

Nematodes Associated with Weeds and Wild Plants Growing on the Banks of Water Channel Bodies at CCS Haryana Agricultural University, Hisar, Haryana

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ABSTRACT

A nematode survey was conducted at eight sites located in university campus. Twelve weed species and 20 genera of plant-parasitic nematodes were identified. Root-knot nematodes, *Meloidogyne* sp., cyst nematodes, *Heterodera* sp., *Pratylenchus* sp., *Paratylenchus* sp., *Tylenchorhynchus* sp., *Helicotylenchus* sp. and *Rotylenchulus* sp., *Criconema* sp., *Hemicriconemoides* sp., etc. were generally the predominant. The four predominant nematode genera, namely, *Pratylenchus* sp., *Paratylenchus* sp., *Tylenchorhynchus* sp. and *Helicotylenchus* sp. had the highest frequency of occurrence on *C. dactylon*. Free-living and predatory members of the families Rhabditidae and Mononchidae were also found in these samples.

Key words : Nematodes, weeds, wild plants, banks of water channel

INTRODUCTION

Weeds are a major constraint in agricultural production since they compete with cultivated crop plants for water, soil nutrients and light, and also interfere with distribution of irrigation water and efficient fertilizer application (Anderson, 1996). Competition for resources with crop plants, particularly in the early stages of growth, can reduce crop yield by more than 70% (Smith 1968; Thurlow and Buchanan, 1972; Barrentine, 1974; Bendixen, 1986a). Due to their ubiquitous presence before, during and after crop cycles, weeds serve as reservoirs for plant pathogens and nematodes that will cause damage in future crops (McWhorter, 1989). A large number of nematode species have been reported to parasitize weeds and wild plants (Kiryanova and Krall, 1980) in nature or under artificial conditions. Few are host specific e. g. *Heterodera mothi*, *Subanguina chrysopogoni*, *Anguina amsinckia*, *A. brenani*, *A. calamagrostis*, *A. moxae*, *A. spermophaga* and *Cynipanguina danthoniae* (Kiryanova and Krall, 1980), while majority of them are polyphagous sharing cultivated crops as their hosts for feeding and reproduction. The weed and wild plants obviously influence the distribution, survival, persistence and management of latter group of plant parasitic nematodes (polyphagous). The problem of plant parasitic nematodes is particularly severe in the sub-tropical and

tropical environments where weeds grow year round (Crane *et al.*, 2008). Several weed and wild plants grow in abundance along the water channels, bunds and green belts in the vicinity of cultivated land. Since such plants harbor many important phytoparasitic nematodes of economic crops, they may provide a ready inoculum whenever a susceptible crop is grown in that or adjoining fields or in following season. Plant-parasitic nematodes including *Aphelenchoides besseyi*, *Ditylenchus angustus*, *Heterodera oryzicola* and *M. graminicola* were found to reproduce on weeds that grow in fallow fields between rice crops, which perpetuate nematode problems (Rao *et al.*, 1986). The objective of this study was to identify frequency distribution and description of major important plant parasitic nematodes encountered from weeds and wild plants.

MATERIALS AND METHODS

Both big and small water channel bodies of CCSHAU, Hisar campus farms were visited. Soil samples were taken from the root zones of predominant weed and wild plant species from different sites on bank of water channel bodies. Samples from weed species like Purple nutsedge (*Cyperus rotundus*), Bermudagrass (*Cynodon dactylon*), *Lantana camera*, *Saccharum spontaneum*, Aak/Ruchki (*Calotropis* spp.), Congress grass (*Parthenium hysterophorus*) Vetch, and wild

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plants like Sisum (*Dalbergia sisso*), Babul (*Acacia arabica*), Nilgiri (*Eucalyptus* spp.) and Date palm (*Coccus* spp.) were collected. Nematodes from these samples were extracted; using the Cobb's decanting and sieving method followed by Modified Baermann funnel method (Cobb, 1918). Nematodes were killed by heat and fixed in 4% formalin and species of nematodes in each of the sample was recorded.

RESULTS AND DISCUSSION

Weed species like Purple nutsedge/Lavala (*Cyperus rotundus*), Bermuda grass (*Cynodon dactylon*), *Lantana camera*, *Saccharum spontaneum*, Aak/Ruchki (*Calotropis* spp.), Congress grass (*Parthenium hysterophorus*), Vetch and wild plants like Sisum (*Dalbergia sisso*), Babul (*Acacia arabica*), Nilgiri (*Eucalyptus* spp.) and Date palm (*Coccus* spp.) were the most frequently encountered (Table 1). Twenty plant-parasitic and six free living nematodes genera were identified in association with several weeds and wild plants grown on bank of water channel bodies in CCSHAU, Hisar farm campus. *Pratylenchus* sp., *Paratylenchus* sp., *Helicotylenchus* sp., *Aphelenchus* sp., *Aphelenchoides* sp., *Hoplolaimus* sp., *Tylenchorhynchus* sp., *Ditylenchus* sp., *Tylenchus* sp., *Criconema* sp., *Hemicriconemoides* sp., *Xiphinema* sp., *Longidorus* sp., *Rhabditids* sp. and *Dorylaimus* sp., etc. were the major plant-parasitic and free living nematodes frequently found in relatively high numbers, whereas *Meloidogyne* sp., *Heterodera* sp., *Psilenchus* sp., *Hirshmanniella* sp., *Monhysterid* sp., *Mononchid* sp., *Diphtherophora* sp., *Acrobeles* sp., etc. were in low numbers.

The endoparasitic *Meloidogyne* sp. and *Heterodera* sp. were identified from soil samples of *C. rotundus* and *P. hysterophorus* and their frequency of occurrence was low from 20 to 40%, respectively. The frequency occurrence of endoparasitic and ectoparasitic nematodes like particularly *Pratylenchus* sp. (50, 66.66 and 80%), *Paratylenchus* sp. (33.33, 50 and 60%), *Helicotylenchus* sp. (66.66 and 100%), *Tylenchorhynchus* sp. (33.33, 80 and 100%) *Criconema* sp. (33.33, 50 and 60%) *Xiphinema* sp. (40, 50 and 66.66%) and *Longidorus* sp. (60 and 50%) were present in mostly all soil samples of weeds and wild plant species during our study. Several weed and wild plants grow in abundance along the water channels, lakes, bunds and green belts in the vicinity of cultivated land. Since such plants also harbor many important phytoparasitic nematodes of economic

crops, they provide a ready inoculum whenever a susceptible crop is grown in that or adjoining fields. In Haryana, several grasses like *C. dactylon*, *C. rotundus*, *V. zizarioides*, *Desmostachya bipinnata* and castor (*R. conimunis*) growing as weed/wild plants are the major source for the introduction and establishment of root-knot, corn cyst and reniform nematodes in fields (Bajaj, unpublished data).

Weed and wild plants may adversely affect the plant parasitic nematode populations and thus may be beneficial in crop production. But majority of them act as reservoir, alternate or collateral hosts facilitating the reproduction and survival of nematodes of economic importance. Nematodes, in general, are polyphagous and host specificity is rare. Many nematodes such as *M. incognita*, *M. javanica*, *M. hapla*, *R. reniformis*, *Pratylenchus* sp. and *Ditylenchus dipsaci* have wide host range and therefore, not only transfer from one cultivated crop to another but also between crops and host weeds. A direct correlation between heterogeneity of nematode fauna of wild plants and the level of agricultural practices was seen. Fields cultivated with advanced practices and having isolated weeds were almost nematode-free, whereas fields in the same area but with faulty practices and containing weeds had heterogeneous nematode fauna both in quality and quantity (cf. Kiryanova and Krall, 1980). Weeds and wild plants have also been recorded as hosts of nematodes with restricted host range in fields supporting nematode populations e. g. *Heterodera avenae* (Bajaj and Gupta, 1982; Dhawan and Kaushal, 1987), *H. zaeae* (Verma and Yadav, 1978), *Globodera rostochiensis* (Goodey, 1963), *Hirschmanniella oryzae* (Mathur and Prasad, 1973; Mohandas *et al.*, 1979; Prasad *et al.*, 1980) and *Tylenchulus semipenetrans* in the presence or absence of crops. Control of weeds acting as reservoir of infection or alternate/collateral hosts of nematodes of crops directly affects the nematode population in the field and has bearing on nematode management.

Although the aim of this study was to identify plant-parasitic nematodes, free-living as well as predatory nematodes and their dissemination. The predatory nematode families were Rhabditidae and Mononchidae.

It was evident from this study that *C. dactylon* and *C. rotundus* overall occurred at most of the sites sampled (Table 2). Furthermore, all five predominant nematode genera, namely, *Pratylenchus* sp., *Criconema* sp., *Helicotylenchus* sp., *Paratylenchus* sp. and *Rotylenchulus* sp., etc. identified during this study also

Table 1. Nematodes genera associated with different weeds and wild plant species

S. No.	Weed and wild plant species	Nematodes genera identified
1.	Purple nutsedge (<i>Cyperus rotundus</i>)	<i>Acrobeles</i> sp., <i>Aphelenchoides</i> sp., <i>Criconrma</i> sp., <i>Ditylenchus</i> sp., <i>Dorylaimus</i> sp., <i>Hemicriconemoides</i> sp., <i>Helicotylenchus</i> sp., <i>Heterodera</i> sp., <i>Hirshmanniella</i> sp., <i>Hoplolaimus</i> sp., <i>Meloidogyne</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> Sp., <i>Rotylenchulus</i> sp., <i>Tylenchorhynchus</i> sp. and <i>Tylenchus</i> sp.
2.	Bermuda grass (<i>Cynodon dactylon</i>)	<i>Criconema</i> sp., <i>Diptherophora</i> sp., <i>Dorylaimus</i> sp., <i>Hemicriconemoides</i> sp., <i>Helicotylenchus</i> sp., <i>Hirshmanniella</i> sp., <i>Hoplolaimus</i> sp., <i>Mononchid</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Psilenchus</i> sp., <i>Rhabditids</i> sp., <i>Tylenchorhynchus</i> sp. and <i>Tylenchus</i> sp.
3.	Aak/Ruchki (<i>Calotropis</i> spp.)	<i>Acrobeles</i> sp., <i>Aphelenchoides</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> sp. and <i>Rotylenchulus</i> sp.
4.	Congress grass (<i>Parthenium hysterophorus</i>)	<i>Criconema</i> sp., <i>Ditylenchus</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Heterodera</i> sp., <i>Pratylenchus</i> sp. and <i>Rhabditids</i> sp.
5.	Big sage (<i>Lantana camera</i>)	<i>Criconrma</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Longidorus</i> sp., <i>Mononchids</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> sp., <i>Tylenchus</i> sp. and <i>Xiphinema</i> sp.
6.	Kans grass (<i>Saccharum spontaneum</i>)	<i>Aphelenchoides</i> sp., <i>Aphelenchus</i> sp., <i>Criconema</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Hoplolaimus</i> sp., <i>Longidorus</i> sp., <i>Mononchid</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> sp., <i>Tylenchorhynchus</i> sp., <i>Tylenchus</i> sp. and <i>Xiphinema</i> sp.
7.	Vetch (<i>Vicia sativa</i>)	<i>Diptherophora</i> sp., <i>Dorylaimus</i> sp., <i>Hoplolaimus</i> sp., <i>Mononchid</i> sp., <i>Psilenchus</i> sp., <i>Rhabditids</i> sp., <i>Tylenchorhynchus</i> sp. and <i>Tylenchus</i> sp.
8.	Sisum (<i>Dalbergia sissoo</i>)	<i>Acrobeles</i> sp., <i>Criconrma</i> sp., <i>Ditylenchus</i> sp. and <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Longidorus</i> sp., <i>Monhysterids</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> sp., <i>Tylenchorhynchus</i> sp., <i>Tylenchus</i> sp. and <i>Xiphinema</i> sp.
9.	Babul (<i>Acacia arabica</i>)	<i>Criconema</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Hemicriconemoides</i> sp., <i>Longidorus</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Paralongidorus</i> sp., <i>Rhabditids</i> sp. and <i>Tylenchus</i> sp.
10.	Nilgiri (<i>Eucalyptus</i> spp.)	<i>Acrobeles</i> sp., <i>Criconema</i> sp., <i>Ditylenchus</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Hemicriconemoides</i> sp., <i>Longidorus</i> sp., <i>Paratylenchus</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> sp., <i>Steinernema</i> sp., <i>Tylenchorhynchus</i> sp. and <i>Tylenchus</i> sp.
11.	Date palm (<i>Coccus</i> spp.)	<i>Criconema</i> sp., <i>Dorylaimus</i> sp., <i>Helicotylenchus</i> sp., <i>Mononchid</i> sp., <i>Pratylenchus</i> sp., <i>Rhabditids</i> sp. and <i>Tylenchus</i> sp.

had the highest frequency of occurrence in soil samples from *C. dactylon*, *C. rotundus* and other important weeds. Subsequently, recommendations for pro-active strategies to prevent buildup of such nematode populations could be made by experts and implemented by the farmers. This will include that farmers should remove *C. dactylon* and *C. rotundus* as soon as these appear in their fields. Except for its high frequency of occurrence, *C. dactylon* and *C. rotundus* were also one of the predominant weed species that had generally been parasitised by the former five plant-parasitic nematode species.

A number of weed species harbor genera like *Meloidogyne* sp. and *Heterodera* sp. that had low population and could be considered as relatively poor hosts of these parasites and could not disseminated from water channel bodies to cultivated crop area. This study confirmed that significant role of these weeds and wild plants could play in maintaining or in the building-up of plant-parasitic nematode populations and their dissemination, particularly lesion nematodes, etc. For this reason, weeds need to be eradicated timely and on a continuous basis to protect crops from nematode parasitism and subsequent yield and quality losses.

Table 2. Frequency occurrence of economically important nematodes encountered from weeds

S. No.	Weed and wild plants	Nematodes genera encountered	Frequency distribution (%)
1.	Bermuda grass (<i>Cynodon dactylon</i>) (No. of samples 6)	<i>Pratylenchus</i> sp.	66.66
		<i>Paratylenchus</i> sp.	33.33
		<i>Helicotylenchus</i> sp.	66.66
		<i>Criconema</i> sp.	33.33
		<i>Hemicriconemoides</i> sp.	33.33
		<i>Hoplolaimus</i> sp.	33.33
		<i>Tylenchorhynchus</i> sp.	33.33
		<i>Xiphinema</i> sp.	66.66
		<i>Longidorus</i> sp.	50.00
2.	Purple nutsedge/Lavala(<i>Cyperus rotundus</i>) (No. of samples 5)	<i>Meloidogyne</i> sp.	20.00
		<i>Heterodera</i> sp.	40.00
		<i>Pratylenchus</i> sp.	80.00
		<i>Paratylenchus</i> sp.	60.00
		<i>Helicotylenchus</i> sp.	100.00
		<i>Ditylenchus</i> sp.	20.00
		<i>Criconema</i> sp.	60.00
		<i>Aphelenchoides</i> sp.	40.00
		<i>Hoplolaimus</i> sp.	80.00
		<i>Tylenchorhynchus</i> sp.	80.00
		<i>Xiphinema</i> sp.	40.00
		<i>Longidorus</i> sp.	60.00
3.	Kans grass (<i>Saccharum spontaneum</i>) (No. of samples 4)	<i>Pratylenchus</i> sp.	50.00
		<i>Paratylenchus</i> sp.	50.00
		<i>Helicotylenchus</i> sp.	100.00
		<i>Criconema</i> sp.	50.00
		<i>Hemicriconemoides</i> sp.	50.00
		<i>Aphelenchus</i> sp.	25.00
		<i>Aphelenchoides</i> sp.	25.00
		<i>Hoplolaimus</i> sp.	50.00
		<i>Tylenchorhynchus</i> sp.	10.00
		<i>Xiphinema</i> sp.	50.00
<i>Longidorus</i> sp.	50.00		

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