Distribution of virus vector nematodes associated with peach and other fruit crops in Essex County, Ontario

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The prevalence of virus-transmitting nematodes near Leamington in Essex County, Ontario, Canada was determined in a survey conducted during 1983 to 1985. At least one species of virus vector was found in 76% of all samples taken and 81% of all peach orchards sampled. ***Xiphinema rivesi, X. americanum, Longidorus breviannulatus, L. diadecturus*** and ***L. elongatus*** were found in 54%, 38%, 16%, 7% and 2%, respectively, of all sites tested, and in 65%, 44%, 28%, 7% and 2%, respectively, of peach orchards sampled.

Can. Plant Dis. Surv. 70:1, 23-26, 1990.

La prevalence de nematodes vecteurs de virus pres de Leamington dans le comté d'Essex (Ontario, Canada) a ete determinee au cours d'une etude réalisée de 1983 a 1985. Au moins une espece vecteur de virus a ete trouvee dans 76 % des echantillons preleves et dans 81 % de tous les vergers de pêchers echantillones. ***Xiphinema rivesi, X. americanum, Longidorus breviannulatus, L. diadecturus*** et ***L. elongatus*** ont ete trouves dans 54 %, 38 %, 16 %, 7 % et 2 % respectivement, de tous les lieux analyses et dans 65 %, 44 %, 28 %, 7 % et 2 % respectivement des vergers de pêchers echantillonnes.

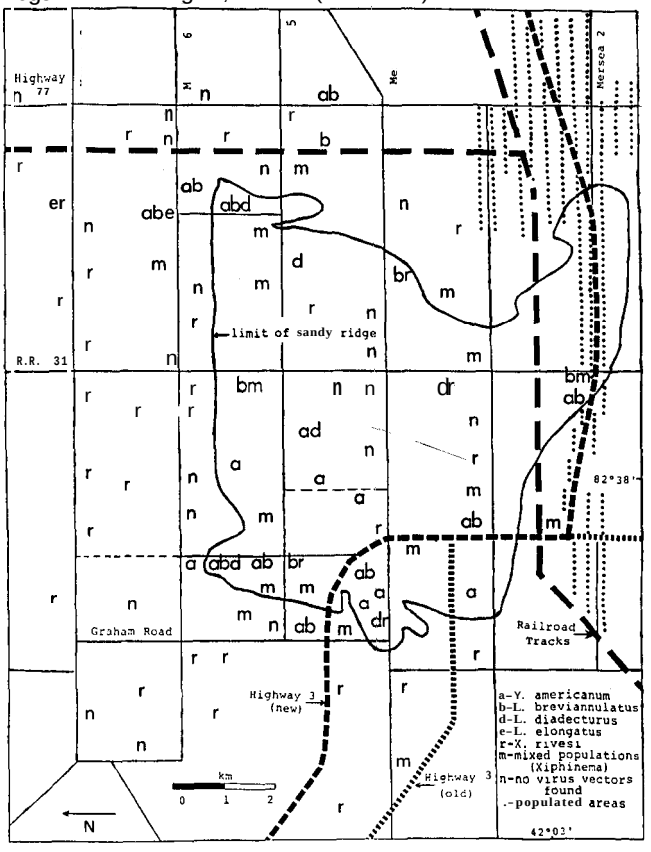
Introduction

An estimated 4,945,000 lbs. of peaches (a value of $1,300,500 representing 7% of the Ontario farm value (OMAF Publication No. 274A)) were marketed from Essex County, Ontario in 1987. The peaches grown in Essex County are prone to injury by insects, fungi, and virus-transmitting nematodes. ***Xiphinema americanum*** Cobb and ***Xiphinema rivesi*** Dalmasso, both known to transmit Tomato Ringspot Virus (TmRSV) (Teliz ***et al,*** 1966; Forer and Stouffer, 1982) and ***Longidorus diadecturus*** Eveleigh & Allen, known to transmit Peach Rosette Mosaic Virus (PRMV) (Allen, 1982) were found in soil samples taken from a sandy ridge near Leamington, Ontario where much of the peach production in Essex County is located. These two virus diseases are associated with yield and quality losses in peach (Forer and Stouffer, 1982; Klos, 1976; Allen, 1986), however, there is no information concerning the extent of nematode virus-vector species in this region. A study was conducted to determine the incidence of ***X. americanum, X. rivesi*** and ***L. diadecturus*** on the sandy ridge. The results of the survey are presented here.

Materials and methods

Peach orchards on and around a 3 km wide, 7 km long sandy ridge found at the juncture of Mersea, Gosfield South, and Gosfield North Townships in Essex County, Ontario were sampled during Sept. 1983, July 1984, and Aug. 1985. The area south of the sandy ridge, delineated by the 205-m contour line (Fig. 1), has undergone extensive urban development and therefore was not sampled. Five randomly selected 3-kg soil samples were taken from different sites, to a depth of 30 cm using a shovel, to form a single bulked soil sample from the interior of each orchard. Soil samples from other potential hosts were similarly taken from areas where peaches were not grown, in order to obtain a complete survey of the sandy ridge. The soil samples were stored in plastic bags at 4°C until they could be processed. Five-kg subsamples of randomly selected soil from each of the 92 samples obtained were processed using the Fenwick Can

Figure 1. Distribution of virus vector nematodes found on the sandy ridge near Leamington, Ontario (1983-1985).



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Accepted for publication December 20, 1989.

Table 1. Summary of survey results for *Xiphinema* americanum and its hosts during 1983-1985.

	% (Ratio) of host samples containing X. americanum: total samples taken	% (Ratio) of host samples containing X. *americanum*: samples taken per host	% (Ratio) of host samples containing X. americanum: total number of samples containing *X.* americanum
Peach	30.4 (28/92)	65.1 (28/43)	80 (28/35)
Apple	4.4 (4/92)	28.6 (4/14)	11.4 (4/35)
Grape	1.1 (1/92)	16.7 (1/6)	2.9 (1/35)
Raspberry	1.1 (1/92)	33.3 (1/3)	2.9 (1/35)
Spruce	1.1 (1/92)	100 (1/1)	2.9 (1/35)

Table 2. Summary of survey results for *Xiphinema* rivesi and its hosts during 1983-1985.

	% (Ratio) of host samples containing *X.* rivesi: total samples taken	% (Ratio) of host samples containing X. rivesi: samples taken per host	% (Ratio) of host samples containing X. rivesi: total number of samples containing *X.* rivesi
Peach	20.7 (19/92)	44.2 (19/43)	36 (18/50)
Apple	10.9 (10/92)	71.4 (10/14)	20 (10/50)
Cedar	6.5 (6/92)	66.7 (6/9)	12 (6/50)
Grape	5.4 (5/92)	83.3 (5/6)	10 (5/50)
Oak	2.2 (2/92)	100 (2/2)	4 (2/50)
Cherry	2.2 (2/92)	100 (2/2)	4 (2/50)
Strawberry	1.1 (1/92)	50 (1/2)	2 (1/50)
Spruce	1.1 (1/92)	100 (1/1)	2 (1/50)
Sour Cherry	1.1 (1/92)	100 (1/1)	2 (1/50)
Pear	1.1 (1/92)	100 (1/1)	2 (1/50)
Plum	1.1 (1/92)	100 (1/1)	2 (1/50)
Chestnut	1.1 (1/92)	100 (1/1)	2 (1/50)
Bush Lot	1.1 (1/92)	100 (1/1)	2 (1/50)

Extraction Procedure (Fenwick, 1940). The runoff from the Fenwick Can was poured through a 250 μm mesh screen. The nematodes were washed from the screen into 100 ml test tubes and stored at 1°C until they could be examined. The virus vector nematodes found were fixed in 4% formalin and stored in dehydrated glycerin and sent to the Biosystematics Research Centre in Ottawa for identification.

Results and discussion

One species of plant parasitic nematode was recovered from 88% (81/92) of the samples tested while at least one species of virus-vector nematode was recovered from 76% (70192) of the samples tested. Of the peach orchards sampled, 81% (35/43) had a virus vector present while 7% (3/43) were completely free of plant parasitic nematodes. Virus vectors found include *Xiphinema rivesi, X. americanum, Longidorus diadecturus, L. breviannulatus* Norton and Hoffman and *L. elongatus* (deMan) Thorne and Swanger. Bonsi (1984) reported that populations of *X. americanum* and *X. rivesi* (100/100 cm^3 soil) will significantly reduce apple and peach seedling growth, even if virus particles are not present.

Of the *Xiphinema* species, *X. americanum* was found in 35 samples (Table 1). Most of the samples containing *X. americanum* were from the ridge itself or from the area south of the ridge. Although the specific soil composition was not recorded, the soil south of the ridge tended to be sandier than that north of the ridge (Richards *et al,* 1949). The prevalence of *X. americanum* in sandier soils supports Allen *et al* (1988) who in their reexamination of *X. americanum* in the Canadian National Collection report "In all cases, *X. americanum* (were) recovered from well-drained soils with a high sand content". On the other hand, *Xiphimema rivesi* was found throughout the area sampled on a variety of hosts (Table 2). The prevalence of *X. rivesi* in this survey agrees with Forer and Stouffer (1982) who reported *X. rivesito* be more widely distributed geographically than *X. americanum* and Allen *et al* (1988) who reported *X. rivesi* to occur in a variety of soil types.

Of the three *Longidorus* species in this survey, *L. breviannularus* was the most prevalent, being found in 15 samples (Table 3 (i)). Allen (1986) reported that *L. breviannulatus* will ingest PRMV particles but does not readily transmit the virus although Huff *er al* (1987) reported that in greenhouse studies *L. breviannulatus* will acquire Brome Mosaic Virus (BMV) from mechanically inoculated barley and transmit BMV to healthy barley. As far as BMV transmission is concerned, *L. breviannulatus* is of limited importance in the area surveyed because little barley is grown on the sandy ridge. However, the host range of *L. breviannularus* has not been examined thoroughly, and eventually may be of concern because of its potential to produce disease. *L. breviannulatus* has been implicated as one of the causes of stunting corn in Iowa (Malek *et al,* 1980) as well as being associated with the decline in bentgrass in Pennsylvania (Forer, 1977). These reports suggest that this species may parasitize grasses predominantly and therefore, in peach orchards, may be probing at peach roots as a last resort (Norton, 1984).

L. diadecturus is considered to be epidemiologically important because of its efficient transmission of PRMV (Allen *et al,* 1986). *L. diadecturus* was found in only 6 samples (Table 3 (ii)) and is therefore of lesser importance than the *Xiphinema* spp. reported. *L. diadecrurus* is known only from its original source location on the sandy ridge in Essex County.

Table 3. Summary of survey results for *Longidorus* spp. and their hosts during 1983-1985.

	% (Ratio) of host samples containing *Longidorus* spp.: total samples taken	% (Ratio) of host samples containing *Longidorus* spp.: samples taken per host	% (Ratio) of host samples containing *Longidorus* spp.: total number of samples containing *Longidorus* spp.
		(i) *Longidorus breviannularus*	
Peach	27.9 (19/92)	27.9 (12/43)	80 (12/15)
Apple	1.1 (1/92)	7.1 (1/14)	6.7 (1/15)
Raspberry	1.1 (1/92)	33.3 (1/3)	6.7 (1/15)
Cherry	1.1 (1/92)	100 (1/1)	6.7 (1/15)
		(ii) *Longidorus breviannularus*	
Peach	3.3 (3/92)	7 (3/43)	50 (3/6)
Raspberry	2.2 (2/92)	66.7 (2/3)	33.3 (2/6)
Cherry	1.1 (1/92)	50 (1/2)	16.7 (1/6)

L. elongatus was found in 2 samples in this survey on non-preferred hosts (peach and cedar), and although this nematode will transmit virus, the species seems to have limited significance in this area.

Other plant parasitic nematodes found include *Tylenchorhynchus nudus* (first Ontario record), *Tylenchorhynchus maximus, Helicotylenchus digonicus, Helicotylenchus platyurus, Helicotylenchus pseudorobustus, Hemicycliophora uniformis, Criconemella xenoplax* (known to reduce root and shoot growth in peach (Nyczepir *et al,* 1986)), *Pratylenchus* spp. and *Heterodera* spp.

Conclusions

Canadian *Xiphinema* spp. are more important pests than *Longidorus* spp. because of their prevalence and ability to survive on a wide variety of hosts (Tables 1, 2). The proven ability of *Xiphinema* spp. to transmit both TmRSV and PRMV increases their significance in Canadian soils. *L. diadecturus,* the more efficient longidorid vector in this study, was less numerous than *L. breviannulatus,* although the vector-significance of the latter is dubious. The two *Xiphinema spp.* found in this survey tend to inhabit different soil types, therefore it is recommended that soil samples from fields to which susceptible crops will be planted be checked for the presence of these nematode species. Also, because peaches are hosts for many virus-vector nematode species (Tables 1, 2, 3), soil samples from old orchards should be tested before planting any susceptible crops.

Acknowledgements

The authors wish to thank Dr. R. Cerkauskas and L. Wainman for their helpful suggestions and editorial assistance and N.B. Willms and S. Daracsh for their technical assistance.

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