

RACHAEL E. BONOAN, PHD

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EDUCATION

- 2018 **PhD** Ecology, Behavior, and Evolution **Tufts University**
2013 **BS** Biology **University of Massachusetts Dartmouth (UMass Dartmouth)**

APPOINTMENTS

- 2020 – present **Assistant Professor** Dept of Biology, Providence College
2018 – 2020 **Post-doctoral Researcher** Dept of Biology, Tufts University & Washington State University
2017 – 2019 **Lecturer** Experimental College, Tufts University

PUBLICATIONS (*UNDERGRADUATE AUTHOR)

Refereed Journal Articles

Bonoan RE, Crone EE, Edwards CB, Schultz CB. *In Press*. Changes in phenology and abundance of an at-risk butterfly. *Journal of Insect Conservation*.

Dorian NN, **Bonoan RE**. 2021. Stingless bees (Apidae: Meliponini) seek sodium at carrion baits in Costa Rica. *Ecological Entomology*. 46: 492-495. <https://doi.org/10.1111/een.12948>

Bonoan RE, Iglesias Feliciano PM,* Chang J,* Starks PT. 2020. Social benefits require a community: the influence of colony size on behavioral immunity in honey bees. *Apidologie*. 51: 701-709. <https://doi.org/10.1007/s13592-020-00754-5>

Bonoan RE, Gonzalez J,* Starks PT. 2020. The perils of forcing a generalist to be a specialist: lack of dietary essential amino acids impacts honey bee pollen foraging and colony growth. *Journal of Apicultural Research*. 59: 95-103. <https://doi.org/10.1080/00218839.2019.1656702>

Wilson-Rich N, **Bonoan RE**, Taylor E,* Lwanga L,* Starks PT. 2019. An improved method for testing invertebrate encapsulation response as shown in the honey bee. *Insectes Sociaux*. 66: 91-105. <https://doi.org/10.1007/s00040-018-0668-x>

Bonoan RE, O'Connor LD,* Starks PT. 2018. Seasonality of honey bee (*Apis mellifera*) micronutrient supplementation and environmental limitation. *Journal of Insect Physiology*. 107: 23-28. <https://doi.org/10.1016/j.jinsphys.2018.02.002>

Bonoan RE, Tai TM,* Tagle Rodriguez MS,* Feller L,* Daddario SR,* Czaja RA,* O'Connor LD,* Burruss G,* Starks PT. 2017. Seasonality of salt foraging in honey bees (*Apis mellifera*). *Ecological Entomology*. 42: 195-201. <https://doi.org/10.1111/een.12375>

Dorian N,* **Bonoan RE**. 2016. Seasonality of stingless bee (*Trigona silvestriana*) mineral preferences in Costa Rica. *Bee World*. 93: 61-63. <https://doi.org/10.1080/0005772X.2016.1229099>

Bonoan RE, Starks PT. 2016. Observation Hive Marking Apparatus (OHMA): an inexpensive method for mass-marking honey bees in observation hives. *Bee World*. 93: 7-10. <https://doi.org/10.1080/0005772X.2016.1205327>

Bonoan RE, Al-Wathiqui N, Lewis S. 2015. Linking larval nutrition to adult reproductive traits in the European corn borer *Ostrinia nubilalis*. *Physiological Entomology*. 40: 306-316. <https://doi.org/10.1111/phen.12116>

Bonoan RE, Goldman RR,* Wong PY, Starks PT. 2014. Vasculature of the hive: heat dissipation in the honey bee (*Apis mellifera*) hive. *Naturwissenschaften*. 101: 459-465. <https://doi.org/10.1007/s00114-014-1174-2>

Bonoan R,* Clodius F,* Dawson A,* Caetano S,* Yeung E, Paz-y-Miño GC. 2013. Dominance hierarchy formation and potential applications in laboratory research using a model organism, the zebra finch (*Taeniopygia guttata*). *BIOS*. 84: 201-209. <https://doi.org/10.1893/0005-3155-84.4.201>

Book Sections

Bonoan RE, Starks PT. 2020. Western honey bee (*Apis mellifera*). Starr CK, editor. *Encyclopedia of Social Insects*. Springer, Cham. https://doi.org/10.1007/978-3-319-90306-4_181-1

Magazine Articles

Bonoan RE. 2020. Watch me work. *Smore Magazine*. Mar/Apr.

Dorian NN, **Bonoan RE**. 2020. Tropical “vulture bees” collect minerals from carrion. *2 Million Blossoms*. Apr.

Bonoan RE. 2020. Distracted by bees. *2 Million Blossoms*. Jan.

Bonoan RE. 2018. Honey bees seek potassium and calcium as they prepare to overwinter. *American Bee Journal* 158: 693-696.

Bonoan RE. 2017. Why do honey bees like dirty water? *American Bee Journal* 157: 315-318.

Bonoan RE. 2016. [Pollinator decline & self-medication: can we help pollinators help themselves?](#) *Bee Culture*.

Online Publications

Bonoan RE, Starks PT. 2020. [Honey bees can't practice social distancing, so they stay healthy in close quarters by working together.](#) *The Conversation*.

Bonoan RE, Dunne B. 2020. [Dress Like A Scientist Day](#). eBook.

Bonoan RE. 2020. [Stop calling it the “murder hornet”.](#) *Tufts Pollinator Initiative Blog*.

Bonoan RE, Starks PT. 2018. [Honey bee immunity: more specific than we thought.](#) *Insectes Sociaux*.

Bonoan RE. 2018. [Livin' on a prairie.](#) *Dispatches from the Field*.

Bonoan RE. 2018 [Interview with a social insect scientist.](#) *Insectes Sociaux*.

Bonoan RE. 2016. [Decisive dancing in honey bees.](#) *Georgia Beekeepers Association Newsletter: Spilling the Honey*. Dec.

Bonoan RE. 2016. [Pollen, it's what's for dinner.](#) *Tufts University Graduate Admissions Blog, LOL: Life Outside the Lab*.

Bonoan RE. 2016. [Decisive dancing in honey bees.](#) *Insectes Sociaux*.

Bonoan RE. 2016. [The secret life of team honey bee.](#) *Dispatches from the Field*.

FELLOWSHIPS & GRANTS

- 2021 Providence College Committee on Aid to Faculty Research
2020 Southeastern New England Educational and Charitable Foundation
2019 Tufts University Green Fund
Tufts University Post-doctoral Travel Award
2017 Garden Club of America Board of Associates Centennial Pollinator Fellowship
Tufts University ExCollege Robyn Gittleman Graduate Fellowship
Tufts University Graduate Student Research Grant
American Association of Professional Apiculturists Extension Activities Award
2016 Sandler International Research Grant
Eastern Apicultural Society Foundation for Honey Bee Research Grant
Plant & Pollen Metabarcoding Summerschool Scholarship
International Society for Behavioral Ecology Travel Grant
Tufts Institute of the Environment Travel Grant
2015 Animal Behavior Society Student Research Grant
Tufts Institute of the Environment Travel Grant
2014 Essex County Beekeeper's Association Research Grant
Foundation for the Preservation of Honey Bees, Inc. Research Grant

Awarded to Research Students

- 2021 Summer Undergraduate Research Grant awarded to Isabelle Heron ('23), Surveying Southeastern New England for a rare butterfly
Walsh Student Research Fellowship awarded to Alexa Pudlo ('22), Providence College pollinators

HONORS & AWARDS

- 2018 Young Alumni Award, UMass Dartmouth
2017 1st Place Graduate 10-min talk, Entomology Conference
ComSciCon National Workshop Attendee (50 accepted of 1050 applicants)
2nd Place 5-minute Talk, Tufts University Graduate Student Research Symposium
2016 1st Place Poster Presentation, Tufts University Graduate Student Research Symposium
2015 1st Place Research Photo, Tufts University Graduate Student Photo Contest
2014 1st Place Presentation, Tufts Ignite
NSF Graduate Research Fellowship Program Honorable Mention

TEACHING

Providence College

Environmental Methods & Statistical Analysis, with Lab (Spring 2021)
Advanced Topics: Pollination Ecology, with Lab (Fall 2020, 2021)
Foundations of Environmental Biology (Fall 2020, 2021)

Tufts University

Tropical Ecology and Conservation (Field Instructor, Fall 2019)
From Bees to Beetles: Insect Pollinators and Real-World Science (Lecturer, Fall 2017, 2018, 2019)

Public

All About Bees, Discovery Museum (Ongoing)
Beekeeping Academy, American Beekeeping Federation (Summer 2017)
Bee School, Boston Area Beekeepers Association (Winter 2015, 2015)

INVITED TALKS

Seminars

- 2020 Pollinator nutritional ecology **Roger Williams University, Marine and Natural Sciences** Bristol, RI
Not all scientists wear lab coats **Massachusetts Science and Engineering Fair**
Pollinator nutritional ecology **Providence College, Biology Dept** Providence, RI
Pollinator nutritional ecology **Colby College, Environmental Studies** Waterville, ME
Pollinator nutritional ecology **Connecticut College, Biology Department** New London, CT
Pollinator nutritional ecology **University of Texas at Austin, Integrative Biology** Austin, TX
- 2019 Keynote: Not all scientists wear lab coats **Women in STEM Summit, Somerville High School** Somerville, MA
Honey bee nutritional ecology **Georgia Institute of Technology, College of Sciences** Atlanta, GA
Species interactions in a changing environment **The Evergreen State College** Olympia, WA
Species interactions in a changing environment **Joint Base Lewis-McChord Fish and Wildlife** Olympia, WA
- 2018 Pollinator decline and what we can do to help **State Street Sustainability Speaker Series** Boston, MA
- 2017 Honey bee nutritional ecology **Babson College, Division of Math & Science** Babson Park, MA
Honey bee nutritional ecology **UMass Dartmouth, Biology Department** North Dartmouth, MA

Lectures

- 2020 Honey bee biology and decline **Tiverton Middle School** Tiverton, RI
Virtual Field Trip: Insect pollinators **Ranger Elementary School** Tiverton, RI
- 2019 Honey bee nutrition **Arrendale State Prison, Beekeeping School** Alto, GA
Workshop: How we can help bees **Camp Micah** Bridgton, ME
Species interactions in a changing environment **Washington State University** Vancouver, WA
- 2018 Honey bee biology and decline **Tiverton Middle School** Tiverton, RI
Social insect research **Providence College, Entomology** Providence, RI
Physiological and behavioral immunity in honey bees **UMass Dartmouth, Comparative Immunology** North Dartmouth, MA
- 2017 Collective behavior in honey bees **Providence College, Intro to Complexity Science** Providence, RI
Guest Lesson: How pollinators find their food **Brookline High School, Drawing for Field Science** Boston, MA

Panels

- 2021 Young professionals panel **50/50 Women's Leadership**
- 2020 Research panel **Providence College Biology Society** Providence, RI
- 2017 Finding the TED in your talk **TEDxTufts** Medford, MA
- 2016 Being a gutsy communicator **Graduate Women @ MIT Empowerment Conference** Cambridge, MA
Choosing a graduate school **American Society of Biochemistry and Molecular Biology** Medford, MA
- 2015 "Alternate" careers in science **Tufts University REU Program** Medford, MA

Public Talks

- 2021 Why do honey bees like dirty water? **Rhode Island Beekeepers Association** RI
Why do honey bees like dirty water? **Middlesex County Beekeepers Association** MA
Honey bee nutrition **Middlesex County Beekeepers Association** MA
Effect of dietary protein diversity on foraging and colony growth **Shenandoah Valley Beekeepers Association** VA

- 2020 Ask an expert: meet an insect researcher **Smore Science**
Species interactions in a changing environment **Washington Butterfly Association** Seattle, WA
Keynote: How diet diversity affects foraging **Georgia Beekeepers Association** Augusta, GA
Keynote: Why do honey bees like dirty water? **Georgia Beekeepers Association** Augusta, GA
- 2019 Why do honey bees like dirty water? **Metro Atlanta Beekeepers Association** Atlanta, GA
Why do honey bees like dirty water? **Marin County Beekeepers Association** San Anselmo, CA
Why do honey bees like dirty water? **York County Beekeepers Association** Sanford, ME
- 2018 Why do honey bees like dirty water? **The Bee Conservancy** New York, NY
- 2017 Why do honey bees like dirty water? **Massachusetts Beekeepers Association** Westfield, MA
Honey bee nutritional ecology **Massachusetts Beekeepers Association** Westfield, MA
Pollinator decline and what we can do to help **Melrose Public Library** Melrose, MA
Beekeeping symposium **Central Square Theater** Cambridge, MA
- 2016 [Embracing science as a verb](#) **TEDxTufts** Somerville, MA
Why do honey bees like dirty water? **Connecticut Beekeepers Association** Bristol, CT
Physiological and behavioral immunity in honey bees **Connecticut Beekeepers Association** Bristol, CT
Why do honey bees like dirty water? **Essex County Beekeepers Association** Topsfield, MA
Thermal imaging and honey bee fever **Boston Area Beekeepers Association** Medford, MA
Pollinator decline and how we can help **Mass Audubon Summer Institute for Teachers** Milton, MA
Honey bee research at Tufts **Boston Area Beekeepers Association, Tour de Hives** Medford, MA
How do honey bees deal with heat stress? **Pint of Science** Boston, MA
Honey bee nutritional ecology **Barnstable County Beekeepers Association** Barnstable, MA
- 2015 Why do honey bees like dirty water? **American Beekeeping Federation, Webinar Series**
Why do honey bees like dirty water? **Greater New York Honey Bee Conference** Queens, NY
Why do honey bees like dirty water? **Georgia Beekeepers Association** Milledgeville, GA
Physiological and behavioral immunity in honey bees **Georgia Beekeepers Association** Milledgeville, GA
Meet the beekeepers **Follow the Honey, National Honey Bee Day Celebration** Cambridge, MA
Honey bee health and nutrition **Follow the Honey, National Honey Bee Day** Cambridge, MA
Perceiving bees: a scientist's and filmmaker's approach **Catalyst Conversations** Lincoln, MA
Honey bee health and nutrition **Pint of Science** Cambridge, MA
Pollinator decline and what you can do to help **Portsmouth, RI Garden Club** Portsmouth, RI
Why do honey bees like dirty water? **Barnstable County Beekeepers Association** Barnstable, MA
Seasonality of honey bee mineral preferences **Boston Area Beekeepers Association** Medford, MA

CONFERENCE PRESENTATIONS

Talks

- 2020 Will climate-mediated phenological shifts affect population viability? A test with butterflies on Department of Defense lands **SERDP and ESTCP Symposium** *Virtual*
Advances in phenology are more consistent than changes in abundance of a rare butterfly **Entomology Conference** *Virtual*
- 2019 Species interactions in a managed landscape: plants, butterflies, and ants **Entomology Conference** St. Louis, MO
- 2018 Effects of burning on a Pacific Northwest ant community **Social Insects in the North-East Regions (SINNERS) Conference** Philadelphia, PA
Getting undergraduates excited about insects **Entomology Conference** Vancouver, BC
Seasonality of honey bee micronutrient limitation **Entomology Conference** Vancouver, BC

- 2017 Seasonality of salt foraging in honey bees (*Apis mellifera*) **Entomology Conference** Denver, CO
Thermal imaging and honey bee fever **Tufts University, Graduate Student Research Symposium** Medford, MA
Diet diversity, foraging behavior, & the microbiome **Eastern Apicultural Society Conference** Newark, DE
- 2016 Thermal imaging and honey bee fever **SINNERS Conference** Washington D.C.
Seasonality of salt foraging in honey bees **International Society for Behavioral Ecology (ISBE) Conference** Exeter, UK
Diet diversity and the honey bee microbiome **PollenBoL Symposium** Wurzburg, Germany
- 2015 Seasonality of mineral preferences in honey bees **SINNERS Conference** Boston, MA
Nutritional ecology: seasonality of mineral preferences in honey bees **Animal Behavior Society Conference** Anchorage, AK
- 2014 Heat dissipation in the honey bee hive **Tufts Ignite** Medford, MA
- 2012 Dominance hierarchy formation & potential applications in laboratory research using a model organism, the zebra finch (*Taeniopygia guttata*) **UMass Amherst Undergraduate Research Conference** Amherst, MA

Posters

- 2019 Importance of nectar resources for population viability of at-risk butterflies **SERDP and ESTCP Symposium** Washington D.C.
- 2016 Seasonality of mineral preferences in honey bees **Tufts University, Graduate Student Research Symposium** Medford, MA
- 2015 Honey bee health and nutrition **Protecting Pollinators in Ornamental Landscapes Conference** Hendersonville, NC
Honey bee health and nutrition **North American Beekeeping Federation 2015 Conference** Anaheim, CA
- 2014 Vasculature of the hive: heat dissipation in honey bees **ISBE Conference** New York, NY

MEDIA

Podcasts

- 2020 [Weird bee behaviors](#) **Beekeeping Today**
- 2017 [The bats and the bees: stories about adventures with winged wildlife](#) **The Story Collider**
[Gettin' buzzed with honeybees](#) **PhDrinking**
- 2016 [Honey bee nutrition, immunology, and behavior](#) **Eating Wisely with Leland Stillman, MD**

Press

- Allen C. 2021. [Maintaining the buzz: beekeeping thrives in Rhody.](#) *MotifRI*.
- Langley L. 2021. [We haven't seen a quarter of known bee species since the 1990s.](#) *National Geographic*.
- Wu KJ. 2020. [Menaced by murder hornets, bees decorate their hives with feces.](#) *New York Times*.
- Nelson A. 2020. [Tufts earns bee-friendly certification.](#) *Tufts Now*.
- Dockser C. 2019. Bees, a classical duo, and outdoor art. *Boston Globe*.
- Tufts University. 2019. [How does bees make honey?](#) **Ever Wonder?**
- Webber R. 2019. [Why do flowers smell nice?](#) *Ask Dr. Universe*.
- Silver M. 2018. [Bees adjust to seasons with nutrients in flowers and 'dirty water'.](#) *Tufts Now*.
- Hodgdon E. 2018. [A trip to the beeyond: students in "From Bees to Beetles" visit the Starks Lab.](#) *ExPress*.
- Evans J. 2017. [Minerals and the bees' needs.](#) *Bee Culture*.
- Rajewski G. 2017. [The bee nutritionist.](#) *Tufts Now*.
- Sifflerin A, Worland J. 2017 [Why scientists are joining the March for Science.](#) *TIME*.
- Langley L. 2017. [Bumblebee buzz literally makes flowers explode with pollen.](#) *National Geographic*.
- Knight KR. 2017. [Honey bees seek out essential nutrients based on seasonal resources.](#) *Tufts Now*.

McNeil T. 2014. [Keeping bees healthy](#). *Tufts Now*.
Reid A. 2014. [How honey bees stay cool](#). *Tufts Now*.
Kaplan M. 2014. [Yolanda bee cool](#). *The Economist*.

SERVICE, LEADERSHIP, & OUTREACH

College

2020 – present Website Committee **Providence College Biology Dept** Providence, RI
Curator, [Twitter Providence College Biology Dept](#) Providence, RI
2020 Consortium for Faculty Development Hiring Committee **Providence College Biology Dept** Providence, RI
2018 – 2019 Founding Member, Media Coordinator [Tufts Pollinator Initiative](#) Medford, MA
2017 Invited Speaker Committee **Tufts University Biology Union of Graduate Students** Medford, MA
Grant Reviewer **Tufts University Graduate Research Competition** Medford, MA
2015 – 2016 Community Outreach Chair **Tufts University Graduate Student Council** Medford, MA
2015 Lab Tours **American Society of Biochemistry and Molecular Biology** Medford, MA
2014 – 2018 Safety Committee, Graduate Student Representative **Tufts University Biology Department** Medford, MA
2013 – 2018 Library Committee, Graduate Student Representative **Tufts University** Medford, MA
Website Committee **Tufts University Biology Union of Graduate Students** Medford, MA
2012 – 2019 Educator/Volunteer **Tufts University Community Day** Medford, MA

Professional

2019 – present Field Reporter [2 Million Blossoms](#)
Curator, [Twitter Int. Union for the Study of Social Insects, North American Section](#)
2019 Field Supervisor **The Evergreen State College** Olympia, WA
2017 Selection Committee, Sponsor-A-Hive **The Bee Conservancy** New York, NY
Curator [@Biotweeps \(Twitter\)](#)
2016 Educator/Volunteer **USA Science and Engineering Festival** Washington D.C.
2013 Poster Judge **BioNES Conference** Bristol, RI

Reviewer for: *Ecological Entomology*, *Ecology Letters*, *Journal of Applied Animal Research*, *Insects*, *Journal of Insect Conservation*, *Molecular Ecology*, *Parasites & Vectors*, *Northwest Science*

Community

2020 Science Fair Judge **Region IV Science & Engineering Fair** *Virtual*
2019 – present Visiting Scientist **Skype A Scientist** *Virtual*
2019 Educator **Brownie Troop “Bugs Badge” Workshop** Medford, MA
Educator **Prairie Appreciation Day** Littlerock, WA
2018 – present Scientific Advisor **Manhattan Theater Club** New York, NY
2015 – 2018 President 2016-18, Vice President 2015-16 **Boston Area Beekeepers Association** Boston, MA
2016 – 2019 Science Fair Judge **Medford High School Science Fair** Medford, MA
2016 – 2019 Pen Pal **Letters to a Pre-Scientist**
2016 Presenter **Medford High School Reverse Science Fair** Medford, MA
Educator **Medford High School Fells Day** Medford, MA
Educator **Girl Scout Troop 62558 Meeting** Brookline, MA

2015 Planning Committee, [Tour de Hives](#) **Boston Area Beekeepers Association** Boston, MA
Presenter **Medford High School Reverse Science Fair** Medford, MA
2015 Medford High School AP Chemistry Field Trip **Tufts University** Medford, MA
2015 Science Fair Judge **Region IV Science & Engineering Fair** Somerville, MA
2014 Presenter **Medford High School Reverse Science Fair** Medford, MA
Science Fair Judge **UP Academy Leonard Middle School Science Fair** Lawrence, MA
2012 Compeer Peer Mentor **Heritage House** New Bedford, MA
2011 Compeer Peer Mentor **Lindencroft Community Care Services** Berkley, MA
Overnight Seminar Assistant **Boston Museum of Science** Boston, MA

PROFESSIONAL MEMBERSHIP

American Beekeeping Federation ♦ Animal Behavior Society ♦ Association for Women in Science ♦
Cambridge Entomological Club ♦ Eastern Apiculture Society ♦ Entomological Society of America ♦
International Society for Behavioral Ecology ♦ International Union for the Study of Social Insects