

Intracolony selection for hygienic behaviour in the Dark European honey bee.

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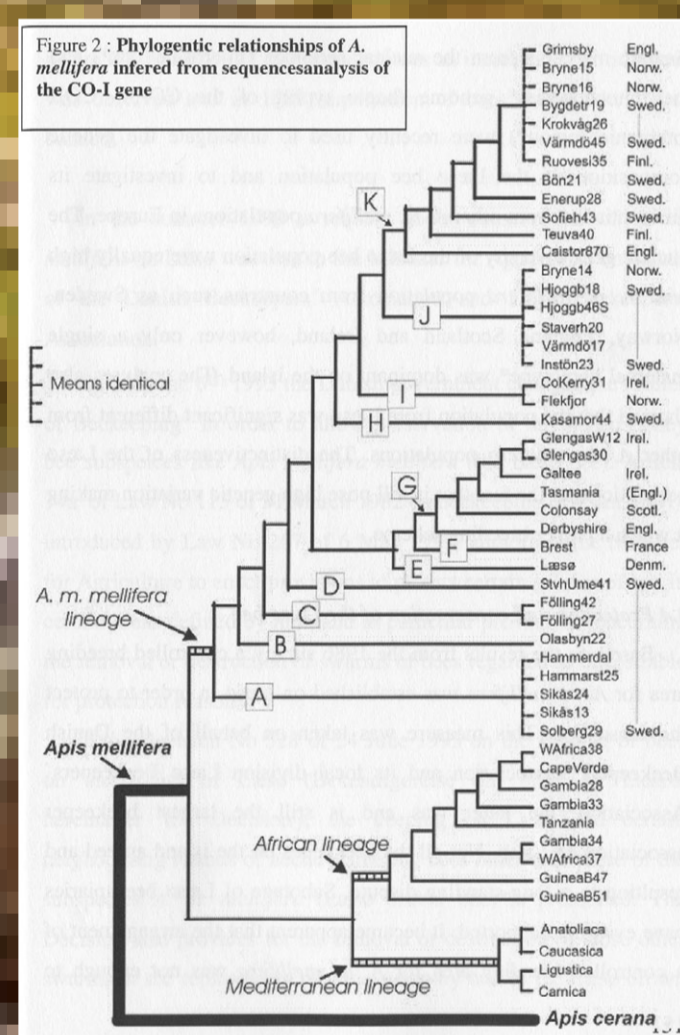
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1. Background

Over the last few years, there has been much concern about extensive losses of honey bee colonies worldwide. These losses are often thought to be unexplained, but consensus is growing that pests and diseases, together with environmental factors, are responsible (Neumann & Carreck, 2010; Ratnieks & Carreck, 2010). In the UK, losses have been greater than normal (Aston, 2010), but are almost certainly caused by inadequate control of the parasitic mite *Varroa destructor*. Mite resistance to the most commonly used chemicals has left beekeepers with few effective alternatives, leading to a search for non chemical methods such as breeding "resistant" strains of bee.

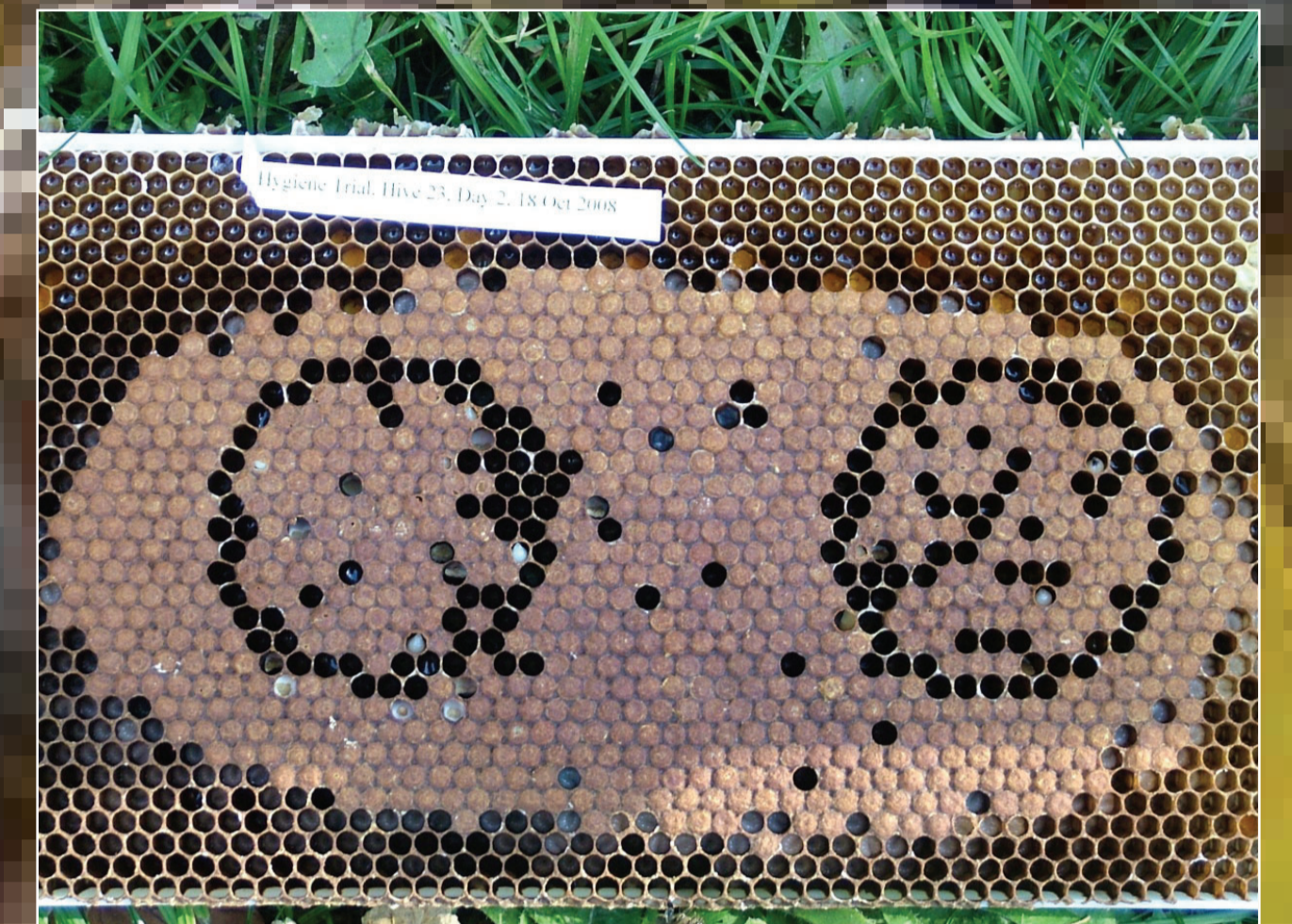
2. What is hygienic behaviour?

"Hygienic behaviour" is a natural trait shown by most strains of honey bee which enables workers to detect and remove brood cells infected by disease. It was first exploited to suppress American foulbrood and chalkbrood, but has also been shown to control *V. destructor* (Peng *et al.*, 1987). Standardised tests using freeze killed brood enable objective measurement of expression of the trait. In various parts of the world "hygienic" strains of bee have been marketed, but these are not available in the British Isles.



Jensen & Pederson (2005).

Non-hygienic colony



Hygienic colony

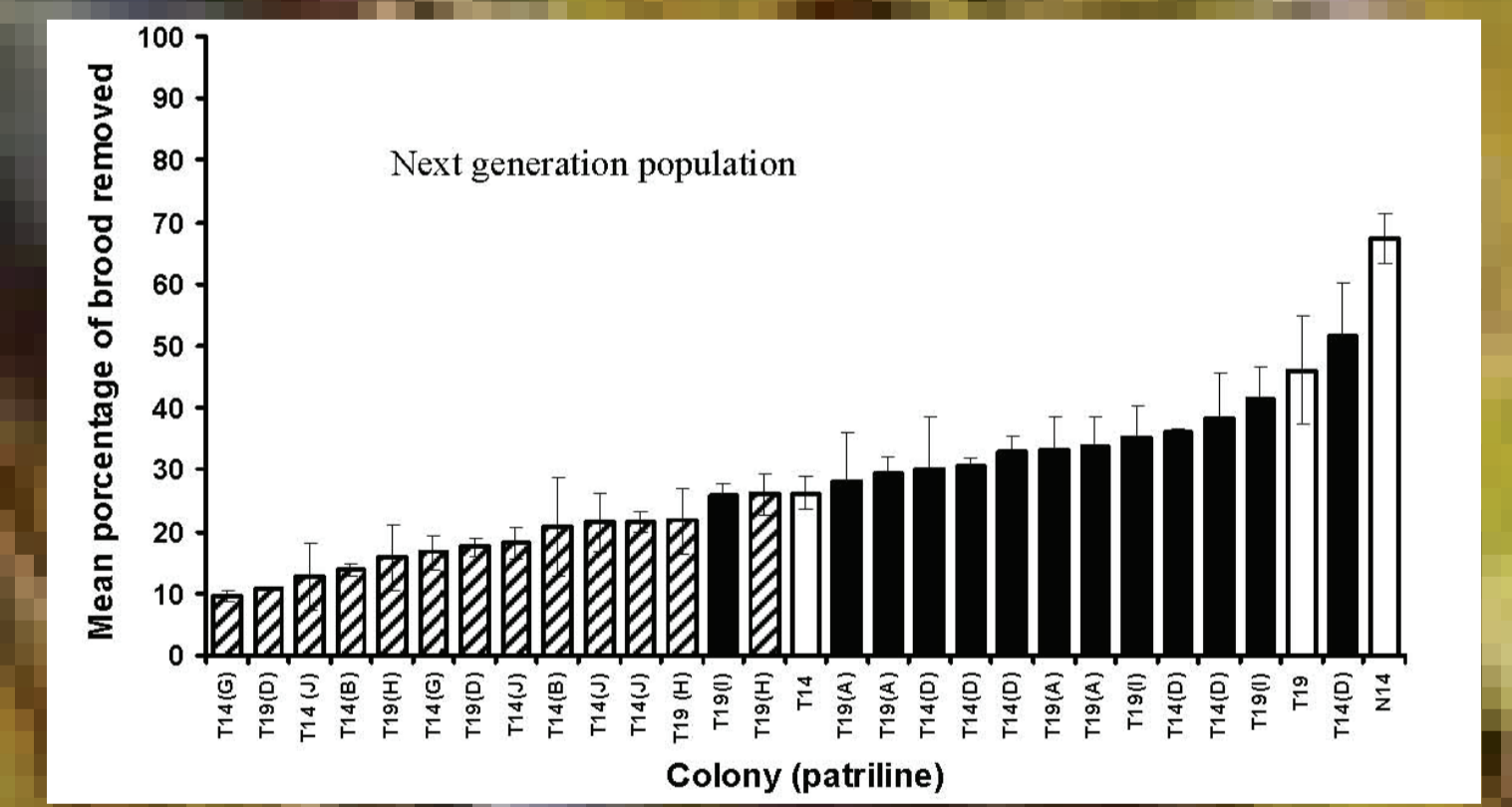
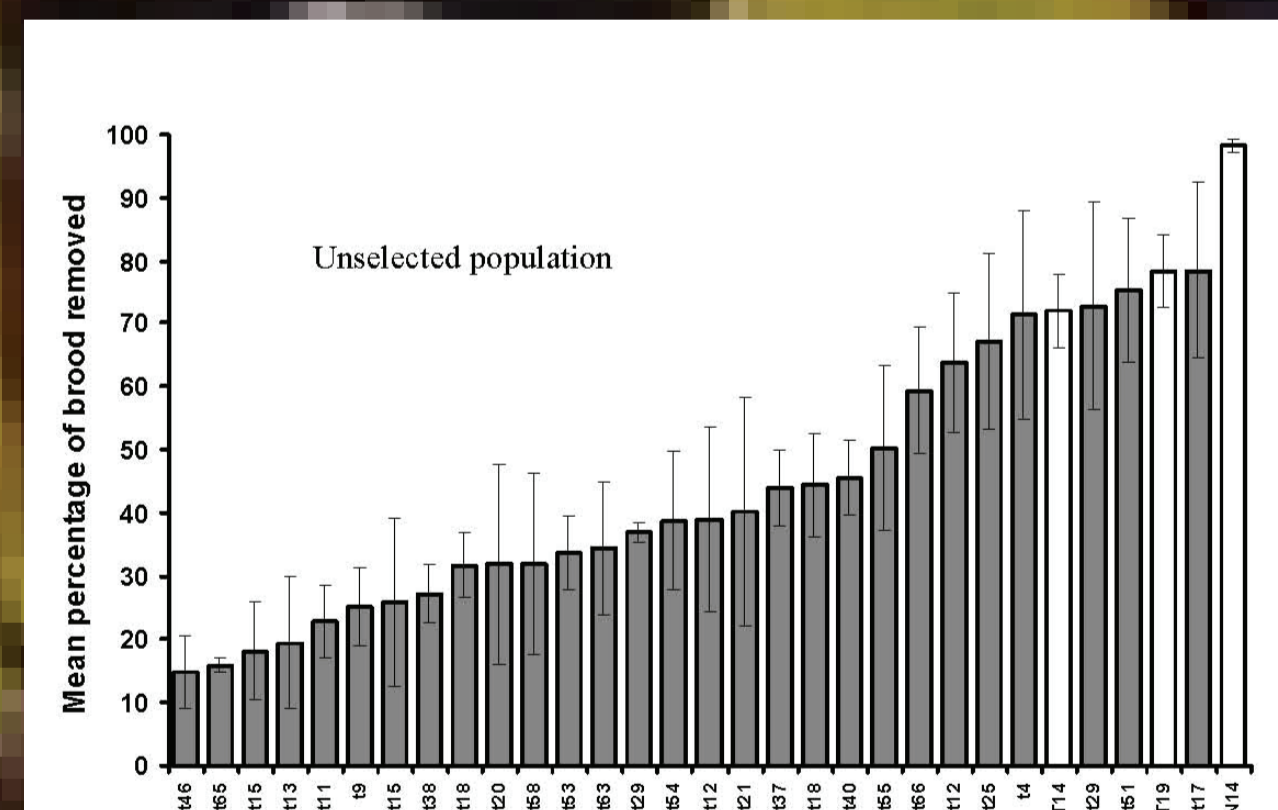


3. Why the dark European honey bee?

The dark European honey bee *Apis mellifera mellifera* is native to the British Isles (Carreck, 2008), and well adapted to the climate. Despite extensive imports of other sub-species over the last 150 years, a number of pure populations remain (Jensen & Pederson, 2005). We are using bees collected in the East Midlands of England, together with additional genetic material from Scotland and Ireland.

4. What is intracolony selection?

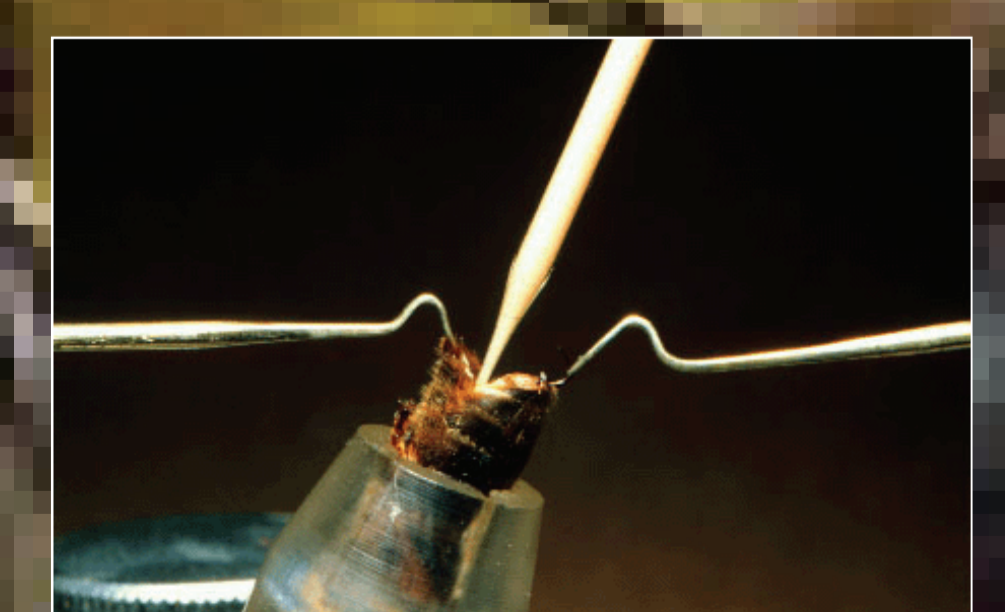
Since a honey bee queen mates with many males, the colony workers consist of a number of groups of different patriline. Even in a colony that has been found to be hygienic, only a small numbers of patriline may show this behaviour. Breeding can therefore be speeded up by selecting only these hygienic patriline. An observation hive containing individually marked nurse bees from hygienic colonies can be tested using freeze killed brood to identify hygienic workers. Microsatellite markers can then be used identify their patriline. Virgin queens reared from those colonies can then be tested non-destructively, and only those individuals corresponding to the hygienic patriline retained for instrumental insemination with selected drones.



Pérez-Sato *et al.* (2009).

5. What next?

Pérez-Sato *et al.* (2009) demonstrated that one round of intracolony selection could significantly increase hygienic behaviour. The current project, begun in 2008, continues this work. We have identified hygienic colonies and have carried out observation hive studies. In 2010 we have reared queens and used instrumental insemination. These queens are being tested for tolerance to *V. destructor* and ultimately will be made available to British beekeepers.



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