Nematodes: new in biological insect control

by Harry Niemczyk, Ph.D.

The Aug. 28, 1987 issue of *The Wall Street Journal* contained a front-page article entitled "Bug-Eating Nematodes Hold Promise as Natural Pesticides." Five papers dealing with these entomogenous (insect-killing) nematodes were presented before the Division of Environmental Chemistry of the American Chemical Society. That's the kind of attention these nematodes have been receiving lately!

Spectrum of activity

Two genera, *Steinernema* and *Heterorhabditis*, show the most promise. They occur naturally all over the world, are known to be destructive to hundreds of species of harmful insects and yet are not harmful to plants, humans, animals, birds or earthworms.

Nematodes prey on insects that live underground during some stage in their life cycles. They actually seek out their prey, entering through natural openings and releasing pathogenic bacteria into the blood.

Typically, the insect dies within 48 hours.

The nematodes breed inside their host, depositing eggs that produce another generation to seek out and destroy other hosts such as grubs, billbug larvae, sod webworms, cutworms and mole crickets, to name a few.

Nematodes are applied by adding them to water and applying them as spray over the infested area.

Table 1. Summary of the field trials (1984-1986) with *Steinernema feltiae (sf), Heterorhabditis heliothidis* (Hh) and a standard insecticide, against selected turfgrass insects.[a]

Nematode: Concentration (billion/acre)	Number of tests	% Control range	Average
Japanese beetles, *Popillia japonica*			
Hh: 1.0-5.0	18	30-91	64
Sf: 1.0-5.0	12	30-72	53
OFTANOL®	7	39-97	69
Northern Masked Chafer, *Cyclocephala borealis*			
Hh: 1.0-5.0	5	42-95	74
Sf: 1.0-5.0	4	41-61	55
OFTANOL®	3	47-99	73
White Grubs, *Phyllophaga* spp.			
Hh: 0.4-5.0	3	48-81	73
Sf: 0.8-5.0	3	39-62	53
OFTANOL®	2	35-46	40
Mole crickets, *Scapteriscus* spp.			
Hh: 1.0-5.0	3	3-12	8
Sf: 1.0-5.0	5	42-73	59
OFTANOL®	3	52-79	65
Cutworms (Noctuidae)			
Hh: 0.5-5.0	2	52-100	92
Sf: 0.5-5.0	2	38-96	74
DURSBAN®	1	88-100	96

[a] Taken from Georgis, R. 1987. Nematodes for biological control of urban insects. Preprint of Paper Presented at 194th Nat. Meet. Amer. Chem. Soc. Div. Environ. Chem. 27(2):816-821.

Persistance

The infective stage of the nematodes, formed in the body of the dead host insect, leave the host and are able to persist in moist soil for months without infesting a host. They are highly resistant to chemicals and natural toxins in the soil. Their movement and search activity is optimal in moist, sandy soils.

Persistance can be reduced in dry soils, during extreme temperatures and in the presence of toxic pesticides, pathogens and predators.

Application

Nematodes are applied by simply adding them to water in a conventional spray system and applying them as a spray over the infested area. As the nematodes are highly resistant to most chemicals, a well-rinsed sprayer should be adequate. Post-treatment irrigation to prevent dessication and facilitate movement into the soil is needed.

Production, shipment

Biosis, Inc. of Palo Alto, Calif. a biotechnology company dedicated to the development of biological controls as an alternative to chemical pesticides, produces and ships nematodes all over the world.

According to Dr. Ramon Georgis, senior entomologist at Biosis, the nematodes are mass-reared on plastic foam soaked in a pork kidney/beef fat homogenate. Commercial production has not yet been achieved, but Biosis is working with scientists of the Alberta (Canada) Research Council to produce the nematodes in 40,000-liter tanks.

Large-scale shipment and storage are problems to be solved before full commercialization. Biosis has developed a process for dessicating the nematodes that appears promising.

Effectiveness

Field trials against a wide range of soil-inhabiting insect pests of turfgrasses have shown this method of biological control has the potential to be a viable alternative to chemicals. Table 1 reviews some of the field trial results. **LM**