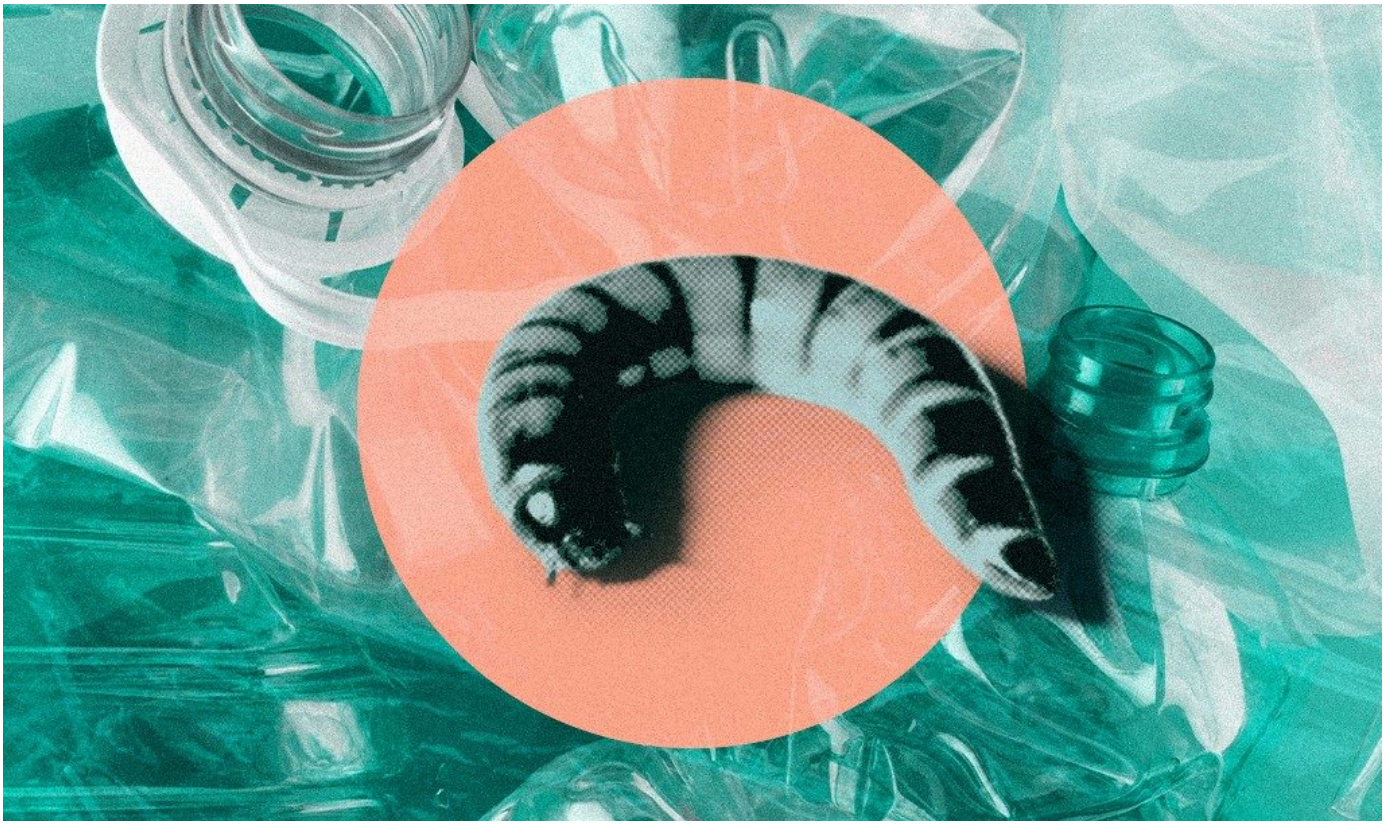
March 14, 2024 Environment By **Puja Bhattacharjee**

“Worm Gut” Bacteria Might Help Speed Up Plastic Degradation

Scientists in Singapore isolated gut bacteria of super worms and demonstrated how they can help cut plastic pollution.



AsianScientist (Mar. 15, 2024) – Researchers in Singapore have developed a new method to accelerate plastic biodegradation by creating an artificial “worm gut” that can break down plastic. This might be a significant breakthrough in combating global plastic pollution by natural means.

Previous studies have demonstrated that the larvae of the darkling beetle – commonly sold as pet food and known as “super worms” for their nutritional value – can survive on a plastic diet because the beetle’s gut contains bacteria capable of breaking down common types of plastic. However, due to their slow feeding and problems with maintenance, using them in plastic processing has been impractical so far.

Now, researchers at Nanyang Technological University’s (NTU’s) School of Civil and Environmental Engineering (CEE) and the Singapore Centre for Environmental Life Sciences Engineering (SCELSE) have demonstrated how the worm’s gut bacteria can be isolated and used for the job without the need for large-scale worm breeding.

“A single worm can only consume about a couple of milligrams of plastic in its lifetime, so imagine the number of worms that would be needed if we were to rely on them to process our plastic waste. Our method eliminates this need by removing the worm from the equation. We focus on boosting the useful microbes in the worm gut and building an artificial ‘worm gut’ that can efficiently break down plastics,” said Cao Bin, associate professor at the School of CEE and Principal Investigator at SCELSE. The study was published in the journal Environment International in January.

For the experiment, the scientists studied different groups of super worms. For a month, three groups of super worms were fed the most common plastics used in everyday items like food boxes and detergent bottles. These included high-density polyethylene (HDPE), a type of plastic known for its high impact resistance, making it difficult to break down. A control group of super worms were fed oatmeal for the same duration.

The researchers then extracted gut bacteria from super worms that had consumed different types of plastic. They placed these bacteria in flasks containing synthetic nutrients and the same kind of plastic the super worms had consumed. Over six weeks, the microbiomes were left to grow in the flasks at room temperature. Compared to the control group, the flasks that contained the gut microbiomes from the plastic-fed worms showed a significant increase in plastic-degrading bacteria.

Furthermore, the microbial communities in the flasks were simpler and better adapted to breaking down the particular type of plastic in the flask than the microbes found on plastics fed directly to the worms.

“Our study represents the first reported successful attempt to develop plastic-associated bacterial communities from gut microbiomes of plastic-fed worms. Through exposing the gut microbiomes to specific conditions, we were able to boost the abundance of plastic-degrading bacteria present in our artificial ‘worm gut,’ suggesting that our method is stable and replicable at scale,” said Liu Yinan, lead author of the study and a research fellow at the School of CEE and SCELSE.

According to the United Nations Environment Program (UNEP), plastic production has exceeded any other material since the 1970s. The world currently produces over 350 million metric tons, less than 10 percent of which is recycled. Without changes to current policies, global plastic waste generation is projected to triple by 2060 to a staggering one billion metric tons.

Next, the researchers want to understand how the super worm’s gut bacteria break down plastics at the molecular level. This will help them engineer plastic-degrading bacterial communities that can efficiently break down plastics in the future.

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Source: Nanyang Technological University ; Image: Yipei Lieu/ Asian Scientist Magazine

The article can be found at: Establishment of plastic-associated microbial community from superworm gut microbiome

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