

California Pest Rating Proposal for
***Meloidogyne chitwoodi* Golden, O'Bannon, Santo & Finley, 1980**

Columbia root-knot nematode

Current Pest Rating: B

Proposed Pest Rating: B

Kingdom: Animalia; Phylum: Nematoda
Class: Secernentea Subclass: Diplogasteria
Order: Tylenchida; Superfamily: Tylenchoidea
Family: Heteroderidae; Subfamily: Meloidogyninae

Comment Period: 04/16/2020 through 05/31/2020

Initiating Event:

None

History & Status:

Background:

Meloidogyne chitwoodi was first described as a pathogen of potatoes in Washington in 1980. It is similar to *M. hapla*, the northern root-knot nematode, but its host range and morphology were different enough to describe it as a new species (Golden, O'Bannon, Santo and Finley, 1980). The common name of Columbia root-knot nematode was chosen because it was first observed in the drainage areas of the Columbia River that divides Oregon and Washington. It is not clear whether this is the true area of origin of this nematode or if it is actually from Europe. There are records that match *M. chitwoodi* from the Netherlands as early as the 1930s (EPPO, 2013).

HOSTS: According to the CABI/EPPO quarantine pest descriptions, hosts of *M. chitwoodi* are found in several plant families including crop plants and common weeds. Potatoes and tomatoes are good hosts, whereas barley, maize, oats, sugar beet, wheat and various Poaceae (grasses and weeds) are moderate hosts. Moderate to poor hosts occur in the Brassicaceae, Cucurbitaceae, Fabaceae, Lamiaceae, Liliaceae, Umbelliferae and Vitaceae.

HOST RACES: At least two races (race 1 and race 2) are distinguished in Pacific Northwest states.

Symptoms. *Meloidogyne chitwoodi* symptoms on plant roots can range from subtle to extreme. As a result of nematode feeding, large galls or "knots" can form throughout the root system of infected plants. As the density of nematodes increases, the number of galls per plant also will increase. Large numbers of nematodes attacking roots in close proximity also will result in larger galls. Carrot roots can undergo severe forking with galling predominantly found on lateral roots. On lettuce roots, root-knot nematode galls are beadlike. On grasses and onions, galls are usually small and barely noticeable.

On potatoes, symptoms caused by *M. chitwoodi* are not easily detected on the exterior of tubers and can variable between cultivars. Tubers may be heavily infected without externally visible symptoms. Galls may appear as small, raised swellings on the tuber surface above the developing nematodes. The galls may be concentrated on one area of the tuber or single galls may be scattered near eyes or lenticils. The internal tuber tissue below the gall can be necrotic and brown. Adult females can be visible just below the surface as glistening, white, pear-shaped bodies surrounded by a brownish layer of host tissue. Potato roots may also be infected but little or no galling occurs, even in heavy infestations (CABI- CPC, 2020; Mitkowski and Abawi, 2003; Agrios, 2005).

Severely affected plants can wilt and sometimes die because galled roots have a limited ability to absorb and transport water and nutrients. Plants also may exhibit nutrient deficiency symptoms because of their reduced ability to absorb and transport nutrients from the soil to their foliage. Stunting and reduced crop yields are common symptoms from root-knot nematodes (Agrios, 2005). Above ground symptoms usually appear on clusters of plants (foci). Because nematodes move slowly through the soil, infestations will gradually radiate outward from an initial point of infection. This can result in large foci of affected plants surrounded by seemingly unaffected plants.

Transmission: Adult males and the second-stage juveniles are vermiform (worm shaped) and able to swim short distances through the soil, or move longer distances with irrigation water. Females are pear-shaped, pearly-white and sedentary, partially embedded in plant roots or potato tubers (Nemaplex, 2010). As is the case with other species of *Meloidogyne*, the males of *M. chitwoodi* are thought to be largely functionless and reproduction is nearly always parthenogenetic. Cultivation and other practices that physically move soil and plants will rapidly spread root-knot nematodes (Agrios, 2005; Mitkowsik and Abawi, 2003)

Damage Potential: Severe infections result in reduced yields on numerous crops and can also affect consumer acceptance of vegetables like carrots and potatoes. Depending upon the crop affected and the severity of infection, these symptoms can often result in economic losses to growers. Significant potato crop damage in high organic matter soils at low densities has been reported in Modoc and Siskiyou counties (Westerdahl, 2019) and long-term integrated management tactics such as crop rotation, cultural controls, fumigation, and nematicides are necessary to prevent substantial devaluations due to tuber blemishes.

Meloidogyne chitwoodi reduces the market value of potatoes as a result of internal necrosis and external galling. Necrotic spots in the flesh of tubers of as little as 5% of a crop make it commercially

unacceptable. Overall yields of tubers are also reduced (Mitkowski and Abawi, 2003). This species is the major nematode pest of potatoes in the Pacific Northwest (Oregon, Washington, and Idaho) and in Northern California. The annual predicted loss in these areas is tens of millions of dollars if control measures were not applied (Santo, 1994).

Nematodes can have a negative effect on the health, quality, production, and maintenance of turfgrass on golf courses. Chaves and Torres (2000) reported the detection of *M. chitwoodi* on golf courses in Argentina. It was also found in a single sample from a golf course in San Luis Obispo (McClure et al., 2012)

Worldwide Distribution: Argentina, Belgium, France, Germany, Italy, Mexico, Mozambique, Netherlands, Portugal, South Africa, Sweden, Turkey, and United States (California, Washington, Oregon, Colorado, Idaho, Nevada, New Mexico, Texas, and Utah) (CABI-CPC).

Official Control: This nematode is on the USDA's harmful organism list for Argentina, Canada, Eurasian Customs Union, European Union, Holy See (Vatican City State), Monaco, New Zealand, Norway, San Marino, Serbia, Switzerland, Thailand, and Uruguay.

California Distribution: Inyo, Modoc, San Luis Obispo, Siskiyou, and Yolo counties

California Interceptions: none

The risk *Meloidogyne chitwoodi* would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** *Meloidogyne chitwoodi* is well adapted to the cooler parts of California where potatoes are produced and has many hosts that grow in temperate climates.

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 is large including agronomic crops in multiple 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:** *Meloidogyne chitwoodi* has high potential for reproduction. A single female may produce several hundred to over one thousand eggs in an egg mass, similar to other *Meloidogyne* species. Dispersal is mainly passive through the movement of infected roots, planting stock, infested soil, and irrigation water. The potential for spread is high.

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:** This nematode reduces yields as it interferes with the normal function of the plant root system, which becomes impaired by root galls. It is especially damaging to potatoes as it causes loss of yield and loss of quality to the underground plant parts. It can also damage high-value turf grasses. It can be moved with irrigation water.

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:** *Meloidogyne chitwoodi* has a large host range that could include native grasses. Individual fields can have very high nematode populations that prevent planting (Chitambar et al., 2018).

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 *Meloidogyne chitwoodi* is 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'. *Meloidogyne chitwoodi* is established in northeastern California where most of the potatoes in the state are produced.

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:

None.

Conclusion and Rating Justification:

Based on the evidence provided above **the proposed rating for *Meloidogyne chitwoodi* is B**

References:

Agrios, G. N. 2005. Plant Pathology, 5th Edition. Elsevier Academic Press. 922 pg

CABI Crop Production Compendium 2020. *Meloidogyne chitwoodi*. Datasheet 33235. Accessed 3/11/2020

Chaves E, Torres MS, 2000. Nematode fauna associated with golf courses in the south-eastern region of the Buenos Aires province. Revista de la Facultad de Agronomía (Universidad de Buenos Aires), 20(3):379-386.

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.

EPPO Global Database. 2020. <https://gd.eppo.int/taxon/MELGCH> Accessed 3/11/2020

European and Mediterranean Plant Protection Organization Bulletin PM 9/17 (1) *Meloidogyne chitwoodi* and *Meloidogyne fallax*. OEPP/EPPO Bulletin (2013) 43 (3), 527–533

Golden, A. M., O'Bannon, J. H, Santo, G. S. and Finley, A. M. 1980. Description and SEM Observations of *Meloidogyne chitwoodi* n. sp. (Meloidogynidae), a Root-knot Nematode on Potato in the Pacific Northwest. Journal of Nematology, Volume 12, No. 4

McClure, M. A., Nischwitz, C., Skantar, A. M., Schmitt, M. E., and Subbotin, S. A. 2012. Root-knot nematodes in golf course greens of the western United States. Plant Dis. 96:635-647

Mitkowski, N.A. and G.S. Abawi. 2003. Root-knot nematodes. The Plant Health Instructor. DOI:10.1094/PHI-I-2003-0917-01

Nemaplex UC Davis Nemabase 2010. *Meloidogyne chitwoodi*. Accessed 3/11/2020
<http://nemaplex.ucdavis.edu/Nemabase2010>

Santo G, S. 1994. Biology and management of root-knot nematodes on potato in the Pacific Northwest. In: Zehner, G. W., Powelson, M. L., Jansson, R. K., Raman, K. V. eds. Advances in potato pest biology and management. St. Paul, USA: APS Press. pp. 193-201

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PEXD) Harmful Organisms Database Report. *Meloidogyne chitwoodi*. Accessed 3/11/2020

Westerdahl, B. B. 2019. UC IPM Pest Management Guidelines: Potato Nematodes. UC ANR Publication 3463

Responsible Party:

Heather J. Scheck, Primary Plant Pathologist/Nematologist, California Department of Food and Agriculture, 204 West Oak Ave, Lompoc, CA. Phone: 805-736-8050, [permits\[@\]cdfa.ca.gov](mailto:permits[@]cdfa.ca.gov).

***Comment Period: 04/16/2020 through 05/31/2020**

***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](mailto: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: B
