CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Xiphinema rivesi Dalmasso 1969
Dagger nematode

Pest Rating: C

Domain: Eukaryota, Kingdom: Metazoa,
Phylum: Nematoda, Class: Enoplea,
Order: Dorylaimida, Family: Longidoridae,
Subfamily: Xiphinematinae

Comment Period: 11/21/2024 through 01/05/2025

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from *Xiphinema rivesi* is described herein and a permanent rating is proposed.

History & Status:

Xiphinema Cobb, 1913 is an important genus of longidorid nematodes, recognized by a long slender body and a long spear-like feeding apparatus called an odontostylet. The odontostylet has no stylet knobs but rather has flanges, which support and anchor the base. A guiding ring in the middle holds the long stylet in position. Dagger nematodes have six life stages, and the life cycle is like that of other ectoparasitic, vermiform nematodes. Parthenogenesis, a form of reproduction that does not require males, is common in many species. Females lay eggs in the soil. Juveniles hatch from eggs and molt three or four times, increasing in size with each molt until they become adults. All stages, except eggs, attack, and feed on the roots of the host plants. The nematode remains outside the root but inserts the long stylet deep into it. The stylet punctures cell walls and during feeding, enzymes such as cellulases, pectinases, hemicellulases, and chitinases are secreted to digest plant cell contents. This destroys the root cells, resulting in malformed roots (Heve et al., 2018). Dagger nematodes are migratory ectoparasites of roots. They are primarily problematic in biennial and permanent crops. *Xiphinema* species are spread worldwide; some can vector viruses that are very damaging to small and tree fruits and vine crops (Decraemer and Robbins, 2007; Taylor and Brown, 1997).

Over 250 species within the genus *Xiphinema* have been divided into various groups and/or subgenera based mainly on morphology. The majority can be separated into two large groups: the *X.*

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americanum-group with approximately 55 species and the non-*X. americanum*-group with approximately 150 species (Loof and Luc, 1990; Lamberti et al., 2000; Gutiérrez-Gutiérrez et al., 2012; Archidona-Yuste et al., 2016).

Xiphinema rivesi was first isolated, described, and illustrated by Dalmasso (1969) from grapevine soil in Bordeaux, France. Today, three *Xiphinema* species, *X. americanum* s. str., *X. californicum,* and *X. rivesi* are considered widespread in California (Chitambar et al., 2018; Orlando et al., 2016). *Xiphinema rivesi* is in the *X. americanum*-group (Orlando et al., 2016) and is a known vector of plant viruses. It occurs in many states and has the largest distribution of any nematode in the *X. americanum* group in North America (Robbins, 1993).

Background:

Hosts: Acer negundo (boxelder maple), *Allium sativum* (garlic), *Avena sativa* (oats), *Betula pubescens* (downy birch), *Celtis* sp. (Hackberry), *Chenopodium quinoa* (quinoa), *Citrus sinensis* (orange), *Cucumis sativus*, (cucumber), *Diospyros kaki* (persimmon), *Fagus* sp. (beech), *Juglans* sp. (walnut), *Juniperus* sp. (juniper), *Liquidambar styraciflua* (sweet gum), *Lonicera* (honeysuckle), *Malus domestica* (apple), *Malus sylvestris* (crab-apple tree), *Mangifera indica* (mango), *Medicago sativa* (alfalfa), *Nicotiana tabacum* (tobacco), *Picea* sp. (spruce), *Picea glauca* (white spruce), *Picea pungens* (blue spruce), *Pinus koraiensis* (fruit pine), *Populus* sp. (poplar), *Prunus avium* (cherry), *Prunus domestica* (plum), *Prunus persica* (peach), *Prunus salicina* (Japanese plum), *Quercus* sp. (oak), *Rosa* sp. (rose), *Rubus idaeus* (raspberry), *Rubus* sp., *Solanum tuberosum* (potato), *Sorghum bicolor* (sorghum), *Taraxacum* (dandelion), *Trifolium* sp. (clover), *Trifolium pratense* (red clover), *Trifolium repens* (white clover), Tsuga (hemlocks), *Ulmus* sp. (elm), *Vaccinium* (blueberry), *Vitis vinifera* (grapevine) (Nemaplex, 2010; EPPO, 2024; CABI, 2024).

Symptoms: *Xiphinema* spp. can be found feeding on many types of woody and herbaceous plants, including fruit trees and turf where, at high densities, they can cause economic damage. The symptoms of plants in response to the feeding by *Xiphinema* spp. include poor growth and/or stunting of the plant, yellowing, or wilting of the foliage, and damaged or reduced root systems, including root necrosis, lack of feeder or secondary roots, and occasional tufts of stubby rootlets (Chitambar et al., 2018; Nemaplex, 2010).

Transmission: The movement of infected rooted plants and soil (including nursery stock), cultural practices that result in the movement of infected soil to clean, non-infected sites, and contaminated irrigation water can all transmit dagger nematodes to new areas (Chitambar et al., 2018).

Damage Potential: Dagger nematodes feed at the root tips causing swelling, stunting, and destruction of roots, which affects water and nutrient uptake from the soil. *Xiphinema rivesi* is an efficient virus vector, with adults and juvenile stages able to transmit (Griesbach and Maggenti, 1989). The viruses known to be transmitted by *X. rivesi* are Cherry rasp leaf virus (CRLV) (Cheravirus), Tobacco ringspot virus (TRSV) (Nepovirus), and Tomato ringspot virus (ToRSV) (Nepovirus) (Brown et al., 1994), and all are important pathogens of small fruit, tree fruit or vines (Taylor and Brown, 1997). In Washington, Akinbade et al. (2014) reported on the rapid spread of CRLV in many cherry orchards and the need for

urgent control measures against *X. rivesi*. Peach rosette mosaic virus vectored by *X. rivesi* causes substantial damage in *Prunus* species, grapes, and blueberries (Brown et al., 1993).

Worldwide Distribution: Africa: *Egypt*. America: *Argentina, Canada, Chile, Guadeloupe, Peru, United States of America* (Arkansas, California, Colorado, Georgia, Idaho, Illinois, Iowa, Kansas, Maryland, Michigan, Montana, Nebraska, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, Washington, West Virginia). Asia: *Iran, Pakistan*. Europe: *Bulgaria, France, Germany, Italy, Moldova, Netherlands, Portugal, Slovenia, Spain*. Oceania: *Australia, Samoa, Tonga* (CABI, 2024; EPPO, 2024).

Official Control*: Xiphinema rivesi* is on the EPPO's A1 list for Brazil, Egypt, the European Union, the Eurasian Customs Union, Georgia, Serbia, Switzerland, Turkey, and the United Kingdom; the A2 list for the European Plant Protection Organization, and is a regulated quarantine pest in Morocco, and Mexico (EPPO, 2024). It is on the USDA PCIT's harmful organisms list for Albania, Antarctica, Brazil, Canada, Colombia, Costa Rica, Ecuador, Egypt, Eurasian Customs Union, European Union, Georgia, Guatemala, Honduras, Mexico, Morocco, Republic of North Macedonia, Serbia, The Republic of Türkiye (USDA PCIT 2024).

California Distribution: Mendocino, San Francisco, and San Mateo counties (Orlando et al., 2016).

California Interceptions: none.

The risk that *Xiphinema rivesi* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This nematode is likely to establish in a range of climates in a variety of soils, from light to heavy, wherever its hosts can grow.

   Evaluate if the pest would have suitable hosts and climate to establish in California.

   Score: **3**
   - Low (1) Not likely to establish in California; or likely to establish in very limited areas.
   - Medium (2) may be able to be established in a larger but limited part of California.
   - **High (3) likely to establish a widespread distribution in California.**

2) **Known Pest Host Range:** *Xiphinema rivesi* is found associated with plants from different families, including hosts that are grown agronomically in California (grasses, alfalfa, sweet potatoes, stone fruit, citrus, and grapes).

   Evaluate the host range of the pest.

   Score: 3
   - Low (1) has a very limited host range.

- Medium (2) has a moderate host range.
- High (3) has a wide host range.

3) **Pest Reproductive Potential:** Males are rare for this species and most reproduction is through parthenogenesis. Females lay hundreds of eggs in moist soils. Natural spread is only at most 1 m/year. Long-distance movement is with infested nursery stock, soil, and water runoff.

Evaluate the natural and artificial dispersal potential of the pest.

Score: 2
- Low (1) does not have high reproductive or dispersal potential.
- Medium (2) has either high reproductive or dispersal potential.
- High (3) has both high reproduction and dispersal potential.

4) **Economic Impact:** This nematode causes some direct yield loss from feeding but is also a virus vector. It is a quarantined pest in many areas due to the viruses it can spread.

Evaluate the economic impact of the pest on California using the criteria below.

Economic Impact: A, B, C, G

A. The pest could lower crop yield.
B. The pest could lower crop value (including increasing crop production costs).
C. The pest could trigger the loss of markets (including quarantines).
D. The pest could negatively change normal cultural practices.
E. The pest can vector or is vectored by another pestiferous organism.
F. The organism is injurious or poisonous to agriculturally important animals.
G. The organism can interfere with the delivery or supply of water for agricultural uses.

Economic Impact Score: **3**
- Low (1) causes 0 or 1 of these impacts.
- Medium (2) causes 2 of these impacts.
- High (3) causes 3 or more of these impacts.

5) **Environmental Impact:** This nematode has a moderate host range. It could trigger treatments in areas where it is of quarantine significance or poses a risk of spreading viruses.

Evaluate the environmental impact of the pest on California using the criteria below.

Environmental Impact: D, E

A. The pest could have a significant environmental impact such as lowering biodiversity, disrupting natural communities, or changing ecosystem processes.
B. The pest could directly affect threatened or endangered species.
C. The pest could impact threatened or endangered species by disrupting critical habitats.
D. The pest could trigger additional official or private treatment programs.

E. The pest significantly impacts cultural practices, home/urban gardening, or ornamental plantings.

Environmental Impact Score: 3
- Low (1) causes none of the above to occur.
- Medium (2) causes one of the above to occur.
- High (3) causes two or more of the above to occur.

Consequences of Introduction to California for *Xiphinema rivesi:* High

Add up the total score and include it here. **14**
-Low = 5-8 points
-Medium = 9-12 points
-High = 13-15 points

6) **Post-Entry Distribution and Survey Information**: Evaluate the known distribution in California. Only official records identified by a taxonomic expert and supported by voucher specimens deposited in natural history collections should be considered. Pest incursions that have been eradicated, are under eradication or have been delimited with no further detections should not be included.

Evaluation is 'High'.

Score: -3
-Not established (0) Pest never detected in California or known only from incursions.
-Low (-1) Pest has a localized distribution in California or is established in one suitable climate/host area (region).
-Medium (-2) Pest is widespread in California but not fully established in the endangered area, or pest established in two contiguous suitable climate/host areas.
-High (-3) Pest has fully established in the endangered area, or pest is reported in more than two contiguous or non-contiguous suitable climate/host areas.

7) **The final score is** the consequences of the introduction score minus the post-entry distribution and survey information score: (Score)

Final Score: *Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information* ***= 11***

Uncertainty:

Because it has been so difficult to distinguish between *Xiphinema* species based on morphology, some proportion of the historical detections of *X. americanum* in California are likely *X. rivesi*. The distribution is likely greater than the three counties listed in the California distribution.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for ***Xiphinema rivesi*** **is C.**

References:

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Responsible Party:

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***Comment Period: 11/21/2024 through 01/05/2025**

***NOTE:**

You must be registered and logged in to post a comment. If you have registered and have not received the registration confirmation, please contact us at permits[@]cdfa.ca.gov.

Comment Format:

- Comments should refer to the appropriate California Pest Rating Proposal Form subsection(s) being commented on, as shown below.

  Example Comment:

  Consequences of Introduction: 1. Climate/Host Interaction: [Your comment that relates to "Climate/Host Interaction" here.]

- Posted comments will not be able to be viewed immediately.
- Comments may not be posted if they:

  Contain inappropriate language which is not germane to the pest rating proposal;

  Contains defamatory, false, inaccurate, abusive, obscene, pornographic, sexually oriented, threatening, racially offensive, discriminatory or illegal material;

  Violates agency regulations prohibiting sexual harassment or other forms of discrimination;

  Violates agency regulations prohibiting workplace violence, including threats.

- Comments may be edited prior to posting to ensure they are entirely germane.
- Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.

Pest Rating: C
