To quiver or to shiver: Explaining warning signal diversity in wood tiger moths

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A central question in evolutionary biology is what causes the diversity of appearance seen in animals of the same species? Diversity is the raw material evolution has to act on, and this is why it is important to study the processes causing diversity. However, organisms that possess warning signals telling that they are unpalatable are not really expected to have very diverse forms of coloration. Such organisms are known as "aposematic," and a similar looking coloration which acts as a warning signal is a way to make sure that potential predators will recognize and avoid them. It is especially interesting to take a look at the cause of diversity in the appearance of aposematic species because it is not predicted.

To probe mechanisms that cause diversity in the appearance of wood tiger moths, researchers from the Centre of Excellence in Biological Interactions at the University of Jyväskylä, Finland, studied how melanization in aposematic male wood tiger moths varied across Europe. They observed that male wood tiger moths were darker in the Alps and also in Northern Finland. Some previous work on other species indicated that more melanized butterflies and moths might have better ability to warm up more efficiently.

"Warming up in places like the Alps and Northern Finland is probably pretty important if you are a male moth trying to fly around to find the females," says researcher Robert Hegna.

Based on the evidence of the moth's appearance and temperature in

places where moths were more melanized together, the researchers hypothesized that the different benefits promoting more melanin was traded of in cooler places and more in warmer places.

After completing laboratory-based thermoregulation studies and field-based predation experiments, researchers concluded their hypothesis was correct. They found that the differences in how melanized the moths look were linked to two processes, both acting on the same trait in a "tug-of-war" competition. Such a phenomenon is known as a "trade-off". Moths with less melanin were more protected against predators probably because their bright colors were more conspicuous to predators, while moths with more melanin were less protected from predators. However, moths with more melanin could warm up more quickly, which might enable them to be out looking for females more often in cooler weather than their less melanized counterparts. This would explain why moths in the Alps tended to be more melanized than many of the moths in Finland and shows that diversity in appearance can potentially be caused by complications.

Provided by Academy of Finland

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