

When 1 + 1 = 4

Diana Sumanatro, - CCD limited to 2006 - 8.
Dennis vanE - no CCD in field for last 3 years.

BUT globally, bees continue to dwindle.

Theme

Research shows that pesticides, fungicides and herbicides while not fatal by themselves, are killing bees by acting together. Each pollutant, according to regulating agencies, is safe for us, but for the first time we are realizing that regulatory limits for single compounds are meaningless.

This has considerable implications for human health as we are exposed daily to thousands of low level toxicants in our food and environment.

What Chris Mullen has called **Toxic House Syndrome**

Began the C20th in PA one room school houses ...

WWII was a turning point :

- from a relatively small-scale, pastoral operation with stationary hives and little chemical input, to
- a highly industrialized business where mobility is intrinsic and pesticides, antibiotics and artificial feed are essential.

All this is happening in a larger context :

- monoculture, with extensive use of insecticides, weed killers, fungicides;
- the many viruses it triggers;
- increasing resistance to chemicals and thus ever more severe treatments.

Theme of beg of C21 :

SYNERGY : when the combined action is greater than the parts.

Bees are on the front line when it comes to testing whether synergy between minute levels of chemicals found in pesticides/fungicides/herbicides might have unexpected toxic effects.

Data Points

6000 scientific articles in 10 years. 600 pa. or 2 per day.

of chemicals formally registered - 50 m (Sept 2009)

In US, 1.2 bn lbs of pesticide sprayed pa. 3 lbs per person.

From Honey Colony web site : we're exposed to 82,000 synthetic chemicals every day!

1. 2007 - 12 : PSU (Mullin, Jim Frazier and Maryann Frazier,)

Looked for 171 toxic chemicals in pollen taken from 1200 plant and wax samples, :

- found 137
- Average of 5.4 chemicals per pollen sample
- up to 31 in a single pollen sample
- 214 ppm in stored pollen

- 121 different chemicals in wax comb
- 39 chemicals in a single wax sample

Of those 137 chemicals, 10 were found at more than 1/10th of the LD level for bees.

Suggests that sub-lethal effects were highly likely. Sub lethal effects include

- bees have less resistance to varroa;
- larval development is abnormal
- adult's ability to perform in-house procedures is confused

Using the above data, **Washington State Univ.** studied worker bees on the comb :

- delayed brood development times (a boon to varroa)
- increased death of larvae in the cells,
- reduced life spans for workers.

Main target of suspicion : Neonicotinoids. Initially thought to be safe as seed treatments, as compared to a spray, but they are present in nectar and pollen at 10 ppm., which was thought to be harmless to bees. But

- France, Apimondia 2009 - bees died when placed near fields of sunflowers treated with imidacloprid, the first of the neonic pesticides.
France : bans in 2013, despite protests of pesticide indus, which continues to test neon's individually.
Discussions with Alsace beekeepers - skeptical (too short, too many ignore.)
- Kim Flottum and monarch butterflies (drift to adjacent acreage, milk weed, 164 ppb, v 9 ppb for monarch butterfly larvae.)
- Ontario - 80% agric. acreage neonic free by 2017.

Note : European credo, promote balance between humans and nature

US credo, manage nature to serve human prosperity.

So Europe - new chemicals must be proven safe before released

US - released with minimal testing and onus is to prove their failings after their release.

2. Yves leConte :

Bees exposed to both imidacloprid and nosema showed

- a higher bee mortality, which was associated with ...
- lower resistance to disease : bees showed a reduced functioning of an enzyme (glucose oxidase) which is involved in the production of hydrogen peroxide, which adult bees secrete into the food they feed larvae, which sterilizes the secretions and prevents disease. Thus the colony environment less antiseptic.

Just as impactful on wild bees.

3. Wanyi Zhu, PSU, life table analysis - plotted all the findings since 2006 :

Subtle effects -

- small increases in larval mortality
- disoriented foragers don't return to the hive, therefore reduced pollen/nectar collection
- workers start to forage one or two days earlier than they normally would.

Result in

- reduction of the adult worker population
- the age structure that characterizes a healthy colony is disrupted;
- disrupts the balance of eggs, larvae, pupae and adults
- earlier foraging by adult bees which removes younger bees from house duties such as feeding the young, and thus higher brood mortality.

Zhu's model mimics toxic house syndrome almost exactly. Superficially all seems well, and then they start to dwindle and eventually die.

Synergy between the chemicals in pesticides, herbicides and fungicides :

- reduces a bee's ability to detoxify itself,
- diminishes the immune system's capacity to respond to disease,
- limit a bee's production of agents that sterilize larval food.

So, add to this more toxic, less sterile. more vulnerable environment ...

- a disease such as nosema which induces worker bees to start foraging at a younger age, or
- a virus triggered by varroa,

and synergy tuns deadly. The factors do not simply add up - they escalate exponentially. 1 +1 not = 2.

Human Health.

US Environmental Working Group's "Dirty Dozen" - crops most contaminated by pesticides and fungicides.

<http://www.ewg.org/foodnews/list.php>

Executive Summary : EWG publishes its annual rating of conventional foods with the most and least pesticide residues to fill the void left by the U.S. Environmental Protection Agency, which has largely failed to tell Americans they have a right to know about the risks of pesticide exposure and ways they can reduce pesticides in their diets.

apples : 99% test positive for at least one pesticide.
 single strawberry contains at least 15 pesticides, as do
 grapes : celery : cherry tomatoes : imported snap peas,
 spinach tests positive for at least one pesticide, as does
 sweet bell peppers, imported nectarines :
 potatoes : have more pesticides by weight than any other food

Because the toxins in even apples are too small to have a noticeable health effect, the argument is that the health benefits of a diet rich in fruits and vegetables outweigh the risks of pesticide exposure. But the EWG site also states that synergy between these minute doses of pesticide is linked to

- toxicity of the nervous system
- cancer
- hormone system disruption
- IQ deficits

and may be associated with

- ADD in children
- diabetes

Add to this the links between

- PVC building materials - childhood asthma
- arsenic in decking materials - bladder cancer
- birth control pills - early onset of puberty in young girls, via drinking water
- vitamin A in sun screen - emergence of skin cancer.
- combustion products from coal - preterm births
- ingredients in plastics - asthma
- air pollution, and heavy metals - autism

and we are living in a toxic chemical soup.

Toxic substances have been screened individually, but none has been evaluated in groups of two, or three, or five, or ten of 100.

Ross Conrad. Realistically, no chemical is going to be thoroughly tested for safety either to humans or insects before being marketed. Consider that to test the synergistic actions of just 1 000 toxic chemicals in combinations of five chemicals each would involve testing over eight trillion chemicals. At one million per year it would take 8 000 years to complete such a study.

Diane Reame on increased death rates of heroin users. Heroin and phenobarbital growers or suppliers cut pheno. into heroin, increases affect by as much as 12 x. Users take usual dose not knowing ...

Marla Spivak; (TED talk) Not no what CCD feels like, but does know what flu (a virus) grocery store, food desert, toxins, not find way home.

Suppose I am exposed to pesticides in strawberries, arsenic from my deck, sunscreen on my face. Is each present at 1 millionth of a harmful dose, or does synergy amplify their effects?

Suppose I just had the flu, or a mild heart attack, or I'm 9 months old and my brain is in over-drive? (EAS - neon's pass thru placenta to brain of babies in utero)

Anecdotal : grandchildren, how often sick, miss school, Luke and pediatrics ... Not what I experienced. New generation of super bugs? My grandchildren not representative of all? or the food we eat, the air we breathe, the water we drink, have been permeated by chemicals, many of which are toxic, many of which synergies in ways of which we are unaware? A chemical soup.

We don't know, and we should be outraged that we don't know. Beekeepers are the ones who are witnessing it first hand in microcosm.

Meanwhile the EPA still issues risk assessments based on tests of one material at a time.

Sacrifice quality of life in the interests of quantity and short term profits.

Berkley, Princeton, Stanford study : honey bee may disappear in three human generations, not because bees are sick but because environment too toxic to support them.

An Alternative :

Pharmaceutical industry.

Estimated global cost of illnesses and deaths caused by synergistic interactions between drugs is \$130 bn. e.g..

- Warfarin (an anticoagulant) interacts with aspirin and antidepressants
- St John's Wort interacts with tobacco and garlic
- Monoamine oxidase (antidepressant) interacts with chocolate, cheese, avocados
- Lipitor + grapefruit can lead to liver damage or kidney failure

So regulatory authorities require exhaustive tests on drug interactions, and pharmacists are trained to inform patients of potential dangers with prescriptions.

Solutions.

- more small, local beekeeping operations integrated into the local agric. system
- Improved habitat (greater diversity, blooming weeds. (Mark Wilson - monocultures NOT the most efficient way to feed a global population of 9 bn by 2050.)
- Improve management of all pollinators,(eg.honey,bumble, mason bees)
- Improve understanding of species needs and interactive mechanisms. eg. monarch butterfly, milk weed and neonics.
- More rigorous testing and less use of pesticides, fungicides, herbicides
- nation wide initiatives, eg
Obama initiative re pollinator habitat
Natureparif : a European wide agency for preserving biodiversity. Three objectives :
 1. to record, evaluate and monitor the status of biodiversity;
 2. to foster public dialogue and support local initiatives;
 3. to identify and share best practices..

The question now is - Are we going to be proactive, or does there have to be a monumental natural disaster before we act?

Beacons of hope :

Ontario

3 years of education of public and journalists

Toronto Star story

Legislation - 2017, neonics free

roadside verges pollinator habitat zones.

Easy to feel pessimistic or powerless and to project one's worst fears.

Think back to dire warnings that preceded freeing of slaves, women getting the vote, civil rights enactment, gay marriage.

1989 - anyone who suggested that Berlin Wall, apartheid, smoking ... Revolutions from below - people voted with their feet and their wallets.

Francesco Panella : The agro-chemical industry is in control. 8000 years ago agriculture was the key in the move from barbarism to civilization. That which made us civilized is now under threat. In the middle of the financial crisis there is also an agricultural crisis.

What was once seen as a magic solution is now poisoning our environment. we see that pesticides are more effective but less safe.