

Nathan J. Fumia

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PhD plant breeder and quantitative geneticist with expertise in food production systems, experimental design/analysis, and modeling

Education

University of Hawai'i at Mānoa, Honolulu, HI

PhD Candidate, Plant Breeding and Genetics

2021-anticipated graduation 2023

M.Sc., Tropical Plant and Soil Sciences with Focus in Plant Breeding

2019-2021

Minor in Ecology, Evolution, and Conservation Biology

California Polytechnic State University, San Luis Obispo, CA

B.S., Agricultural Business with Focus in Plant Protection Science

2011-2015

Research

University of Hawai'i at Mānoa

2019-Present

As a graduate research assistant to Dr. Michael Kantar (breeding and genetics), my research has focused on the uses and breeding of wild and semi-domesticated species with a focus on domestication syndrome and stress resistance. I am on track to contribute to at least 7 publications in journals such as Royal Society and Crop Science (including 4 first author and 3 contributing author). My skillset and accomplishments can be summarized as follows:

- Classification, identification, and selection of potato wild relative species for adaptation to abiotic stress tolerance (phylogenetic inference; occurrence data analysis; climate projection analysis; bioclimatic mixed-model analysis).
- Development and optimization of neo-domestication breeding schemes for strategic parametrization within the breeding cycle (experimental design; mixed-model analysis; genomics and phenomics; simulation).

Hawai'i Agriculture Research Center

2019-Present

As a HARC-HSPA Sustainable Agriculture Fellow under the supervision of Tyler Jones (Director of Research), my research has focused on the breeding and development of under-utilized tropical and subtropical species: *Stevia rebaudiana*, *Theobroma cacao*, and *Acacia koa*. My roles and contributions to HARC-HSPA include:

- Improvement of photoperiod response and yield components in stevia (4 cycles of phenotypic recurrent selection) with systems and methodologies development (CEA speed-breeding; kinship-based prediction) and multinational field evaluation logistics (Zambia; Kenya; China; USA).
- Evaluation methodologies optimized for high accuracy and precision of estimates to strategically reduce phenotyping costs in cacao.
- Trait frequency investigation in koa of disease resistance (*Fusarium* isolation and growth; experimental design) across wild and early breeding populations (seed source collection; generalized and ordinary mixed-model analysis).
- Facilities improvement (irrigation, electrical, structural) of greenhouse and controlled environment.
- SOP development for clonal propagation in papaya, ti, and coffee.

World Vegetable Center

2021-2023

Continued collaboration under the co-supervision of Dr. Roland Schafleitner and Dr. Derek Barchenger has been towards the development and deployment of predictive line selection from vegetable core collections. I am on track to contribute to at least 2 publications in The Plant Phenome (2 first author) which can be summarized as:

- Multi-omics predictive selection of *Capsicum annuum* lines for adaptability and resistance to abiotic (heat) stress and of *Vigna radiata* lines for yield and component traits.

Professional

iUNU, Inc.

2020-Present

Under the supervision of John Allen for contractual work, my focus has been as a horticultural specialist for customer success with roles in data analysis, crop model comparison, and reporting while also contributing to the development of a new product for insect identification and IPM protocol through camera vision.

Higher Plants Consulting, LLC.

2018-Present

I am the managing member and advise agricultural and horticultural clients on best management practices, agronomics, IPM, and controlled environment manipulation for maximizing productivity.

The Proving Grounds

2016-2019

My role as the manager of greenhouse production of cannabis included the design of fertilizer and IPM programs, soil media formulation, irrigation system design, and the programming of controlled environment software across a 1-acre facility with 25 direct and indirect reporting staff.

Nutrien (Crop Production Services)

2015-2016

As a crop consultant and trial supervisor under the co-supervision of Paul Maxwell (Branch Manager – Hollister, CA) and Doug Barnes (Branch Manager – Watsonville, CA), I performed two main roles across dozens of specialty row and tree crops: (1) diagnosis and recommendation of plant fertility and pest control and (2) design, implementation, and analysis of field and tree crop trials. Prior to this, as an agronomic intern under the supervision of Michael Atkins (Central Coast Division Agronomist), I assisted with agronomic and IPM related consultation from Oxnard, CA to Half Moon Bay, CA on dozens of specialty row crops.

Publications

Peer-reviewed

1. Jungers, J, Ewing, PM, Runck, B, Maaz, T, Carlson, C, Neyhart, J, **Fumia, N**, Bajgain, P, Subedi, S, Sharma, S, Senay, S, Hunter, M, Cureton, C, Gutknecht, J, Kantar, M. Adapting perennial grain and oilseed crops for climate resiliency. *Crop Science*, <https://doi.org/10.1002/csc2.20972>.
2. **Fumia, N.**, Kantar, MB, Lin, YP, Schafleitner, R, Lefebvre, V, Paran, I, Börner, A, Diez, MJ, Prohens, J, Bovy, A, Boyaci, F, Pasev, G, Tripodi, P, Barchi, L, Giuliano, G, Barchenger, DW. (2023). Exploration of high-throughput data for heat tolerance selection in *Capsicum annuum*. *The Plant Phenome*, <https://doi.org/10.1002/ppj2.20071>.
3. **Fumia, N.**, Pironon, S., Rubinoff, D., Khoury, C. K., Gore, M. A., & Kantar, M. B. (2022). Wild relatives of potato may bolster its adaptation to new niches under future climate scenarios. *Food and Energy Security*, <https://doi.org/10.1002/fes3.360>.
4. **Fumia, N.**, Rubinoff, D., Zenil-Ferguson, R., Khoury, C.K., Pironon, S., Gore, M.A., Kantar, M.B. (2022). Interactions between breeding system and ploidy affect niche breadth in *Solanum*. *R. Soc. Open Sci.* 9: 211862. <https://doi.org/10.1098/rsos.211862>.
5. Del Valle-Echevarria, A., **Fumia, N.**, Gore, M. A., & Kantar, M. (2021). Accelerating Crop Domestication in the Era of Gene Editing. *Plant Breeding Reviews*, Volume 45, 185.
6. Pironon, S., Borrell, J.S., Ondo, I., Douglas, R., Phillips, C., Khoury, C.K., Kantar, M.B., **Fumia, N.**, Soto Gomez, M., Viruel, J., Govaerts, R., Forest, F., Antonelli, A. (2020). Toward Unifying Global Hotspots of Wild and Domesticated Biodiversity. *Plants*, 9, 1128.

In-Review or in-preparation

1. **Fumia, N.**, Wolfe, M.D., Jones, T.C., Kantar, M.B. (2024). Optimizing cost efficiency under neo-domestication breeding schemes (in preparation)

2. **Fumia, N.**, Wolfe, M.D., Jones, T.C., Maaz, T., Dudley, N., Jackson, S., Dobbs, J., Stewart, J., Zenil-Ferguson, R., Kantar, M.B. (2023). Breeding cycle parametrization for neo-domestication breeding scheme development (in preparation)
3. **Fumia, N.**, Nair, R., Lin Y.P., Bishop-von Wettberg, E., Kantar, M.B., Schafleitner, R. (2023). Leveraging genomics and phenomics to speed improvement in mung bean (in preparation)

Popular Press Articles

1. **Fumia, N.**, Kantar, M., Radovich, T. (2022, October 19). Nathan Fumia is in The Science Zone on in Your Head with Professor Ted [Radio broadcast]. KTUH. <https://ktuh.org/podcasts>
2. Wight, A. J., **Fumia, N.**, Kantar, M.B., Khoury, C. (2022). Better Breeding Tools for Future-Proofing Potatoes. Alliance Biodiversity-CIAT. <https://alliancebioiversityciat.org/stories/future-proofing-potatoes>

Presentations

1. **Fumia, N.** “Predictive line selection with high-throughput data.” An invited workshop training at the WorldVeg Headquarters: Tainan, Taiwan. 30 March 2023.
2. **Fumia, N.**, Lin, Y.P., Shafleitner, R. “Development of a pipeline for line selection with insights into the mung bean mini-core collection.” An invited seminar presentation at the WorldVeg Headquarters: Tainan, Taiwan. 30 March 2023.
3. **Fumia, N.**, Kantar, MB, Lin, YP, Schafleitner, R, Lefebvre, V, Paran, I, Börner, A, Diez, MJ, Prohens, J, Bovy, A, Boyaci, F, Pasev, G, Tripodi, P, Barchi, L, Giuliano, G, Barchenger, DW. "Exploration of High-Throughput Data for Heat Tolerance Selection in *Capsicum annuum*." A poster presentation at Plant and Animal Genome Conference (PAG30): San Diego, CA. 13-18 January 2023.
4. **Fumia, N.**, Kantar, M.B., Khoury, C. “Wild relatives to potato may bolster its adaptation to new niches under future climate scenarios.” An invited webinar presentation to the International Center for Tropical Agriculture (CIAT) – Alliance Biodiversity. 7 June 2022.
5. **Fumia, N.**, Wolfe, M.D., Zenil-Ferguson, R., Kantar, M.B. “Simulation and Evidence: Comparison of predicted and realized phenotypic gain during the domestication of *Stevia rebaudiana*.” A poster presentation at the 46th Annual Tester Symposium (Best Graduate Poster Runner-Up), UH Manoa School of Life Sciences: Honolulu, HI. 20-22 April 2022.
6. **Fumia, N.** and Burden, J. “Tropical plant breeding.” A presentation and tour for the UH Manoa program Ho‘ākamai! Building Expertise In Fact Using Active Learning (BE-FACTUAL): Maunawili, HI. 16 June 2021.

Additional

Workshop Training

1. Griffith, E. and Sharp, J. “Navigating Tough Conversations in Statistical Collaboration.” University of Hawaii at Manoa, Honolulu, HI. 30 August 2022
2. Bernardo, R. “Genomewide Markers in Plant Breeding.” University of Minnesota, Minneapolis-Saint Paul, MN. 22-24 June 2022.
3. Lorenz, A. “Data Bootcamp for Genomic Prediction in Plant Breeding.” University of Minnesota, Minneapolis-Saint Paul, MN. 20-22 June 2022.
4. Byrne, D., Riera-Lizarazu, O., Endelman, J. “Tools for Genomics-Assisted Breeding in Polyploids.” San Diego State University, San Diego, CA. 13-14 January 2022.
5. Walsh, B. and Rosa, G. “Mixed Models in Quantitative Genetics: 26th Summer Institute in Statistical Genetics (SISG).” University of Washington, Seattle, WA. 7-23 July 2021.
6. Walsh, B., Gore, M., Gutierrez, L. “Introduction to Plant Quantitative Genetics and Advanced Statistical Plant Breeding: Tucson Plant Breeding Institute.” University of Arizona, Tucson, AZ. 6-10 January 2020.

Leadership

- Invited Panelist for “Press Exposure” in Communication in the Sciences (TPSS 654). University of Hawaii at Manoa, Honolulu, HI. 2 December 2022.
- Invited Panelist for “Taking the Comprehensive Exam” in Evoluncheon: Ecology, Evolution, and Conservation Biology Group. University of Hawaii at Manoa, Honolulu, HI. 18 November 2022.
- Student Mentor for “Greenhouse Facilities Learning” in Seeds4Tomorrow and Waipahu High School Internship Program. HARC-HSPA, Kunia, HI. January-April 2022.

Fellowships and Scholarships

HARC-HSPA Sustainable Agriculture Fellow

2020-Present

James L. Brewbaker Endowed Fellow

2021-Present

Haruyuki Kamemoto Scholarship

2021-2022

Languages

English – native fluency

Spanish – working proficiency

References

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Academic advisor in plant breeding and quantitative genetics during MSc and PhD program

Tyler Jones

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Personal and professional mentor of HARC-HSPA Sustainable Agriculture Fellowship program

Dr. Roland Schafleitner

Head of Molecular Genetics

Flagship Program Leader – Vegetable Diversity and Improvement

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International research mentor and continued collaborator

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Collaborator and mentor in horticultural controlled environment production