

Science

The very hungry caterpillar: these plastic-eating wax worms could solve our pollution problem

The discovery could dramatically reduce the amount of pollution caused by plastic

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This shows the plastic after being biodegraded by 10 worms for 30 minutes

CSIC Communications Department

Researchers have discovered that a caterpillar usually bred for use as fishing bait is capable of biodegrading plastic shopping bags made

from polyethylene.

The wax worm, which is the larvae of the great wax moth, is well known as a pest to beekeepers. Wax moths lay eggs inside hives which then hatch into wax worms living as parasites on the beeswax.

Now, their plastic-busting capabilities have been discovered, by chance, when a researcher from the Institute of Biomedicine and Biotechnology of Cantabria (CSIC) in Spain (who coincidentally is an amateur beekeeper), was removing the parasites from honeycombs in her hives.

"I removed the worms, and put them in a plastic bag while I cleaned the panels," explained CSIC's Federica Bertocchini. "After finishing, I went back to the room where I had left the worms and I found they were everywhere. They had escaped from the bag even though it had been closed and when I checked, I saw the bag was full of holes. There was only one explanation: the worms had made the holes and escaped. This project began there and then".

In a study carried out in collaboration with the University of Cambridge, around 100 wax worms were exposed to a bag from a UK supermarket. After 40 minutes, holes had started to appear and after 12 hours, there was a 92g reduction in the mass of plastic from the bag. This degradation rate is extremely fast, say the researchers, giving the example of a bacteria that was reported last year to biodegrade some plastics at a rate of just 0.13g a day.

"If a single enzyme is responsible for this chemical process, its reproduction on a large scale using biotechnological methods should be achievable," said Cambridge's Paolo Bombelli, first author of the study published in the journal *Current Biology*.

"This discovery could be an important tool for helping to get rid of the polyethylene plastic waste accumulated in landfill sites and oceans."



Close-up of a wax worm next to biodegraded holes in a polyethylene plastic shopping bag from a UK supermarket as used in the experiment

Paolo Bombelli

To confirm the plastic wasn't just being chomped on by the worms, and that they were actually breaking down polymer chains in the plastic, the researchers mashed up some of the worms and smeared them on polyethylene bags. The test gave them similar results to the one with the live worms.

The scientists believe the worms' mysterious plastic-degrading skills are likely related to the way in which they digest beeswax. They speculate that digesting beeswax and polyethylene involves breaking similar types of chemical bonds.





Wax worms (pictured) are usually bred commercially as fishing bait

César Hernández/CSIC

"Wax is a polymer, a sort of 'natural plastic,' and has a chemical structure not dissimilar to polyethylene," said CSIC's Federica Bertocchini, the study's lead author. "The caterpillar produces something that breaks the chemical bond, perhaps in its salivary glands or a symbiotic bacteria in its gut. The next steps for us will be to try and identify the molecular processes in this reaction and see if we can isolate the enzyme responsible".

The research could lead to a large-scale method of breaking down plastic waste that finds its way into rivers and oceans, endangering wildlife. Low-density polyethylene plastic bags take around 100 years to decompose completely, while the toughest plastic bags can take even longer.

In October 2015, a [5p charge was introduced](#) in the UK in an attempt to dramatically reduce plastic bag use and encourage shoppers to carry reusable bags. The charge applies at all retailers with more than 250 employees, with supermarkets being the main target.

In the six months after the charge was introduced, the number of bags given out was estimated to have dropped by around 83 per cent.