California Pest Rating Proposal for

Anguina pacificae Cid del Prado Vera & Maggenti 1984

Pacific shoot-gall nematode

Current Pest Rating: none

Proposed Pest Rating: C

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

Comment Period: 05/16/2022 through 06/30/2022

Initiating Event:

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

History & Status:

Background:

The family Anguinidae includes both mycophagous and plant-parasitic nematodes. Members of the genus *Anguina* Scopoli, 1777 are obligate, specialized parasites of grasses and cereals. *Anguina* spp. cause necrosis, swelling, deformation, distortion or galls on leaves, stems, inflorescences, or roots. The formation of galls is from intensive plant cell hypertrophy and proliferation that is triggered by the nematode feeding. The nematodes all start with vermiform bodies, but as they age the adult females become swollen and practically motionless. This group is known for having very effective survival stages. The J2 can enter a cryptobiotic (anabiotic) state that survives long periods of desiccation or freezing or both. Some can remain viable for more than 25 years in this cryptobiotic state. Thus, many species can parasitize above-ground plant parts and are found in semi-arid environments with hot, dry summers, as they are able to become quiescence under unfavorable conditions, later to be revived by seasonal rains to become an infective stage (Subbotin and Riley, 2012). Three species of *Anguina*: *agrostis, tritici,* and *funesta*, induce seed galls on some cereals and grasses and are considered of economic importance as agricultural and quarantine pests (Chizhov and Subbotin 1990).

A shoot gall-forming nematode was first found on grasses by UCCE Farm Advisor Dr. Larry Costello in 1978. It was described and named *Anguina pacificae* by Cid del Prado Vera and Maggenti (1984) as a new species from the central and northern Pacific Coast of California. This nematode was found only along an approximately 20 to 30-mile-wide coastal corridor from Carmel to Mendocino (McClure et al., 2008), until it was found for the first time in turf from a golf putting green in Ireland in 2013 (Fleming et al., 2015).

Golf is a major activity in California, where it supports hundreds of thousands of jobs and contributes billions annually to the economy. In Northern California, McClure et al. (2008) estimated there were over 1 million golfers who play on 400+ courses on which *Poa annua* accounts for more than 75% of the turf grass maintained on putting greens. *Anguina pacificae* is a major threat to greens in cool, coastal golfing areas.

Hosts: Agrostis canina (velvet bentgrass) (Fleming et al., 2015) and *Poa annua* (annual bluegrass) (Cid Del Prado Vera and Maggenti, 1984). All California golf course surveys have found the nematode on *Poa* greens with no detections found on the bentgrass (*Agrostis stolonifera)* or other grasses in or around the *Poa* putting greens (McClure et al., 2008).

Symptoms: On annual bluegrass, this nematode induces galls at the crown of the plant that sequentially contain developing juveniles, adults, eggs and second-generation J2. Initial symptoms on turf consist of small yellow patches, 25 to 75mm in diameter, which enlarge and may coalesce as the nematodes spread. Young, infected plants may die and, when the infestation is severe, a rough, uneven putting surface results (McClure et al., 2008).

Transmission: This nematode can be spread by any method that moves infected plant material or soil, or with irrigation water. It is not known to be seed borne.

Damage Potential: This nematode is one of the most destructive pests of *Poa annua* in Northern California on golf courses. Their feeding results in yellow patches and irregular surfaces on golf course putting greens. The damage to patches of turf is unacceptable to golfers, who depend on the consistency of the putting green surface for accurate shots (McClure et al., 2008).

Worldwide Distribution: Ireland, United States (California).

Official Control: *Anguina pacificae* is on the EPPO's A1 list for Brazil (EPPO, 2022).

California Distribution: *Anguina pacificae* has been found by surveys on 31 golf courses in Northern California, from Mendocino in the north to Monterey in the south (Westerdahl et al., 2005; McClure et al., 2008; CDFA PDR database). Its range is limited to areas close to the Pacific Ocean. The most inland site it has been recorded is approximately 30 km from the coast at Santa Rosa, CA.

California Interceptions: None

The risk *Anguina pacificae* poses to California is evaluated below.

Consequences of Introduction:

1) **Climate/Host Interaction:** Both high and low temperatures limit the growth of the host, *Poa annua* and, consequently, that of *A. pacificae*.

   Evaluate if the pest would have suitable hosts and climate to establish in California.

   Score: **2**
   - 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 just two grass species, *Poa annua* in California and *Agrostis canina* in Europe

   Evaluate the host range of the pest.

   Score: 1
   - 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:** *Poa annua* seeds germinate from April to November on Northern California golf greens and there is time for at least two generations of *A. pacificae* per year. When mature galls are broken and infective J2 are released by cultural practices such as mowing and aeration of greens, three or four generations would be possible (McClure et al., 2008).

   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:** Because high quality and uniform *Poa annua* is so important to golf putting greens, infestation of this nematode has a high economic cost (Chitambar et al., 2018). It is a quarantine pest in Brazil.

   Evaluate the economic impact of the pest to 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 (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:** *Poa annua* is non-native to California. It is widespread and often considered a weed in agricultural settings.

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: 1
- 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 *Anguina pacificae:*

Add up the total score and include it here. 9
-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.

For many years this nematode was known only from California and only on *Poa annua* golf courses. Surveys have detected infestations across multiple counties, but limited to coastal areas of Northern California, from Carmel, Monterey Co. to Mendocino Co.

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* ***= 6***

Uncertainty:

None

Conclusion and Rating Justification:

Based on the evidence provided above the proposed rating for *Anguina pacificae* is C.

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.

Chizhov, V. N., and Subbotin, S. A. 1990. [Plant-parasitic nematodes of the subfamily Anguininae (Nematoda, Tylenchida). Morphology, trophic specialization, system.] Zool. Zh. 69:15-26 (in Russian).

Cid del Prado Vera, I., and Maggenti, A. R. 1984. A new gall-forming species of *Anguina* Scopoli, 1777 (Nemata: Anguinidae) on bluegrass *Poa annua* L., from the coast of California. Journal of Nematology, 16, 386–392.

EPPO Global Database. 2022. https://gd.eppo.int/taxon/ANGUPC Accessed 4/15/22

Fleming, T.R., Maule, A.G., Martin, T., Hainon-McDowell, M., Entwistle, K., McClure, M.A. and Fleming, C.C., 2015. A first report of *Anguina pacificae* in Ireland. Journal of Nematology, 47(2), p.97.

McClure, M.A., Schmitt, M.E. and McCullough, M.D., 2008. Distribution, biology and pathology of Anguina pacificae. Journal of nematology, 40(3), p.226.

Nemaplex UC Davis Nemabase 2010. http://Nemaplex.ucdavis.edu. Accessed 1/20/22

Subbotin, S. A., and I. T. Riley. 2012. Stem and gall nematodes. In Practical Plant Nematology (book) Edited by R. H. Manzanilla-Lopez and N. Marbán-Mendoza. Biblioteca Basica de Agricultura, p. 521-577.

USDA Phytosanitary Certificate Issuance and Tracking System, Phytosanitary Export Database (PExD) Harmful Organisms Database Report. *Anguina pacificae.* Accessed 4/14/2022

Westerdahl, B.B., Harivandi, M.A. and Costello, L.R., 2005. Biology and management of nematodes on turfgrass in Northern California. USGA Green Section Record.

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.

***Comment Period: 05/16/2022 through 06/30/2022**

***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: C