

Females shut down male-male sperm competition in leafcutter ants

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Leafcutter ant workers carry leaf pieces down into underground nests where they use them as fertilizer for their fungus garden. Ants eat the fungus, not the leaves.
Credit: STRI

Leafcutter ant queens can live for twenty years, fertilizing millions of eggs with sperm stored after a single day of sexual activity.

Danish researchers who have studied [ants](#) at the Smithsonian Tropical Research Institute in Panama since 1992 discovered that in both ant and bee species in which queens have multiple mates, a male's seminal fluid favors the survival of its own sperm over the other males' sperm. However, once sperm has been stored, leafcutter ant queens neutralize male-male sperm competition with glandular secretions in their sperm-storage organ.

"Two things appear to be going on here," explains Jacobus Boomsma, professor at the University of Copenhagen and Research Associate at STRI. "Right after mating there is competition between sperm from different males. Sperm is expendable. Later, sperm becomes very precious to the female who will continue to use it for many years to fertilize her own eggs, producing the millions of workers it takes to maintain her colony."



Intense male-male competition continues even after mating has taken place in Atta ants. This study showed that in both ant and bee species in which queens have multiple mates, a male's seminal fluid favors the survival of its own sperm over the other males' sperm. Credit: Miriam Arrueta, STRI

With post-doctoral researchers Susanne den Boer in Copenhagen and Boris Baer at the University of Western Australia, professor Boomsma studied sperm competition in sister species of ants and bees that mate singly—each queen with just one male—or multiply—with several males.

Their results, published this week in the prestigious journal, *Science*, show that the ability of a male's seminal fluid to harm the sperm of other males only occurs in species that mate multiply, and that their own [seminal fluid](#) does not protect sperm against these antagonistic effects.



Leafcutter ant queens store sperm for several decades, slowly fertilizing eggs to create colonies of millions of worker-daughters. After mating with multiple males, they can halt sperm competition within their own bodies using fluid from their sperm-storage organ. Credit: Miriam Arrueta, STRI

"Females belonging to many species—from vertebrates to insects-- have multiple male partners. Seminal products evolve rapidly, probably in response to the intense male-male competition that continues even after courtship and mating have taken place," said William Eberhard, Smithsonian staff scientist. "This study continues the STRI tradition of

looking at post-copulatory selection in a very biodiverse range of organisms, following in the footsteps of people like Bob Silberglied, who asked why butterflies and moths have two kinds of sperm in the 1970's."

Similar sperm competition systems appear to have evolved independently in ants and in bees. Researchers now aim to discover how genes that control [sperm](#) recognition in [bees](#) and ants may differ, thus continuing to elucidate the details of a process key to reproduction and evolution.

More information: Susanne P.A. den Boer, Boris Baer, Jacobus Boomsma. Seminal fluid mediates ejaculate competition in social insects. *Science*. 18 Mar. 2010.

Provided by Smithsonian Tropical Research Institute

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