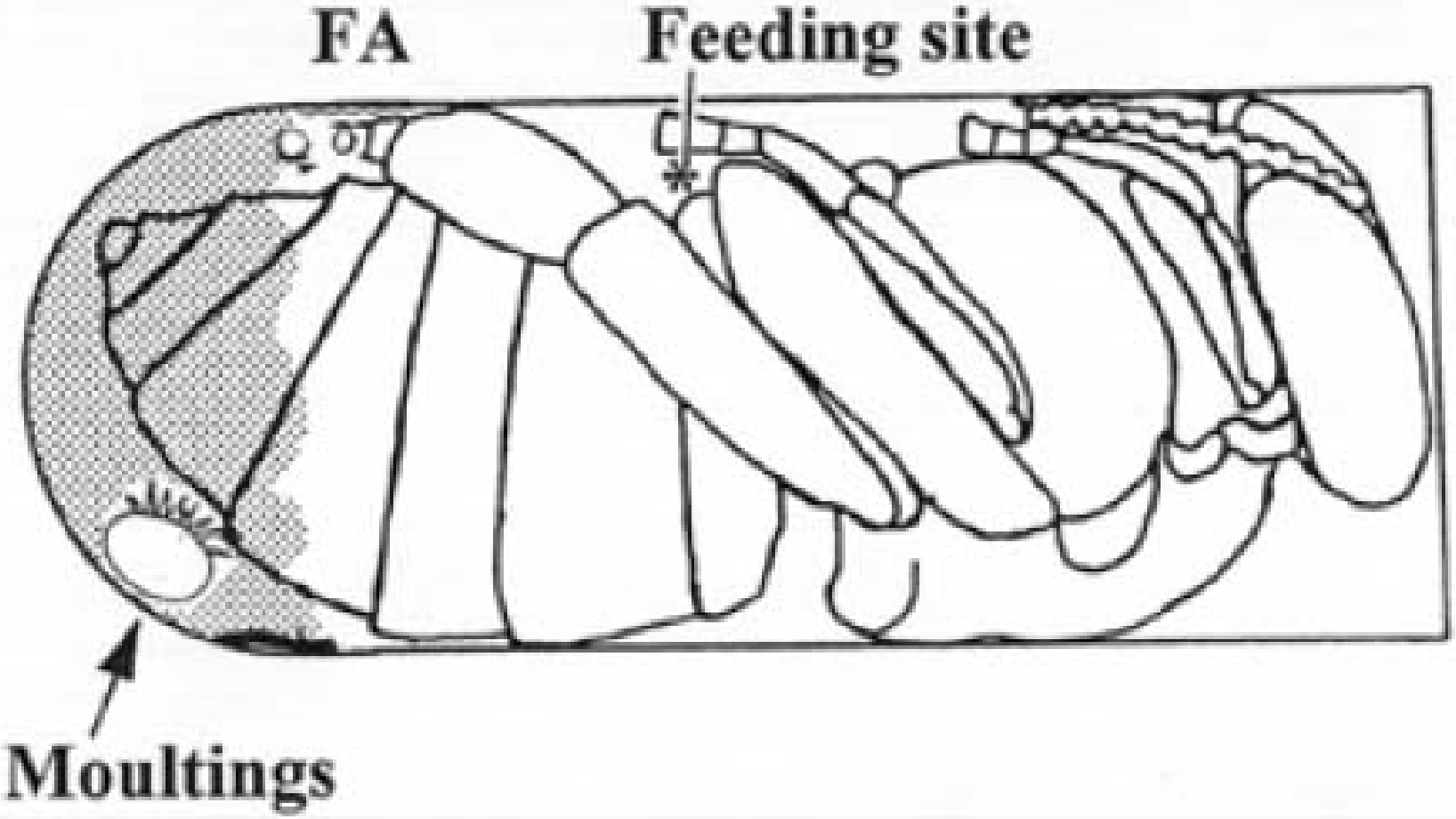
Breeding Objectives II: Prospects for *Varroa* Resistance


FA
Feeding site
Moultings

Varroa destructor

- Jumped twice from *Apis cerana* to *Apis mellifera*
  - N Korea/E Russia
  - Japan
- UK in 1992
- Very little genetic variation, but has adapted rapidly to pyrethroids

Issues with *Varroa*

- CCD partially linked with *Varroa*
- Shown to be … unlike pesticides … the major cause of massive colony losses in France 2003-2005
- Spreads viruses
- Becoming resistant to pyrethroids in Scotland
- Number 1 problem for honeybees

Where have bees been found with *some* resistance?

- Tunisia, Uruguay, Brazil, New Guinea, Argentina.
- France, Germany, Sweden
- UK: Yorkshire, Cornwall, Wiltshire
- US: Louisiana, Michigan, others
- US: Arizona
- E Russia (Primorsky region)
- New Zealand

Who is selecting resistant stock?

- Dee Lusby, Arizona
- Cornwall Bee Breeding Group
- Gard Otis, Canada
- Mark Goodwin, NZ
- Commercial American breeders (x9)
- John Keyfuss, Chile and S. France
- Ron Hoskins, Swindon
- John Tyler, Ayrshire?
- John McLean, C Scotland
- Pete Haywood and colleagues, Wales

How might bees defend themselves?

Four main ones:

1. Grooming: biting, cutting, damaging, disturbing, dislodging.
2. Interfering with mite reproduction signals.
3. Uncapping and cleaning infested cells.
4. Accelerating sealed cell phase.

From Harbo and Harris (1999)

	Recorded & useful?	Heritable?
• Grooming	☺☺☺	☺
• Interfering with reproduction.	?	?
• Varroa Sensitive Hygiene	☺☺☺	☺☺☺
• Short capped phase.	☺	☺☺

Heritability from Harbo and Harris, but the low heritability for grooming behaviour could be because they did not use conditions to stimulate that behaviour.

Harbo, J., and J. Harris. 1999. Heritability in honey bees (Hymenoptera: Apidae) of characteristics associated with resistance to Varroa jacobsoni (Mesostigmata: Varroidae). Journal of Economic Entomology 92: 261-265.

‘Breeding Resistant Bees for Dummies’

- Need:
  - Colonies surviving *Varroa* pressure
- Select:
  - Any showing VSH
  - Any with high levels of grooming behaviour
- Then:
  - Mix lines with different traits
  - Add *Varroa*
  - Wait
  - Select, purify, propagate
  - Add other help as appropriate (OMFs, small cell)

Progress is already being made in Scotland …

- Now 5th year of no treatment
- Survivor colonies show different resistance traits

Partially based on feral stock

VSH

- Varroa Sensitive Hygiene
- Cells uncapped and excavated
- Look for freshly uncapped cells and check for presence of *Varroa* faeces (white spotting on upper back wall)
- See lower right part of following slide
- Needs better quantification

Whole areas can be uncapped

- This cast had high *Varroa* levels
- Central area was emptied before brood could have hatched
- In tests of these bees VSH alone does not seem to be sufficient to control *Varroa*

- John was visited by Dennis Anderson of CSIRO

The Way Forward …

- Swapping stocks between breeding and testing sites?
- Quantitative testing for VSH?
- Select for low mite fall or low mite population only?
- Select by mite damage?
- Viruses?
- Traits are available in Amm