

Ring Nematode *Mesocriconema xenoplax* Raski, 1952 and *Mesocriconema ornatum* Raski, 1958 (Nematoda: Rhabditida: Tylenchina: Criconematidae)¹

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The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

Ring nematodes (*Mesocriconema*, *Criconemoides*, *Criconemella*, etc.) in the family *Criconematidae* make up a group of nematodes that feed on a wide range of plant hosts. They live in the soil and feed on plant roots as ectoparasites (nematode's body remains outside of the plant). Most species of ring nematodes are not considered as important plant pests. However, the peach ring nematode *Mesocriconema xenoplax* and peanut ring nematode *Mesocriconema ornatum* are two species common in Florida that cause damage to certain agriculturally important crops.

Importance

Species of ring nematode are commonly encountered in natural ecosystems, and in horticultural and agricultural production, but only *Mesocriconema xenoplax* and *Mesocriconema ornatum* are known to cause economic damage to plants in Florida. *Mesocriconema xenoplax* and *Mesocriconema ornatum* are known to parasitize many different kinds

of plants. While direct damage to peach by *Mesocriconema xenoplax* is difficult to demonstrate, it is a critical player in peach trees' predisposal to peach tree short life (PTSL) (Ritchie and Clayton, 1981) (Figure 1). With PTSL, ring nematode infested trees become susceptible to cold injury and diseases, leading to premature death (Nyczepir et al. 1983). *Mesocriconema xenoplax* has been associated with chlorosis and decline of lawn grasses in Europe (Inácio et al., 2019), and is considered a minor pest of grape, walnut and carnation. The common Florida lawn grass centipede is particularly susceptible to *Mesocriconema ornatum* (Ratanaworabhan and Smart, 1969), and it is the primary nematode problem and most common cause of decline of centipedegrass in Florida. *Mesocriconema ornatum* can cause stunting, yellowing and reduced yield of peanut, decline of bermudagrass on golf courses and athletic fields and it is also a minor pest of blueberry.

Description

Nematodes in *Criconemaidae* are characterized by having an amalgamated procorpus (Figure 2). This means that the esophageal lumen, median bulb, and esophageal glands are compressed, and the esophageal glands are greatly reduced. The stylet is well developed and long, and its base is often near, or even within, the median bulb. *Mesocriconema* are characterized by having thick, rounded, protruding,

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retorse cuticular annulations. These annulations make the nematode's body look like it is made up of "rings" and, hence, the common name ring nematode. The body of *Mesocriconema xenoplax* and *Mesocriconema ornatum* is 'cigar-shaped'; adult females (Figure 3) are generally around 500 μm long and 50 μm wide and their vulva is located posterior, approximately 80-90 percent down the body. Males are rare for both species. When males (Figure 4) are present, they exhibit sexual dimorphism, greatly differing in appearance from the females, have no stylet and apparently do not feed. Juveniles of both species are smaller, and their body shape generally resembles the adult females (Figure 5). *Mesocriconema xenoplax* and *Mesocriconema ornatum* are very similar in appearance, have overlapping morphometrics, and are often confused for each other. There are subtle differences in the lip annules (Figure 2), projections in vulval annules, and tail annules (Figure 6), but even trained nematode taxonomists often have a hard time separating them morphologically. Therefore, the easiest way to speciate these ring nematodes is with DNA sequencing.



Figure 1. A peach tree showing symptoms of Peach Tree Short Life (PTSL) associated with ring nematode, *Mesocriconema xenoplax*. Credits: A. P. Nyczepir, USDA ARS (retired) used with permission

Life Cycle and Biology

Like other nematodes, *Mesocriconema xenoplax* and *Mesocriconema ornatum* have four juvenile stages before molting into an adult. The first molt occurs inside the egg and the second-stage juvenile nematode (J2) emerges from the egg. The J2 must feed on live plant cells in order to develop into other life stages. Ring nematodes are ectoparasites, meaning they do not go inside the root with their body to feed. The J2 is attracted to a host root, probes it until a suitable site is located. Once a suitable site is located the nematode inserts its needle-like stylet through the root epidermis and into a live cortical cell. The nematode injects secretions through the stylet and into

the cortical cell, causing it to modify into a feeding cell and withdraws nutrients through the stylet to feed. Unlike most other ectoparasitic nematodes that move their feeding site often, *Mesocriconema* spp. seldom move and remain feeding on a single feeding cell for up to 8 days (Wescott and Hussey, 1992). Upon feeding the J2 molts into a J3 after approximately 3-5 days, and then to a J4 after 5-7 days. During the final molt, the nematode becomes an adult, typically a female. *Mesocriconema xenoplax* and *Mesocriconema ornatum* reproduce parthenogenetically without sex. The female ring nematode lays one egg every two to four days (Thomas, 1959).

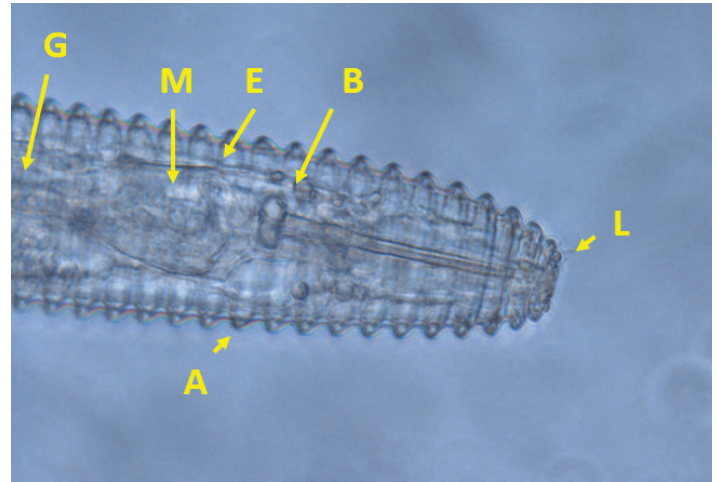


Figure 2. Anterior region of *Mesocriconema ornatum*. A = annulations. L = Lip annules. B = Base of stylet. E = Esophageal lumen. M = Median bulb. G = Esophageal glands. G, M, and E are compressed to create an amalgamated procorpus (compressed upper digestive organs), and B is near M. These features are characteristic of nematodes in Criconematidae. A are large, rounded and retrorse, these are characteristic of *Mesocriconema xenoplax* and *Mesocriconema ornatum*. Subtle differences in L are used to distinguish between these two species.

Credits: J. E. Luc, University of Florida



Figure 3. Female *Mesocriconema ornatum*. The body is cigar-shaped and heavily annulated.

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Figure 4. Male ring nematode *Mesocriconema ornatum*. Male ring nematodes exhibit sexual dimorphism, meaning the males and females look very different from each other. Male *Mesocriconema* spp. are slender and lack feeding apparatus and heavy annulations that are present in females.

Credits: William T. Crow, UF/IFAS



Figure 5. Adult female (A) and juvenile (J) *Mesocriconema ornatum*. Juvenile stages look similar to adult females, but they are smaller.

Credits: William T. Crow, UF/IFAS

Distribution

Mesocriconema xenoplax was first described on grapevines in California in 1952 (Raski 1952). Since then, it has been reported on every continent except Antarctica and throughout the United States on grape, stonefruit, many other woody plants, legumes, different kinds of grasses, forest trees and weeds. It is the most common ring nematode species found on peaches in Florida and Georgia. *Mesocriconema ornatum* is widely distributed in the United States on peanut and other agronomic plants, vegetable crops, grasses, ornamental plants, forest plants, and weeds.

It is the most common plant-parasitic nematode detected from all plants in Florida by the UF Nematode Assay Lab.

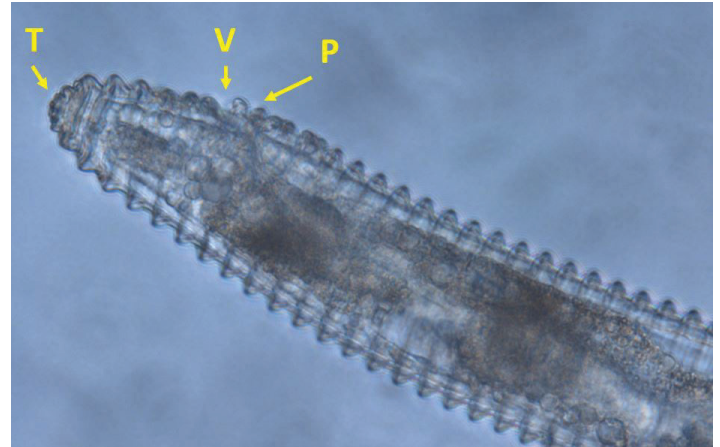


Figure 6. Anterior of *Mesocriconema ornatum*. Subtle differences in the annule projections (P) anterior to the vulva (V), and the annules at the base of the tail (T) are used to distinguish between *Mesocriconema xenoplax* and *Mesocriconema ornatum*.

Credits: J. E. Luc, University of Florida

Symptoms and Diagnosis

Similar to damage caused by many other plant-parasitic nematodes, symptoms caused by *Mesocriconema* spp. can be non-descript and difficult to diagnose based on symptoms alone. *Mesocriconema xenoplax* and *Mesocriconema ornatum* on turfgrasses are not as virulent as certain other nematode species such as the [Grass Root-Knot Nematode-Meloidogyne graminis](#) or [Sting Nematode Belonolaimus longicaudatus](#). Still, in high numbers it can cause wilt and decline on most turfgrasses. Centipedegrass is particularly susceptible to *Mesocriconema* spp. Typically damage appears in irregularly-shaped patches that enlarge very slowly over time (Figure 7). While a minor pest of peanut, *Mesocriconema ornatum* can reduce pod weight and cause necrotic lesions on pegs, pods, and roots. *Mesocriconema ornatum* has been implicated as a possible causal agent for blueberry replant disease (Jagdale et al., 2013), a condition where plants being replaced exhibit stunting and slow growth. *Mesocriconema xenoplax* can result in the predisposal of peach to peach-tree-short-life (Nyczepir et al. 1987). Above-ground symptoms of peach-tree-short-life include collapsed foliage and stunted tree growth (Figure 1) (Beckman and Nyczepir 2005). When cut into, the bark will look brownish, and water soaked. If the peach tree is affected by cold injury the bark will be cracked and separated from the tree trunk (Beckman and Nyczepir 2005). On grape *Mesocriconema xenoplax* reduced carbohydrate reserves and certain nutrients in the roots and wood, and reduced shade tolerance (Schreiner et al., 2011).



Figure 7. Aboveground symptoms of *Mesocriconemas ornatum* on centipede grass.

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Because symptoms are imprecise for diagnosing ring nematode, diagnosis is primarily based on nematode soil assays performed by a credible nematode diagnostic lab like the UF Nematode Assay Lab. Go to the [UF Nematode Assay Lab](#) webpage for instructions on how to collect and submit these kinds of samples. Ring nematodes are among the least mobile plant-parasitic nematodes. Therefore, active extraction methods that depend on nematode movement are not effective for extracting ring nematodes from soil. Passive extraction methods such as centrifugal-flotation or decant-sieving work best for extracting ring nematodes from soil.

Hosts

Both *Mesocriconema xenoplax* and *Mesocriconema ornatum* have extensive host ranges, in fact it is more difficult to identify plants that are non-hosts for these nematodes than to identify hosts. Some of the important crop plants known to be hosts of *Mesocriconema xenoplax* are: peach, grape, chrysanthemum, walnut, clover, fescue, vetch, ryegrass, curly dock, cowpea. Important hosts of *Mesocriconema ornatum* are: peanut, all major turfgrasses, blueberry.

Management

Understanding the crop you have, soil type, and what pests can affect your yield are the first steps in developing a management plan. Correct identification of the problem will assist with the management strategy. One way to reduce nematode damage is to replace susceptible plants with those that are more tolerant or resistant. For example; centipede-grass damaged by ring nematodes could be replaced with St. Augustinegrass that is more tolerant. Peach trees declining from peach-tree-short-life can be replaced with peach scion grafted onto Guardian® or another tolerant rootstock (Beckman, 1998). Time of pruning can also mitigate cold

injury and reduce wounding and pathogen entry (Beckman and Nyczepir 2005). Breeding programs have developed peach rootstocks and peanut cultivars with resistance to root-knot nematodes, but these do not impart resistance to ring nematodes.

In some cases, use of chemical control is warranted. For fruit production (peach, blueberry, etc.) soil fumigation before planting or replanting can reduce the nematode load and give the new plants a head start on the nematodes. Post-planting nematicides are seldom used on fruit trees. Check with your local Cooperative Extension Service for help determining if any nematicides are currently legal and recommended. In Florida, nematicides are commonly used on peanut, particularly for management of root-knot nematode, and these may provide incidental control of ring nematode at the same time. On golf and high-end sports turf nematicides are commonly used that are effective against *Mesocriconema ornatum* and other important turfgrass nematodes.

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