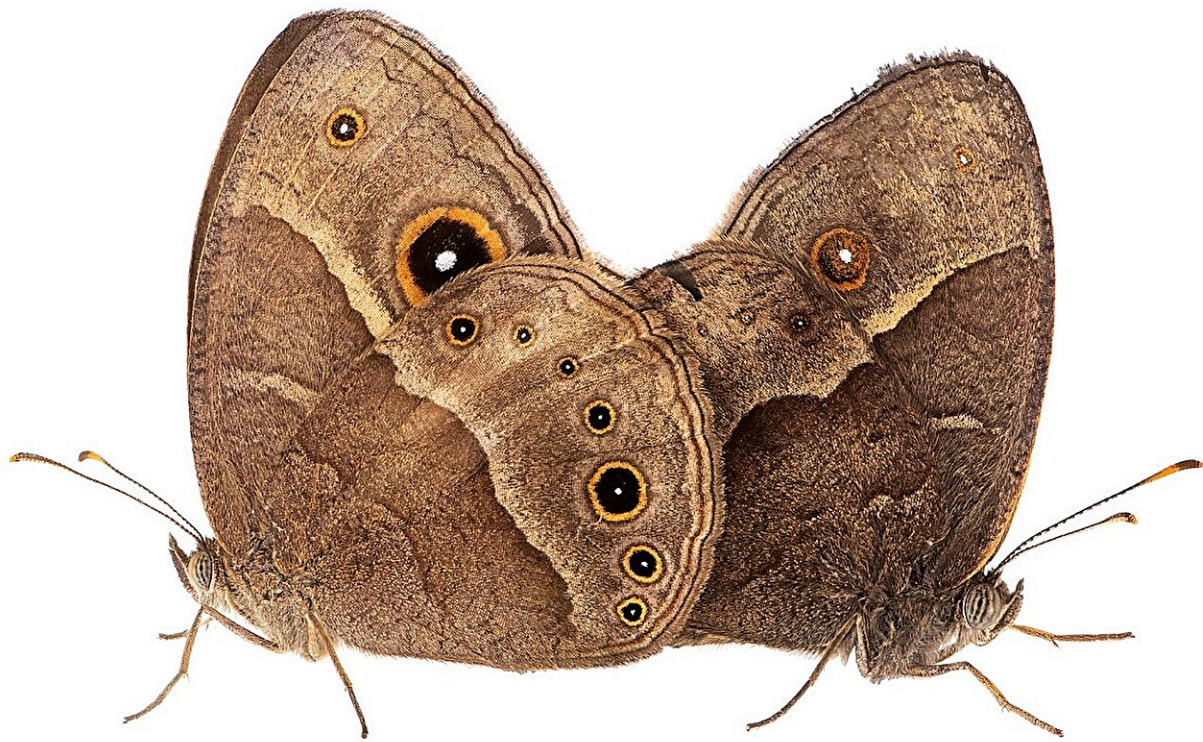


# Male or female? Scientists discover the genetic mechanism that determines sex development in butterflies

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A mating pair of *Bicyclus anynana* female (left) and male (right). Credit: Arjen Van't Hof, Biology Centre CAS

Scientists of the Biology Centre, Czech Academy of Sciences, in collaboration with University of Liverpool have found the genetic

mechanism that determines whether individuals of the butterfly species *Bicyclus anynana* become male or female.

They also discovered that if individuals with the same variant of the sex-determining gene mate, the embryos will not survive. This can have critical consequences in small butterfly populations with low genetic variation, where mating occurs between related individuals.

This is the first time that scientists have described this mechanism in butterflies and, surprisingly, it resembles a similar mechanism in honey bees. The discovery is [published](#) in the journal *Science Advances*.

The squinting bush brown *Bicyclus anynana* is native to the African continent. It is often used for genetics research, partly due to its ability to reproduce rapidly and breed relatively easily in laboratory conditions, moreover, its entire genome has already been sequenced.

As revealed by entomologists led by Arjen Van't Hof from the Biology Centre CAS and an international team of collaborators, the sex of this butterfly is regulated by different combinations of variants of a gene called Masculinizer. A single variant leads to female development and two different variants result in male development.

The butterflies die as embryos when two identical variants of Masculinizer are combined but this is very uncommon in [natural populations](#) because a huge number of different variants was found. The chance of having two identical variants resulting in embryonic death becomes much higher in strongly declined populations with reduced [genetic variation](#) caused by inbreeding.

Many [butterfly species](#) are strongly in decline and if other species do have the same mechanism as *Bicyclus anynana*, it can have serious consequences for [critically endangered species](#).



Lepidoptera, a large insect group consisting of butterflies and moths, have W and Z sex chromosomes instead of X and Y. Females usually have a W and a Z chromosome and males have two Z chromosomes. Sex is determined by the W chromosome in some species, but there are also species in which females do not have a W chromosome.

"These species have different sex-determining mechanisms which are not known yet. The mechanism we discovered in *Bicyclus anynana* is very different from the W chromosome-dependent mechanism discovered earlier in the silkworm *Bombyx mori*," say the researchers.

**More information:** Arjen van't Hof et al, Zygoty-based sex determination in a butterfly drives hypervariability of Masculinizer, *Science Advances* (2024). DOI: [10.1126/sciadv.adj6979](https://doi.org/10.1126/sciadv.adj6979).  
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Provided by Biology Centre of the Czech Academy of Sciences

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