California Pest Rating Proposal for

Hoplolaimus galeatus (Cobb, 1913) Filipjev & Schuurmans Stekh
Lance nematode

Current Pest Rating: Q

Proposed Pest Rating: A

Kingdom: Animalia, Phylum: Nematoda,
Class: Secernentea, Subclass: Diplogasteria,
Order: Tylenchida, Superfamily: Tylenchoidea,
Family: Hoplolaimidae, Subfamily: Hoplolaiminae

Comment Period: 04/12/2022 through 05/27/2022

Initiating Event:

This pathogen has not been through the pest rating system. The risk to California from *Hoplolaimus galeatus* is described herein and a permanent rating is proposed.

History & Status:

Background:

Lance nematodes (*Hoplolaimus* spp.) can be migratory ectoparasites, semi-endoparasites and endoparasites that feed on the roots of a wide range of plants, some of which are agronomic crops (Fortuner, 1987). *Hoplolaimus galeatus* was first found by Nathan Cobb in 1913 and was originally named *Nemochus galeatus*. In 1935 *N. galeatus* was reclassified as *H. galeatus* and described in detail by Thorne (Krall, 1985). They are vermiform, straight, and relatively large (1-2 mm) with a distinct cephalic region and massive well-developed stylet. They are amphimictic (reproduce sexually with males and females), and eggs are not deposited in a gelatinous matrix.

Lance nematodes are the second-most damaging nematode pest of turfgrass in Florida (after sting nematodes), especially on St. Augustine grass. Lance nematodes cause damage on Bermudagrass putting greens in the southeast, and they are commonly found causing damage on golf courses. While sting nematodes are easier to eliminate with pesticides, lance nematodes have a considerably greater ability to disperse, and are much more difficult to control (Crow and Brammer, 2001; Zeng et al., 2012).

Hosts: Agropyron smithii (western wheatgrass), *Agrostis canina* (velvet bentgrass), *A. palustris* (creeping bentgrass), *A. stolonifera* (creeping bentgrass), *Alysicarpus ovalifolius* (alyce clover), *A. vaginalis* (alyce clover), *Andromeda* sp. (bog rosemary), *Antirrhinum* sp. (snapdragon), *Armoracia rusticana* (horseradish), *Bambusa* (bamboo), *Brassica oleracea* (broccoli), *Borrichia frutescens* (sea-oxeye), *Capsicum annuum* (pepper*), Chamaecyparis* sp., *Citrus* sp., *Cucurbita pepo* (squash), *Cynodon dactylon* (bermuda grass), *Dactylis glomerata* (orchardgrass), *Digitaria decumbens* (pangola grass), *D. sanguinalis* (large crabgrass), *Diospyros kaki* (persimmon), *Elymus wawawaiensis* (Snake River wheatgrass), *Eremochloa ophiuroides* (centipedegrass), *Festuca elatior* (tall fescue), *Glycine max* (soyabean), *Gossypium hirsutum* (upland cotton), *Hordeum vulgare* (barley), *Ilex crenata* (Japanese holly), *Lespedeza cuneata* (Chinese lespedeza), *L. stipulacea* (Korean Lespedeza), *Lolium multiflorum* (Italian ryegrass), *Medicago sativa* (alfalfa), *Oryza sativa* (rice), *Paspalum vaginatum* (seashore paspalum), *Phaseolus vulgaris* (common bean), *Picea glauca* (white spruce), *Pimpinella anisum* (anise), *Pinus clausa* (sand pine), *P. cubensis* (Cuban pine), *P. echinata* (shortleaf pine), *P. edulis* (pinyon pine), *P. elliottiee* (slash pine), *P. nigra* (European black pine), *P. palustris* (longleaf pine), *P. ponderosa* (ponderosa pine), *P. rigida* (pitch pine), *P. serotina* (pond pine), *P. strobus* (eastern white pine), *P. taeda* (loblolly pine), *P. virginiana* (swamp oak), *Platanus occidentalis* (American sycamore), *Poa annua* (annual meadowgrass), *Populus heterophylla* (swamp cottonwood), *Quercus palustris* (pin oak), *Quercus rubra* (red oak), *Saccharum officinarum* (sugarcane), *Sansevieria trifasciata* (snake plant), *Solanum lycopersicum* (tomato), *Sorghum bicolor* (sudangrass), *Stenotaphrum secundatum* (St. Augustinegrass), *Trifolium pratense* (red clover), *Trifolium repens* (white clover), *Triticum aestivum* (wheat), *Zea mays* (maize), *Zoysia matrella* (Manilagrass) (Nemaplex).

Symptoms: Damage from root feeding may appear as yellowing, dead, or unproductive grass areas, and is similar to the damage caused by chinch bugs or some fungal pathogens. Drought or nutrient deficit can also look similar. A comprehensive examination of the roots of a lance nematode-infested lawns will typically reveal extensive root damage. Root tips look to be dead, and small feeder roots have vanished. If new roots have started to sprout, they are frequently also harmed. The yellow or dying areas of grass are caused by root system injury (Crow and Brammer, 2001).

Transmission: The main mode of long- and short-distance spread is through artificial means: movement of nematode-contaminated soil, infected transplants or nursery stock, run-off and irrigation water, cultivation tools, and equipment, and any human activity that can move soils from infested to noninfested sites (Chitambar et al., 2018).

Damage Potential: Hoplolaimus galeatus attaches itself by embedding its anterior end, or sometimes its entire body, inside the roots. It damages the root system as it feeds, causing the dead roots' outer layers to slough away. This type of damage, however, is not diagnostic of lance nematodes, and the above ground symptoms can be confused with symptoms of fungal root rot. Infected cotton plants grown with *H. galeatus* under conditions of limited moisture are susceptible to stunting, yellowing, and defoliation. In cotton, lance nematodes are primarily endoparasitic, causing considerable cortical damage during penetration (Donald et al., 2013).

Infected pine seedlings fed upon by *H. galeatus* are devoid of healthy lateral roots and mycorrhizae. High nematode population levels can reduce root weight of *Pinus* by 54% (Pine seedlings can suffer 50% mortality (Ruehle, 1973).

Plants may also be harmed indirectly by nematodes. When lance nematodes feed on the roots, they create wounds that microorganisms in the soil can enter, causing the root to decay. These microbes are usually present in the soil, but they do not cause damage until the lance nematode offers easy access to the interior of the roots. After 75 days, peach seedlings growing in soil infected with *Fusarium oxysporum* and *H. galeatus* were markedly smaller than controls or combinations of fungus and other nematode species tested (Wehunt & Weaver, 1972).

Worldwide Distribution: Canada, Central and South America, India, Pakistan, Sumatra, Tanzania. In the United States, it can be found along the East Coast from New England to Florida and the Mississippi River basin from Minnesota and Wisconsin to Louisiana, as well as in Colorado, and Texas. (CABI-CPC, 2022).

Official Control: *Hoplolaimus galeatus* is on the USDA PCIT's harmful organism list for Colombia, Honduras, India, Korea, Republic of and Mexico (USDA, 2022). It is on the EPPO's A1 list for Argentina (EPPO, 2022).

California Distribution: none

California Interceptions: Interceptions of this nematode have been made multiple times at border stations from plants with soil from Florida.

The risk *Hoplolaimus galeatus* would pose to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** This nematode is established across a range of climates and soil types in other places, it would likely survive in California 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 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 many grasses and woody 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:** This nematode produces large numbers of eggs that are deposited into the soil.

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 is a serious pest of turfgrass, cotton and pine. It is very difficult to eradicate. It can move with water and soil and is a quarantine pest for other countries.

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

Economic Impact: A, B, C, G
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: 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:** With a large host range of plants in diverse families, it is likely that this nematode will threaten non-agricultural areas. It could also be a serious problem for residential lawns and landscapes

Evaluate the environmental impact of the pest to 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 *Hoplolaimus galeatus:* High

Add up the total score and include it here. **15**
-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 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* ***= 15***

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Hoplolaimus galeatus* is A.

References:

CABI Crop Production Compendium 2022. https://www.cabi.org/cpc/datasheet/ Accessed 8/9/22

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.

Crow, W. T. and Brammer, A. S. 2001. Featured Creatures: Lance Nematode. FDACS/DPI https://entnemdept.ufl.edu/creatures/nematode/lance_nematode.htm#imp

Donald, P.A., Holguin, C.M. and Agudelo, P.A., 2013. First report of lance nematode (*Hoplolaimus magnistylus*) on corn, soybean, and cotton in Tennessee. Plant Disease, 97(10), pp.1389-1389.

EPPO Global Database. 2022. *Hoplolaimus galeatus* https://gd.eppo.int/taxon/HOLLGA Accessed 3/4/22

Fortuner, R., 1987. A reappraisal of Tylenchina (Nemata). 8. The family Hoplolaimidae Filip'ev, 1934. Revue de Nématologie, 10(2), pp.219-232.

Krall, E. L. 1985. Root Parasitic Nematodes Family Hoplolaimidae. Oxonian Press Pvt. Ltd, New dehli, pg 96

Nemaplex UC Davis Nemabase 2010. *Meloidogyne hapla*. Accessed 11/14/21

Ruehle, J.L., 1973. Nematodes and forest trees--types of damage to tree roots. Annual review of Phytopathology, 11(1), pp.99-118.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. Alfalfa mosaic virus. Accessed 2/26/2022

Wehunt, E.J. and Weaver, D.J., 1972. Effect of nematodes and *Fusarium oxysporum* on the growth of peach seedlings in the greenhouse. Journal of nematology.

Zeng, Y., Ye, W., Martin, S.B., Martin, M. and Tredway, L., 2012. Diversity and occurrence of plant-parasitic nematodes associated with golf course turfgrasses in North and South Carolina, USA. Journal of Nematology, 44(4), p.337.

Responsible Party:

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

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

***Comment Period: 04/12/2022 through 05/27/2022**

***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.

Proposed Pest Rating: A
