Disturbing ant-aphid mutualism for better biological control of aphids

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Introduction

\begin{itemize}
\item Ants and myrmecophilous aphids have a complex mutualistic relationship.
\item Rosy apple aphid, \textit{Dysaphis plantaginea} (Passerini), is a serious pest of apple, and is commonly attended by the ant, \textit{Lasius niger} (L.).
\item Ants feed on the sugar rich honeydew of aphids and provide protection against natural enemies.
\item Sticky barriers exclude ants from trees, but application is time consuming, and may exclude important natural enemies (e.g. \textit{Forficula auricularia} L.).
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Objective

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\item Can effective biological control of \textit{D. plantaginea} on apple be achieved by disturbing ant-aphid mutualism by application of an alternative sugar source for ants?
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Material and methods

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\item Replicated orchard experiment in three organic apple orchards (East Malling Research (EMR, UK) in 2011 (cv. Queen Cox and Bramley) and 2012 (cv. Fiesta)) and (Research and Extension Centre for Fruit Growing, Újfehértó (Hungary) in 2013 (cv. Topaz))
\item There were 3 treatments (see pictures on left):
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\item Sucrose solution in bottle feeders at the base of tree trunks
\item Sticky barrier bands around tree trunks (positive control)
\item Untreated trees (negative control)
\end{itemize}
\item Preparation of aphid colonies for assessments:
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\item Labelling of the original fundatrices (EMR, UK, 2011, 2012)
\item Artificial aphid infestation (Újfehértó, Hungary, 2013)
\item Marking the original and new colonies
\item Numbering of leaves within each colony
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\item Sampling:
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\item Spring, early summer
\item Regular field counts of aphids, ants and predators
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Results

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\item Sticky barriers on the tree trunks excluded most ants from the tree canopy, resulting in a rapid decrease of \textit{D. plantaginea} populations as a result of increased activity of natural enemies (see pictures below).
\item Sticky barriers, but not sucrose feeders, prevented \textit{F. auricularia} climbing the trees.
\item Sucrose feeders reduced the activity of \textit{L. niger} in the tree canopy. Ants were distracted from aphid searching or abandoned the colonies they were already tending.
\item The loss of ant protection caused rapid reduction in \textit{D. plantaginea} numbers by increasing the activity of natural enemies.
\item Occasionally, the ants did not completely stop visiting the colonies, but they stopped or reduced their efforts in protecting the aphids.
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Conclusions

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\item Application of sucrose solution can be an alternative way to reduce the level of protection of the aphid colonies by ants, and through this to support biological control of \textit{D. plantaginea} by natural enemies.
\item This method is likely to be applicable to organic growing systems.
\item Further work is needed to develop an economical and more practical sugar feeder formulation, which could be used in commercial orchards.
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