

California Pest Rating Proposal for

Paratrichodorus minor (Colbran, 1956) Siddiqi, 1974

Current Pest Rating: **D**

Proposed Pest Rating: **C**

Comment Period: **09/04/2019 through 10/19/2019**

Initiating Event: none

History & Status: During the 1950s and 1960s, many species of plant-parasitic nematodes were given a D rating as they were considered to be of little or no economic importance and not justifying State-enforced regulatory action. However, these nematode species were incorrectly 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 (Chitambar et al., 2018). One of these nematodes originally rated D is *Paratrichodorus minor*. The risk of infestation and permanent rating of this nematode are re-assessed here.

Background: *Paratrichodorus minor* is known commonly as the stubby-root nematode because feeding by these nematodes can cause roots to become stunted or "stubby" in appearance. Stubby-root nematodes are in the Triplonchida, an order of nematodes characterized by having a six-layer cuticle (body covering). Most individuals of the species are female, males are rare, and they reproduce by parthenogenesis, producing offspring without fertilization. The females lay eggs in the soil and the juveniles feed on roots as they develop. The length of the life cycle varies with temperature, but it may be as short as 16 days. *P. minor* is more commonly found in sandy and sandy-loam soils, but can occasionally be found in organic, peat, and muck soils (Christie, 1959; Perry and Rhoades, 1982).

Species of the genus *Paratrichodorus* tend to be found more in the tropics. *Paratrichodorus minor* can be found in the tropics or sub-tropics and causes direct damage to plant roots (Nemplex, 2019). This nematode is ectoparasitic, meaning that it feeds on plants while its body remains in the soil. They feed primarily on meristem cells of root tips. Stubby-root nematodes have a unique (among plant-parasitic nematodes) type of stylet, called an onchiostylet, that is used to punch holes in cells, allowing the contents to drain out. This contrasts with other plant-parasitic nematodes, which have hollow stylets

that function more like straws (Christie and Perry, 1951; Crow, 2004). In addition, *Paratrichodorus* is one of the few groups of nematodes that can transmit plant viruses. *Paratrichodorus minor* transmits tobacco rattle tobnavirus, which infects many types of plants. Tobacco rattle virus can be very damaging to potatoes where it causes corky root disease (Walkenshaw et al., 1961).

Other scientific names for *P. minor* are *Nanidorus christiei* (Allen, 1957) Siddiqi, 1974; *N. minor* (Colbran, 1956) Siddiqi, 1974; *Paratrichodorus christiei* (Allen, 1957) Siddiqi 1974; *P. obesus* (Razj. & Pent., 1975) Rodr. & Bell, 1978; *Trichodorus christiei* Allen, 1957; *T. minor* Colbran, 1956; *T. obesus* Razjivin & Penton, 1975. (CABI, 2019)

Hosts: Stubby-root nematodes are associated with the roots of hundreds of species of plants including tobacco, cotton, oats, corn, other agricultural crops, fruit trees, ornamentals, nursery stock, forest trees and shrubs, desert shrubs, grasses, and weeds (Siddiqi et al., 1973). Databases records show the widespread occurrence of *P. minor* in soil and in plant rhizospheres, but parasitism has not always been established or quantified (Nemaplex, 2019).

Symptoms: Symptoms of attack by *P. minor* are non-specific and include irregularly-shaped patches within a field, generally more severe in sandy and light soils. Seedlings are the most seriously damaged. As the seedling roots develop, the tips are attacked, and growth stops. The roots will branch at the points of nematode feeding and then the new root tips can also be attacked (Christie and Perry, 1951). Plants may appear stunted with poor stand establishment and they may wilt under heat stress. The roots will appear “stubby” and shortened because feeding by the nematode causes the root tips to fail to grow and inhibits root elongation. The damaged roots are less able to take up water and nutrients from the soil and the plants may show nutrient deficiency symptoms. Affected plants may fall over more easily in the wind (Crow, 2004, MacGowan, 1983). Plant roots usually show little or no necrosis or discoloration (Christie and Perry, 1951; Brodie, 1984).

Paratrichodorus minor is the primary vector of tobacco rattle virus which causes a corky ringspot disease on potato as it moves infected sap between plants. When potato plants are infected with the virus, their tubers develop noticeable brown rings on the surface and brown discoloration or flecking inside the potato (Weingartner et al., 1983). On herbaceous ornamentals including daffodils, gladiolus and hyacinths, tobacco rattle virus causes the leaves to have yellow line patterns (Zwieg and Hudelson, 2010).

Transmission: The main mode of long- and short-distance spread is through artificial (human) means, primarily movement of nematode-contaminated soil, infected transplants or seed potatoes, run-off and irrigation water, cultivation tools, and equipment.

Damage Potential: *Paratrichodorus minor* is polyphagous and should be regarded as a potentially serious root pathogen. *Paratrichodorus minor* is considered an important limiting factor for vegetable crops grown in contaminated light soils in the subtropical regions of the United States (Perry and Rhoades, 1982). Because of its ability to transmit Tobacco rattle virus, feeding damage from this

nematode can be especially serious for potatoes and other viral hosts (Davis et al., 2014; Brodie, 1984; Walkinshaw et al., 1961). Infections from tobacco rattle virus has been shown to cut yields from 6-55 percent in the Pacific Northwest, with damage to tubers causing potatoes to be unmarketable (Hafiz et al., 2009).

Worldwide Distribution: *Paratrichodorus minor* is widespread around the world in tropical and subtropical agriculture and forests (CABI, 2019; Siddiqi et al., 1973)

Official Control: *Paratrichodorus minor* is on the Harmful Organism list for Honduras, Jordan, Republic of Korea, Peru, and Taiwan (USDA-PCIT, 2019).

California Distribution: *Paratrichodorus minor* is widespread in California (Siddiqi et al., 1973; CDFA Pest Damage Record database)

California Interceptions: There are hundreds of interceptions of *Paratrichodorus* spp. on incoming nursery stock. Most were not speciated; its highly likely that *P. minor* is among them.

The risk *Paratrichodorus minor* would pose to California is evaluated below.

Consequences of Introduction:

- 1) **Climate/Host Interaction:** This nematode inhabits sub-tropical agricultural areas worldwide.

Evaluate if the pest would have suitable hosts and climate to establish in California.

Score: 2

- 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 *P. minor* is very large including important agronomic crops.

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:** This nematodes spreads with human activities and with infested planting materials such as potato tubers. It does not have any vectors but it is parthenogenic with a high reproductive potential.

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:** Reports of serious damage from this nematode are few. Notable exceptions are potatoes and sugarcane. However, under high population levels in residences, nurseries, and other small-area plantings, infestations could result in lowered crop yield. It is able to vector Tobacco Rattle Virus which also cause economic loss.

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

Economic Impact: A, 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: 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:** The impact of *P. minor* on natural environments is most likely not very significant as the species has been widespread in California for decades without causing apparent detriment to ecological balances and processes.

Environmental Impact: 1

- 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:

- **Low (1) causes none of the above to occur.**
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- 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 *Paratrichodorus minor*: Medium

Add up the total score and include it here. **11**

-Low = 5-8 points

-Medium = 9-12 points

-High = 13-15 points

- 6) Post Entry Distribution and Survey Information:** CDFA records show detections of *P. minor* in 20 counties, including those along the south and central coast, the Monterey Bay area, the San Francisco Bay area, the central valley and southern deserts. The most common hosts are grapes, plums and turfgrass.

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 introduction score minus the post entry distribution and survey information score:**

Final Score: Score of Consequences of Introduction – Score of Post Entry Distribution and Survey Information = 11-3=8

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Paratrichodorus minor* is C.**

References:

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Responsible Party:

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***Comment Period: 09/04/2019 through 10/19/2019**

***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 [plant.health\[@\]cdfa.ca.gov](mailto:plant.health[@]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.
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Proposed Pest Rating: C
