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Can chelifers be made to control varroa mites in beehives?

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Background

Resistance by *Varroa destructor* (varroa) (Figure 1) is occurring to miticides from two of the three chemical classes currently used in New Zealand to control this pest⁽¹⁾. As an alternative, or to complement, existing miticide options, Pseudoscorpions (Arthropoda, Arachnida, Pseudoscorpionida) as generalist predators, are being investigated in New Zealand for biological control of varroa.

Two native species of Pseudoscorpion surviving in beehives in the North Island⁽²⁾ were shown not to be suitable candidate species. *Heterochnes novaezealandiae* was not easily propagated in captivity. *Nesochnes gracilis* was easily propagated⁽³⁾, with each adult consuming 1–9 mites a day in dishes⁽⁴⁾. However, the adults were rapidly evicted from an experimental hive by bees when introduced into the brood chamber containing varroa.



Figure 1. Honey bee with *Deformed Wing Virus* transmitted by varroa mites.



Figure 2. Chelifer (5 mm long body).

Chelifers

Recently, attention has focused on an introduced species, *Chelifer cancroides* (chelifer) (Figure 2). This species can live with honey bees and were common in skep hives throughout parts of Europe⁽⁵⁾⁽⁶⁾, but have not tolerated modern beekeeping practices.

Chelifers are known to feed on varroa⁽⁷⁾ and have been shown to live commensally with bees when refuged in specially constructed beehives⁽⁸⁾. Adults live 3–4 years, with females typically producing 1–3 clusters of c. 30 eggs per year. The nymphs hatch and mature through 3 growth stages over 10–24 months⁽⁹⁾. However, it is not known whether the rate of predation on varroa is sufficient to make a useful contribution to control of varroa or if chelifers even preferentially feed on varroa within a hive.

We propagated chelifers in captivity to provide enough individuals to evaluate their potential for control of varroa in New Zealand. The chelifers were raised in bars, which attached to a frame designed to fit into a standard hive.

Evaluations

Trial

The chelifers were transferred in frames directly into 10 honey bee hives at an apiary (Figure 3). Their effects on varroa numbers were compared with varroa numbers in untreated control hives and those treated with Bayvarol[®] miticide.



Figure 3. Chelifer evaluation in hives (a) with chelifers courting in bars within hives (b).

After 5 months, varroa populations in the chelifer treatments were as high as those in the untreated control hives.

	Numbers of varroa/100 bees		
	Feb.	Apr.	Jun.
Untreated	0.0	7.2	18.7
Chelifers	0.1	8.2	17.6
Miticide	0.1	0.3	11.7

A DNA test⁽¹⁰⁾ confirmed that while some chelifers had fed on varroa, there was no evidence of varroa feeding in 87% of the chelifers tested (Figure 4).

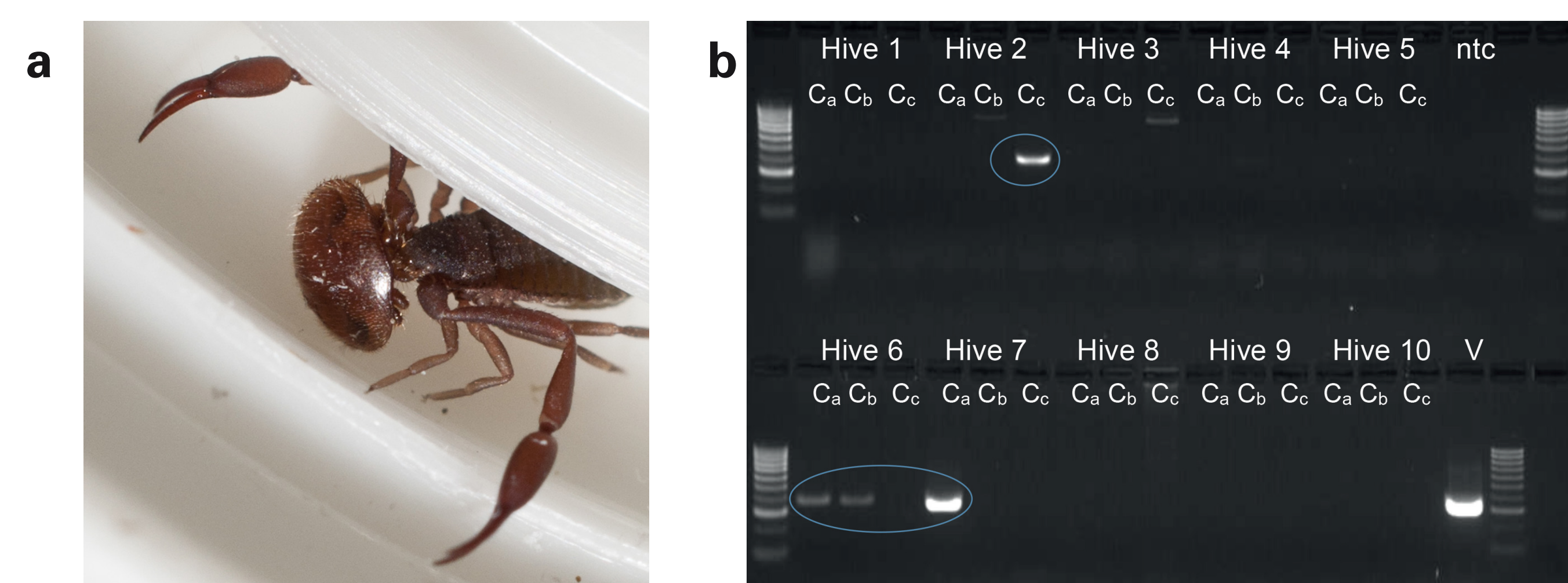


Figure 4. Chelifer feeding on varroa (a) and DNA analysis (b). Varroa (V) DNA was found in four (circled) of the 30 chelifers (C_a, C_b, C_c) sampled from each of 10 hives, compared with the non-treated control (ntc), indicating these four chelifers had fed on varroa within the last 4 weeks.

Further observations

A new design of chelifer insert was tested in the following summer-autumn (Figure 5). A mean of 201 chelifers/hive was placed on the bottom boards of six hives. After a mean of 13 weeks:

- In chelifer-treated hives, chelifer numbers declined to a mean of 88 chelifers/hive and mean varroa numbers were 46 mites/100 bees.
- In 3 hives with the Bayvarol[®] for 9 weeks, varroa numbers were 0.8 mites/100 bees.



Figure 5. Observations showing chelifers feed on varroa in commercial hives.

General conclusions

- The method used to introduce chelifers into hives did not result in any measureable reduction in varroa mite numbers in hives compared with untreated hives
- To evaluate the potential of chelifers to contribute to varroa control, we need a fundamental understanding of the predation rate and food preferences of chelifers
- If the predator/prey relationship appears to support the potential use of chelifers for biological control of varroa, the methods used to introduce and hold the varroa within the hives will be a critical success factor.

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