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Species under threat: Honey, who shrunk the bee population?

Across America, millions of honey bees are abandoning their hives and flying off to die, leaving beekeepers facing ruin and US agriculture under threat. And to date, no one knows why. Michael McCarthy reports

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It has echoes of a murder mystery in polite society. There could hardly be a more sedate and unruffled world than beekeeping, but the beekeepers of the United States have suddenly encountered affliction, calamity and death on a massive scale. And they have not got a clue why it is happening.

Across the country, from the Atlantic coast to the Pacific, honey bee colonies have started to die off, abruptly and decisively. Millions of bees are abandoning their hives and flying off to die (they cannot survive as a colony without the queen, who is always left behind).

Some beekeepers, especially those with big portable apiaries, or bee farms, which are used for large-scale pollination of fruit and vegetable crops, are facing commercial ruin - and there is a growing threat that America's agriculture may be struck a mortal blow by the loss of the pollinators. Yet scientists investigating the problem have no idea what is causing it.

The phenomenon is recent, dating back to autumn, when beekeepers along the east coast of the US started to notice the die-offs. It was given the name of fall dwindle disease, but now it has been renamed to reflect better its dramatic nature, and is known as colony collapse disorder.

It is swift in its effect. Over the course of a week the majority of the bees in an affected colony will flee the hive and disappear, going off to die elsewhere. The few remaining insects are then found to be enormously diseased - they have a "tremendous pathogen load", the scientists say. But why? No one yet knows.

The condition has been recorded in at least 24 states. It is having a major effect on the mobile apiaries which are transported across the US to pollinate large-scale crops, such as oranges in Florida or almonds in California. Some have lost up to 90 per cent of their bees.

A reliable estimate of the true extent of the problem will not be possible for another month or so, until winter comes to an end and the hibernating bee colonies in the northern American states wake up. But scientists are very worried, not least because, as there is no obvious cause for the disease as yet, there is no way of tackling it.

"We are extremely alarmed," said Diana Cox-Foster, the professor of Entomology at Penn States University and one of the leading members of a specially convened colony-collapse disorder working group.

"It is one of the most alarming insect diseases ever to hit the US and it has the potential to devastate the US beekeeping industry. In some ways it may be to the insect world what foot-and-mouth disease was to livestock in England."

Most of the pollination for more than 90 commercial crops grown throughout the United States is provided byApis mellifera, the honey bee, and the value from the pollination to agricultural output in the country is estimated at $14.6bn (£8bn) annually. Growers rent about 1.5 million colonies each year to pollinate crops - a colony usually being the group of bees in a hive.

California's almond crop, which is the biggest in the world, stretching over more than half a million acres over the state's central valley, now draws more than half of the mobile bee colonies in America at pollinating time - which is now. Some big commercial beekeeping operations which have been hit hard by the current disease have had to import millions of bees from Australia to enable the almond trees to be pollinated.

Some of these mobile apiaries have been losing 60 or 70 per cent of their insects, or even more. "A honey producer in Pennsylvania doing local pollination, Larry Curtis, has gone from 1,000 bee colonies to fewer than eight," said Professor Cox-Foster. The disease showed a completely new set of symptoms, "which does not seem to match anything in the literature", said the entomologist.

One was that the bees left the hive and flew away to die elsewhere, over about a week. Another was that the few bees left inside the hive were carrying "a tremendous number of pathogens" - virtually every known bee virus could be detected in the insects, she said, and some bees were carrying five or six viruses at a time, as well as fungal infections. Because of this it was assumed that the bees' immune systems were being suppressed in some way.

Professor Cox-Foster went on: "And another unusual symptom that we're are seeing, which makes this very different, is that normally when a bee colony gets weak and its numbers are decreasing, other neighbouring bees will come and steal the resources - they will take away the honey and the pollen.

"Other insects like to take advantage too, such as the wax moth or the hive beetle. But none of this is happening. These insects are not coming in.

"This suggests that there is something toxic in the colony itself which is repelling them."

The scientists involved in the working group were surveying the dead colonies but did not think the cause of the deaths was anything brought in by beekeepers, such as pesticides, she said.

Another of the researchers studying the collapses, Dennis van Engelsdorp, a bee specialist with the State of Pennsylvania, said it was still difficult to gauge their full extent. It was possible that the bees were fleeing the colonies because they sensed they themselves were diseased or affected in some way, he said. This behaviour has been recorded in other social insects, such as ants.

The introduction of the parasitic bee mite Varroa in 1987 and the invasion of the Africanised honey bee in 1990 have threatened honey bee colonies in the US and in other parts of the world, but although serious, they were easily comprehensible; colony collapse disorder is a deep mystery.

One theory is that the bees may be suffering from stress as beekeepers increasingly transport them around the country, the hives stacked on top of each other on the backs of trucks, to carry out pollination contracts in orchard after orchard, in different states.

Tens of billions of bees are now involved in this "migratory" pollination. An operator might go from pollinating oranges in Florida, to apples in Pennsylvania, to blueberries in Maine, then back to Massachusetts to pollinate cranberries.

The business is so big that pollination is replacing honey-making as the main money earner at the top end of the beekeeping market, not least because in recent years the US has been flooded with cheap honey imports, mainly from Argentina and China.

A typical bee colony, which might be anything from 15,000 to 30,000 bees, would be rented out to a fruit grower for about $135 - a price that is up from $55 only three years ago. To keep the bees' energy up while they are pollinating, beekeepers feed them protein supplements and syrup carried around in large tanks.

It is in these migratory colonies where the biggest losses have been seen. But the stress theory is as much speculation as anything else. At the moment, the disappearance of America's bees is as big a mystery as the disappearance of London's sparrows.