



Safe Natural Biological Insect Control

Effective against:

- Ants
- Black Currant Borers
- Cabbage Root Maggots
- Coding Moth Larvae
- Corn Rootworms
- Cutworms
- Flea Beetles
- Gypsy Moth Larvae
- Mole Crickets
- Peach Tree Borers
- Raspberry Crown Borers
- Strawberry Weevils
- Weevils
- Wireworm Beneficial
- Artichoke Moth Larva
- Black Vine Weevils
- Carpenter Worms
- Corn Earworms
- Cucumber Beetles
- Flea Larvae
- Fungus Gnat Larvae
- Japanese Beetles
- Onion Maggots
- Poplar Clear Borers
- Sod Webworms
- Tobacco Budworms
- White Grubs

Nematodes for Insect Control

Philip Cranz

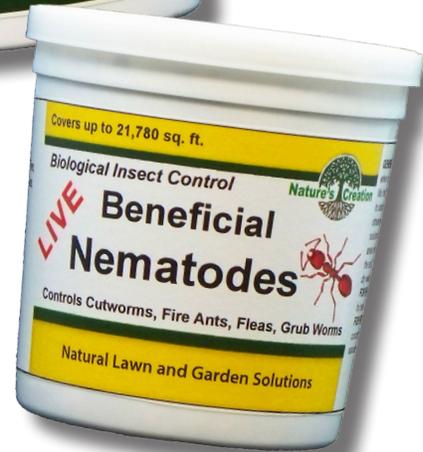
Predator and prey, host and parasite; these are among the mechanisms that Nature has put in place to maintain balance on our planet. We have all experienced insects preying on our vegetables, flowers, and lawns and we know that Lady Bugs and the Praying Mantis are insects that prey on other insects. Now through the use of careful breeding techniques we can add one more live soldier to our battle to keep insect pests in check and avoid the use of toxic chemicals. That soldier is the teeny weeny, itsy bitsy, microscopic NEMATODE.

Nematodes are unsegmented roundworms. Most are not visible to the naked eye. They can be found practically everywhere on the planet from the deepest caves and ocean depths to mountain tops. Over 25,000 different strains have been cataloged. Some are beneficial and others are not. Our subject is the friendly, Beneficial Nematode or *Entomopathogenic* (kills insects) Nematode. They are raised commercially for their ability to control insects safely and biologically. One of the most useful is the *Steinernema feltiae*. They prey on soil borne insects and their larvae. Interestingly, it is not actually the worm itself that kills the insect. This particular variety has a symbiotic relationship with the *Xenorhabdus nematophilus* bacteria. One cannot exist without the other. The nematode with its predatory instinct enters an insect through the mouth or spiracles, then excretes the bacteria which in turn infects the insect.

The bacteria produces exo- and endotoxins that kill the host insect. The bacteria and the nematode live off the decaying host and produce new generations.



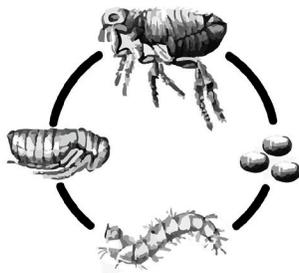
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Live Nature's Creation® Beneficial Nematodes

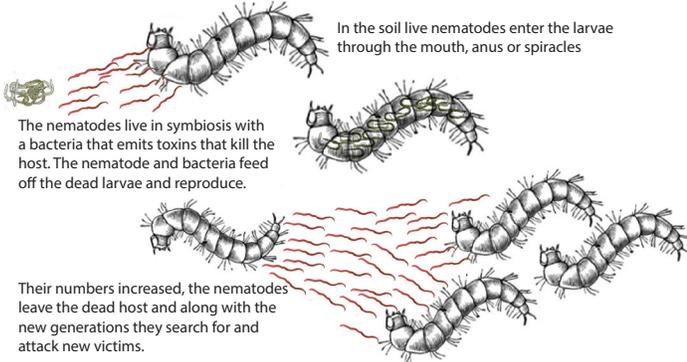
Safe, Effective Control
of Over 230 Soil Borne Insects
Including Fire Ants and Fleas



Typical Insect Life Cycle

1. Adult lays eggs
2. Larvae hatch from eggs
3. Larvae change to pupae
3. Adults emerge

Nature's Creation® Live Beneficial Nematodes stop the cycle by killing insect larvae in the soil.



In the soil live nematodes enter the larvae through the mouth, anus or spiracles

The nematodes live in symbiosis with a bacteria that emits toxins that kill the host. The nematode and bacteria feed off the dead larvae and reproduce.

Their numbers increased, the nematodes leave the dead host and along with the new generations they search for and attack new victims.

When the nutrients are depleted, the two organisms and their new generations are off to find more prey. This nematode and its bacterial sidekick are completely harmless to mammals, birds, and reptiles. Even earthworms are unaffected.

Commercial breeding takes place under laboratory conditions using a liquid growing medium. After the desired numbers are produced. The liquid containing suspended juveniles, the most active form, is sprayed on a neutral carrier, usually a very coarse vermiculite, allowed to dry, packaged and refrigerated.

This species can survive temperatures of as low as 32° F. To keep them fresh and happy the containers are kept refrigerated between 35° and 40° and NEVER allowed to reach 85°. The worms may not be visible to the naked eye but if the container is allowed to overheat and the worms die they emit an odor that you will not soon forget. Storage is very critical. Never leave a container in a hot car or in the direct sun.

Application is simple. The mixture, including the medium is mixed with cool water and allowed to stand. After 20-30 minutes the mixture should be filtered through a fine kitchen strainer or piece of fine screen to separate the liquid from the vermiculite. The concentrate is mixed at the rate of one ounce to a gallon of cool water then applied with a hose-end or pump up sprayer. Some sources discuss applying either early in the morning or late in the afternoon. For maximum viability, we recommend that you apply them at dusk. They are sensitive to uv light. Water the areas to be treated thoroughly. Concentrate the spray to areas where control is needed. Remember to apply to the soil, for most insects it is not necessary to spray foliage. Water again after

application. It makes it easier for them to travel and seek their hosts in a cool wet medium and washes them down onto the soil where they do the most good.

In the soil, the worms begin the hunt. They are especially devastating to ants, flea larvae, grub worms, fungus gnats, mole crickets, root knot nematodes, thrips, wireworms, and weevils.

Fungus gnats are one of the most annoying and prolific of all insect pests. They are difficult to treat with anything but the most toxic pesticides and then not always effectively. Once they get started in a greenhouse, the warm humid conditions are perfect for breeding. Water infected pots, concentrating on those that need to be kept moist, like cutting beds, with the nematode solution. They will destroy the larvae and end the infestation.

Fleas prefer to lay their eggs in loose soil where the emerging larvae can feed on organic matter. The larvae are blind and avoid sunlight. By spraying or drenching the most likely areas with the nematode solution the majority of the larvae will be infected and never reach the pupal or adult stage.

The *Steinernema feltiae* has been discovered to be a very effective control for thrips. These destructive sucking insects are particularly damaging to roses. They prefer breeding in the soil around the base of plants and can also breed on the foliage or stems. The eggs are laid in a cut or break in the plant. For thrip control the foliage should be sprayed thoroughly. Keep the plants wet for at least 24-48 hours. If the nematodes are allowed to dry out they can die quickly especially in very warm weather.

Remember:

- *Moist conditions enhance effectiveness.*
- *Wet plants and soil before application.*
- *Spray around the base of plants or trees and water thoroughly.*
- *For thrip control saturate the foliage completely then keep misted and moist. Do not spray too heavily or they will be washed away.*
- *Following application keep the area wet for at least two hours.*
- *Never apply in direct sunlight.*
- *UV rays from direct sunlight will kill nematodes*
- *Evening application when overcast skies are forecast for a day or two will improve effectiveness*

Beneficial nematodes are an example of responsible modern insect control methods. By learning how to breed them properly and in sufficient numbers to make them commercially viable we have a new and safe means of insect control using nature as our guide. It is great to see more and more commercial growers using this method rather than harmful chemicals.

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