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, Plant Breeding and Genetics *2021- 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

Hawai'i Agriculture Research Center *2019-Present*
As a HARC-HSPA Sustainable Agriculture Fellow (*2019-2023*) and Research Associate – Genetic Resources Scientist *(2024-Present)* 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.

University of Hawai'i at Mānoa *2019-2023*
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).

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

Hawaii Agriculture Research Center *2024-Present*

Broadly my role as Research Associate – Genetic Resources Scientist is the management and implementation of research projects, infrastructure development and providing general scientific expertise to the Organization. Work includes building and managing a genetic resources laboratory towards investigations in basic and applied science with relevance to the tropics and subtropics, including but not limited to, plant breeding, quantitative genetics, functional genomics, phenomics, controlled-environment agriculture, and agronomy.

iUNU, Inc. *2020-2023*

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, breeding and genetics, agronomics, IPM, and controlled environment manipulation for optimizing 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. **Fumia, N.**, Nair, R., Lin, Y. P., Lee, C. R., Chen, H. W., von Wettberg, E. B., Kantar, M. ,Schafleitner, R. (2023). Leveraging genomics and phenomics to accelerate improvement in mungbean: A case study in how to go from GWAS to selection. The Plant Phenome Journal, 6(1), e20088.
2. 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. (2023). Adapting perennial grain and oilseed crops for climate resiliency. Crop Science, https://doi.org/10.1002/csc2.20972.
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. (2023). Exploration of high-throughput data for heat tolerance selection in Capsicum annuum. The Plant Phenome, https://doi.org/10.1002/ppj2.20071.
4. **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.

5. **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.
6. 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.
7. 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., Zenil-Ferguson, R., Kantar, M.B. (2024). Optimizing cost efficiency under neo-domestication and wide hybridization breeding schemes (in Review – Crop Science)
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. (2024). Breeding cycle parametrization for neo-domestication breeding scheme development (in preparation)
3. Campbell, Q., Domingo, R., Castaneda-Alvarez, N., Bishop-von Wettberg, E., Runck, B., McCormick, A., **Fumia, N.**, Neyhart, J., Wang, D., Kilian, B., Wambugu, P., Nyamongo, D., Thompson, A., Rieseberg, L., Gore, M.A., Kantar, M.B. (2024). Climate adaptive capacity within Sorghum germplasm collections (in preparation)
4. Pratt, R., Kantar, M.B., **Fumia, N.**, Nankar, A. (2024). Highlights from the 18th EUCARPIA International Meeting on Genetics and Breeding of Capsicum and Eggplant; From wild to mild and back again: genetic diversity, crop improvement strategies and our shared cultural heritage with chile (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://alliancebioversityciat.org/stories/future-proofing-potatoes

Presentations

1. **Fumia, N.** "The International Research Center experience and predictive line selection in mung bean at WorldVeg." An invited seminar presentation at the Graduate Seminar Series in the Tropical Plant and Soil Science Department: UH Manoa TPSS, Honolulu, HI. 8 September 2023.
2. **Fumia, N.** and Burden, J. "The history of breeding tropical crops at the Hawaii Agriculture Research Center." An invited talk for the UH Manoa program Hoʻākamai! Building Expertise in FACT Using Active Learning (BE-FACTUAL): Maunawili, HI. 21 July 2023.
3. **Fumia, N.**, Nair, R., Lin Y.P., Bishop-von Wettberg, E., Kantar, M.B., Schafleitner, R. "Leveraging genomics and phenomics to speed improvement in mung bean." A poster presentation at the National Association of Plant Breeders Conference (NAPB): Greenville, SC. 16-20 July 2023.
4. **Fumia, N.** "Predictive line selection with high-throughput data." An invited workshop training at the WorldVeg Headquarters: Tainan, Taiwan. 30 March 2023.
5. **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.
6. **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.

7. **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.
8. **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.
9. **Fumia, N.** and Burden, J. "Tropical plant breeding." A presentation and tour for the UH Manoa program Hoʻākamai! 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 *2020-2023*
James L. Brewbaker Endowed Fellow *2021-2023*
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

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

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Collaborator and mentor in horticultural controlled-environment production