

California Pest Rating Proposal for *Hemicriconemoides* spp. Chitwood & Birchfield, 1957

Sheathoid nematodes

Current Pest Rating: D

Proposed Pest Rating: C

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

Comment Period: 10/27/2021 through 12/11/2021

Initiating Event:

During the 1950s and 1960s, several genera of plant parasitic nematodes were given a 'D' rating in California as they were regarded as parasites, predators, or organisms of little or no economic importance that did not require State-enforced regulatory action. However, these nematode species were inaccurately assigned a 'D' rating as most, if not all, are plant parasitic and therefore capable of damaging plant production and causing significant economic losses especially at the county and local residential/grower level. Furthermore, the detection of plant parasitic nematodes in nursery stock may be an indication of contamination in violation of the State's standard of pest cleanliness required for nurseries. *Hemicriconemoides* spp. (sheathoid nematodes) were originally rated 'D'. The risk of infestation and permanent rating of this genus is re-assessed here.

History & Status:

Background: Generally, pest risk assessments and assignment of pest ratings are conducted at the species level and not at the genus level, primarily due to differing pest biologies, geographical distributions, host ranges, damage potentials, and risk mitigating requirements. However, an exception to this rule is made here for the genus *Hemicriconemoides*, largely because of historical practice. Over the past several decades, the nematodes in the genus *Hemicriconemoides* were seldom differentiated to species level by CDFA nematologists mainly due to 1) the common occurrence and wide distribution of important member species within California, 2) no state-enforced regulatory action required

subsequent to their detection, and 3) prioritizing diagnosis of other nematode species in other genera considered to be of greater economic importance than those belonging to *Hemicriconemoides*.

Sheathoid nematodes are migratory ectoparasites found mainly in warm climates that feed on various agricultural crops and fruit trees. The genus *Hemicriconemoides* was created to include those species that didn't fit well into *Criconemoides* Taylor, 1936 or *Hemicycliophora* de Man, 1921. Their common name is derived from the morphology of the female, whose body is covered by a loose outer cuticular sheath, which is attached to her body at the head and vulva. Males are known in this genus but the characteristic cuticular sheath is absent. Juveniles have a single cuticle, ornamented by rows of scales and spines. The type species is *Hemicriconemoides wessonii* Chitwood and Birchfield, 1957 (Goodey, 1963), originally collected from Florida on *Myrica cerifera* (southern wax myrtle) (Dasgupta et al., 1969).

The genus *Hemicriconemoides* includes at least 52 species (Geraert, 2010; Van den Berg et al., 2014). The identification of these nematodes with morphological characters is challenging. Around the world, sheathoid nematodes are commonly found in cultivated and uncultivated lands in association with a wide range of plants and it is not unusual to find two or more species co-occurring. Warm temperatures, flooding, and overwatering favor an increase of sheathoid nematode population levels (Inserra et al., 2014).

Sheathoid nematodes have multiple developmental stages that consist of egg, four juvenile stages (J1-J4) without a sheath and adults, both females and male. Samples of field soil from grapevines in Davis, California yielded few or no males, and for all stages in test pots, females were far more common than males (Chang and Raski, 1972). Males have a degenerated esophagus and do not feed. Juveniles and females feed on the roots. In general, sheathoid nematodes are obligate migratory ectoparasites (Whitlock and Steele, 1960). Females of *H. strictathecatus* in Florida have semiendoparasitic habits; they are found partially embedded with the anterior portion of their body inside the root to feed on cortical cell tissue near the root tip. These females remained attached to the root even after the removal of the soil particles that coated the root (Inserra et al., 2014).

Hosts: Many species are reported from trees and hardwood forests including: *Alnus* spp. (alder), *Ammophila arenaria* (European beach grass), *Anacardium occidentale* (cashew), *Andropogon gayanus* (bluestem), *Arctostaphylos* spp. (manzanita), *Areca catechu* (betel nut), *Artabotrys hexapetalus* (climbing ilang-ilang), *Artocarpus heterophyllus* (jackfruit), *A. lakoocha* (monkey jack), *Avena sativa* (oat), *Axonopus compressus* (carpet grass), *Bambusa arundinacea* (giant thorny bamboo), *Bambusa* spp. (bamboo), *Brachiaria mutica* (para grass), *Camellia grijsii* (camellia), *C. sasanqua* (camellia), *C. sinensis* (tea), *Camellia* spp. (camellia), *Carex kobomugi* (Japanese sedge), *Carica papaya* (papaya), *Carya glabra* (pignut), *Carya* spp. (hickory), *Ceanothus* spp. (redroot), *Cicer arietinum* (chickpea), *Citrullus lanatus* (watermelon), *Citrus aurantiifolia* (lime), *C. limon* (lemon), *C. maxima* (pummelo), *C. reticulata* (mandarin orange), *C. sinensis* (sweet orange), *Citrus* sp. (citrus), *C. X paradisi* (grapefruit), *Cleome gynandra* (spider wisp), *Cocos nucifera* (coconut), *Cunninghamia lanceolata* (China fir), *Cynodon dactylon* (Bermuda grass), *Eragrostis minor* (eragrostis), *Escallonia* spp. (escallonia), *Feronia limonia* (wood apple), *Grewia asiatica* (grewia), *Hydrangea* spp. (hydrangea), *Ischaemum antheophoroides*

(*ischaemum*), *Juglans* spp. (walnut), *Justicia prostrata* (water willow), *Largestroemia indica* (crape myrtle), *Ligustrum quihoui* (waxleaf privet), *Liquidambar styraciflua* (sweet gum), *Litchi chinensis* (lychee), *Macadamia* spp. (macadamia), *Malpighia glabra* (malpighia), *M. puniceifolia* (malpighia), *Malus sylvestris* (applewood), *Mangifera indica* (mango), *Manilkara zapota* (sapodilla), *Metasequoia glyptostroboides* (dawn redwood), *Morus alba* (white mulberry), *Musa acuminata* (banana), *Musa* spp. (banana), *Myrica cerifera* (wax myrtle), *Olea europaea* (olive), *Osmanthus fragrans* (sweet olive), *Paspalum dilatatum* (dallisgrass), *P. sanguinale* (paspalum), *P. vaginatum* (water fingergrass), *Persea americana* (avocado), *Philodendron* spp. (philodendron), *Phoenix dactylifera* (date palm), *P. reclinata* (Senegal date palm), *Phyllanthus emblica* (myrobalan), *Phyllostachys* spp. (bamboo), *Pinus pinaster* (pine), *Pinus* spp. (pine), *Piper nigrum* (pepper), *Platanus* spp. (sycamore), *Poncirus trifoliata* (trifoliolate orange), *Populus* spp. (poplar), *Prunus avium* (wild cherry), *P. domestica* (European plum), *P. persica* (nectarine), *Prunus* spp. (prunus), *Psidium acidus* (guava), *P. guajava* (guava), *Punica granatum* (pomegranate), *Quercus acutissima* (oak), *Quercus* spp. (oak), *Q. suber* (oak), *Rhododendron* spp. (rhododendron), *Rosa indica* (rose), *Rosa* spp. (rose), *Saccharum officinarum* (sugarcane), *Salix* spp. (willow), *Setaria sphacelata* (bristle grass), *Solanum lycopersicum* (tomato), *Sorghum* sp. (sorghum), *Stenotaphrum secundatum* (St. Augustine grass), *Syringa oblata* (lilac), *Syzygium cumini* (java plum), *Thea sinensis* (tea), *Theobroma cacao* (cacao), *Typha* spp. (cattail), *Ulmus* spp. (elm), *Vicia faba* (broad bean), *Vitis rupestris* (wild grape), *V. solonis* (grape rootstock), *V. vinifera* (grape), *Washingtonia robusta* (Mexican fan palm), *Zantedeschia* spp. (calla), *Zea mays* (corn), *Zizyphus jujuba* (jujube), *Zoysia* spp. (zoysiagrass) (Nemaplex, 2010).

California detections have been made on plants in the genera *Acorus*, *Citrus*, *Galax*, *Juglans*, *Licuala*, *Mangifera*, *Poa*, *Prunus*, *Picea*, and *Vitis* (PDR database).

Symptoms: Disease symptoms induced by nematode feeding consist of stunting, premature wilting, leaf yellowing, root malformation, necrosis of cortical root tissues, and related symptoms difficult to distinguish from nutrient deficiencies (McSorley et al., 1980).

Transmission: Ectoparasitic nematodes can travel short distances by swimming and longer distances with the movement of soil (e.g. with equipment and tools) or water (e. g. with irrigation or flooding). For long distance spread, nematodes can move with planting stock.

Damage Potential: Many of the species in *Hemicriconemoides* are a component of the nematofauna of mixed hardwood forests and natural areas, but their economic importance in agriculture and the environment is largely undetermined. *Hemicriconemoides* spp. have been found on golf courses showing nematode feeding damage, but in these cases, there were many co-occurring nematode species, so it was not possible to determine which species were responsible for damage (Zhang et al., 2012). In research plots with grapevines in Yolo County, Chang and Raski (1972) showed that very high populations of two species of *Hemicriconemoides* could build up on test plants. Some sheathoid nematode species cause decline of some crops, but most of them are not considered aggressive parasites. In Florida and in other countries, damage is documented for litchi, mango, sugarcane, and tea (Inserra et al., 2014).

Worldwide Distribution: Generally in warmer areas of the world. Many species are reported from trees and hardwood forests (Nemaplex, 2010).

Official Control: *Hemicriconemoides* spp. is on the USDA PCIT's harmful organism list for Australia, French Polynesia, and Nauru (USDA, 2021).

California Distribution: Butte, Napa, Riverside, Sacramento, San Diego, San Francisco, San Luis Obispo, Sonoma, and Yolo counties (CDFA PDR Database, 2021).

California Interceptions: Sheathoid nematodes have been detected multiple times on house plants, palms, grass with soil, and roses from Florida at border stations (PDR Database, 2021).

The risk *Hemicriconemoides* spp. would pose to California is evaluated below.

Consequences of Introduction:

- 1) Climate/Host Interaction:** Sheathoid nematodes are cosmopolitan ectoparasites. They are more prevalent in warmer areas, but are likely to be found wherever their hosts can be grown

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 includes diverse species of woody plants and turfgrass.

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 reproduces with eggs and relies on the movement of soil, water, or infested plant material.

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.
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- 4) Economic Impact:** Impacts have been reported ornamentals and agronomic crops. There is no clear economic impact on grapevines although large populations can grow in association with the roots. The genus is a quarantine pest for a few countries.

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

Economic Impact: A, 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:** The impact of *Hemicriconemoides* spp. on natural environments is most likely not significant as the genus is already widespread without causing apparent detriment to ecological balances and processes, however, heavy infestations of sheathoid nematodes could affect home/urban gardening (Chitambar et al., 2018).

Evaluate the environmental impact of the pest to California using the criteria below

Environmental Impact:

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 *Hemicriconemoides* spp: Medium

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'.

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:

The molecular characterization of populations of sheathoid nematodes from the type localities of the original description has been conducted only for a few species, and its highly likely that undescribed species exist. It is not unusual to find two or more species occurring together with each other and with other genera of nematodes, making damage assessment more challenging.

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Hemicriconemoides* spp. is C.

References:

Chang, H.Y. and Raski, D.J., 1972. *Hemicriconemoides chitwoodi* on grapevines. Plant disease reporter. Vol 56: 1028-1030

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McSorley, R., Campbell, C.W. and Goldweber, S. 1980. Observations on a mango decline in south Florida. Proceedings of Florida State Horticultural Society 93, 132-133.

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Responsible Party:

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***Comment Period: 10/27/2021 through 12/11/2021**

***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: C
