

# Nematode Survey in Strawberry Production Fields in Florida

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## Summary

The most common nematodes in Florida strawberries are sting, stubby root and root-knot nematodes. While sting nematode is the most damaging nematode, these two other nematodes can also damage strawberries as well as double cropped vegetables.

## Background

Plant-parasitic nematodes are a major limiting factor to successful strawberry production. Sting nematodes (*Belonolaimus longicaudatus*) are the most important, capable of causing total yield loss, and they are often the main reason why soil is fumigated. Not much information is available on presence and distribution of other plant-parasitic nematodes in Florida.

## Methods

A total of 137 soil samples and 43 samples of symptomatic leaves for foliar nematodes were collected from 22 different strawberry farms in Hillsborough County, FL, USA from January 2018 to February 2021. In addition, 6 root, 23 soil and 2 foliage samples were collected from seven fields of a nursery in North Carolina in September 2018, 2019, and 2020. These samples were taken during the growing seasons from mostly conventional, and a few organic strawberry fields, following a zig-zag pattern within a suspected nematode hot spot, which typically had smaller plants showing nutrient deficiencies, or an area indicated by the farmer as having nematode problems in the past. Each sample consisted of a composite of 5 to 10 soil cores (2.5 cm-diam. × 25 cm-deep) collected from strawberry rhizosphere of symptomatic and asymptomatic plants.

Soil samples were sealed in plastic bags and transported inside insulated coolers to the GCREC. The samples were stored at 4°C and nematodes extracted within two weeks. Each sample was mixed and a subsample of 200 cm<sup>3</sup> was used for nematode extraction using the salad spinner method. Plant-parasitic nematodes were identified to genus, and depending on the morphological complexity of the species, the nematode was also identified into species level. Free-living nematodes were also morphologically identified into trophic (feeding) group. Molecular identification of some representative samples of each

genus was also performed by using Sanger sequencing or Restriction Fragment Length Polymorphism (RFLP).

## Results

The total farms surveyed was 22. The most common plant parasitic nematodes found in Florida fields were *Belonolaimus longicaudatus* (sting), *Nanidorus minor* (stubby root), *Meloidogyne hapla* (northern root-knot) *Pratylenchus penentrans* (northern lesion), *Tylenchorhynchus* spp. (stunt) and *Aphelenchoides besseyi* (foliar). All these were found in considerable numbers (>50 specimens/200 cm<sup>3</sup> soil) (Table 1). An additional three genera of plant-parasitic nematodes (*Criconemella* (ring), *Helicotylenchus* (spiral) and *Paratylenchus* (pin) were occasionally found but in very low numbers (<10 specimens/200 cm<sup>3</sup> soil), and data is not given.

Sting nematodes were found in 63% of the sampled farms (14 out of 22 farms). The average population density was 118 specimens/200 cm<sup>3</sup> soil, but nematode recovery was highly variable as the number ranged from 1 to 914 specimens per 200 cm<sup>3</sup> soil. Root-knot nematodes were also found in the soil samples with the northern root-knot nematode being the most prevalent (22% of the sampled farms, 5 out of 22), on average 74 J2s per 200 cm<sup>3</sup> soil. Other root-knot species were *Meloidogyne graminicola* and *M. incognita* but only from a single farm, and the number of nematodes was low. Ten samples also had very few unidentified root-knot nematodes species due to lack of biological material. Northern lesion nematodes were present in 31% of the sampled farms (7 out of 21 farms) but at very low population densities, averaging 3 specimens per 200 cm<sup>3</sup> soil from 11 samples.

Stubby root and stunt nematodes were present in 63% and 31% of the sampled farms, respectively. Stubby root was found on 14 farms and the average of population density was 35 nematodes per 200 cm<sup>3</sup> soil, with numbers ranging from 1 to 499 specimens per 200 cm<sup>3</sup> soil. On two farms this nematode showed visible plant damage (season 19-20 and 21-22). Stunt nematodes were found in seven farms and the average was 54 specimens per 200 cm<sup>3</sup> soil, but they did not appear to cause visible damage. Foliar nematodes were found in one sample (38 specimens per 10 grams of foliage tissue).

## Contact

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Table 1. Frequency and densities of major plant-parasitic nematodes found in Florida strawberry fields from 2018 to 2021.

Nematode	No. of farms	No. of samples	% of farms	Average pop. density <sup>a</sup>	Range (200 cm <sup>3</sup> soil)
Sting					
<i>B. longicaudatus</i>	14	35	63%	118	(1-914) <sup>b</sup>
Root-knot					
<i>M. hapla</i>	5	21	22%	74	(1-852)
<i>M. incognita</i>	1	1	4%	18	(18)
<i>M. graminicola</i>	1	2	4%	10	(8-11)
<i>Meloidogyne</i> sp. <sup>c</sup>	5	10	22%	17	(1-29)
Lesion					
<i>P. penetrans</i>	7	11	31%	3	(1-7)
Stunt					
<i>Tylenchorhynchus</i> spp.	7	15	31%	54	(2-328)
Stubby root					
<i>Nanidorus minor</i>	14	44	63%	35	(1-499)
Foliar					
<i>A. besseyi</i>	1	1	4%	38	38
Total	22	137	-	-	-

<sup>a</sup>Average found from the total number of samples; <sup>b</sup>Numbers in parentheses indicates the range of nematodes found per 200 cm<sup>3</sup> soil. <sup>c</sup>Samples were not molecularly identified due to lack of biological materials.