

# Nematodes vs Nematodes

## Nematodes as biocontrol agents of plant-parasitic nematodes

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The need of carrying out biologic control for regulate population densities of plant-parasitic nematodes (PPNs) appeared in the 1950s when investigators realized that chemical nematicides could be pernicious both to people and environment. Although there are many agents we can use for control plant-parasitic nematodes (bacteria, fungi, protozoa, virus...), in this work we will focus only on predaceous nematodes and entomopathogenic nematodes (EPNs). As regards the first ones, we will show and compare the different orders that we can apply, and about the EPNs we will study the evolution in the last three decades of how the antagonism relationship takes place.

### Predaceous nematodes

**Mononchida:** long life cycle, unstable in soil, lack in preference for predating PPN.



Figure 3. Mononchida feeding on a PPN.  
<http://plpnemweb.ucdavis.edu/nemaplex/Ecology/antagoni.htm>

**Aphelenchida:** short life cycle, high reproductive potential and easy culturing.



Figure 4. *Seinura* (Aphelenchida) feeding on a PPN.  
<http://plpnemweb.ucdavis.edu/nemaplex/Ecology/antagoni.htm>

**Dorylaimida:** long life cycle, wide predation range on PPNs, prey preference, prey searching ability and attraction and aggregation at feeding sites.

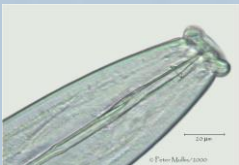


Figure 5. *Labronema* (Dorylaimida).  
Imatge modificada: <http://nematode.unl.edu/labros12.jpg>

**Diplogasterida:** short life cycle, easy culturing, high preference for PPNs, chemotaxis, high persistence in soil.



Figure 6. *Odontopharynx* (Diplogasterida).  
<http://plpnemweb.ucdavis.edu/nemaplex/images/antago16.jpg>

### Plant-parasitic nematode

The features that make PPNs such a difficult pest to control are:

- High reproductive potential
- Different stages in the same moment
- Protective structures: cuticle
- Metabolic adaptations
- Oral stylet for puncturing plant cells



Figure 1. Plant-parasitic nematode from the genus *Meloidogyne*, root-knot nematode.  
<http://bioinformatics.towson.edu/RKN/>



Figure 2. Infected roots (left) compared to non-infected (right).  
[http://nematology.umd.edu/images/eis14\\_3.jpg](http://nematology.umd.edu/images/eis14_3.jpg)

### Entomopathogenic nematodes

For controlling insect pests EPNs, *Steinernematidae* and *Heterorhabditidae*, are widely used. However they play a role in controlling PPNs, the mechanism that allows EPNs for reduce PPNs population has been under discussion for years:

First report about the antagonism relationship between PPNs and EPNs, the last ones could reduce population density of PPNs. Results weren't studied properly and no explanation was found (Ishibashi and Kondo, 1986).

First possible explanation: both EPNs and PPNs were attracted to root tips, but as EPNs are larger and more active they could colonize them faster, preventing PPNs reproduction (Bird and Bird, 1986).

Next investigations were focused on finding a product that the symbiotic bacteria living inside EPNs (*Xenorhabdus*) could produce and was toxic to PPNs (Lewis et al., 2001).

Next year was demonstrated that all the theories given before were wrong. It was neither about root surface competition nor bacterial products secreted. Just applying dead EPNs, with also dead bacteria, and there still was a reduction in PPNs population density. (Jagdale et al., 2002)

Now studying the changes taking place in the plant protein activity, they determined that the presence of EPNs in the soil induced systemic resistance in plants, what prevented a PPN infection in those plants (Jagdale et al., 2009)



Entomopathogenic nematode  
*Steinernema carpocapsae*.  
<http://sites.bio.indiana.edu/~livelylab/Farrar.html>

### Conclusions

Predaceous nematodes are not yet a viable option for fighting a PPN pest because they are not commercialized, they should be first studied at experimental level and tested in a wide variety of soils. The order with more probabilities to be someday sold as a product is Diplogasterida, because they satisfy the conditions for being a good PPN predator. The order Dorylaimida may be the second, but they have a longer life cycle. So, from these studied in this work, the easiest way for controlling a PPN pest with nematodes would be with the EPNs, as they are widely commercialized for alleviate insect pests.

### Bibliography

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### References

Background:  
<http://www.wageningenur.nl>