits (*P. longuemareus*), visit spider webs including those of the large Golden Orb Spider, *Nephila clavipes* (hereafter *Nephila*) (Stiles 1995, Young 1971, pers. obs.). For both hermits, lek and nesting sites are located in the understory, and foraging and flight paths are largely confined to trails, stream courses, and other open areas in the understory (Stiles 1992, 1995; pers. obs.).

Nephila is conspicuous throughout its range due to its size (1–2 g), abundance, and placement of webs across trails, streams, along ridgetops and across natural gaps in the vegetation (Higgins 1987; Lubin 1978, 1983; Rypstra 1985). Webs are large (to 1 m in diameter), frequently aggregated, and surrounded by a tangle of strong non-sticky threads. Fresh sticky strands are extremely viscous (Lubin 1978, 1983; Rypstra 1985, Young 1971).

On 16 Jul. 1990, two Long-tailed Hermits were found on the ground tangled in a destroyed *Nephila* web, less than 50 m from an active lek. The attention of my party (C. Horvitz, J. LeCorff, M. Molina, and I) was drawn by the birds' distress calls. One bird freed itself as we approached, the other was thickly coated with sticky webs, gluing it to several dead twigs and leaves. When we removed the webbing, this bird could not fly, but recuperated after 2–3 min and two extended drinks of proffered Gatorade®; it would certainly have died without intervention.

In November 1992, L. Vargas and I observed a single Long-tailed Hermit tangled in a *Nephila* web 4–5 m off the ground. This bird freed itself after about 30 s (assuming it began giving distress calls the moment it became entangled), and the web was not totally destroyed. The third record of which I am aware was of a Little Hermit found tangled in a *Nephila* web in 1977 by L. McDade (A. Mack, pers. comm.). This bird was released and presumably survived. Considering the rarity with which predation events are witnessed, or dead birds encountered in forest habitats, I suggest that these observations are significant.

For hummingbirds that forage in locations favored by *Nephila* such as forest understory and edges, entanglement in spider webs could be an underrated or unacknowledged source of mortality. During periods of food scarcity, weakened birds might be especially likely to die. When hitting a web, a bird's momentum may either carry it through the web, or, when webs are aggregated, cause it to become coated with both the sticky strands of the inner web and the strong supporting strands. Hummingbirds are much larger than recorded *Nephila* prey items (Higgins 1987, Rypstra 1985), and it is unlikely that *Nephila* prey on birds. Entrapment of hummingbirds in spider webs has been reported repeatedly, but is usually treated as a rare, chance occurrence. Accounts of entrapment in *Argiope* and *Nephila* webs are related by Bent (1964), Baird et al. (1905), McCook (1889), Skutch (1973), Sick (1993), and Teixeira et al. (1991).

In addition to death from exhaustion and shock, trapped hummingbirds may be subject to predation. Raptors are often attracted to mistnetted birds (B. Loiselle, pers. comm.; pers. obs.), and trapped hermits are typically conspicuous, struggling vigorously and giving repeated distress calls. Small trapped birds are also open to attack by other avian and mammalian predators.

Windows.—Observations at La Selva suggest that window-kills may be a significant source of mortality for local hummingbird populations. During two years at La Selva, birds hit windows daily. While some birds suffered glancing blows and flew away apparently uninjured, others were stunned or killed outright. Based on dead birds found beneath windows, I estimate that 2–3 birds were killed weekly. Two sides of a laboratory with large windows were checked on a near-daily basis while other locations were checked irregularly; 2–3 deaths per week may thus be an underestimate.

The birds most commonly impacting windows were hummingbirds, especially the abundant Rufous-tailed Hummingbird (*Amazilia tzacatl*) and the Long-tailed Hermit. These two species accounted for about one-third of birds observed or known to hit windows. Only two impacts by the Rufous-tailed Hummingbird are known to have resulted in death. In contrast, dead Long-tailed Hermits were found beneath windows at least once a month, and stunned individuals every 1–3 wk. The mass of Long-tailed Hermits (6.0 g; Stiles and Skutch 1989) and long traplining flights may mean that this species is more likely to hit windows with lethal force than many other hummingbird species.

Stunned birds that eventually flew away may have sustained injuries fatal in the short term. One Long-tailed Hermit bent half of the lower and upper mandibles at a 30° angle to the side, for instance, and Klem (1990a) documents non-apparent internal injuries in birds that hit windows. Injured birds may also be vulnerable to predator attack, or be killed by fire ants (*Solenopsis* sp.) which scavanged dead birds.

For species such as the Long-tailed Hermit, even a mortality rate of one individual per month might affect local populations. At La Selva, Stiles (1992) estimated that despite their seeming abundance, there may be only a few hundred individuals on the 1500 ha property. Window mortality could conceivably affect demographics of nearby leks if, for instance, wider-ranging males (Stiles and Wolf 1979) are more likely to impact windows, or if naive juveniles suffer disproportionate mortality.

Given that window-kills may be the greatest source of human-related bird mortality in the United States (Klem 1990b), and that populations of different bird species may be affected to different degrees by window-induced mortality, investigation into window-kills at tropical sites is warranted. Additionally, research stations, private individuals and others should consider methods of reducing window-kill deaths (see Klem 1979, 1990b).

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