

Unusual sex chromosome creates third sex in Hessian flies

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(PhysOrg.com) -- Expectant human parents might wish for a boy or girl, but Hessian flies actually have a third option, and, no matter what, the flies are never surprised by the sex of their offspring.

Jeff Stuart, a Purdue University professor of entomology, and graduate student Thiago Benatti found that a [sex chromosome](#) in the mother predetermines the sex of Hessian fly [offspring](#). The chromosome carries a gene called Cm (chromosome maintenance) that can create one of three basic sexes.

"When a mother carries this chromosome, she produces two types of females: female-producing females and male-producing females. Without the chromosome, the mother produces only males," Stuart said. "That means the species is composed of three different sex-related groups."

In humans, an egg contains an [X chromosome](#), and a sperm contains an X or a Y. When [sperm](#) and egg unite, offspring with an XX combination become female and offspring with an XY combination become male. In Hessian flies, however, a female with the unusual chromosome, called W-prime (W') produces only females. Half of her offspring will carry the W' and produce only females, whereas the other half lacking the W' will produce only males.

Cm, one or more [genes](#) on the chromosome, has caused the evolution of the W' chromosome. It arose because the chromosome combination in

Hessian flies isn't created at conception, as is the case with humans, but is established by chromosome elimination during [embryonic development](#).

"I think that the mechanism of embryonic chromosome elimination is an evolutionary remnant of when this insect's ancestors were able to produce offspring without having sex," said Stuart, whose findings were released in the March issue of the journal *Genetics*.

Understanding the sex-determination process in the Hessian fly could lead to a way to control its populations or eliminate it altogether. The Hessian fly is the major pest of wheat crops, causing millions of dollars of damage annually.

Stuart said it might be possible to genetically modify Hessian flies using the Cm gene to eliminate the fly's ability to produce one of the sexes. Those modified flies could be introduced into fly populations to eliminate it as a pest.

"We're hopefully going to be able to manipulate this to bring the insect to its own demise," he said. "We may be able to use it to drive maladaptive traits into the population."

Stuart said the next step in the research would be to study the evolution of the Cm gene and determine the mechanisms it uses to control sex determination.

Provided by Purdue University

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