

Shelton-Mason County Journal - Dedicated to the citizens of Mason County, Washington since 1886

Knowing your nematodes

Peninsula Permaculture · December 9, 2021



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A bacterial-feeding nematode has ornate, almost decorative, mouth-parts. (*Soil and Water Conservation Society (SWCS). 2000. Soil Biology Primer. Rev. ed. Ankeny, IA: Soil and Water Conservation Society.*)

A few bad nematodes have maligned the whole class of creatures. While gardeners curse the nematodes that knot their carrots or riddle their tomatoes' roots with tumors, a much larger world of nematodes is at work defining our planet.

These largely microscopic roundworms are so ubiquitous and varied that nematologist Nathan Cobb described them as a means of mapping Earth: "In short, if all the matter in the universe except the nematodes were swept away, our world would still be dimly recognizable, and if, as disembodied spirits, we could then investigate it, we should find its mountains, hills, vales, rivers, lakes and oceans represented by a film of nematodes."

If that hasn't put you off your - well, everything, read on. Nematodes are wonderful natural allies of the gardener and permaculturist.

My ongoing studies of the soil food web have brought nematodes into some relief. In a soil context, these microscopic worms eat fungi, bacteria, roots and each other, and their populations have been used to assess soil and water quality.

For gardening purposes, they are classed by their chow: fungal-feeding, bacterial-feeding, root-feeding, and omnivorous. Each class is identifiable by certain physical features visible under a microscope.

Fungal-feeding nematodes use a spearlike mouthpart to penetrate the tips of fungal hyphae, the rootlike structures that are the bulk of fungal biomass. Hyphal tips are tender and easy to siphon nutrients from, so fungal feeders are identifiable by their plain sharpened tube.

Root-feeding nematodes also use a sharpened siphon, but theirs has to penetrate harder plant roots. As such, it has knobs at the base so the nematode's muscles can drive it through the root wall to where it can sip away at the vitality of the plant. Endoparasitic nematodes will move into roots, and females produce hormones to enlarge root tissue and direct the plant to send sugars to that tissue.

Bacterial-feeding nematodes are filter feeders, sucking in anything that fits their mouth-hole. This gives them the most ornate "lips" and makes them easy to recognize.

Predatory nematodes often have a huge mouth with an obvious "tooth," a protuberance for snagging other nematodes while mouth muscles pull them in for ingestion. They show up when there are adequate numbers of other nematodes to pique their appetites.

Finally there are omnivorous nematodes, with huge rectangular mouths and teeth (each mouth has but one) or big broad mouth-spears used for eating fungi or algae. These have been observed eating whatever is most abundant.

Why should we care about and encourage nematodes? Except for root-feeders, whatever nematodes eat they excrete large quantities of ammonium as a plant-available fertilizer. They are nutrient cyclers, turning other microorganisms into bioavailable nitrogen and other nutrients.

They are in turn preyed upon by crab-like microarthropods and even fungi with specialized hyphae for strangling nematodes. These hyphae colonize the corpses.

Nematodes can be bred in compost or made into extracts to add to compost teas. Populations are examined by shadow microscopy to determine their density in given quantities of soil amendments.

They are important parts of what soil scientist Elaine Ingham calls the "poop loop": a cycle of eating and excreting that keeps nitrogen in play through biology, rather than just sitting and decaying into gas that rejoins the atmospheric nitrogen pool.

Originally published in the Shelton-Mason County Journal, December 9, 2021: <https://www.masoncounty.com/story/2021/12/09/news/knowing-your-nematodes/496.html>

Text from the Internet Archive copy captured December 10, 2021: <https://web.archive.org/web/20211210194119/https://www.masoncounty.com/story/2021/12/09/news/knowing-your-nematodes/496.html>