NEMATODES ASSOCIATED WITH IRRIGATED CORN IN SOUTH DAKOTA[1]

James D. Smolik
Department of Plant Science
South Dakota State University
Brookings, S. D. 57006

ABSTRACT

A total of 63 nematode species representing three trophic levels were identified from eight, continuously cropped, irrigated corn fields. The dominant plant feeding forms in all fields except one were *Pratylenchus* spp., primarily *P. scribneri*. *Hoplolaimus galeatus* was the dominant plant parasite in only one field and occurred sporadically or not at all in the remaining fields. The most common predaceous forms were *Aporcelaimellus* spp. Species of *Acrobeles*, *Acrobeloides*, and *Rhabditis* were the most numerous microbial feeding forms. Length of time fields had been successively cropped to corn and use of insecticides did not markedly influence species diversity. Lowest plant feeding nematode populations were recovered from fields with the highest salt contents.

INTRODUCTION

Significant increases in corn yields under dryland conditions have been correlated with nematode control in South Dakota (Smolik, 1975). More recent evidence (author, unpublished) indicates nematodes are also capable of reducing yield of irrigated corn. Very little is known concerning the nematode taxa associated with irrigated corn in South Dakota. The primary objective of this study was to identify the species of plant feeding, predaceous, and microbial feeding nematodes in several producers' irrigated corn fields. Effects of several soil properties on nematode populations were also determined.

MATERIALS AND METHODS

Samples were obtained following harvest from eight corn fields. Fields I, II, III, IV and V were located in Fall River County near Oral. Field VI was in Butte County near Vale and VII in Pennington County near Wasta. Field VIII was in Beadle County near Cavour. Fields I through VI were furrow irrigated and fields VII and VIII were overhead irrigated. All fields except VII had been continuously planted to corn for at least the previous 5 years. Field VII was second year corn on former native range. Insecticides for control of corn rootworm (*Diabrotica* spp.) had been used in all fields except IV and VII. Root and soil samples were obtained from

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four randomly selected locations in each field. Four plants were dug at each location and root systems were quartered. One quarter of each root system, along with adhering soil, from each of the four plants was placed in a plastic bag, labeled and stored at 4C. until processed.

Soil was shaken from roots, thoroughly mixed, and nematodes extracted from a 200 cc subsample by the method of Christie and Perry (1951). Roots were then washed, cut into approximately 1 cm segments and mixed, and endoparasites were extracted from a 2 g aliquot by the shaker method (Bird, 1971). Nematode densities at each location were estimated by counting the number present in each of three 1-ml aliquots of a 50 ml suspension. After counting, nematode suspensions from each location within a field were combined, heat relaxed, and fixed in FAA. Permanent mounts (Thorne, 1961) were prepared of approximately 150 randomly selected specimens from each field.

Soil from fields I, III, IV, V, VI and VII remaining after removal of the 200 cc subsample was submitted to the Soil Testing Service, Plant Science Department, SDSU.

RESULTS AND DISCUSSION

A total of 63 nematode species were identified from the eight fields. This is about 30% less than the number identified from a native range site near Cottonwood in an earlier study (Smolik, 1974). Based on frequency of occurrence in the permanent mounts, the dominant plant feeding forms in all fields except VII were *Pratylenchus* spp., primarily *P. scribneri*. In field VII *Hoplolaimus galeatus* dominated; however, *H. galeatus* occurred sporadically or not at all in the remaining fields. The dominance of *P. scribneri* in the lighter textured soils in this study is in agreement with previous taxonomic surveys (Thorne and Malek, 1968). Fourteen other plant feeding genera occurred less frequently (Table 1).

The most common predaceous forms were *Aporcelaimellus* spp., followed by *Ecumenicus monohystera*. Eight other predaceous genera were also identified (Table 1). Species of *Acrobeles, Acrobeloides* and *Rhabditis* were the most numerous microbial feeders. Eleven other microbial feeding genera also occurred (Table 1).

Length of time fields had been successively planted to corn and use of insecticide did not appear to influence species diversity. The greatest number of species (27) were recovered from field VI and lowest number (11) from field IV (Table 1). Field VII with a 2-year history of corn had substantially fewer species (18) than might be expected from former native range on the basis of the earlier study (Smolik, 1974).

Soil test results and total number of plant feeding nematodes are shown in Table 2.

TABLE 1

Nematode Taxa Identified From Eight Producers' Irrigated Corn Fields

Field No.	Plant Feeding	Predaceous	Microbial Feeding
I	*Pratylenchus scribneri* *Tylencholaimellus* sp. *Tylencholaimus* sp.	*Aporcelaimellus* sp. *Aporcelaimellus porcus* *Ecumenicus monohystera* *Eudorylaimus* sp. *Eudorylaimus miser* *Seinura oswegoensis*	*Acrobeles ctenocephalus* *Acrobeloides minor* *Chiloplacus contractus* *Panagrolaimus subelongatus* *Paraphelenchus* sp. *Rhabditis* sp.
II	*Dorylaimellus occidentalis* *Pratylenchus scribneri* *Quinisulcius acutus* *Trichodorus* sp. *Xiphinema americanum*	*Aporcelaimellus* sp. *Discolaimium* *Discolaimus* sp. *Ecumenicus monohystera* *Eudorylaimus miser* *Eudorylaimus* sp. *Thonus* sp.	*Acrobeles ctenocephalus* *Acrobeloides buetschli* *Acrobeloides minor* *Aphelenchus avenae* *Chiloplacus contractus* *Eucephalobus oxyuroides* *Mesorhabditis* sp. *Panagrolaimus subelongatus* *Rhabditis terricola*
III	*Boleodorus acutus* *Boleodorus thylactus* *Ditylenchus* sp. *Dorylaimellus* sp. *Paratylenchus* sp. *Pratylenchus scribneri* *Pratylenchus tenuis*	*Aporcelaimellus conoidus* *Aporcelaimellus obscurus* *Carcharolaimus teres* *Discolaimium* sp. *Eudorylaimus aquilonarius* *Eudorylaimus dubius* *Mesodorylaimus* sp.	*Acrobeles ctenocephalus* *Acrobeloides minor* *Chiloplacus contractus* *Eucephalobus oxyuroides* *Panagrolaimus subelongatus* *Paraphelenchus intermedius*

Field No.	Plant Feeding	Predaceous	Microbial Feeding
	Tylencholaimellus sp.	*Nygolaimus dorotheae* *Seinura oswegoensis* *Thonus* sp.	
IV	*Aorolaimus baldus* *Pratylenchus scribneri* *Quinisulcius acutus* *Xiphinema americanum*	*Aporcelaimellus obscuroides* *Aporcelaimellus obscurus*	*Acrobeles ctenocephalus* *Aphelenchoides* sp. *Aphelenchus avenae* *Mesorhabditis* sp. *Rhabditis* sp.
V	*Ditylenchus clarus* *Dorylaimellus occidentalis* *Helicotylenchus pseudorobustus* *Pratylenchus hexincisus* *Pratylenchus scribneri* *Tylencholaimus nanus* *Tylencholaimus proximus* *Tylenchus exiguus*	*Discolaimium* sp. *Ecumenicus monohystera* *Nygolaimus* sp.	*Acrobeles ctenocephalus* *Acrobeloides minor* *Chiloplacus contractus* *Cephalobus* sp. *Cervidellus* sp. *Eucephalobus oxyuroides* *Panagrolaimus subelongatus* *Paraphelenchus* sp. *Rhabditis terricola*
VI	*Boleodorus thylactus* *Ditylenchus microdens* *Dorylaimellus* sp. *Helicotylenchus pseudorobustus* *Pratylenchus scribneri* *Psilenchus hilarulus*	*Aporcelaimellus obscuroides* *Aporcelaimellus obscurus* *Discolaimus texanus* *Ecumenicus monohystera* *Eudorylaimus miser*	*Acrobeles* sp. *Acrobeloides buetschli* *Acrobeloides minor* *Aphelenchoides confusus* *Aphelenchoides sacchari* *Aphelenchus avenae*

Field No.	Plant Feeding	Predaceous	Microbial Feeding
	Tylencholaimellus sp. *Tylenchorhynchus maximus* *Tylenchus exiguus* *Xiphinema americanum*		*Chiloplacus propinquus* *Eucephalobus oxyuroides* *Panagrolaimus subelongatus* *Pelodera* sp. *Prismatolaimus* sp. *Rhabditis* sp.
VII	*Helicotylenchus exallus* *Hoplolaimus galeatus* *Psilenchus hilarulus* *Quinisulcius acutus* *Tylencholaimus* sp. *Tylenchus davaini* *Tylenchus exiguus*	*Aporcelaimellus* sp. *Ecumenicus monohystera* *Seinura oswegoensis*	*Acrobeles ctenocephalus* *Acrobeloides tricornis* *Aphelenchoides confusus* *Aphelenchus avenae* *Cephalobus persegnis* *Chiloplacus contractus* *Eucephalobus oxyuroides* *Panagrolaimus subelongatus*
VIII	*Ditylenchus* sp. *Hoplolaimus galeatus* *Paratylenchus dianthus* *Pratylenchus scribneri* *Quinisulcius acutus* *Xiphinema americanum*	*Aporcelaimellus obscurus* *Aporcelaimellus* sp. *Discolaimium* sp. *Ecumenicus monohystera*	*Acrobeles ctenocephalus* *Acrobeloides* sp. *Aphelenchus avenae* *Cephalobus* sp. *Chiloplacus* sp. *Eucephalobus oxyuroides* *Mesorhabditis* sp. *Panagrolaimus subelongatus* *Paraphelenchus* sp. *Rhabditis terricola*

TABLE 2

Number of Nematodes in Irrigated Corn and Results of Soil Tests

Field No. and location	Nematode no.	Organic Matter	pH	Salts	Salts Soil paste	Soluble Na	Soil Texture
I, Oral	18584[a]	1.2[b]	7.1	0.8	2.2	3.9	Sandy loam
III, Oral	11253	1.7	6.9	1.0	2.6	3.5	Sandy loam
IV, Oral	15078	1.2	6.3	1.1	2.9	8.5	Sandy loam
V, Oral	7917	1.0	7.4	1.4	2.9	5.9	Sandy loam
VI, Vale	851	1.7	7.2	2.0	4.1	14.4	Silt
VII, Wasta	558	1.7	6.7	2.1	4.7	22.2	Sandy loam

[a]Total number of plant feeding nematodes in 200 cc of soil plus number in lg of roots (dry wt.). Average of 4 replications.

[b]Soil test results furnished by Soil Testing Service, Plant Science Department, South Dakota State University. Based on composite of 16 subsamples from each field.

The only soil factors that appeared to influence nematode numbers were salt measurements, with the lowest number of nematodes occurring in those fields with the highest salt content (Table 2). The reason for the higher salt content in field VI may have been due to the heavier textured soil in this field (Table 2). However, soil texture in field VII was similar to others with lower salt contents. Field VII was irrigated with water pumped from the Cheyenne River, and in both years mechanical problems with the irrigation equipment resulted in insufficient water application. It is possible that insufficient irrigation may have concentrated river salts in the upper soil profile due to inadequate leaching.

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