2023

Can the Food Preparation Hypothesis Account for Anting Behavior in Birds?

Ella Brady
Paul D. Camp Community College

Title:

CAN THE FOOD PREPARATION HYPOTHESIS ACCOUNT FOR ANTING BEHAVIOR IN BIRDS?

Author: Ella Brady[1]
Mentor: Deborah Waller[2]

[1]Paul D. Camp Community College
Franklin, VA 23851
[2]Old Dominion University
Norfolk, VA 23529

Abstract:
This report discusses the food preparation hypothesis, one of several proposed hypotheses to explain anting behavior in birds. A brief review of the theory's history and development, as well as an assessment of evidence for and against such a function of anting, is provided. Although there are indeed experimental data supporting food preparation as the purpose of anting behavior, there is also conflicting evidence which complicates the theory. Ultimately, it is suggested that food preparation is a secondary function of anting – a pleasant but latent "side effect" achieved alongside the behavior's primary purpose, which is still unknown.

Key terms: Anting by birds, food preparation hypothesis, active anting, passive anting, formic acid

1. INTRODUCTION

Anting is a complex and little-understood behavioral pattern observed in birds, characterized by inciting ants or other arthropods to spray chemicals onto the plumage. Although observations of anting by birds are relatively infrequent, the behavior has been confirmed in well over 200 species, mostly passerines (Morozov, 2015). Possible purposes for anting behavior in birds include deterring ectoparasites, inducing a state of ecstasy, relieving skin irritation during molt, and improving the effectiveness of grooming procedures – however, no particular one of these theories has garnered much more experimental support than any other (Morozov, 2015). One relatively sustainable proposal is that of *food preparation*, which views anting as a mechanism to remove unpleasant chemicals from food. Rather than spreading acids on the wings to kill parasites or bacteria, or some equally complex purpose, anting might be as simple as using the feathers like a towel. Rubbing ants repeatedly against the feathers forces them to expel all stored toxic chemicals, so that they may be safely consumed (Eisner & Aneshansley, 2008; Morozov, 2015). As long as the food preparation theory has existed, it has been championed by some in the field and rejected by others; upheld by some studies and cast in doubt by quite a few more. Although there certainly appears to be a relationship between anting and eating behaviors, it may not be as simple as the theory implies.

2. HISTORY

Anting behavior has been sporadically recorded as early as the 1830s, but organized attempts to study it began with the publications of Alec Chisholm, an Australian author, editor, journalist, and ornithologist. In 1934, Chisholm published a major work - *Bird Wonders of Australia* – which made mention of anting (Morozov, 2015). Within two years, a Swedish scientist proposed the food preparation hypothesis in response to published observations (Adlersparre, 1936, as cited in Morozov, 2015). It was soon adopted by renowned German ornithologist Erwin Stresemann, but was simultaneously rejected by several others, including Chisholm himself (Morozov, 2015).

3. SUPPORT

Decades after its dismissal from the general ornithology community, Adlersparre's theory resurfaced with a 1992 publication by Judson and Bennett (Morozov, 2015), who found a positive correlation between hunger and anting behavior in the common starling (*Sturnus vulgaris*) when presented with *Formica* ant species. The study's authors concluded that hunger increased the starlings' sensitivity to formic acid, which, in turn, triggered anting behavior in order to avoid ingestion of harmful chemicals (as cited in Eisner & Aneshansley). Following less than two decades later, a study of six tame blue jays (*Cyanocitta cristata*) revealed that, when presented with ants whose formic acid sacs were surgically removed, the jays would eat 96% of ants without anting first. The pattern of anting followed by eating was far more likely to be observed for a group of normally functioning ants. The same study noted that typical anting behavior effectively rids an ant of all its formic acid secretion, but does so gently enough to preserve the crop, which is perhaps the most nutritious portion (Eisner & Aneshansley, 2008).

Finally, many smaller reports published within the last century illustrate that birds in nature do often eat ants after anting with them. For example, in 1943, a Russian parasitologist performed a study on four Blyth's pipits (*Anthus godlewskii*) that he had seen anting and concluded that the number of ants counted in the birds' bills and stomachs was almost equal to the number involved in the anting procedure (Dubinin, 1951, as cited in Morozov, 2015). And in one of the latest publications, a turquoise jay (*Cyanolyca turcosa*) was seen performing anting behaviors with a millipede before consuming it (Coulson, 2023). These two reports, published eighty years apart, and a multitude of case studies between them identify a possible link between anting and foraging.

4. CHALLENGES

Despite the evidence above supporting a food-preparatory function of anting, there are several challenges – the first being passive anting behavior. During "active" anting, birds deliberately pick up one or more ants in the beak and rub them against the feathers (Morozov, 2015). In contrast, birds that practice "passive" anting visit anthills, attract a swarm of ants (usually by some means of agitation), and allow them to crawl at random over the plumage. Although passively anting birds often engage with the ants – usually to agitate them further, remove them from the head or legs, and/or "smear" a few at a time across the feathers – eating is not confirmed as a typical part of such interactions. Moreover, since the ants are free to roam as they please, there is no guarantee that any particular ant will spray away all its formic acid. Finally, if the purpose of anting is simply to prepare a tasty snack, why would anting birds intentionally arouse swarms of biting, caustic-chemical-spraying insects? Clearly, food preparation accounts poorly – if at all – for passive procedures.

The second issue is that birds are sometimes observed anting without eating, and vice versa. For instance, during a multi-year observational period in a central Japanese forest, anting was confirmed in eight bird species over 100 times total (Ohkawara et al., 2022). However, less than 30% of those events resulted in eating - the remaining 70% of anting birds discarded their ants afterward. Also, at least one of the eight species – the Japanese Gray Thrush (*Turdus cardis*), which made nearly 130 visits to the research site - spent 40-50% of its visits foraging for food *without* anting first. The study's authors wrote that "the food preparation hypothesis was ruled out for all cases."

A third concern is that ants aren't in the standard diets of some anting species. For example, in 1997, an American Dipper (*Cinclus mexicanus*) in Montana was seen rubbing approximately fifteen ants, one at a time, up and down the underside of its right wing (Osborn, 1998). Similarly, in 2012, a European Honey-buzzard in central Spain was observed gathering fresh maple and oak twigs, spreading the twigs across a sandy trail, and assuming a passive anting posture in the center. Subsequent visits to the site confirmed that the twigs were likely an example of "tool use" intended to attract ants for anting (Camacho & Potti, 2018). The problem is that American Dippers are aquatic passerines, eating worms, snails, aquatic insects, and sometimes even small fish ("American Dipper," n.d.), while Honey-buzzards are raptors that feed on wasp larvae (Sterry, 2021). How, then, can their behavior be explained in light of the food preparation theory?

Finally, the hypothesis is challenged by the use of toxic substitutes during anting. The academic literature records some 40 or more "substitute" objects that birds apply to the plumage during active anting procedures, ranging from millipedes to even hot chocolate (Morozov, 2015). Many of these substitutes are non-nutritious, inedible, or even toxic – soap suds, bubbles of tap water, beer, tobacco products (e.g., smoking cigarettes, cigarette butts, lit matches, and pipe ashes), mothballs, and even pure naphthalene, to name a few (Morozov, 2015). These case studies support the idea that pungent chemicals (e.g., formic acid and naphthalene) are the triggers for anting. However, they also suggest that anting is practiced not to remove those chemicals, but to extract some desirable quality from them.

5. CONCLUSION

Although the food preparation hypothesis is validated by multiple experiments and observations, it is challenged by the existence of passive anting, the use of inedible substitutes in anting procedures, and the clear distinctions between anting and foraging events. It seems the primary purpose of anting lies in some useful function of an ant's chemicals, rather than merely their removal from the ant. Of course, for birds that do feed on ants, anting can certainly be said to expel toxic ingredients from a potential meal. Therefore, it becomes useful for food preparation, whether that is its intended purpose or not. At this time, it is reasonable to suggest that food preparation is a secondary function of anting – somewhat akin to a beneficial "side effect." That said, there is still much to discover about the nature behind this complex bird behavior.

REFERENCES

American Dipper: *Cinclus mexicanus*. (n.d.). *Dakota Birder Blog*. Retrieved August 10, 2023, from https://www.sdakotabirds.com/species/american_dipper_info.htm

Camacho, C., & Potti, J. (2018). Non-foraging tool use in European Honey-buzzards: An experimental test. *PLoS One, 13, e*0206843. Retrieved August 6, 2023, from https://doi.org/10.1371/journal.pone.0206843

Coulson, J. O. (2023). Turquoise jay *Cyanolyca turcosa* self-anointing (anting) with a millipede. *Ornitología Neotropical, 34*(1), 17-20. Retrieved August 6, 2023, from https://doi.org/10.58843/ornneo.v34i1.971

Eisner, T., & Aneshansley, D. (2008). 'Anting' in blue jays: Evidence in support of a food-preparatory function. *Chemoecology*, 18(4), 197-203. Retrieved August 6, 2023, from https://doi.org/10.1007%2Fs00049-008-0406-3

Morozov, N. S. (2015). Why do birds practice anting? *Biology Bulletin Reviews, 5*(4), 353-365. Retrieved August 11, 2023, from http://dx.doi.org/10.1134/S2079086415040076

Ohkawara, K., Kamei, Y., & Akino, T. (2022). Anting behavior in birds: the behavioral patterns and the interactions with ants in the subgenus *Dendrolasius* of the genus *Lasius*. *Journal of Ornithology, 163*, 633-641. Retrieved August 6, 2023, from https://doi.org/10.1007/s10336-022-01974-5

Osborn, S. A. H. (1998). Anting by an American dipper *(Cinclus mexicanus)*. *The Wilson Bulletin, 110*(3), 423-425. Retrieved August 6, 2023, from http://ezjtcc.vccs.edu/login?url=https://www.proquest.com/scholarly-journals/anting-american-dipper-cinclus-mexicanus/docview/
198749349/se-2

Sterry, P. (2021). *In focus - a closer look at European Honey-buzzard.* Birds on the Brink. Retrieved August 10, 2023, from https://www.birdsonthebrink.co.uk/blog/in-focus-a-closer-look-at-european-honey-buzzard