General overview of bee diseases

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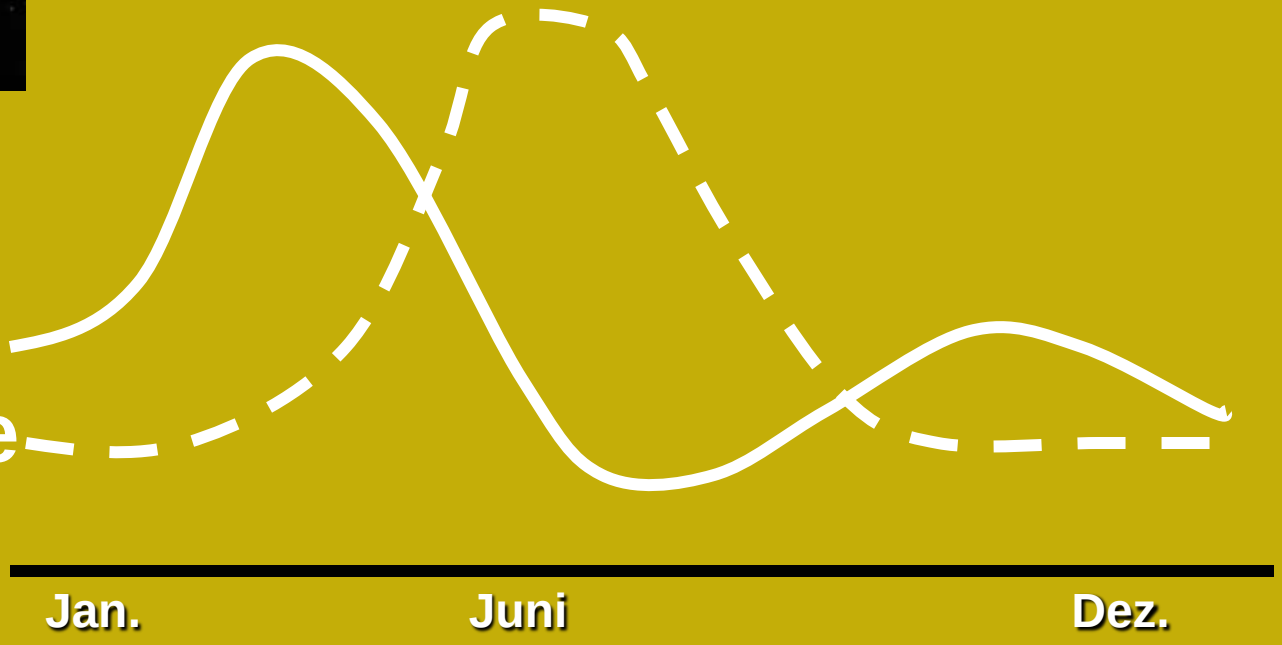
Honeybee Colony = Animal

- **Honeybee colony = Animal**
- **Individual bees = part of the animal**

  (like cells or organs of mammals)

North Africa
Central Europe



Brood development

Hatching of imagos

Bee swarm

=

Reproduction

Honeybee Colony = Superorganism

- **Division of labour**
- **Interaction**
- **Food hoarding**
- **Social Homoiothermic**
- **Social immune defence**
- **Hygienic behaviour**

Immune defence mechanisms

Individual Bee

Cellular system:
Melanisation, phagocytosis etc.

Humoral immune system:

Inhibition, lyses of cell wall etc.

Social immune defence

Hygienic Behaviour

- **Absconding:**
  Bees fly out and do not return
- **Swarming:**
  Whole colony leaves hive
- **Disinfections:**
  Nest with propollis

Propollis: resinous mixture that honey bees collect from tree buds and others

Social immune defence

Hygienic Behaviour

- **Grooming:**
  Self- and social-cleansing
- **Hygienic:**
  Removal of brood
- **Heating:**
  Fever and heat attack
- **Encapsulation:**
  Enemies and infection sources

Factors reducing Immune response

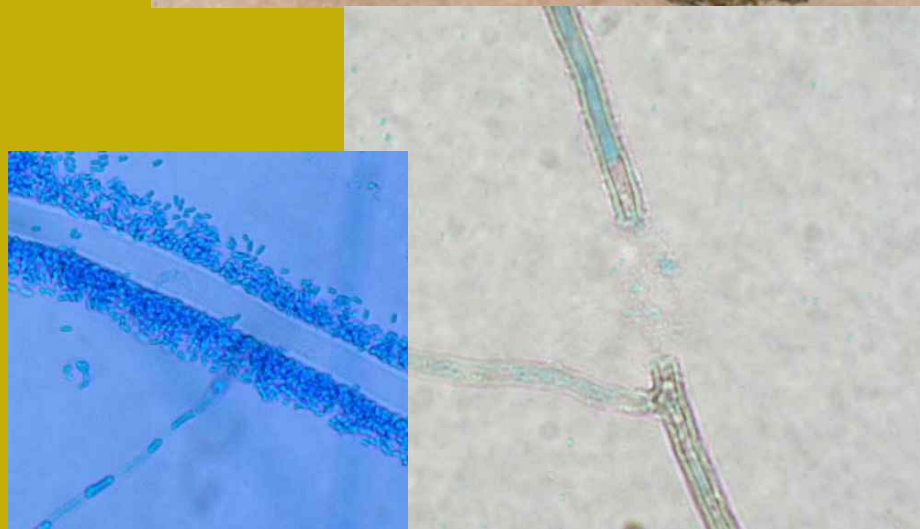
- **Nutrition**
  - **Lack of permanent carbohydrate supply**
  - **Low diversity of pollen sources**
- **Pollution**
  - **Pesticides**
  - **Air pollution**
- **Management** **(good beekeeping practices)**
  - **Chemical treatments**
  - **Damage of natural arrangements in brood nest**
  - **Inadequate bee races (brood cycle etc.)**

Biodiversity of pollen supply

Pollen supplies bees with:
protein + fungus + bacteria

Antagonists and infectibility

- **Antagonists**
  - **Bacteria**
  - **Fungus**
- **Chalkbrood (Ascosphaera apis)**



Fungus tube

(Nayudu, Khan 2007)

Diversity of bacteria in midgut

(Nayudu, Khan 2007)

In healthy honey bee colonies

per midgut:

100 mill. to 1000 mill.

25 bis 30 species

(10 bis 20 % inhibit chalkbrood)

In diseased honey bee colonies

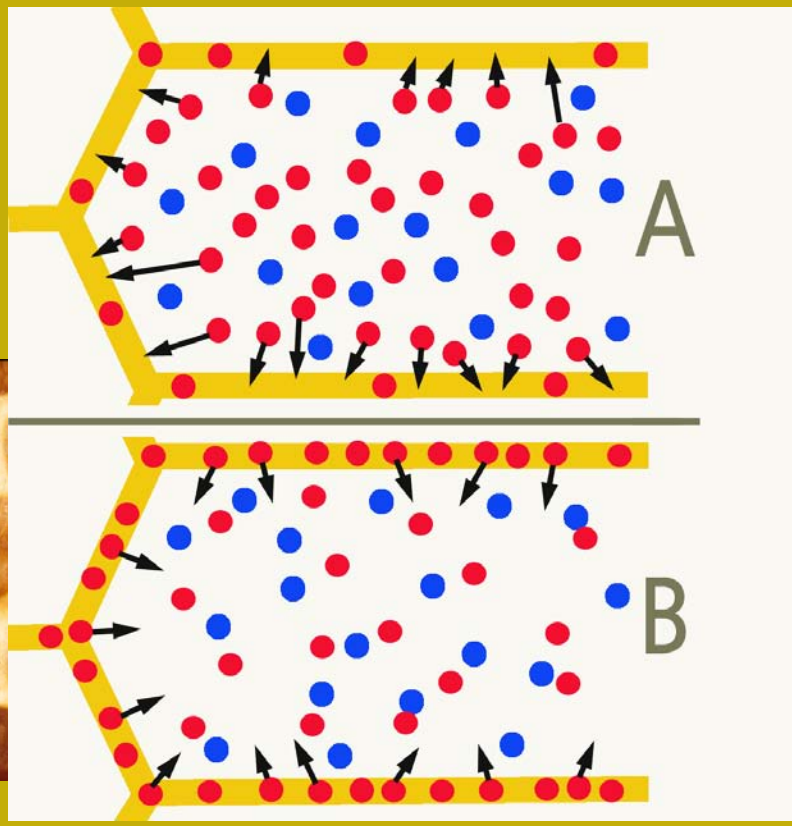
per midgut :

10.000 to 100.000

10 bis 15 species

Pesticides

- Acute toxic effects
- Sublethal effects



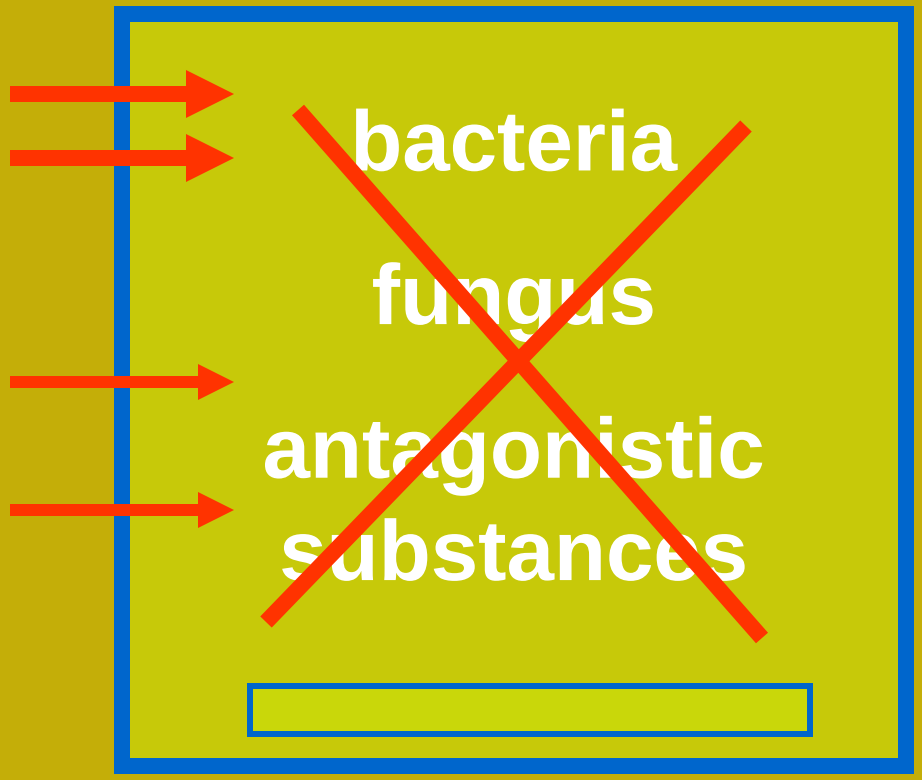
Beekeeping practice

Chemical treatment with desinfective effects

Synthetic substances

Organc acids

Etheric oils



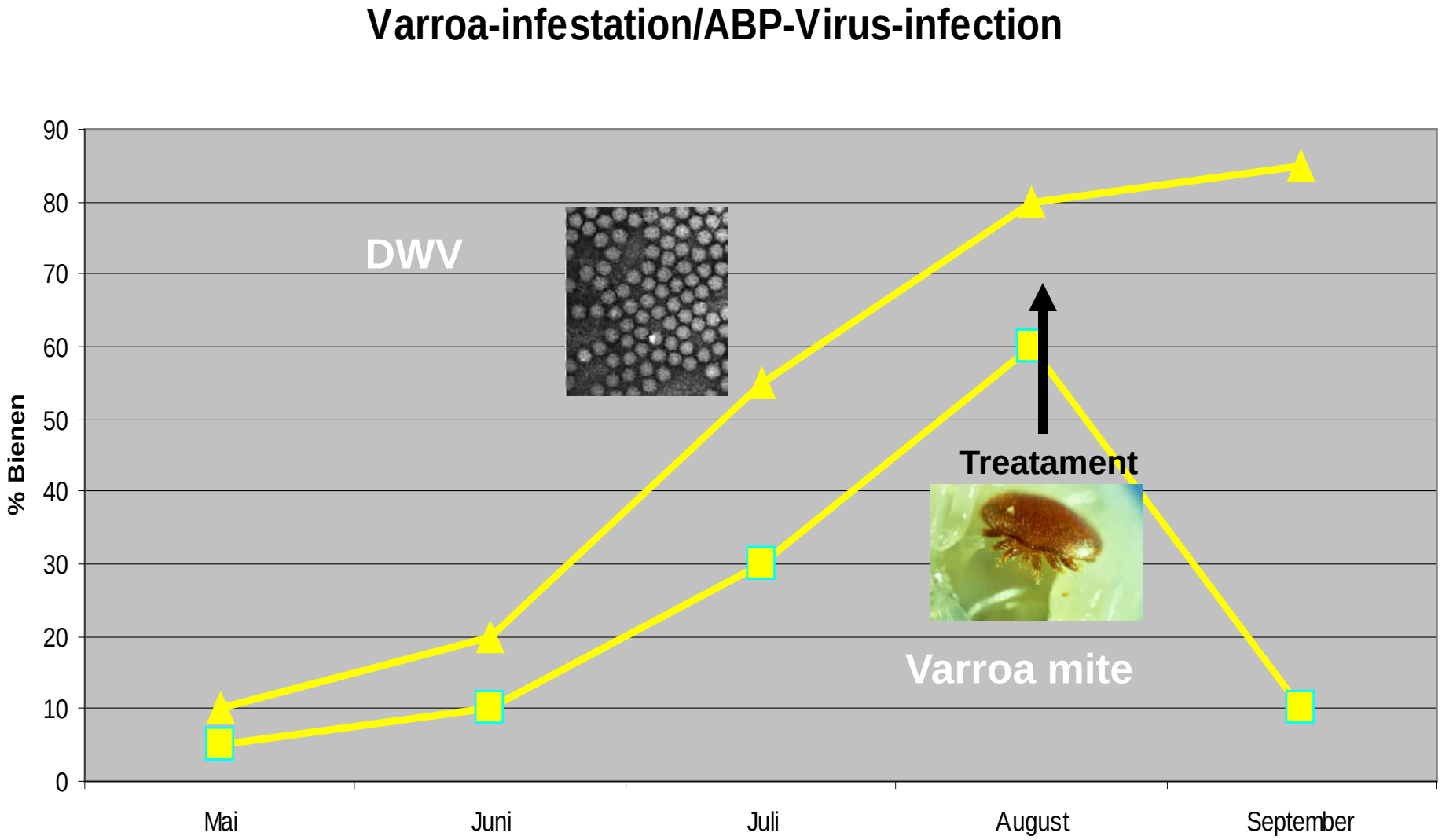
Beekeeping practice

Fixed combs to moveable frames

Important diseases of brood and imago

Pathogen	Brood	Imago
Bacteria	AFB/EFB	
Fungi	Chalkbrood	Nosema
Viruses	Sacbrood (SBV)	DWV,CBPV
Mites	Varroa, Tropilaelaps	Varroa, Acarapis
Insects	SH Beetle	A.m. capensis

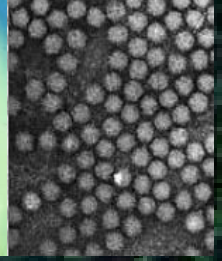
Multiple infections



Pathogenesis
Individual bees

- Reduction of lifespan
- Morphological changes
- Physiological changes
- Changes in behaviour

Reduction of lifespan



3 weeks

2 weeks

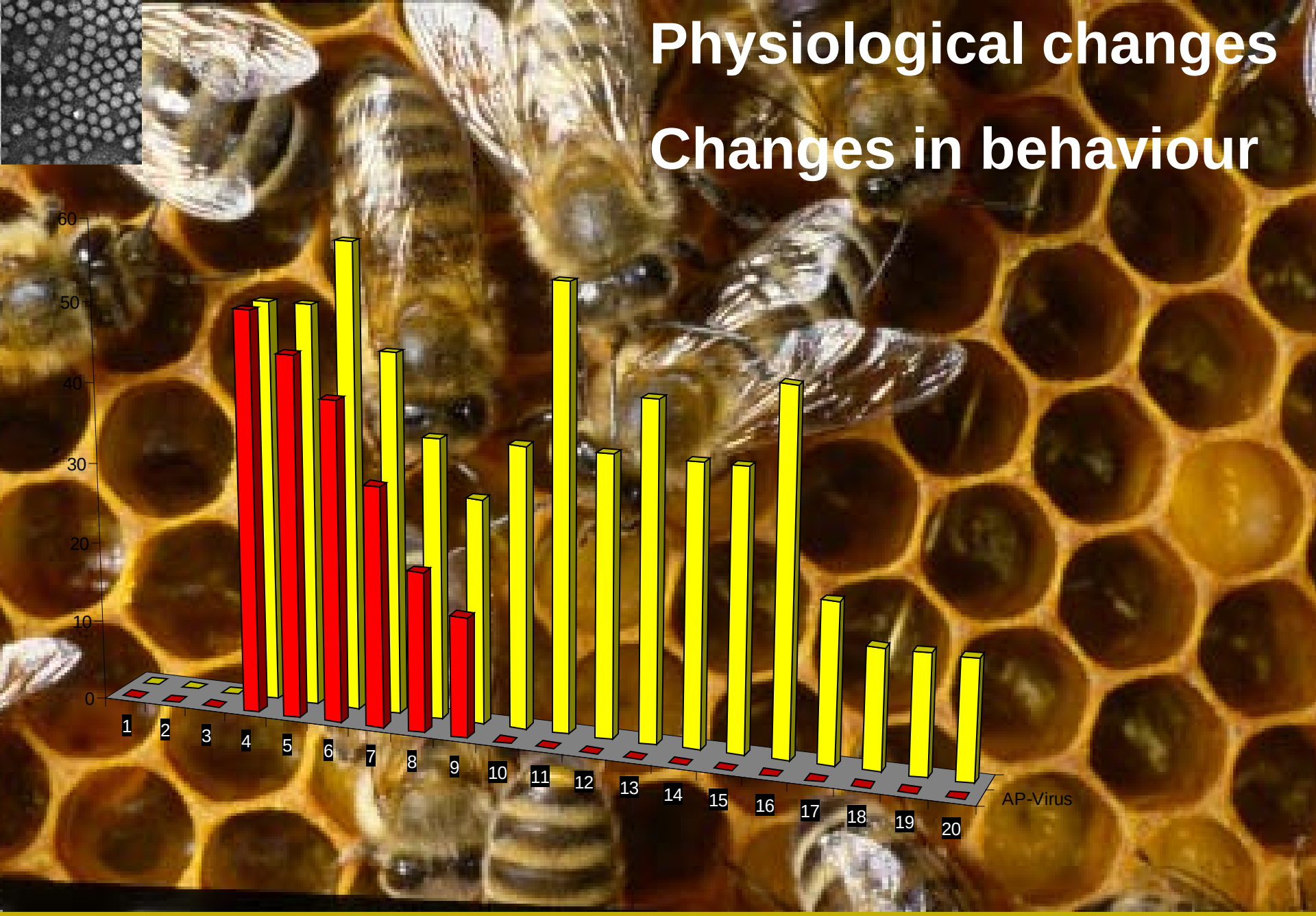
2 weeks

1 week

Morphological changes

Physiological changes

Changes in behaviour



Pathogenesis bee colony

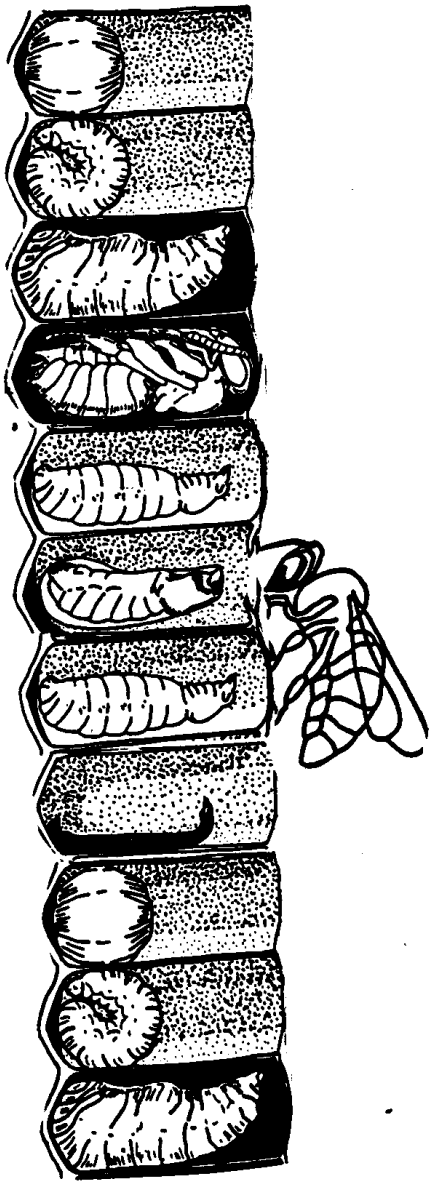
- Reduced productivity
- Scattered brood
- Dwindling
- Death

Scattered brood

Scattered Brood

Hygenic Behaviour

Recognition and removal of diseased brood



Adult Bee Diseases

Hygenic Behaviour

leaving and do not return

Dwindling

Unbalanced: bee production and bee losses

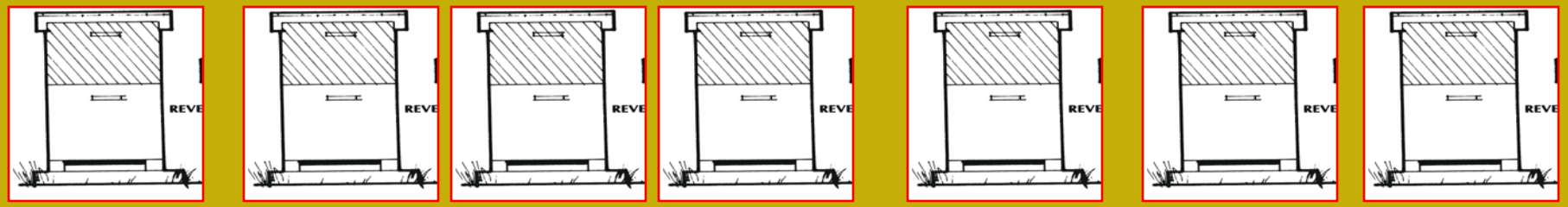
Colony Collapse disorder (CCD)

Epidemiology

- **Influence of bees**
  - **Robbing**
  - **Drifting**

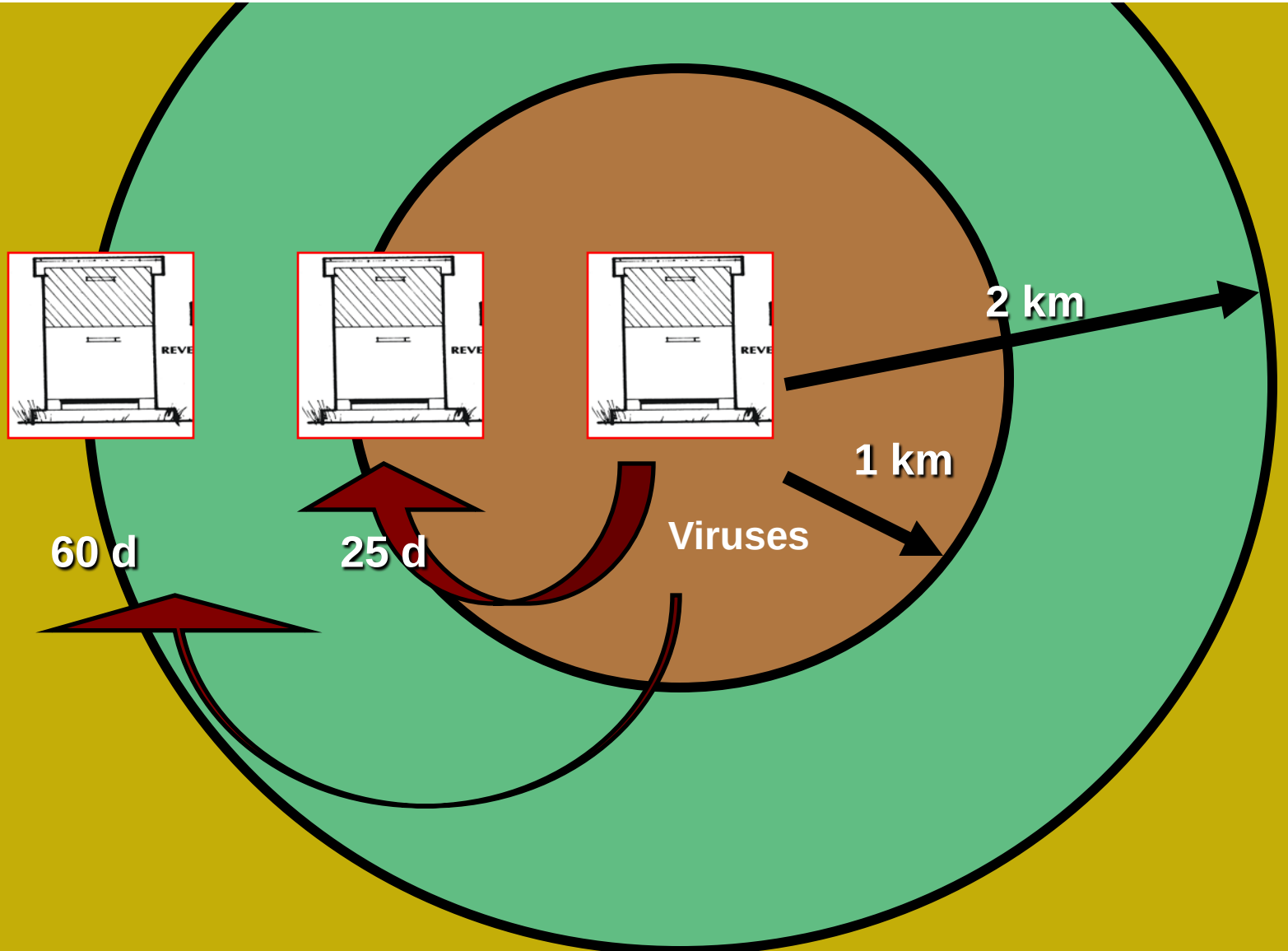
Density of bee colonies

Distribution of diseases in bee yard



2 d 6 d 6 d Viruses + 4 d 6 d 2d

Distribution of diseases in flight area



Epidemiology

- **Influence of beekeeper**
  - **Exchange of material**
  - **Migratory beekeeping**
  - **Bee trade**

Exchange of combs honey harvest

Migratory bee keeping

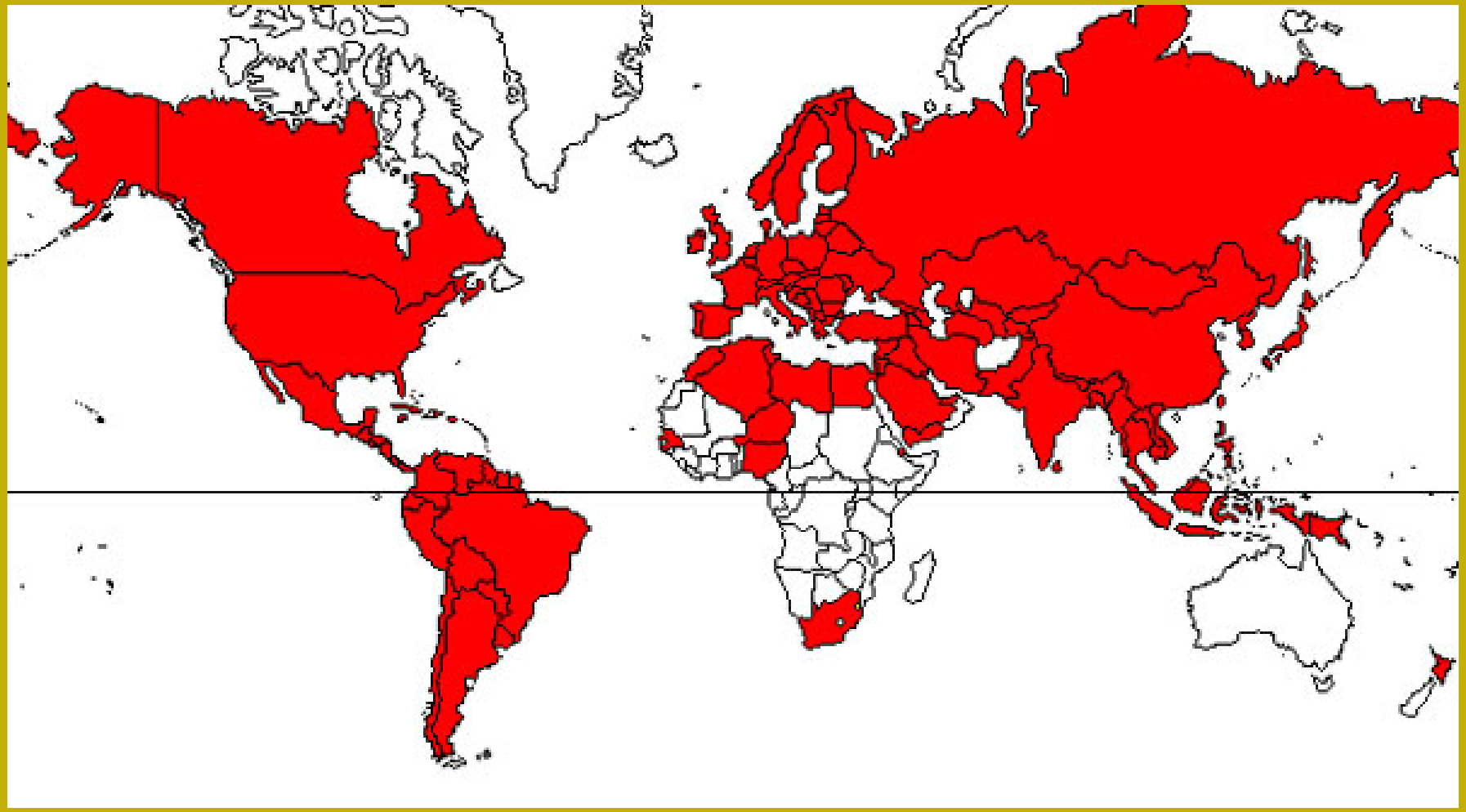
J.Pettis

Host shifts caused by man

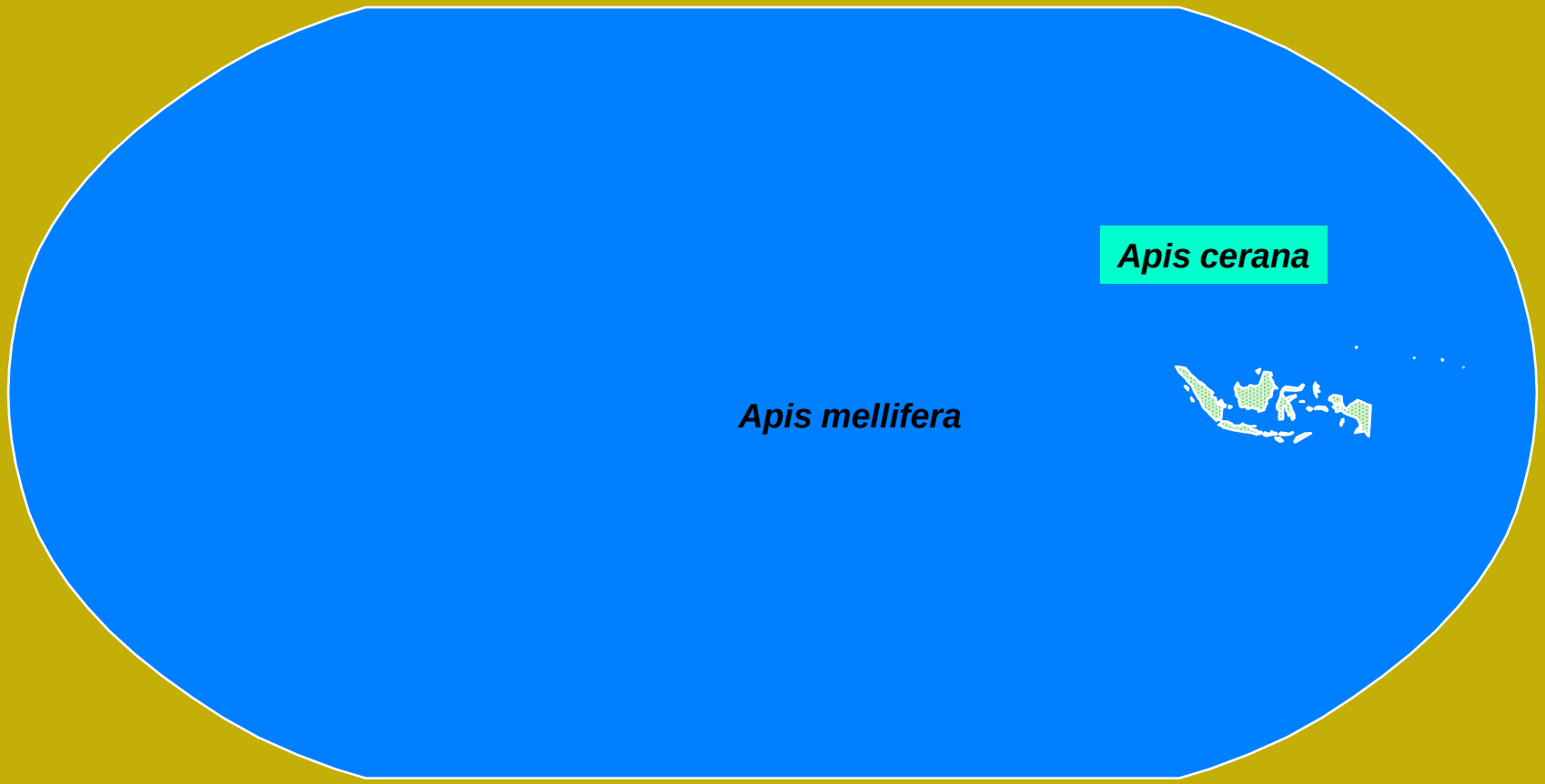
- **Varroa destructor**

- **Host-parasite relationship:**
  not adapted in co-evolution

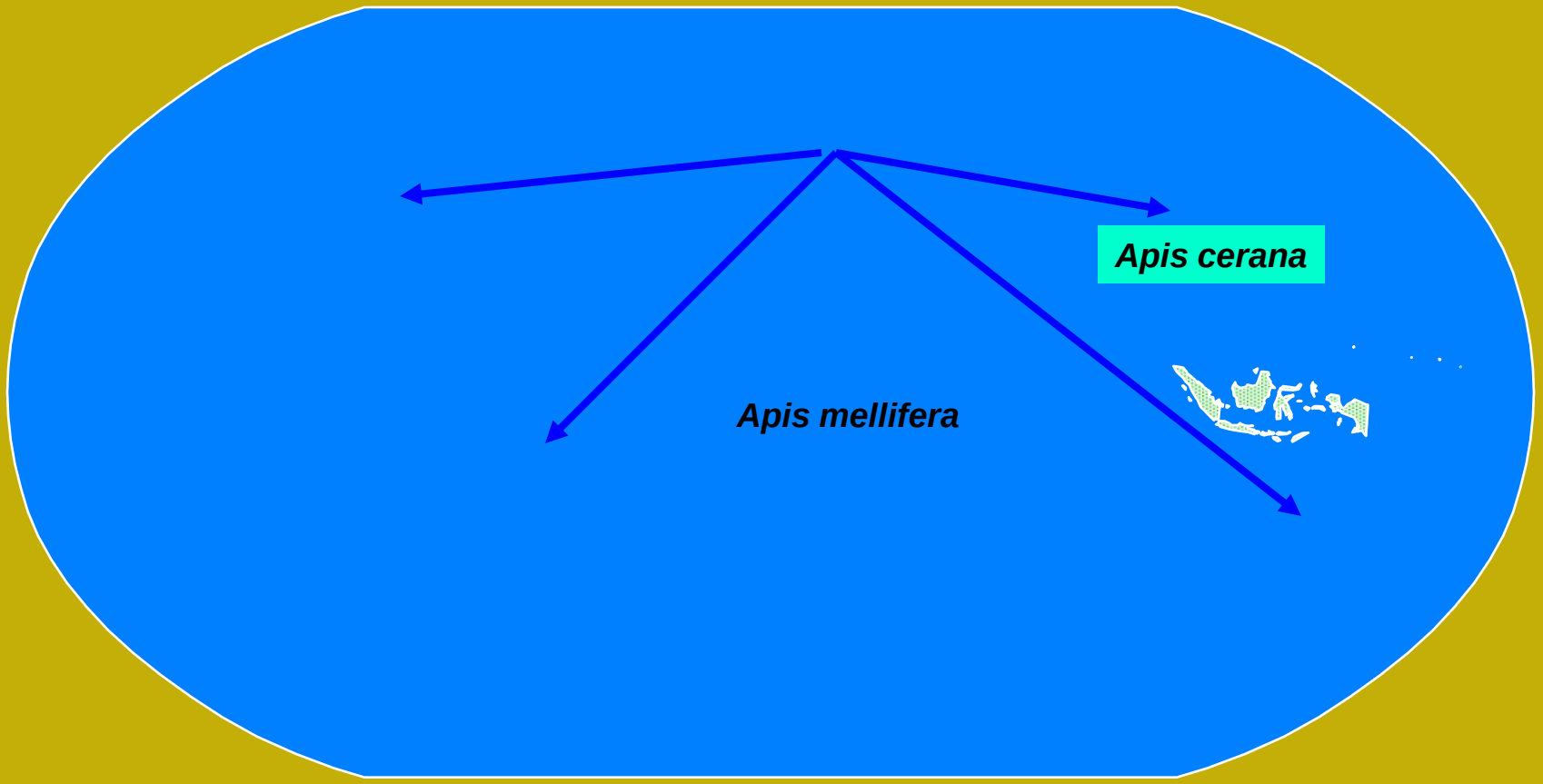
Globally spreading of diseases Varroosis



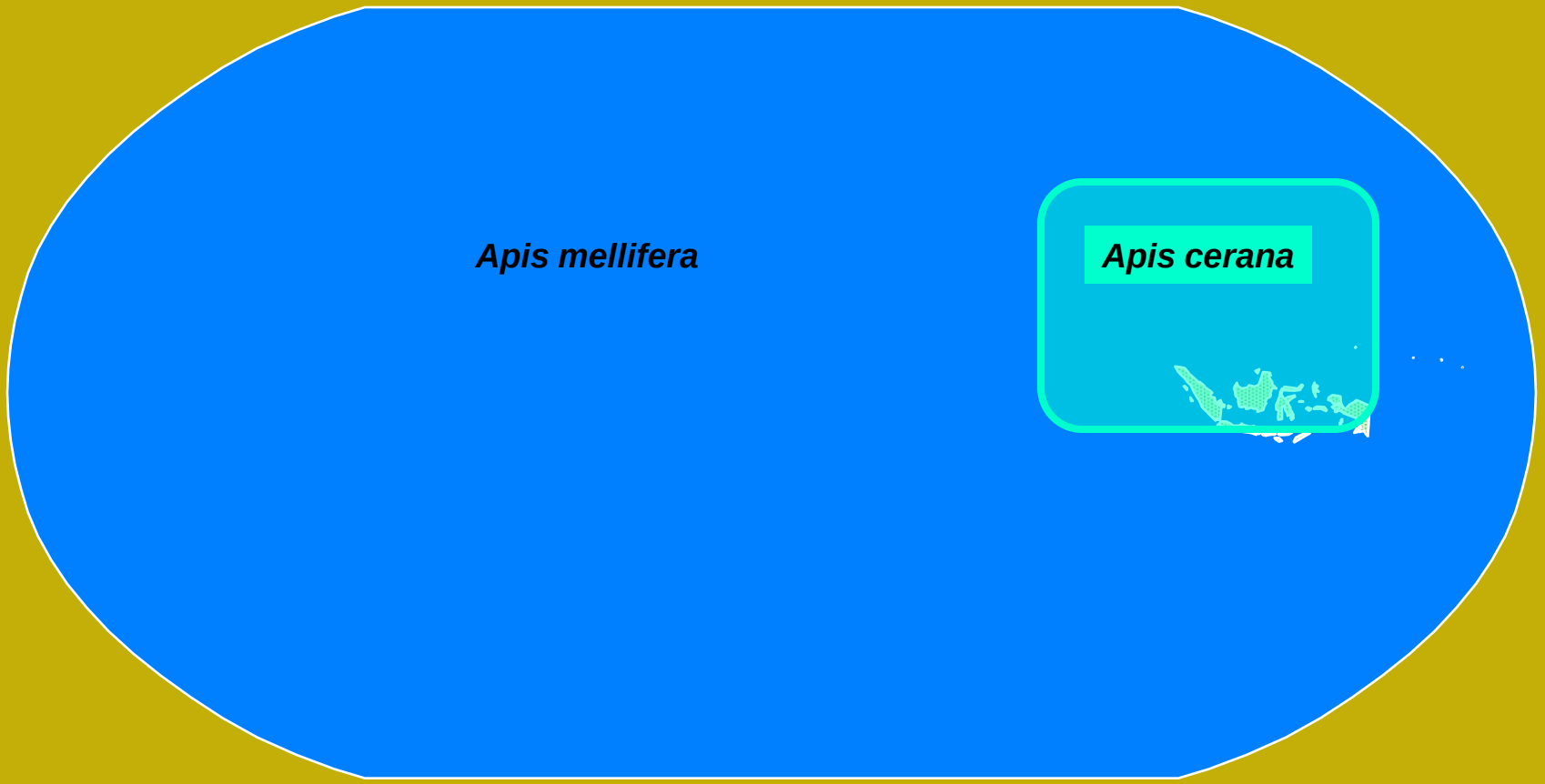
Distribution of *Apis* before colonisation



Distribution of *Apis* during colonisation

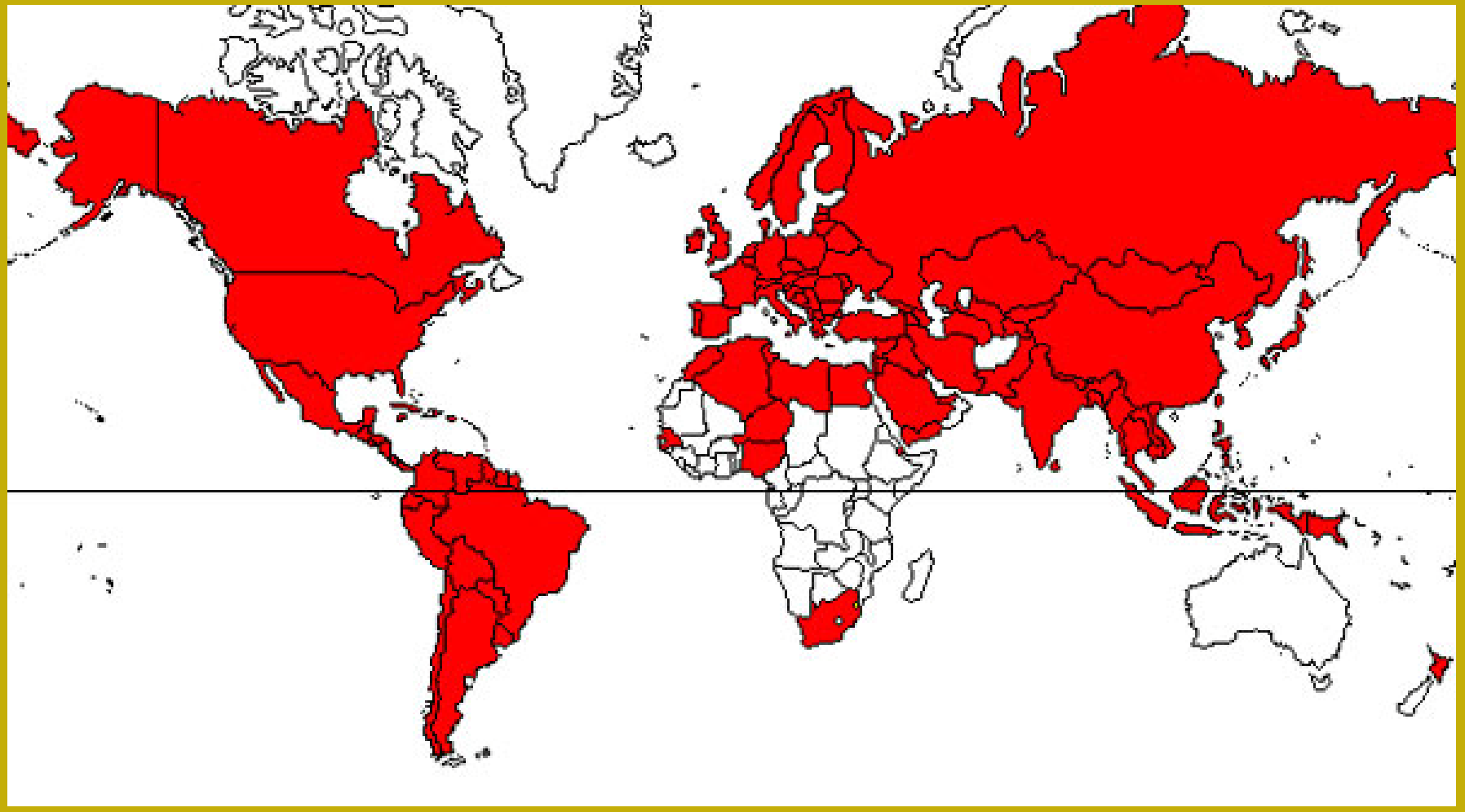


Current distribution of Apis

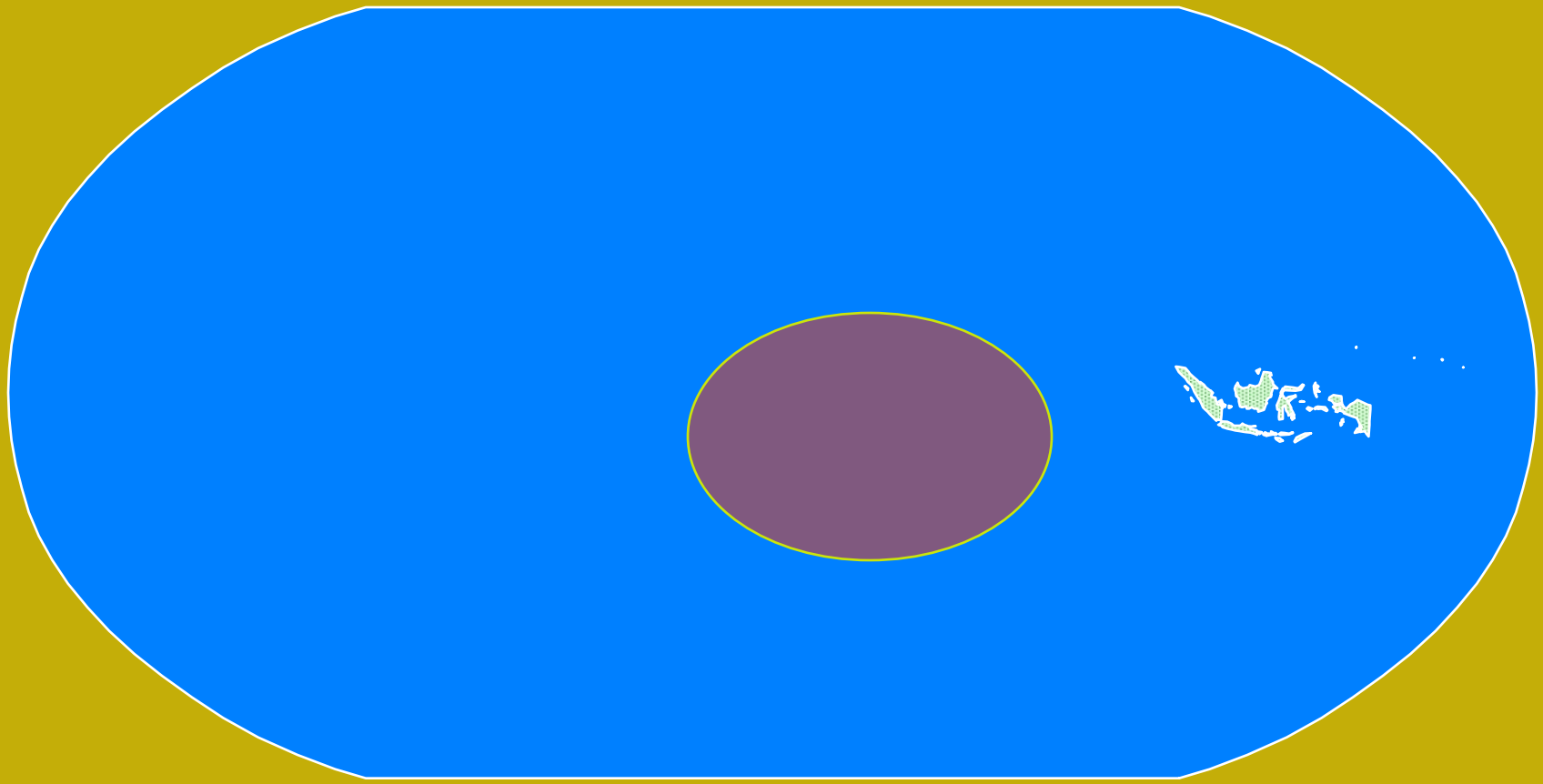


Current distribution of *Varroa destructor*

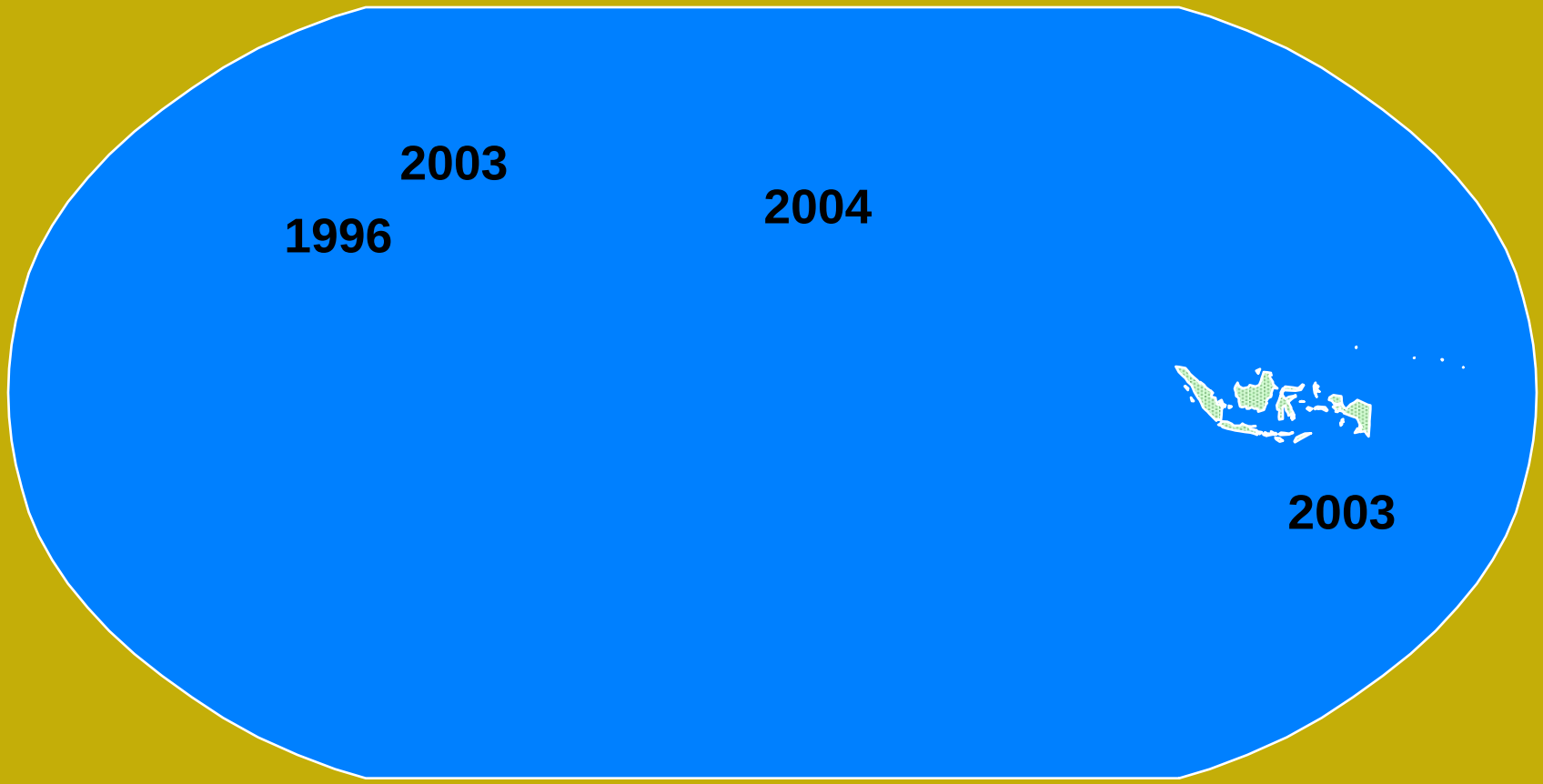
Globally spreading of Diseases Varroosis

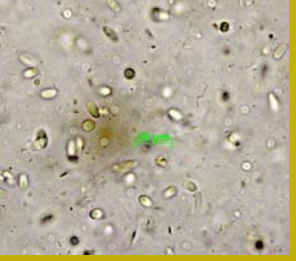


Distribution of *Aethina tumida*



Distribution of *Aethina tumida*

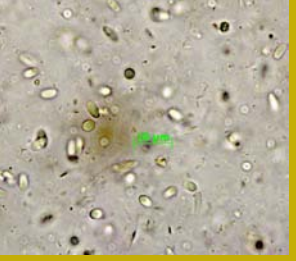




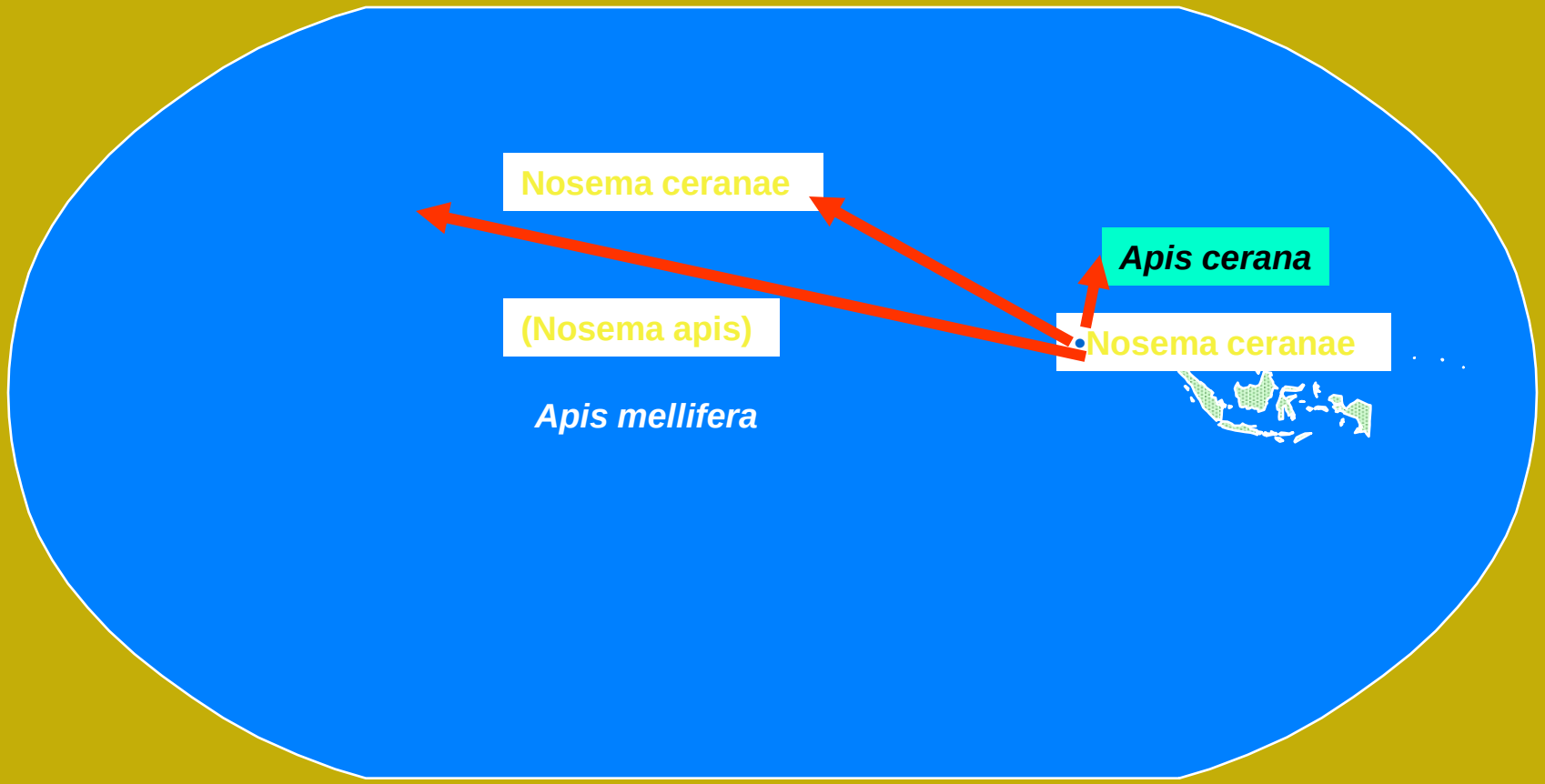
Host shifts caused by man

- **Nosema ceranae**
  - **Original parasite of Apis cerana**
- **Nosema apis**
  - **Original parasite of Apis mellifera**

- **N. apis replaced by N. ceranae**
- **new pathogenesis ?**



Current distribution of Nosema ceranae



Host shifts caused by man

- **Tropilaelaps spp.**

- **Not jet distributed outside of south east Asia**

Current distribution of Tropilaelaps spp.

Apis mellifera

Apis dorsata
Apis laboriosa

Apis cerana

- **Tropilaelaps spp**
.

Apis dorsata

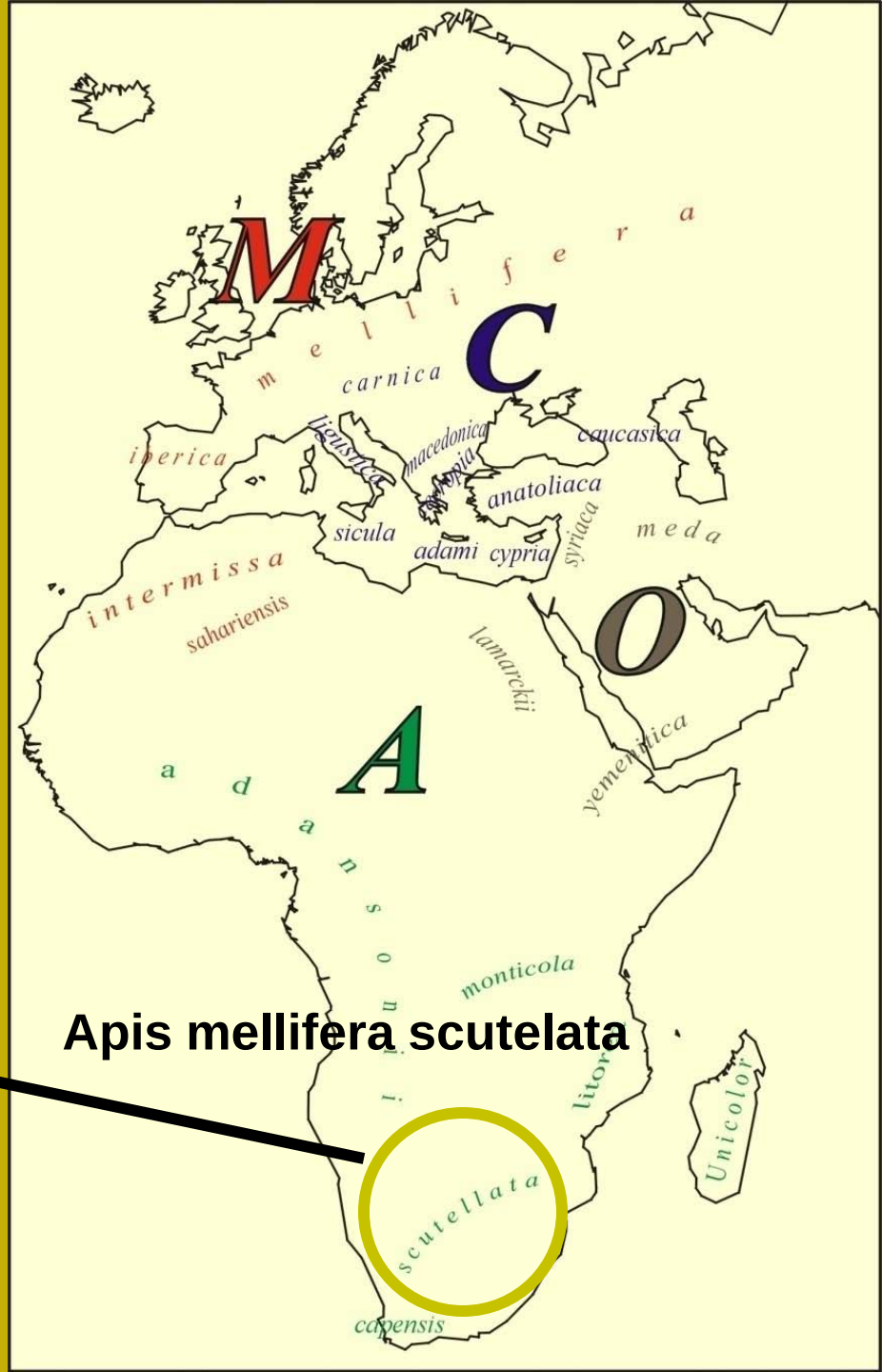
Tropilaelaps spp.

Tropilaelaps spp.

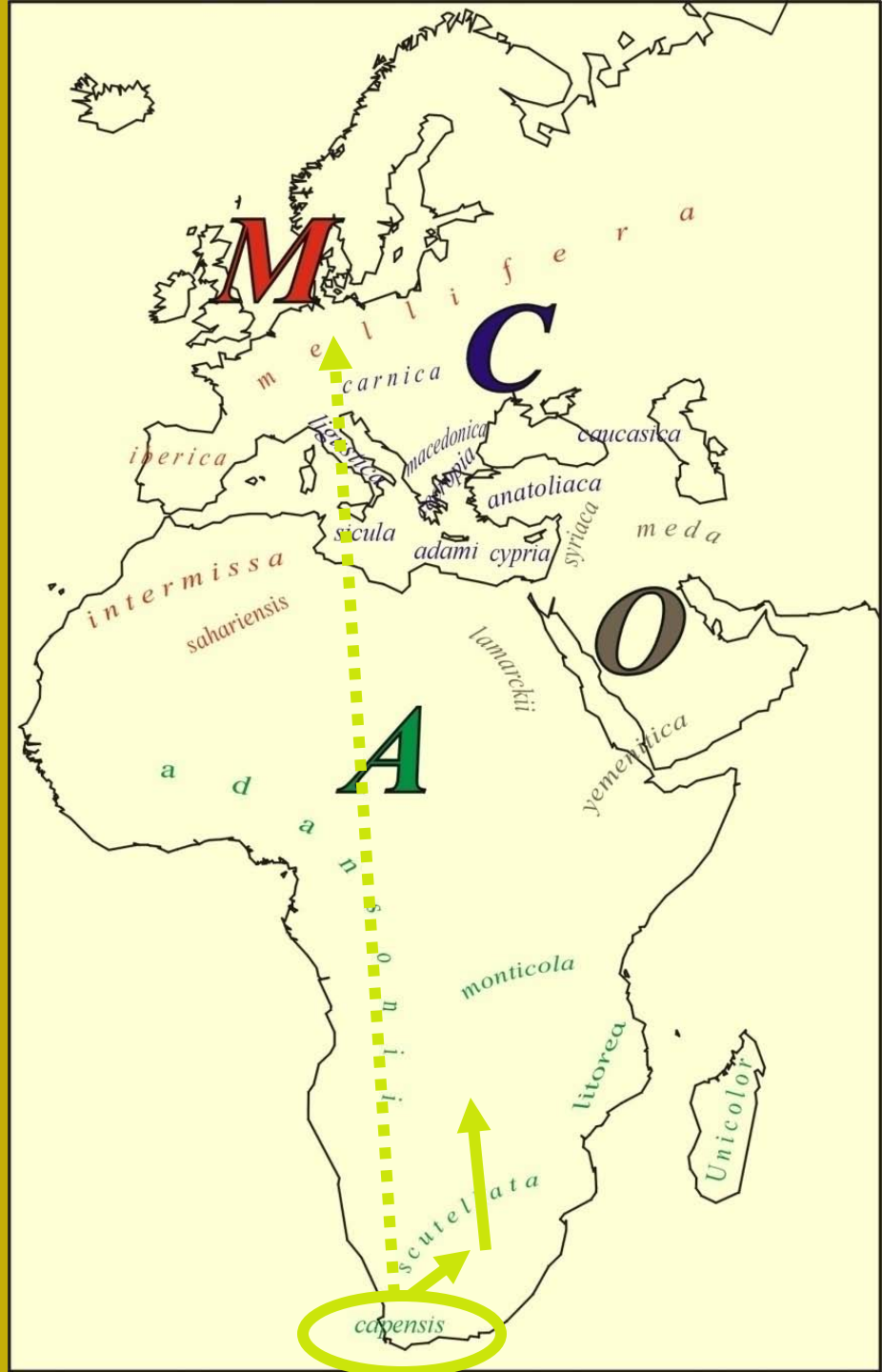
Introduction of new honeybee races by man

- **Africanized honey bee (Killer bees)**
- **Apis mellifera capensis**


Russland
Beaufort-see
Alaska (USA)
Beringsee
Grönland (Dk.)
Baffin-meer
K a n a d a
PAZIFISCHER
U S A
ATLANTISCHER
OZEAN
Mexico
Karibisches Meer
Venezuela
Kolumbien
Guyana
Suriname Fr. Guyana
Ecuador
Brasilien
Peru
Paraguay
Argentinien
Chile
Kiribati
Französisch Polynesien
Äquator
Südlicher Wendekreis
Nördlicher Wendekreis
Africanized honey bee


M
C
A
O
m e l l i f e r a
carnica
iberica
ligustica
macedonica
caucasica
anatoliaca
sicula
adami
cypria
syriaca
meda
intermissa
sahariensis
lamarckii
yemenitica
a d a n s o n i i
monticola
litorea
Unicolor
scutellata
capensis
Apis mellifera scutelata

Apis mellifera capensis



Migratory bee keeping

local and global trade with bees

causes increasing problems

for bee health

OIE List

Pathogen	List of OIE
Bacteria	American/European Foulbrood
Fungi	(Nosemosis)
Viruses	(SBV, DWV, CBPV)
Mites	Acarapisosis, Varroosis, Tropilaelaps spp.
Insects	Small Hive Beatle

www.beehealth.info

www.bienengesundheit.info