

# Dr. Prem Pratap Singh

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## Summary

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Plant scientist with expertise in plant-pathogen interactions and multi-omics analysis. Currently investigating grapevine-virus interactions using transcriptomic and metabolomic approaches at UC Davis. Led CDFA/USDA-funded projects on grapevine virus impacts and developed nano-encapsulated antifungal formulations. Track record of 20+ publications, grant contributions, and mentorship. Proficient in R, Python, GC-MS, LC-MS/MS, RNA-seq, and bioinformatics pipelines.

## Education

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### Ph.D. in Plant Pathology / Postharvest / Food Safety

2017 – 2023

Banaras Hindu University, India

*Thesis:* Assessment and amelioration of plant-based bioactive formulation against food-borne pathogens

### M.Sc. in Botany

2017

*Gold Medalist*

Banaras Hindu University, India

*Specialization:* Plant Pathology & Plant Protection; Microbial Genetics & Biotechnology; Conservation & Restoration Ecology

### B.Sc. in Botany

2012 – 2015

Banaras Hindu University, India

## Professional Experience

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### Postdoctoral Scholar

Sep 2023 – Present

University of California, Davis

*Mentors:* The late Dr. Anita Oberholster & Dr. David E. Block

- Led a multi-year, omics-driven project funded by CDFA and USDA to dissect the metabolic and transcriptional impacts of Grapevine Red Blotch Virus (GRBV) on *Vitis vinifera* cv. Merlot berries and wine quality.
- Developed and validated RT-qPCR and digital PCR assays to quantify GRBV titers across >10 vineyard blocks, enabling spatial and seasonal tracking of infection load.
- Integrated multi-platform datasets (GC-MS, LC-MS/MS, RNA-Seq) to identify putative biomarkers linked to virus-induced changes in grape cell wall composition and metabolite profiles.
- Collaborated with interdisciplinary teams of virologists, analytical chemists, and bioinformaticians to translate mechanistic findings into practical strategies for precision viticulture and harvest decision-making.
- Presented results at national conferences (ASEV and ASPB), contributing to stakeholder outreach and industry workshops on GRBV management.

### Ph.D. Researcher

2017 – 2023

Banaras Hindu University, India

- Engineered a nano-encapsulated essential oil formulation using chitosan-gel matrices, significantly inhibiting *Aspergillus flavus* growth and aflatoxin B<sub>1</sub> production for postharvest food safety.
- Set up a multi-disciplinary R&D pipeline integrating antifungal screening, GC-MS metabolomics, SEM imaging, and gene expression analysis to uncover mechanisms of oxidative stress and membrane disruption.

- Developed a green, cost-effective, and scalable chitosan-based delivery system with enhanced stability and sustained release over 60 days.
- Published >10 peer-reviewed articles and presented at 5+ national conferences, contributing to IARI's translational postharvest biotech program.

## Research Areas

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- Grapevine–virus interactions & berry metabolism
- Transcriptomics & multi-omics integration
- Computational biology (pathway analysis, molecular docking, protein modeling)
- Plant pathology & postharvest biology
- Nanoencapsulation of plant-derived bioactives
- Plant volatiles: extraction, characterization & bioactivity

## Technical Skills

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<b>Plant–Pathogen</b>	Grapevine virus–host dynamics, transcriptomic profiling, viral detection & quantification (RT-qPCR, dPCR), metabolic pathway analysis
<b>Analytical</b>	GC-MS, LC-MS/MS, RT-qPCR, digital PCR, RNA-seq, SEM imaging, spectral analysis
<b>Computational</b>	R (Bioconductor, DESeq2, ggplot2), Python, multi-omics integration, statistical modeling, pathway enrichment, data visualization
<b>Postharvest</b>	Quality evaluation, storage trials, maturity indices, microbial safety, aflatoxin analysis, controlled atmosphere systems
<b>Formulation</b>	Nano-encapsulation, chitosan matrices, essential oil formulations, sustained-release systems
<b>Management</b>	Experimental design, grant writing, mentorship, cross-functional coordination, stakeholder communication

## Publications

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### Research & Review Articles

1. **Singh, P.P.**, Singh, R., Verma, P.K. & Prakash, B. Systematic elucidation of aflatoxigenic *Aspergillus flavus* inhibition: Integrating EOs-based formulation with mathematical modeling and transcriptomic analysis. (*In preparation*).
2. **Singh, P.P.**, Scully, H., Reddy, K., Boghozian, A.M., Medina-Plaza, C., Oberholster, A. & Sudarshana, M.R. Temporal dynamics of GRBV accumulation in grapevine leaves is influenced by fruit maturity stages. (*In preparation*).
3. **Singh, P.P.**, Reddy, K., Boghozian, A.M., Oberholster, A. & Sudarshana, M.R. Grapevine Red Blotch Disease: An emerging threat to global viticulture. (*In preparation*).
4. **Singh, P.P.**, Jaiswal, A.K., Singh, R., Kumar, A., Gupta, V., Raghuvanshi, T.S., Sharma, A. & Prakash, B. (2024). Assessment of *Trachyspermum ammi* essential oil against *Aspergillus flavus*, aflatoxin B<sub>1</sub> contamination, and post-harvest quality of *Sorghum bicolor*. *Food Chemistry*, 443, 138502.
5. Prakash, B., **Singh, P.P.**, Gupta, V. & Raghuvanshi, T.S. (2024). Essential oils as green promising alternatives to chemical preservatives for agri-food products. *Food and Chemical Toxicology*, 183, 114241.
6. **Singh, P.P.**, Jaiswal, A.K., Raghuvanshi, T.S. & Prakash, B. (2023). Insights into the antimicrobial efficacy of *Coleus aromaticus* essential oil against food-borne microbes. *Food and Chemical Toxicology*, 182, 114111.

7. Gupta, V., **Singh, P.P.** & Prakash, B. (2023). Synthesis, characterization, and assessment of chitosan-nanomatrix enriched with antifungal formulation. *International Journal of Biological Macromolecules*. DOI:10.1016/j.ijbiomac.2023.123684.
8. Kumar, A., **Singh, P.P.**, Kumar, M. & Prakash, B. (2022). Nanoencapsulated plant-based antifungal formulation against *Aspergillus flavus* and aflatoxin B<sub>1</sub> contamination. *International Journal of Food Microbiology*, 109681.
9. Kumar, A., **Singh, P.P.** & Prakash, B. (2022). Assessing the efficacy of chitosan nanomatrix incorporated with *Cymbopogon citratus* essential oil against food-borne molds. *Pesticide Biochemistry and Physiology*, 180, 105001.
10. Prakash, B., **Singh, P.P.**, Kumar, A. & Gupta, V. (2022). Botanicals for sustainable management of stored food grains. *Anthropocene Science*, pp. 1–18.
11. Kumar, A., Singh, S.K., Kant, C., Verma, H., Kumar, D., **Singh, P.P.** et al. (2021). Microbial biosurfactant: a new frontier for sustainable agriculture and pharmaceutical industries. *Antioxidants*, 10(9), 1472.
12. Kumar, M., Singh, S.K., **Singh, P.P.** et al. (2021). Potential anti-*Mycobacterium tuberculosis* activity of plant secondary metabolites: Insight with molecular docking interactions. *Antioxidants*, 10(12), 1990.
13. **Singh, P.P.**, Jaiswal, A.K., Kumar, A., Gupta, V. & Prakash, B. (2021). Untangling the multi-regime molecular mechanism of verbenol-chemotype *Zingiber officinale* essential oil against *Aspergillus flavus* and aflatoxin B<sub>1</sub>. *Scientific Reports*, 1, 1–20.
14. **Singh, P.P.**, Gupta, V. & Prakash, B. (2021). Recent advancement in functional properties and toxicity assessment of plant-derived bioactive peptides using bioinformatic approaches. *Critical Reviews in Food Science and Nutrition*. DOI:10.1080/10408398.2021.2002807.
15. Yadav, A., Kumar, A., **Singh, P.P.** & Prakash, B. (2021). Pesticidal efficacy, mode of action and safety limits profile of essential oils based nanoformulation. *Pesticide Biochemistry and Physiology*, 175, 104813.
16. **Singh, P.P.**, Kumar, A. & Prakash, B. (2020). Elucidation of antifungal toxicity of *Callistemon lanceolatus* essential oil encapsulated in chitosan nanogel against *Aspergillus flavus*. *Food Additives & Contaminants: Part A*, 37, 1520–1530.
17. Kumar, A., Gupta, V., **Singh, P.P.** & Prakash, B. (2020). Unravelling the antifungal and anti-aflatoxin B<sub>1</sub> mechanism of chitosan nanocomposite incorporated with *Foeniculum vulgare* essential oil. *Carbohydrate Polymers*, 236, 116050.
18. Kumar, A., Gupta, V., **Singh, P.P.**, Kujur, A. & Prakash, B. (2020). Fabrication of volatile compounds loaded-chitosan biopolymer nanoparticles. *International Journal of Biological Macromolecules*, 165, 1507–1518.
19. Kumar, A., Kujur, A., **Singh, P.P.** & Prakash, B. (2019). Nanoencapsulated plant-based bioactive formulation against food-borne molds and aflatoxin B<sub>1</sub> contamination. *Food Chemistry*, 287, 139–150.
20. Prakash, B., Kujur, A., Yadav, A., Kumar, A., **Singh, P.P.** & Dubey, N.K. (2018). Nanoencapsulation: An efficient technology to boost the antimicrobial potential of plant essential oils in food system. *Food Control*, 89, 1–11.
21. Singh, A.K., Singh, S.K., **Singh, P.P.**, Srivastava, A.K., Pandey, K.D., Kumar, A. & Yadav, H. (2018). Biotechnological aspects of plants metabolites in the treatment of ulcer. *Biotechnology Reports*, 18, e00256.

22. Singh, V.K., Singh, A.K., **Singh, P.P.** & Kumar, A. (2018). Interaction of plant growth promoting bacteria with tomato under abiotic stress: a review. *Agriculture, Ecosystems & Environment*, 267, 129–140.
23. Singh, A.K., Singh, S.K., **Singh, P.P.**, Tripathi, V., Verma, H., Srivastava, A.K. & Kumar, A. (2018). Distribution of cyanobacteria and their interactions with pesticides in paddy field: a comprehensive review. *Journal of Environmental Management*, 224, 361–375.
24. Kumar, A., Singh, M., **Singh, P.P.**, Singh, S.K., Singh, P.K. & Pandey, K.D. (2016). Isolation of plant growth promoting rhizobacteria and their impact on growth and curcumin content in *Curcuma longa* L. *Biocatalysis and Agricultural Biotechnology*, 8, 1–7.

## Book Chapters

1. Prakash, B., **Singh, P.P.**, Kumar, A. & Gupta, V. (2022). Food and human health: An outlook of the journey of food from hunger satisfaction to health-promoting agent. In *Research and Technological Advances in Food Science*, pp. 1–30. Academic Press.
2. **Singh, P.P.**, Kumar, A., Gupta, V. & Prakash, B. (2021). Recent advancement in plant disease management. In *Food Security and Plant Disease Management*, pp. 1–18. Woodhead Publishing.
3. Prakash, B., Kumar, A., **Singh, P.P.** & Dubey, N.K. (2021). Prospects of plant products in the management of insect pests of food grains. In *Natural Bioactive Compounds*, pp. 317–335. Academic Press.
4. Prakash, B., **Singh, P.P.**, Kumar, A. & Gupta, V. (2020). Prospects of omics technologies and bioinformatics approaches in food science. In *Functional and Preservative Properties of Phytochemicals*. Academic Press.
5. Prakash, B., Kumar, A., **Singh, P.P.** & Songachan, L.S. (2020). Antimicrobial and antioxidant properties of phytochemicals. In *Functional and Preservative Properties of Phytochemicals*. Academic Press.
6. Singh, M.K., Singh, S.K., Singh, A.V., Verma, H., **Singh, P.P.** & Kumar, A. (2020). Phytochemicals: Intellectual property rights. In *Functional and Preservative Properties of Phytochemicals*, pp. 363–375. Academic Press.
7. Prakash, B., **Singh, P.P.**, Kumar, A., Das, S. & Chaudhari, A.K. (2019). Microbes as a novel source of secondary metabolite products of industrial significance. In *Role of Plant Growth Promoting Microorganisms in Sustainable Agriculture and Nanotechnology*, pp. 21–37.
8. **Singh, P.P.**, Kujur, A., Yadav, A., Kumar, A., Singh, S.K. & Prakash, B. (2019). Mechanisms of plant–microbe interactions and its significance for sustainable agriculture. In *PGPR Amelioration in Sustainable Agriculture*, pp. 17–39.

## Awards & Honors

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- 2020** Best Poster Presentation — 7th International Conference on Phytopathology in Achieving UN Sustainable Development Goals, ICAR-IARI, New Delhi, India
- 2018** Prof. Radhey Shyam Ambasht Gold Medal (M.Sc.)
- 2017** GATE — Conducted by IIT Roorkee

## Selected Conferences

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- **Plant Biology 2024**, American Society of Plant Biologists (ASPB) Centennial Meeting, June 22–26, 2024, Honolulu, HI.

*Poster:* Temporal Dynamics of Grapevine Red Blotch Virus Titer in Infected Grapevines is Influenced by Fruit Maturity Stages.

- **International Conference on Microbiology** (ICMBB 2021), Institute of Microbiology in collaboration with ASM, Asian PGPR Society, and Society for Environmental Sustainability, Sep 16–17, 2021.

- **7th International Conference on Phytopathology in Achieving UN SDGs**, Indian Phytopathological Society, Jan 16–20, 2020, ICAR-IARI, New Delhi.

*Poster:* Optimization of nanoencapsulated plant-based synergistic formulation in postharvest disease management of aflatoxin.

- **National Seminar on Recent Advances in Fungal Diversity, Plant–Microbes Interaction and Disease Management**, Centre of Advanced Study in Botany, BHU, Feb 28–29, 2020.

*Poster:* Nano-encapsulated synergistic formulation of plant-derived bioactive compounds in postharvest management of aflatoxin.

- **Biotechnological Interventions for Societal Development**, Dept. of Biotechnology, MNNIT Allahabad, Feb 21–23, 2020.

*Oral:* Nano-encapsulated and optimised plant-based bioactive formulation against food-borne moulds and aflatoxin B<sub>1</sub> contamination.

## **Professional Training**

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- Scientific Leadership & Management Skills Program, Lawrence Berkeley National Laboratory (2025).
- International Workshop on Genome Informatics (1 month), jointly organised by Ensembl Outreach team (EMBL-EBI, UK) and Decode Life, Jun–Jul 2023.
- Bioinformatics & Data Analysis Workshop, Redcliffe Genetics, Banaras Hindu University, Jul 2022.
- International Workshop on Basics to Advanced Modules in Multi-omics Data Analysis, Nextgenhelper, New Delhi, Apr 2022.
- National Training on Bacterial Endophytes in Agriculture: Concepts to Application, ICAR-NBAIM, Mau, Jan 2019.