Studies on environmental adaptations and plant parasitism of nematodes

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Abstract

Nematodes have successfully adapted to nearly every ecological niche and are one of the most successful animal groups on Earth, on par with insects. Many free-living nematodes live in the ocean, in freshwater, and on land, and many nematode species parasitize a variety of plants and animals. My research aims to understand how nematodes can adapt to such diverse environments. Thus, my research has mainly focused on three topics: 1) the elucidation of the parasitism of the pine wood nematode, *Bursaphelenchus xylophilus*, 2) the establishment of *B. okinawaensis* as a genetic model organism, 3) the elucidation of the adaptation mechanisms of nematodes to extreme environments.

To understand the molecular mechanism underlying pine wilt disease, we performed proteomic analysis of the secreted proteins of *B. xylophilus*, and successfully identified 1515 secreted proteins[1]. Using bioinformatic analysis, we discovered that the secretome of *B. xylophilus* is most highly enriched for proteases. Remarkably, *B. xylophilus* also secretes mimics of host proteins, as well as many antioxidant and detoxifying enzymes, suggesting that *B. xylophilus* employ these molecules to evade and disturb host defense responses. Recently, we have established a genetically tractable system with the hermaphroditic nematode *B. okinawaensis*[2]. This system is useful for understanding the parasitism of plant-parasitic nematodes and how they adapt within their hosts in more detail.

Extremophiles have much to reveal about the biology of resilience, yet their study is limited by sampling and culturing difficulties. We investigated the arsenic-rich, alkaline, and hypersaline Mono Lake (CA, US) for extremophile nematodes. Though Mono Lake has previously been described to contain only two animal species (brine shrimp and alkali flies) in its water and sediments, we discovered the eight nematode species from the lake[3]. Then, we demonstrated that one species, *Tokorhabditis tufae*, is new, culturable, and survives 500 times the human lethal dose of arsenic. These findings provide a new system for studying arsenic resistance and adaptations to extreme environments in animals.

References

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