

## California Pest Rating Proposal for

*Xiphinema diversicaudatum* (Micoletzky, 1927), Thorne, 1939

European dagger nematode

**Pest Rating: A**

Domain: Eukaryota, Kingdom: Metazoa,  
Phylum: Nematoda, Class: Adenophorea,  
Order: Dorylaimida, Family: Xiphinematidae

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**Comment Period: 12/17/2020 through 01/31/2021**

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### Initiating Event:

None

### History & Status:

**Background:** *Xiphinema* are migratory ectoparasitic nematodes that feed on an extensive range of hosts and can be vectors of nepoviruses. In California, *X. diversicaudatum* was found in two residential gardens in San Diego County in 1970 during an urban detection program. It was also found in a rose cut-flower greenhouse in Alameda County in 1975. All three sites were treated with the nematicide Dibromochloropropane (a soil sterilant no longer in use) and the nematode populations were declared eradicated. The greenhouse site has since been replaced by residential development. The San Diego properties are not close to any commercial agricultural production, and this nematode has not been detected elsewhere within the state.

*Xiphinema diversicaudatum* is a proven vector of Arabis mosaic (ArMV) and Strawberry latent ringspot (SLRS) nepoviruses (Brown et al., 1983). ArMV is of great economic importance in viticulture as it is associated with grapevine fanleaf degeneration disease. This nematode is an "A" rated pest in California warranting eradication, quarantine regulation, or other holding action of established infestations.

*Hosts:* *Acer pseudoplatanus* (sycamore), *Allium porrum* (leek), *Beta vulgaris* (beet), *Brassica oleracea* (cabbage, cauliflower), *Chamaecyparis lawsoniana* (Port Orford cedar), *Chamomilla suaveolens* (rounded chamomile), *Chrysanthemum coronarium* (garland chrysanthemum), *Crataegus laevigata*

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(midland hawthorn), *Cucumis sativus* (cucumber), *Daucus carota* (carrot), *Fagus sylvatica* (common beech), *Fragaria X ananassa* (strawberry), *Fraxinus excelsior* (ash), *Hordeum vulgare* (barley), *Humulus lupulus* (hop), *Lactuca sativa* (lettuce), *Malus sylvestris* (apple), *Mentha arvensis* (corn mint), *Pisum sativum* (pea), *Prunus domestica* (plum), *Prunus persica* (peach), *Prunus salicina* (Japanese plum), *Prunus spinosa* (blackthorn), *Pyrus communis* (European pear), *Rosa* spp. (rose), *Rosa canina* (dog rose), *Rubus fruticosus* (blackberry), *Rubus idaeus* (raspberry), *Sambucus nigra* (elderberry), *Senecio vulgaris* (groundsel), *Solanum lycopersicum* (tomato), *Solanum tuberosum* (potato), *Trifolium pratense* (red clover), *Tussilago farfara* (colt's-foot), *Veronica* (speedwell), *Viburnum tinus* (viburnum), *Vitis vinifera* (grapevine) (CABI-CPC, 2020).

**Symptoms:** This nematode is a migratory root ectoparasite that inhabits rhizosphere soils of host plants while feeding on the roots. Juveniles and adults feed with a long stylet that penetrates the vascular tissue of roots. Feeding of *X. diversicaudatum* on roots results in mechanical and physiological damage seen as terminal swellings or severe galling of root tips with necrosis, cessation of root elongation, and extensive necrosis of main roots. There can be a witches'-broom effect from lateral root proliferation in heavily parasitized plants. Above ground symptoms caused by the nematode alone are general symptoms of an impaired root system, not diagnostic, and may not be present. This reduction in growth can also reduce plant crop yield. Indirect damage can result from the nematodes ability to transmit nepoviruses (Pitcher et al., 1974). Heavy nematode infestations may reduce the vigor of small herbaceous plants, however, plants with larger root systems may not exhibit any apparent symptoms above ground (Chitambar, 2007).

**Transmission:** Infected rootings and soil, cultural practices that result in the movement of infected soil to clean, non-infected sites, and contaminated irrigation water are the main ways these nematodes move. The life cycle of the dagger nematode involves development from egg through four vermiform, motile, juvenile stages to adults. Eggs are laid in the soil and hatch in 6-8 days. A population may be generated by a single nematode. Once hatched, each juvenile stage must feed in order to molt and develop to the next stage. Males do occur, and reproduction can be sexual or by parthenogenesis. During feeding, the nematode can acquire nepovirus from infected plants and transmit it to virus-free plants. The virus is retained in the cuticle lining of the esophageal lumen of the nematode, and adults and juveniles can transmit the virus. The virus is not transmitted through the egg and is lost at molting (Agrios, 2005; Chitambar et al., 2018).

**Damage Potential:** The nematode causes direct damage by feeding on a wide range of crops. However, *X. diversicaudatum* is most damaging when it transmits nepoviruses, with these viruses able to render some infected plants unable to grow and produce marketable crops, and in some instances to kill infected plants either directly, or through subsequent infection by secondary pathogens (CABI-CPC, 2020). In citrus in Morocco, *X. diversicaudatum* was not shown to cause any damage where it had become established. However, there is now a serious risk of its spread by soil to nearby susceptible crops (Mokrini et al., 2014).

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**Worldwide Distribution:** Argentina, Austria, Belgium, Bulgaria, Canada, Croatia, Czechia, Denmark, France, Germany, Ireland, Israel, Italy, Mexico, Moldova, Morocco, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, and United States (California) (Robbins and Brown, 1991; Chizhov et al., 2014). (CABI-CPC, 2020).

**Official Control:** This nematode is on the EPPO's A1 list for Argentina, Brazil, Chile, and Uruguay, and a quarantine pest in Mexico (EPPO, 2020). USDA PCIT lists this nematode among the harmful organisms for Brazil, Canada, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Republic of Korea, Mexico, Peru, Taiwan, Thailand, and Uruguay (USDA-PCIT, 2020). Florida has an external quarantine to prevent introduction to the state (National Plant Board, 2020).

Arabis mosaic nepovirus, which is transmitted by *X. diversicaudatum*, is of quarantine significance for the North American Plant Protection Organization (NAPPO) and, although not listed by the European Plant Protection Organization (EPPO) as a quarantine pest, it is listed by the European Community Plant Health Directive and given an Annex designation of II/A2 (Smith et al., 1992).

**California Distribution:** None

**California Interceptions:** None

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

## Consequences of Introduction:

- 1) Climate/Host Interaction:** *Xiphinema diversicaudatum* can establish in cool to warm climates, in light and medium-textured soils. It survives in climates as diverse as those in northern Europe to north Africa, when it has suitable hosts.

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 establish in a larger but limited part of California.
- **High (3) likely to establish a widespread distribution in California.**

- 2) Known Pest Host Range:** *Xiphinema diversicaudatum* is polyphagous and parasitizes various woody and herbaceous plants.

Evaluate the host range of the pest.

**Score: 3**

- Low (1) has a very limited host range.
  - Medium (2) has a moderate host range.
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- **High (3) has a wide host range.**

- 3) Pest Reproductive Potential:** The nematode's life cycle and increase is dependent on soil temperature and plant host. Long and short distance spread is mainly through infested soils accompanying plant stock, farm machinery, runoff and splash contaminated irrigation water, human and animal activity, and soil-contaminated clothing.

Evaluate the natural and artificial dispersal potential of the pest.

**Score: 3**

- 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:** Infestations of *Xiphinema diversicaudatum* could result in lowered crop yield and value, loss in market, and change in cultural practices to mitigate risk of spread to non-infested sites. The main economic damage is due to the ability of the nematode to vector the economically important nepoviruses.

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

**Economic Impact: A, C, E,**

- A. **The pest could lower crop yield.**
- B. The pest could lower crop value (includes increasing crop production costs).
- C. **The pest could trigger the loss of markets (includes 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:** The impact of *Xiphinema diversicaudatum* on natural environments is not known. However, the infestations of the pest could affect cultural practices, home gardening, and ornamental plantings.

**Environmental Impact: 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.
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- 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: 2**

- 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 diversicaudatum*: 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 'not established'***. This nematode has been introduced but was declared eradicated

**Score: -0**

**-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 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 = 14***

**Uncertainty:**

None

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## Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Xiphinema diversicaudatum* is A.

## References:

Agrios, G. N. 2005. Plant Pathology, 5th Edition. Elsevier Academic Press. 922 pg

Brown, D. J. F., Topham, P. B., Trudgill, D. L. 1983. Differential transmissibility of arabis mosaic and strains of strawberry latent ringspot viruses by three populations of *Xiphinema diversicaudatum* (Nematoda: Dorylaimoidea) from Scotland, Italy and France. *Revue de nematologie* 6: 229-238.

CABI Crop Production Compendium 2020. *Xiphinema diversicaudatum* (dagger nematode).  
<https://www.cabi.org/cpc/datasheet/57028>. Accessed 11/20/2020

Chitambar, J. 2008. Status of Ten Quarantine "A" Nematode Pests in California' in 2007. CPPDR. (California Plant Pest & Disease Report, 2008. 24: 62-71.

Chitambar, J. J., Westerdahl, B. B., and Subbotin, S. A. 2018. Plant Parasitic Nematodes in California Agriculture. In Subbotin, S., Chitambar J., (eds) Plant Parasitic Nematodes in Sustainable Agriculture of North America. Sustainability in Plant and Crop Protection. Springer, Cham.

Chizhov, V.N., Pridannikov, M.V., Peneva, V. and Subbotin, S.A., 2014. Morphological and molecular characterisation of the Saratov population of the European dagger nematode, *Xiphinema diversicaudatum* (Nematoda: Dorylaimida), with notes on phylogeography of the species. *Nematology*, 16(7), pp.847-862.

EPPO Global Database. 2020. <https://gd.eppo.int/taxon/XIPHDI>. Accessed 11/20/2020

Mokrini, F., Andaloussi, F.A., Waeyenberge, L., Viaene, N. and Moens, M., 2014. First report of the dagger nematode *Xiphinema diversicaudatum* in citrus orchards in Morocco. *Plant disease*, 98(4), pp.575-575.

Pitcher, R. S., Siddiqi, M. R. and Brown, D F. G. 1974. *Xiphinema diversicaudatum* C. I. H. Descriptions of plant parasitic nematodes Set 4 no. 60

Robbins, R. T., and D. F. J. Brown. 1991. Comments on the taxonomy, occurrence and distribution of Longidoridae (nematode) in North America. *Nematologica* 37:395-419

Smith, I. M., McNamara, D. G., Scott, P. R., Harris, K. M. (Editors), 1992. Quarantine pests for Europe: data sheets on quarantine pests for the European Communities and for the European and Mediterranean Plant Protection Organization. Wallingford, UK; CAB International, ix + 1032 pp.

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USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PEXD)  
Harmful Organisms Database Report. *Xiphinema diversicaudatum*. Accessed 2/26/2020

### **Responsible Party:**

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**\*Comment Period: 12/17/2020 through 01/31/2021**

### **\*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](mailto:permits[@]cdfa.ca.gov).

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### **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.
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- ❖ Posted comments shall be those which have been approved in content and posted to the website to be viewed, not just submitted.
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**Proposed Pest Rating: A**

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