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An Inventory of Stylet-Bearing Nematodes in Ohio

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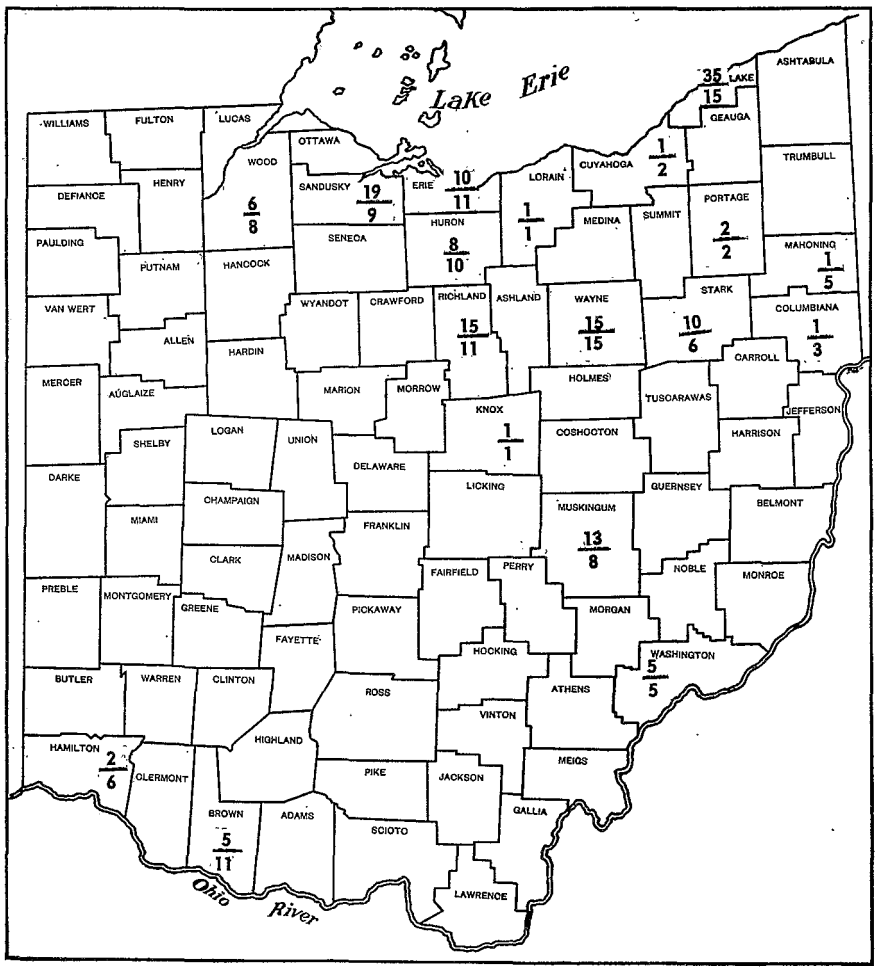
Introduction

Nematodes that attack plants are not new arrivals on the agricultural scene in Ohio. A search of records on the occurrence of plant diseases revealed the fact that nematodes were present on plant specimens examined at the Ohio Agricultural Experiment Station as early as 1905. Plants with visible nematode damage were collected from 15 different counties in Ohio by 1925. They were found on such plants as carnation, catalpa, cucumber, and cyclamen from Clark, Champaign, Delaware, and Lucas counties during this 19-year period. Although research workers and many of those engaged in crop production have known of the presence of the root-knot nematode for years, the great economic importance of the damage which plant parasitic nematodes can do to crop and ornamental plants has been fully appreciated for only two or three decades. Even in instances where nematodes were known to be a serious handicap to crop production little was known of possible control measures until 1944 when it was discovered that a chemical known as D-D, when applied to the soil, greatly reduced the damage caused by root-knot nematode to pineapple. This led to the development of other nematocides, and today rather definite recommendations can be given for the control of nematodes on most economic plants. Other control methods, such as crop rotation and the breeding of resistant plant species, are being developed.

Nematodes, or eelworms as they are sometimes called, are small animals, so small in fact (mostly less than 1/50 of an inch in length) that they cannot be seen except with the aid of a microscope. Approximately 5000 species have been described (1), most of which are animal parasites and marine forms. Christie (2) in a recent book on nematodes mentions 135 distinct species that feed on seed plants. All, or nearly all, of the known plant parasitic forms possess a stylet or spear which they can project and puncture the cells that make up the tissue of the plants on which they feed. The nematodes that attack plant roots are sometimes classified according to the manner in which they feed. Those that enter root tissue are known as endoparasites, and those that feed on the root surface, are spoken of as ectoparasites. Nematodes reproduce by the action of egg-laying females and under favorable conditions may result in sizable populations in and around plant roots.

Counties of Ohio sampled for nematodes. The upper figure represents the number of locations in each county and the lower figure the number of nematode genera recorded.



This article presents the findings of an inventory of the stylet-bearing nematodes that have been found in association with various plants in Ohio. Sampling was restricted primarily to areas of fruit, vegetable, or nursery crop production in the state. It is not intended to represent all nematode genera which may occur in the state nor does it imply that a certain genus, although found associated with a given plant, is parasitic or pathogenic. The material is for the use of those concerned with plant nematodes and to compliment other reports on the distribution of stylet-bearing nematodes in sections of the United States (3).

Methods

The occurrence of stylet-bearing nematodes was recorded in the examination of soil or plant samples from 19 counties of Ohio during 1959–60 (See map for counties sampled). Over 500 individual samples were collected and examined. If the soil from a specific field was obtained on several different dates, as was often the case, the combined collection has been counted as one sample. When several plant species in a given field were sampled, the nematodes found have been listed with each plant species.

Soil samples were examined for nematodes by a variation of the Baermann funnel technique (4). This technique consisted of placing approximately 15 ml of soil on a wet-strength paper tissue which was supported in the flaring portion of a glass funnel by an aluminum screen. The funnel was then filled with water to moisten the soil sufficiently without actually covering it, thus allowing the nematodes to move to the bottom of the funnel. Nematode suspensions were drained from the funnel stem 24 hours after the sample was prepared. The nematodes so collected were then identified as to genus by examination under appropriate magnifications of stereoscopic and binocular microscopes. Recovery of nematodes from plant roots followed much the same procedure as that used with soil samples; by suspending sections of roots on a screen above a glass dish in a moist chamber for 48 to 72 hours nematodes were collected in water.

Results

One or more genera of stylet-bearing nematodes have been recovered from virtually all of the samples so far examined. Nineteen of the most commonly found genera are listed in Table 1. Some genera of the family Corylaimidae are not listed, although stylet-bearing members of this family were present.

Table 1. Some nematodes which were found in samples collected in Ohio. Percentage occurrence based on collections from 150 different locations.

Genus	Percentage Occurrence
Aphelenchus	38.6
Aphelencoides	8.6
Boleodorus	4.0
Criconemoides	6.0
Ditylenchus	4.6
Helicotylenchus	14.6
Hemicyliophora	0.6
Heterodera*	3.3
Hoplolaimus	3.3
Meloidogyne	18.6
Paratylenchus	24.0
Paurodontus	4.0
Pratylenchus	52.6
Psilenchus	10.6
Rotylenchus	5.3
Tetylenchus	2.0
Tylenchorhynchus	10.0
Tylenchus	26.0
Xiphinema	6.0

*Samples examined by a means which did not permit recovery of *Heterodera* cysts.

Members of the genus *Pratylenchus*, referred to as the lesion or meadow nematodes, occurred in over half of the samples, and it may be inferred from the results of this survey that members of this genus are the most widely distributed plant-parasitic nematodes in Ohio. These lesion nematodes were found in association with 44 of the 57 plant species, or 77 percent of the kinds of plants listed in Table 2. This does not imply, however, that all of the plants listed are necessarily suitable hosts of this nematode genus. Individual species may not invade the roots of all the plants listed, since some plants are probably more suitable food sources than others. The symptoms of injury to plants by members of this genus vary somewhat but are generally characterized by root pruning that results from the formation of lesions at the site of nematode invasion.

Thirty-eight percent of the samples examined contained species of *Aphelenchus*. The significance of this nematode genus as injurious to green plants has not been demonstrated, but species of this genus are known to feed on fungi, insects, and other nematodes.

Table 2. Nematode genera associated with 57 different kinds of plants in Ohio.

Plant or Soil Sampled	Nematode Genera																		
	Aphelenchus	Aphelencoides	Boleodorus	Criconemoides	Ditylenchus	Helicotylenchus	Hemicycliophora	Heterodera	Hoplolaimus	Meloidogyne	Paratylenchus	Paurodontus	Pratylenchus	Psilenchus	Rotylenchus	Tetylenchus	Tylenchorhynchus	Tylenchus	Xiphinema
Alfalfa	•					•				•	•	•	•			•		•	•
Anemone										•			•						
Apple		•											•			•			•
Arborvitae						•							•						
Ash, white													•						
Azalea	•										•		•				•		
Barberry, Jap.	•									•			•						
Beet, garden	•																		
Beet, sugar	•					•				•	•		•					•	
Bluebeard										•	•		•						
Blueberry	•	•											•						
Boxwood															•				•
Carrot	•									•	•		•						
Celery	•									•	•		•						
Cherry, sour	•	•		•	•	•				•	•	•	•	•	•			•	•
Cherry, wild	•												•						
Cockscomb	•																		
Corn	•	•	•			•		•				•	•					•	•
Daisy, Shasta	•									•	•								
Endive	•																		
Grape	•					•					•		•	•		•	•	•	•
Grass, bent			•	•								•	•	•	•			•	
Grass, mixture	•			•		•		•		•	•	•	•		•			•	•
Iris														•	•				
Lettuce	•					•				•	•		•						
Lilac	•					•					•		•						
Lily, trumpet		•											•						

Table 2.—Continued—Nematode genera associated with 57 different kinds of plants in Ohio.

Plant or Soil Sampled	Nematode Genera																	
	Aphelenchus	Aphelencoides	Boleodorus	Criconemoides	Ditylenchus	Helicotylenchus	Hemicycliophora	Heterodera	Hoplolaimus	Meloidogyne	Paratylenchus	Paurodontus	Pratylenchus	Psilenchus	Rotylenchus	Tetylenchus	Tylenchorhynchus	Tylenchus	Xiphinema
Locust	•	•									•		•					•	
Narcissus	•		•								•				•				•
Oat	•												•					•	•
Onion	•										•		•						
Peach									•		•	•	•	•	•			•	•
Pear	•									•	•		•						•
Peony	•									•			•						
Pepper, red													•						
Petunia	•									•			•					•	
Phlox	•									•			•						
Pine	•										•						•	•	
Plum												•	•						•
Poplar	•		•								•		•					•	
Potato	•									•	•		•						
Radish	•												•	•					
Rhododendron																	•		
Rose, multiflora	•				•					•			•	•					•
greenhouse							•				•		•					•	
Rye	•			•		•		•			•		•	•					
Soybean	•																	•	
Spinach	•																		
Spindle tree										•	•		•				•		
Spruce		•		•									•				•	•	
Strawberry	•	•		•	•	•				•	•		•	•				•	
Tobacco	•	•			•				•		•	•	•					•	•
Tomato										•			•				•		
Tulip													•						
Weigelia	•									•	•								
Wheat	•												•					•	

Members of the genus Tylenchus were identified in 25.8 percent of the samples. The importance of this genus as a plant damaging nematode also is somewhat doubtful even though it was found associated with alfalfa, cherry, corn, oat, pine, soybean, strawberry, and tobacco.

Members of the genus *Paratylenchus,* the pin nematodes, were present in approximately 24 percent of the samples. Classified as ectoparasites, these nematodes were found in the soil about alfalfa, anemone, azalea, carrot, cherry, celery, grape, lettuce, locust, rye, strawberry, and tobacco. Further study of these nematodes should be made to demonstrate their role as vagrant plant parasites.

A large part of experimental work for nematode control has been directed toward the control of the root-knot nematodes, since it is with members of this genus that vegetable growers and nurserymen are concerned. Members of the genus *Meloidogyne,* principally *M. hapla,* were present in 18.5 percent of the samples, and this fact in itself warrants continued emphasis on their control in Ohio.

Other nematode genera which may be considered important plant pests in this state are *Helicotylenchus* and *Tylenchorhynchus.* These nematodes, known as the true spiral and stunt nematodes, respectively, are external feeding nematodes and normally do not enter the root tissue. *Helicotylenchus* species were found in 14.6 percent of the samples and in association with such plants as arborvitae, cherry, corn, rye, strawberry, and sugar beet, as well as alfalfa, grape, and lettuce. Species of *Tylenchorhynchus* were identified in 10 percent of the samples examined. It is believed that members of this genus may be more widely distributed in Ohio than this survey would indicate.

Xiphinema, the dagger nematode, was found associated with 18.5 percent of the plant species listed. These externally feeding nematodes are known to cause severe injury to the roots of many plants. One species causes a gall formation on rose roots which resembles those caused by root-knot nematodes. It is interesting to note that the only reports of plant virus transmission by nematodes have dealt with species of *Xiphinema.*

Several other genera, certain species of which may be extremely important as pathogens on specific plants under certain conditions, were found in sufficient numbers of samples to warrant mention. These include species in the genera *Aphelencoides, Criconemoides, Ditylenchus, Hoplolaimus,* and *Rotylenchus.*

Conclusions

A survey of 19 counties in Ohio revealed that virtually all samples contained stylet-bearing nematodes. The purpose of this report is to record the relative prevalence of nematode genera as has been determined during two years of sampling. Since most of this exploratory work has been confined to the nursery, fruit, and vegetable growing areas of the state, this report is not intended to serve as a comprehensive survey of all crops, or for the entire state.

Members of the genus *Pratylenchus* were the most commonly found nematodes, occurring in 52.6 percent of the samples, and in association with more kinds of plants than any other genus. *Paratylenchus* spp. were less prevalent, occurring in 24 percent of the samples. Species of Aphelenchus and Tylenchus occurred rather frequently, but their importance is doubtful at present.

The root-knot nematodes, *Meloidogyne* spp.; the spirial nematodes, *Helicotylenchus* spp.; and the stunt nematodes, *Tylenchorhynchus* spp.; were associated with diversified plant types and in a sufficient number of samples to warrant interest from the standpoint of their pathogenicity.

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