Earthworms could help reduce antibiotic resistance genes in soil

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Earthworms improve the soil by aerating it, breaking down organic matter and mineralizing nutrients. Now, researchers reporting in ACS' *Environmental Science & Technology* have dug up another possible role:

reducing the number and relative abundance of antibiotic-resistance genes (ARGs) in soils from diverse ecosystems. These results imply that earthworms could be a natural, sustainable solution to addressing the global issue of antibiotic resistance, the researchers say.

The overuse of antibiotics in humans and animals has caused ARGs to accumulate in soils, which could contribute to the rise in antibiotic-resistant infections. Earthworms consume tons of soil per year worldwide, and their guts have a unique combination of low-oxygen conditions, neutral pH and native microbial inhabitants that could have an effect on ARGs. However, the role of earthworms in the spread of antibiotic resistance has been controversial. Some studies in controlled settings suggest that their guts are hot spots for ARGs, which they can spread through soil with their movements, while other studies indicate that the earthworms' guts can reduce ARG abundance by destroying host bacteria and mobile genetic elements. To better understand the issue, Yong-Guan Zhu and colleagues wanted to compare the microbiomes and ARGs of earthworm guts with those of soils from diverse ecosystems across China.

The researchers collected earthworms and surrounding soil samples from 28 provinces in China. Then, they analyzed the composition of microbial communities in the worms' guts and the surrounding soil, finding that they differed between guts and soil and also among sites. In addition, the team found a lower number and relative abundance of ARGs in the earthworm guts than in the corresponding soil across all sampling sites. The earthworm guts also had lower levels of bacterial species that commonly host ARGs. These bacteria and their ARGs could be destroyed during digestion, or bacteria that live in the gut could out-compete them, the researchers say. In other experiments, they used controlled environments to show that the number and relative abundance of ARGs were higher in earthworm guts than in their feces, and that the addition of earthworms reduced ARGs in soil samples.

These findings suggest that earthworms have the potential to mitigate these genes in soils as a form of natural bioremediation, the researchers say.

More information: "Deciphering Potential Roles of Earthworms in Mitigation of Antibiotic Resistance in the Soils from Diverse Ecosystems" *Environmental Science & Technology* (2021). pubs.acs.org/doi/abs/10.1021/acs.est.1c00811

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