Making sure your prey eat well: parasitoids prefer aphids that feed on good host plants.

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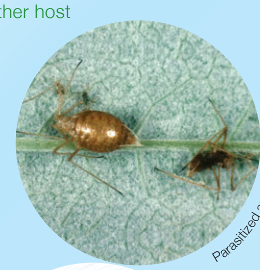
The large raspberry aphid (*Amphorophora idaei*) is an important virus transmitting vector in UK raspberry production. Genetic aphid resistance within the plant is breaking down and alternative methods of control that are not reliant on chemicals are urgently required. One option is biological control with parasitoids such as *Aphidius ervi* which has a wide host range and is commercially available.

We investigated whether host plant suitability (e.g. raspberry cultivars with differing aphid resistance) and aphid biotype (e.g. the ability of aphids to overcome this resistance) affected the ability of *A. ervi* to attack aphids.



Parasitized aphid

UK raspberry production

Large raspberry aphid

Materials and Methods

A mated female *A. ervi* was allowed to parasitise a set density (5, 10, 20 or 50) of aphids for 30 minutes. There were 5 treatments (Table 1). The data were analysed using ANOVA. The estimation and comparison of the functional response was done using Rogers Random Parasitoid model (Rogers, 1972).

$N_a = N\,[1 - \exp\{-TaP/(1 + aT_hN)\}]$

Treatment	*A. idaei* biotype	Raspberry cultivar	Plant suitability for aphids
1	Biotype 2	Malling Jewel	✓✓✓✓
2	Biotype 2	Malling Landmark	✓✓✓
3	A_{10} resistance breaking	Malling Jewel	✓✓✓
4	A_{10} resistance breaking	Malling Landmark	✓✓
5	A_{10} resistance breaking	Glen Rosa	✓

Table 1 The five treatments used in the experiment and the suitability of the cultivar for aphid development.

Results

There was a significant effect of cultivar (P = 0.001), aphid biotype (P = 0.05) and aphid density (P < 0.001) on parasitoid oviposition behaviour. In particular, there were significantly more ovipositions within biotype 2 aphids feeding on Malling Landmark . There was a significant difference in the number of ovipositions at all densities except 20 versus 50 (Figure 1).

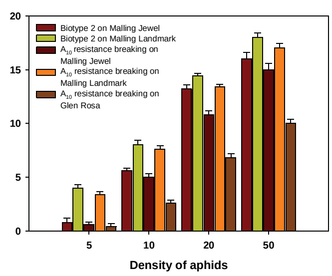


Figure 1 Mean number of ovipositions at different densities in the five treatments. Error bars represent standard error.

Linear transformation of the data enabled the searching efficiency (a) and handling time (b) to be estimated and from these, an estimated model curve was generated. (Figure 2)

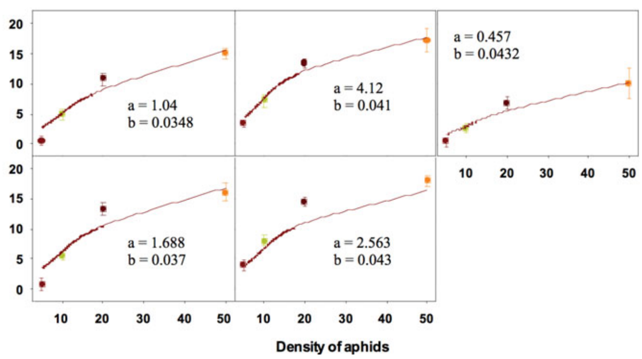


Figure 2 Comparison of the random parasitoid model with actual values for *A. ervi* ovipositing (a) A_{10} resistance breaking biotype on Malling Jewel (b) A_{10} resistance breaking biotype on Malling Landmark (c) A_{10} resistance breaking biotype on Glen Rosa (d) Biotype 2 on Malling Jewel (e) Biotype 2 on Malling Landmark. Errors bars represent 95% confidence limits.

Conclusions

There are tritrophic interactions between resistance genes within the plant, the two biotypes of *A. idaei* and the parasitoid, *A. ervi*. This gives scope for combining already present resistance genes within the plant with a new method, biological control, to control *A. idaei* numbers without a reliance on insecticides.

Aphidius ervi favoured biotype 2 aphids and also favoured aphids feeding on less resistant plants indicating that the parasitoid was able to distinguish between hosts of different quality.

The model indicates a Type 2 functional response which suggests that the parasitoid is relatively ineffective at controlling pest numbers when they are at high densities. If biological control was used, the parasitoid would have to be introduced before the aphid pest became established.

References

Rogers, D. (1972) Random search and insect population models. *Journal of Animal Ecology*, 41, 369-383.

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