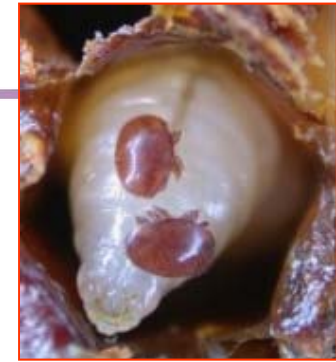


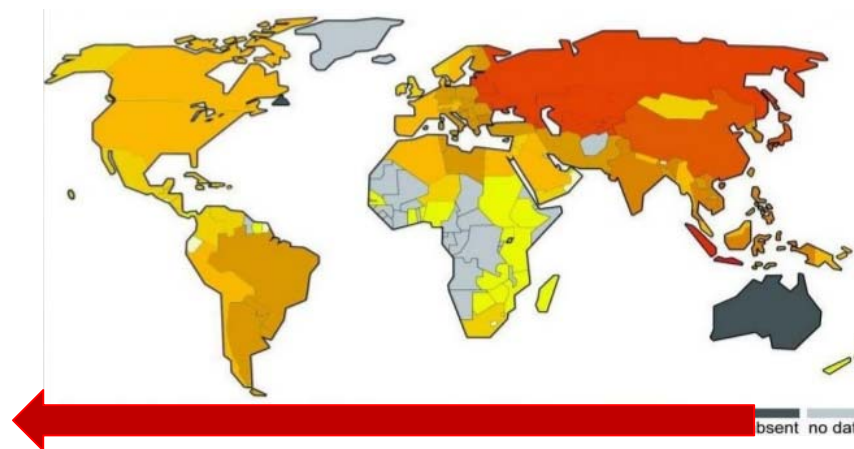
New approaches to a long-known disease: should viruses be included under the definition of varroosis ?

M-P. Chauzat, L. Espinosa

What is varroosis?



- Four obligate ectoparasitic species have been described:
 - *Varroa jacobsoni*
 - *V. underwoodi*
 - *V. rindereri*
 - *V. destructor*
- Spread outside its native range during the 1970's- 1980's



- No exhibition of an adapted host-parasite relationship
- Nowadays considered to have the **most severe disease** of beekeeping world-wide

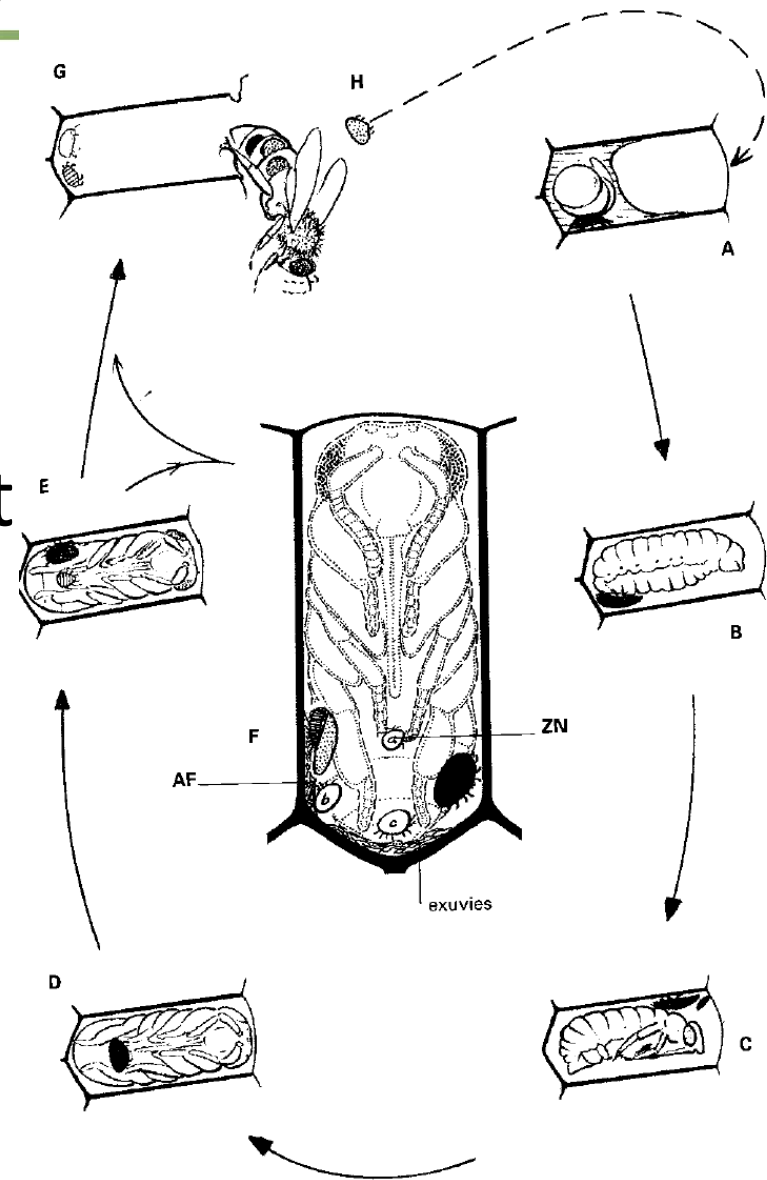
What is varroosis?



Traditionally defined as the infestation of honey bees by the obligate ectoparasitic Varroa mites

Varroa destructor : key facts

- Feeds on the haemolymph of bees
- The brood is the most sensitive host stage
- 2 phases
 - Phoratic phase
 - Reproductive phase



Fernandez & Coineau 2002

Varroa destructor - Pathology

- Direct pathogenic effects at individual level
 - Significant reduction of size and weight
 - Shorter life span
 - Affect foraging and cognitive abilities
 - Substantial depletion of haemolymph
 - Impairment of the immune system
 - Increased disease susceptibility



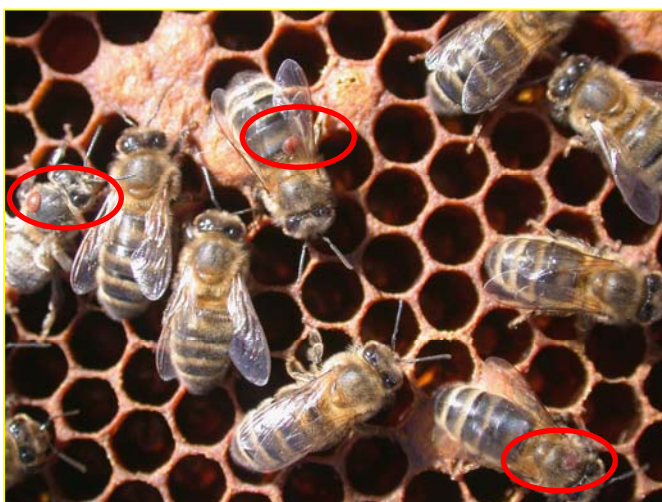
P. Rosenkranz

- At colony level
 - Parasitic Mite Syndrome
 - Weak colonies
 - In temperate climate: damage at colony level is observed during fall and through overwintering mortality



Varroa destructor - Transmission

- Direct contact from adult honey bee to adult honey bee



- Movement of infested honey bees, bee brood, bee products and used apicultural equipment



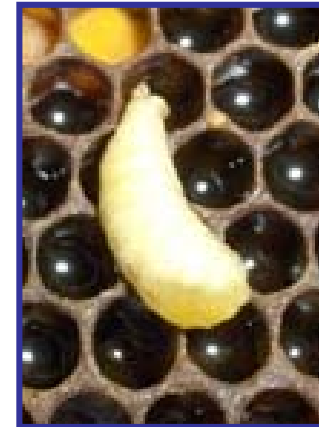
... And what about honeybee viruses?



- More than 20 known viruses
 - Many viruses infect brain tissues
 - Reduced life expectancy

- Symptoms

- Sometimes highly characteristic (e.g. DWV, Sacbrood Virus)



- Sometimes less obvious and consistent or can have multiple causes (e.g. the paralysis viruses).

Virus transmission

Horizontal
From adult bee to another bee



Virus transmission

Horizontal
From adult bee to another bee



Vertical
From queen to descendants

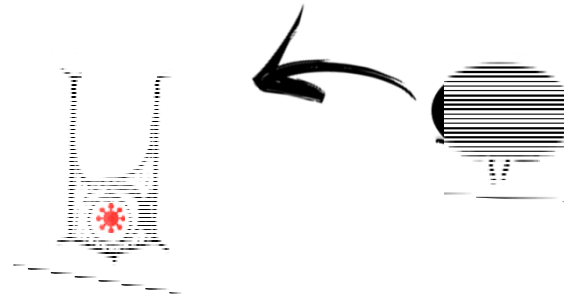


Virus transmission

Horizontal
From adult bee to another bee



With varroa
Vector-borne transmission



Vertical
From queen to descendants



Virus transmission

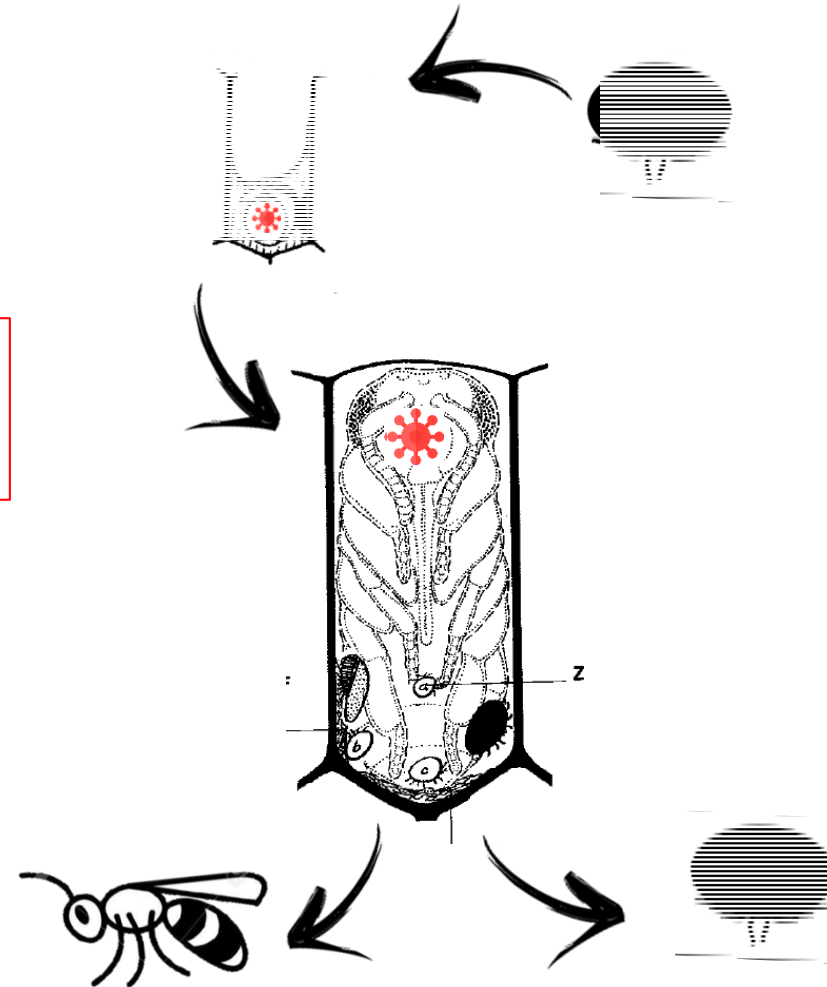
Horizontal
From adult bee to another bee



Vertical
From queen to descendants



With varroa
Vector-borne transmission



Virus transmission

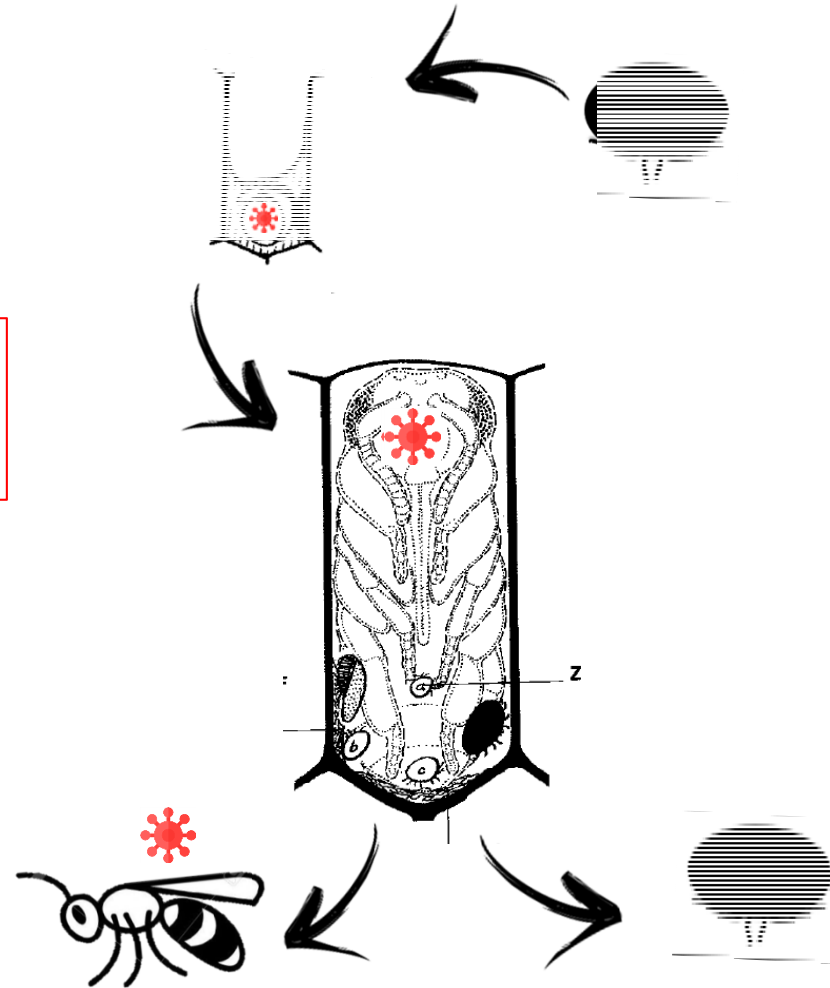
Horizontal
From adult bee to adult bee



Vertical
From queen to descendants



With varroa
Vector-borne transmission



Virus transmission

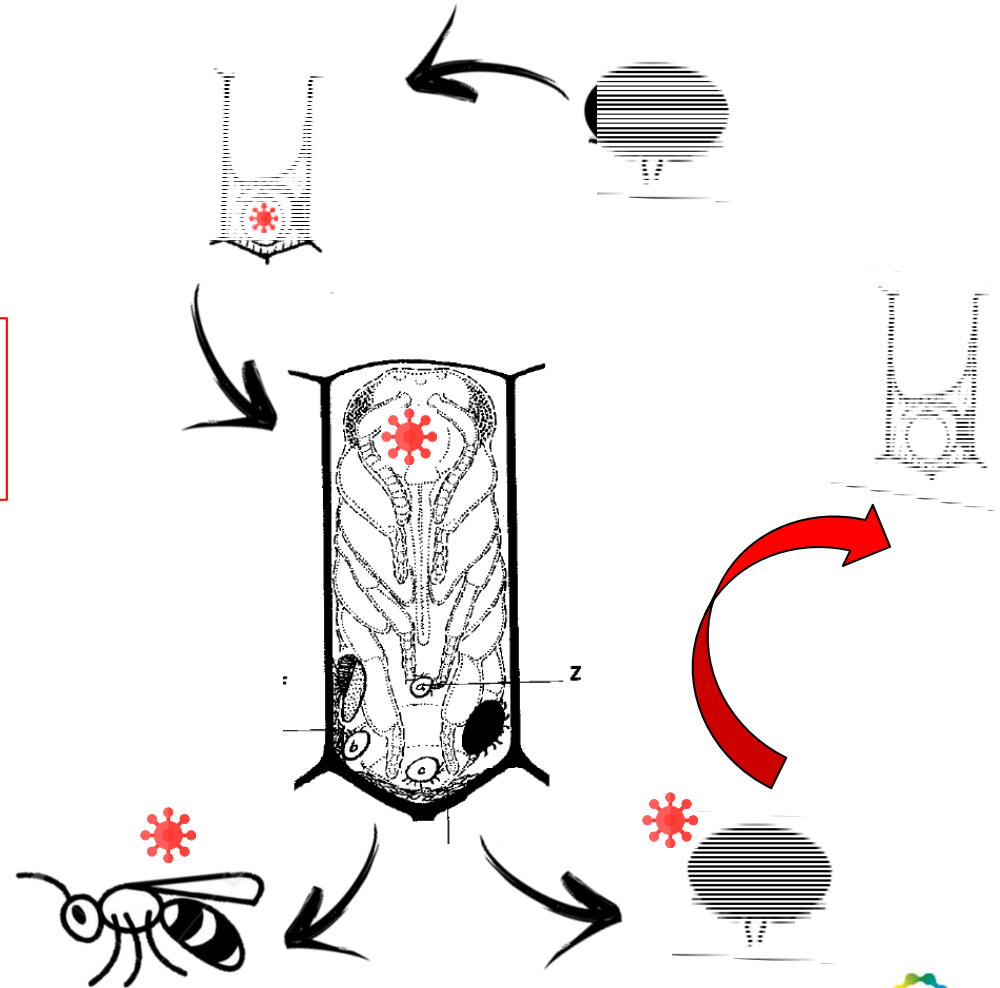
Horizontal
From adult bee to another bee



Vertical
From queen to descendants

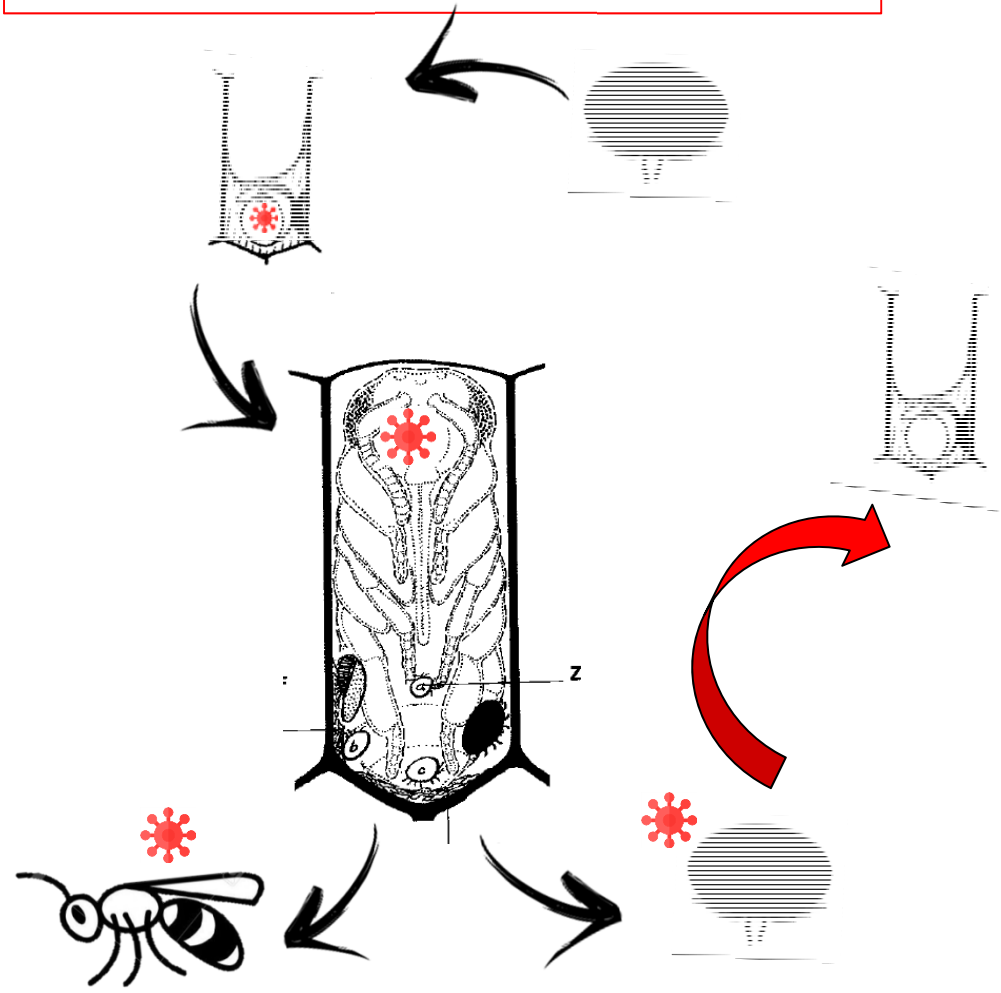


With varroa
Vector-borne transmission



Virus transmission

With varroa
Vector-born transmission



Dissemination
extremely efficient

AKI-complex
DWV virus



Then, what is really the disease varroosis?



- The infestation of honeybees **only** by *V.destructor* is **no longer representative** of the full process of disease
 - viruses should be included
- BUT the virus precise roles have not yet been fully characterised
 - in the pathogenesis of the disease and
 - in the complex symptoms observed

Current consideration of varroosis by OIE

Manual of Diagnostic Tests and Vaccines for Terrestrial Animals

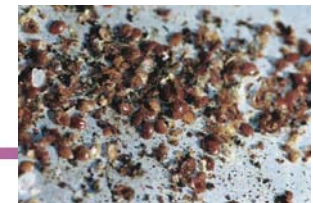
- Definition: The *Varroa* mites are parasites of brood and adult bees.
- Just one vague reference to viruses DWV and ABPV
- Diagnostic techniques
 - Debris examination
 - Bee examination
 - Brood examination

Terrestrial Animal Health Code

- Case definition: Varroosis is a disease of honey bees caused by [...] *V. destructor*
- And the role of viruses is acknowledged
 - The mite acts as a vector for viruses (particularly DWV)
 - The viral load within the colony increases with the mite infestation

Conclusion

The diagnosis of varroosis is performed by measuring the parasitic load



Should viruses be included under the definition of varroosis?

- State of knowledge: enough?
- How to do it?
 - Through the update of the Varroosis chapter from the OIE **Manual**
 - By whom? OIE Ref Labs (or Collab Centres), external experts or an *Ad hoc* Group
 - Evaluation of the draft by the OIE Biological Standards Commission and by OIE Member Countries
 - Final approval and adoption by the World Assembly of Delegates



Challenges

- Diagnostic techniques should be adapted

For now they aim at detecting the mites and measuring the parasitic load



- Diagnosis of viruses

- Clinical symptoms: inaccurate and unreliable

- Using molecular techniques
DNA or ARN based methods
(e.g. PCR-based methods)



→ sensitive and accurate

Molecular techniques, but...

- Virus detection
 - Convenience: are they really necessary?
 - Quantification → pathogenic threshold of viral loads?
 - High mutation rate of viruses
 - risk of under-detection?
- Standardization of sampling
 - Type of samples
 - Proportion to be taken from the colony and apiary
 - Specific transport requirements

Commercial implications for beekeepers in exchanging healthy honeybee colonies



Mersi – Thank you!



- Dr Laura Espinosa – currently available for a nice position in your laboratory

eurl.bee@anses.fr

