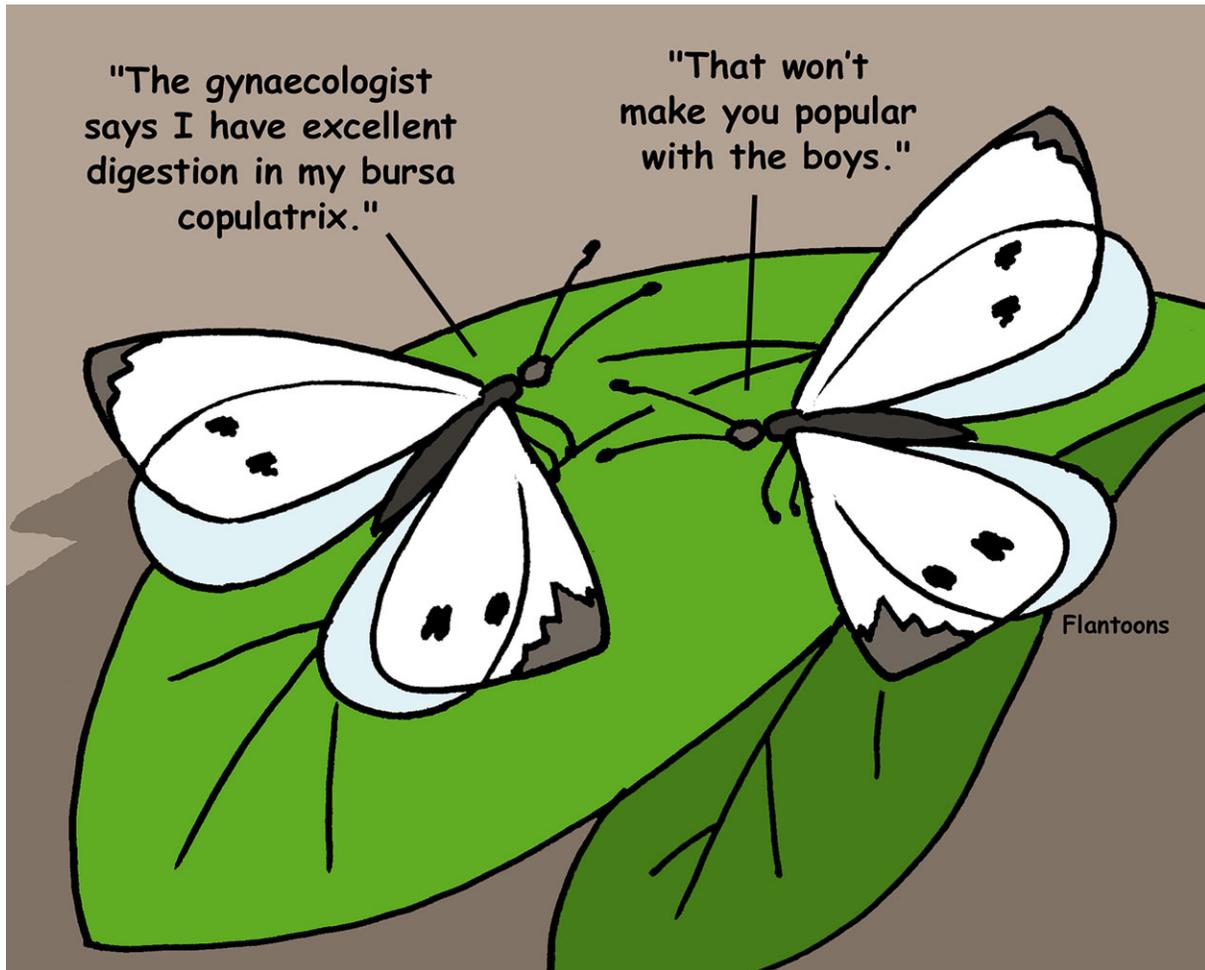


## Female butterflies digest sperm packages in love duel



When the Elizabethan dramatist John Lyly coined the phrase, 'All is fair in love and war', butterflies were probably the last thing on his mind. But, in the never-ending battle between the sexes, the sentiment is tailor-made for these duelling mates. Melissa Plakke and colleagues from the University of Pittsburgh, USA, explain that ejaculating male butterflies deliver their sperm in a package, called the spermatophore, containing other compounds that probably nourish the female, although this may sometimes be at her expense. However, in the spirit of combat, the females have fought back, developing a specialised organ – the bursa copulatrix – designed to release the sperm rapidly and then dispose of the remaining package with grinding structures and protein-digesting enzymes in a bid to mate with as many males as possible. Plakke says, 'Little was known about how the bursa digests the spermatophore',

so the team began investigating the bursa of small cabbage white butterfly virgin females in various social situations and recently mated females to find out how they break down spermatophores.

Painstakingly extracting proteins from the butterflies' bursal tissue, the team found the reproductive organ produced high levels of proteolytic enzymes: by 3 days after emergence, the protein-digesting capacity of the females' tiny bursas surpassed the protease activity of the large intestines of hungry caterpillars. However, after mating, the protease levels in the bursas of recently mated females initially fell, increasing again 5 days later. And when the team investigated which protein-degrading enzymes the tissue was producing, they identified nine proteases.

Admitting that they are impressed that the bursa copulatrix (~1 mg) is capable

of producing as much protease activity as the 20 mg caterpillar midgut, the team also points out that the enzyme activity varies wildly over time, suggesting that both the males and females may contribute to protease regulation. They also suggest that instead of producing proteases on demand, the females accumulate and store large amounts of the enzymes in the bursa, placing them at risk of internal damage, although they suspect that the females mate early and frequently enough to protect them from self-harm.

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Plakke, M. S., Deutsch, A. B., Meslin, C., Clark, N. L. and Morehouse, N. I. (2015). Dynamic digestive physiology of a female reproductive organ in a polyandrous butterfly. *J. Exp. Biol.* **218**, 1548-1555.

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