

# Colony Collapse Disorder

PENNSTATE



Pennsylvania Department of  
**AGRICULTURE**



United States Department Of Agriculture  
Agricultural Research Service

Florida Department of Agriculture  
and Consumer Services

**NC STATE UNIVERSITY**

Dennis vanEngelsdorp  
Acting State Apiarist  
Commonwealth of Pennsylvania

# Honey Bees



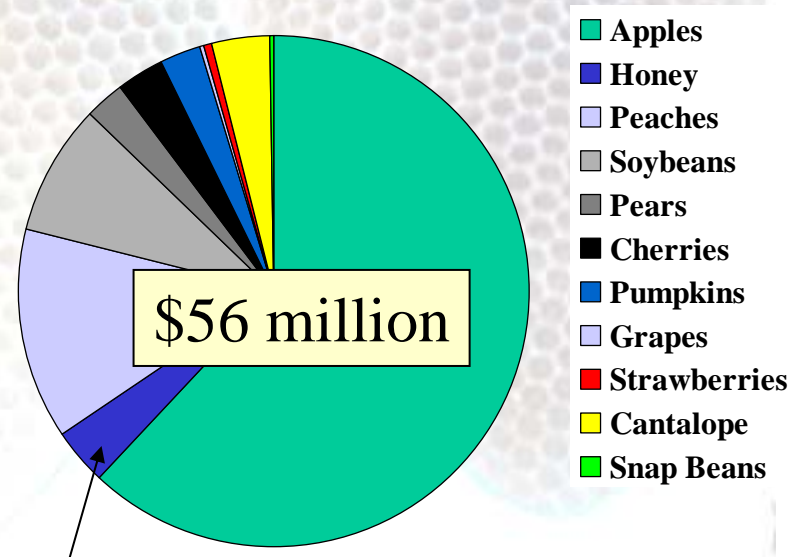
# Honeybees as Pollinators



©



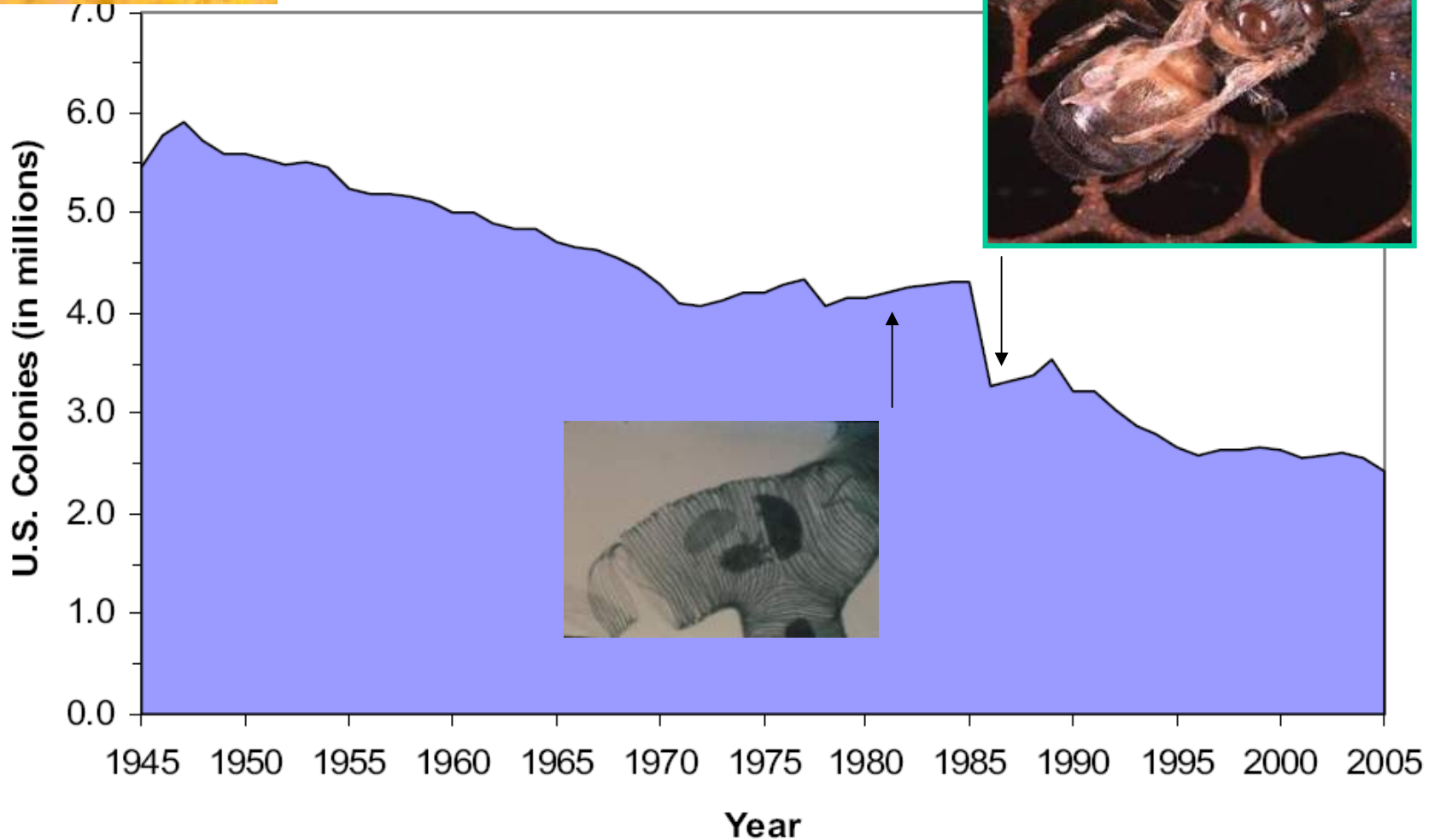
# Value of Honeybee pollination to PA economy



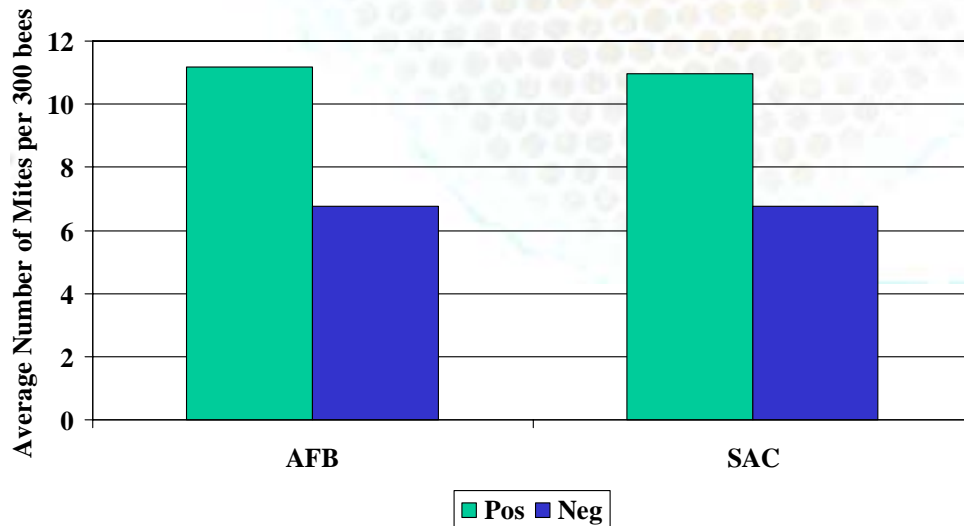
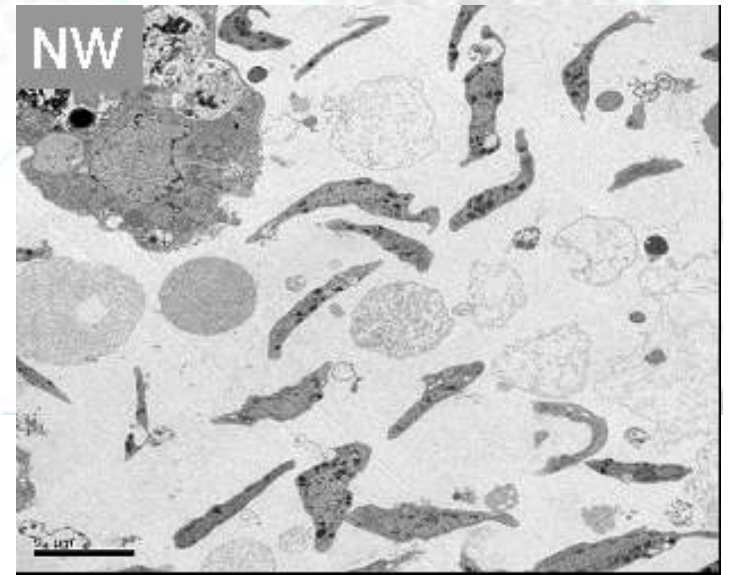
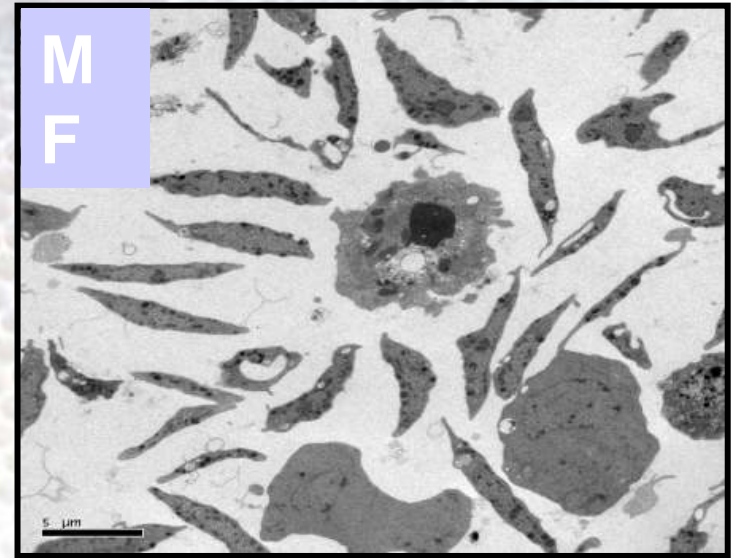
3.8% honey

- in 2005 we estimated that each colony provided \$1,659.21 to the PA economy

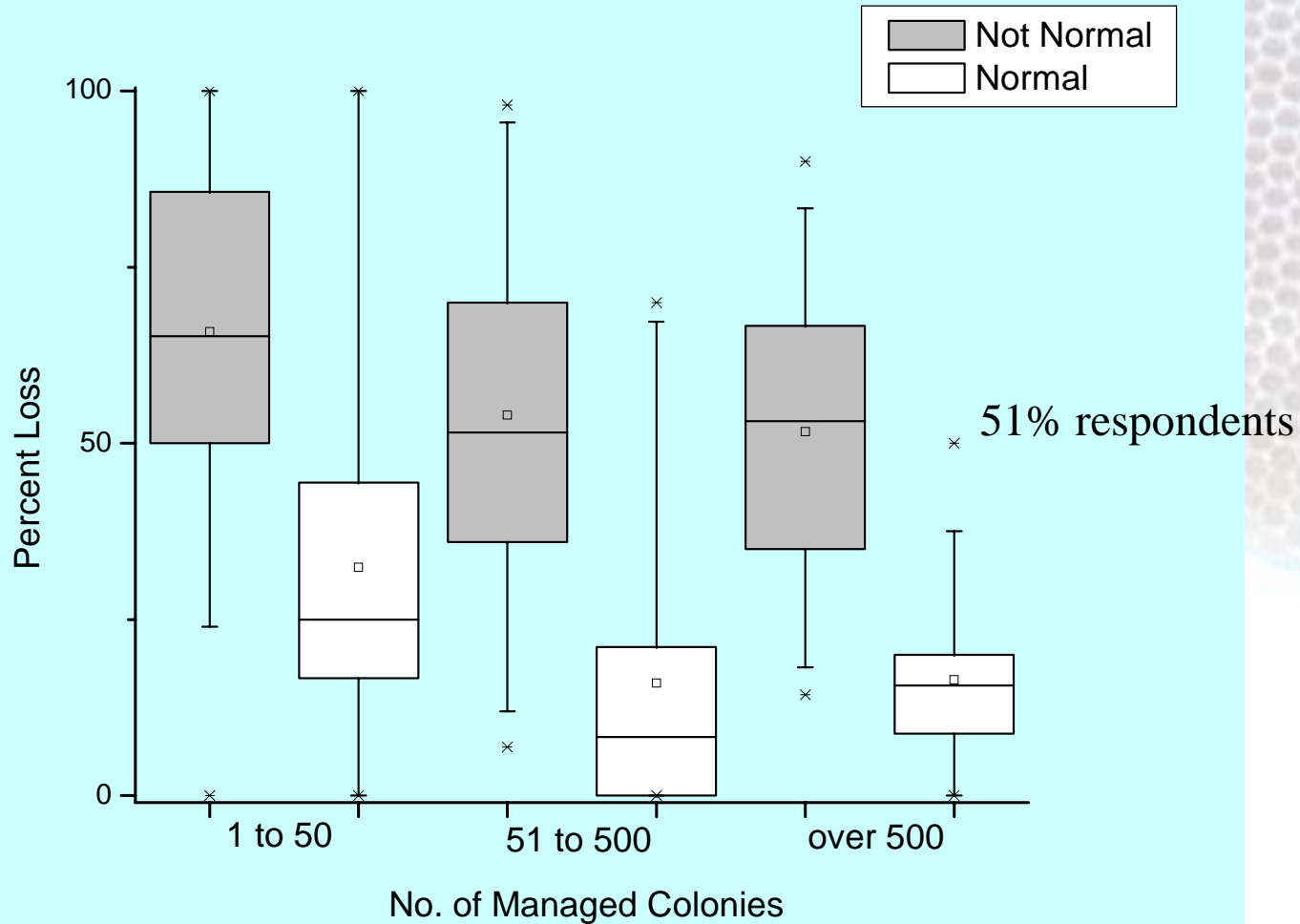
# Bees are in Trouble



# Varroa Mites



# Extent of Losses 2006-2007





# Symptoms of CCD

- Absence of dead bees
- When bees present
  - Appear young
  - Queen right
  - Insufficient amount to cover brood



N. Rice

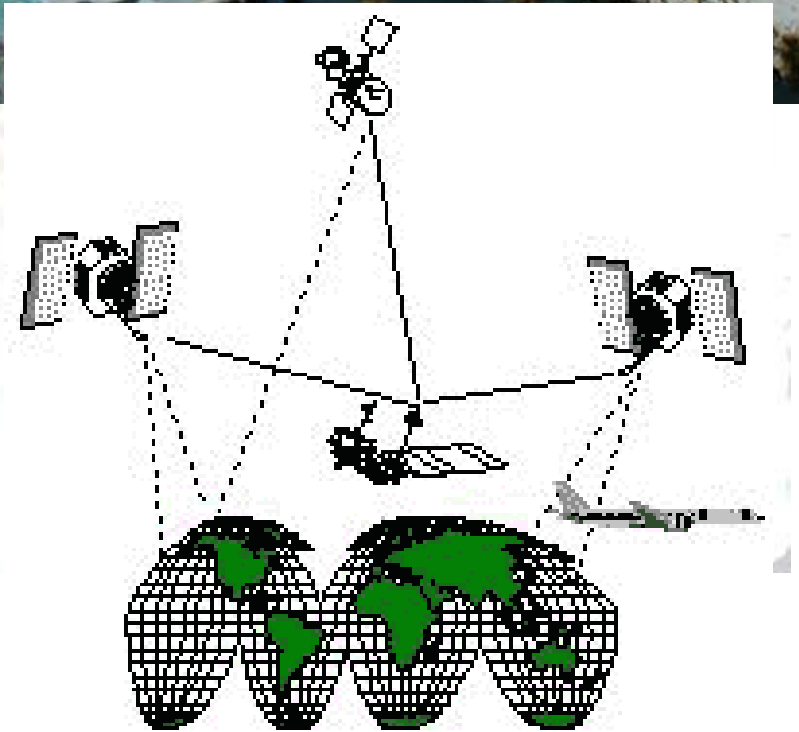


# Proposed Causes of CCD

- Cell Phones
- Rapture
- Terrorist
- Russian plot



C. Vorsek



# Top Lines of Investigation

## 1. Pathogen

1. New
2. Newly evolved

## 2. Pesticide

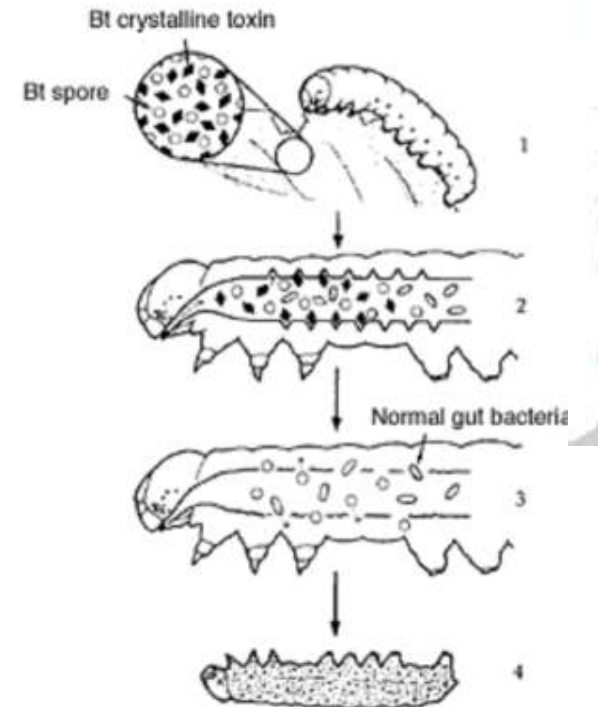
1. Beekeeper applied
2. Farmer applied

## 3. Environmental stress

1. Nutrition
2. Genetics

## B. Diagnostic test

1. In field
2. Laboratory

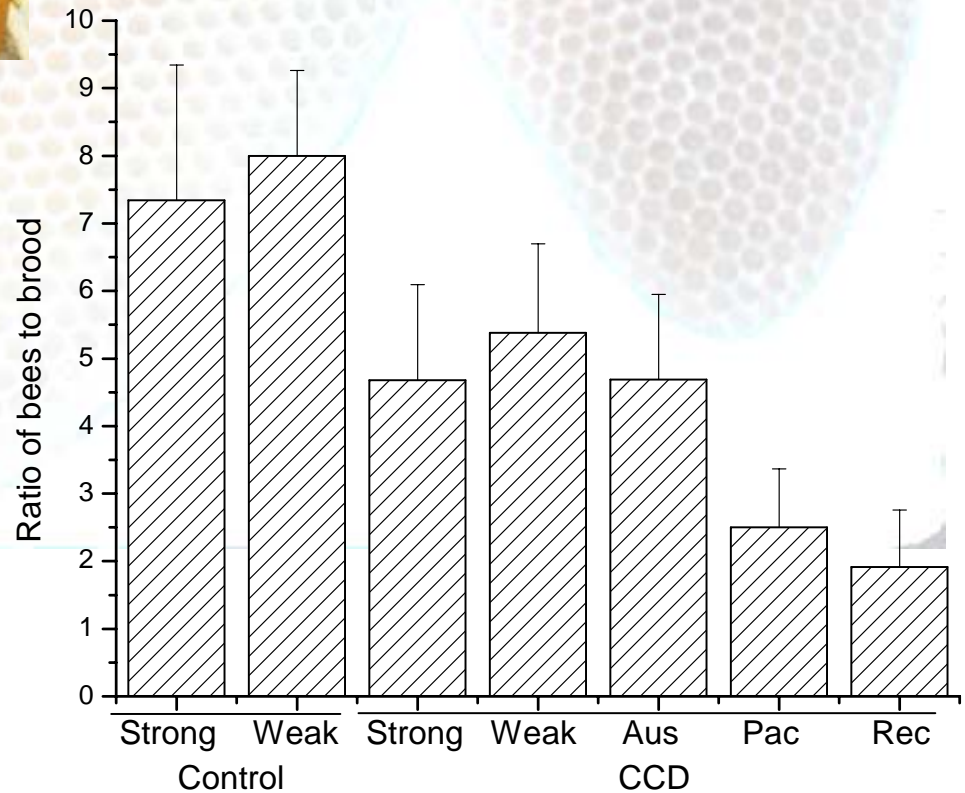


# Sample Collection



Yard Type	Colony type	N
Control	Strong	9
	Weak	6
CCD	Strong	24
	Weak	30
	Dead	14
	Recovering	6
	Package added	8
	Package installed	3

# Measure of Colony Strength





Andree & vanEngelsdorp

# Alcohol Samples: Necropsies

Type	N	Mean $\pm$ SE (%)	Sig
Aussie Package added	8	1 $\pm$ 1	A
Package	3	3 $\pm$ 3	A
Recovering	6	83 $\pm$ 17	B
Strong	34	16 $\pm$ 6	A
Weak	37	6 $\pm$ 4	A

# “Pebbled” Malphigial Tubules

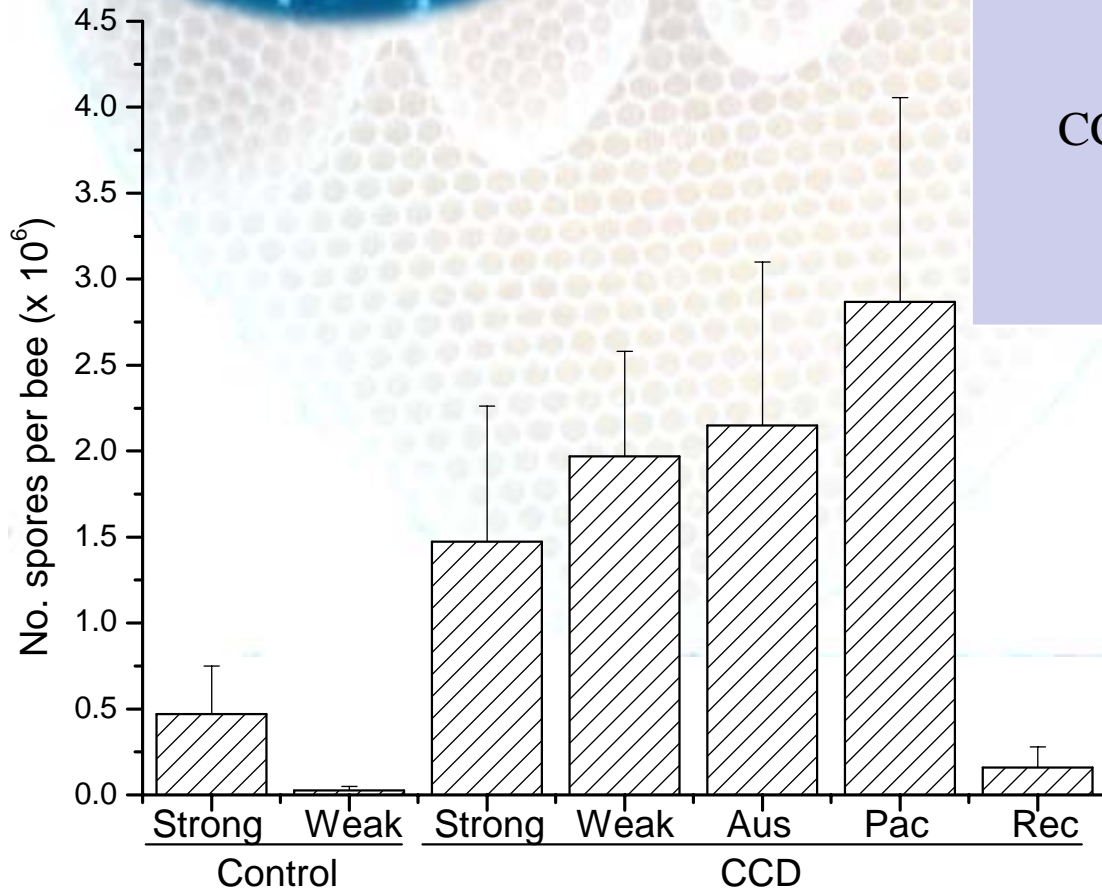


Type	N	Mean $\pm$ SE (%)	Sig
CCD	69	17 $\pm$ 4	A
Control	18	2 $\pm$ 2	B



vanEngelsdorp

# Nosema



Yard Type	Colony type	Median
Control	Strong	0
	Weak	0
CCD	Strong	0
	Weak	0
	Recovering	0.05
	Package added	1.5
	Package	2.6

**Table 1.** Closest sequenced relatives identified through BLAST analysis of the high-throughput sequence data.

Kingdom	Taxon (rank)	Organism
Bacteria	Firmicutes (phylum)	<i>Lactobacillus</i> sp.*† Uncultured Firmicutes†
Bacteria	Actinobacteria (class)	<i>Bifidobacterium</i> sp.*
Bacteria	Alphaproteobacteria (class)	<i>Bartonella</i> sp.*† <i>Gluconacetobacter</i> sp.*†
Bacteria	Betaproteobacteria (class)	<i>Simonsiella</i> sp.*†
Bacteria	Gammaproteobacteria (class)	Two uncultured species*†
Fungus	Entomophthorales (order)	<i>Pandora delphacis</i>
Fungus	Mucorales (order)	<i>Mucor</i> spp.
Fungus/microsporidian	Nosematidae (family)	<i>Nosema ceranae</i>
Fungus/microsporidian	Nosematidae (family)	<i>Nosema apis</i>
Eukaryota	Trypanosomatidae (family)	<i>Leishmania/Leptomonas</i> sp.
Metazoan	Varroidae (family)	<i>Varroa destructor</i>
Virus	(Unclassified)	CBPV‡
Virus	<i>Iflavirus</i> (genus)	SBV
Virus	<i>Iflavirus</i> (genus)	DWV‡
Virus	Dicistroviridae (family)	BQCV
Virus	Dicistroviridae (family)	KBV‡
Virus	Dicistroviridae (family)	ABPV
Virus	Dicistroviridae (family)	IAPV of bees‡

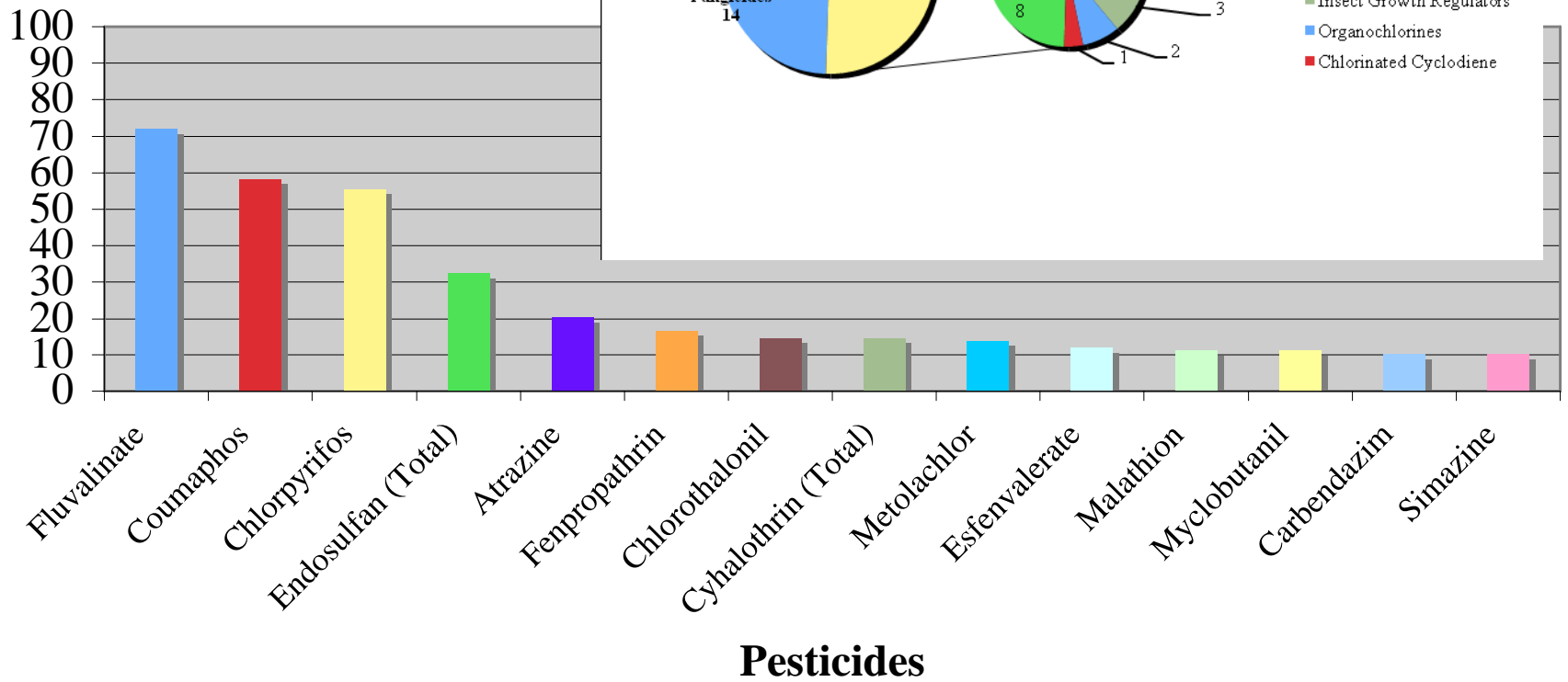
\*Found by Jeyaprakash *et al.* (10). †Found by Babendreier *et al.* (9). ‡Indicates viruses not yet classified by the International Committee on the Taxonomy of Viruses but that exhibit the key features of the indicated taxon.

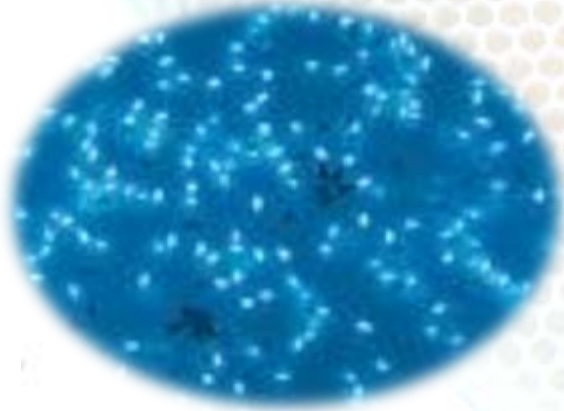
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# Pesticide Detections in Pollen





# Longitudinal Study Comb Treatment



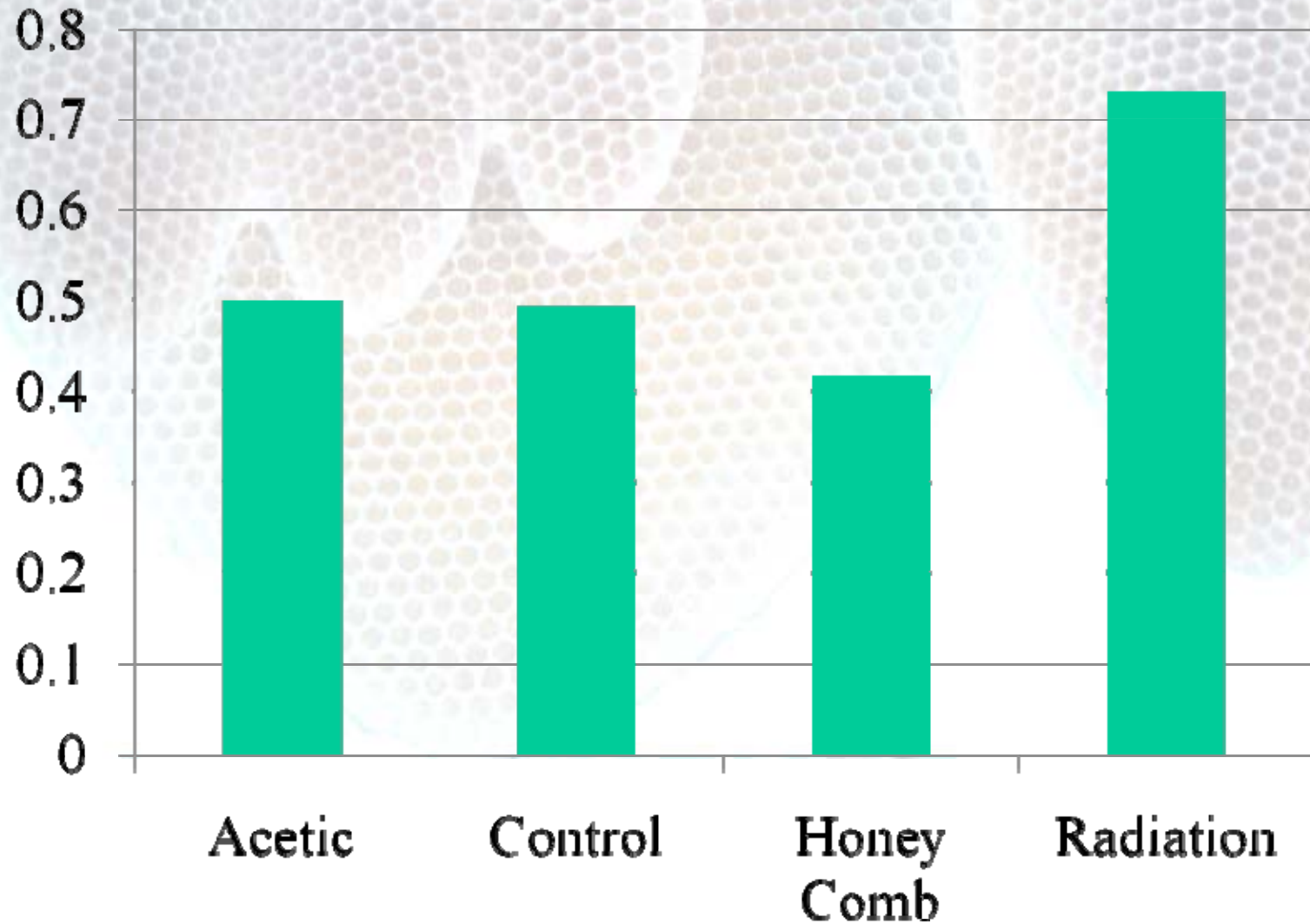
40 radiation  
40 control  
40 acetic acid  
40 honey comb

½ moved for pollination  
½ moved for honey

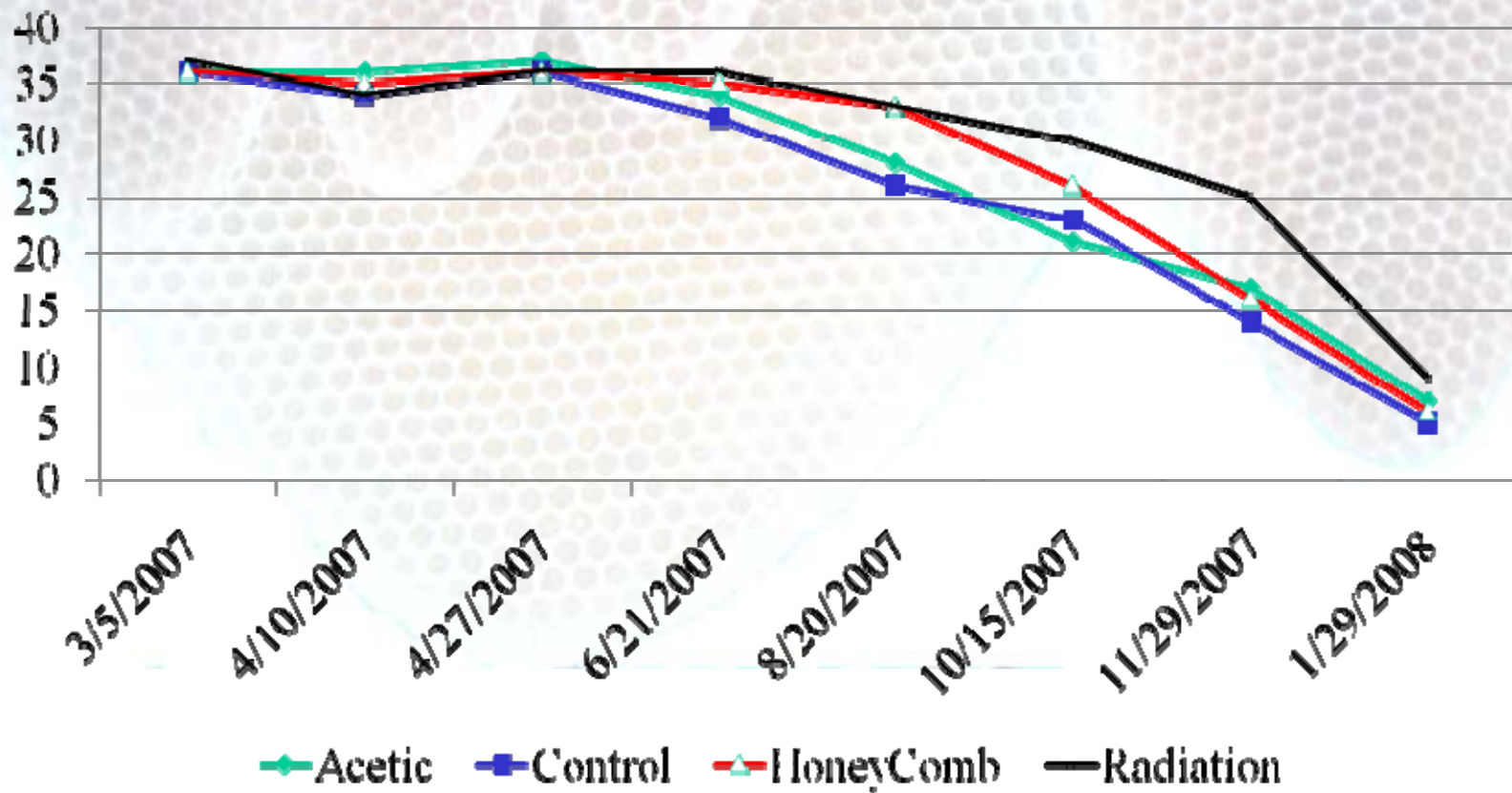
D. vanEngelsdorp

PDA/Penn State/NC State/USDA-ARS

# Percentage of colonies alive



# Survivorship of Colonies







# Past Funding



Beekeeping organizations  
Individual Beekeepers



United States Department Of Agriculture  
Agricultural Research Service



# This Years Funding



- USDA ARS
  - Federal bee labs
  - Additional funds in area wide grant



Häagen-Dazs loves Honey Bees



- Extramural Funding
- Emergency and critical issues grants
- NRICAP grant





# Future Funding

## “Pollinator Health”

- CCD Steering committee
  - Action plan
    - [Http://www.ars.usda.gov/is/br/ccd](http://www.ars.usda.gov/is/br/ccd)
  - Liaison within government

# Take Home Message

- Pollinators are not healthy
- Pollinators are essential
- No one “smoking gun” can explain CCD
- Long term sampling has been initiated and continue