

again on Guam unless some recovery of this highly endangered population is achieved.

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### Three-striped Warbler (*Basileuterus tristriatus*) "Anting" with a Caterpillar

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**ABSTRACT.**—Anting behavior is widespread among passerine species but its function is unknown. In typical anting episodes, a bird holds an ant or other object in the bill and rubs it in the plumage. In addition to ants, many other objects have been used for "anting." Here I describe the use of a caterpillar for anting by a tropical warbler, and evaluate four of the hypothesized functions of anting in light of this observation.

I suggest that an experimental approach is likely to yield insight into the adaptive significance of anting. Received 5 May 1997, accepted 27 Oct. 1997.

Anting is a poorly understood behavior that has been observed in a wide variety of birds, especially temperate-zone passerine species. During "active anting" a bird holds one or more ants in the bill and rubs them on the feathers or skin, typically near the base of the

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remiges or rectrices. "Passive anting" involves a bird with spread wings and tail lying on an ant nest and allowing ants to crawl through the plumage. Several hypotheses concerning the function and adaptive significance of anting behavior in birds have been proposed, including (1) removal of, or defense against ectoparasites (Simmons 1985, Clayton and Vernon 1993), (2) protection against fungal or microbial infection (Ehrlich et al. 1986), (3) to soothe skin irritation during molt (Potter 1970, 1989; Potter and Hauser 1974), and (4) as a method of food preparation by removing unpalatable substances (Judson and Bennett 1992). Additional hypotheses have been proposed (reviewed by Whitaker 1957, Chisholm 1959, Simmons 1966). In addition to using ants, birds have been observed "anting" with millipedes (Clunie 1976), flowers (Dennis 1985), mothballs (Dubois 1969, Clark et al. 1990), fruits (Clayton and Vernon 1993), and many other objects (Chisholm 1959, and references above). Here I report an observation of a tropical warbler performing "active anting" with a lepidopteran larva. To the best of my knowledge, anting with a caterpillar has not been reported previously. Most reports of anting involve passerines, especially in the families Corvidae, Sturnidae, Muscicapidae, and Emberizidae. Surprisingly few warblers (Parulinae) have been observed anting (Dater 1953, Tedards 1967), and this is the first report of a tropical paruline anting.

On 20 July 1991, at 07:30, I observed a Three-striped Warbler (*Basileuterus tristriatus*) foraging with a mixed-species flock on the edge of a treefall gap in the Monteverde Cloud Forest Reserve, Puntarenas, Costa Rica. The flock, which included another adult and one immature Three-striped Warbler, was near the intersection of the Chomogo and Pantanoso trails in lower montane rain forest at 1600 m elevation. The warbler captured a large (6 cm long) light green caterpillar and immediately dove from its perch down about 3 m to another perch in the same tree. The bird partially extended one wing at a time, and rapidly rubbed the caterpillar back and forth for about 2 seconds on the underside of each wing near the bases of the first few primary and secondary feathers in the bend of the wing. During the sequence of anting each wing was done twice, the right wing was rubbed before the

left wing both times, and the same place was rubbed on each wing. The caterpillar was vigorously writhing in the bird's bill. After anting the bird flew down to a lower perch where it was lost from sight but emerged a few seconds later and spent nearly 20 seconds wiping its bill on the perch. This bill wiping was more exaggerated than is typical for insectivorous passerines (pers. obs.) and included the commissural, loreal, and malar regions. Then the bird flew to another small tree where it captured and ate a mottled gray caterpillar that was much smaller and thinner than the first one. It handled this second prey item in a more typical fashion; striking the caterpillar against the branch several times while holding the prey in its bill. I searched the area where the bird disappeared from view but was unable to find the first caterpillar, whose color, size and shape suggested the family Sphingidae (sphinx moth). It is doubtful, however, that the bird had time to consume such a large item in the time it was out of sight.

Most observations of active anting involve pungent substances (Ehrlich et al. 1986, Clark et al. 1990, but see Hailman 1960), and it is likely that the caterpillar also released such a substance because lepidopteran larvae often do so (DeVries 1987). For example, the larvae of the Silver-spotted Sphinx Moth (*Callionira falcifera*), which occurs in Monteverde and fits the description of the larvae I observed, secrete a bitter yellow substance from a gland behind the head (Haber and Frankie 1980). This substance is thought to contain alkaloids but has not been analyzed. Larvae of the Papilionidae have eversible scent glands (osmeteria) that are believed to contain defensive compounds against predators and parasitoids (DeVries 1980). Additionally, it is well known that many lepidopteran larvae sequester plant compounds making them less palatable prey items (Dyer 1995). Many lepidopteran larvae regurgitate when handled by a potential predator, and such egesta would contain whatever chemicals were in the plant it had been feeding on (L. Brower, pers. comm.).

Because the warbler was foraging when it captured the caterpillar, and because caterpillars are a major component of the diet of *B. tristriatus* (pers. obs.), one might conclude that this observation supports the food prep-

aration hypothesis. Indeed, my first impression was that the bird was attempting to eat the caterpillar. Anting, however, is not the typical method of "food preparation" by *B. tristriatus*, but rather prey items are usually hit against the branch as this bird did with the second caterpillar. On the other hand, anting may be the typical food preparation of toxic prey with banging the typical preparation for nontoxic prey.

The molt irritation hypothesis is a possible explanation, considering that molt is usually symmetrical and this bird anted in the same place on both wings. *Basileuterus tristriatus* molts its primaries and secondaries sometime between early June and early August (F. G. Stiles, pers. comm.). I looked for, but could not see any signs of molt; however, it would be difficult to determine on a free-ranging small bird. Defense against ectoparasites or fungal infections is also possible although uncertain because I was unable to identify the caterpillar or examine the bird. It is interesting that so few tropical birds have been observed anting (Skutch 1948, Sutton 1951, Sick 1957, Whittaker 1996) as one might expect fungal or microbial infections to be at least as common in the humid tropics as in the north temperate zone. Skutch (1996:70), however, implies that he has seen anting behavior many times in Central America and notes that anting in the tropics usually takes place in trees or shrubs, whereas anting usually occurs on the ground in the temperate zone. Perhaps for this reason, many instances of anting in the tropics go unobserved.

Anting remains one of the unexplained puzzles of ornithology. The available information is dominated by anecdotal observations (such as this one). The diversity of items used for anting suggests that it is an opportunistic behavior induced by some feature of the ant or other object used. An experimental approach is likely to shed light on the function(s) of anting, but the few experiments thus far have reached conflicting conclusions (Judson and Bennett 1992, Clayton and Vernon 1993, Clayton and Wolfe 1993) perhaps because each has tested only one of the hypothesized functions.

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## Adoption Of Yellow Warbler Nestlings By Song Sparrows

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**ABSTRACT.**—Although interspecific brood adoption has been reported in several species of birds, the process by which it occurs has seldom been reported. We observed a pair of Song Sparrows (*Melospiza melodia*) that adopted a brood of Yellow Warblers (*Dendroica petechia*) and, gradually, over several days, took over the parental duties of the original parents. During the first five days of the nestling period, the brood was only attended by Yellow Warblers. In the following three days, however, a pair of Song Sparrows took over an increasingly larger proportion of the parental duties. This adoption probably resulted from misdirected parental care. Although the factors that led to the adoption are unknown, it is clear that the absence of the original parents was not prerequisite. Received 30 June 1997, accepted 3 Oct. 1997.

Interspecific parental care has been reported for several species of birds (e.g., Southern 1952, Watson et al. 1993). Perhaps the best known example is that of a Northern Cardinal (*Cardinalis cardinalis*) feeding a group of goldfish at the edge of a pond (Welty 1982). These accounts are usually limited to the actual observation of young of one species being cared by parents of another, and provide no information about the process by which this situation arose. Here we report an instance of adoption of Yellow Warbler (*Dendroica petechia*) nestlings by a pair of adult Song Spar-

rows (*Melospiza melodia*), and document a gradual process whereby over a period of a few days the Song Sparrows took over the parental duties of the original Yellow Warbler parents.

Our observations were obtained as part of a study of parental behavior in Yellow Warblers (see Lozano and Lemon 1996 for further details about the methods). During June 1995, at Pointe a Fourneau (45° 55' N, 73° 51' W), Ile Perrot, Quebec, Canada, we were conducting focal nest watches of several nests of a population of Yellow Warblers. The nest in question had been built in late May; the first egg was laid on May 29, and 4 additional eggs were laid on consecutive days. Of these eggs only 4 hatched, but, as part of an experiment, the brood size at this nest was increased to 6 nestlings. Two other nestlings of similar age and size were obtained from other Yellow Warbler nests, and were added the day after the nest's first nestling hatched.

Nest watches lasted 30 min and were conducted daily from the time nestlings were 3 days old until fledging occurred. During the first 3 nest watches only the two Yellow Warbler parents visited the nest (Fig. 1). In addition to feeding the nestlings, the female brooded them for 2:15, 0:45 and 11:40 min: s respectively. During the fourth watch, when the nestlings were 6 days old, a Song Sparrow fed the Yellow Warbler nestlings, as did the two Yellow Warblers parents. The two species were never present at the nest at the same time.

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