

Vomiting caterpillars weigh up costs and benefits of group living

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Many species of caterpillars defend themselves by regurgitating semi-digested food. Image by Dr Mike Speed

(PhysOrg.com) -- A type of caterpillar which defends itself by regurgitating on its predators is less likely to do so when in groups than when alone, a new study by researchers from the University of Bristol and the University of Liverpool has found. Such reluctance is sufficient to cancel out the benefits of being in a group.

The study, published today in [Ecology Letters](#), will help in the design of more sustainable methods for reducing crop losses caused by [caterpillars](#) and similar pests.

[Animals](#) have some remarkable and unusual ways to defend themselves

against enemies. While many rely on nasty stings and dangerous venoms, the caterpillars of the large white butterfly (*Pieris brassicae*) protect themselves by vomiting on their [predators](#).

These caterpillars, like many other species that have anti-predator defences, live in groups so that they have safety in numbers. However, many studies have shown that the size of a group does not affect the chance of survival in several different species.

Caterpillars of this species have reason to use their defensive regurgitation weapon sparingly since the loss of food through vomiting slows down growth, reduces survival and even reduces female reproduction by lowering the number of eggs.

This new study shows that there is a social side to defensive vomiting. The researchers found that whether a caterpillar is willing to regurgitate – and to what extent – depends on the size of its social group.

Dr Andrew Higginson of Bristol’s School of Biological Sciences said: “Because defensive regurgitation is so costly, each individual does better if one of its siblings is the one to vomit to deter the predator. Therefore, some individuals appear willing to risk being ‘cheats’, not investing in the costly defence, and exploiting the likelihood that other individuals will defend instead. Crucially we found that the number of non-vomiting individuals increased as their risk decreased with group size – a result of safety in numbers.”

Co-author, Dr Mike Speed of Liverpool’s Institute of Integrative Biology continued: “Caterpillars take account of their group size when ‘deciding’ whether to vomit because they are trying to avoid the cost of vomiting. In a group, it is quite likely that the predator will taste other individuals as well, each of whom might vomit and cause the predator to give up and leave. Also, caterpillars compete with each other for food, and so the

bigger the group the more important it is to not vomit.”

Using a mathematical model, the researchers show that this reduced tendency to vomit can easily explain why the size of a group does not affect the chance of survival.

Dr Higginson added: “This study helps us to better understand the defences of many caterpillars and similar insects, several of whom are important crop [pests](#). It will ultimately help in the design of more sustainable methods for reducing [crop losses](#) experienced by farmers.”

More information: ‘Density-dependent investment in costly anti-predator defences: an explanation for the weak survival benefit of group living’ by Derek Daly, A. D. Higginson, Dong Chen, G. D. Ruxton and M. P. Speed in [Ecology Letters](#)

Provided by University of Bristol

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