

Hind wings help butterflies make swift turns to evade predators, study finds

January 7 2009, By Krishna Ramanujan

(PhysOrg.com) -- New tires allow race cars to take tight turns at high speeds. Hind wings give moths and butterflies similar advantages: They are not necessary for basic flight but help these creatures take tight turns to evade predators.

"To escape a predator, you don't have to be fast, you just have to be more erratic," said Tom Eisner, a world authority on animal behavior, ecology and evolution and the Jacob Gould Schurman Professor Emeritus of Chemical Ecology at Cornell. Eisner is co-author of a study on butterfly wings recently published in the *Proceedings of the National Academy of Sciences* (105: 43).

The study proposes that in the course of evolution, the ability of butterflies to evade predators became linked with bright coloring, as an added protection. In evolutionary terms, gaudy colors are usually a sign to such predators as birds that a prey species has a protective quality, such as a bad taste or great agility, and that chasing them isn't worth the energy. Anyone who has tried to net a colorful butterfly knows they are hard to catch, but this is the first study to show that a butterfly's hind wings are responsible for making them evasive.

Eisner and the paper's lead author, Benjamin Jantzen, (M.S. physics '02), a doctoral student in philosophy of science at Carnegie Mellon University, clipped off the hind wings of butterflies and then filmed their flight using two cameras to get three-dimensional views of their flight trajectories; then they analyzed and plotted on a computer the

insects' flight velocity, acceleration, how fast they changed direction, the curvature of their path and more.

They found that clipping the back wings did not affect basic flight, but "we were able to show that removing the hind wings cut their turning acceleration in half," said Jantzen. The butterfly's hind wings scoop air and provide extra force to quickly turn when chased.

Eisner added that some butterflies have other qualities that are linked with their bright coloring as a sign for predators not to eat them. Monarchs also taste bad, for example. Other studies have shown that distasteful butterflies are slower and easier to catch. Butterfly wings are also scaly, slipping easily from a bird's bill, and if the butterfly is caught it's found to be "mostly wrapper and very little candy," said Eisner.

"The wings are also colorful advertising for the whole group," said Jantzen. "The colors say, we are butterflies, don't bother to chase us, because you won't catch us."

Movie: www.news.cornell.edu/stories/J...utterfliesEisner.mov

Provided by Cornell University

Citation: Hind wings help butterflies make swift turns to evade predators, study finds (2009, January 7) retrieved 19 April 2024 from <https://phys.org/news/2009-01-hind-wings-butterflies-swift-evade.html>

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