cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Mesocriconema (*Macroposthonia*) *xenoplax* (Raski) Loof & de Grisse 1989

ring nematode

Current Pest Rating: D

Proposed Pest Rating: C

Kingdom: Animalia, Phylum: Nematoda,

Class: Secernentea, Subclass: Diplogasteria,

Order: Tylenchida, Superfamily: Criconematoidea,

Family: Criconematidae, Subfamily: Criconematinae (Macroposthoniinae)

Comment Period: 11/25/2020 through 01/09/2021

Initiating Event:

During the 1950s and 1960s, several species of plant parasitic nematodes were given 'D' rating as they were regarded as parasites, predators, or organisms of little or no economic importance that did not require State-enforced regulatory action. However, most of these nematode species were inaccurately assigned a D rating as they are plant parasitic and therefore capable of damaging plant production and causing significant economic losses especially at the county and local residential/grower level. Furthermore, the detection of plant parasitic nematodes in nursery stock may be an indication of contamination in violation of the State's standard of pest cleanliness required for nurseries. *Mesocriconema xenoplax* was originally rated D. The risk of infestation and permanent rating of this nematode is re-assessed here.

History & Status:

Background:

Multiple genera of nematodes in the family Criconematidae have the common name of "ring nematodes" due to the fact they have distinctive coarse rings (annulations) around their bodies. This

ring nematode, *Mesocriconema xenoplax*, was first discovered and described by Raski in 1952 as *Criconemoides xenoplax* (= *Macroposthonia xenoplax, Criconemella xenoplax*) from specimens collected in a California vineyard. *Mesocriconema xenoplax* is a ectoparasitic nematode that survives in the rhizosphere soil of host plants and feeds on root tissue. It uses an elongate stylet that is inserted into a root to feed while the nematode body remains outside. Feeding often results in the death of fine roots. *Mesocriconema xenoplax* reproduces the best in irrigated, very sandy soils, and has a life cycle of only 25–34 days at 22–26 °C (Seshadari, 1964).The species is now widely distributed in vineyards and several other perennial crops (e.g. stone fruit, walnuts, and alfalfa) planted throughout California (Ferris et al., 2012).

Hosts: This nematode has a very wide host range including grasses, cucurbits, legumes, herbaceous and woody ornamentals, trees (pome fruit, stone fruit, nuts, olives, citrus), and grapevines (Nemabase, 2010). In surveys of major agricultural corps and nursery production areas within California, the highest frequency detections were from apricot, cherry, plum, prune, grape, peach, walnut, and alfalfa, with relatively fewer detections from cotton, long bean, oats, orange, and tomato (Dong et al., 2007).

Symptoms: Ring nematodes reduce the number and volume of feeder roots, destroy cortical root tissue, darken roots, increase water stress, lower nutrient levels in leaves, reduce fresh and dry weights, and cause growth to be stunted in stone fruit and grape vines (English et al., 1982; Ferris et al., 2012).

Transmission: As an ectoparasite, the eggs, juveniles, and adult nematodes of *M. xenoplax* can be moved to non-infested areas with planting stock, and anything that moves soil between orchards or fields (equipment, machinery, vehicles) and recycled irrigation water (McKenry and Westerdahl, 2009)

Damage Potential: Mesocriconema xenoplax feeds on and damages the fine feeder roots of its hosts. This damage can be great; it has been shown to cause reduction of 85% of the fine roots in young peaches (Westerdahl and Duncan 2015). Large populations will develop that can be very damaging to the root systems of many types of stone fruits such as plums, prunes, peaches, and almonds plus grapes and walnuts (English et al., 1982; McKenry and Kretsch, 1987; Ferris et al., 2004; Lownsbery, et al. 1978). Sometimes damage is hard to quantify as they can co-occur with other nematodes, such as *Pratylenchus vulnus*, which also retards plant growth by damaging root systems of perennial hosts.

There are great economic damages associated with high populations of this nematode that can develop on stone fruit orchards and grape vineyards with a replant history (Ferris et al., 2004 Ferris et al, 2012). But even greater economic damage caused by *M. xenoplax* comes from is its ability to predispose *Prunus* spp. and *Malus* spp. to bacterial canker caused by *Pseudomonas syringae* pv. *syringae*, and Cytospora canker of prune caused by *Cytospora leucostoma* (English et al., 1982). *Mesocriconema xenoplax* was the most damaging nematode of almonds because of the associated bacterial canker complex in the San Joaquin Valley, where about half the orchards had both pathogens (McKenry and Kretsch, 1987).

Worldwide Distribution: Brazil, Canada, France, India, Italy, Portugal, Spain, United States (CABI, 2020; Forge et al., 2013).

Official Control: None

California Distribution: *Mesocriconema xenoplax* has been detected in the following 28 counties: Butte, Fresno, Glenn, Humboldt, Imperial, Kern, Kings, Los Angeles, Madera, Merced, Monterey, Napa, Orange, Riverside, San Bernardino, San Diego, San Joaquin, San Luis Obispo, Santa Barbara, Shasta, Solano, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Yolo, and Yuba (CDFA PDR database, 2020; Chitambar et al., 2018,; Dong et al., 2007).

California Interceptions: In 2006, *M. xenoplax* was detected under the Burrowing and Reniform nematode exterior quarantine in San Diego County on an incoming shipment of *Ficus* nursery stock from Florida.

The risk *Mesocriconema xenoplax* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This nematode is widespread in California in association with its hosts (mainly perennial tree crops plus alfalfa)

   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:** The host range of this nematode is very large including annual and woody perennials plus grasses

   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:** Ring nematodes reproduce very quickly and produce large numbers of eggs under moderate temperatures and especially in sandy soils. As they live entirely in the rhizosphere soil, they move very slowly without the assistance of people moving infested nursery stock and contaminated soils in agricultural operations.

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: There are both direct impacts from the feeding behavior of this nematode, which damages the fine feeder roots, and the indirect impact of feeding damage, which increases the susceptibility of trees to bacterial and fungal diseases, plus cold injury.

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

Economic Impact: A, B

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: **2**

- 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: As agricultural plantings and practices have spread this nematode (which has a very wide host range) throughout the state, it has most likely moved into natural plant communities. Pre-planting and post-planting nematicides have been important for control of ring nematodes, especially in orchard replant situations and for hosts that are susceptible to bacterial canker (Chitambar et al., 2018).

Environmental Impact: A, D

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 *Mesocriconema xenoplax:* High

Add up the total score and include it here. **13**
-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'. Official detections have been made from 28 California counties.

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 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* **= 10**

Uncertainty:

Variants of *M. xenoplax* with different reproductive potentials on grapes have been described in California. Sequence analysis revealed the existence of two prevalent variants, a coastal haplotype and a Central Valley haplotype. Observed genetic differences correspond with a phenotypic difference in stylet length, with the coastal populations possessing smaller stylets compared to the Central Valley populations. In the future, these may be split taxonomically (De Ley et al., 2005).

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Mesocriconema xenoplax* is C.

References:

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.

De Ley, T.I., Li, Q., Abolafia-Cobaleda, J., Mckenry, M., Kaloshia, I. and De Ley, P., 2005. Systematics of *Mesocriconema xenoplax* revisited: combined analysis of morphological and molecular markers. Journal of Nematology, 37, p.336.

Dong, K., Chitambar, J., Subbotin, S., Alzubaidy, M., Luque-Williams, M., Romero, J., Kosta, K., and Luna, R. 2007. Significant records in Nematology: California statewide nematode survey project for 2006. California Plant Pest and Damage Report., (July 2005 through December 2006), 23, 45–71.

English, H., Lownsbery, B. F., Schick, F. J., and Burlando, T. 1982. Effect of ring and pin nematodes on the development of bacterial canker and Cytospora canker in young French prune trees. Plant Disease, 66, 114–116

Ferris, H., McKenry, M. V., Jaffee, B. A., Anderson, C. E., & Juurma, A. 2004. Population characteristics and dosage trajectory analysis for *Mesocriconema xenoplax* in California Prunus orchards. Journal of Nematology, 36, 505–516

Forge, T.A., Smit, R., Koch, C., Neilsen, G.H., Neilsen, D. and Hannam, K. 2013, January. Ring nematodes (*Mesocriconema xenoplax*) affect early establishment of self-rooted 'Merlot' grapevines under Okanagan Valley growing conditions. Canadian journal of plant pathology Vol. 35, No. 1, pp. 110-110

Lownsbery, B. F., Moody, E. H., Moretto, A., Noel, G. R., & Burlando, T. M. 1978). Pathogenicity of *Macroposthonia xenoplax* to walnut. Journal of Nematology, 10, 232–236

McKenry, M. V., and Westerdahl, B. B. 2009. Prune nematodes. UC Pest Management Guidelines. UCIPM Statewide Integrated Pest Management Program, University of California Agriculture and Natural Resources. (Updated 4/09). http://ipm.ucanr.edu/PMG/r606200111.html

McKenry, M. V., and Kretsch, K. 1987. Survey of nematodes associated with almond production in California. Plant Disease, 71, 71–73.

Nemaplex UC Davis Nemabase 2010. *Mesocriconema xenoplax*. Accessed 10/14/2020

Raski, D. J. (1952a). On the morphology of Criconemoides Taylor, 1936, with descriptions of six new species (Nematoda: Criconematidae). Proceedings of the Helminthological Society of Washington, 19, 85–99.

Seshadari, A. R. (1964). Investigations on the biology and life cycle of *Criconemoides xenoplax* Raski, 1952 (Nematoda: Criconematidae). Nematologica, 10, 540–562.

Westerdahl, B. B., & Duncan, R. A. 2015. Peach nematodes. UC Pest Management Guidelines (updated 9/15). UCIPM University of California Agriculture and Natural Resources, Statewide Integrated Pest Management Program. http://ipm.ucanr.edu/PMG/r602200111.html

Responsible Party:

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***Comment Period: 11/25/2020 through 01/09/2021**

***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.

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.

Proposed Pest Rating: C