Mario A. **Sandoval-Molina**

sandoval.m@hotmail.com mariosandovalmx.github.io/ecology/ mariosandovalm mariosandovalmo

Education

Cornell University-EEB Department *NY, USA*

PhD Student. *2022- Present*

- Thesis: Plant defenses in *Mimosa pudica*: Ecological and Evolutionary implications.
- Committee: André Kessler

Instituto de Ecología (INECOL)-Departamento de Ecología Funcional *Veracruz, México*

Master of Science in Ecology. GPA: 9.27/10 *2019*

- Thesis: Interaction between ants, herbivore insects and extrafloral nectaries in *Opuntia robusta*: a test of the defensive function.
- Committee: MK, Janczur, JG, García-Franco, C, Diaz-Castelazo, and Rodolfo Dirzo.

Universidad Autónoma del Estado de México (UAEM) *Estado de México, México*

Bachelor of Science Degree in Biology. GPA: 8.20/10 *2014*

- Thesis: Morphology and anatomy of extrafloral nectaries of *Opuntia robusta*.
- Committee: MK, Janczur, and H, Zavaleta-Mancera.

Research Experience

Volunteer Research Assistant

Optimal Defense Theory in *Mimosa pudica* *Cornell University. Apr 2021 - Present*

- Collaborators: Dr. André Kessler
- Greenhouse work analyzing leaf movement, and response to herbivory.
- Results: one scientific publication in process.

Plant-pollinator interaction networks *Cornell University. Apr 2021 - Present*

- Collaborators: MSc. Zaidee Powers
- Collected and identified insect pollinators in the botanic garden and natural areas. Performed plant-pollinator interaction network analysis.
- Results: one scientific publication in process.

Principal Researcher

Morphology, ultrastructure and function of extrafloral nectaries *Puebla, Mexico. 2017 - 2018*

- Analyzed the morphological and ultrastructural characteristics of extrafloral nectaries from two cactus species in Tehuacán-Cuicatlán Valley, México. Examined their function in association with ants and pollinators in the field.
- Funded by the Cactus and Succulents Society of America.
- Results: two scientific publications, one submitted and the other in process.

Defense against herbivores in *Myriocarpa longipes* (Urticaceae)" *Veracruz, Mexico. 2019 - 2020*

- Principal Investigator: Dr.Mariusz Janczur
- Conducted field work related to analyzing the effect of ants and domatia position on herbivore damage of *Myriocarpa longipes*.
- Results: one scientific publication.

Morphological and anatomical description of extrafloral nectaries of *Opuntia robusta* *COLPOS, Mexico. 2015*

- Conducted laboratory work using different microscopical techniques, such as TEM, SEM, and light. This was part of a research internship at Colegio de Postgraduados.
- Results: one scientific publication.

Collaborator

Evolution of defense against herbivores in plants: an optimal model allocation and field study *Hidalgo, Mexico. 2012 - Present*

- Principal Investigator: Dr.Mariusz Janczur
- Conducted field work related to collect tissues for secondary metabolite analysis, arbuscular mycorrhizal fungi, measuring plant defensive traits and seed set of *Opuntia robusta* plants.
- Results: four scientific publications in process.

Peer-Reviewed publications:

1. **Sandoval-Molina, M. A.**, Gracía-Franco, J. G., Díaz-Castelazo, C. and Janczur M. K. (2023) Plant sex change the outcome of ant-plant interactions in a facultative myrmecophytic cactus. *Functional Ecology*, 00, 1– 13.
   DOI: https://doi.org/10.1111/1365-2435.14267
2. **Sandoval-Molina, M. A.**, Lugo-García, B. R., Mendoza-Mendoza, A. D., and Janczur M. K. (2021). Females restrict the position of domatia and suffer more herbivory than hermaphrodites in *Myriocarpa longipes*, a Neotropical myrmecophyte. *Journal of Tropical Ecology.*
   DOI: http://dx.doi.org/10.1017/S0266467421000584
3. Janczur, M. K., González-Camarena, E., Leon-Solano H.J, **Sandoval-Molina, M. A.**, Bartosz J. (2021). Impact of the female and hermaphrodite forms of *Opuntia robusta* on the plant defence hypothesis. *Scientific Reports 11, 12063*.
   DOI: https://doi.org/10.1038/s41598-021-91524-5

4. **Sandoval-Molina, M. A.**, Flórez-Gómez, N. A., Reyes-Tovar, J. M., Pérez-Botello, A. M., Hinojosa-Díaz, I. A., Ayala, R. (2020). Effects of floral display and abiotic environment on the foraging activity of bees on *Kallstroemia pubescens* (Zygophyllaceae). *Ethology Ecology and Evolution* 32(6), 551-571. DOI: https://doi.org/10.1080/03949370.2020.1755371
5. **Sandoval-Molina, M. A.**, Zavaleta-Mancera, H. A., León-Solano, H., Solache-Ramos, L., Jenner, B., Morales-Rodríguez, S., Patrón-Soberano, A. and Janczur M. (2018). First description of extrafloral nectaries in *Opuntia robusta* (Cactaceae): anatomy and ultrastructure. *PLOS ONE 13(7)*. DOI: https://doi.org/10.1371/journal.pone.0200422

Non-peer-reviewed publications:

1. **Sandoval-Molina, M. A.**, Morales-Rodríguez, S., and Janczur, M. K. (2023). Morphological and anatomical characterization of extrafloral nectaries of Opuntia streptacantha and Ferocactus recurvus (Cactaceae). EcoEvoRxiv preprint. URL: https://doi.org/10.32942/X2PW2J
2. **Sandoval-Molina, M. A. (2021).** tlamatini: Funciones utiles para biologxs y ecologxs confundidos con los modelos lineales. R package version 0.1. URL: https://mariosandovalmx.github.io/tlamatini-website/
3. León-Solano,H.J., Janczur,M.K., González-Camarena, E., Czarnoleski, M., Jenner, B., **Sandoval-Molina, M. A. (2021).** Resource Allocation Among Cladodes of *Opuntia robusta* From East-central Mexico, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-161086/v1]

Peer-Reviewed publications in process:

1. **Sandoval-Molina, M. A.**, Gonzales-Camarena, E., N., Rosas-Sánchez J., Janczur M. K. The Distraction Function of Extrafloral Nectaries: Keeping Ants Away From Flowers and Preventing Disruption of Pollination in *Ferocactus recurvus*. OIKOS [Manuscript submitted]
2. Martínez-Estrella, D; Mariezcurena-Berasain M.D, **Sandoval-Molina, M. A.**, Janczur M. K. Implications of the existence of different sexual forms on the interaction with arbuscular mycorrhizal fungi in a dioecious population of *Opuntia robusta* Wendl. (Cactaceae). *Scientific Reports*. [Manuscript in preparation]
3. Rosas-Sánchez J., Janczur, M. K., Nowakowski, J. K., Lugo-García B., Bata-Benítez R., Flores-Dimas, C.A., **Sandoval-Molina, M. A.**, Carbajal, A. Are morphological traits of individuals of *Junco phaeonotus* associated with habitat disturbance and casually associated with infection by Coccidia? *Ecological Engineering* [Manuscript in preparation]
4. Bata-Benitez, R, Nowakowski, J, Rosas-Sánchez, JJ, Lugo-García, BR, Fernández-Villavicencio, MJ, **Sandoval-Molina, M. A.**, Janczur, M. K. Disturbance of a deciduous tropical forest increases the competition between migratory and resident or endemic birds. *Ecological Engineering* [Manuscript in preparation]
5. Macotela, L., **Sandoval-Molina, M. A.**, Venebra-Muñoz, A., Anaya, M., González-Morales, J.C., Daniel E. Naya and Manjarrez, J. Histomorphological changes due to altitude in a high-altitude lizard (Sceloporus grammicus) from three mountain systems? J Therm Biol [Manuscript in preparation]

Fellowships, awards, and grants:

2024	**Grant: Cornell Atkinson Center for Sustainability (SBF)**, Amount: $7,264.00	*NY, USA*
2023	**Grant: Cornell Chapter of Sigma Xi**, Amount: $1,000.00	*NY, USA*
2023	**Grant: Andrew W. Mellon Student Research**, Amount: $1,000.00	*NY, USA*
2023	**Grant: EEB-Cornell University, Department Summer Research Support**, Amount: $1,000.00	*NY, USA*
2022	**Award: EEB Book Award**, EEB Cornell University Annual Graduate Student Symposium	*NY, USA*
2022	**Fellowship: Graduate Education- PhD**, Consejo Nacional de Ciencia y Tecnología (CONACYT)	*México*
2017	**Grant: Cactus and Succulents Society of America**, Amount: $2,616.21	*CA, USA*
2016	**Fellowship: Graduate Education**, Consejo Nacional de Ciencia y Tecnología (CONACYT)	*México*
2014	**Fellowship: Bachelor's Research**, Secretaría de Educación Pública and CONACYT	*México*

Conferences and symposiums:

Speaker at the 3rd Joint Congress Of Evolutionary Biology with: "Evolución de las defensas anti-herbivoria en plantas sensitivas del clado Mimosa: Tigmonastia, y defensas físicas" Chiapas, Mexico. October 2024.

Speaker at the 3rd Joint Congress Of Evolutionary Biology with: "Evolution of plant defenses in sensitive plants of the Mimosoid clade: Thigmonasty and physical defenses" Montreal, Canada. June 2024.

Speaker at the EEB Annual Graduate Student Symposium with: "Negative effects of mutualisms: ants visiting extrafloral nectaries disrupt pollination in *Ferocactus recurvus*" Cornell University. December 2022.

Speaker at the Iberoamerican Myrmecology Symposium with: "Sex is important: extrafloral nectaries and ant-plant interactions on young buds of *Opuntia robusta*". Online version. December 2020.

Speaker at the Iberoamerican Myrmecology Symposium with: "Effects of plant sex on domatia position and leaf herbivory in a gynodioecious population of *Myriocarpa longipes*". Online version. December 2020.

Speaker at the Mexican Congress of Ecology with: “Sex matters: effect of ant-plant interaction on herbivore, growth and survival in different sexes of *Opuntia robusta*”. Queretaro, México. October 2019.

Speaker at the research seminar at the Instituto de Ecología A.C. with: “Interaction between ants, herbivore insects and extrafloral nectaries in *Opuntia robusta*: a test of the defensive function”. Xalapa, México. July 2018.

Speaker at the simposyum ”Cátedras del semidesierto”, Fourth Research Forum: Weaving proposals towards action for conservation with the presentation: ”Spines in development are extrafloral nectaries in *Opuntia robusta* (Cactaceae): ultrastructure, anatomy and morphology.” Queretaro, Mexico. July 2018.

Speaker at the simposyum ”Cátedras del semidesierto”, Fourth Research Forum: Weaving proposals towards action for conservation with the presentation: “Effect of ants visiting the extrafloral nectaries of *Opuntia robusta* in a population of Central-Eastern Mexico.” Querétaro, México. July 2018.

Speaker at the XXII International Course on Biological Bases of Behavior with the poster: ”Defensive behavior of ants against herbivorous insects, nectar robbers and floral visitors of *Opuntia robusta*.” Tlaxcala, Mexico. October 2017.

Speaker at the VI Mexican Congress of Ecology with the poster: ”Interaction between ants, herbivorous insects and extrafloral nectaries of *Opuntia robusta*”. Guanajuato, Mexico. July 2017.

Speaker at the XX Mexican Congress of Botany with the poster: ”Morphology and anatomy of extrafloral nectaries of *Opuntia robusta* Wendl.” Mexico City, September, 2016.

Assistant to the VIII Meeting of the Mexican Society of Astrobiology (SOMA), Universidad Autónoma del Estado de Morelos, Cuernavaca, Morelos, August 2012.

Speaker at the 19th Exhibition of fungi and V Biodiversity Exhibition, Universidad Autónoma del Estado de México, Universidad Nacional Autónoma de México -UNAM, Instituto Mexiquense de Cultura, Toluca, Mexico, August 2008.

Courses and workshops:

- ”Theoretical and practical concepts of chemical ecology of insects”, by Dr. Samuel Cruz, at the Instituto de Ecología A.C., INECOL, Xalapa, Mexico. June 2020.
- ”Geometric morphometrics in R” (Morfometría geométrica en R), by Miriam Zelditch and Donald Swidersky from Michigan State University, at the Instituto de Ecología A.C., INECOL, Xalapa, Mexico. March 2019.
- “Measures of functional diversity in communities” (Medidas de diversidad funcional en las comunidades), by Dra. Claudia Moreno from UAEH, XIII Student Colloquium. Instituto de Ecología A.C., Xalapa, México. October 2018.
- “Rarefaction, diversity partitioning, and phylogenetic diversity: how to implement and interpret them” (Rarefacción, particionamiento de diversidad, y diversidad filogenética: cómo implementar e interpretarlos)” by Lou Jost, XIII Student Colloquium. Instituto de Ecología A.C., Xalapa, Mexico. October 2018.
- ”Intensive Field Course: Native bees from Mexico (Hymenoptera: Apoidea), diversity and plant-pollinator interactions” (Curso Intensivo de Campo: Abejas nativas de Mexico (Hymenoptera: Apoidea), diversidad e interacción planta-polinizador), by Dr. Ricardo Ayala and Dr. Ismael Hinojosa from the Graduate Program in Biological Sciences - Universidad Nacional Autónoma de México (UNAM), at the Chamela Biological Station, Jalisco. September-October, 2017.

Teaching experience:

- **Instructor** ”BIOEE 1610 Introductory Biology: Ecology and the Environment. Cornell University. July 2024
- **Instructor** ”Introduction to Statistics in R: applied for Biological Sciences”. Neuroscience laboratory, Universidad Autónoma del Estado de México, Mexico. Online version. July 2020
- **Instructor** ”Introduction to Statistics in R”, Research Group in Ecology and Evolutionary Biology, Universidad Autónoma del Estado de México. July - August 2019

Outreach:

- Nine science communication publications in several Mexican newspapers. 2012-2016
- One science communication publication in the magazine of Social Sciences entitled ”The Ixion Wheel”, Faculty of Humanities, Universidad Autónoma del Estado de México, 2012.

Scientific societies and editorial positions:

- **EcoEvoRxiv preprints**. Editorial Committee. *2023 - Present.*
  The American Society of Naturalists. Student member. *2024 - Present.*

Ecological Society of America. Student member. *2024 - Present.*
Botanical Society of Mexico. Student member. *2016 - Present.*
Mexican Scientific Society of Ecology. Student member. *2017 - Present.*