

Cockroaches Control Their Breathing to Save Water

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A cockroach mom shelters her newborn babies. Credit: by Allen Moore

(PhysOrg.com) -- Many insects have been known for decades to hold their breath when resting, but the reasons have not been well understood. A new study on cockroaches suggests the insects reduce their breathing to conserve moisture.

Cockroaches can hold their breath for up to seven minutes. Their [respiratory system](#) is highly efficient but there are no lungs. Instead, the insects draw in air through external valves called spiracles and transport the air directly to the cells via tubes called trachea. To stop breathing, they simply close the spiracles.

The new study, reported in the *Journal of Experimental Biology* tested

the major hypotheses put forward to explain the practice of holding the breath for long periods. One hypothesis is that the insects are trying to build up the carbon dioxide produced during respiration, which makes it easier to expel from the body. Another idea is that they stop breathing to protect themselves from high oxygen concentrations (which can be toxic). The third hypothesis is that the practice aims to regulate water loss.

One of the scientists, Dr Craig White, an animal physiologist at the University of Queensland, explained that the trachea do not just carry air inwards to the cells, they also carry water out of the cells. The hypothesis is that when they are resting and have a lower oxygen requirement, they close the spiracles to conserve water.

The Australian team of scientists tested the hypotheses by monitoring the breathing of cockroaches over four weeks and under different conditions of humidity, and oxygen and [carbon dioxide](#) levels, so some cockroaches spent the four weeks in high humidity, others in low humidity, some with humidity constant but oxygen levels low or high, and so on.

The study found that in low humidity the cockroaches held their breath longer, which confirms these [insects](#) adapt to dry environments by adjusting their behavior. This ability to adapt to the conditions may be one reason why cockroaches are such a successful group, and why they have survived for so long.

More information: Cockroaches breathe discontinuously to reduce respiratory water loss, [Journal of Experimental Biology](#) 212, 2773-2780 (2009); [doi: 10.1242/jeb.031310](https://doi.org/10.1242/jeb.031310)

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