

Insects hold atomic clues about the type of habitats in which they live

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Scientists have discovered that insects contain atomic clues as to the habitats in which they are most able to survive. The research has important implications for predicting the effects of climate change on the insects, which make up three-quarters of the animal kingdom.

Applying a method previously only used to examine the possible effects of [climate change](#) on plants, scientists from the University of Cambridge can now determine the climatic tolerances of individual insects. Their research was published today, 16 February, in the scientific journal *Biology Letters*.

Because insects are at constant risk of desiccation, they have a waterproof [exoskeleton](#) which protects them from [dehydration](#). Therefore, measuring hydration levels in an insect gives little if no indication of the type of habitat they live in (for example, whether it is humid or dry). Moreover, most insects live in the undergrowth, or in the soil; in tropical rainforests the insects live many hundreds of feet up in the canopy, which makes it very difficult to observe them directly. Using the atmospheric imprint, it will now be possible to decipher the habitat preferences of individual insects no matter where they live.

By taking advantage of a unique property of the [oxygen isotopes](#) in water; namely that the isotopes behave differently during [evaporation](#) and condensation, the researchers were able to determine how much water an insect loses when it 'breathes' through holes in its outer skeleton called spiracles, providing important insight into the type of atmosphere

(for example, humid like the rain [forest](#)) it could survive.

Water (H₂O) is made up of two types of oxygen – ¹⁸O and ¹⁶O. Because ¹⁶O is lighter, when water evaporates it leaves behind more ¹⁸O. Using cockroaches, the scientists measured the levels of the two different oxygens in the insects' circulatory fluid - called haemolymph - as well as in their outer skeleton. From this information they were able to determine how much water had evaporated and therefore identify the atmospheric conditions necessary for the insect to survive.

Insects living in a dry atmosphere have a higher concentration of ¹⁸O as a result of a greater water loss. Insects living in very humid conditions tend to lose less [water](#) and therefore have a nearly equal ratio of ¹⁶O to ¹⁸O. With this new method, researchers will be able to predict where species are most likely to survive (e.g. in Sahara-desert dry and rainforest humid), and will be able to pinpoint with great accuracy which species share the most similar niches.

"There is an urgent need for a better understanding of how global environmental change will affect threatened plants and animals," said Dr Farnon Ellwood, lead author of the paper. "If we can determine the habitat preferences of individual [insects](#), we can use this information to predict how climate change will impact on a group representing three-quarters of the Earth's animal species."

More information: The paper 'On the vapour trail of an atmospheric imprint in insects' was published today, 16 February 2011 in the advanced online publication of the journal *Biology Letters*. It will appear in the April issue of the print edition.

Provided by University of Cambridge

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