

Elisabeth G. Darling, Ph.D.

elisabeth.darling@ucr.edu | (517) 715-3600

Department of Entomology
University of California, Riverside
Kearney Agricultural Research and Extension Center
9240 S Riverbend Ave
Parlier, CA 93648

Education

Michigan State University 2019 - 2023

Ph.D., Entomology

Dissertation: *Evaluating distribution, pathology, and management of economically significant plant-parasitic nematode species in Michigan carrot and wheat production.*

Michigan State University 2014 - 2018

B.S., Entomology

Minor in Environmental Sustainability

Research Experience

2023 - present

Postdoctoral scholar research

Department of Entomology, University of California, Riverside

Principal Investigator: Dr. Houston Wilson

My objectives as a postdoctoral scholar in the Wilson Lab center around developing an integrated pest management research network for California industrial hemp farmers, university researchers, farm advisors, and industry stakeholders. Additionally, we aim to investigate the extent of distribution and damage produced by prevalent arthropod pests (corn earworm, cannabis aphid, spider mites, and beet leafhopper).

Ph.D. research

2019 - 2023

Department of Entomology, Michigan State University

Advisors: Drs. Marisol Quintanilla, Henry Chung

My dissertation research focused on determining the extent of damage that plant-parasitic nematodes posed on carrot and winter wheat systems. I communicated with growers around the state of Michigan to plan and execute soil and root surveys of over 15% of state acreage. This involved utilizing molecular barcoding in Dr. Chung's laboratory to confirm species identification for *Pratylenchus* spp. From there, we conducted greenhouse trials to determine the extent of damage produced to both carrot and winter wheat crops, identifying that *P. penetrans* is the most damaging species for carrots and *P. neglectus* is the most damaging species for winter wheat.

Undergraduate research

2018 - 2019

Department of Entomology

Advisor: Emile Cole, Dr. Marisol Quintanilla

As an undergraduate research assistant in Dr. Quintanilla's laboratory, I worked with Emile Cole, whose M.S. research focused on the disease complex between *Verticillium dahliae* and *Pratylenchus penetrans* in potato systems (known as Potato Early Die). Part of my role was to aid her in conducting seasonal field trials, greenhouse trials, and laboratory assays to investigate the potential of animal manure-based composts to reduce pressure by *V. dahliae* and *P. penetrans*.

2014 - 2017

Department of Entomology

Advisor: Dr. Michael Kaufman

As an undergraduate research assistant in Dr. Kaufman's laboratory, I reared *Aedes japonicus* and *Aedes triseriatus* mosquitoes for use in graduate and postdoctoral scholar research trials. This involved working with bovine blood to feed and maintain colonies. I was also taught the identification of key mosquito genera within Michigan (*Aedes*, *Anopheles*, *Culex*, etc.).

Publications (6)

1. **Darling, E.**, Palmisano, P., Chung, H., and Quintanilla-Tornel, M. 2023. A new biological product shows promising control of the northern root-knot nematode, *Meloidogyne hapla*, in greenhouse tomatoes. *Journal of Nematology* 55(1). <https://doi.org/10.2478/jofnem-2023-0023>
2. Thapa, S., **Darling, E.**, Cole, E., Poley, K. and Quintanilla-Tornel, M. 2023. Distribution of Plant-Parasitic Nematodes in Michigan Corn Fields. *Journal of Nematology* 55(1). <https://doi.org/10.2478/jofnem-2022-0015>
3. Jain, A., Huston, D.C., Wainer, J., Hodda, M., Hayes, O., Whittock, S., **Darling, E.**, Mann, R., Rodoni, B., and Edwards, J. 2023. Geographic range extension of hop cyst nematode, *Heterodera humuli*, from Tasmania to the Australian mainland. *Australian Plant Disease Notes* 18(8). <https://doi.org/10.1007/s13314-023-00494-2>
4. **Darling, E.**[^]; Núñez-Rodríguez, L.[^]; Chung, Henry; Zasada, Inga; Quintanilla-Tornel, M. 2022. The Hop Cyst Nematode, *Heterodera humuli*: History, Distribution, and Impact on Global Hop Production. *Phytopathology* 113(2). <https://doi.org/10.1094/PHYTO-04-22-0121-RVW>
[^]=co-first authorship.
5. **Darling, E.**, Pu, J., Cole, E., Christian, R., Warner, F., Zasada, I., Chung, H., and Quintanilla, M*. 2021. First Report of the Hop Cyst Nematode, *Heterodera humuli*, in Two Counties of the Yakima Valley Region, WA, USA. *Plant Disease Notes* 105(4). <https://doi.org/10.1094/PDIS-08-20-1769-PDN>
6. **Darling, E.**, Quintanilla, M*, and Chung, H. 2020. Plant-Eating Nematodes and the Key to Fighting Them. *Front. Young Minds*. 9:604175. <https://doi.org/10.3389/frym.2021.604175>

Under Review (3)

1. **Darling, E.**, Henderson, S., Palmisano, A., Consoli, E., Chung, H., and Quintanilla, M. Damage severity caused by root lesion nematodes varies by species in carrot and winter wheat plants. *APS Plant Disease*.

2. **Darling, E.**, Thapa, S., Parrado, L., Poley, K., Chung, H., Quintanilla, M. Evaluating alternative management techniques for the root lesion nematode, *Pratylenchus penetrans*, and the root-knot nematode, *Meloidogyne hapla*, in specialty root cropping systems. Pest Management Science.
3. Hauri, K., Schillmiller, A., **Darling, E.**, Howland, A., Douches, D., and Szendrei, Z. Constitutive level of specialized secondary metabolites affect plant phytohormone response to above- and belowground herbivores. Journal of Chemical Ecology.

In Prep (2)

1. **Darling, E.**, Nakasato, K., Palmisano, A., Malmstrom, C., Chung, H. and Quintanilla, M. Manure-based compost amendments influence nematode populations and viral loads in *Humulus lupulus*. Intended for submission: PhytoFrontiers.
2. **Darling, E.**, Palmisano, A., Henderson, S., Chung, H. and Quintanilla, M. Crop history and soil type impact plant-parasitic nematode harvest populations in carrot and winter wheat crops. Intended for submission: Journal of Nematology.

Extension Publications (4)

1. Thapa, Sita, **Darling, E.** and Quintanilla, M. Integrated Approach to Manage Nematode Damage in Carrot Production. Carrot Country. Winter 2021.
2. **Darling, E.**, Cole, E. and Quintanilla, M. Nematode Control: Exploring alternative strategies for nematode management in processing carrots. Carrot Country. Summer 2020, pg. 8-9.
3. **Darling, E.**, Cole, E. and Quintanilla, M. Tips for nematode management in carrots, parsnips. Vegetable Grower News, April 2020: p.13. <http://digital.vegetablegrowersnews.com/i/1227876-april-2020/11?>
4. **Darling, E.**, Thapa, S., Cole, E. and Quintanilla, M. Surveying Michigan carrot growers on plant-parasitic nematode control habits: current control practices and commonly encountered nematodes in Michigan carrot fields. MSU Extension. April 2020.

Awards and Scholarships

2023 Outstanding Ph.D. Student [Department of Entomology, MSU]
 2022 Jordan Tatter Scholarship [Michigan State Horticulture Society]
 2022 Science and Art Contest, 1st place [Cobb Foundation]
 2022 Outstanding Student in Extension Award [Department of Entomology, MSU]
 2019 Bayer Travel Award [Society of Nematologists]
 2019 Great Lakes EXPO Student Award [Michigan Vegetable Council, Gerber]
 2019 Travel Scholarship [College of Agriculture and Natural Resources, MSU]

Research Grants

Contributions to Submitted Research Grants

August 2022 – August 2023 [EROF2023: Expanding and Sustaining the Entomology Research and Outreach Fellowship Program](#)
 Michigan State University Creating Inclusive Excellence Grant, \$11,000.
 Role: Addition to introduction and body, editing.

May 2022 – April 2025 [Evaluation of the Hop Cyst Nematode, *Heterodera humuli*, an Emerging Pathogen of United States Hop Production](#)

Principal Investigator(s): Drs. Marisol Quintanilla, Henry Chung, Inga Zasada
USDA-NIFA Critical Ag Research and Extension, \$299,999.
Role: Background, experimental design development, and project implications.

March 2021 – February 2024

[*Evaluation of Damage and Integrated Management Strategies for Two Lesion Nematode Species in Carrot and Wheat systems*](#)

Principal Investigator(s): Drs. Marisol Quintanilla, Henry Chung
USDA-NIFA Critical Ag Research and Extension, \$299,999.
Role: Background and experimental design development.

January 2020 – December 2022

[*Finding Solutions to Manage Plant-Parasitic Pests of Michigan Hopyards*](#)

Principal Investigator(s): Drs. Marisol Quintanilla, Henry Chung, Carolyn Malmstrom
MDARD-MCBC, \$44,512.11 + \$39,948 (Year 1 + 2)
Role: Objective and experimental design development.

Teaching Experience

2020-2021

Graduate Teaching Assistant, Michigan State University

Course: Insects, Society, and Globalization (ISB201L)

As a graduate teaching assistant, I developed and delivered three weekly sections of 2-hour lectures over the course of two semesters, with 30-40 students in each section.

Additionally, each week I met with a faculty teaching supervisor to overview lesson plans and goals for the upcoming week.

Mentoring Experience

Mentor for Saniya Henderson, Michigan State University

2022-2023

Current Status: M.S. student, Dept. of Entomology, MSU

Mentor for Abigail Palmisano, Michigan State University

2021-2022

Current Status: M.S. student, Dept. of Entomology, MSU

Leadership Experience

Biological Control Committee, Society of Nematologists

2023-present

Vice Chair and Secretary

My role as the vice chair within the committee is to assist the chair, Ambria Small, in creating bimonthly agendas and goals for the year. Additionally, alongside committee leaders Drs. Catherine Wram and Richard Sikora, we have begun planning and organizing a workshop for the 2024 Society of Nematologists meeting.

Active Plant Nematologists

2020-present

Administrative member

APN is a Slack network connecting 500+ Nematologists worldwide, encouraging multinational research collaboration and offering a platform for the next generation of Nematologists to communicate across borders. As an original administrator since the founding of the network, I assist in updating the platform with job postings or directing member questions. Additionally, I contribute to the organization of webinars and conferences affiliated with APN:

- [Virtual Nematology Conference](#) (12-13 Oct 2023)
- The Effect of Nematodes in Soil Health (14-25 March 2021)
- The Hidden Enemy for Perennial Crops (30 October 2020)

ComSciCon, Michigan

2020-2023

Co-Chair of Organizing Committee

- 2020 Accepted Attendee
- 2021 [Organizing Committee member](#)
- 2023 [Co-Chair](#)

Entomological Research and Outreach Fellowship Committee 2021-2023

Chair

As the EROF chair, I attended weekly meetings on developing, selecting, and interviewing students for the program. Additionally, I helped organize fundraising to secure financial security for the EROF program fellows.

Graduate and Undergraduate Entomology Student Society

2019-2023

MSU, EROF Chair

As the 2023 chair and liaison between GUESS and EROF, my role was to attend monthly GUESS meetings to give EROF status updates.

Awards Committee Graduate Student Representative

As the sole graduate student member, my goal was to work with the Department of Entomology's Awards Committee to nominate staff, students, and faculty for departmental and CANR awards.

Treasurer

As the GUESS treasurer, my tasks were to maintain the Department of Entomology merchandise sales and inventory, place orders for apparel, and deposit funds and receipts to the business office. Additionally, I was responsible for ordering and arranging food delivery for GUESS meetings.

Professional Associations

Organization of Nematologists of Tropical America (2022-present)

American Phytopathological Society (2020-present)

Society of Nematologists (2019-present)

Entomological Society of America (2014-present)

Presentation and Outreach Experience

Oral Presentations (27)

1. Quintanilla, M. and **Darling, E.** The legion of root lesion nematodes in carrots. Great Lakes Fruit and Vegetable EXPO: Grand Rapids, MI. 6 Dec 2023.
2. Henderson, S., **Darling, E.**, Quintanilla, M. Root exudates impact attraction of the root lesion nematode, *Pratylenchus penetrans*, to non-host plants. Entomological Society of America annual meeting: Washington D.C. 5 Nov 2023.

3. **Darling, E.**, Thapa, S., Parrado, L., Poley, K., Chung, H., and Quintanilla-Tornel, M. Evaluating alternative management strategies for the root lesion nematode, *Pratylenchus penetrans*, and the root-knot nematode, *Meloidogyne hapla*, in specialty root cropping systems. 62nd Annual Meeting of the Society of Nematologists: Columbus, OH. 11 Jul 2023.
4. Parrado, L., **Darling, E.**, and Quintanilla, M. Manure-based amendments influence on soil biological parameters and its correlation with *Pratylenchus penetrans* infection in potato plants. 62nd Annual Meeting of the Society of Nematologists: Columbus, OH. 11 Jul 2023.
5. **Darling, E.**, Muhammad, U., and Quintanilla, M. Plant-feeding nematodes of hops: distribution, management, and the future. Great Lakes Hop Working Group Annual Meeting: Detroit, MI. 13 Apr 2023.
6. **Darling, E.**, Henderson, S., Chung, H., and Quintanilla, M. Michigan Vegetable Council. Developing molecular diagnostic services for root lesion nematode species identification in vegetables. 16 Mar 2023.
7. **Darling, E.**, and Quintanilla, M. Nematode research updates in carrots. Michigan Carrot Committee Winter Meeting. 16 Feb 2023.
8. **Darling, E.**, Thapa, S., Chung, H. and Quintanilla-Tornel, M. Nematodes in Root Crops: Basics, Nematicides, and Cover Crops. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 6 Dec 2022.
9. **Darling, E.**, Yazdani Fazlabadi, R., Thapa, S. and Quintanilla-Tornel, M. Celery Talk. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 7 Dec 2022.
10. **Darling, E.**, Thapa, S., Chung, H. and Quintanilla-Tornel, M. Investigating the impacts of plant-parasitic nematode communities on Michigan carrot production. Society of Nematologists Annual Meeting: Anchorage, AK. 26-30 Sept 2022.
11. Thapa, S., **Darling, E.**, Cole, E., Poley, K. and Quintanilla-Tornel, M. Surveys on plant-parasitic nematode distribution in Michigan corn and vegetable. Society of Nematologists Annual Meeting: Anchorage, AK. 26-30 Sept 2022.
12. **Darling, E.**, Parrado, L., Thapa, S., and Quintanilla, M. Plant-parasitic nematode wheat research update and proposal. Michigan Wheat Program. 31 Aug 2022.
13. **Darling, E.**, Chung, H., Quintanilla-Tornel, M. Hop nematodes and management in Michigan. MSU Hop Research Field Day. 13 Jul 2022.
14. Palmisano, A., **Darling, E.**, and Quintanilla-Tornel, M. Effect of root-knot nematodes on hop plants. University Undergraduate Research and Arts Forum. 8 Apr 2022.
15. Quintanilla, M., **Darling, E.**, Thapa, S. Plant-parasitic nematode update in carrot research. Winter Carrot Research Meeting. 8 Feb 2022.
16. Quintanilla, M., **Darling, E.**, and Thapa, S. Management of plant-parasitic nematodes in vegetables webinar. University of Georgia Extension. 25 Jan 2022.
17. **Darling, E.**, Chung, H., and Quintanilla-Tornel, M. Plant-eating worms? How soil-dwelling nematodes could limit your hop yields. Michigan's Great Beer State Conference. Acme, MI. 12-14 Jan 2022.
18. **Darling, E.**, Thapa, S., Chung, H., and Quintanilla-Tornel, M. Differences in root penetration and feeding by *Pratylenchus penetrans* and *P. crenatus* on carrot. Society of Nematologists Annual Meeting. 9-12 Sept 2021.
19. **Darling, E.** and Quintanilla, M. Applied Nematology update on hop research. Great Lakes Hop Working Group. 29 Mar 2021.
20. Cole, E., **Darling, E.**, and Quintanilla, M. Nematodes of Parsnip and Field Trial Updates. Michigan Vegetable Council. 18 Mar 2021.
21. **Darling, E.**, Thapa, S., and Quintanilla, M. Plant-parasitic nematode trial updates in carrot. Michigan Carrot Committee. 24 Feb 2021.

22. **Darling, E.**, Chung, H., and Quintanilla, M. Nematode control of processing vegetables. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 10 Dec 2020.
23. **Darling, E.**, Thapa, S., Cole, E., and Quintanilla, M. Plant-parasitic nematode research of carrot and parsnip. Vegetable and Root Crop Virtual Field Day. Talk. 16 Sept 2020. <https://www.canr.msu.edu/news/msu-to-host-vegetable-and-root-crop-virtual-field-day>
24. **Darling, E.** and Quintanilla, M. Plant-parasitic nematodes in Michigan hops. MSU Extension Hops Bine and Dine. Virtual Talk. 3 Aug 2020. https://mediaspace.msu.edu/media/t/1_b9taevwz
25. **Darling, E.** Brief overview of plant-parasitic nematodes and how they impact the carrot and parsnip industry. Annual Gerber Michigan Grower Banquet. 2 Mar 2020.
26. **Darling, E.**, Thapa, S., and Quintanilla, M. Plant-parasitic nematodes of carrots: Winter report. Winter Michigan Carrot Meeting 2020: DeWitt, MI. 19 Feb 2020.
27. **Darling, E.** and Quintanilla, M. Investigating nematicides for integrated nematode control: What we've learned from ongoing research trials on carrot and parsnip. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 10 Dec 2019.

Poster Presentations (10)

1. Palmisano, A., **Darling, E.**, Chung, H., and Quintanilla, M. A new biological product shows promising control of the northern root-knot nematode, *Meloidogyne hapla*, in greenhouse tomatoes. 62nd Annual Meeting of the Society of Nematologists: Columbus, OH. 11 Jul 2023.
2. Muhammad, U., **Darling, E.**, Palmisano, A., Núñez-Rodríguez, L., Zasada, I., Chung, H., and Quintanilla, M. Abundance and distribution of plant-parasitic nematodes in hopyards in Michigan. 62nd Annual Meeting of the Society of Nematologists: Columbus, OH. 13 Jul 2023.
3. Henderson, S., **Darling, E.**, and Quintanilla-Tornel, M. The Impact of *Pratylenchus penetrans* on Three Different Carrot Varieties. University Undergraduate Research and Arts Forum. 8 Apr 2022.
4. **Darling, E.**, Chung, H., and Quintanilla, M. Impact of manure-based soil amendments on plant-parasitic nematode taxa associated with hop (cv. Centennial). Society of Nematologists Virtual Conference 2020. 15-16 Dec 2020.
5. **Darling, E.**, Chung, H., and Quintanilla, M. Nematode pests of hop and how to combat them: a soil friendly approach. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 10 Dec 2020.
6. **Darling, E.** Cole, E., and Quintanilla, M. Evaluation of the Hop Cyst Nematode, *Heterodera humuli*, on Hop (cv. Centennial). Plant Health 2020: American Phytopathological Society annual meeting. 3-14 Aug 2020.
7. **Darling, E.** and Quintanilla, M. Evaluating alternation nematicides for Root Knot Nematode, *Meloidogyne hapla*, control in parsnip (cv. Panorama). Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 10 Dec 2019.
8. **Darling, E.** and Quintanilla, M. Reduction of a Mixed Population of Root Lesion Nematodes, *Pratylenchus penetrans* and *P. neglectus*, using Nematicide Applications in Carrot. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 10 Dec 2019.
9. **Darling, E.**, Poley, K., and Quintanilla, M. "Reduction of the root lesion nematode, *Pratylenchus penetrans*, in carrot using nematicide applications." Society of Nematologists Annual Meeting: Raleigh, NC. 11 Jul 2019.
10. **Darling, E.**, Cole, E., and Quintanilla, M. The biocontrol of *Paecilomyces lilacinus* on the root lesion nematode, *Pratylenchus penetrans*. Great Lakes Fruit and Vegetable Expo: Grand Rapids, MI. 8 Dec 2018.

Other notable contributions/mentions:

1. Invited to contribute to GeniusBar (2020, 2021) to serve as a nematology advisor for grower questions at the annual Great Lakes Fruit and Vegetable EXPO, Grand Rapids, MI.
2. Articles featuring: <https://www.canr.msu.edu/news/new-grant-to-help-carrot-and-wheat-growers-deter-invisible-pests>
3. News article featuring: <https://lansingcitypulse.com/stories/researchers-battle-tiny-menace-to-craft-beers,20051>