MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #218

Earthworms

Regarded by Aristotle as the "intestines of the earth," earthworms aid in soil fertility and structure and contribute to overall plant health.

Earthworm Types

There are three types of earthworms: [**Figure 1**]

Anecic – Greek for "up from the earth" or "out of the earth."

- Capable of burrowing to depths of six feet.
- Builds permanent burrows into the deep mineral layers of the soil.
- Drags organic matter from the soil surface into their burrows for food.
- Includes the familiar bait worm, the nightcrawler or dew worm (Lumbricus terrestris).

Endogeic – Greek for "within the earth."

- Builds extensive non-permanent burrows in the upper mineral layer of soil.
- Feeds on the organic matter in the soil.
- Lives exclusively in soil and usually are not noticed, except after a heavy rain when they come to the surface.

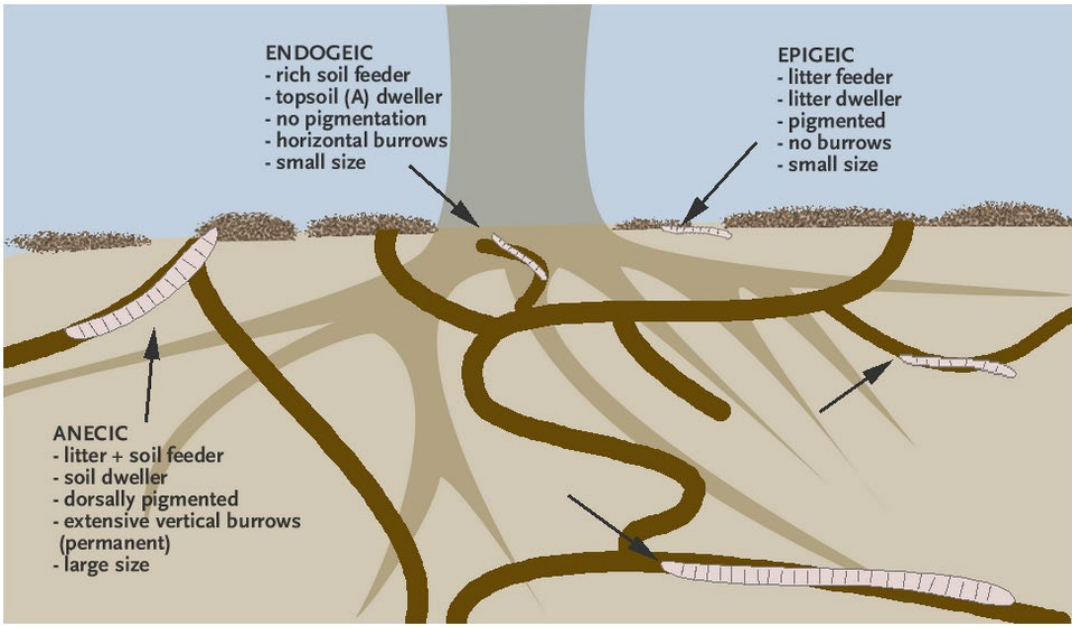
Epigeic – Greek for "upon the earth."

- Lives on the soil surface.
- Forms no permanent burrows.
- Feeds on decaying organic matter.
- Common names: red worm, manure worm, brandling worm, red wiggler, and compost worm.

The anecic and endogeic are the types most often noticed in Colorado soils. Because the upper foot of soil freezes here during the winter, the epigeic worms are usually killed. In addition, the low

organic matter content of Colorado soils will likely not support the food needs of epigeic earthworms. Anecic are larger than the endogeic.

Figure 1. Three Types of Earthworms. Image from UNM, Natural Resources Research Institute



Biology of Earthworms

Earthworms breathe through their skin and must be in an environment that has at least 40% moisture (at least as damp as a wrung-out sponge). If their skin dries out, they cannot breathe and will die.

Earthworms prefer a near-neutral soil pH.

Instead of teeth, earthworms have a gizzard like a chicken that grinds the soil and organic matter that they consume. They eat the soil microorganisms that live in and on the soil and organic matter.

Worm excrement is commonly called worm casts or castings. These soil clusters are glued together when excreted by the earthworm and are quite resistant to erosive forces. Their castings contain many more microorganisms than their food sources because their intestines inoculate the casts with microorganisms.

Earthworms become sexually mature when the familiar band (the clitellum) appears around their body, closer to their mouth. Each worm with a clitellum is capable of mating with other worms and producing cocoons that contain baby worms. Cocoons are lemon shaped and slightly and slightly smaller than a pencil eraser.

Benefits of Earthworms

Charles Darwin, known for his work with evolution of species wrote a paper on earthworms during his final years. In it he surmised that most all the fertile soil on earth must have passed through the gut of an earthworm. While not entirely accurate, earthworms do play an important role in soil and plant health.

Soil Fertility

Earthworms are part of a host of organisms that decompose organic matter in the soil. As earthworms digest the microorganisms and organic matter in soil, the form of nutrients is changed as materials pass through the earthworm's gut. Thus, worm casts are richer than the surrounding soil, containing nutrients changed into forms that are more available to plants. For example, one study found that in a sample of soil with 4% organic matter, worm casts contained 246 pounds of nitrogen per 1000 square feet while the surrounding soil contained 161 pounds of nitrogen per 1000 square feet (Source: ATTRA, Sustainable Soil Systems).

Soil Structure

The deep burrows of anecic earthworms create passages for air, water, and roots. Burrows provide easy avenues for the exchange of soil gases with the atmosphere. Clay soils with extensive earthworm burrows will allow water to infiltrate and percolate more readily than those without. Plants have the capacity to root deeper and the lower layers of soil can recharge with air more quickly. Air is an essential component of root development.

Anecic worms mix the soil as they create their burrows and build soil organic matter and humus as they drag litter into their burrows and excrete castings in the soil.

Endogeic worm burrows contribute to soil tilth, tying together many of the large pore spaces in the soil and increasing soil porosity.

The mucus from the skin of earthworm's aids in the formation of soil aggregates, which are integral components of the crumb of soil structure. Aggregates are also formed in castings.

Water-Holding Capacity

By increasing the organic matter content, soil porosity and aggregation, earthworms can greatly increase the water-holding capacity of soils.

How to Encourage Earthworm Activity

Earthworms will not go where it is too hot/cold or too dry/wet. Soil temperatures above 70ºF or below 40ºF will discourage earthworm activity. While soil temperature is hard to alter, moisture can be managed. When soil becomes waterlogged, oxygen is driven out of the large pore spaces. Without this free oxygen, earthworms cannot breathe. Conversely, when soil dries beyond half of field capacity, earthworm skin dries in the soil. Maintaining moisture levels that are ideal for optimum plant growth in a landscape or garden will also be ideal for earthworm activity.

Providing a food source in the form of organic matter is also important. Mulching grass clippings into the lawn, putting down a layer of organic mulch in beds, amending the soil with compost, and turning under a green manure are all excellent ways to feed earthworm populations.

Detrimental Practices to Earthworm Activity

- High rates of ammonium nitrate are harmful to earthworms.
- Tillage destroys permanent burrows and can cut and kill worms. Fall tillage can be especially destructive to earthworm populations. Deep and frequent tillage can reduce earthworm populations by as much as 90%.

- Earthworms are also hindered by salty conditions in the soil.
- Some chemicals have toxic effects on earthworm populations. [**Table 1**]

Table 1. Earthworm Population Reduction by Pesticides

Pesticide	Toxicity to Earthworms	Reduction
Sevin (carbaryl) insecticide	Severe	76-100%
Diazinon insecticide	Moderate	26-50%
2,4-D herbicide	Low	0-25%

Study from University of Kentucky Department of Entomology.

Transplanting Earthworms

To create worm populations in a soil without worms simply dig a large spade-full of soil from an area with visible worm numbers and bury this soil in the area where worms are needed.

Asian Jumping Worm

The Asian Jumping Worm, in the genus *Amynthas*, is an invasive worm making its way through the United States. These jumping worms are currently not in Colorado, but in nearby states and are very invasive. The Asian Jumping Worm is typically found in moist areas, like mud along a creek or river, and have been found in Eastern and Northwest states.

If you visit areas where Asian Jumping Worms are found, please note that they and can be transferred on footwear. The current recommendation is to wash footwear. Do not purchase Asian jumping worms for vermiculture, fishing or gardening. As with all purchases, make sure you know what you are purchasing and that you are not bringing a new issue into your garden and community.

Learn more from University of Nebraska Extension:
https://lancaster.unl.edu/pest/resources/asianworms.shtml.

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