



European Honey Bee Decline Continues While Aggressive Africanized Honey Bees Attack in Southern U. S.

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"I think bringing African bees to Brazil in 1957 for hybridization experiments was the environmental blunder of the 20th Century!"

- Jerry Hayes, Apiary Dir., Florida Dept. of Agriculture



Left: European honey bees surround their queen on right that has larger body and short wings.

Right: Africanized honey bees surround their queen on right, marked with pink dot for clarity.

The only scientific way to distinguish between the two honey bee species is DNA analysis.



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Earthfiles, news category.

March 30, 2009 Gainesville, Florida - The mysterious disappearance of hundreds of European honey bee colonies in Pennsylvania was first reported in late fall 2006. In the past three years, the baffling empty hive syndrome called Colony Collapse Disorder (CCD) has been reported in many parts of the world. Some beekeepers have lost nearly 100% of their bees. Even though nicotine-based pesticides are high on the culprit list, to date, scientists have not been able to pinpoint the exact cause - and empty hives continue - although the good news is that American bees are not disappearing as *rapidly* as they were.

A year ago, the California almond growers were so worried about getting enough honey bees to pollinate their valuable almond crop that there were discussions about importing Mexico's Africanized honey bees to fill the gap created by disappearing European honey bees that have traditionally been the main American pollinator.

The Apiary Assistant Chief in Florida's Department of Agriculture in Gainesville, Florida, is Jerry Hayes. He never thought using Africanized honey bees to pollinate almond or any other crop was a good idea. He has long worried that the encroachment of Africanized bees into the southern United States would bring violence and speed the elimination of calmer European honey bees since the aggressive and tough Africanized honey bees take over genetically.

Ironically, as 2009 came with the severe financial collapse that keeps rippling around the world like dominoes falling, orders for almonds fell off sharply. Now, almond growers are desperate to save money in a declining market and have even plowed under almond acreages! That means less pollination demands on the European honey bees this spring, which might help them recover more strongly. But surging even stronger are the Africanized honey bees making their own way from Mexico into the southern states where they can survive year round and are viciously attacking people and animals.

Recently I asked Jerry Hayes for a current update on colony collapse disorder and the Africanized bee threat. He begins with the surprising decline in almond demand, a crop entirely dependent upon honey bee pollination.

Interview:

Jerry Hayes, Assistant Chief, Bureau of Plant and Apiary Inspection, Division of Plant Industry, Florida Department of Agriculture, Gainesville, Florida: : “The situation for almond pollination has changed. With the economy, almonds are not as valuable and then in California, they are having major water irrigation issues in agriculture. Almond groves have actually been bulldozed. Others are not being irrigated so they won’t produce a crop. But of course, there are others that still need pollination.

WHAT YOU MEAN IS THAT THE COMBINATION OF DROUGHT AND WATER PROBLEMS, PLUS THE ECONOMY AND REDUCTION IN DEMAND FOR ALMONDS, THAT SOME ALMOND ACREAGE HAS EVEN BEEN PLOWED UNDER AND THAT MEANS LESS DEMAND FOR THE HONEY BEES.

Right, less demand for honey bees and then almond growers were concerned earlier about getting enough pollination, they negotiated contracts early on for \$150 per colony. And then with these things that have popped up, they went back to re-negotiate or to cancel contracts with beekeepers, unlike things we’ve done with A.I.G. But I’m not bitter, OK? (laughs)

A.I.G. GETS BAILED OUT, BUT THE POOR HONEY BEE KEEPERS DO NOT GET BAILED OUT BY ANYBODY.

Nobody gets bailed out by anybody. The almond growers are left to fend for themselves and the old question remains: do we care where our food comes from (international food imports to the U. S. continue to rise with unknown consequences.)

WHAT IS YOUR OWN ASSESSMENT AS ASSISTANT CHIEF OF THE APIARY DIVISION IN FLORIDA’S DEPARTMENT OF AGRICULTURE ABOUT WHAT IS HAPPENING NOW TO THE EUROPEAN HONEY BEE DECLINE?

We still do not know. We still think it’s a combination of stressors – nutrition problems, pesticides, environmental changes in moving colonies for pollination, pathogens.

I was watching some show on PBS the other night and it was about striped bass and how the populations of striped bass have fallen. If you had switched the words striped bass for honey bees, it was the same thing from researchers on striped bass – poor environment, the water is bad and because the water is bad and we are over-fishing, the fish don’t have enough nutrition. Then because of that, secondary pathogens move in and there is over-fishing on the striped bass themselves. The thought for me was, ‘Golly! Maybe honey bees were the canaries in the mineshaft, alerting us to the things that are now happening to other species. It certainly seems like we’re poisoning ourselves.

HAVE YOU BEEN GETTING REPORTS FROM FLORIDA HONEY BEE KEEPERS ABOUT THEM OPENING UP HIVES AND FINDING A LOT OF EMPTY ONES IN THIS WINTER TO SPRING 2009?

Yes, we have. Opening up some colonies and the bees appear to be gone, similar to

CCD-like symptoms. Others that the bees are weak and are not building up. Their population is not increasing as it normally would, but these reports are dramatically less than they have been in the past couple of years.

FROM YOUR PERSPECTIVE, COLONY COLLAPSE DISORDER IS STILL A PHENOMENON THAT IS AFFECTING HONEY BEES IN NORTH AMERICA AND OTHER PLACES?

Yes, absolutely! Hopefully, we are on the downhill slide, but is it Darwin in action that has killed off all the weak and the survivors are the ones that are reproducing?

WELL, I'M CURIOUS WHAT YOU THOUGHT OF THAT LATE FEBRUARY 2009 ARTICLE OUT OF THE BBC IN WHICH THE HEADLINE SAID SOMETHING ABOUT COLONY COLLAPSE DISORDER NOT BEING A DISEASE AND QUESTIONING THE CCD PHENOMENON.

IT WAS AS IF SOMEONE WANTED TO PRESENT SOMETHING IN THE WORLD MEDIA THAT THERE WAS NOTHING TO COLONY COLLAPSE DISORDER. DID YOU READ IT? AND IF SO, WHAT WAS YOUR REACTION?

I was rather shocked because we certainly have amassed data over the last couple of years not only in the United States, but in Europe and Asia that this phenomenon has been going on. It's a bizarre shock coming from the BBC because you expect the BBC to have its ducks better lined up in a row than it did in this particular article.

AND WHAT WAS REALLY PECULIAR WAS BURIED ON PAGE 3 OF THAT ARTICLE WAS THE ACTUAL HEART OF WHAT SO MANY BEEKEEPERS THINK IS THE PROBLEM AND THAT'S THE NICOTINE-BASED PESTICIDES.

THIS SAME BBC REPORTER SAID THEY CAUSE MEMORY PROBLEMS IN THE BEES SO THEY CANNOT GET BACK TO THEIR HIVES. AND I THOUGHT, WHY ISN'T THIS THE LEAD ON THIS BBC STORY?

Well, yeah. That's well documented. Research on that, we have lots of data from Europe. I just read a research report from Taiwan – all the data is the same. Neonotinoids, and some other pesticides as well, affect honey bee short term and long-term memories and many other things. I'm not quite sure where the BBC was going with all that stuff.

YOU AND I HAVE TALKED OVER THE PAST YEAR THAT IF COLONY COLLAPSE DISORDER CONTINUED TO DECIMATE THE HONEY BEE POPULATION THAT ALMOND GROWERS AND OTHERS MIGHT HAVE TO TURN TO MEXICO FOR AFRICANIZED BEES FOR POLLINATION. RECENTLY YOU WERE TALKING TO NPR ABOUT THIS VERY QUESTION OF WHAT IS THE IMPACT OF THE AFRICANIZED BEES IN THE UNITED STATES.

Let me just set the stage here. The European bees that we have are temperate bees. They evolved in a temperate climate that has seasons – winter being the most significant – so that's why over time, the bees that stored the most honey could make it through winter because they had something to eat. That's why humankind had a relationship with honey bees, at least initially is for the production of the food, honey. But the European bees do not do well in tropical and sub-tropical climates because there are no seasons for the most part.

In 1957, the Brazilians had the great idea, let's go to some place in the same latitude and bring bees back that might be more adapted to tropical and sub-tropical conditions in Brazil. So, they went to Africa and got some bees, and I'll cut to the chase: the Brazilians brought bees over with little concern or testing of what these bees would do, how they would interact in the new environment.

I think bringing African bees to Brazil in 1957 for hybridization experiments was the environmental blunder of the 20th Century! They brought an insect over (to Brazil) without knowing anything about its biology, how it would act, how it would react, what it

would do.

So, they brought these African bees to Brazil and found over time that they were highly defensive, highly aggressive, and that they were a super bee. They out bred, they dominated genetically and biologically in mating and breeding the European bee.

So, fast forward to right now – the Africanized bee has taken over most of South America, Central America, Mexico and has moved into the United States. Our population in Florida came, we think on shipping traffic as reproductive swarms that were hitchhiking on ship traffic coming to our deep-water ports in Florida. We now have about 500 traps set along the coastline at port areas, but the Africanized bees don't always select our traps, so they enter the environment and now are filling up our North American tropical and sub-tropical environment, out breeding and out competing European bees that were in the wild population.

Dangerous Spread of Africanized Honey Bees in U. S.



Hundreds of Africanized honey bee stingers left in a beekeeper's leather glove after an attack.
Image source Florida Dept. of Agriculture.

Africanized honey bees, known also as “killer bees,” are a hybrid produced by genetically combining African honey bee with various European honey bee species. Visually, you can't tell an Africanized honey bee from a European honey bee – they look the same. It started in 1957, when Brazilian biologists brought a collection of honey bees from the same latitude in Africa as honey bee colonies in Brazil. The idea was to use the tropical African honey bees to create a stronger and more abundant honey-producing bee that would do well in Brazil. None of the scientists anticipated that the quick-tempered, aggressive traits of the African bees would dominate after genetic hybridization. Further, twelve of the hybridized and aggressive “Africanized honey bees” escaped the biology lab and started to mate with drones in Brazil. The highly aggressive Africanized hybrids have been spreading ever since and reached Texas in 1990.

If you disturb a European honey bee hive, perhaps twenty or thirty guard bees will fly around warning the intruder away. But Africanized bees mobilize their whole colony to attack – and that can be tens of thousands of bees. They swarm fast into a raging, stinging mob that can kill humans and animals.

Another big difference between Africanized honey bees and European honey bees is that the Africans will swarm as many as seventeen times a year. The much calmer European honey bees only swarm a couple of times a year.

Recent Africanized Honey Bee

Attacks in the United States



Thousands of Africanized honey bees swarming in tree.



Manuel Trevino in San Diego, Texas, near Corpus Christi on April 11, 2007, was stung by more than 1,000 Africanized bees that attacked him while he was working on his ranch. Four people worked for two hours to remove the stingers. Image © 2007 by AP.

On March 25, 2009, in La Mesa, California, four people were hospitalized after a large hive of Africanized bees living in the roof of a house near Helix High School swarmed with a new queen and began attacking people walking nearby.



Inspecting La Mesa, California, home where Africanized honey bees living in the roof attacked four people who had to be hospitalized.
Image © 2009 by Sandiego6.com.

A local TV news photographer on the scene reported: “Those bees are not gentle. They are mean. They’re insane. They are hostile!”

Four days earlier on Saturday, March 21, in Las Vegas, Nevada, a 53-year-old man was hospitalized after being stung at least 2,000 times by Africanized honey bees after he overturned a large rock with a backhoe and exposed a huge, 50-pound beehive.

The Clark County Fire Department responded with fire hoses to wash down the victim who was said to have a “black mass of bees on his back repeatedly stinging him.”

First Reported Human Death in Florida from Africanized Bee Attack

A year ago on April 10, 2008, an Okeechobee County, Florida, resident was stung more than 100 times by Africanized bees and died in an allergic reaction – the first reported human death of bee stings in Florida.

In 2005, a 900-pound horse in Hendry County, Florida, was stung to death. In 2002, 8% of DNA samples sent to the Florida Department of Agriculture were Africanized. By 2007, 40% of the DNA samples turned out to be from Africanized bees - and the percentage continues to rise. The consequence is that most of the wild honey bee colonies in Florida are now the more aggressive Africanized bees that can kill.

Jerry Hayes says he is so worried about the Africanized bees doing violence in Florida that he wakes up at night wondering what he can do about it.

Interview:

Jerry Hayes: “Our only Florida human fatality so far was in April 2008, when a gentleman was clearing an old agricultural barn and some fuel tanks a couple miles from the main road. We also lost a 900-pound horse in 2005. And as of yesterday (March 17, 2009), Africanized honey bee attacks have killed 20 dogs, goats and sheep.

How Do Africanized Bees Kill Humans and Large Animals?

HOW DO AFRICANIZED BEES KILL A HUMAN AND KILL A HORSE AND ALL THE ANIMALS THAT ARE DYING?

All bees are defensive. They want to protect their home, their babies, their resources. European bees, if you disturb their colonies might send out 20 or 30 guard bees to assess the situation and then if it's perceived as bad, they try to drive off the perceived threat.

Africanized honey bees, because they evolved in a very harsh part of Africa – a lot of predators including humans and honey badgers – the weak bees were killed and the strong, aggressive survived. That's what the Brazilians brought over. So, these Africanized bees will mobilize virtually the whole colony of tens of thousands of bees and simply through mass stinging will kill either the perceived threat or drive them away.

One of the unfortunate things is that one of the last target acquisitions that Africanized bees use is CO₂ (carbon dioxide). So, the bees will fly up the CO₂ plume that an animal or person is exhaling or when they are screaming and go up your nose and your mouth and sting as they go down those airways, causing very quick swelling. So most of the deaths are not caused by swelling, but by asphyxiation (swelling and cutting off airways.)

The horse that we lost – the vet at the necropsy found 3 or 4 pounds of Africanized bees in the horse's lungs and its stomach. So, it's a pretty dramatic way to go.

IF I UNDERSTAND WHAT YOU JUST SAID, THAT 3 TO 4 POUNDS OF AFRICANIZED BEES FLEW UP INTO THE HORSE'S NOSE AND MOUTH BECAUSE THE BEES WERE TRACKING AFTER THE EXHALED CO₂?

Yes, ma'am. And this is not unusual. There have been other deaths of humans and animals in the southwestern United States. Yeah, this is one of the things that the Africanized honey bees do.

Brazil, I think, has something like 300 human fatalities a year. Venezuela has about 400 human fatalities. This is a pretty dramatic and significant way to die and we certainly don't want to do that anymore.

AND THAT THE AFRICANIZED BEE WILL ACTUALLY TARGET CO₂ BEING EXHALED FROM WHATEVER THE BEES ARE ATTACKING TO GO RIGHT FOR THE CO₂ AND INTO THE ANIMAL OR HUMAN.

Or human, yes.

HAD THE VETERINARIAN EVER SEEN 3 TO 4 POUNDS OF BEESE INSIDE OF A STOMACH OF A HORSE BEFORE?

Not that he related.

IT'S JUST KIND OF MIND BLOWING.

It is. And horses, in this particular case, have a small airway and so if you have bees climbing in your nose and down your throat and stinging, those mucous membranes swell quite rapidly and you asphyxiate. This horse was in a stall! Our recommendation is for anybody who has an altercation with stinging insects, whether honey bees or not, is to run and get away and get inside some place. Here we had a horse in a stall. Most of the dogs that have died have been in kennels or restrained some how. Goats and sheep just can't get away.

Unfortunately, our human fatality was a gentleman who was clearing some old agricultural barn and some fuel tanks a couple of miles away from the main road. This old fuel tank was open. It had no fuel in it and the Africanized bees had nested in there. He had taken a

backhoe and knocked this thing to the ground. The bees came out to see who was attacking their home and saw him and he could not make it to the main road. It was pretty dramatic.

THE BEES ARE FAST AND THEY SWARM AS AN ENTIRE HIVE MASS.

Pretty much, yes.

AND BECAUSE THEY ARE FOLLOWING THAT CO₂ AND ARE GOING INTO THE MOUTH, THE NOSE AND DOWN INTO THE THROAT AND STINGING THE WHOLE WAY, ESSENTIALLY THE THROAT AND THE TRACHEA WOULD SWELL UP AND THERE WOULD BE NO POSSIBILITY OF BREATHING.

Exactly right.

IF I UNDERSTAND CORRECTLY, YOU ARE HAVING INCREASED NUMBERS OF AGGRESSIONS BY THE AFRICANIZED BEES, INCLUDING YOUR FIRST ATTACK AND DEATH ON A HUMAN, A HORSE, ALL OF THIS INCREASING EVEN INTO THE SPRING OF 2009, AND THAT THE AFRICANIZED BEE WILL BASICALLY GET RID OF THE CALM, DOMESTIC HONEY BEE WHEREVER THE AFRICANIZED BEES GO, CORRECT?

Yes, and the reason for that is that the genes for aggressiveness and defensiveness are dominant, carried by the drone male bee. The Africanized bees will interbreed at first and hybridize. But because of the genetic dominance, over a period of time the European characteristics go away and these aggressive and defensive characteristics prevail.

DO YOU THINK IT'S REALISTIC TO EXPECT THAT FLORIDA AND OTHER BEEKEEPING STATES ARE GOING TO BE ABLE TO BLOCK THE TAKING OVER BY THE AFRICANIZED BEE?

No, I don't.

Guyana, South America Africanized Beekeepers Lose Control of Hive

I was in Guyana, South America, several months ago and was on a beekeeping tour. They have had Africanized bees, I think, since 1974 when these bees moved from Brazil to Guyana (northeast coast of South America between Brazil and Venezuela). Guyana beekeepers have been working with Africanized bees for 30 or 35 years or so and are confident that they can manage these bees.

They took us out to an area of the jungle that had been cleared and that there were probably some 50 Africanized bee colonies there. We had been assured that the beekeepers knew what they were doing and that everything would be safe and well and so they drove a bus of us up to about 300 yards away from the apiary with these colonies. We got off the bus and walked towards the apiary. Everybody said everything is OK and there were people out there and they had very large smokers. If you are aware that beekeepers use smokers to control bees, but these smokers are very large, kind of trash can size.

And I'm getting to be an old guy and I looked around and I said, 'This doesn't look real good to me.' So, I just calmly walked back to the bus and started making friends with the bus driver thinking that if something goes bad, I want to see it from a distance. And smoke is billowing and people have their bee suits on and veils and they are looking in hives

And then, there was the first scream. The bees were fine until they had reached some trigger level that they did not want anybody manipulating them any more. So, the bees mobilized themselves and people were being stung. One man running through the bushes had a tree limb grab his protective veil and rip it off and he was stung severely. He had to

go to the hospital ultimately and many other people were stung. So, as a good American, I got in the bus and put the windows up in the bus, knowing that my friends would be coming back.

They came back and got in the bus and we drove about another 300 yards to main road around the jungle and the Africanized bees had given up at that point, which is pretty typical, and people were getting out. There was swelling and people were telling war stories.

Then all of a sudden, this herd of goats comes tearing out of the jungle. The Africanized bees, looking for any perceived threat, were attacking some goats that were in the jungle and drove them out.

Then the first thing I thought to myself was, 'We can't do this in Florida! This won't work!'

That just mobilized my thoughts even more of public safety and safety of the beekeeping industry. What can we do to protect the industry so they can have manageable colonies and not be zoned and ordinances out of beekeeping?

IS THERE AN ANSWER TO YOUR QUESTION?

I don't know. I'm making up a lot as we go along. Certainly there are other states in the United States that have had Africanized bees.

Possible Answer to Keeping Africanized Bees Controlled Could Be European Queens?

HOW ELSE COULD YOU EVER STOP THE AFRICANIZATION OF NORTH AMERICAN BEES AND BEES EVERYWHERE UNLESS YOU GO INTO A GENETIC PROGRAM THAT WOULD CHANGE THE GENETICS OF THE AFRICANIZED BEE?

No, you're absolutely right. But, we still have places in North America and Canada that have winter, that have significant winters where this tropical bee cannot live year round. So, we can access queens, the fertile females, from these areas. Part of our best management practices is to encourage beekeepers to access queen bees of known parentage from northern regions, have them marked in such a way that when the beekeeper checks his or her colony, they know that that queen is in fact the mother of all those bees in the colony. And if the queen is not, then she needs to be replaced with a queen that is marked and has these characteristics.

So, that's one of the key elements of our best management practices. We think we can help the beekeepers maintain manageable colonies even though the wild feral environment might be full of Africanized bees. This is why it's important for beekeepers to be thought of as part of the solution because these manageable colonies will put out also drones that will mate with Africanized queens.

Will this stop the aggressiveness and defensiveness? No, it won't, but it will tone it down and tame it down so we hopefully we'll at least have a population that is not as defensive and not as aggressive as a pure Africanized bee population would be.

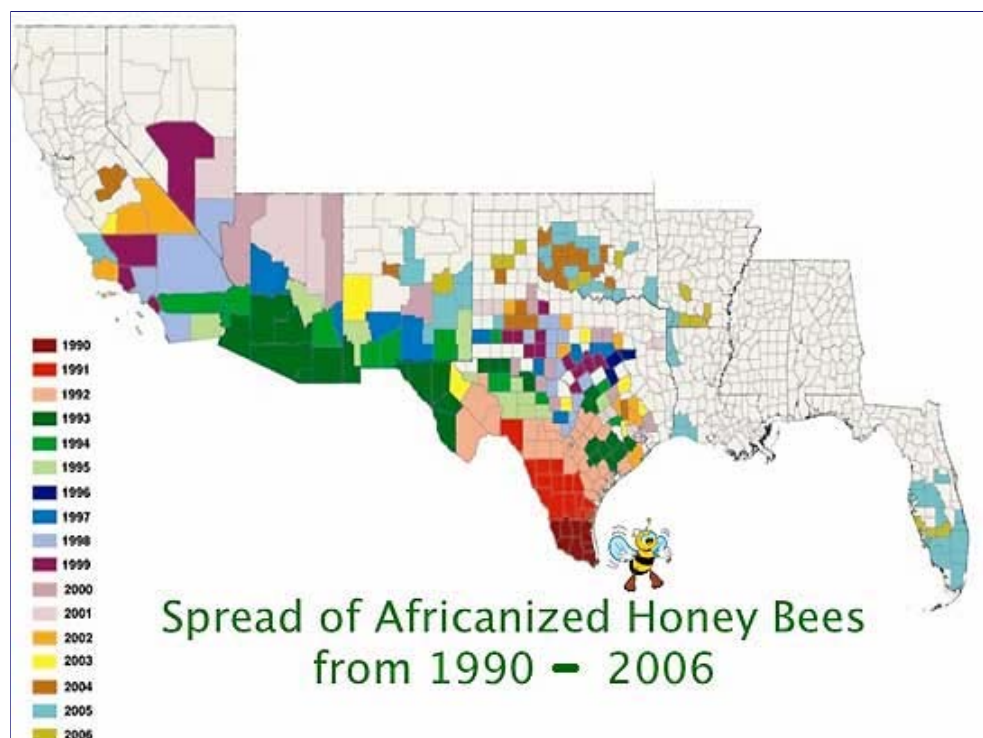
Will Africanized Honey Bees Be Forced by Winters to Remain in Southern U. S.?

IS THERE A LATITUDE IN THE UNITED STATES ABOVE WHICH THE AFRICANIZED BEES WILL NOT GO BECAUSE OF COLD?

For year round? Everyone has summer, so theoretically these Africanized bees can exist everywhere during the summertime. But there is probably a line at Tennessee, North Carolina where below that latitude, the bees can live year round, but not above that line – probably like the tide going in and out. The Africanized bees might wash across in the summertime and then be pushed back in the wintertime.

DOES BRAZIL TRY TO DO ANYTHING ABOUT THE VIOLENCE OF THE BEES IF THEY ARE LOSING 300 HUMANS A YEAR TO THE VIOLENT ATTACKS?

They have been doing this for 50 years and it is what it is. In some cases, the Brazilians like the Africanized bees. You certainly don't have a problem with somebody stealing your colonies. And because these Africanized bees swarm so often and asexually reproduce. Our American honey bees will send out a swarm maybe once, twice or three times a year. Africanized bees will swarm 15, 16 or 17 times a year and this is how they dominate the genetic landscape so much. So, if their bees die, they can leave their colonies out there and more Africanized bees will fill up the hives and so the Brazilians will suit up and protect themselves and try to guard their chickens and their pigs – and then cross your fingers!"



Source Florida Dept. of Agriculture.

Bee aware ... look, listen, run

- If attacked, cover your mouth and nose and run inside a building, vehicle or other enclosure
- Don't swat at bees – only makes them more defensive
- Don't jump in a pool – they'll wait for you
- If stung, scrape off the stinger with a fingernail or credit card
- Call a pest control company to remove the hive
- Seek medical attention if necessary




Stinger in arm

More Information:

For more information about honey bee decline in colony collapse disorder and other environmental threats, please see Earthfiles reports in the **Earthfiles Archive**:

- 02/26/2009 — Unprecedented Northeast Bat Die-off Spreading Rapidly
 - 01/29/2009 — Part 1: Nanodiamonds Link Outer Space Impactors to Earth Extinctions 12,900 Years Ago
 - 01/29/2009 — Part 2: Nanodiamonds Link Outer Space Impactors to Earth Extinctions 12,900 Years Ago
 - 12/21/2008 — Mystery of Missing East Coast Acorns
 - 09/26/2008 — NRDC Sues EPA for Honey Bee Lab Data and EPA Approves Another Bee-Killing Pesticide
 - 08/31/2008 — Honey Bees Not Healthy in U. S. or U. K.
 - 08/15/2008 — Amphibian Warning Bell of Mass Extinctions
 - 04/10/2008 — Honey Bee Collapse Now Worse on West Coast
 - 02/29/2008 — Mysterious Bat Deaths in New York, Vermont and Massachusetts
 - 01/18/2008 — Amphibians Dying Out At Alarming Rate
 - 10/13/2007 — Now Bumblebees Are Disappearing, Too.
 - 09/26/2007 — North American Honey Bees Still Weak
 - 09/18/2007 — E. coli and Salmonella Continue to Threaten American Bagged Salad Greens
 - 09/07/2007 — Honey Bee DNA Study Finds Australian Virus in Colony Collapse Disorder
 - 07/11/2007 — Mystery of Night Shining Clouds - Another Global Warming Change?
 - 06/28/2007 — Hackenberg Apiary, Pennsylvania - 75-80% Honey Bee Loss in 2007. What Happens If Colony Collapse Disorder Returns?
 - 05/04/2007 — Environmental Emergency Updates: Part 1 - Spreading Honey Bee Disappearances - Nosema ceranae Not the Answer?
 - 04/06/2007 — Collapse of Honey Bees in U. S., Canada and 9 European Countries
 - 03/17/2007 — Honey Bee Disappearances Continue: Could Pesticides Play A Role?
 - 02/23/2007 — Part 1: Earth Life Threats - Alarming Disappearance of Honey Bees
-

Websites:

Environmental News Network: <http://www.enn.com/wildlife/article/38233>

Movento at Bayer CropScience: http://www.bayercropscienceus.com/products_and_seeds/insecticides/movento.html

Environmental Protection Agency: <http://www.epa.gov/>

AAAS Science Journal: <http://www.sciencemag.org/cgi/content/summary/317/5843/1304>

Truth Behind Insecticide “Merit”: http://www.rosemania.com/Pesticide_update.htm

Mid-Atlantic Apiculture Research and Extension Consortium (MAAREC):
<http://maarec.cas.psu.edu/>

Colony Collapse Disorder (CCD): <http://www.ento.psu.edu/MAAREC/pressReleases/CCDSummaryWG0207.pdf>

Apiary Inspectors of America (AIA): <http://www.apiaryinspectors.org/>

Biology of Honey Bees: http://plantphys.info/Plants_Human/bees/bees.html

Varroa Mites: <http://www.uky.edu/Ag/Entomology/entfacts/struct/ef608.htm>

Honey Bee Tracheal Mites: http://creatures.ifas.ufl.edu/misc/bees/tracheal_mite.htm

National Bee Loss Survey: <http://beealert.blackfoot.net/~beealert/surveys/index.php>

American Beekeeping Federation: <http://www.abfnet.org/>

American Honey Producers Assoc.: <http://www.americanhoneyproducers.org/>

The Xerces Society (Pollinators At Risk): http://www.xerces.org/Pollinator_Insect_Conservation/pollinators_at_risk.html

American Assoc. of Professional Apiculturists: <http://entomology.ucdavis.edu/aapa/aapapubs.cfm>

***Bee Culture*, The Magazine of American Beekeeping**
<http://www.beeculture.com>

Credits

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