Inbreeding insects cast light on longer female lifespans

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Inbreeding can unexpectedly extend male lifespan. Insect experiments described in the open access journal BMC Evolutionary Biology have shown that, in seed beetles, inbreeding causes males to live longer, while shortening female lifespan.

Both sexes do, however have lower reproductive fitness when inbred.

Trine Bilde from Uppsala University, Sweden, worked with a team of researchers investigating why females tend to live longer than males. She said, "Sex differences in lifespan are ubiquitous throughout the animal kingdom but the causes underlying this phenomenon remain poorly understood. We used sex-specific responses to inbreeding to study the genetic architecture of lifespan and mortality rates in seed beetles."

One theory to explain the shorter male lifespan commonly seen in mammals and insects, the 'unguarded X-hypothesis', holds that any mutated deleterious genes on the X-chromosome are expressed in males who have only one X-chromosome, while these genes are 'guarded' by the second X chromosome in females and therefore not expressed. According to this theory, inbreeding should cause females to suffer from a reduction in lifespan, while male lifespan should be less affected. This is because when the two female X chromosomes both contain the same version of a gene, which is more likely under inbred conditions, the deleterious genes are expressed and no longer 'guarded'.

The authors created lines of inbred beetles and compared their lifespans to normal, outbred beetles. They found that males did suffer less than females from lifespan reduction as a result of inbreeding, in accordance with the unguarded-X theory. However, they also noted a significant shift towards an altogether longer male lifespan following inbreeding compared with outbred males, a pattern that the theory cannot satisfactorily account for.

According to Bilde, "No model based on asymmetrical inheritance can explain increased male lifespan in response to inbreeding". The authors' results are, however, compatible with sex-specific lifespan selection based on reproductive strategies. This theory holds that males and females have different routes to maximal reproductive success and, therefore, the relationship between lifespan and fitness can differ among the sexes. For example, males can benefit from intense early investment in finding mates at the expense of a prolonged lifespan, while females need to invest more in each offspring and therefore benefit from a relatively longer lifespan. If inbred males are less likely to engage in normal energy-demanding male reproductive behaviours, the result would be both prolonged lifespan and reduced fitness. Females, who may optimize their reproductive output by conserving energy, might then be expected to experience a reduction in fitness and lifespan as a result of inbreeding, as shown here.

Bilde concludes, "Our results suggest that differences in lifespan among males and females may result from such sex-specific selection".

More information: Sex-differences in the genetic architecture of lifespan in a seed beetle: extreme inbreeding extends male lifespan, Trine Bilde, Alexei A Maklakov, Katrine Meisner, Lucia la Guardia and Urban Friberg, *BMC Evolutionary Biology* (in press)
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