CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

California Pest Rating Profile for

Meloidogyne graminicola Golden & Birchfield 1965
Rice root-knot nematode

Pest Rating: A

Kingdom: Animalia, Phylum: Nematoda,
Class: Secernentea, Order: Rhabidita
Family: Meloidogynidae

Comment Period: 10/17/2025 through 12/01/2025

Initiating Event:

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

History & Status:

Background:

California leads the nation in rice production, and rice is one of this state's top commodities. In 2023, it ranked #12 in commodities produced in 2023 with a value close to $100M, growing on approximately 500,000 acres (https://www.cdfa.ca.gov/Statistics/PDFs/2023-2024_california_agricultural_statistics_review.pdf). Ninety-five percent of rice production is concentrated in the Sacramento Valley, where there are excellent conditions for growing high-yield, medium-grain, japonica rice varieties.

Meloidogyne spp. are obligate, sedentary endoparasites that feed within host plant roots. *Meloidogyne* is a name of Greek origin, meaning "apple-shaped female." Adult females, globose and sedentary, are found embedded in their host's roots. They produce eggs within a mass either on the surface of, or within roots. *Meloidogyne graminicola* generally reproduces by meiotic parthenogenesis, meaning that males are not necessary and viable eggs can be produced by females alone in the absence of fertilization (Triantaphyllou, 1969).

Eggs hatch in the soil, and vermiform juveniles swim to new roots. The first-stage juvenile develops within the egg and molts to develop into the second stage. The second-stage juveniles (J2) are the infective stage that hatch from eggs and migrate in the rhizosphere soil to host roots. The J2s penetrate the host roots and establish a specialized feeding site that is formed at the head end of the nematode in response to its feeding. They become sedentary while feeding at the specialized site, increasing in size, and undergoing two more molts and non-feeding stages before developing into mature adult females or males and completing the life cycle (Perry and Moens, 2013; Mitkowski and Abawi, 2003; Sasser and Carter, 1985).

The feeding site inside the root is a group of plant cells, known as "giant cells", created when the nematode injects secretory proteins that stimulate changes within the parasitized cells. The secretory proteins cause the plant cells to rapidly become multinucleate when division occurs without cell wall formation. Giant cells can be very large and act as significant nutrient sinks, producing large amounts of proteins that the nematodes can use for growth. Increases in the production of plant growth regulators from nematode feeding also play a role in this increase in cell size and division. Root cells next to the giant cells enlarge and divide rapidly, resulting in gall formation. Females remain in the galled roots, and eggs are laid in a gelatinous matrix inside the root cortex. After hatching, the J2 can be released into the soil or stay inside the gall to migrate and establish new feeding sites. This is an unusual way of laying eggs and is an advantage that allows this nematode to complete its life cycle without leaving the host. Under continuously flooded conditions that can occur with rice production, egg masses can remain viable for over a year, allowing them to attack root tips until fields are drained (Bridge and Page, 1982).

Meloidogyne graminicola is a major threat to rice, particularly in South and Southeast Asia, where it is an important pathogen of irrigated and rainfed rice. It was first isolated in India (Israel et al., 1963) and formally described from the roots of barnyard grass (*Echinochloa colona*) in Louisiana (Golden and Birchfield, 1965).

Hosts: The main economically important host is rice (*Oryza sativa*), including irrigated and rainfed rice, lowland and upland rice, and deepwater rice. It has a wide host range with cultivated and wild plants belonging to different families, mainly Poaceae but also Asteraceae, Cucurbitaceae, Fabaceae, and Solanaceae (MacGowan and Langdon, 1989; EPPO, 2025; Nemaplex, 2010). Host status can depend on the host plant varieties and on the *M. graminicola* biotypes.

Symptoms: Hyperplasia and hypertrophy of plant cells accompany the formation of macroscopic galls on the root systems that are the result of nematode feeding and reproduction. These galls have a characteristic hook shape and are near the root tips. Galls cause a profuse proliferation of very slender and fluffy roots. This disruption of water and nutrient transport from the roots to above-ground parts results in a loss of plant vigor, poor growth, and a yield reduction (Soriano et al., 2000). Above-ground symptoms include patches in the fields, stunted growth, chlorotic leaves, poor tillering, early flowering and maturation, and few grains in the panicles. These symptoms are non-specific, resembling water or nutritional deficiencies that depend on the time of infection, age of the plants, and environmental conditions (Mantelin et al., 2017).

Transmission: Infected roots, bare root propagative material, and anything that moves soil, including containers, tools, equipment, machinery, irrigation water, and people, can move this nematode. Long-distance spread is with contaminated nursery stock (Chitambar et al., 2018).

Damage Potential: Meloidogyne graminicola is considered a major threat to rice, as yield losses in some cultivars and situations can reach up to 70% (Plowright and Bridge, 1990). Losses occur in nurseries (Soriano and Reversat, 2003) and in flooded seeded rice fields, where infected seedlings fail to develop, leaving patches of open water (Bridge and Page, 1982). Losses often correlate with nematode population densities and affected by the method of seeding and irrigation (Khan and Ahamad, 2020).

Worldwide Distribution: Africa: *Madagascar, South Africa*; America: *Brazil, Colombia, Ecuador, United States of America* (Florida, Georgia, Indiana, Louisiana, Mississippi); Asia: *Bangladesh, Cambodia, China, India, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Vietnam*; Europe*: Italy* (EPPO, 2025).

Official Control*: Meloidogyne graminicola* is on the EPPO's A1 list for Iran, A2 list for European Plant Protection Organization, and is a quarantine pest in Morocco (EPPO, 2025). It is on the USDA PCIT's harmful organisms list for El Salvador, the European Union, Indonesia, Morocco, Panama, the Republic of Korea, and Timor-Leste (USDA-PCIT, 2025).

California Distribution: none

California Interceptions: none

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

Consequences of Introduction:

1) **Climate/Host Interaction:** This nematode is likely to survive 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 exceeds 150 species of plants

   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:** A single female nematode can produce hundreds of eggs in her lifetime. Root-knot nematodes do not have a high dispersal potential unless moved by people. They can be moved accidentally with infected plants, soil, and water.

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:** In high numbers, these nematodes are damaging to plant growth and crop yield. They are moved with water, which is critical for rice production.

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 is a polyphagous nematode that could attack native plants.

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

Environmental Impact: A

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 graminicola:* 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 is 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 consequence 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: none

Conclusion and Rating Justification:

Based on the evidence provided above, the proposed rating for ***Meloidogyne graminicola*** **is A.**

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Responsible Party:

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***Comment Period: 10/17/2025 through 12/01/2025**

***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