MANAGEMENT OF INSECT PESTS IN HONEY BEE COLONIES

Lambert Kanga, PhD

Entomology Department
College of Agriculture and Food Sciences
Florida A&M University
Tallahassee, FL 32307

HONEY BEE IMPORTANCE

Honey production

State	Million pounds	Number colonies	Estimated value $ million
North Dakota	34.2	495,000	$ 64.5
California	11.9	340,000	$ 22.9
FLORIDA	12.7	199,000	$ 23.1
Montana	17.7	149,000	$ 14.8

USDA statistics -- (2013)

Honey production has dropped from

235 million pounds (1987); 153 million (2007)

HONEY BEE IMPORTANCE

Pollination (1-4 hives per acre)

HONEY BEE IMPORTANCE

Added value to U. S. agriculture from honey bee pollination

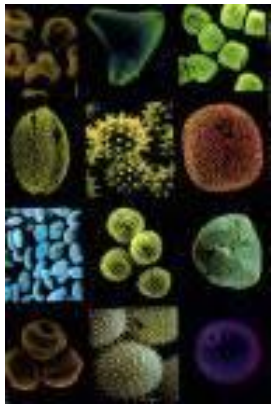
$15 billion annually

$ Biodiversity

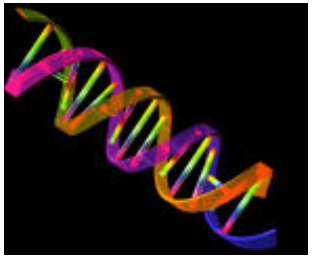
$ Biodiversity

HONEY BEE IMPORTANCE

Health foods / alternative medicine



- Propolis (glue within hive) - antiseptic, antibiotic
- Bees wax – candles, cosmetics, antiseptic
- Royal jelly – dietary supplement for general health
- Bee bread – pollen and honey; amino acids, vitamins
- Bee venom – for arthritis, rheumatism, MS
- Bee genome – understanding of human diseases



Value not known. Some people allergic

Pests and Pathogens of the Honey Bee

Pests and Microorganisms

Varroa mite

Tracheal mite

Small hive beetle – Wax moth

Nosema (Microsporidian)

Bacterial diseases

American Foulbrood

European Foulbrood

Fungal Diseases

Chalkbrood, Stonebrood

Viral Diseases

Acute bee paralysis virus,

Israeli acute paralysis virus

Kashmir bee virus

Deformed wing virus

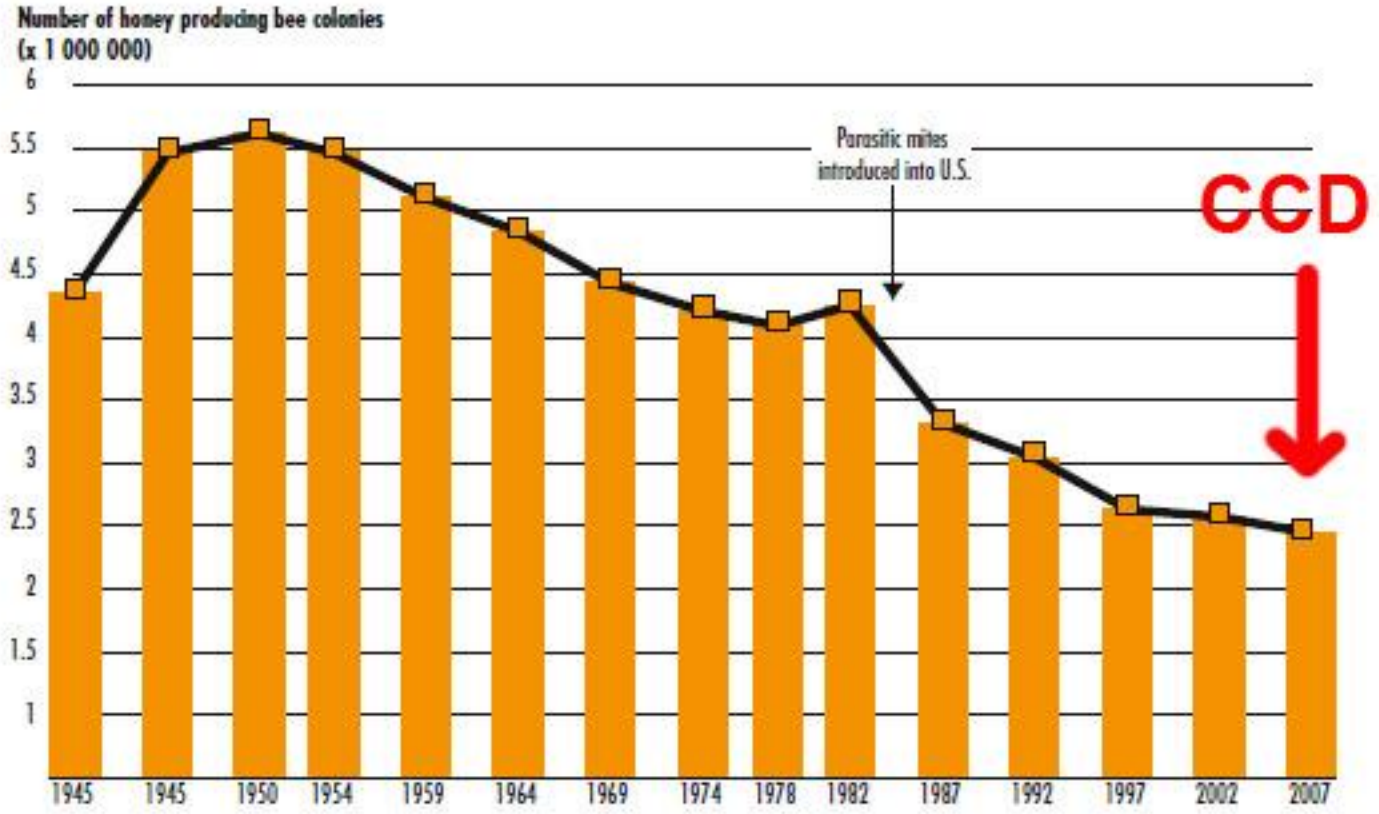
Black Queen Cell Virus

Chronic paralysis virus

Sacbrood virus

*Colony Collapse Disorder

Figure 4: US honey-producing colonies



Data source: U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS) NB: Data collected for producers with 5 or more colonies. Honey producing colonies are the maximum number of colonies from which honey was taken during the year. It is possible to take honey from colonies which did not survive the entire year.

HONEY BEE DISEASES

"Colony Collapse Disorder"

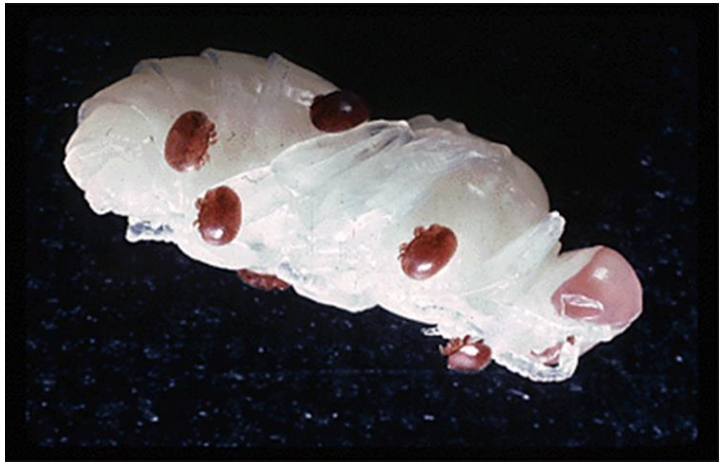
- **Possible causes and research**

  - **Malnutrition**
  - **Bee rentals and Migratory beekeeping**
  - **Electromagnetic radiation**
  - **Genetically modified crops (GMC)**
  - **Antibiotics and miticides**
  - **Pesticides**
  - **Pathogens and immunodeficiency (BQCV, DWV, ABPV, IAPV)**

MAJOR HONEY BEE PESTS

Varroa Mite

Small Hive Beetle



- **Biotechnical Control: Natural products, mite traps (Pettis et al. 1999)**

- **Genetic Control: Breeding for resistance (Rinderer et al. 2000)**

- **Chemical Control:**

  - Soft: Formic & Oxalic acids

  - Essential oils: Tymol

  - **Hard: Fluvalinate, Coumaphos (Elzen et al. 1998)**

- **Biological Control**

Biotechnical Control

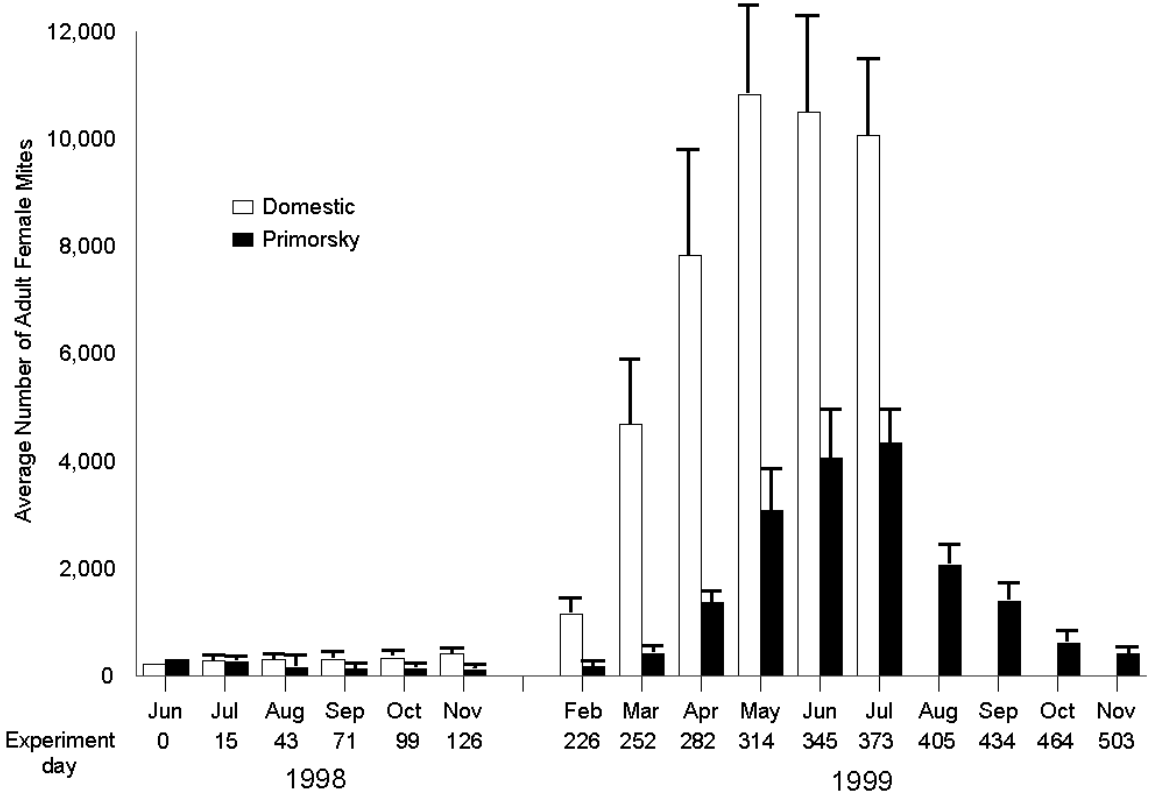
Biotechnical control Methods	Advantages	Disadvantages
Sticky traps	Mites are trapped at bottom of hive	Low level of control
Screen or mesh bottoms to hive	Slows mite development	Doesn't control mites
Powdered sugar dusting	Organic, inexpensive, no residue, will not contaminate honey	Tedious, and time consuming, attracts ants and honey robbers
Drone trap combs	Quick, efficient, change every 4 weeks	

Chemical Control

Chemical	Advantages	Disadvantages	Resistance
Amitraz	99% mite mortality No operator safety issues, inexpensive treatment No residue in beeswax	Increased 1-3 day old bee larvae mortality, Increased adult mortality, can cause bees to leave hive and form clusters	Yes, cross-resistance with Fluvalinate
Coumaphos	85-99 % mite mortality, low risk to operator	Some bee death, residue found in honey and wax	Yes
Fluvalinate	Mite mortality >95%,	Accumulates in beeswax over time . Cross resistance with Amitraz	Yes, cross-resistance with Amitraz
Apiguard (Thymol, Eucalyptus, Menthol, Camphor (Api-lifeVar)	90% mite mortality,	Overwintering problems	Not detected
Oil and Organic Acids	Mite mortality, various degree of success (50-99% mite mortality)	Labor intensive, multiple applications	Not detected

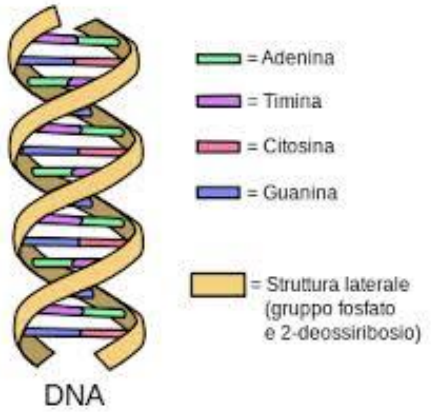
Breeding for Resistance to Varroa Mite

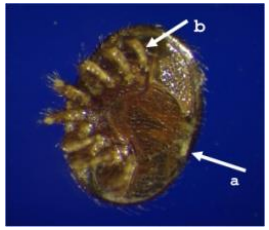
Russian Queen



Average *V. destructor* infestations (numbers of adult female mites) in Primorsky (black bars) and domestic colonies (white bars) through time American (Rinderer et al. 2000)

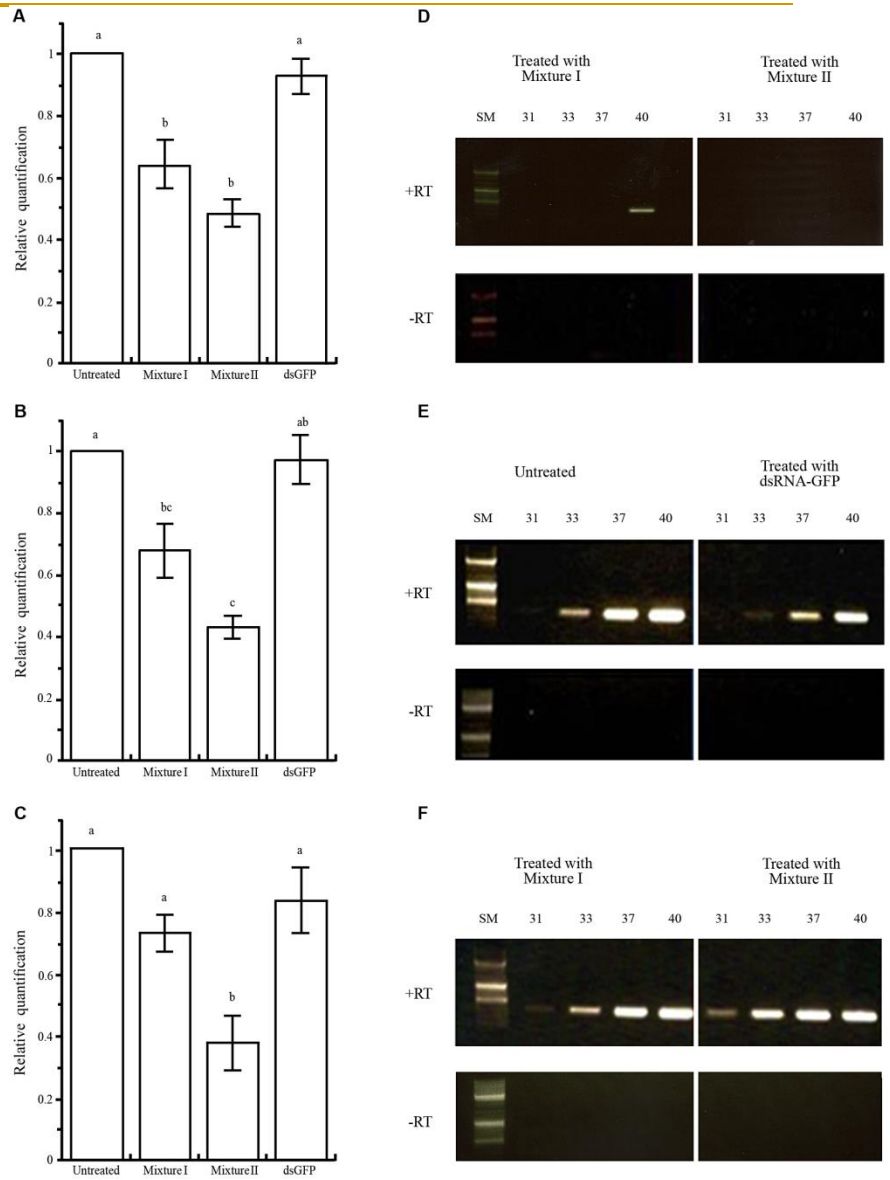
RNA interference





RNAi, or gene silencing, suppresses the activity of a specific gene in a target organism by disrupting gene expression(Rojahn, 2013)

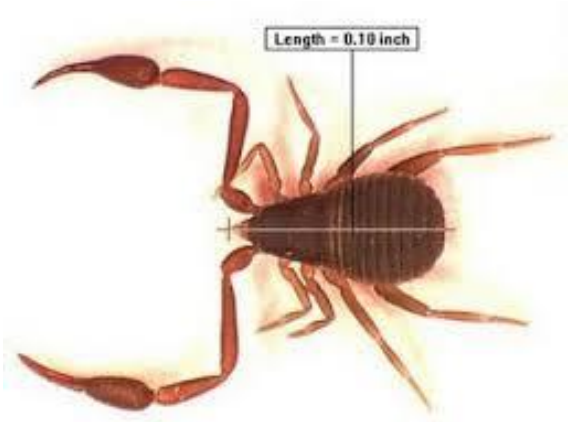
Targeting and silencing specific genes in a target organism may provide an excellent strategy for pest and pathogen control (Scott et al. 2013)



Mean number of *Varroa* mites per bee in four treatments (Garbian et al. 2012)

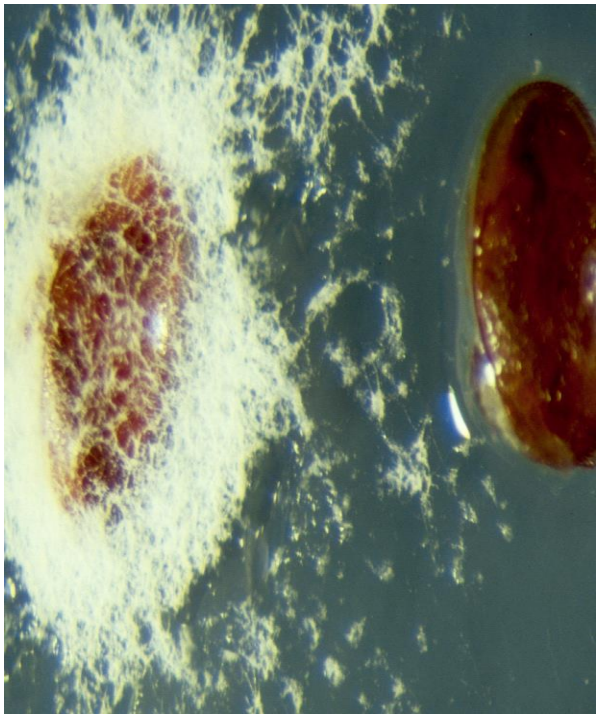
Biological Control

- Chelifers (Pseudoscorpions) are generalist predators of mites
- Presence in honey bee hives suggests a potential to exploit them as part of a management program for Varroa mites
- Two species of New Zealand chelifers, *Nesochernes gracilis* and *Heterochernes novaezealandiae*, were shown to consume Varroa mites

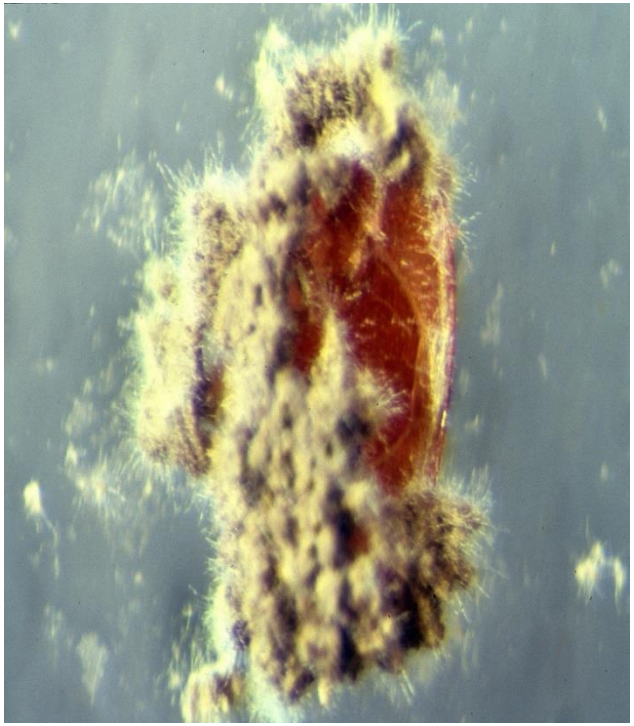


Nesochernes gracilis

Biological Control with Fungal Pathogens



Hirsutella thompsonii



Metarhizium anisopliae

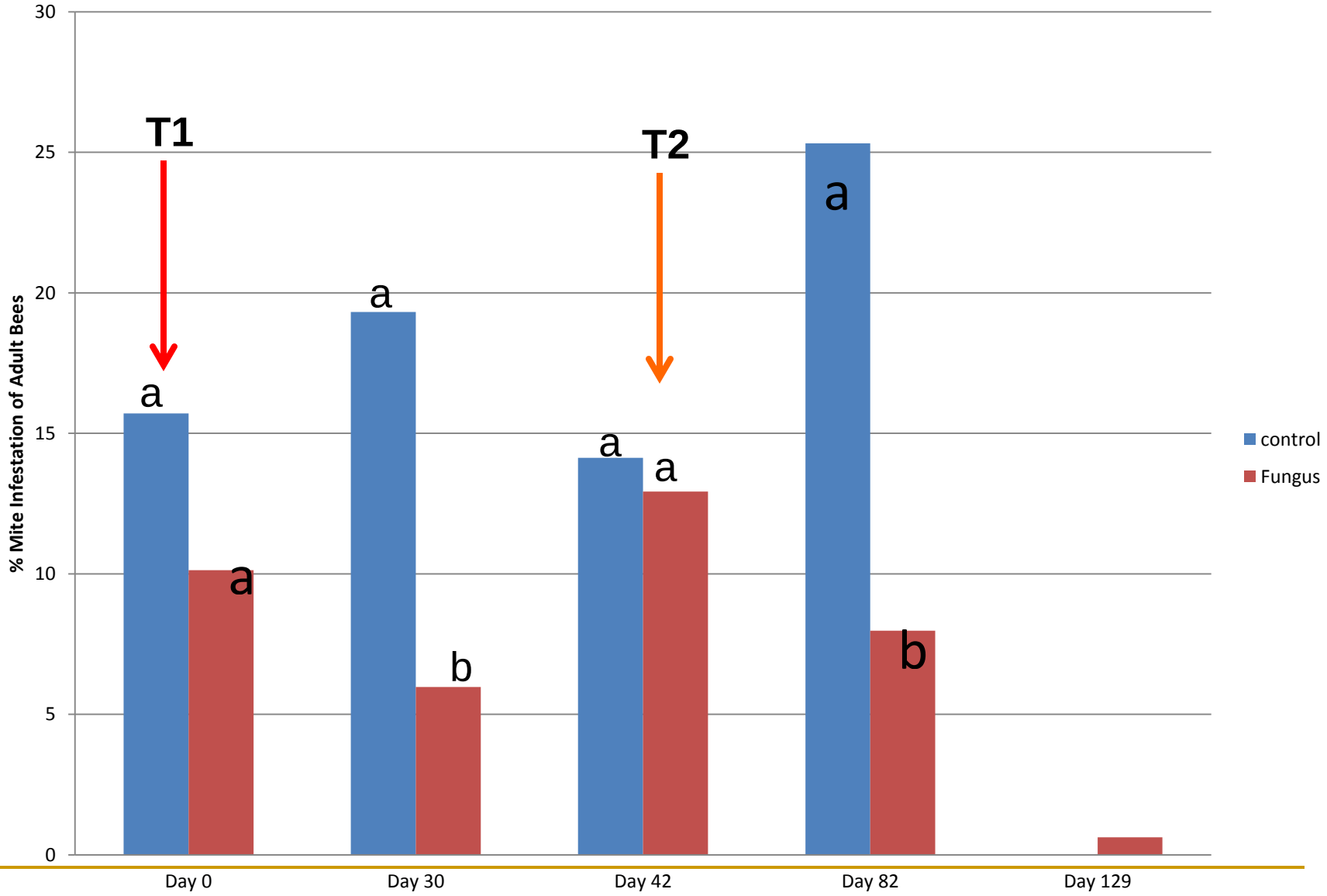
Patty Formulations

Strip Formulations

Fungal Spores

Varroa Mite Infestations after Fungal Treatments in Monticello, FL

(Kanga et al. 2013)



Small Hive Beetle

- **Pheromone traps**
- Trapping devices (beetle traps….)

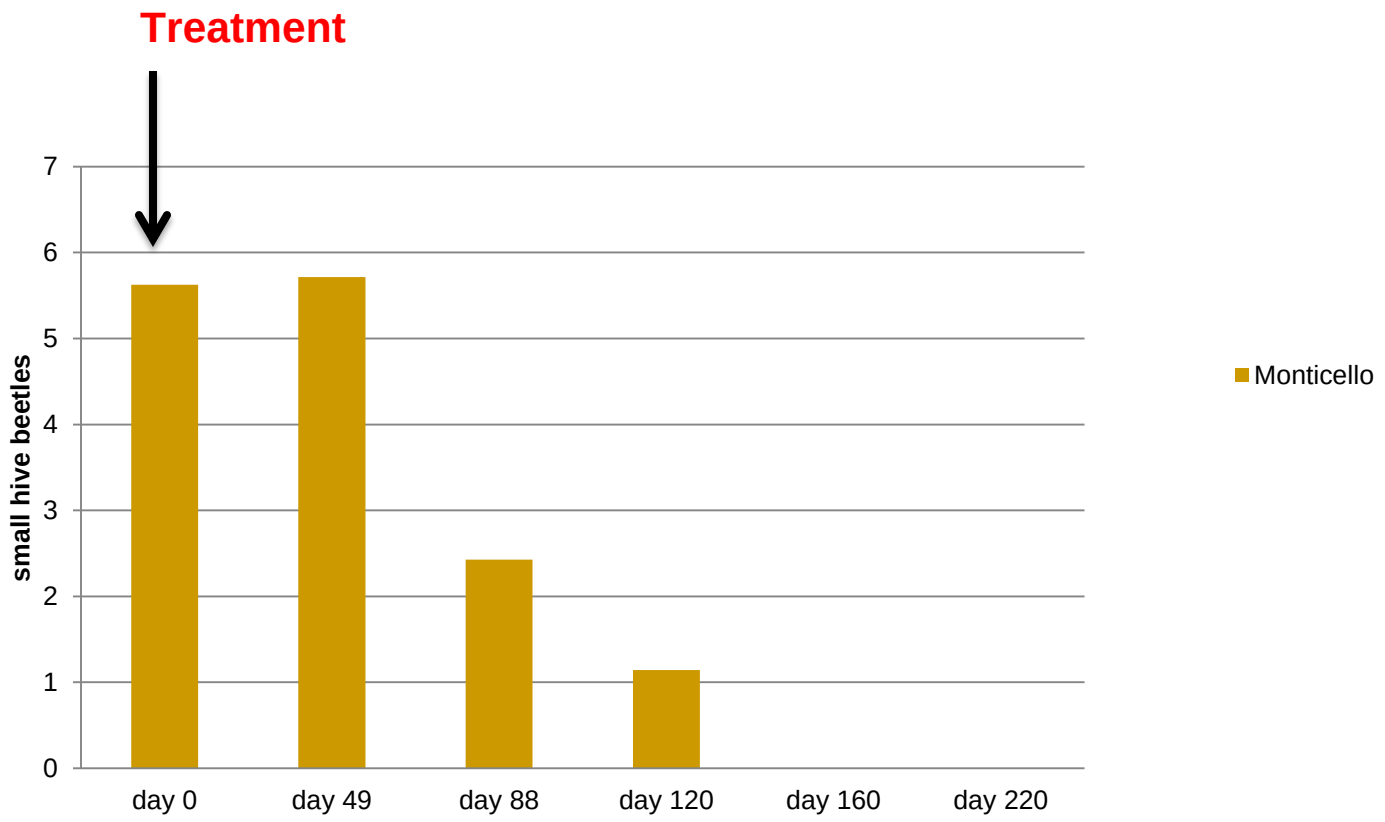
- **Chemical Control**
- Coumaphos (CheckMite®)
- Soil drench (permethrin)

- **Biological control**
- Nematodes (soil treatments)

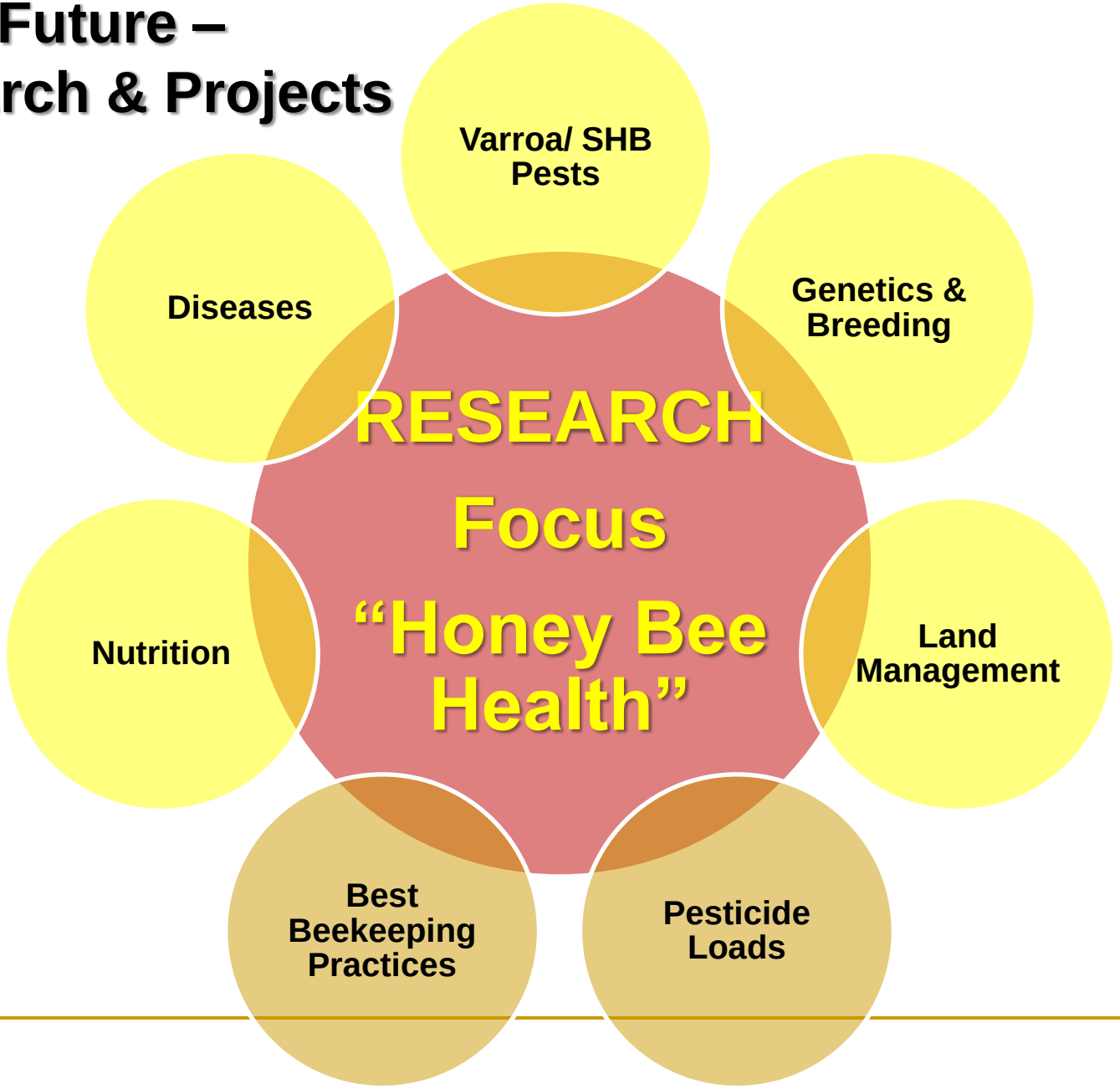
▪**FungalControl**
(bait station, soil treatments)

A. Beach sand was measured B. Crisco© shortening was placed on pan C. Fungal treatments were mixed with sand and Crisco© Shortening D. Pans treated fungal spores

Small Hive Beetle Infestations after Fungal Treatments in Monticello, FL (Kanga et al. 2013)



Future – Research & Projects



THANK YOU