Fighting fruit flies: Aggressive behavior influenced by previous interactions

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Aggressive fruit flies in battle. Credit: University of Guelph

Once a bully, always a bully?

It's not that simple, according to a new University of Guelph study of aggression in fruit flies that underlines the often unpredictable nature of behaviour from insects to humans.

The study is the first to show that effects of an earlier aggressive encounter carry over in time and across different social groups but not necessarily in expected ways, said Julia Kilgour, lead author and a Ph.D. student in the Department of Integrative Biology.

The study was published recently in the journal *Behavioral Ecology*.

"This study shows that aggression doesn't just depend on who you are and who you're interacting with but also depends on your previous interactions. That's the unique part," Kilgour said.

In different settings and from one encounter to the next, the schoolyard bully might turn passive or the mild-mannered office worker might unexpectedly lash out at a colleague.

"Aggression is a plastic trait," said Prof. Andrew McAdam, who co-advised Kilgour along with integrative biology professor Ryan Norris. "Someone may be aggressive with one partner and not another."

For this study, Kilgour worked with two strains of fruit flies specially bred for aggressive or non-aggressive behaviour.

She sorted the flies into five social groups, including two homogeneous groups: one with all aggressive insects and another with all non-aggressive flies.

For the three other groups, she mixed flies with those opposing traits: 75-percent aggressive; 50-50 aggressive and less aggressive; and 75-percent less aggressive.

From each of the five social groups, half were placed in clusters of only 30 insects and the other half in swarms of 300 flies. Each of the resulting 10 clusters received the same amount of food for four days, forcing the insects into less or more competition for the fixed resource.

Kilgour also separated males and females to see whether sex affected behaviour.

PhD student Julia Kilgour, Department of Integrative Biology Credit: University of Guelph

After four days, she measured aggression in all the groups. To do that, she paired an individual fly from each group with a new fly and looked for characteristic head-butting in females and lunges in males.

Describing pugilism Drosophila-style, Kilgour said, "One fly will rear up and snap down on the other fly. It gets pretty aggressive."

The team found that males in homogeneous groups—whether in high- or

low-density clusters of flies—became more aggressive in later one-on-one encounters.

Among mixed groups, male flies that made up a minority also became more aggressive. But males from groups of equally mixed strains and males that made up a majority showed no more aggression in subsequent one-on-ones.

In all cases, the effects lasted for up to three days.

Researchers found no behavioural change among female flies, although Kilgour said further tests might uncover more subtle differences.

Although she can't explain the varied responses among groups, she said the study underlines the unpredictable nature of behaviour. "We thought that aggression was always going to be beneficial to get what you want. But it's not so clear cut. This shows how complicated behaviour is, even in fruit flies."

As for people, she added: "Our behaviour is heavily influenced by past social experiences. We may not always behave in a way that is optimal—being angry when we shouldn't or being passive when we shouldn't. Part of the reason is our social experiences."

McAdam said behaviour in one place may not always predict what happens later in other settings.

Referring to day-to-day stresses, he said, "We all hope to leave work at work and not bring it home, but inevitably you carry some of your previous social interactions back home, and these influence how you interact with your loved ones.

"Or a child in school acting in one way: that behaviour might not

necessarily be explained only by what happens in the classroom. Children bring previous experiences from home or other places with them to school each day."

More information: R J Kilgour et al, Carry-over effects of resource competition and social environment on aggression, *Behavioral Ecology* (2019). DOI: 10.1093/beheco/arz170

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