

CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Heterodera latipons Franklin, 1969

Mediterranean cereal cyst nematode

Pest Rating: A

Domain: Eukaryota, Kingdom: Metazoa, Phylum: Nematoda, Class: Secernentea Order: Tylenchida, Family: Heteroderidae

Comment Period: 01/31/2025 through 03/17/2025

Initiating Event:

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

History & Status:

Background:

Cyst nematodes, including those in the genus *Heterodera*, have a wide distribution and impact on the world's key agricultural regions. The persistent dormant stage of cyst nematodes, resilient lemon-shaped cysts filled with eggs, makes *Heterodera* spp. particularly threatening as invasive species.

Schmidt (1871) established the genus *Heterodera* from Greek heteros = other, and deros = skin, the type and oldest genus for the family Heteroderidae, for those species having sexual dimorphism in which the mature females become swollen, while the males remain vermiform. *Heterodera latipons* is a sedentary endoparasite. After emerging from the egg, the J2s penetrate feeder roots, become sedentary, swell, and establish a permanent feeding site in the root stele. The posterior portion of the body of the adult female protrudes from the roots. The female dies and becomes a cyst containing 500-600 embryonated eggs. Males are sedentary in the J3 and become active after reaching maturity (Subbotin et al., 2010).



Cereal cyst nematodes are important pests that limit the production of small-grain cereals. Extensive nematode feeding reduces root mass, removes plant nutrients, and can result in greatly reduced crop yields. Cyst nematodes are biotrophic sedentary endoparasites that can establish prolonged parasitic interactions with their hosts. They are among the most challenging nematodes to control because the "cyst" is the body of a dead female nematode containing hundreds of eggs. Cysts with viable eggs can persist in dry soil for years, where they remain relatively resistant to chemical and biological stresses. Cysts are easily moved with soil. There are many closely related cereal cyst nematode species that are found in most regions of the world where small grains are grown.

Heterodera latipons was described by Franklin (1969) based on material from the roots of wheat, barley, oats, and rye from Israel, Libya, and Bulgaria. *Heterodera latipons* belongs to the Avenae group within *Heterodera* and closely resembles *H. hordecalis* and *H. turcomanica*. Today it is widespread in the eastern Mediterranean area, North Africa, the Near East, and Japan. It is often found in mixed populations with *H. avenae* in cereal cropping systems. Verifications of mixed populations and/or detection of rare species require advanced identification techniques, including morphological biometrics and biochemical or molecular methodologies (Handoo and Subbotin 2018).

Hosts: Avena sativa (oats), *Cicer arietinum* (chickpea), *Elytrigia repens* (couch grass), *Hordeum vulgare* (barley), *Phalaris minor* (small canary grass), *P. paradoxa* (awned canary-grass), *Secale cereale* (rye), *Triticum aestivum* (wheat), *T. longissimum*, *T. tauschii*, *T. turgidum* subsp. *durum*, *T*, *umbellulatum*, *and T. variabile* (CABI, 2025; Mokabli et al., 2002; Nemaplex 2010; Mor and Sturhan, 2002; Subbotin et al., 2000).

Symptoms: There are no specific above-ground symptoms in plants that can be used to diagnose infection by cyst nematodes. Plants with severely infested roots are stunted, senesce earlier, and have fewer flowers and pods. The pods may be empty with no seeds produced. The severity of these symptoms is correlated with the population density of the nematode in the soil. Generally, infestations become obvious from early flowering onwards. Symptoms include characteristics of a plant with root damage and impaired water and nutrient uptake, including stunting with leaves appearing yellowish red and then turning necrotic in the older parts. In fields, poor and patchy plant growth is apparent in small, circular areas that get larger over years or with soil cultivation if the nematodes are spread (Chitambar et al., 2018).

Transmission: This nematode moves with infected nursery stock, infected plants, soil contaminated with cysts, seeds contaminated with cysts, cysts moving with wind, nematode-infested soil, or irrigation water.

Damage Potential: In Cyprus, barley yield losses of up to 50% have been documented (Philis, 1988). The nematode in Syria reduces barley and durum wheat yields by an average of 20% and 30%, respectively. More damage has been reported when there is water stress (Scholz, 2001). Furthermore, fields that are simultaneously infested with *H. latipons* and the fungus *Bipolaris sorokiniana*, the causative agent of barley's common root rot and seedling blight, sustains more damage; the nematode's presence makes the fungus more aggressive (Scholz, 2001).



<u>Worldwide Distribution</u>: Africa: Algeria, Libya, Morocco, Tunisia; Asia: Armenia, Iran, Israel, Japan, Jordan, Lebanon, Kazakhstan, Syria, Tajikistan, Turkey, Turkmenistan, Uzbekistan; Europe: Bulgaria, Cyprus, Czechia, Estonia, France, Greece, Italy, Poland, Russia, Spain, United Kingdom, Ukraine; Africa: Libya, Tunisia (CABI, 2025; Subbotin et al., 2010).

<u>Official Control</u>: Heterodera latipons is on the EPPO's A2 list for Jordan and is a regulated quarantine pest in the United States (EPPO, 2024). It is on the USDA PCIT's harmful organisms list for Jordan (USDA PCIT, 2025).

California Distribution: none

California Interceptions: none

The risk that *Heterodera latipons* would pose to California is evaluated below.

Consequences of Introduction:

1) Climate/Host Interaction: Cereal cyst nematodes have been found in diverse climates around the world and it is likely to become established wherever suitable hosts can grow. Wheat is the predominant small grain crop in California, grown on over 500,000 acres, with small grains serving as important rotational crops (UC Agronomy Research and Information Center: Small Grains; Chitambar et al., 2018).

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: The host range includes several genera of grasses

Evaluate the host range of the pest.

Score: 2

- 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 nematode has only one generation per year. Tens to hundreds of eggs can be produced while the females are alive, with an additional ten to hundreds retained within her cyst after her death. For long and short-distance dispersal these nematodes are dependent on



movements of cysts, cyst-infested soils, and cyst-infested seed lots. It spreads slowly in undisturbed sites but spreads easily with normal farming practices including flood irrigation and soil cultivation.

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: Infestations of the cereal cyst nematode impact small grain production resulting in direct plant loss and shriveled, unmarketable grains. Cysts in soil could be spread by movements of soil and irrigation water requiring changes in normal cultural practices. It is also a quarantine pest.

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

Economic Impact: A, B, C, D, 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: Infestations of the Mediterranean cereal cyst nematode could significantly affect other hosts in the family Poaceae outside of agricultural crops, potentially including native species. This nematode can significantly impact cultural practices.

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

Environmental Impact: A, 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: 3

- 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 Heterodera latipons: 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 "not established".

Score: 0

-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 = 13

Uncertainty:

Accurate species identification is necessary for determining pest management options and for monitoring and surveillance activities to establish distribution, movement, and quarantine measures. The ability to analyze DNA has progressively led to more advanced and accurate methods of species identification and this is likely to continue to improve in the future (Chitambar et al., 2018).

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for Heterodera latipons is A.



References:

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

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Franklin, M.T., 1969. *Heterodera latipons* n. sp., a cereal cyst nematode from the Mediterranean region. Nematologica 15, 535-542.

Handoo, Z.A. and Subbotin, S.A., 2018. Taxonomy, identification and principal species. In Cyst nematodes (pp. 365-398). Wallingford UK: CAB International.

Mokabli, A., Valette, S., Gauthier, J.P. and Rivoal, R., 2002. Variation in virulence of cereal cyst nematode populations from North Africa and Asia. Nematology, 4(4), pp.521-525.

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Subbotin, S., Waeyenberge, L. and Moens, M., 2000. Identification of cyst forming nematodes of the genus *Heterodera* (Nematoda: Heteroderidae) based on the ribosomal DNA-RFLP. Nematology, 2(2), pp.153-164.

Subbotin, S.A., Mundo-Ocampo, M. and Baldwin, J.G., 2010. Systematics of cyst nematodes (Nematoda: Heteroderinae), part B (Vol. 8). Brill.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report *Heterodera latipons*. Accessed 1/10/2025.

Responsible Party:

Heather J. Martin, Primary Plant Pathologist/Nematologist, CDFA/PHPPS ECOPERS, 1220 N St Rm 221, Sacramento, CA 95814 Phone: (916) 654-1017, permits[@]cdfa.ca.gov.

*Comment Period: 01/31/2025 through 03/17/2025

***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.

Pest Rating: A