CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Pratylenchus brachyurus (Godfrey, 1929) Filipjev & Schuurmans-Stekhoven, 1941

smooth-headed lesion nematode

Current Pest Rating: none

Proposed Pest Rating: C

Kingdom: Animalia, Phylum: Nematoda,
Class: Chromadorea, Order: Rhabditida,
Family: Pratylenchidae, Subfamily: Pratylenchinae

Comment Period: 10/30/2023 through 12/14/2023

Initiating Event:

This nematode has not been through the pest rating process. The risk to California from *Pratylenchus brachyurus* is described herein and a permanent pest 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. 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).

Tylenchus brachyurus was first collected from pineapple roots in Hawaii and described in 1929 by Godfrey. Filipjev, in 1936, established the genus *Pratylenchus*, and *Tylenchus brachyurus* was re-named *Pratylenchus brachyurus* Filipjev & Schuurmans-Stekhoven, in 1941. Today *P. brachyurus* is distributed widely through the warmer regions of the world, including the Southeastern U.S., and widely documented in Florida citrus groves (McGowan, 1978; CABI, 2023).

Pratylenchus brachyurus 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 can occur parthenogenically with only females and in this species; males are extremely rare. 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 brachyurus* survives the winter in infected roots or 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 brachyurus is highly polyphagous and has a very wide host range including herbaceous and woody plants in multiple families. Important hosts include bananas, beans, cabbage, cereals, citrus, coffee, cotton, date palms, guava, peaches, peanuts, pineapples, potatoes, soybeans, tea, tobacco, tomatoes, and yams (Nemaplex, 2010; CABI, 2023).

Symptoms: *Pratylenchus brachyurus* 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).

Potato tubers are often attacked, and small lesions are found on the surface of the outer peel of tubers. The lesions are initially light brown becoming purplish brown with raised centers. They are shallow and rarely penetrate more than 0.5 mm deep. Lesions, scabs, pustules, or pimples are also formed, reducing the market value of potatoes (Koen, 1967).

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).

Transmission: 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 very 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.

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 greater distances with cultivation (Davis and MacGuidwin, 2000).

Damage Potential: Although long considered a nematode of economic importance to California (Chitambar et al., 2018), there is no modern literature on the impact of this nematode on common agronomic crops, and damage thresholds have not been established. McKenry and Roberts (1985) list nematode-crop damage associations in California for *P. brachyurus* with cotton and beans, but the effects on these crops were not studied. Both upland cotton Acala (*Gossypium hirsutum)* and Pima (*G. barbadense)* are listed as susceptible hosts for *P. brachyurus*.

Although *P. brachyurus* is damaging to pineapples in some countries, with leaf emergence delayed, and plant growth and leaf weight reduced along with fruit yield (Daramola and Afolami, 2014), it is of limited significance in Hawaii and is found to be an economic issue only on a small hectarage (Rohrback and Apt, 1986). Greenhouse and field trials in Florida on citrus concluded *P. brachyurus* was a relatively weak pathogen and was not believed to be an economic pest (MacGowan, 1978). Although frequently reported in cotton fields in Brazil, its pathogenicity is still in question (Machado et al., 2012). On soybeans, *P. brachyurus* reduced seed yield and when co-infected with *Rhizoctonia solani*, greater damage was observed when they were combined, than with either acting alone (Lindsey and Cairns, 1971).

Worldwide Distribution: *Pratylenchus brachyurus* is widely distributed throughout the tropical and subtropical regions of the world. In the U.S. there are records in the following states: Alabama, Arkansas, California, Florida, Georgia, Hawaii, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia (CABI, 2023).

Official Control: *Pratylenchus brachyurus* is on the USDA PCIT's harmful organism list for Canada, Ecuador, French Polynesia, Honduras, Namibia, Panama, South Africa, and The Republic of Korea (USDA PCIT, 2023).

California Distribution: The following California counties have had field detections of *P. brachyurus*: Butte, Fresno, Glenn, Imperial, Kern, San Diego, San Joaquin, Santa Barbara, Stanislaus, and Yolo. The detections have been made on alfalfa, almond, barley, bean, cherry, cotton, grape, prune, sugar beet, or tomato. Additionally, it has been detected in association with almond, grape, and pistachio nursery stock in Madera, Merced, and Kern counties. Many of these counties had only a single detection on a single host, and in total, there are only around 25 field detections in records going to 1982 (CDFA PDR database, 2023). It is widespread in California, but its impact appears nominal.

California Interceptions: Of the approximately 930 detections in the CDFA PDR database (2023), 900 were made from incoming shipments of ornamental nursery stock, mainly from the S.E. United States, but also from Central America. The detection of any 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, however, with an informal C-rating, it is unlikely regulatory action would be taken at the County level.

The risk *Pratylenchus brachyurus* 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 brachyurus:* 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 brachyurus*** **is C.**

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Responsible Party:

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*Comment Period: 10/30/2023 through 12/14/2023

*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
