CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Pratylenchus zeae Graham, 1951

Corn lesion nematode

Current Pest Rating: C

Proposed Pest Rating: C

Domain: Eukaryota, Kingdom: Metazoa,

Phylum: Nematoda, Family: Pratylenchidae

Comment Period: 01/04/2024 through 02/18/2024

Initiating Event:

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

History & Status:

Background:

The genus *Pratylenchus* Filipjev, 1936, includes approximately 100 described species. They are considered among the most widespread and important nematode parasites in a variety of crops (Sasser and Freckman, 1987). Species of *Pratylenchus* are distinguished primarily by morphology, but they can also be identified by molecular methods (Subbotin et al., 2008).

The name “lesion nematode” describes the darkened, necrotic lesions or patches that form on plant roots because of the damage caused by nematode feeding. *Pratylenchus* sp. are migratory endoparasites, meaning they enter the root cortical tissues, rhizomes, and tubers and feed as they tunnel. The cortical cell walls of the roots break down and cavities form in the root cortex as a result. Damaged roots are often subject to serious attacks from secondary fungal and bacterial plant pathogens. Plants with root damage from lesion nematodes suffer reduced absorption of water and nutrients, making the plants stunted and chlorotic. They grow poorly, have reduced yields, and may die (Agrios, 2005).

Pratylenchus zeae was first reported in California by French et al. in 1964, in pear orchards in Placer County. It has had an informal C-rating since that time. It is polyphagous and is considered a serious pest of grasses, most notably sugarcane and rice.

Pratylenchus zeae enters plant roots and feeds, reproduces, and moves freely within the tissue, spending its entire life cycle inside of roots or in the soil around roots. Within the roots, feeding is confined to the root cortex. Like other *Pratylenchus* species, it has six life stages: egg, four juvenile stages, and adult. Reproduction occurs parthenogenically with only females in this species; males are absent. First-stage juveniles develop within the egg, followed by a first molt to the second-stage juvenile that hatches from the egg. Each stage develops into the next via a molt of its cuticle (outer body covering). The juvenile and adult stages are worm-shaped (vermiform). All post-hatch stages are motile and can infect plants. Generally, root lesion nematodes have a life cycle of 45-65 days, but the duration is affected by temperature and moisture. *Pratylenchus zeae* survives the winter in infected roots or the soil as eggs, juveniles, or adults. During spring, when plant growth is active, eggs hatch to commence the life cycle within roots or in rhizosphere soil (Agrios, 2005; Chitambar et al., 2018).

Hosts: Pratylenchus zeae is a pest of rice and other graminaceous crops: principally, corn, sorghum, and sugarcane (Fortuner, 1976). It has a wide host range that includes many plants grown in California, including onion, garlic, cabbage, pepper, citrus, grape, lettuce, onion, peach, tomato, and walnuts (CABI, 2023; Nemaplex, 2010; CDFA PDR database, 2023).

Symptoms: *Pratylenchus zeae* causes damage to plants through its migratory endoparasitic feeding habits. It causes brown to black lesions to form on the roots. The damage to the root systems can lead to stunted growth, reduced plant vigor, chlorotic symptoms, defoliation, and a gradual decline in yield. The affected plants often appear in patches and are not uniformly distributed. The appearance of the lesions varies according to the level of infestation, the age of the lesion, and the host species. When the lesion breaks open, the cortex sloughs off like a sleeve, leaving only the vascular cylinder. Secondary pathogens often enter these lesions causing rot (CABI, 2023).

The above-ground symptoms depend on the environmental conditions, and the host involved. Above-ground symptoms are not diagnostic for lesion nematodes. Stunted and chlorotic (yellowish) plants give the field a “ragged” appearance. The damage is often most severe in the center of these areas; symptoms diminish toward the edges and plants appear increasingly normal. Related symptoms include poor vigor, reduced tillering, reduced grain yield and grain quality, and increased susceptibility to winter injury. The above-ground parts of the plants may exhibit symptoms of nutrient deficiency (Chitambar et al., 2018).

Transmission: Lesion nematodes are spread through the movement of contaminated soil and infected plant debris. They can be introduced to non-infested sites with poorly sanitized farm equipment, contaminated planting stock, such as tubers or seedlings, nursery stock, such as bare root trees, and irrigation water. The spread of lesion nematodes within fields is often accelerated by cultural practices, such as moving soil with cultivation. Some nematodes may leave the root, enter the soil, and re-enter the root at a different site, causing a new infection. Lesion nematodes are usually only able to migrate slowly, 1-2 meters from the root zone they infect. However, in plantings where root grafts may occur,

such as fruit trees, the nematodes may travel from plant to plant through roots (Davis and MacGuidwin, 2000).

Damage Potential: Pratylenchus zeae generally thrives on lighter, sandy soils. It has a wide host range and few specific habitat requirements; however, it does not survive in permanently flooded conditions such as deepwater rice but can be found in hydromorphic soils (Plowright and Hunt, 1994). Control of *P. zeae* has resulted in 13-55% increases in the yield of upland rice (Plowright et al., 1990).

Substantial yield losses from *P. zeae* have also been reported from maize, sugarcane, and sorghum (Severino et al., 2010; Jordaan et al., 1987; Fortuner, 1976). The interaction of lesion nematodes and pathogenic soil fungi such as *Verticillium, Rhizoctonia,* and *Fusarium* can result in more severe disease complexes. Infected plants have roots with black lesions and fewer feeder roots than non-infected plants thereby resulting in stunted root growth. Top growth may exhibit general symptoms of an impaired root system including lack of vigor, dieback, and chlorotic and small leaves (Davis and MacGuidwin, 2000; Back et al., 2002).

Worldwide Distribution: Africa: *Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Gambia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mozambique, Namibia, Nigeria, Senega, Somalia, South Africa, Tanzania, Togo, Uganda, Zambia, Zimbabwe*. Asia: *Afghanistan, China, India, Indonesia, Iraq, Japan, Malaysia, Oman, Pakistan, Philippines, South Korea, Sri Lanka, Taiwan, Turkey, Vietnam*. Europe: *Austria, Bulgaria, Croatia, Slovenia*. North America: *Barbados, Belize, Canada, Costa Rica, Cuba, El Salvador, Jamaica, Martinique, Panama, Puerto Rico, Saint Vincent and the Grenadines, Trinidad and Tobago, United States* (Arkansas, California, Florida, Georgia, Hawaii, Louisiana, Mississippi, North Carolina, Texas). Oceania: *Australia, Fiji, Papua New Guinea, Samoa, Tonga.* South America: *Argentina, Brazil, Colombia, Ecuador, Venezuela* (CABI, 2023).

Official Control: *Pratylenchus zeae* is on the EPPO's A1 list for Chile, and a quarantine pest in Mexico. It is on the USDA PCIT's harmful organism list for Chile, Ecuador, Honduras, Mexico, Nicaragua, Taiwan, and The Republic of Korea.

California Distribution: Los Angeles, Riverside, San Diego, San Luis Obispo, San Mateo, Santa Barbara, Solano, Sutter, Tulare, and Yuba counties (CDFA PDR Database, 2023).

California Interceptions: Multiple interceptions have been made at California border inspection stations (CDFA PDR Database, 2023).

The risk that ***Pratylenchus zeae*** would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** As it lives in close association with roots, this nematode is likely to be found 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:** This nematode is highly polyphagous with a long list of known hosts and associated plants in many diverse families.

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:** Lesion nematodes do not have a long-lasting resting stage in the soil. They move slowly on their own but are moved easily with soil, water, and infected plants.

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:** Root lesion nematodes cause direct damage from feeding, and from wounding roots which allows the attack of various other plant pathogens. It can be spread with irrigation water. This species is a quarantine pest for some trading partners.

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 been in California for many decades. No environmental damage has been reported. It could significantly impact home/urban gardens.

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

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.
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 *Pratylenchus zeae:* 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'.

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* ***= 10***

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for ***Pratylenchus zeae*** **is C.**

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Responsible Party:

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*Comment Period: 01/04/2024 through 02/18/2024

*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