

California Pest Rating Proposal for *Heterodera ciceri* Vovlas, Greco & Di Vito, 1985

Chickpea cyst nematode

Current Pest Rating: none

Proposed Pest Rating: A

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

Comment Period: 05/17/2024 through 07/01/2024

Initiating Event:

This pathogen has not been through the pest rating process. The risk to California from *Heterodera ciceri* 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. *Heterodera ciceri* is listed as a National Priority Pest for survey in the United States for 2024 (Cooperative Agricultural Pest Survey (CAPS) program, Plant Protection Act 7721).

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 ciceri* 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. Adult female and the posterior portions of their bodies protrude from the root. The female dies and becomes a cyst, each containing 500-600 embryonated eggs. Males are sedentary in the J3 and become active after reaching maturity (Subbotin et al., 2010).

The first report of the chickpea cyst nematode seems to be from Bellar and Kebabeh (1983), who found lentil fields in Syria infested with a cyst nematode. Greco et al. (1984) collected it from chickpea roots and soil in Syria, and it was later described and named by Vovlas et al. (1985). *Heterodera ciceri* belongs to the Schachtii group within *Heterodera*. It resembles *H. trifolii*, *H. rosii*, and *H. daverti* in its general morphology. It differs from *H. trifolii* by the presence of males, and the two species have different host ranges (none of the *Trifolium* spp. tested were a host for *H. ciceri*) (Subbotin et al., 2010).

Hosts: *Cicer arietinum* (chickpea), *Lathyrus sativus* (grass pea), *Lens culinaris*, *Lens culinaris* subsp. *culinaris* (lentil), *Medicago rigidula* (annual medic), *Medicago sativa* (alfalfa), *Phaseolus vulgaris* (common bean), and *Pisum sativum* (pea) (CABI, 2024; Vovlas et al., 1985).

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).

When there are heavy infestations of *H. ciceri*, small necrotic spots (2-3 mm long and 0.5 mm wide) on chickpea roots, caused by juvenile penetration, appear longitudinally on the roots. From the center of the spots, the fourth stage juvenile and the adult stage of the nematode can sometimes be seen protruding. The more obvious symptoms on the roots are the presence of white and yellow females as they become cysts, visible at the flowering to the early podding stage of the plants, and brown cysts full of eggs on older plants. Rhizobium nodulation is reduced on heavily infested roots (CABI, 2024).

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: This nematode survives in the soil as a cyst in the absence of host plants or during unsuitable environmental conditions. Under field conditions, it is inferred that there is only one generation of the nematode during the growing season of spring-sown chickpeas (Kaloshian et al., 1986).

The most significant damage documented from *H. ciceri* is on chickpeas in Syria, where complete crop failure has been described. Severe symptoms have been seen sporadically on chickpeas in Jordan, Lebanon, and Turkey. Lentils are less severely affected by this nematode. Seed quality is also affected by nematode attack since the seed protein content of lentils and chickpeas can be reduced by 10 and 25%, respectively, at large nematode population densities (Greco et al., 1988).

Worldwide Distribution: Asia: *Jordan, Lebanon, Syria, and Turkey.*

Official Control: *Heterodera ciceri* is on the EPPO's A1 list for Brazil (EPPO, 2024). It is on the USDA PCIT's harmful organisms list for Brazil (USDA PCIT 2024).

California Distribution: none

California Interceptions: none

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

Consequences of Introduction:

- 1) **Climate/Host Interaction:** This nematode is likely to establish 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:** The host range includes plants in several genera.

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. 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:** Complete crop failure has been reported on chickpeas. For other hosts, significant yield losses have been reported. It is a quarantine pest in Brazil.

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

Economic Impact: A, 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 can significantly impact cultural practices.

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 *Heterodera ciceri*:

Add up the total score and include it here. 12

- 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 = 12

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 ciceri* is **A**.

References:

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Responsible Party:

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***Comment Period: 05/17/2024 through 07/01/2024**

*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.
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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: A
