Biologists expand on more than 150 years of textbook wisdom with a new explanation for wasp mimicry

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An almost perfect similarity: A wasp (left) and a moth are barely distinguishable from each other. Credit: Michael Boppré

The masquerade is almost perfect. Certain moths of the subfamily Arctiinae are marked with a yellow and black pattern. But these day-active insects have wasp waists and their antennae resemble those of wasps. Their transparent wings are folded in a wasp-like way. For more than 150 years there has been a plausible explanation for this type of imitation, which is commonly known as mimicry. It says that the moths - just like many hoverflies and other insects - imitate wasps in order to protect themselves from birds and other hostile predators. According to textbook wisdom, these voracious foes have learned from painful experience. They have been stung by wasps and since then have avoided any animal that looks like one. In the scientific journal *Ecology and Evolution*, a University of Freiburg biologist, Prof. Dr. Michael Boppré and his team have now presented an additional hypothesis that goes beyond this traditional view. Their interpretation is that, above all, the moths' appearance deceives the very wasps they are mimicking.

As a rule, insects developing imperfect similarity to wasps is enough to keep learning predators at a distance. Yet the Arctiinae that Boppré observed during his biodiversity studies in South and Central America are different. The biologist says, "Especially when they are in flight, even for the trained eye it's nearly impossible to tell apart the examples from the mimics." That led Boppré to question why these Arctiinae have evolved this near-perfect imitation and what creatures they are trying to deceive. He says, "The answer - wasps - is stunningly simple." Wasps hunt other insects as food for their larvae. Yet wasps do not attack each other, even when they are out on hunting flights they do not differentiate the wasps they encounter as originating from their own or other nests. The moths, therefore, are imitating the wasps so that these predators will perceive them as members of the same species and not attack for that reason.

Boppré and his co-authors emphasize that they are expanding upon rather than providing an alternative to the traditional explanation for mimicry. The researcher emphasizes, "The new explanation may seem to be a small detail at the outset, but this concept alone has far-reaching consequences." The conventional explanation established more than 150 years ago played an immediate role in Charles Darwin's theory of evolution. It is also based on fundamental assumptions. One of these is that mimicry can only function if the true 'models' (in this example the actual wasps), at least at times, are more abundant than their imitators. The assumption says that only then is it probable that predators learn to avoid these species through bad experiences. Species that develop this type of deception must pay for the advantage - the protection that imitation offers - with the cost of being fewer in number. But that's not the case for these Arctiinae and various other insects. Says Boppré, "The imitation of wasps that innately fail to

attack their imitators does not come at this cost."

More information: Michael Boppré et al, A hypothesis to explain accuracy of wasp resemblances, *Ecology and Evolution* (2017). DOI: 10.1002/ece3.2586

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