

# Indicators of honey bee health and stress

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# Honey bee health

- Honey bees are part of our natural environment
- Honey is considered healthy and even healing
- Media report on colony losses regularly
- Numerous theories on causes but no consensus
- Does multifactorial mean, we just don't know?



# Honey bee stressors

- Numerous diseases are well known
- New technologies uncover new diseases
- Invasive species are adding to the list
- Land use competition with humans
- Toxic environment



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## Scientists and Soldiers Solve a Bee Mystery



Mike Albans for The New York Times

Members of a joint United States Army-University of Montana research team that located a virus that is possibly collapsing honeybee colonies scanning a healthy hive near Missoula, Mont.

By KIRK JOHNSON  
Published: October 6, 2010

DENVER — It has been one of the great murder mysteries of the garden: what is killing off the [honeybees](#)?

### Related

The Basics: Trouble in the Hive (October 10, 2010)

Green Blog: Giving the Honeybee Its Due (October 7, 2010)

Since 2006, 20 to 40 percent of the bee colonies in the United States alone have suffered “colony collapse.” Suspected culprits ranged from pesticides to genetically modified food.

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## Bee mystery not over yet

News reports overstate recent findings

By [Susan Milius](#)

Web edition : Tuesday, October 26th, 2010

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Ambushed on his way to the cafeteria one recent Wednesday after giving a talk, bee biologist Jeff Pettis proved remarkably gracious to this entomology paparazzo with a burning question.

On opening day at the 10th annual conference of the North American Pollinator Protection Campaign, Pettis allowed himself to be stopped for a chat in an echoing, block-long corridor in the U.S. Department of Agriculture's central hive in Washington, D.C. Asked whether the recent media buzz over a fungus-virus pair of bee pathogens means science has finally figured out why bees are vanishing in a mysterious illness called colony collapse disorder, he replied directly.

“We have not,” Pettis said, sounding a bit wistful.

A recent scientific paper made news by suggesting that a newly discovered virus and a long-lamented fungus might be combining to hammer the bees. Pettis, of the USDA Bee Laboratory in Beltsville, Md., rates the headlines as “overblown.”

Other bee researchers too have been saying “wait and see” since the latest fungus-virus hypothesis appeared in a [PLOS ONE paper](#) online October 6. The cautious chorus even includes the scientist who led the study that caused the fuss, Jerry Bromenshenk of the University of Montana in Missoula. Excited as he sounds about his research, he's not ready to claim that he has found the cause of colony collapse disorder.

What he and his colleagues say they have found is a link between the disorder and a pair of pathogens. All 45 of the collapsing or collapsed colonies the researchers sampled showed what look like signatures of infections by both a *Nosema* fungus, already well established in apiarists' nightmares, and some form of what's called an iridescent virus. Using a stand-in iridescent virus from moths, the researchers also found that combining the fungus and the virus did more damage to bees than either did alone.



## Controversial Pesticide Linked to Bee Collapse

Wired Magazine · 21 hours ago



A controversial type of pesticide linked to declining global bee populations appears to scramble bees' sense of direction, making it hard for them to find home. Starved of foragers and the pollen they carry, colonies produce fewer queens, and eventually collapse.

## Neocotinoid Pesticides Play a Role in Bees' Decline, 2 Studies Find

## How bees are harmed by common crop pesticides

sciencedaily.com · 1 day ago



ScienceDaily (Mar. 29, 2012) A widely used insecticide can threaten the health of bumblebee colonies and interfere with the homing abilities of honeybees, according to a pair of new

## Pesticides cause bees to lose their bearings

New Scientist · 1 day ago



If they eat the wrong thing, bees cannot find their way home. Two new studies confirm that a group of widely used pesticides subtly affect the insects' behaviour, and may be partly to blame for their

## The brain is full of Manhattan-like grids

Discover Magazine · 1 day ago

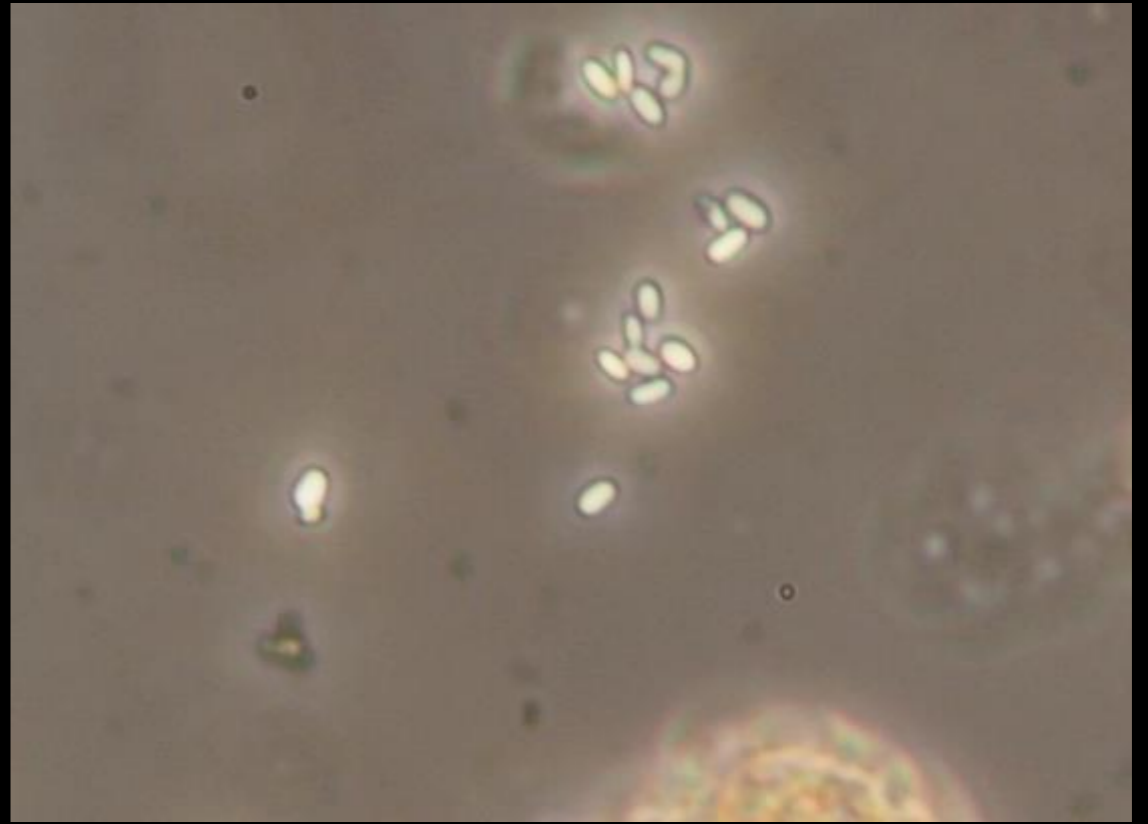
Headlines a few years back, on my web crawler.

# Homeostatis

Honey bees have evolved mechanisms to sustain large number of individual over the whole year

- Some resilience result from simply being too many to kill at once
- Loss of foragers leads to quicker maturation of younger workers towards this task
- Larvae are affected different from adults





# Disease related losses

- Varroa mites are suspect no. 1
- Causes the spread of two viral diseases
- Deformed Wing Virus and late winter loss
- Acute Bee Paralysis Virus early winter loss
- Nosema ceranae may cause problems in Southern Europe

# Honey bee immunity

- The honey bee genome suggest similar immune system to other insects
- Varroa mites and nosemosis inhibit honey bee immune respons
- Pesticides have been demonstrated to also inhibit immunity
- Virus diseases are rising as a consequence

# How to measure this?

- Bacterial community indicate health status
- High viral titres indicate weak immunity
- Hemocytes density indicate health status
- Challenge with inserted irritants
- Exposure to pathogenes in the lab



Honey bees exposed to fungal infection, not known to cause disease in bees

# Some key publications



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**

Current Opinion in  
**Insect Science**

## **Superorganism resilience: eusociality and susceptibility of ecosystem service providing insects to stressors**

Lars Straub<sup>1,2</sup>, Geoffrey R Williams<sup>1,2</sup>, Jeff Pettis<sup>3</sup>,  
Ingemar Fries<sup>4</sup> and Peter Neumann<sup>1,2</sup>



# SCIENTIFIC REPORTS

**OPEN**

## **Social apoptosis in honey bee superorganisms**

Paul Page<sup>1,\*</sup>, Zheguang Lin<sup>2,\*</sup>, Ninat Buawangpong<sup>3,\*</sup>, Huoqing Zheng<sup>2</sup>, Fuliang Hu<sup>2</sup>,  
Peter Neumann<sup>3,4,5</sup>, Panuwan Chantawannakul<sup>3</sup> & Vincent Dietemann<sup>1,5</sup>



Contents lists available at [ScienceDirect](#)

## Journal of Insect Physiology

journal homepage: [www.elsevier.com/locate/jinsphys](http://www.elsevier.com/locate/jinsphys)



Sperm viability and gene expression in honey bee queens (*Apis mellifera*) following exposure to the neonicotinoid insecticide imidacloprid and the organophosphate acaricide coumaphos



Journal of  
**proteome**  
research

Article

[pubs.acs.org/jpr](http://pubs.acs.org/jpr)

**Infections with the Sexually Transmitted Pathogen *Nosema apis* Trigger an Immune Response in the Seminal Fluid of Honey Bees (*Apis mellifera*)**

Julia Grassl,<sup>\*,†</sup> Yan Peng,<sup>†,‡</sup> Barbara Baer-Imhoof,<sup>†</sup> Mat Welch,<sup>†</sup> A. Harvey Millar,<sup>†</sup> and Boris Baer<sup>†</sup>

# A mutualistic symbiosis between a parasitic mite and a pathogenic virus undermines honey bee immunity and health

Gennaro Di Prisco<sup>a,1</sup>, Desiderato Annoscia<sup>b,1</sup>, Marina Margiotta<sup>a</sup>, Rosalba Ferrara<sup>a</sup>, Paola Varricchio<sup>a</sup>, Virginia Zanni<sup>b</sup>, Emilio Caprio<sup>a</sup>, Francesco Nazzi<sup>b,2</sup>, and Francesco Pennacchio<sup>a,2</sup>

<sup>a</sup>Dipartimento di Agraria, Laboratorio di Entomologia "E. Tremblay," Università degli Studi di Napoli "Federico II," 80055 Portici (NA), Italy; and <sup>b</sup>Dipartimento di Scienze AgroAlimentari Ambientali e Animali, Università degli Studi di Udine, 33100 Udine, Italy

Journal of Insect Physiology 86 (2016) 40–47

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The neonicotinoids thiacloprid, imidacloprid, and clothianidin affect the immunocompetence of honey bees (*Apis mellifera* L.)



Annely Brandt<sup>\*</sup>, Anna Gorenflo, Reinhold Siede, Marina Meixner, Ralph Büchler



