New species of 'golden death' bacterium digests parasitic worms from the inside out

27 February 2019

Caenorhabditis elegans. Credit: Wikipedia

A new species of bacterium, *Chryseobacterium nematophagum*, has been found to digest its hosts—roundworm parasites—from the inside out. The findings, which are presented in the open access journal *BMC Biology*, suggest that the bacteria may potentially be used in future, to control roundworm infections in animals, plants, and, potentially, humans.

Professor Antony Page, University of Glasgow, the corresponding author said: "Nematodes, commonly called roundworms, cause serious chronic diseases in animals and are particularly common in grazing livestock. Some nematodes, such as hookworms, also infect humans. These parasites have developmental stages that naturally feed on bacteria before they infect the final host. This study describes a newly discovered bacterial species, called *Chryseobacterium nematophagum* - or golden death bacillus—that effectively kills a wide range of important nematode parasites."

The researchers isolated two new bacterial strains—JUb129 and JUb275—from free-living roundworms found on a rotten apple in Paris, France, and a rotten fig in Bangalore, India. In laboratory experiments, the researchers fed the bacteria, which produce yellow mucoid colonies that have a pungent odor, to larvae of the nematode worm *C. elegans*, a common model species for the study of nematode pathogens.

The authors observed that the *C. elegans* larvae that fed on the bacteria became immobilized within one hour. Of the exposed larvae, 50% were killed within three to four hours. By seven hours after ingesting the bacteria, all worms had died. After 24 hours, only outline traces of the larvae, representing the worms' exoskeletons—known as cuticles—were present.

C. elegans worms were not repelled by the presence of *C. nematophagum* bacteria. In the laboratory experiments, the worms remained on the bacterial lawns cultivated by the researchers and actively ingested the bacteria, which multiplied inside the worms' pharynx and digested them from the inside out. Infection and digestion of the worms' pharynx was followed by rupture of the bacteria into the rest of the body and digestion of the worms' insides, until they had been completely consumed.

To investigate which genes might be involved in conferring the nematode-killing ability of *C. nematophagum*, the authors compared the genomes of the two newly identified species to those of five other *Chryseobacterium* species that are not known for killing nematodes. They found that *C. nematophagum* possesses specific genes that encode enzymes which break down chitin and collagen. These genes are part of about 13% of the bacteria's' genome that is unique to *C. nematophagum*.

The authors tested *C. nematophagum* against a number of different parasitic nematodes, including Trichostrongylid and Strongylid worms, which infect cattle and domesticated animals, and some of which are becoming resistant to worm treatments.

These worms were killed by the bacterium in the same way as *C. elegans*.

Professor Page said: "Nematode parasites are very common, cause disease and have an economic impact on livestock rearing. They are mainly controlled by a limited group of drugs called anthelmintics, which are becoming less effective as worms are becoming resistant to many of these drugs. Our findings raise the possibility that *C. nematophagum* - or the specific properties that make it highly virulent in many nematode species—could provide a future means of controlling increasingly problematic parasites that currently are a major burden to public health and the farming industry."

More information: The golden death bacillus Chryseobacterium nematophagum is a novel matrix digesting pathogen of nematodes, Page et al. *BMC Biology* 2019 , DOI: 10.1186/s12915-019-0632-x

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