

Host birds only tolerate parasitic cuckoo eggs in their nests when they fear retaliation

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The American brown-headed cowbird lays its eggs in other birds' nests and leaves its young to the foster parents. If the host birds reject the eggs the cowbird turns nasty: It destroys the nest and by this forces the victims to accept its eggs in the future. Credit: 123RF/S. Byland

The brown-headed cowbird is nothing short of a nightmare for its hosts:

If they eject the brood parasite's eggs from the nest, it punishes them by destroying their entire clutch. Researchers from the Max Planck Institute for Evolutionary Biology in Plön and Harvard University have designed a mathematical model for analyzing the interaction between avian brood parasites and their hosts. The model calculations show that birds only accept a brood parasite's eggs in their nests if they are forced to do so by retaliation on the part of the invader.

The mafia hypothesis provides an explanation as to why some host birds do not remove parasites' [eggs](#) from their [nests](#). The cuckoo lays its eggs in other birds' nests to spare itself the effort of raising its own young. However, some parasitic avian species like the North American brown-headed cowbird (*Molothrus ater*) or the European great spotted cuckoo (*Clamator glandarius*) depredate their hosts' nests out of revenge when the hosts do not accept their eggs. Under these circumstances, it makes sense for the host birds to tolerate the additional work involved in raising the cuckoos in the nest to avoid endangering the lives of their own offspring.

Host birds can have different reactions to [brood parasites](#): while some basically accept other birds' eggs, others weed them out immediately. Others again only accept parasitic eggs when their nests have already been depredated on one occasion. Which of these behavioural strategies is most successful depends on the prevailing environmental conditions and on how often the adversary arises in a population: if there are a lot of mafia parasites around, it is worthwhile for the hosts to accept the parasitic eggs without resistance. However, if the parasites do not retaliate, host birds that remove the cuckoo eggs from their nests immediately are at an advantage. As a result, the frequency of the different behavioural strategies fluctuates in regular cycles.

Not all scientists support the mafia hypothesis, however. It is also possible that parasitic birds depredate other birds' nests so that the hosts

will be forced to produce a new clutch, in which they can then place their own eggs at a time that suits them best. This behaviour, which is known as 'farming', is not always easy to distinguish from retaliation in practice. Hence it is not entirely clear whether retaliation or 'farming' is a better strategy for ensuring the toleration of parasitic eggs by host birds.

The Max Planck researchers reconstructed the interaction between farming and retaliation and conditional and unconditional tolerance with the help of a computer model. The results they obtained suggest that hosts only tolerate cuckoo eggs in their nests when the parasites punish them by adopting a strategy of retaliation. "In contrast, farming behaviour – that is the depredation of mature clutches without the hosts being able to learn from it – results in the rejection of parasitic eggs by the hosts. In the absence of mafia parasites, it makes more sense for the hosts to throw cuckoo eggs out of the nest," explains Maria Abou Chakra from the Max Planck Institute for Evolutionary Biology.

The frequency of the four behaviours fluctuates cyclically depending on the prevailing environmental conditions. Hosts and parasites compete against each other in a constant evolutionary race. Each strategy is met with a counter-strategy. "There is no optimal behaviour in such host-parasite relations. Neither party can outsmart the other on a permanent basis," says Arne Traulsen, Director of the Department for Evolutionary Theory at the Max Planck Institute in Plön.

More information: Maria Abou Chakra et al. Coevolutionary interactions between farmers and mafia induce host acceptance of avian brood parasites, *Royal Society Open Science* (2016). [DOI: 10.1098/rsos.160036](https://doi.org/10.1098/rsos.160036)

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