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DO SWALLOWS SUNBATHE TO CONTROL ECTOPARASITES? AN EXPERIMENTAL TEST[1]

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Key words: Violet-green Swallow; Tachycineta thallisina; *sunbathing; ectoparasites.*

Several species of swallows (Hirudinidae) sunbathe in a manner producing the appearance of heat stress (Barlow et al. 1963, Simmons 1986, Blem and Blem 1992). These swallows spread their wings and tails in an obvious attempt to expose those surfaces to the sun. They also gape, pant markedly, and even appear to go into a trance (Hauser 1957, Kennedy 1969, Blem and Blem 1992). This behavior occurs only on bright, sunny days with low wind velocities and high ambient temperatures and has been observed to occur on substrates exceeding 52°C (Blem and Blem 1992). Plausible hypotheses explaining this behavior in birds include: (1) acquisition of heat for thermoregulation (e.g., Lustick 1969, Cade 1973), (2) drying of wet plumage (Kennedy 1969, Storer et al. 1975), (3) soothing of feather tracts irritated by molting (Potter and Hauser 1974, Simmons 1986), and (4) deliberate overheating in order to stun or kill tiny ectoparasites, particularly mites (Acarina) and lice (Mallophaga) (see Simmons 1986). The present paper provides experimental evidence supporting the last hypothesis.

STUDY AREA AND METHODS

During the period 20 June–30 June 1992, we mist-netted and color-banded 32 adult (16 male, 16 female) Violet-green Swallows (*Tachycineta thalassina*) at Flathead Lake Biological Station, 30 km north of Polson, Montana (47°41.4'N, 114°09.3'W). The resident swallow population at this site includes at least 50 nesting pairs of Violet-green Swallows as well as several pairs

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of Tree Swallows (*T. bicolor*) and Barn Swallows (*Hirundo rustica*). U.S. Fish and Wildlife Service bands were placed on each bird's right leg, and distinctive combinations of color bands were placed on the left leg. Half of the swallows (eight males, eight females) were treated at the time of banding with "8 in 1 mite and lice bird spray," a pesticide for treatment of mite and louse infestations in caged birds. This spray is composed of 0.03% pyrethrin, 0.30% piperonyl butoxide, 0.12% petroleum distillates, and 99.55% inert ingredients. The pesticide was applied as a fine spray on all outer feather surfaces, with the exception that each bird's head was protected during the process. We could detect no stain or odor on sprayed birds. Mites (Mesostigmata) and lice (*Bruelia* sp. and other unidentified lice) were observed to fall from some treated birds, but we did not evaluate the degree to which they spray was effective in killing ectoparasites, except to note that parasites were much less evident on recaptured treated swallows. However, we applied the pesticide in a manner known to be effective for one to two weeks in caged birds. Control birds (eight males, eight females) were banded but not sprayed. Since we were not able to recapture many of these swallows in the time frame of the study, we did not apply pesticide a second time. All adult swallows were incubating eggs or feeding young during the marking/treatment process and we assume they were exposed to further infestation of ectoparasites from contact with nests and young.

We alternated treated and control birds throughout the capture sequence. We similarly treated 23 young birds (12 controls, 11 experimentals in five nests) 2–4 days before fledging. All young in any given nest and the nest itself were sprayed with the insecticide. No mortality resulted from treatment with the pesticide and all nestlings fledged normally.

Swallows subsequently were observed, identified, and recorded as they sunbathed on a shiny, aluminum, laboratory roof (Blem and Blem 1992, for site details). We counted sunning birds during 25 hr of observation over a four-week period from July 2–July 30. This represented most of the time that swallows were seen at the site commonly used for sunbathing. Much of the month was cloudy and rainy; there were few periods with bright sunlight and low wind velocity, conditions necessary for basking behavior in this species (Blem and Blem 1992). No swallows were observed sunbathing elsewhere on the station in 1992 and previous studies allowed us to predict accurately when sunbathing would occur. All other roofs at the station are dark and swallows have not been observed basking on them. Furthermore, the station is surrounded by old-growth coniferous forest and there are few open sites where basking could be done. When not sunning or tending nests, many swallows rested for extended periods in two large dead ponderosa pines (*Pinus ponderosa*) at the water's edge and many marked birds could be found there.

RESULTS

We were able to find nearly all of the marked adults on station grounds in July (15 controls; 13 experimentals); most of these were recorded at the basking station (Table 1). Swallows ceased sunning in early August.

TABLE 1. Sunbathing in control adult Violet-green Swallows vs. those treated with pesticide.

	Controls	Treated	Unmarked
	Days 1–14[a]		
Individuals	10	2	—
Visits	23	2	37
	Days 15–28[b]		
Individuals	12	11	—
Visits	49	29	321
	Totals		
Individuals	12	11	—
Visits	72	31	358

[a] Total of 8 hr of observation.
[b] Total of 17 hr of observation.

The largest single aggregations of sunbathing Violet-green Swallows included 36 birds. Overall, more males than females were observed at the sunning site (302 males, 156 females; $\chi^2 = 45.91$, $P < 0.01$; Yates correction for continuity performed; Zar 1984), and specific occurrences of marked birds support this observation (63 males, 40 females; $\chi^2 = 4.70$; $P < 0.05$).

Over the entire study period nearly identical numbers of individuals from each test group were identified at the sunning site (Table 1), but controls basked more frequently than birds treated with pesticide ($\chi^2 = 15.53$; $P < 0.01$). We noticed that more controls sunbathed during the early part of the study period than later (Table 1). For this reason, and because the recommended treatment interval for the pesticide was two weeks, we separated the data into two-week intervals (Table 1). During the first two weeks following treatment, only two treated birds were identified at the sunning site vs. 10 control birds ($\chi^2 = 4.08$; $P < 0.05$). These treated birds only visited the sunning station once each; control birds basked a total of 23 times ($\chi^2 = 16.00$; $P < 0.01$). Fewer birds were recorded in the first two-week period partly because weather conditions were not conducive to basking and because most birds were tending nests with eggs or young. In the second two-week period, nearly equal numbers of individual swallows visited the sunning station, but treated birds sunbathed less frequently than controls (49 vs. 29; $\chi^2 = 4.63$; $P < 0.05$). Sunbathing of adults often was preceded or followed by extensive preening, scratching, and stretching. No feathers were observed to be removed during this process and there was no evidence of molt in adult birds mist-netted during the experiment. Very few immatures came to the basking station and only five were observed sunning. None of these were banded birds. The young that came to the sunning site seemed to be engaged mainly in attempts to obtain food from arriving adults.

DISCUSSION

The present study supports the hypothesis that sunbathing in extreme heat by swallows is an attempt to control ectoparasites. Swallows treated with pesticide sunned less than control birds and the effect of the

treatment seemed to disappear at about the time the pesticide would be expected to lose its effect. Furthermore, other possible causes—molting, wet plumage, and cool weather—were not observed to be associated with sunbathing in the present instance. However, it is not certain that swallows can subject ectoparasites to sufficient heat to kill or immobilize them. Specific data on thermal sensitivity of mites and lice seem to be lacking, although both are responsive to high ambient temperature (Slansky and Rodriguez [1987] and the eggs of some mites are killed by 15–30 min exposure to 60°C (Belding, 1965). However, Violet-green Swallows seldom sunbathe for more than 1–3 min. Such short sunning bouts seem to be common in small birds (Simmons, 1986). It seems plausible that short exposure to high temperature could discourage mite/louse populations or concentrate them for more effective removal during preening, but we have no direct evidence of this effect. It also is possible that other components of sunlight have pesticidal effects (e.g., ultraviolet light). Given the overt way in which the swallows in this study oriented their bodies to direct sunlight and spread their wings and tails in what appears to be an effort to expose these surfaces maximally and that application of pesticide significantly decreases the frequency of sunning, we maintain that pest control is a reasonable explanation of such behavior.

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EFFECTS OF NESTLING PROVISIONING ON THE TIME-ACTIVITY BUDGETS OF MALE RED-WINGED BLACKBIRDS[1]

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Key words: Male parental care; mating effort; time-activity budgets; Red-winged Blackbird; Agelaius phoeniceus.

Parental effort, mating effort and somatic effort are generally viewed as the major components of reproductive effort (Williams 1966, Maynard Smith 1977). During the breeding season, time and energy expended in reproductive effort are expected to be limited (e.g., Ricklefs 1974, Hails and Bryant 1979). As a result, a conflict may arise in biparental species regarding the allocation of time and energy among parental, mating and maintenance activities. This conflict may be greater for males because they can influence positively their fitness by caring for offspring, gaining additional matings or performing maintenance activities. For male birds, a conflict may arise if the time required to feed and protect nestlings (parental effort) necessitates a reduction in the time spent attracting additional mates and pursuing extra-pair fertilizations (mating effort) or a reduction in their investment in maintenance activ-

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