

Climate change damaging male fertility

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T. castaneum spermatozoon. Credit: University of East Anglia

Climate change could pose a threat to male fertility—according to new research from the University of East Anglia.

New findings published today in the journal *Nature Communications* reveal that heatwaves damage [sperm](#) in insects—with negative impacts for fertility across generations.

The research team say that male infertility during heatwaves could help to explain why climate change is having such an impact on species populations, including climate-related extinctions in recent years.

Research group leader Prof Matt Gage said: "We know that biodiversity is suffering under climate change, but the specific causes and sensitivities are hard to pin down.

"We've shown in this work that sperm function is an especially sensitive trait when the environment heats up, and in a model system representing a huge amount of global biodiversity.

"Since sperm function is essential for reproduction and population viability, these findings could provide one explanation for why biodiversity is suffering under climate change.

"A warmer atmosphere will be more volatile and hazardous, with extreme events like heatwaves becoming increasingly frequent, intense and widespread.

"Heatwaves are particularly damaging extreme weather events. Local extinctions are known to occur when temperature changes become too intense. We wanted to know why this happens. And one answer could be related to sperm."

The research team investigated the red flour beetle (*Tribolium castaneum*) to explore the effects of simulated heatwaves on [male reproduction](#).

The beetles were exposed to either standard control conditions or five-day [heatwave](#) temperatures, which were 5°C to 7°C above their thermal optimum.

Afterwards, a variety of experiments assessed the potential damage to reproductive success, sperm function and offspring quality.

Heatwaves killed sperm

The team found that heatwaves halved the amount of offspring males could produce, and a second heatwave almost sterilised males.

Females, by contrast, were unaffected by heatwave conditions. However, female reproduction was affected indirectly because experiments showed that heatwaves damaged inseminated sperm within female reproductive tracts.

Following experimental heatwaves, males reduced sperm production by three-quarters, and any sperm produced then struggled to migrate into the female tract and were more likely to die before fertilisation.

Kirs Sales, a postgraduate researcher who led the research, said: "Our research shows that heatwaves halve male reproductive fitness, and it was surprising how consistent the effect was."

The group also explored the underlying causes of male vulnerability. Heatwaves caused some impact on male sexual behaviour—with males mating half as frequently as controls.

Heatwaves caused damage across generations

"Two concerning results were the impact of successive heatwaves on males, and the impacts of heatwaves on future generations," said Sales.

"When males were exposed to two heatwave events 10 days apart, their offspring production was less than 1 per cent of the control group. Insects in nature are likely to experience multiple heatwave events, which could become a problem for population productivity if male reproduction cannot adapt or recover."

The research also shows that offspring sired by heatwaved dads—or their sperm—live shorter lives—by a couple of months.

And the reproductive performance of sons produced by dads—or sperm—exposed to heatwave conditions was also impacted. Sons were found to be less able to fertilise a series of potential mates, and produced less offspring.

The researchers warn that this could add extra pressure to populations already suffering through climate change over time.

"Beetles are thought to constitute a quarter of biodiversity, so these results are very important for understanding how species react to [climate change](#). Research has also shown that heat shock can damage male reproduction in warm blooded animals too, and past work has shown that this leads to infertility in mammals," added Sales.

The researchers hope that the effects can be incorporated into models predicting species vulnerability, and ultimately help inform societal understanding and conservation actions.

'Experimental heatwaves compromise sperm function and cause transgenerational damage in a model insect' is published in *Nature Communications* on Tuesday, November 12, 2018.

More information: Kris Sales et al, Experimental heatwaves compromise sperm function and cause transgenerational damage in a

model insect, *Nature Communications* (2018). DOI: [10.1038/s41467-018-07273-z](https://doi.org/10.1038/s41467-018-07273-z)

Provided by University of East Anglia

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