

Gautam Shirsekar

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EDUCATION

- 2006 – 2013 **PhD in Plant Pathology**, The Ohio State University, Columbus, OH, USA
- 2000 – 2002 **MSc in Plant Pathology**, Konkan Agricultural University, Dapoli, Maharashtra, India
- 1996 – 2000 **BSc in Agriculture**, Konkan Agricultural University, Dapoli, Maharashtra, India

RESEARCH EXPERIENCE


- 2024 – present **Assistant Professor**
Department of Entomology and Plant Pathology
Institute of Agriculture, University of Tennessee, Knoxville
Co-evolutionary dynamics in the North American wild grape-downy mildew pathosystem
- 2014 – 2024 **Post-doctoral Fellow**
Advisor: Prof. Detlef Weigel (Department of Molecular Biology, Max Planck Institute for Biology), Germany
- **Evolutionary genomics of plant colonization**: showed how [North America is a melting pot of Eurasian *Arabidopsis* and admixture is prevalent](#) in this predominantly selfing species.
 - **Plant pathosystem co-evolution**: leading the project on understanding tangled population history of Eurasian *Arabidopsis thaliana* and its obligate biotrophic pathogen *Hyaloperonospora arabidopsis* by applying population genomics tools on [range-wide collection of both the organisms](#).
- 2006 – 2013 **Graduate Research Associate**
Advisor: Dr. Guo-liang Wang (Department of Plant Pathology, The Ohio State University), USA
- **Molecular plant-microbe interactions**: showed how fungal effector protein [AvrPiz-t suppresses host defense](#) and [how it triggers](#) immune responses in rice
 - **Genetics of plant immunity**: [identified and characterized](#) suppressor mutants of a rice lesion mimic mutant *spl11* to study regulation of programmed cell death in rice
- 2002 – 2005 **Senior Research Fellow**
Advisor: Dr. Akhilesh Nandan Mishra (Regional Wheat Research Station, Indian Agricultural Research Institute, India)
- **Disease resistance breeding**: identified [diverse sources of resistance](#) to leaf rust of wheat and elucidated [genetics of leaf rust resistance](#) in elite wheat breeding program of India

PUBLICATIONS





(» = first author, ✉ = corresponding author, Rx= preprint on bioRxiv)

PUBLISHED





- 2023 Wlodzimierz P, Rabanal FA, Burns R, Naish M, Primetis E, Scott A, Mandakova T, Gorringer N, Tock AJ, Holland D, Fritschi K, Habring A, Lanz C, Patel C, Schlegel T, Collenberg M, Mielke M, Nordborg M, Roux F, **Shirsekar G**, Alonso-Blanco C, Lysak MA, Novikova PY, Bousious A, Weigel D, and Henderson IR. Cycles of satellite and transposon evolution in *Arabidopsis* centromeres. *Nature*. doi:[10.1038/s41586-023-06062-z](https://doi.org/10.1038/s41586-023-06062-z)
- 2021 » **Shirsekar G**, Devos J, Latorre SM, Blaha A, Queiroz-Dias M, González-Hernando A, Lundberg DS, Burbano H, Fenster CB and Weigel D. Multiple sources of introduction of North American *Arabidopsis thaliana* from across Eurasia. *Molecular Biology and Evolution*. doi:[10.1093/molbev/msab268](https://doi.org/10.1093/molbev/msab268) @
- Vogt F, **Shirsekar G** ✉ and Weigel D. *vcf2gwas* - Python API for comprehensive GWAS analysis using GEMMA *Bioinformatics*. doi:<https://doi.org/10.1093/bioinformatics/btab710> @
Code:  [frankvogt/vcf2gwas](https://github.com/frankvogt/vcf2gwas)
- Lundberg DS, Ayutthaya PPN, Strauss A, **Shirsekar G**, Lo WS, Lahaye T and Weigel D. Host-associated microbe PCR (hamPCR) enables convenient measurement of both microbial load and community composition. *eLife*. doi:[10.7554/eLife.66186](https://doi.org/10.7554/eLife.66186) @
- 2020 Karasov TL, **Shirsekar G**, Schwab R and Weigel D. What natural variation can teach us about resistance durability. *Current Opinion in Plant Biology*. doi:[10.1016/j.pbi.2020.04.010](https://doi.org/10.1016/j.pbi.2020.04.010).
- Regalado J, Lundberg DS, Deusch O, Kersten S, Karasov TL, Poersch K, **Shirsekar G** and Weigel D. Combining whole-genome shotgun sequencing and rRNA gene amplicon analyses to improve detection of microbe–microbe interaction networks in plant leaves. *The ISME Journal* doi:[10.1038/s41396-020-0665-8](https://doi.org/10.1038/s41396-020-0665-8) @
- 2019 Bai P, Park CH, **Shirsekar G**, Songkumarn P, Bellizzi M and Wang GL. Role of lysine residues of the Magnaporthe oryzae effector AvrPiz-t in effector- and PAMP-triggered immunity. *Molecular Plant Pathology*. doi:[10.1111/mpp.12779](https://doi.org/10.1111/mpp.12779) @
- 2018 Fan JB, Bai,P, Ning Y, Wang J, Shi X, Xiong Y, Zhang K, He F, Zhang C, Wang R, Meng X, Zhou J, Wang M, **Shirsekar G**, Park CH, Bellizzi M, Liu W, Jeon JS, Xia Y, Shan L and Wang GL. The monocot-specific receptor-like kinase SDS2 controls cell death and immunity in rice. *Cell Host & Microbe*. doi:[10.1016/j.chom.2018.03.003](https://doi.org/10.1016/j.chom.2018.03.003) @
- Kieu TXV, Kim CY, Hoang TV, Lee SK, **Shirsekar G**, Seo YS, Lee SW, Wang GL and Jeon JS. OsWRKY67 plays a positive role in basal and XA21-mediated resistance in rice. *Frontiers in Plant Science*. doi:[10.3389/fpls.2017.02220](https://doi.org/10.3389/fpls.2017.02220) @
- 2016 Chakraborty S, Hill AL, **Shirsekar G**, Afzal AJ, Wang GL, Mackey D and Bonello P. Quantification of hydrogen peroxide in plant tissues using Amplex Red *Methods*. doi:[10.1016/j.ymeth.2016.07.016](https://doi.org/10.1016/j.ymeth.2016.07.016) @
- Weiss CL, Schuenemann VJ, Devos J, **Shirsekar G**, Reiter E, Gould BA, Stinchcombe JR, Krause J and Burbano HA. Temporal patterns of damage and decay kinetics of DNA retrieved from plant herbarium specimens *Royal Society Open Science*, doi:[10.1098/rsos.160239](https://doi.org/10.1098/rsos.160239) @

- » Park CH*, **Shirsekar G***, Bellizzi M, Chen SB, Songkumarn P, Xie X, Shi X, Ning Y, Suttiviriya P, Wang M, Umemura K and Wang GL. The E3 ligase APIP10 connects the effector AvrPiz-t to the NLR receptor Piz-t in rice. *PLoS Pathogens*, doi:[10.1371/journal.ppat.1005529](https://doi.org/10.1371/journal.ppat.1005529) @ (* equal contribution)
- 2015 Mishra AN, Kaushal K, Dubey VG, **Shirsekar G** and Saiprasad SV. Validation of race non-specific, adult plant leaf resistance genes *Lr34* and *Lr67* in some common wheat (*Triticum aestivum* L.) cultivars. *Indian Journal of Genetics*,  [pdf](#)
- Mishra AN, **Shirsekar G**, Yadav S, Kaushal K, Dubey VG and Saiprasad SV. Sources of resistance to Indian pathotypes of *Puccinia graminis tritici* and *P. triticina* in durum wheat. *Plant Breeding*, doi:[10.1111/pbr.12295](https://doi.org/10.1111/pbr.12295) @
- 2014 » **Shirsekar G***, Vega-Sanchez ME*, Bordeos A, Baraoidan M, Swisshelm A, Fan J, Park CH, Leung H and Wang GL. Identification and characterization of suppressor mutants of *sp11*-mediated cell death in rice. *Molecular Plant-Microbe Interactions* doi:[10.1094/MPMI-08-13-0259-R](https://doi.org/10.1094/MPMI-08-13-0259-R) @ (* equal contribution)
- 2012 » Park CH*, Chen S*, **Shirsekar G***, Zhou B*, Khang CH, Songkumarn P, Afzal AJ, Ning Y, Wang R, Bellizzi M, Valent B, and Wang GL The *Magnaporthe oryzae* effector AvrPiz-t targets the RING E3 ubiquitin ligase APIP6 to suppress pathogen-associated molecular pattern-triggered immunity in rice. *Plant Cell*, doi:[10.1105/tpc.112.105429](https://doi.org/10.1105/tpc.112.105429) @ (* equal contribution)
- 2011 Mishra AN, Yadav S, **Shirsekar G**, Dubey VG, Kaushal K, and Saiprasad SV. Diversity for resistance to stem and leaf rusts in Indian wheat germplasm. *Indian Journal of Plant Genetic Resources*. <https://www.indianjournals.com/ijor.aspx?target=ijor:ijpgr&volume=24&issue=3&article=005>
- 2010 » **Shirsekar G**, Dai L, Hu Y, Wang X, Zeng L, and Wang GL. Role of ubiquitination in plant innate immunity and pathogen virulence. *Journal of Plant Biology* doi:[10.1007/s12374-009-9087-x](https://doi.org/10.1007/s12374-009-9087-x)
- 2009 Mishra AN, **Shirsekar G**, Yadav S, Dubey V, Kaushal K, Saiprasad SV and Pandey HN. Protocols for evaluating resistance to leaf and stem rusts in durum and bread wheats. *Indian Phytopathology* <https://www.cabdirect.org/cabdirect/abstract/20103251718>
- 2005 Mishra AN, Kaushal K, Yadav S, **Shirsekar G**, and Pandey HN. A leaf rust resistance gene, different from *Lr34*, associated with leaf tip necrosis in wheat. *Plant Breeding* doi:[10.1111/j.1439-0523.2005.01140.x](https://doi.org/10.1111/j.1439-0523.2005.01140.x)
- Mishra AN, Kaushal K, **Shirsekar G**, Yadav S, Brahma R and Pandey HN. Genetic basis of seedling-resistance to leaf rust in bread wheat "Thatcher". *Plant Breeding* doi:[10.1111/j.1439-0523.2005.01141.x](https://doi.org/10.1111/j.1439-0523.2005.01141.x)
- Mishra AN, Kaushal K, Yadav S, **Shirsekar G**, and Pandey HN. The linkage between the stem rust resistance gene *Sr2* and pseudo-black chaff in wheat can be broken. *Plant Breeding* doi:[10.1111/j.1439-0523.2005.01136.x](https://doi.org/10.1111/j.1439-0523.2005.01136.x)


PREPRINTS / IN REVIEW

- 2024 Tao Y, Xian W, Rabanal F, Movilli A, Lanz C, **Shirsekar G**, and Weigel D. Atlas of telomeric repeat diversity in *Arabidopsis thaliana*. *In review: Genome Biology*
Rx:  [doi.org/https://doi.org/10.1101/2023.12.18.572118](https://doi.org/10.1101/2023.12.18.572118)
- 2023 Mencia R, Arce AL, Houriet C, Xian W, Contreras A, **Shirsekar G**, Weigel D, and Manavella PA. Transposon-triggered epigenetic chromatin dynamics modulate EFR-related pathogen response. *In review: Nature Structural and Molecular Biology*
Rx:  [doi.org/https://doi.org/10.1101/2023.10.06.561201](https://doi.org/10.1101/2023.10.06.561201)
- 2022 Karasov TL, Neumann M, **Shirsekar G**, Monroe G, PATHODOPSIS Team, Weigel D, and Schwab R. Drought selection on *Arabidopsis* populations and their microbiomes. *In review: Nature Microbiology*
Rx:  [doi.org/https://doi.org/10.1101/2022.04.08.487684](https://doi.org/10.1101/2022.04.08.487684)
- 2020 Karasov TL, Neumann M, Duque-Jaramillo A, Kersten S, Bezrukov I, Schroepel B, Symeonidi E, Lundberg DS, Regalado J, **Shirsekar G**, Bergelson J and Weigel D. The relationship between microbial population size and disease in the *Arabidopsis thaliana* phyllosphere. *bioRxiv*.
Rx:  doi.org/10.1101/828814

IN PREP


- 2023 Murray K, Vogt F, Schwab R, Paul F, Tahtsidou C, Duerr HK, Kontos I, Deusch O, Velthoven R, Collenberg M, Karwounopoulos S, Kersten S, Lucke M, Neumann M, PATHODOPSIS Team, Weigel D , and **Shirsekar G**  Evolutionary history of *Arabidopsis*-downy mildew pathosystem. (*co-corresponding author*)
- Teasdale L*, Murray K*, Schlegel T, Collenberg M, Contreras-Garrido A, Van Ess L, Vogt F, Juettner J, Bader L, Lundberg DS, Lanz C, Ayutthaya PPN, Mencia R, Velthoven R, Drost HG, Weigel D , and **Shirsekar G**  Birth and death; or persistence of an immune system. (*co-corresponding author*)

OPEN-SOURCE SOFTWARE

- 2021 – present **vcf2gwas**
A Python API for GWAS analysis using GEMMA.
Streamlines GWAS workflow for beginners and experts alike while improving reproducibility of the analysis using principles of object oriented programming (OOP).
- Role: Software architect and co-developer
- Code:  [frankvogt/vcf2gwas](https://github.com/frankvogt/vcf2gwas)

TALKS

- 2023 Innovations in the immune system: Towards understanding mechanisms of evolvability. *SPP2125 DECRYPT: Plant Immunity Workshop, ETH, Zürich, Switzerland, 13-14 April, 2023*
- Lessons from the wild!: evolutionary applications to plant pathology. *Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN, USA*


- 2022 Entangled co-evolutionary history of *Hyaloperonospora arabidopsidis* and its host *Arabidopsis thaliana*. 21st Annual meeting of the Oomycete Molecular Genetics Network, Mendel University, Brno, Czech Republic. (Conference talk)  [pdf](#)
- 2020 5 and 'Dopsis: Genetic history of North American Arabidopsis, Distinguished speaker seminar series of Max Planck Institute for Biology, Tuebingen, Germany. (Campus Talk)
- 2017 North American Arabidopsis: Population structure and co-evolution with downy mildew pathogen. Regional Plant Science Meeting (Baden-Wuerttemberg region), Tuebingen, Germany. (Invited Talk)
- 2012 Arms race between rice and rice blast fungus. Department of Plant Pathology, Penn State University, University Park, PA, USA (Invited Talk)

CONFERENCES

- 2022 21st Annual meeting of the Oomycete Molecular Genetics Network, Mendel University, Brno, Czech Republic. (Talk)
- 2017 Gordon Research Conference on Ecological and Evolutionary Genomics. University of New England, Biddeford, ME, USA (Poster)
- 2016 2nd Wild Plant Pathosystems Conference, Helsinki, Finland (Poster)
- 2013 Keystone Symposium on Plant Immunity: Pathways and Translation (D5). Big Sky, MT, USA (Poster)
- 2010 Gordon Research Conference on Plant Molecular Biology. Holderness, NH, USA (Poster)
- 2009 International Plant Molecular Biology Congress. St. Louis, MO, USA (Poster)
- 2008 The American Phytopathological Society Centennial Meeting, Minneapolis, MN, USA (Poster)

TEACHING

UNDERGRADUATE

- 2021 – 2022 Co-instructor, *Practical course for Biochemistry majors, University of Tuebingen, Tuebingen, Germany.*
Developed and conducted genome annotation workshop using [Web-apollo](#). Zoom-based instruction for 80 students.
- 2019 Co-instructor, *Practical course for Biochemistry majors, University of Tuebingen, Tuebingen, Germany.*
Developed and instructed quantification of gene expression lab.  : [lab handout](#) (80 students)

UPPER-UNDERGRADUATE/GRADUATE

- 2016-17 Co-instructor, "*Genotype to Phenotype Module*", *Ph.D Introductory Course, Max-Planck-Institute for Developmental Biology, Tuebingen, Germany.*
Presented lectures on genotyping methods with next-generation sequencing platforms (12 students)
- 2013 Teaching Assistant, *Course: Graduate Seminar on "Epigenetics and Plant-Microbe Interactions", Department of Plant Pathology, the Ohio State University, Columbus, OH, USA.*
Selected papers, guided discussions (7 students)
- Guest Lecturer, *Course: "Molecular Bases of Plant Host-Microbe Interactions", Department of Plant Pathology, the Ohio State University, Columbus, OH, USA.*
Topic: Genetics of Host-pathogen Interactions 📄 : [lecture handout](#)
- 2010 Teaching Assistant, *Course: "Mycology", Department of Plant Pathology, the Ohio State University, Columbus, OH, USA.*
Developed and instructed laboratory exercises, graded laboratory exams and presented lecture on phylum Ascomycota.

STUDENT SUPERVISION

MASTER'S THESIS AND INTERN

- 2022 Laura Bader (Master's thesis, Microbiology), University of Tuebingen, Germany.
Determinants of broad-spectrum disease resistance in Arabidopsis thaliana against downy mildew causing oomycete pathogen Hyaloperonospora arabidopsidis
- 2021 Amr Saadeldin (Intern, Bio-medicine) , University of Eastern Finland, Finland.
Transcriptome of three Hyaloperonospora arabidopsidis isolates for annotation of the genomes
- 2020 – 2021 Frank Vogt (Intern, Nano-science), University of Tuebingen, Germany.
Arabidopsis high-throughput pathogen screening, and developing GWAS workflow pipeline in Python, vcf2gwas.
- 2019 Rosanne Velthoven (Intern, Plant Sciences), Department of Plant Sciences, Wageningen University, the Netherlands.
Long-read sequencing (Pacific Biosciences platform) of three Hyaloperonospora arabidopsidis isolates that resulted in the generation of 3 reference genome assemblies
- Arianna Weingarten (Intern, Archaeology), University of Tuebingen, Germany.
NBS-LRR diversity in North American Accessions
- 2018 Andreas Blaha (Intern, Biochemistry), University of Tuebingen, Germany.
Whole-genome sequencing of North American Arabidopsis project using Illumina platform

BACHELOR'S THESIS

- 2022-ongoing Hanna Kai Duerr (Biology), University of Tuebingen, Germany.
Targeted sequencing in a patho-system using Oxford Nanopore Technology.
- 2020 Theresa Schelgel (Biochemistry), University of Tuebingen, Germany.
High throughput downy mildew disease screening in Arabidopsis and generation of HiFi (Pacific Biosciences) reads for 20 Arabidopsis lines genome assembly.

- 2019 Anamaria Bernal (Biology), University of Applied Sciences Bonn-Rhein-Sieg , Germany.
Identifying disease resistance loci in Swedish Arabidopsis with QTL mapping using genotyping-by-sequencing technology.

UNDERGRADUATE

- 2014 – 2017 Chrisoula Tahtsidou (Biochemistry), Robson Lotario, Alba González-Hernando, and Maique Queiroz-Dias (Biology), Sara Karwounopoulos (Physics)
- 2006 – 2013 Andrew Swisshelm (Agronomy), Megan Murphy and Qi Sun (Biology), Nicolas Zane Conley and Diana Saebuyul Shin (Molecular Genetics), Amanda Ferguson (Plant Pathology)

GRANTS & FELLOWSHIPS

- 2009 – 2010 Ohio Agricultural Research and Developmental Council (OARDC), SEEDS competitive grant
"Mapping of Suppressor Genes Responsible for Suppression of Lesion- Mimic Phenotype Caused by the *spl11* Mutation in Rice (*Oryza sativa* L.)" (\$5000)
- 2006 – 2007 University Fellowship. The Ohio State University, Columbus, OH, USA.

AWARDS & HONORS

- 2011 CC Allison Award, in **recognition of high achievement in research and service** to the Department of Plant Pathology, the Ohio State University, Columbus, OH, USA.
- 2008 The Zahir Eyal **Travel Award**, American Phytopathological Society, Minneapolis, MN, USA
- 2002 Hexamar Foundation Gold Medal, for **Academic Excellence** in Plant Pathology, Konkan Agricultural University, Dapoli, MH, India.
- 2000 University Gold Medal, for **Academic Excellence** in the University, Konkan Agricultural University, Dapoli, MH, India.
- Sir Robert Allan Gold Medal, for **Academic Excellence** in the Agriculture faculty of Konkan Agricultural University, Dapoli, MH, India.
- ASPEE Foundation Gold Medal, for **Academic Excellence** in the field of Plant Protection, Konkan Agricultural University, Dapoli, MH, India.

WORKSHOPS & PROFESSIONAL DEVELOPMENT

- 2022 Building and managing your research group. Planck Academy, Max Planck Society (Virtual)
- 2020 Voice training for the virtual stage: Communicating with confidence and accuracy, Planck Academy, Max Planck Society (Virtual)
- 2016 Workshop on Population and Speciation Genomics, Cesky Krumlov, Czech Republic.
- 2014 Workshop on Molecular Evolution, Marine Biological Laboratory, Woods Hole, MA, USA.

ACADEMIC SERVICE & AFFILIATIONS

REVIEWER

Peer-reviewed journals

Proceedings of the National Academy of Sciences of the United States of America (PNAS), BMC Genomics, New Phytologist, Theoretical and Applied Genetics, PLoS ONE, Molecular Plant Pathology, and Genome Research

Grant review panels

2007, '10, '11 **SEEDS competitive grants for graduate students** Ohio Agricultural Research and Development Council (OARDC), the Ohio State University, Columbus, OH, USA

2009 **The travel grants committee**
American Phytopathological Society (APS), Minneapolis, MN, USA.

COMMITTEES AND COMMUNITY SERVICE

2019, 2022 **Genomics and Microbiology Volunteer**
Open House of Max Planck Campus, Max Planck Institute for Biology, Tuebingen, Germany

2010 **Graduate student representative**
The task force assigned by the Ohio State University's graduate school to review all the graduate programs in the life sciences. The Ohio State University, Columbus, OH, USA.

2008 – 2009 **President**
Plant Pathology Graduate Student Association, the Ohio State University, Columbus, OH, USA.

2007 – 2008 **Member of the graduate studies committee**
Department of Plant Pathology, the Ohio State University, Columbus, OH, USA.

HOST

2022 **Session chair**, Novozymes Prize Symposium of Prof. Detlef Weigel, Plant Biology: From the field to the lab and back. University of Tuebingen, Germany.

2012 **Prof. Mary-Beth Mudgett**, Department of Biology, Stanford University, CA, USA.
Plant Pathology Graduate Students' Association (PPGSA) invited speaker

AFFILIATIONS

2021 – present Society for Molecular Biology and Evolution

2007 – 2010 American Phytopathological Society

REFERENCES

Prof. Detlef Weigel, Director, Department of Molecular Biology, Max Planck Institute for Biology, Tuebingen, 72076, DE. weigel@tue.mpg.de

Dr. Guo-Liang Wang, Professor and OSU Distinguished Scholar, Department of Plant Pathology, the Ohio State University, Columbus, OH, 43210, USA. wang.620@osu.edu

Dr. Sophien Kamoun, Group Leader, The Sainsbury Laboratory, Norwich Research Park, Norwich, NR4 7UH, UK. sophien.kamoun@tsl.ac.uk