

The small insect with a big heart: the 'giving' aphids endangered by their selflessness

February 3 2010



An aphid giving birth to live young. Image: Wikipedia.

One of the founding principles of Darwin's theory is that biological evolution has been shaped by the survival of the fittest. Things, however, are not always that simple as researchers from Royal Holloway, University of London have discovered while analysing the social behaviour of aphids.

A few aphid species have “soldiers” who stop reproducing and instead contribute to the public good. Not only do they risk their lives to defend the nest from invaders, but they also mend and clean it. The repair work involves the aphids secreting a glue-like substance from their bodies - comprising two thirds of their body size. They use their legs to mix it and form a scab. But many of the soldier aphids die from the significant loss of [body mass](#). Without the soldiers’ efforts all the aphids could be

destroyed by a [predator](#) or the nest could fall apart.

Researchers from Royal Holloway wanted to discover whether the selfless behaviour of the soldiers was putting them in danger of being wiped out by selfish free-riders who come to inhabit the nests. These “immigrant” aphids do not contribute to the running of the nest and continue to reproduce at a normal rate. An average nest will have 25% immigrants, allowing free-riders a chance to spread throughout the population at large, similar to the spread of a tumour.

The study, ‘The impact of colonial mixing on the [evolution](#) of social behaviour in aphids’, is being published in [Proceedings of the Royal Society B](#) today. Dr John Bryden, from the School of Biological Sciences at Royal Holloway, said, “We are interested in understanding why animals are nice to each other - why they show social behaviour. This is puzzling because, in a fiercely competitive fight for resources, helping others seems like a fool’s game.”

The academics attempted to answer the question by making a [mathematical model](#). "It turned out that the complex lifecycle of the aphids can be captured in simple numbers expressing levels of relatedness, that help understand why social behaviour can evolve. What surprised us is not that this is possible, this has long been known, but that something so difficult can be boiled down to something so simple," says Vincent Jansen, Professor of Mathematical Biology at Royal Holloway.

“We know that helping behaviour can evolve if the recipient is more likely than an average member of the population to show the same behaviour. This likelihood of being the same is called relatedness. As relatedness is increased, more helpful behaviour will evolve. What isn't well known is how we can predict the relatedness of a population and how that will affect the levels of social behaviour,” says Dr Bryden.

The study shows how it is possible to reduce the complex system of aphids growing, living in, and migrating between nests down to a simple equation - predicting the relatedness of the [aphid](#) system.

“We have discovered that immigration can reduce the level of social behaviour, but that the quite surprising levels of immigration that we see in aphids is still not sufficient to trigger a full-scale collapse of the aphid's societies,” adds Dr Bryden.

The scientists say the model they have created can be reused, with additions and modifications, to try and understand more complex social behaviour in other animals.

Dr Bryden, said, “The goal of modelling and understanding human societies is still a long way away, but we hope that through tackling increasingly complex biological systems we can take steps toward that goal.”

More information: ‘The impact of colonial mixing on the evolution of social behaviour in aphids’, by Dr John Bryden and Professor Vincent A. A. Jansen, School of Biological Sciences at Royal Holloway, University of London, is published in *Proceedings of the Royal Society B*.

Provided by Royal Holloway, University of London

Citation: The small insect with a big heart: the 'giving' aphids endangered by their selflessness (2010, February 3) retrieved 9 April 2024 from <https://phys.org/news/2010-02-small-insect-big-heart-aphids.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.
