

Dr. Jawahar Singh

Plant Molecular Biologist · Legume–Microbe Symbiosis & Nitrogen Fixation
Postdoctoral Research Associate, Sainsbury Laboratory, University of Cambridge, UK

Email jawahar.singh@slcu.cam.ac.uk · jawaharsingh53@gmail.com | ORCID [0000-0003-4893-741X](https://orcid.org/0000-0003-4893-741X) | [Google Scholar](#) | [ResearchGate](#)

ABOUT / RESEARCH SUMMARY

Unravelling Symbiotic Interactions in Legumes for Sustainable Crop Productivity. I decode the molecular and genetic mechanisms governing root nodule symbiosis, nutrient signalling, and stress adaptation in legumes to enhance biological nitrogen fixation (BNF). My long-term goal is to build a research programme that decodes the cell-type-specific nutrient-signalling logic of nodulation and rewires it through genome engineering to generate climate-resilient, low-fertilizer legume varieties in cowpea, chickpea, and soybean - priority crops for food security in South Asia.

RESEARCH & ACADEMIC INTERESTS

- **Root nodule symbiosis and biological nitrogen fixation** - signaling, development, and cell biology of the legume–rhizobium partnership.
- **Nutrient-signalling control of symbiosis** - phosphate, nitrate, and iron regulation of nodule development.
- **Single-cell & regulatory genomics** - snRNA-seq atlases, gene-regulatory-network inference, and comparative legume genomics.
- **Genome engineering & abiotic stress adaptation** - CRISPR-based rewiring and stress-resilient crop improvement.

RESEARCH APPROACHES

Single-nucleus transcriptomics, gene-regulatory-network inference and comparative/evolutionary genomics across nodulating and non-nodulating legumes to identify the regulatory logic of nodule development; CRISPR-Cas9 and promoter engineering in cowpea and soybean, with hairy-root and stable transformation for functional testing; protein–DNA and protein–protein biochemistry (EMSA, ChIP-seq, Y2H, BiFC) and confocal cell biology to resolve mechanism.

EDUCATIONAL QUALIFICATIONS

Year	Degree	Discipline / Specialization	University / Institute
2016–2022	Ph.D.	Plant Molecular Biology / Legume Symbiosis	National Institute of Plant Genome Research (NIPGR), New Delhi, India
2012–2014	M.Sc.	Biochemistry	West Bengal State University, Kolkata, West Bengal, India
2009-2012	B.Sc. (Hons.)	Chemistry	West Bengal State University, Kolkata, West Bengal, India

POSITIONS HELD / RESEARCH EXPERIENCE

Period	Position	Organization
2023–Present	Postdoctoral Research Associate	Sainsbury Laboratory, University of Cambridge, UK · Prof. Sebastian Schornack
2022–2023	DGAPA Postdoctoral Fellow	FES Iztacala, UNAM, Mexico · Prof. Oswaldo Valdés-López
2016–2022	Doctoral Researcher (CSIR-SRF/JRF)	NIPGR, New Delhi, India · Prof. Praveen K. Verma
2015–2016	Research Fellow	Jai Narain Vyas University, Jodhpur, India · Prof. Shweta Jha

KEY RESEARCH CONTRIBUTIONS

- **University of Cambridge, UK:** Developing multi-omics strategies to identify regulatory hubs controlling nodule development and senescence in cowpea, targeting improved N-fixation efficiency under field conditions.
- **UNAM, Mexico:** First to demonstrate that phosphate signalling regulates the master nodulation gene NIN; identified a PHR-like transcription factor binding the NIN promoter, linking phosphate availability to symbiotic regulation.
- **NIPGR, India:** Uncovered MAP kinase as a key downstream component of Nod-factor perception in chickpea and characterized LysM-RLK receptors in root nodule formation.
- **JNVU, India:** Established proteomic and physiological markers for salinity-stress tolerance in pearl millet, contributing to stress-resilient crop development.

PUBLICATIONS

~35 peer-reviewed publications (journal articles, commentaries, and book chapters). * denotes corresponding / co-corresponding author.

A. Selected / Key Journal Articles

1. Singh, J., Valdés-López, O., & Schornack, S. (2026). Beyond Nitrogen: Phosphate Controls Root Nodule Symbiosis Commitment. **Trends in Plant Science**.
2. Singh, J.*, Mendoza-Soto, A. B., Tiwari, M., Acevedo-Sandoval, T. T., Formey, D., Ané, J. M., Isidra-Arellano, M. C., & Valdés-López, O. (2025). Phosphate deficiency reduces nodule formation through a phosphate starvation response-like protein in *Phaseolus vulgaris*. **Plant and Cell Physiology**.
3. Singh, J., Isidra-Arellano, M. C., & Valdés-López, O. (2023). Harnessing the potential of symbiotic associations of plants in nutrient-deficient soil for sustainable agriculture. **Plant and Cell Physiology**.
4. Singh, J.*, & Verma, P. K. (2023). Role of Nod factor receptors and its allies involved in nitrogen fixation. **Planta**.
5. Singh, J.*, Varshney, V., & Jha, S. (2023). Genome-wide identification and expression analysis of glycogen synthase kinase encoding genes in foxtail millet (*Setaria italica* L.) under salinity, dehydration, and oxidative stress. **Plant Stress**.
6. Singh, J., & Valdés-López, O. (2022). Discovering the genetic modules controlling root nodule symbiosis under abiotic stresses: salinity as a case study. **New Phytologist**.
7. Singh, J., & Verma, P. K. (2022). Genome-wide identification, expression, and characterization of CaLysM-RLKs in chickpea root nodule symbiosis. **Environmental and Experimental Botany**.
8. Singh, J., & Valdés-López, O. (2022). A nodule peptide confiscates haem to promote iron uptake in rhizobia. **Trends in Plant Science**.
9. Singh, J., & Verma, P. K. (2021). NSP1 allies with GSK3 to inhibit nodule symbiosis. **Trends in Plant Science**.

B. Other Journal Articles

1. Jha, S.*, Tyagi, S., Soni, S., Choudhary, D., & Singh, J.* (2025). The role of PIN-FORMED (PIN) auxin efflux transporters in plant abiotic stress responses. **Physiologia Plantarum**.
2. Li, F., Singh, J.*, & Kumar, A.* (2025). Symbiotic Advantage Beyond Root Architecture: How AMF Levels the Playing Field for Phosphorus Uptake in Sorghum. **Molecular Plant-Microbe Interactions**.
3. Singh, J., Mishra, V., & Varshney, V. (2024). Arsenic tolerance unveiled in Arabidopsis: CPK23 and PHT1;1 alliance. **Journal of Plant Biochemistry and Biotechnology**.
4. Shukla, K., Mishra, V., Singh, J., Varshney, V., Verma, R., & Srivastava, S. (2024). Nanotechnology in sustainable agriculture: A double-edged sword. **Journal of the Science of Food and Agriculture**.
5. Singh, J.*, Mishra, V., Varshney, V., & Jha, S. (2023). Interplay of calcium signaling and ERF-VII stability in plant hypoxia tolerance. **Functional & Integrative Genomics**.
6. Singh, J.*, Varshney, V., & Mishra, V. (2023). AUR1 and its pals: orchestration of intracellular rhizobia infection in legume for nitrogen fixation. **Plant Cell Reports**.

7. Pasari, N., Gazara, R. K., Singh, J., & Verma, P. K. (2023). Genome-Wide Identification of *SWEET* Genes in *Cicer arietinum* and Modulation of Its Expression in Endophytic Interactions with *Serendipita indica*. **Journal of Plant Growth Regulation**.
8. Varshney, V., Singh, J., & Mishra, V. (2023). Unlocking the plant ER stress code: IRE1-proteasome signaling cohort takes the lead. **Trends in Plant Science**.
9. Isidra-Arellano, M. C., Singh, J., & Valdés-López, O. (2023). Unraveling the potential of the strigolactones-NSP1/NSP2 friendship in crop improvement. **Trends in Plant Science**.
10. Jha, S., Singh, J., Chouhan, C., Singh, O., & Srivastava, R. K. (2022). Evaluation of multiple salinity tolerance indices for screening and comparative biochemical and molecular analysis of pearl millet genotypes. **Journal of Plant Growth Regulation**.
11. Jha, S., Maity, S., Singh, J., Chouhan, C., Tak, N., & Ambatipudi, K. (2022). Integrated physiological and comparative proteomics analysis of contrasting genotypes of pearl millet reveals underlying salt-responsive mechanisms. **Physiologia Plantarum**.

C. Commentaries / Editorials

1. Singh, J.* (2025). Metabolic detour, symbiotic delay: Insights from *S. meliloti* suppressor mutants. **Molecular Plant-Microbe Interactions**.
2. Prakash, V., & Singh, J. (2025). A viral brake on bloom: BYDV-GAV delays flowering via VOZ degradation. **Molecular Plant-Microbe Interactions**.
3. Tiwari, R.* & Singh, J. (2025). Tracking rust effector protein delivery into plant cells. **Molecular Plant-Microbe Interactions**.
4. Gomez-Gutierrez, S. V., & Singh, J. (2025). When Mutualism Turns Parasitic: How Alfalfa Balances Cooperating and Cheating Rhizobia. **Molecular Plant-Microbe Interactions**.
5. Singh, J.* (2024). Fortifying Plant Armor: CESA3 Enhances *Arabidopsis thaliana*'s Defense Against Bacterial Wilt Under Heat Stress. **Molecular Plant-Microbe Interactions**.
6. Singh, J.* & V Prakash, V. (2024). Rethinking Growth and Defense: miR472 as a Sensor and Regulator of Plant Immunity. **Molecular Plant-Microbe Interactions**.
7. Tiwari, R., & Singh, J. (2024). Decoding the Fancy Coat Worn by Rhizobia in Symbiosis. **Molecular Plant-Microbe Interactions**.

D. Book Chapters

1. Jha, S., Singh, J., Dutta, S., Varshney, V., Mishra, V., Choudhary, D., & Tak, N. (2025). Regulatory genes for the improvement of salt and drought tolerance. In *Exogenous Priming and Engineering of Metabolic and Regulatory Genes*. Elsevier.
2. Mishra, V., Shukla, P., Shukla, K., Varshney, V., Singh, J., & Srivastava, S. (2025). Strategies for Increasing Zinc Uptake Efficiency in Plants. In *Zinc in Soil-Plant Continuum* (pp. 139–161). Springer.
3. Singh, J., Varshney, V., Jha, S., Saadhe, A., Manuka, R., & Penna, S. (2024). Molecular techniques for improvement of abiotic stress tolerance in plants. In *Innovative Methods in Horticultural Crop Improvement*. Springer.
4. Mishra, V., Singh, J., & Varshney, V. (2024). Biotechnological insights into cold-stressed adapted microorganisms for plant health and soil improvement. In *Extremophiles for Sustainable Agriculture and Soil Health Improvement*. Springer.
5. Varshney, V., Singh, J., Dutta, S., Mishra, V., & Jha, S. (2024). Understanding the problem at hand: nanotechnological implications that cannot be foreseen. In *Molecular Impacts of Nanoparticles on Plants and Algae* (pp. 397–424). Academic Press.
6. Singh, J., & Verma, P. K. (2023). Plant transcription factors and nodule development. In *Plant Transcription Factors* (pp. 175–196). Academic Press.
7. Varshney, V., Singh, J., & Salvi, P. (2023). Sugar Signaling and Their Interplay in Mitigating Abiotic Stresses in Plant. In *Smart Plant Breeding for Field Crops in Post-genomics Era*. Springer.
8. Singh, J., Kumar, K., & Verma, P. K. (2020). Functional characterization of genes involved in legume nodulation using hairy root cultures. In *Hairy Root Cultures Based Applications* (pp. 217–228). Springer.

AWARDS, HONOURS & FELLOWSHIPS

- **DGAPA Postdoctoral Fellowship (2022–2023)** - DGAPA, Universidad Nacional Autónoma de México (UNAM). Prestigious international postdoctoral fellowship to investigate phosphate regulation of nodulation in legumes.
- **CSIR Senior Research Fellowship (SRF, 2018–2021) & UGC Junior Research Fellowship (JRF, 2016–2018)** - Council of Scientific and Industrial Research / University Grants Commission, Government of India. Competitively awarded to support doctoral research.
- **Swachhta Saarthi Fellowship (2021)** - Waste to Wealth Mission, Office of the Principal Scientific Adviser to the Government of India. National-level young-researcher award for sustainability and science outreach.
- **Graduate Aptitude Test in Engineering (GATE), 2016** - MHRD, Government of India. Qualified with national ranking for Ph.D. admissions in life sciences and biotechnology.

RESEARCH GUIDANCE & MENTORING

- **Master's Research Students - University of Cambridge (2025–Present):** Mentored master's research projects on root nodule development and molecular regulation of symbiosis; hands-on training in molecular biology, confocal imaging, and data analysis.
- **Summer Research Interns - University of Cambridge (2023–Present):** Mentored several summer students over 10-week projects on nodule development and symbiosis regulation.
- **Undergraduate Supervision - University of Cambridge (2024–Present):** Supervisor for the Plant and Microbial Sciences (IBPMS) course; revision sessions, essay guidance, and research-data interpretation.

ACADEMIC SERVICE, EDITORIAL & PEER REVIEW

- **Assistant Feature Editor** - Molecular Plant-Microbe Interactions (2024–Present). Accessible research summaries, author interviews, and commentaries promoting early-career researcher visibility.
- **Peer Reviewer** - The Plant Cell, New Phytologist, The Plant Journal, Journal of Experimental Botany, Frontiers in Plant Science, BMC Plant Biology, Journal of Genetics, South African Journal of Botany, Scientific Reports.

SCIENTIFIC EVENT ORGANIZATION & LEADERSHIP

- Satellite Meeting Co-organizer & Chair - "Building Careers in MPMI through Effective Mentoring", IS-MPMI Congress 2025, Cologne, Germany.
- Poster Judge, Best Poster Award - IS-MPMI Congress 2025, Cologne, Germany.
- Mini-Symposium Co-organizer - "Molecular Mechanisms of Plant Symbiosis and Pathogen Interaction" (21 July 2025), Sainsbury Laboratory, University of Cambridge.
- Scientific Committee Member & Abstract Review Panel - Sainsbury Laboratory Symposium (17–19 September 2024), University of Cambridge.
- Co-convenor - SciEfflux-2018, 10th Annual Student Symposium, NIPGR, India.

REFEREES

Prof. Sebastian Schornack (Sainsbury Laboratory, University of Cambridge, UK) · Prof. Oswaldo Valdés-López (FES Iztacala, UNAM, Mexico) · Prof. Praveen K. Verma (School of Life Sciences, JNU, New Delhi, India). Contact details available on request.