

# *Xiphinema* spp. Associated with Tomato Ringspot Virus Infection of Pennsylvania Fruit Crops

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## ABSTRACT

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Sixty-six soil samples were collected from fruit plantings (apple, blueberry, grape, peach, or raspberry) infected with tomato ringspot virus in seven Pennsylvania counties and analyzed for *Xiphinema* spp. *X. rivesi*, a nematode species recently reported from Pennsylvania, was prevalent and widely distributed geographically, occurring either alone or in combination with *X. americanum*. The association of *X. rivesi* with tomato ringspot virus infection of fruit crops could be an important factor in the epidemiology of these diseases.

*Xiphinema americanum* Cobb was the only species of *Xiphinema* thought to be present in Pennsylvania until the recent detection of *X. rivesi* Dalmasso (Wojtowicz, Golden, Forer, and Stouffer; unpublished). *X. rivesi* was described in France by Dalmasso (1), but its North American distribution, host range, and virus-vector status remain unknown. The taxonomic treatise of Lamberti and Bleve-Zacheo (5) described significant variation among populations considered as *X. americanum*. They proposed splitting the present grouping into numerous new species and retaining the species designation "*americanum*" for more homogeneous populations with a geographic distribution restricted

primarily to eastern North America. *X. americanum* has been considered the primary vector of tomato ringspot virus (TmRSV) and other North American NEPO (nematode-transmitted polyhedral) viruses.

In Pennsylvania, TmRSV has been associated with several destructive diseases of fruit crops. A survey of the *Xiphinema* spp. in Pennsylvania associated with TmRSV-infected apple, peach, grape, raspberry, and highbush blueberry was conducted to correlate disease incidence with the species of *Xiphinema* present in the soil.

## MATERIALS AND METHODS

Sites were selected in seven counties in central and east central Pennsylvania where TmRSV-infected fruit crops were known to occur. Peach and apple sites were selected on the basis of disease symptoms; blueberry, grape, and raspberry sites were selected after the serological confirmation of TmRSV from declining plants in those sites. Each soil sample consisted of a composite of three to five soil cores taken at a depth of 20–25 cm with an Oakfield 102 soil tube or JMC soil tube (1.9 × 30.5 cm). The soil samples were placed in polyethylene bags and maintained at about 15 C. Samples were processed within 48 hr after collection. The nematodes were extracted

from a 100-cm<sup>3</sup> aliquot of the sample by a modified sieving-Baerman funnel technique (2). The recovered nematodes were fixed in a hot, 4% formaldehyde solution.

## RESULTS

*X. americanum* and/or *X. rivesi* were recovered from 62 of the 66 soil samples (Table 1). The identity of *Xiphinema* present in six of the 62 samples could not be determined because of lack of sufficient specimens. In the remaining 56 samples, 11 (20%) contained only *X. americanum*, 33 (59%) contained only *X. rivesi*, and 12 (21%) contained both species.

In the 30 samples from Adams County that contained *Xiphinema*, of the species that could be determined, *X. rivesi* was present in 21 (70%) and *X. americanum* in 17 (57%). In the 26 samples from outside Adams County in which species identity could be determined, 24 (92%) contained *X. rivesi* and only 6 (23%) contained *X. americanum*. On the basis of these data, *X. rivesi* was prevalent and widely distributed geographically in TmRSV-affected fruit plantings. *X. americanum* was also common in fruit plantings in Pennsylvania's major fruit-growing county but occurred less frequently in other fruit-producing counties.

## DISCUSSION

*X. rivesi* was widely distributed in association with TmRSV-infected fruit crops in Pennsylvania. This was the only species of *Xiphinema* found in two of three soil samples from TmRSV-infected apple orchards in the Hudson Valley region of New York and in a similarly infected apple orchard in Maryland (unpublished). Although *X. americanum* was also associated with TmRSV-infected fruit crops, this species was detected half as frequently as *X. rivesi*

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**Table 1.** *Xiphinema* spp. associated with tomato ringspot infection of fruit crops in Pennsylvania

County	Crop	Samples collected (no.)	Samples (no.) with				
			Only <i>X. americanum</i>	Only <i>X. rivesi</i>	Both <i>Xiphinema Xiphinema</i>	Unidentified <i>Xiphinema</i>	No <i>Xiphinema</i>
Adams	Peach	32	9	9	6	4	4
	Apple	6	0	4	2	0	0
Franklin	Peach	6	0	4	0	2	0
	Blueberry	2	1	0	1	0	0
Lancaster	Grape	2	0	2	0	0	0
	Raspberry	1	0	1	0	0	0
Lehigh	Peach	4	0	3	1	0	0
Lycoming	Peach	5	0	5	0	0	0
Snyder	Peach	4	0	3	1	0	0
York	Peach	4	1	2	1	0	0
Totals		66	11	33	12	6	4

from Pennsylvania.

Preliminary transmission studies indicate that *X. rivesi* is a vector of TmRSV (3); however, transmission efficiency tests have not been completed. Therefore, this species may be important in the epidemiology of TmRSV-induced diseases in deciduous fruit crops. The taxonomic revision of *X. americanum* by Lamberti and Bleve-Zacheo (5) includes a description of 15 new species that were previously considered to be *X. americanum*. As a result, these taxonomic

changes make interpretation of previous TmRSV transmission reports difficult.

Virus transmission is only one facet of the biology of *Xiphinema* spp. that must be reinvestigated. *Sorghum vulgare* var. *sudanense* was reported by Miller (7) not to be a host for *X. americanum*, yet Fulton (4) and McGuire (6) routinely use this plant to maintain high populations of *X. americanum* for virus transmission research in Arkansas. Perhaps some of these apparent discrepancies will be resolved by reexamining the taxonomy of

*Xiphinema* populations formerly considered to be *X. americanum*.

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