Darwin was right: Females prefer sex with good listeners

May 26 2017, by Dr Nerissa Hannink

The gum-leaf skeletoniser moth. Credit: Peter Marriott

Almost 150 years after Charles Darwin first proposed a little-known prediction from his theory of sexual selection, researchers have found that male moths with larger antennae are better at detecting female signals.

In 1871, Charles Darwin suggested that a female's choice of mate could drive the evolution of mating signals in males. His idea stems from his observations of the iconic courtship displays of peacocks, the songs of crickets and his contemporary insights into the whimsical nature of human females.

The male is effectively advertising his qualities and if a female chooses to mate with him, the genes for his traits are passed on to their offspring in the next generation, ensuring the evolution of the male display and the female's preference.

The theory of sexual selection has dominated research into animal behaviour for decades, and Darwin's theory of sexual selection is well supported by thousands of studies, says evolutionary biologist Professor Mark Elgar, from the University of Melbourne's School of Biosciences.

"But Darwin also proposed that sexual selection can favour males who are better at detecting and responding to signals from females, including chemical signals like pheromones. So males with sensory structures that can better detect female signals may have the edge in finding them in order to mate and pass on their genes."

But he says this idea has been largely overlooked until now.

Professor Elgar and his team have been investigating the idea using moths. They are now the first to show that males with larger antennae are better equipped to detect the low quantities of sex pheromone, a chemical signal, released by females moths to attract males.

The study included PhD student Tamara Johnson, Professor Elgar and Dr Matthew Symonds from Deakin University and has been published in the journal *Science of Nature*.

A female Uraba lugens moth in calling posture. Credit: Author supplied

The team set up field experiments with the gum-leaf skeletoniser moth, *Uraba lugens*. The moths get their name from the damage they cause to Eucalyptus trees.

The adults only live for around seven days and do not eat in this time, says PhD student Tamara Johnson.

"Within this week, the moths must attract a mate, sometimes competing

with many other moths in the same area," she says.

Female U.lugens moths attract the attention of males by releasing sex-phermonones, with the chemical signal peaking at seven hours into the first phase of darkness in their adult life.

While adult females have a simple filiform or threadlike antennae, males have feathery, bipectinate antennae.

Following Darwin's original suggestion, the team predicted that males with larger antennae, which have more chemical sensors, would better detect smaller amounts of sex pheromone.

As part of her PhD project, Ms Johnson placed traps at dusk with either one or two female moths. The number of males, and the size of their antennae, that were caught in the traps were recorded the next day.

"We conducted our field experiments in Royal Park, Melbourne which has a large population of *U.lugens*," says Ms Johnson.

The antenna of a male gum-leaf skeletoniser moth. Credit: Author supplied

The researchers found that male moths with larger antennae, independent of their body size, were more likely to detect the sex pheromone of a single female.

"Our data are consistent with Darwin's 1871 prediction that sexual selection favours exaggerated sensory receptor structures like antennae," says Dr Symonds.

"As evolutionary biologists, it's very rewarding to be able to support a long-standing idea, originally floated by Darwin, that hasn't attracted much attention," he says.

The team also suggests that females adjust their signaling to maximise their encounters with particular kinds of males, rather than to simply maximise encounters with any males.

"Our data suggest that by releasing smaller amounts of pheromone, the female increases the likelihood of attracting males with longer antennae. These males may be better mates because producing and maintaining a large sensory structure is costly and possible for higher quality males only. Those male qualities may be passed onto her offspring," says Professor Elgar

The team also found that if females are initially unsuccessful at attracting a male, then calling effort is increased to attract more mates, but potentially poorer quality males, as reflected by their shorter antennae.

Males attracted to traps with two females, whose combined pheromone emission was presumably greater, had relatively smaller antennae.

Our results show that females may have a significant and largely unrecognised role in the sexual selection of elaborate antennae, Professor Elgar says.

"For the gum-leaf skeletoniser moth, males that are good listeners apparently make attractive mates."

More information: Tamara L. Johnson et al. Sexual selection on receptor organ traits: younger females attract males with longer antennae, *The Science of Nature* (2017). DOI: 10.1007/s00114-017-1466-4

Provided by University of Melbourne