Anuj Dwivedi, Ph.D.,
National Post-Doctoral (N-PDF) Fellow
Erasmus Mundus (EMEA) Fellow
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Present Status

I was working as a **Project Scientist-II** in the Indian SARS-CoV-2 Genomics Consortium (INSACOG), jointly initiated by the Ministry of Health and Family welfare and Department of Biotechnology (DBT) with Council of Scientific Industrial Research (CSIR) and Indian Council of Medical Research (ICMR).

Doctor of Philosophy

I have done my doctoral from **Department of Botany**, University of Delhi, Delhi, India working on the project entitled **"Analysis of putative candidate genes associated with apomictic and sexual modes of reproduction in *Cenchrus ciliaris* L. using transcriptomic, *in situ* hybridization and phylogenetic approaches".**

Publications

Articles published

- Sazda Abdi, **Anuj Dwivedi**, Shashi Prasad and Vishnu Bhat (2019) "Development of EST-SSR markers in *C.ciliaris* and their applicability in studying genetic diversity, cross-species transferability." **Journal of Genetics,** September 2019, 98:101.

- Chandra Bhan Yadav, **Anuj Dwivedi**, Suresh Kumar, Vishnu Bhat (2019) "AFLP-based genetic diversity analysis distinguishes apomictically and sexually reproducing Cenchrus species." **Brazilian Journal of Botany** June 2019, Volume 42, Issue 2, pp 361–371.

- Agnihotri, Ashish, Praveen Gupta, **Anuj Dwivedi,** and Chandra Shekhar Seth**.** "Counteractive mechanism (s) of salicylic acid in response to lead toxicity in Brassica juncea (L.) Czern. cv. Varuna." ***Planta*** July 2018, Volume 248, Issue 1, pp 49–68.

- Yadav CB, **Dwivedi A**, Kumar S, Gupta MG and Bhat V (2012) Genetic linkage maps of the chromosomal regions associated with apomictic and sexual modes of reproduction in *Cenchrus ciliaris*. **Mol. Breeding** June 2012, Volume 30, Issue 1, pp 239–250.

Book chapter National /International

- **Anuj Dwivedi**, Sonal Mishra and Vikas Srivastava (2021) "Sodium Transport in Plants" in "Cation transporters in plants". ISBN 978-0-323-85790-1, Pages 85-98 Publisher: **Elsevier**

- Vibhav Gautam, Priyamvada Gupta, Prafull Salvi, Akanksha Sharma, Deepak Kumar, **Anuj Dwivedi** (2021) "Role of miRNAs in shaping plant root architecture "MicroRNA in root development" in volume Rhizobiology: molecular Physiology of roots. ISBN 978-3-030-84985-6, Pages, 93-113 Publisher**: Springer nature**

- **Anuj Dwivedi**, Kamal Kumar, Praveen Kumar Verma (2018) "Constructing Synthetic Pathways in Plants: Strategies and Tools." "Current Developments in Biotechnology and Bioengineering". ISBN: 9780444640857 2019, Pages 77-113, Publisher: **Elsevier**.

- Sazda Abdi, Shashi, **Anuj Dwivedi** and Vishnu Bhat (2015) "Harnessing apomixis for heterosis breeding in crop improvement." Gene pool diversity and crop improvement. **ISBN: 978-3-319-27088-3** Publisher**: Springer nature.**

- **Dwivedi A**, Shashi, C. Mahalakshmi and Vishnu Bhat (2014) chapter 7, "Apomixis in Angiosperms". Plant Reproductive Biology and Conservation. Editor, Rupam Kapoor, Monika Kaul, Inderdeep Kaur I K International Publishing House Pvt. Ltd. Delhi. **ISBN 978-93-82332-90-9**

Manuscript in preparation or submitted

- **Anuj Dwivedi** and R. Geetha (2022) Plant Artificial Chromosome: A Synthetic Biology Tool**.**

- **Anuj Dwivedi** and Vishnu Bhat (2022) Characterization of the developmental stages of megaspore & megagametogenesis in apomictic and sexual ovaries using ovule clearing techniques.

- **Anuj Dwivedi**, Shashi, Mahalakshmi Abhishek and Vishnu Bhat (2022) *De novo* flower transcriptome analysis for uncovering differentially expressed genes during apomictic and sexual reproduction in *C. ciliaris* L.

- **Anuj Dwivedi,** Shashi, Girish Mishra, Geeta R, and Vishnu Bhat (20221Evolution of the *CcKIP1* gene in Land Plants: Unraveling the origin of KIP1 domain in seed plants.

- **Anuj Dwivedi,** Shashi, Girish Mishra and Vishnu Bhat (2022) Recombinant expression of epitopic region of CcRLK & CcKIP1 genes for antibody production.

Research Grants

- Research project entitled "Identification of effectors genes during biotrophic and necrotrophic phases of *Bipolaris sorokiniana* and wheat (*Triticum aestivum*) interaction" sanctioned under the scheme of **Science and Engineering Research Board- Department of Science and Technology (SERB-DST),** Government of India, India.

Awards/ Fellowships

- I have been selected as a recipient of **APS Global Membership Fund** with two years of complimentary membership with APS commencing **July 1st, 2021 through June 30th, 2023** from The American Phytopathological Society, USA**.**

- Fellowship to attend training course on "**Genomics-assisted breeding of wheat**" organized by **Wheat Initiative** at Cosmopolitan **Hotel, Via del Commercio Associato 9, Bologna, Italy** from 28-29 October 2019.

- **National Post-Doctoral Fellowship (N-PDF)** from Science and Engineering Research Board, Department of Science and Technology, Government of India, India.

- Fellowship to attend workshop entitled "**Practical Workshop for High-Throughput Sequencing Data Analysis"** organized by **"OIST" Okinawa Institute of Science And Technology, Okinawa, Japan** from **29th September to 5th October 2013.**

- **Erasmus Mundus Europe Asia (EMEA)** Scholarship Program. Host University: **University of Milano, Italy and** Coordinated by **Lund University Sweden**. 30th Nov 2011 to 30th Sep 2012.

- **Senior Research Fellowship** from Feb 2010 to Sep 2011 by Department of Biotechnology, Government of India.

- **Junior Research Fellowship** from Dec 2007 to Feb 2010 by Department of Biotechnology, Government of India.

Research experience

- As a **Research Associate**, recently, I have completed research project entitled "Sensors of Heat Stresses: Exploring Mitogen-Activated Protein Kinase Genes and Dissecting their Role in Thermotolerance of Wheat (*Triticum aestivum L.*)" funded by Council of Scientific and Industrial Research, Ministry of Science and Technology, Government of India, in association of Dr. Ranjeet Ranjan Kumar, Senior Scientist, Division of Biochemistry, Indian Council of Agriculture Research- Indian Agriculture Research Institute, New Delhi. The primary aim of this project was to identification and characterization of heat sensors. In order to do so, I have identified putative candidates genes associated with heat stress from RNA-seq data. Of these, four genes showing close association with heat stress were successfully isolated and cloned. Furthermore, two of them were sub-cloned in expression vector for recombinant protein production. The recombinant protein will be used for the production of polyclonal antibody.

- As a **Principal Investigator**, I have successfully completed research project entitled "Identification of effectors genes during biotrophic and necrotrophic phases of *Bipolaris sorokiniana* and wheat (*Triticum aestivum*) interaction". The major aim of this project is to identification of new secretory/effector proteins during key developmental stages of infection, especially during lifestyle transition through LCM based stage specific transcriptome profiling. In addition to this cataloging of differentially expressed genes of host and pathogen and their functional validation using knockout approach.

- I worked as **Research Associate** with Prof. Praveen Verma at National Institute of Plant Genome Research in the DBT Multi Institutional Project entitled "Towards identification, isolation and characterization of Exobasidium vexens strains and their pathogenic determinants/ effectors, from blister blight infected tea-plantation of Assam and

development of a future roadmap for effective management practices" for the period of 6 months. The primary aim of this project was to develop novel strategy to irradiate fungal disease. To this, I have characterized several stains for pathogenicity and their mode of infection via cytological approach.

- I was selected for 10 month **Erasmus Mundus Student fellowship** to carry out my collaborative research work with **Prof. Martin M. Kater**, Department of Bimolecular Sciences and Biotechnology, University of Milan, Italy. I have performed various experiments such as *in-situ* and yeast-two hybridizations to analyze protein-protein interaction of BASIC **PENTACYSTINE1** (BPC 1) gene with **SHORT VEGETATIVE PHASE** (SVP) gene and mRNA localization in *Arabidopsis thaliana*. Also, I isolated and characterized 800bp partial fragment of receptor like kinase gene and cloned it Gateway vector for protein production and western blot analysis using anti-His mouse IgG antibody.

- I worked as Junior and Senior Research Fellow in research project entitled **"Molecular characterization of genes associated with apomixis in *Cenchrus ciliaris*"** in which I have done structural and functional characterization of two genes i.e., KIP1 and LRR receptor like kinase using bioinformatics tools and have optimized *in situ* hybridization for both the genes isolated from *Cenchrus ciliaris* during the key stages of ovule development.

- I worked in the project entitled **"Map based cloning of genes controlling apomixis in *Cenchrus ciliaris* and their functional validation using RNAi approach"** for short period of time. In this project I screened a mapping population through ovule clearing techniques using DIC microscopy and constructed genetic linkage map of the chromosome associated with apospory region through AFLP marker (Yadav et. al. 2012).

- Summer training under the supervision of Dr. V.K. Mishra, Head, Dept. of Biotechnology, DCAST, Dehradun, topic entitled **"Micro propagation of Maize embryo & Ginger bud through Tissue Culture"** for a period of 2 months. In this project various methods of propagation including efficient cost effective method of *in vitro* multiplication were used which is essential for improvement of ginger.

Workshops/ Trainings Attended

- Attended a Symposium cum workshop on **Applications of Flow Cytometry in Plant and Crop Research"** organized by **National Center for Plant Biotechnology, IARI, New Delhi** on 8th December 2014**.**

- Attended short term training on **"NGS Hands-On Training Analysis"** organized by Bionivid Technology, Bangalore, India from August, 19-23 2014. The course content consisted of topics such as Genome de-novo and re-sequencing, Transcriptome de-novo and re-sequencing.

- Attended short term training on "**Practical Workshop for High-Throughput Sequencing data Analysis**" organized by "OIST" **Okinawa Institute of Science and Technology, Okinawa, Japan** from 29th September to 5th October 2013. The course content consisted of topics such as Quality control of sequencing reads, Data handling and visualization, Genomic mapping, Statistical concepts for data analysis, RNA-seq data analysis, ChIP-seq data analysis, Functional analyses.

- Attended a Short Term Training on **"National workshop on Molecular Evolution and Phylogenetics"** organized by Center for Bioinformatics, Maharishi Dayanand University, Rohtak, Haryana from 21st to 22ndOctober 2011.

- Attended a Short Term Training on **"Bioinformatics applications in agriculture Science"** held at Bioinformatics Infrastructure facility (BIF), Center of Excellence in Bioinfoarmatics (COEBI) Department of Biochemistry, University of Lucknow from March 7-8, 2011.

- Attended a Short Term Training on **"Bioinformatics in Genomics and Proteomics"** organized by **Indian Institute of Technology, Kharagpur** from September 26-27, 2008.

Conferences Attended

- Attended Virtual XIX National Plant Biochemistry and Molecular Biology Congress XII Symposium Mexico / USA 2nd ASPB Mexico Section Meeting November 8-11 • 2021

- Attended International Plant Physiology Virtual Conference (IPPVC 2020) on "**Prospects of Plant Physiology for Climate Proofing Agriculture**" organized by Sher-e-Kashmir University of Agricultural Science & Technology, Jammu, India and Indian Society for Plant Physiology, New Delhi, India from December 6-7, 2020.

- Attended Live Webinar in the series of Next Generation Genomics and Integrated Breeding for Crop Improvement (VII-NGGIBCI) on "**Genomics for food, health and nutrition**" organized by Center of Excellence in Genomics & Systems Biology (CEGSB) ICRISAT, Hyderabad, India on Thursday 14 May, 2020

- Attended an interactive meet on "Molecular Intricacies of Plant Associated Microorganism (MIPAM 2019) " held at National Institute of Plant Genome Research, New Delhi from February 01-03, 2019

- Attended an INSCR international conference (ISCB-2108) on "International Symposium on Ciliate Biology with International Research coordination network of biodiversity of Ciliates affiliated society of International Society of Protistologists" held at Indian Habitat Center, New Delhi, Delhi, from April 04-06, 2018.

- Attended an INSCR international conference (IIC-2107) on "**Role of Microbe-plant-Animal Interaction in Human health**" held at Department of Zoology, University of

  Delhi, Delhi organized by Department of Zoology, University of Delhi, Delhi, from September 26-28, 2017.

- Attended an international symposium on "**Plant Signaling and Behavior**" held at Department of Botany, University of Delhi, Delhi organized by Department of Botany, University of Delhi, from March 7-10, 2014.

- Attended an International conference on **"Genomics and Biodiversity"** held at Center for Cellular and Molecular Biology (CCMB) Hyderabad, India, organized by Association for

the promotion of DNA Fingerprinting and other DNA Technologies (ADNAT) and CCMB, Hyderabad, from February 23rd -25th, 2011.

- Attended a National Seminar on **"Role of Analytical Techniques in Biological &Environmental Science"** held at the Conference Center at Kirori Mal College, University of Delhi, Delhi, India from January 27th -29th, 2011.

- Attended an international conference on **"Recent Trends in Developing Bioremediation strategies for Hexa-chloro-cyclohexane (HCH) & Other Chlorinated Contaminants"** held at Department of Zoology, University of Delhi, India in association with Department of Biotechnology,(DBT) Swiss agency for Development and Co-operation (SDC) from February 9th -11th , 2011.

- Attended an international conference on **"Epigenetic Modifications of the Genome: Mechanisms and Implication"** held at Center for Cellular and Molecular Biology (CCMB) Hyderabad, organized by Association for the promotion of DNA Fingerprinting and other DNA Technologies (ADNAT), and CCMB, Hyderabad India from February 23rd -24th, 2009.

Poster Presentation

- Shashi, **Anuj Dwivedi** and Vishnu Bhat 2015. Down regulation of Receptor like kinase gene in apomictic *Cenchrus ciliaris.* XXIII International Grassland Congress on Sustainable use of Grassland Resources for Forage Production, Biodiversity and Environmental Protection, organized by Range Management Society of India (RMSI) and Indian Grassland Fodder Research Institute, from 20-24 November 2015, Ab-1570.

- **Anuj Dwivedi** and Vishnu Bhat (2014). *In silico* analysis indicates Receptor like Kinase and Kinase Interacting Protein 1 genes isolated from *Cenchrus ciliaris* interact during apomictic female gametophyte development. International Symposium on "Plant Signaling and Behavior 2014" March 7-10, 2014, Delhi Organized by Department of Botany, University of Delhi, Delhi, India.

- **Anuj Dwivedi** and Vishnu Bhat (2013). Expression Analysis of Genes Associated with Apomixis. International workshop on High-Throughput Sequencing data Analysis organized by Okinawa Institute of Science And Technology, (OIST) Okinawa, Japan from 29th September to 5th October 2013**.**

- CB Yadav, **Anuj Dwivedi**, Mahender Thudi, S Kumar and Vishnu Bhat (2012). Linkage disequilibrium mapping of apomixes in *Cenchrus cilaris* using AFLP markers. International Conference on Plant Biotechnology for Food security: New Frontiers-2012. Organized by the Society for Plant Biochemistry and Biotechnology, National Research Centre on Plant Biotechnology. February 21-24, 2012. Pusa Campus, New Delhi India.

- CB Yadav, **Anuj Dwivedi**, S Kimar, and Vishnu Bhat (2011) Genetic linkage mapping of apomixis and sexuality in *Cenchrus ciliaris*. Proceedings of 15th ADNATE conference of Genomics and Biodiversity, from 23rd -25th February 2011, held at CCMB, Hyderabad, India.

Tools and Techniques confident of handling:

- Isolation, purification and handling DNA and RNA and cDNA preparation
- Cloning and transformation using *E. coli*
- Heterologous protein production and purification
- Southern & western blotting and hybridization
- AFLP analyses techniques
- Bioinformatics tools for functional genomics and proteomics analysis
- Deep sequencing library construction and RNAseq data analysis
- Whole mount and Section mRNA *in situ* hybridization (chromogenic)
- Yeast two hybridization for protein-protein interaction
- Co-immunoprecipitation for identification of associated proteins
- Protoplast isolation and transformation
- Comet Assay (single-cell gel electrophoresis) for DNA damage analysis
- Tissue culture and *Agrobacterium*-mediated plant and fungal transformation
- Microscopy:- working experience of florescence microscope with DIC, stereomicroscope and confocal laser scanning microscope (CLSM) and Laser Capture Microdissection (LCM), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM)
- Cytogenetic technique: - Mitotic and meiotic chromosome preparation in root tips & floral buds of *Cenchrus ciliaris.*

Bioinformatics tools

- Phylogeny: MEGA, PHYLIP, Mesquite, FigTree
- Protein-Protein interaction and Expression analysis: STRING, *ProPrint*, and GENEVESTIGATOR
- Gene family annotation in crop plants
- Homology Based 3D structural prediction and validation: I-TASSER, Pcons.net, BHAGEERATH-H, SAVES server, PROTSAV.
- Epitope Prediction: IEDB Analysis Resource, SEPPA2.0
- Primer designing and conting assembling : Gene Runner, Net primer and Vector NTI

Teaching Experience

I have assisted in **Botany** courses Bot 201: **Developmental Biology** and Bot 402: **Reproductive Biology of Flowering Plants**, Department of Botany, University of Delhi, This entailed assistant lectures and Laboratory Course Preparation of post-graduate students.

Presentation:

Delivered presentation in Symposium-2016 organized by Prof. R. Geeta for master's course **BOT 305** (Evolutionary Biology) at department of Botany, University of Delhi, Delhi, Oct, 2015.

Society Memberships

- Member of **The American Phytopathological Society, USA** from July 1st, 2021 through June 30th, 2023.

- Life member of **Delhi University Botanical Society** (DUBS) Department of Botany, University of Delhi, Delhi, India.
- Life Member of **Khushahal Samiti** (A society for rural and urban development) Lucknow, India.

Plant Science promotion:

- I have been volunteering in the organization of **"Molecular intricacies of plant associated microorganisms (MIPAM) "An Interactive meet"** on 1-3 February 2019, organized by **National Institute of Plant Genome Research**, New Delhi, India.

- I have been volunteering in the organization of '**Fascination for Plants day**' on May 18, 2012, in which more than 500 young students participated in various fun plant science activities organized by **Dept. Biomolecular Sciences and Biotechnology, Università degli Studi di Milano**, Milano, Italy.

- I was judge in poster session presented by master's students in **BOT 305** (Evolutionary Biology) course conducted by the course coordinator Prof. R. Geeta at Department of Botany, University of Delhi, North Campus, New Delhi, India.

- I have been volunteering or leading team member of **Department of Botany** in annual cultural festival '**Antardhvani**' 2014, in which 80 colleges participated to share enterprise that celebrates creativity, talent, innovations, experiments, achievements and unique features of this large university spread through the national capital region of Delhi, organized by University of Delhi, Delhi, India. We have won **3rd prize** (5, 00,000/- INR) in this competition.

Education

2010 - 2015: Ph.D., from Department of Botany, University of Delhi, New Delhi, India.
Title of the thesis: "Analysis of putative candidate genes associated with apomictic and sexual modes of reproduction in *Cenchrus ciliaris* L. using transcriptomic, *in situ* hybridization and phylogenetic approaches".

2005 - 2007: Maters in Biotechnology from H.N.B.Garhwal University, Sri Nagar, U.K. with first division.

2003 - 2005: B.Sc. in Chemistry, Zoology and Botany from Dr. B. R. A University, Agra, U.P. with Second division.

2002: Higher Secondary from Christian Inter College, Mainpuri, U.P. with Second division.

1999: High school from V.B.I College, Mainpuri, U.P. with second division.

References:

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