cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Proposal for

Pratylenchus crenatus Loof 1960

Root lesion nematode

Current Pest Rating: D

Proposed Pest Rating: C

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

Comment Period: 09/19/2023 through 11/03/2023

Initiating Event:

During the 1950s and 1960s, several species of plant parasitic nematodes were given a '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, these nematode species were inaccurately assigned a D rating as most if not all, 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. *Pratylenchus crenatus* is currently rated D. The risks posed by this nematode are re-assessed here and a new rating is proposed.

History & Status:

Background:

The genus *Pratylenchus* Filipjev, 1936, includes approximately 100 described species. They are migratory endoparasites that feed within root cortical tissues, rhizomes, and tubers. Their common name is "lesion nematodes" for the damage they cause to plant root systems. 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).

Pratylenchus crenatus was first described by P.A.A. Loof in 1960 from the Netherlands. It is a polyphagous nematode that mainly reproduces asexually (males are rare) (Karssen and Bolk, 2000). Most reports are from the Northern temperate zone (North America, Europe, and Japan), but it has also been found in Brazil, South Africa, and Venezuela (Nemaplex, 2010; EPPO, 2023; CABI, 2023). Predominantly it has been found in light sandy soils, parasitizing cereals, and grasses (Loof, 1991). It is often found with another important lesion nematode, *P. penetrans* (Krause, 1981).

Pratylenchus crenatus 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, *P. crenatus* has six life stages: egg, four juvenile stages, and adult. Reproduction can occur parthenogenically with only females. 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 crenatus* 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.

Hosts: Abies concolor (white fir), *A. procera* (noble fir), *Abies sp.* (fir), *Acer sp.* (maple), *Aira caryophyllea* (silver hair grass), *Alnus sp*. (alder), *Anthurium sp.* (tailflower), *Asparagus officinalis* (asparagus), *Aster sp.* (aster), *Astilbe sp.* (spiraea), *Avena sativa* (oat), *Begonia sp.* (begonia), *Beta vulgaris* (beet), *Betula sp.* (birch), *Chrysanthemum coccineum* (chrysanthemum), *C. leucanthemum* (oxeye daisy), *C. maximum* (max daisy), *Cichorium endivia* (endive), *C. intybus* (chicory), *Cimicifuga sp.* (bugbane), *Convallaria majalis* (lily of the valley), *Corylus sp.* (filbert), *Crataegus sp.* (hawthorn), *Cucumis melo* (sweet melon), *Cynara scolymus* (artichoke), *Dahlia sp.* (dahlia), *Daucus carota* (carrot), *Fragaria chiloensis* (strawberry), *Fragaria sp.* (strawberry), *Fuchsia sp.* (fuchsia), *Helleborus niger* (hellebore), *Hordeum distichum* (barley), *H. vulgare* (barley), *Humulus lupulus* (European hop), *Hydrangea sp.* (hydrangea), *Iris sp.* (iris), *Jasminum sp.* (jasmine), *Laburnum anagyroides* (golden chain), *Lactuca sativa* (lettuce), *Lilium longiflorum* (trumpet lily), *Lolium longiflorum* (ryegrass), *L. multiflorum* (Italian ryegrass), *L. perenne* (perennial ryegrass), *Lolium sp.* (ryegrass), *Lotus corniculatus* (lotus), *Malus sylvestris* (apple), *Miscanthus X giganteus* (miscanthus), *Musa sp.* (banana), *Narcissus sp.* (narcissus), *Nolana sp.* (nolana), *Olea europaea* (olive), *Panicum virgatum* (switchgrass), *Papaver somniferum* (opium poppy), *Pernettya sp.* (pernettya), *Petunia sp.* (petunia), *Phlox sp.* (phlox), *Picea sp.* (spruce), *Pinus nigra* (Austrian pine), *Pinus sp.* (pine), *Pisum sativum* (pea), *Poa annua* (annual bluegrass), *Polypodiaceae sp.* (polypody family), *Populus sp.* (poplar), *Prunus armeniaca* (apricot), *P. avium* (wild cherry), *P. dulcis* (almond), *P. persica* (nectarine), *Prunus sp.* (cherry), *Pseudotsuga menziesii* (Douglas fir), *Pyrus communis* (pear), *Raphanus raphanistrum* (wild radish), *Rhododendron sp.* (rhododendron), *Rosa sp.* (rose), *Rubus sp.* (blackberry), *Scabiosa caucasica* (scabiosa), *Scorzonera hispanica* (black salsify), *Secale cereale* (cereal rye), *Sequoia sp.* (redwood), *Solanum lycopersicum* (tomato), *S. tuberosum* (potato), *Sorbus aucuparia* (European mountain ash), *Spergula arvensis* (spurry), *Stellaria media* (chickweed), *Trifolium pratense* (red clover), *T. repens* (white clover),

Vaccinium sp. (blueberry), *Vicia sp.* (vetch), *Vitis vinifera* (grape), *Wisteria sp.* (wisteria), *Zea mays* (corn) (Nemaplex, 2010).

CDFA detections have been made associated with alfalfa, apple, cherry, clover, currants gooseberry, grape, lilac, lily, maple, nightshade, oak, oat, pear, peperomia, pepper, potato, raspberry, and strawberry (CDFA PDR database, 2023).

Symptoms: All life stages of *P. crenatus* are microscopic and must be extracted from soil or plant material before they can be identified. Lesion nematodes cause a variety of symptoms in plants, including swollen roots, lack of branching, stunted roots, and reddish-brown or black lesions along the roots. These lesions may appear in small spots at the early stages of infection, but the lesions expand as the nematodes move lengthwise within the infected roots, expanding over time. Within the roots, the nematodes feed on cortical tissue causing cell breakdown and formation of cavities.

Aboveground 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 tops of the plants may exhibit symptoms of nutrient deficiency (Chitambar et al., 2018).

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 contaminated soil. 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: On well-managed turf and in some woody ornamentals the only problems associated with infections are a lack of winter hardiness. High nematode populations and infection of young plants can lead to stunting, nutrient and water deficiencies, and eventual dieback (Davis, and MacGuidwin, 2000). For carrots, *P. crenatus* populations were significantly negatively correlated with plant density and sometimes with average carrot weight (Hay and Pethybridge, 2005). *Pratylenchus crenatus* affects the yield and quality of potatoes, and movement over long distances in infected tubers

is a significant risk (Florini et al., 1987; Orlando et al., 2020). *Pratylenchus* causes significant damage in cereal production worldwide, often in mixed infections with multiple species (Fatemi et al., 2023).

Worldwide Distribution: *Pratylenchus crenatus* has a worldwide distribution, mainly in temperate and subtropical zones, including Europe, the United States, and Canada. It has also been reported in tropical Africa (Castillo and Vovlas, 2007), and Brazil (Bonfim Junior et al., 2016).

Official Control: *Pratylenchus crenatus* is on the EPPO's A1 list for Argentina, and on the USDA PCIT's Harmful Organism List for Brazil, Canada, Colombia, Ecuador, Honduras, Peru, and The Republic of Korea.

California Distribution: Butte, Del Norte, El Dorado, Humboldt, Kern, Lake, Mendocino, Monterey, Orange, Placer, Plumas, Riverside, San Bernardino, San Francisco, San Joaquin, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Siskiyou, Sonoma, Sutter, Tulare, and Yuba counties (CDFA PDR database, 2023).

California Interceptions: This nematode has been intercepted with some regularity in nursery stock including pome fruit trees and small fruit vines, mainly from Oregon and Washington (CDFA PDR database, 2023).

The risk *Pratylenchus crenatus* 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 long-lasting resting stages 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 crenatus:* 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 crenatus*** **is C.**

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Responsible Party:

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***Comment Period: 09/19/2023 through 11/03/2023**

***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