

### The Use of Green Plant Material in Bird Nests to Avoid Ectoparasites

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Certain birds characteristically place green plant material in their nests. This greenery is not part of the nest structure proper but is placed haphazardly around the edges or inside the nest. The birds replenish the sprays of green material, often daily, during incubation and the nestling period (Brown and Amadon 1968, Beebe 1976, pers. obs.).

I hypothesize that the plants are placed in the nests to repel or actually kill avian ectoparasites. Plant material may repel or kill ectoparasites because of the secondary compounds it contains. Secondary compounds often function as insect repellents in plants (Levin 1971). The compounds work as olfactory repellents, toxins, or juvenile hormone analogues to deter insects. If the parasite-repellent hypothesis is correct, the plant species chosen should be aromatically repellent, because avian ectoparasites do not ingest these leaves.

The aromatic compounds of plants are hydrocarbons, mainly monoterpenes and isoprene (Rasmussen 1972). In general, trees and long-lived shrubs emit the greatest volume of volatile compounds, whereas annuals emit the lowest volume of these compounds (Rasmussen 1972). Plant volatiles are used as a defense against herbivores but are also used by insects to locate their host plant (Freeland 1980). It has been established that volatile plant compounds can disrupt olfaction in insects by masking the particular chemical cue that the insect uses to find a host (Tahvanainen and Root 1972). If this is true of host-plant location, it may also be true of host-animal location. If my hypothesis is correct, then nest greenery would function in these manners.

There is evidence that infestations of ectoparasites

causes nestling mortality in and nest desertion by birds (Webster 1944, Neff 1945, Fitch et al. 1946, Moss and Camin 1970, Feare 1976, Wheelwright and Boersma 1979). In general, the increased mortality due to ectoparasites is caused by the loss of blood, which weakens the host, by viral disease, or by disease caused by noxious endoparasites for which arthropod parasites are vectors (Herman 1955). The groups of ectoparasites most responsible for mortality are dipterans, fleas, ticks, and mites (Herman 1955).

Three predictions follow from the hypothesis that the use of nest greenery evolved to inhibit infestations of ectoparasites. (1) Birds that reuse their nests over successive years should be more prone to the use of foliage than birds that build a new nest each year. Nest reuse is implicated because hippoboscids fly larvae overwinter in nests and emerge about the time the eggs hatch (Bequaert 1953). The larvae are large relative to their hosts. Thus, it does not take many of them to weaken their host significantly. A number of endoparasitic diseases also are transmitted by hippoboscids and simuliid flies (Herman 1955). (2) The incidence of foliage use among birds that prey on higher vertebrates (birds and mammals) should be greater than that among birds that prey on lower vertebrates, because higher vertebrates often harbor large flea populations, as well as some dipterans, ticks, and mites. Parasite transmission occurs when mammals are taken by birds; owls have been found infested with rodent fleas (Rothschild and Clay 1952). (3) The types of greenery used in the nest should be high in volatile secondary compounds.

I used the order Falconiformes in order to test the first two predictions because of the variability in greenery use, nesting habits, and food preferences that members of this order exhibit. To get the most accurate and consistent data base about relative frequency of greenery use for this comparative study, I

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