



2018

DEPARTMENT OF
BOTANY

UNIVERSITY OF DELHI





DEPARTMENT OF BOTANY UNIVERSITY OF DELHI

The Department of Botany (DoB), established in 1947 under the leadership of Dr. J. J. Chinoy, completed 70 years in 2017. Since its inception, the Department of Botany has remained at the forefront of teaching and research in Botany, both Internationally and Nationally. DoB has had the good fortune of being associated with stalwarts such as Prof. Panchanan Maheshwari, Prof. B. M. Johri, Prof. H. Y. Mohan Ram, Prof. S. C. Maheshwari, to name a few. Several alumni of the DoB have subsequently been highly successful in their respective area of academics and administration - Prof. Sudhir Kumar Sopory (Padma Shri; Shanti Swarup Bhatnagar awardee; Ex-Vice-Chancellor, JNU, New Delhi); Shri Anup Moudgil (Ex-High Commissioner, Mauritius); Ms. Subhdarshini Tripathi (Ambassador to Kingdom of Jordan) Shri Balwinder Kumar (Ex-Vice-Chairman, DDA); Dr. Hari Krishan Sharma (Ex-Chief Secretary. Govt. of Arunachal Pradesh); Dr. A. K. Malhotra (IFS, PCCF, Jharkhand); Dr. Subhadra Menon and Shri Pallav Bagla (noted Science Correspondents); as Advisors in several Departments and Ministries of the Government of India - Dr. S. Natesh and Dr. Suman Govil (DBT, Govt. of India), Dr. Subodh Sharma and Dr. Sujata Arora (MoEFCC, Govt. of India), and several others.

At present, the strength of faculty stands at 23. There are currently 155 students enrolled for M.Sc. program, and 175 research scholars including M.Phil, Ph.D, and Post-docs.

Address for correspondence

Head, Department of Botany; University of Delhi; Delhi -110007

Telephone: 227667573, 27667725 Ext. 1420; e-mail: hodbotanydu@gmail.com

<http://www.du.ac.in/du/index.php?page=botany>

Batch of students 1948-49



Batch of students 1976-77





DEPARTMENT OF BOTANY UNIVERSITY OF DELHI

PAST DISTINGUISHED FACULTIES AND VISITORS

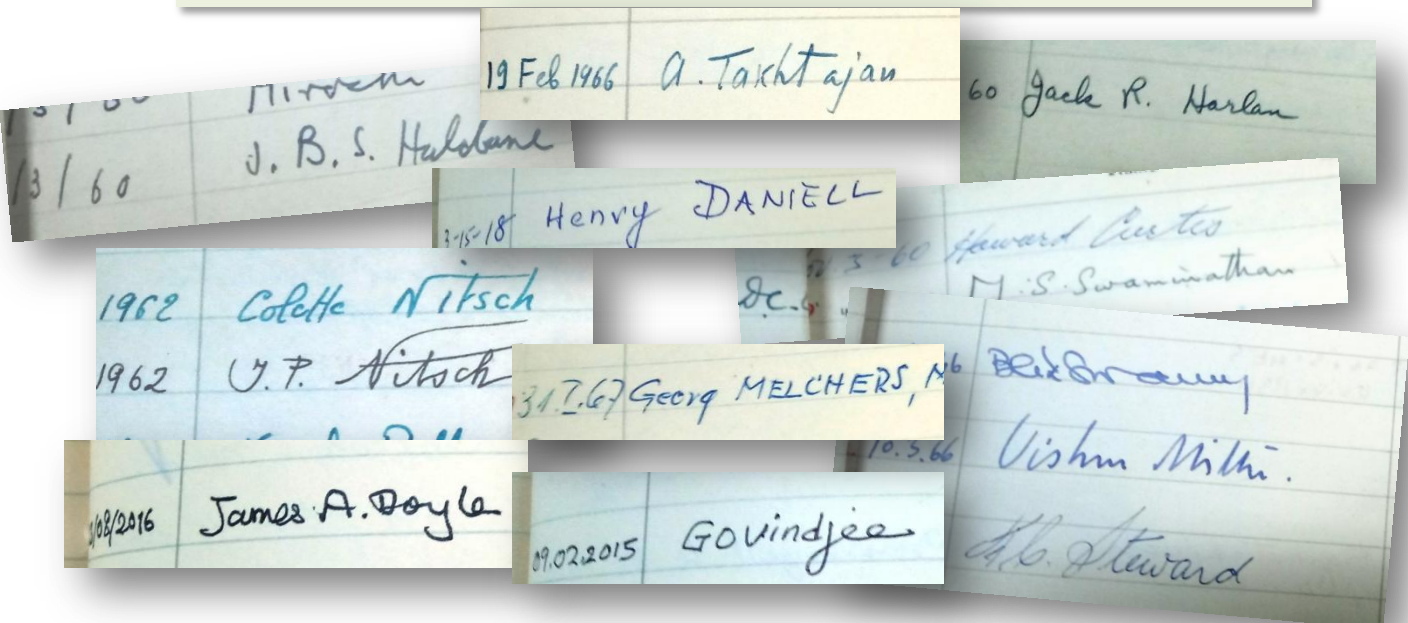


(1967): Left to Right:

Sitting: Reayat Khan, GC Mitra, PR White, BM Johri, Mrs PR White, S. Narayanaswami

Standing 1st Row: Hardev Singh, HC Arya, HY Mohan Ram, RN Chopra, Mridul Wadhi, Pushpa Khanna, RA Srimathi, DS Sulkiyan, SS Bhojwani, VN Gadgil, HN Singh.

Standing 2nd Row: NS Rangaswamy, Dinesh Kumar, VP Fadia, A Rashid, CB Sehgal, KR Shivanna, R Doreswamy, RD Iyer, AR Mehta, RN Konar, PS Ganpathy



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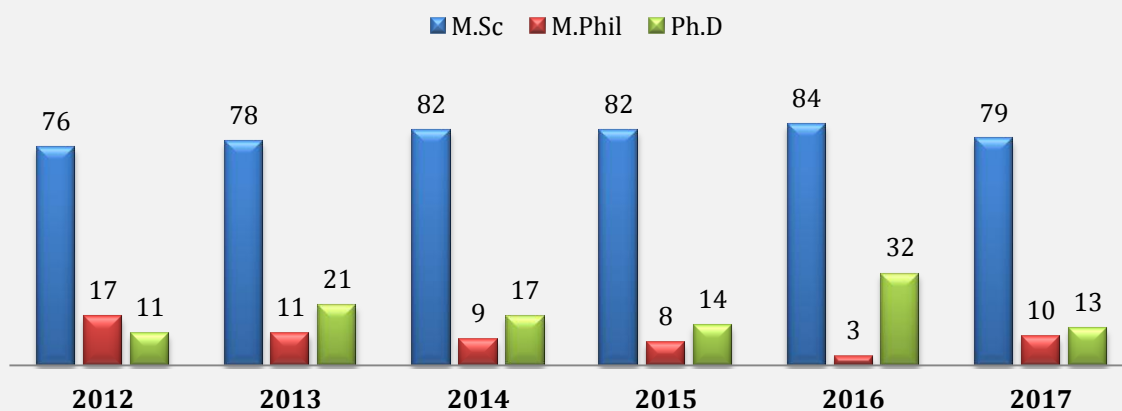
TEACHING AND RESEARCH-BROAD THEMES

- Biodiversity, Plant Developmental & Reproductive Biology
- Ecology, Systematics & Evolution
- Plant Biochemistry & Physiology
- Crop Genetics / Breeding
- Cell Biology and Plant Biotechnology
- Genomics / Proteomics/ Bioinformatics
- Microbiology/Interactions of Plants with Pathogens, Pests and Symbionts
- Abiotic stress and climate change adaptation

Admission

Program	Selection process	Student intake	Student-Teacher ratio
M.Sc.	50% merit and 50% entrance based	78	6:1
M.Phil.	As per University ordinance VI	As per University ordinance VI	As per University ordinance VI
Ph.D.	As per University ordinance VI	As per University ordinance VI	As per University ordinance VI

Student Intake

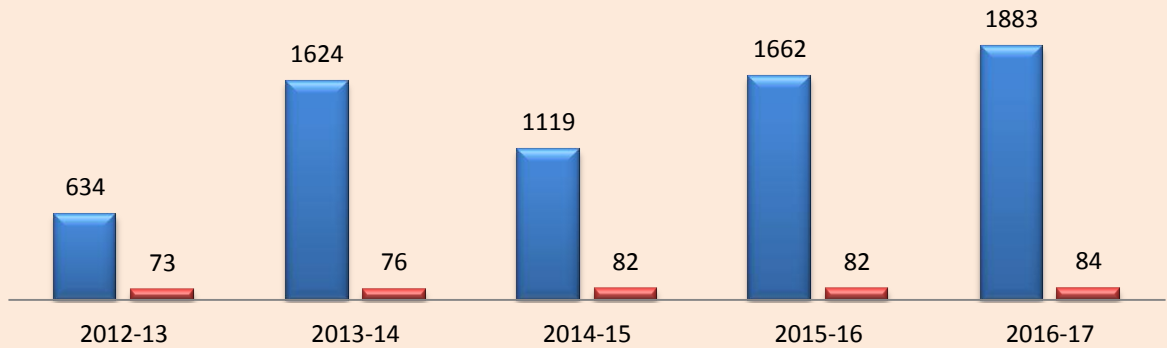


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DEMAND RATIO

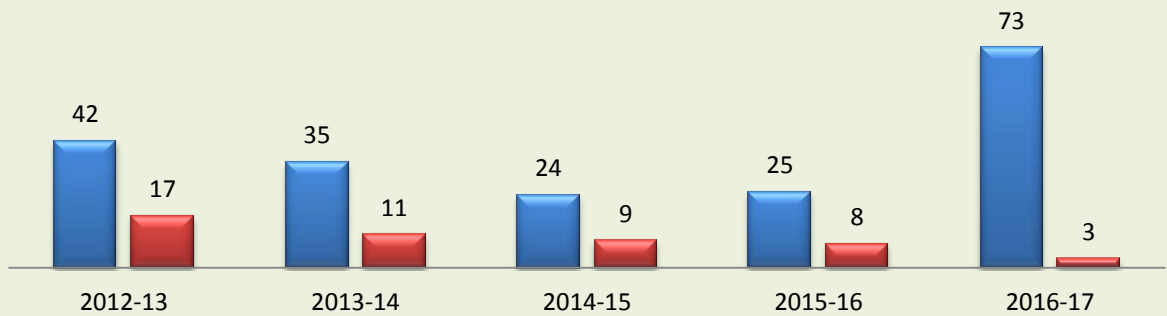
M.Sc.

■ Number of eligible applications received ■ Number admitted



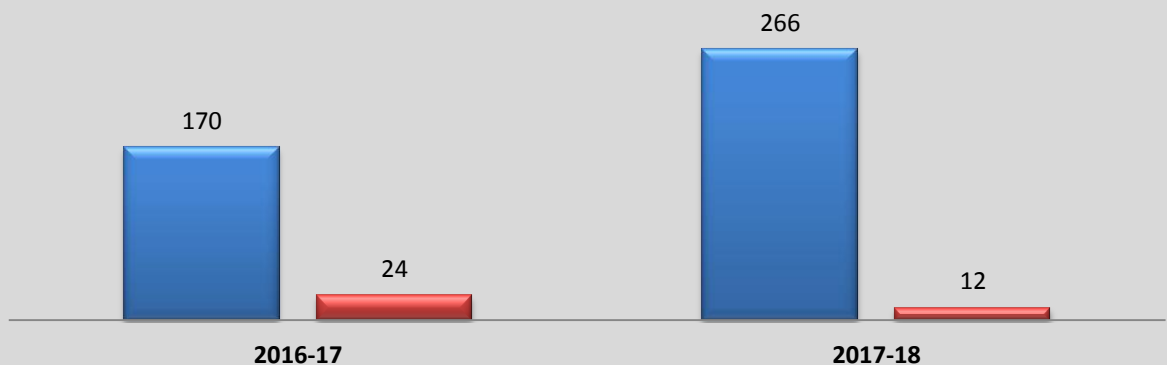
M.Phil.

■ Number of eligible applications received ■ Number admitted



Ph.D.

■ Number of eligible applications received ■ Number admitted

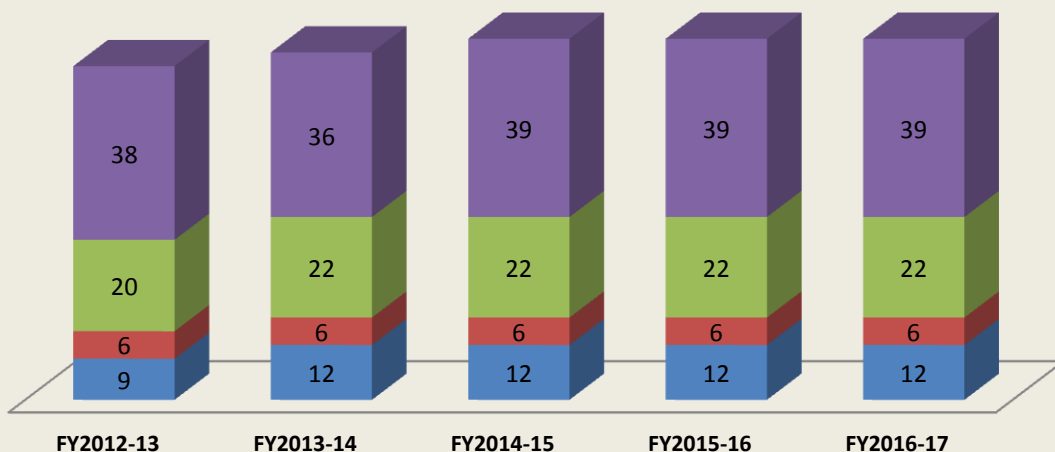


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STUDENT DIVERSITY AND SUPPORT

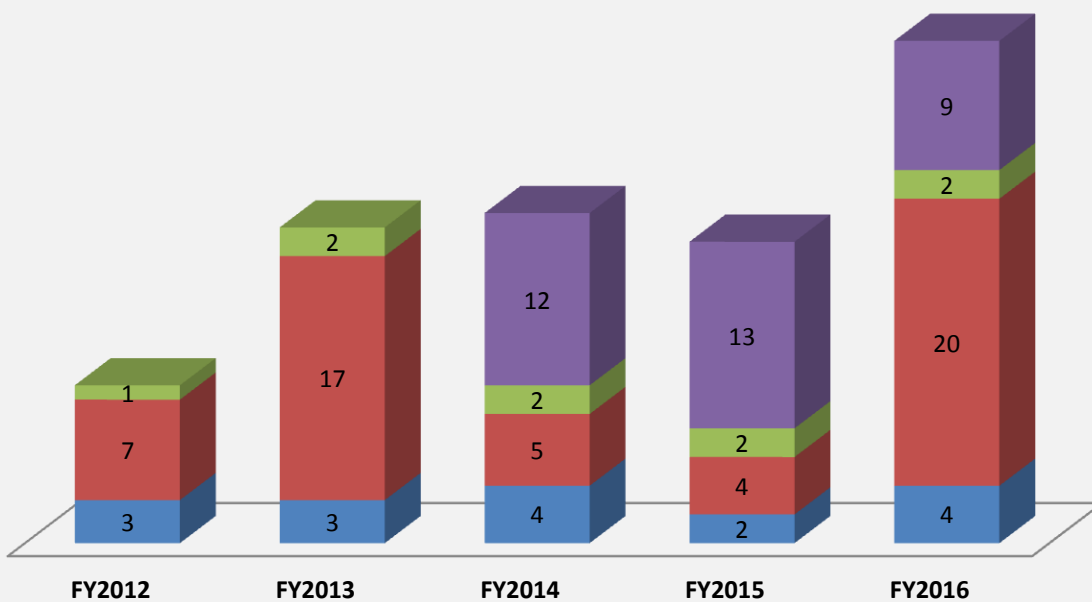
Student representation

■ SC ■ ST ■ OBC ■ Gen



Financial support to students

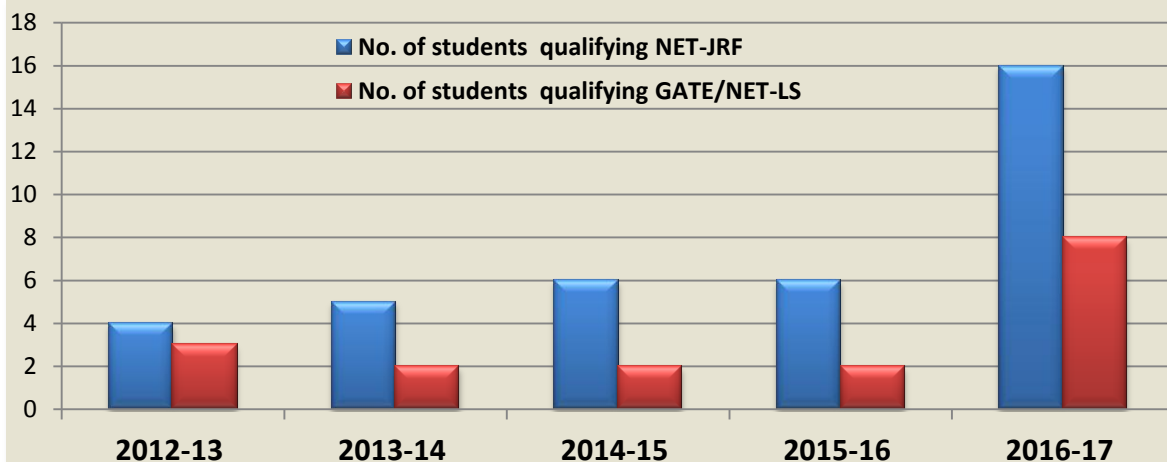
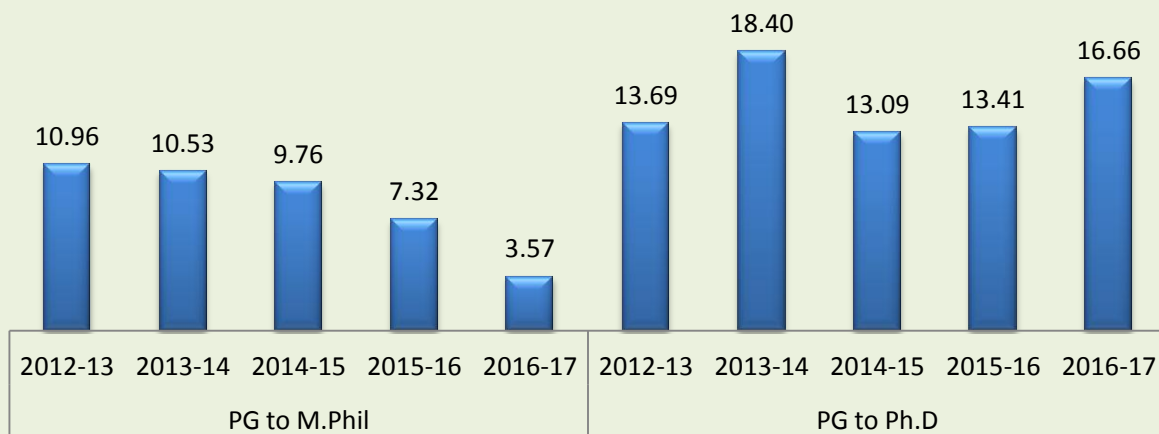
■ UGC/BSR/RGNF/INSPIRE ■ NET-UGC/CSIR/ICMR ■ Project/UTA ■ Non-NET



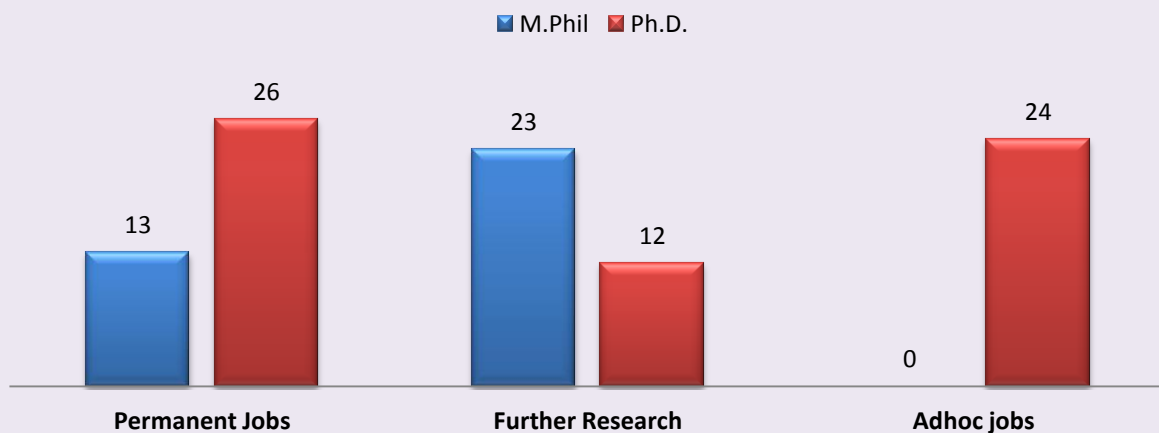
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STUDENT PERFORMANCE AND PLACEMENT

Student progression (%)



Student placement



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Course details

M.Sc.

Semester I (Core Courses)

- BOT 101 (Cell and Molecular Biology)
- BOT 102 (Genetics and Cytogenetics)
- BOT 103 (Physiology and Biochemistry)
- BOT 104 (Recombinant DNA Technology and Proteomics)

Semester II (Core Courses)

- BOT 201 (Developmental Biology)
- BOT 202 (Systematics, Evolution and Environmental Science)
- BOT 203 (Plant Biotechnology and Resource Utilization)
- BOT 204 (Pathogens and Pests of Crop Plants)

Semester III (Optional courses)

- BOT 301 (Algae, Environment & Human Welfare)
- BOT 302 (Microbes and Microbial Technology)
- BOT 303 (Advances in Archegoniatae)
- BOT 304 (Principles of Ecology)
- BOT 305 (Evolutionary Biology)
- BOT 306 (Bioinformatics, Computational Biology & Biostatistics)

- BOT 307 (Genomics and Proteomics)

- BOT 308 (Immunology)

Semester IV (Optional courses plus BOT 409)

- BOT 401: In Vitro Technologies and Industrial Applications
- BOT 402: Reproductive Biology of Flowering Plants
- BOT 403: Molecular Interactions of Plants with Symbionts, Pathogens and Pests
- BOT 404: Advanced Genetics and Plants Breeding
- BOT 405: Agricultural Ecology – Principles and Applications
- BOT 406: Advanced Plant Systematics
- BOT 407: Contemporary Concepts and Methods in Cell Biology
- BOT 408: Topics in Plant Physiology and Biochemistry
- BOT 409: Dissertation (compulsory)

Syllabus:

[http://www.du.ac.in/du/uploads/pg-courses/M.SC.%20\(BOTANY\)SYLLABUS.pdf](http://www.du.ac.in/du/uploads/pg-courses/M.SC.%20(BOTANY)SYLLABUS.pdf)

M.Phil/Ph.D (RM1-4 are compulsory;

EL1-20 are optional: M.Phil. and Ph.D to select any 12 EL courses)

RM 1 Introduction to Scientific Practice

RM 2 Statistics for Biologists

RM 3 Science Writing

RM 4 Online Tools and Presentation Skills

EL 1 Bryophyte Diversity and Evolution

EL 2 Community and Ecosystem Ecology

EL 3 Comparative Genomics

EL 4 Developmental Biology

EL 5 Functional Plant Structure

EL 6 Genetic Markers and Mapping

EL 7 Integrative Plant Biology

EL 8 Interactions of Plants with Pathogens, Pests and Symbionts

EL 9 Landscape Ecology

EL 10 Lipid Biochemistry and Metabolism

EL 11 Photosynthetic Responses to Abiotic Stresses in Plants

EL 12 Phylogenetic Biology

EL 13 Plant Growth regulators

EL 14 Plant Metabolic Engineering

EL 15 Plant Systematics

EL 16 Population Ecology

EL 17 Proteomics

EL 18 Nano-Biotechnology

EL 19 Redox Physiology

EL 20 Regulation of Eukaryotic Gene Expression

Syllabus and faculty:

http://www.du.ac.in/du/uploads/06122017_Botany_M.Phil.pdf

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TEACHING AND LEARNING



Visit to NBPGR



Visit to Landsdowne



Poster presentation by M.Sc. students and
evaluation by Ph.D. students



Journal Club & Reverse learning approach
used in M.Sc. class



Student-teacher interaction and
counselling

Students are involved in active learning in the laboratory, which is a regular part of the curriculum in all courses. In several cases, these activities are augmented with other strategies, such as the reverse learning approaches and active learning through poster preparation, and field trips.

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TEACHING AND LEARNING



Annual field trip (Ramgarh)



Annual field trip (Ramgarh)



Students taking observation in a farmers field (outskirts of Delhi) as a part of M.Sc. program

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Teaching and Research Facilities

- Classrooms and laboratories are accessible by ramp, are air conditioned and ICT enabled
- Department is equipped with high-speed internet connectivity with Wi-Fi enabled facility
- Dedicated laboratory for Bioinformatics with 35 thin-clients
- Glass house, green house and herbarium



M.Sc teaching laboratory



Tissue culture laboratory



Bioinformatics laboratory



Bioinformatics laboratory



Greenhouses and Nethouses



Herbarium

DEPARTMENT OF BOTANY UNIVERSITY OF DELHI

Teaching and Research Facilities

- Central Instrumentation Facility (Monday to Saturday -9 a.m. to 6 p.m.)
- Tissue culture facility, *Arabidopsis* growth room, Microbial culture room, Herbarium, Museum;



Central Instrumentation Facility



Scanning Electron Microscope Facility



Transmission Electron Microscope Facility



Museum



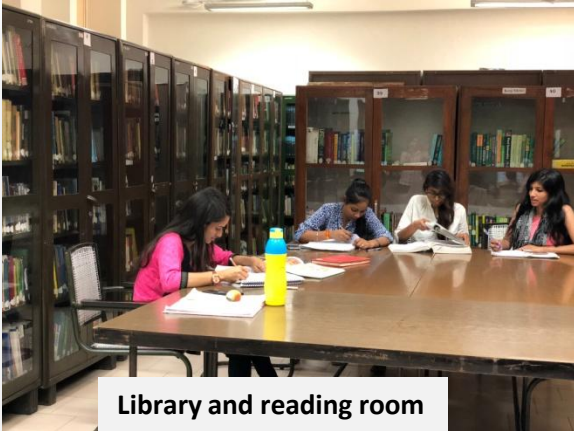
Museum



Museum

DEPARTMENT OF BOTANY UNIVERSITY OF DELHI

Teaching and Research Facilities: Library: The Departmental library houses close to 9000 books, ~300 doctoral theses and 400 M. Phil dissertations. The library includes reading space as well as computers for use by students.



Library and reading room



Library and reading room

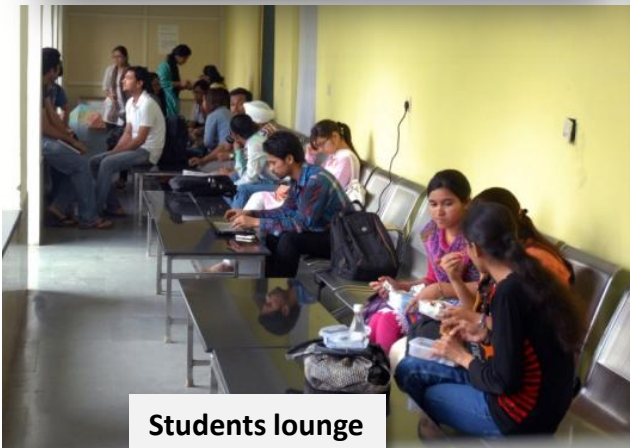
Other Facilities



Ramp-access



Ramp-access



Students lounge



Medical room

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TEACHING AND RESEARCH OUTREACH

- **Developed E-content for ePathshala (UGC) and Virtual Learning Environment (VLE; ILLD, Delhi University)**
- **Hands-on training programs for students, researchers and teachers**
 - National Workshop on Geometric Morphometrics – March 20-30, 2012
 - 1st Plant Proteomics workshop/training programme; December 26-30, 2013
 - 2nd Plant Proteomics Workshop/Training Programme December 21-26, 2015
 - UGC Refresher Course; December 9-30, 2014
 - 3rd Plant Proteomics workshop/training programme; December 17-24, 2017
 - Fundamentals of R Analytics and Applications for Biostatistics under Skill Enhancement Scheme for Research Students; November 27-29, 2017
 - Basic Biostatistics Course under Skill Enhancement Scheme for Research Students (Prof. T.R Rao) August-December 2017
- **International and National Conferences, and seminars:**
 - International Symposium on Plant Signaling and Behavior 2014; March 7-10, 2014, Delhi
 - 1st Himalayan Conclave (September 9-10, 2015)
 - National Conference on Plant Science Research: Looking beyond 21st Century for Environmental and Agricultural Revolution. February 5-7, 2016
 - National Seminar on Identifying and Avoiding Publishing in Predatory Journals: A Lesson for Researchers; March 18, 2017
 - XXVII Annual conference of Indian Association for Angiosperm Taxonomy & International symposium on “Plant Systematics: Priorities and Challenges” November 10-12, 2017

DEPARTMENT OF BOTANY UNIVERSITY OF DELHI

CONFERENCES, SEMINARS AND WORKSHOPS



RELEASE OF SOUVENIR & ABSTRACTS OF SPREA-2016 HELD IN UNIVERSITY OF DELHI BY SECRETARY GENERAL AARDO H.E. WASSFI HASAN EL SREIHIN, SECRETARY GENERAL, SPR PROF S K BHATNAGAR, PRESIDENT SPR PROF R K GUPTA AND THE HONORABLE MEMBERS OF ORGANIZING COMMITTEE.

Conferences and workshops:

- Hands-on training programs for students, researchers and teachers
- National Workshop on Geometric Morphometrics – March 20-30, 2012
- Plant Proteomics workshop/training programme; 2013, 2015, 2017
- UGC Refresher Course; Dec 9-30, 2014
- Fundamentals of R Analytics November 27-29, 2017
- Basic Biostatistics Course under Skill Enhancement Scheme August-December 2017
- **International and National Conferences, and seminars:**
- International Symposium on Plant Signaling and Behavior 2014; March 7-10, 2014, Delhi
- National Conference on Plant Science Research: Looking beyond 21st Century for Environmental and Agricultural Revolution. February 5-7, 2016
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OUTREACH ACTIVITIES: WORKING WITH LOCAL COMMUNITIES

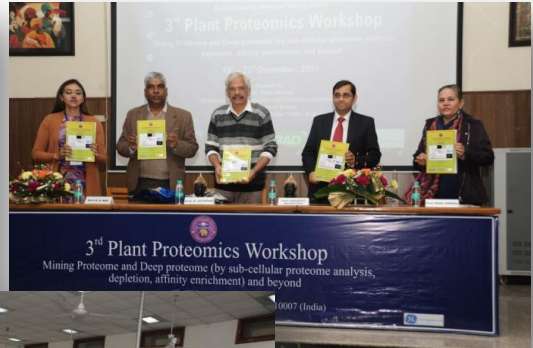


OUTREACH ACTIVITIES: CARING FOR THE ENVIRONMENT



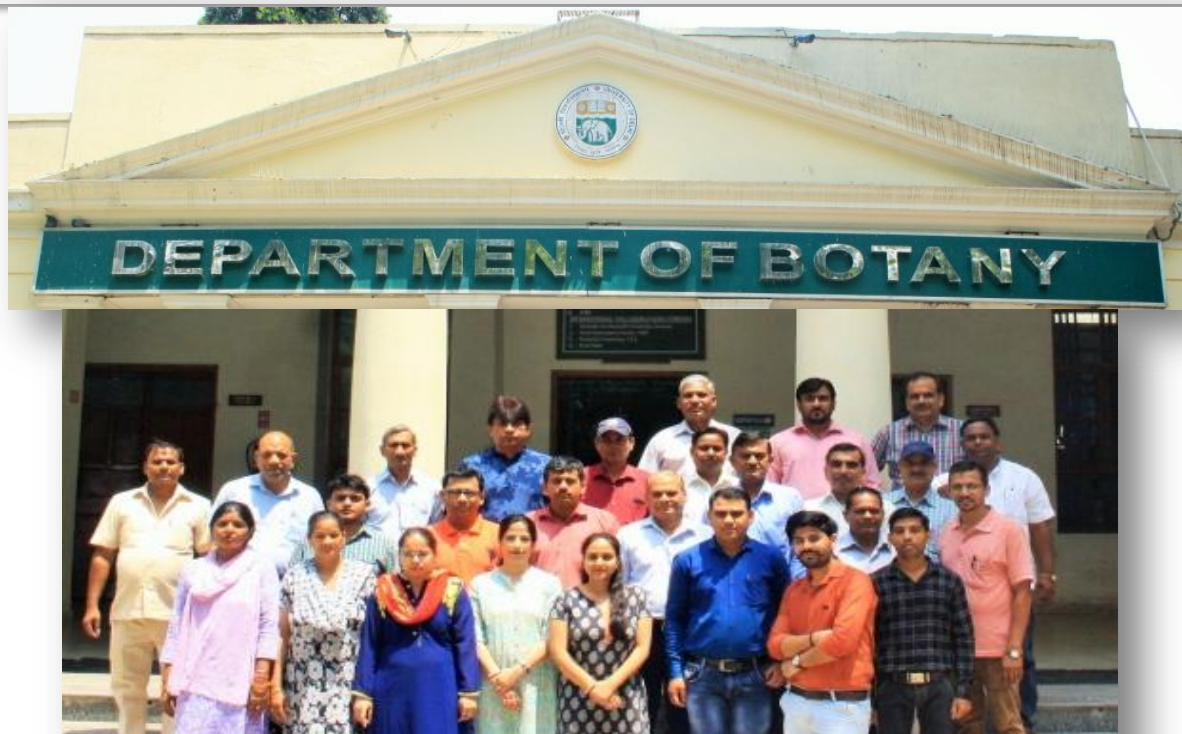
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OUTREACH ACTIVITIES: HANDS-ON TRAINING PROGRAM



DEPARTMENT OF BOTANY UNIVERSITY OF DELHI

OUR SUPPORT: ADMINISTRATIVE, NON-TEACHING AND LIBRARY STAFF



Left to Right:

Bottom Row 1: Mrs. Rani, Mrs. Kanta, Mrs. Swati, Mrs. Anita, Ms. Nancy, Mr. Rahul Giri, Mr. Sagar, Mr. Rakesh

Row 2: Mr. Rahul, Mr. Virendra, Mr. Amit, Mr. Ramesh, Mr. Satish-I, Mr. Jagdish, Mr. Mahesh

Row 3: Mr. Devender, Mr. Satish-II, Mr. Surinder, Mr. Mukesh, Mr. Rohit, Mr. Bharat Bhusan, Mr. Gianender, Mr. S.K. Thakur, Mr. Munni Lal

Top Row: Mr. Samay, Mr. Ajay Giri, Mr. Mohinder



L to R: Mr. Vikram; Mr. Vinod Kumar Giri; Mr. Nizaam; Mr. Devender Kumar; Mr. Jagdish Kumar; Mr. Samay Singh; Mr. Ram Kishor.



Left to Right: Mr. O.P.Tiwari, Mr. S.K.Thakur, Mr. Sobhan Singh



Mr. Ghasi Ram

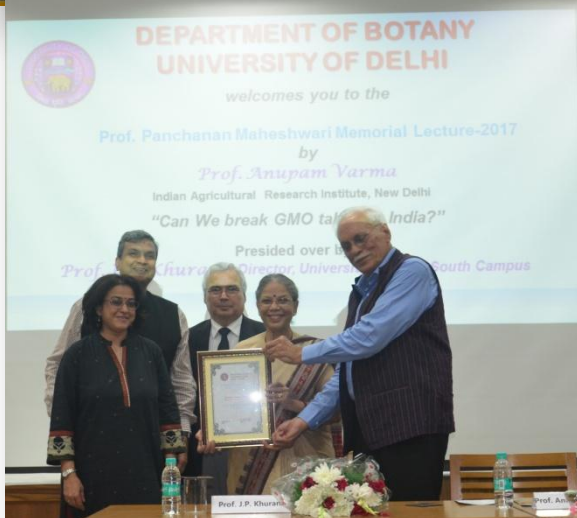
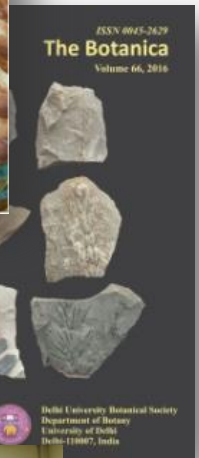
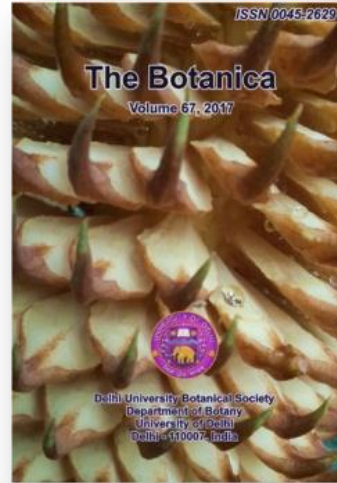
DEPARTMENT OF BOTANY UNIVERSITY OF DELHI



EXTRA-CURRICULAR ACTIVITIES

THE DELHI UNIVERSITY BOTANICAL SOCIETY

Founded in 1950 by Professor P. Maheshwari, DUBS may be the only student society at the University of Delhi to have continued this long. The objectives of the society, as outlined in the first issue of the first volume of the magazine "The Botanica," are to introduce to students various aspects of Botany that are not usually dealt with in the classroom and to give them a well-rounded education by organizing various co- and extra curricular activities like field trips for plant collection, lectures and training workshops by eminent scientists, seminars, debates, quizzes, paper presentation competitions. The Society continues to pursue these objectives with great enthusiasm and hopes to continue to do so in the years to come. The Botanica is an annual publication of the DUBS and the 67th volume was released in 2017-2018.



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EXTRA-CURRICULAR ACTIVITIES

Darwin Day



International Darwin Day Celebration
Delhi University Botanical Society
Cordially invites you for
Lecture by
Prof. T. R. Rao
On
"Alfred Russel Wallace: The unsung hero of Natural Selection"
Venue: Seminar Hall, Department of Botany, University of Delhi
Date : February 12, 2018
Time : 3 pm
Dr. Babbar DUBS Ms. Shruti Kasana President, DUBS

गोभी कहां से आया
Select these individuals for the next generation. 1. Parental Generation: Select individuals with largest and most compact flowering stalks and breed them



Flower show



University of Delhi | दिल्ली विश्वविद्यालय
Delhi-110007 | दिल्ली-110007
antardig 2014
(February 14-16, 2014)
This certificate is awarded to Department of Botany of _____ for participating in Awards of Good Practices Event during Cultural Festival, Antardigvani - 2014. He/She was awarded Third position.
H.Kal



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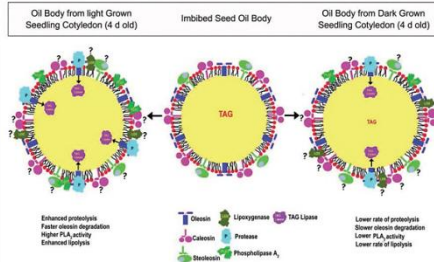
EXTRA-CURRICULAR ACTIVITIES: SPORTS AND QUIZ



DEPARTMENT OF BOTANY
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PH.D. AWARDEES AND FELICITATION (2017-18)





S.C. Bhatla, Ph.D.
Professor



Salt stress physiology
Plant Physiology and Biochemistry
Physiology of adventitious rooting

Fellow, Alexander von Humboldt Foundation (Germany)
Fellow, National Academy of Sciences, India

Our major research interests are to understand the interplay of signalling mechanisms, especially role of Nitric Oxide (NO) and its interaction with various other components, under salt stress in plants using sunflower seedling as a model. Some of our major recent findings can be summarized as:

- Serotonin, Melatonin and NO, through differential distribution, plays a major role and regulates growth of sunflower seedlings under salt stress
- Glutathione content, and activity of Glutathione reductase Cu/Zn SOD, and Mn SOD are modulated by levels of Melatonin and NO under salt stress
- Post-translation modifications such as Nitration of protein tyrosinase, and Nitric Oxide (NO) accumulation acts as a long distance signalling in response to salt stress
- NO together with Fe also modulates heme-oxygenase activity, in response to salt stress, and that this modulation also acts as long distance signalling response
- The Long Distance transport of NO is mediated by S-Nitrosothiols which acts as a carrier molecule
- Unravelling of the molecular mechanisms of NO signalling and NO cross-talk with ROS (bhatlasc@gmail.com)

SELECTED PUBLICATIONS

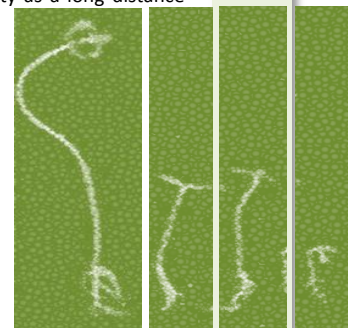
Arora, D. and Bhatla, S.C. (2017). Melatonin and nitric oxide regulate sunflower seedling growth under salt stress accompanying differential expression of Cu/Zn SOD and Mn SOD. *Free Radical Biology and Medicine*.

Singh, N. and Bhatla, S.C. (2016). Nitric oxide and iron modulate heme oxygenase activity as a long distance signaling response to salt stress in sunflower seedling cotyledons. *Nitric oxide* 53: 54-64.

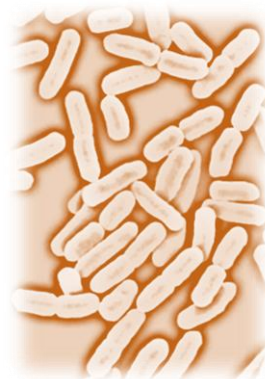
Mukherjee, S. and Bhatla, S.C. (2014). A novel fluorescence imaging approach to monitor salt stress-induced modulation of ouabain-sensitive ATPase activity in sunflower seedling roots. *Physiologia Plantarum* 150: 540-549.

Yadav, M.K. and Bhatla, S.C. (2011). Localization of lipoxygenase activity on oil bodies and in protoplasts using a novel fluorescence imaging method. *Plant Physiology and Biochemistry* 49: 230-234.

Bhatla, S.C., Kaushik, V. and Yadav, M.K. (2010). Use of oil bodies and oleosins in recombinant protein production and other Biotechnological applications. *Biotechnology Advances* 28:293-300.



Ved Pal Singh, *Ph.D.*
Professor



Applied Microbiology and Biotechnology

Microbial and Molecular Genetics

Fellow, Indian Botanical Society (FBS)

Fellow, Linnean Society of London (FLS)


Fellow, International Society of Plant Morphologists (FISPM)

Fellow, International Society for Conservation of Natural Resources (FNRS)

INSA Young Scientist Award – 1985

UNESCO/ROSTSCA Young Scientist Award – 1987.

National Youth Development Award – 2004



Dr. Ved Pal Singh was awarded his Ph.D by the University of Delhi in 1981. Dr. Singh worked as Research Associate /Research Scientist at DoB from 1981-1986 before joining as Lecture in 1986. He served as head, DoB (2014-2017). He worked as Commonwealth Academic Staff Fellow, University of Strathclyde, Glasgow (UK; 1990 –1991); INSA (1985) and UNESCO (1987) Young Scientist Awards; elected as Fellow of the International Society for Conservation of Natural Resources (FNRS), International Society of Plant Morphologists (FISPM), Fellow of Indian Botanical Society (FBS) and Linnean Society of London (FLS). During his stay as a faculty at DoB, his research interests were in the field of Applied microbiology & Biotechnology with special reference to genetic transformation and molecular basis of thermophily in bacteria, in addition to Microsome Technology for bioremediation of xenobiotics. He taught Genetics and Cytogenetics, Molecular Genetics & Biostatistics, Microbial & Molecular Genetics, Microbes and Microbial Technology. (vpsingh_biology@rediffmail.com)

SELECTED PUBLICATIONS

Thomas, L., Ram, H. and Singh, V.P. (2017). Evolutionary relationships and taxa specific conserved signature indels among cellulases of Archaea, Bacteria, and Eukarya. *Journal of Computational Biology*. 24: 1029-1042.

Thomas, L., Ram, H., Kumar, A. and Singh, V.P. (2016). Production, optimization, and characterization of organic solvent tolerant cellulases from a lignocellulosic waste-degrading actinobacterium, *Promicromonospora* sp. *Applied Biochemistry and Biotechnology*. 179: 863-79.

Mandal, S., Upadhyay, S., Singh, V.P. and Kapoor, R. (2015). Enhanced production of steviol glycosides in mycorrhizal plants: A concerted effect of arbuscular mycorrhizal symbiosis on transcription of biosynthetic genes. *Plant Physiology and Biochemistry*. 89: 100-106.

Kohli, I., Tuli, R. and Singh, V.P. (2014). Isolation and biochemical characterization of an amylase producing thermophilic bacterium from garden soil. *Journal of Plant Development Sciences*. 6: 159-166.

Mathur, P., Sharma, E., Singh, S.D., Bhatnagar, A.K., Singh, V.P. and Kapoor, R. (2013). Effect of elevated CO₂ on infection of three foliar diseases in oilseed *Brassica juncea*. *Journal of Plant Pathology*. 95: 135-144.

Research Guidance: Ph.D. 20; M.Phil:20

Publications :120

K.S. Rao, Ph.D.
Professor



Soil and water conservation
Land use/cover analyses
Ecosystem analysis
Plant nutrition
Agroforestry systems
Ecosystem redevelopment
Reserve-People conflict mitigation



Vishisht Vaigyanik Puraskar, 2005.
UGC Swami Pranavananda Saraswati Award.2006.
Prof. Gnanam Endowment Lecture Award.2016.
Fellow of National Institute of Ecology
Fellow of International Society for Plant Morphologists
Fellow of Andhra Pradesh Akademi of Sciences
Fellow of Linnean Society of London
Fellow of Indian Botanical Society.

Prof. K.S. Rao's research interest is in the area of natural resource management and sustainable development in the Himalaya and biodiversity assessment in critical ecosystems in hill and mountain regions. Besides being an active researcher, Prof. K.S. Rao is also involved in application of participatory approaches for restoration of degraded lands using agroforestry and land rehabilitation techniques. Research contribution of Prof. K.S. Rao is unique in that socio-ecological systems approach has been developed and applied to analyze the causes and consequences of ecosystem degradation over a range of spatial and temporal scale and to develop sustainable approaches for restoration of ecosystem functions. (rao.srkottapalli@gmail.com; srkottapalli@yahoo.com)

SELECTED PUBLICATIONS

- Bidalia, A., Hanief, M. and Rao, K.S. (2017). Tolerance of *Mitragyna parvifolia* (Roxb.) Korth. seedlings to NaCl salinity. *Photosynthetica*, 55 (2): 231-239.
- Dinakaran, J., Bidalia, A., Kumar, A., Hanif, Md., Meena, A. and Rao, K.S. 2016. Near infrared-spectroscopy for determination of carbon and nitrogen in Indian soils. *Communications in Soil Sciences and Plant Analysis*, 47(12): 1503-1516.
- Shimrah, T., Rao, K.S. and Saxena, K.G. (2015). The shifting agricultural system (Jhum) and strategies for sustainable agroecosystems in Northeast India. *Agroecology and Sustainable Food Systems*, 39: 1154-1171.
- Pardha Saradhi, P., Yamal, G., Peddisetty, T., Sharmila, P., Nagar, S., Singh, J., Nagarajan, R. and Rao, K.S. (2014). Reducing strength prevailing at root surface of plants promotes reduction Ag⁺ and generation of AgO/Ag₂O nanoparticles exogenously in aqueous phase, *PLOS ONE*, 9(9): e106715.
- Semwal, R.L., Nautiyal, S., Maikhuri, R.K., Rao, K.S. and Saxena, K.G. (2013). Growth and carbon stocks of multipurpose tree species plantations in degraded lands in central Himalaya, India. *Forest Ecology and Management*, 310: 450-459.
- Khuman, S.C., Pandey, R. and Rao, K.S. (2012). Micro-watershed level population based fuelwood consumption dynamics: Implications of seasonal vs. annual models for sustainable energy. *Renewable and Sustainable Energy Reviews*, 16: 6142-6148.

Research Guidance: Ph.D. 18; M.Phil. 3

Publications :155

A.K. Pandey, Ph.D.
Professor



Plant systematics

Reproductive biology of flowering plants



Fellow, National Academy of Sciences, India

President, Indian Botanical Society

Vice President, East Himalayan Society of Spermatophyte Taxonomy

Prof. Panchanan Maheshwari Medal of Indian Botanical Society. 2015.



Our group has published a series of papers on taxonomy and molecular phylogeny of Indian taxa - *Alysicarpus*, *Crotalaria*, *Dactyliandra*, *Indigofera*, and *Zehneria*. Six new species of legumes (*Indigofera himachalensis*, *Crotalaria meghalayensis*, *C. multibracteata*, *C. suffruticosa*, *Alysicarpus gautalensis*, *Alysicarpus poklianus*) have been described. Taxonomic revision of *Tricholepis*, *Inula*, *Aralia*, *Panax*, trifoliolate *Indigofera*, and *Alysicarpus* have been completed. Our publication of checklist of Indian Cucurbitaceae provides an up-to-date reference material. We have described the spermoderm pattern in more than 100 taxa of papilionoid legumes. Pollen morphological studies in *Inula* and related genera provide useful data of systematic significance. Reproductive biology of taxa belonging to Asteraceae, Sterculiaceae, Theaceae, and Sapindaceae has been carried out. Ultrastructural studies of phytomelanin in Asteraceae have given new insights in understanding the evolutionary, systematic and adaptive significance in the sunflower family. Ethnobotanical studies have helped to record important, useful traditional knowledge from among different tribal groups in Jharkhand, Odisha and Manipur. (arunpandey79@gmail.com)

SELECTED PUBLICATIONS

Dwivedi, M.D., Barfield, S., Pandey, A.K. and Schaefer, H. (2018). Phylogeny of *Zehneria* (Cucurbitaceae) with special focus on Asia. *Taxon* (DOI 10.10705/6714).

Rather, S.A., Danda, S., Subramaniam, S. and Pandey, A.K. (2018). Two new species of *Crotalaria* (Fabaceae, Crotalareae) discovered in Western Ghats, India. *PLoS ONE* (in press)

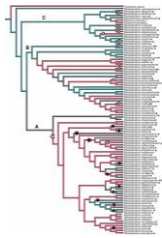
Linder, K., Yue, Hu., Pandey, A.K. and Schaefer, H. (2017). The Namib-Thar desert disjunction in *Dactyliandra* (Cucurbitaceae) is the result of a recent introduction to India. *Systematic Botany* 42 (1): 63-72.

Chauhan, V. and Pandey, A.K. (2014). Structure and evolution of the pod in *Indigofera* (Fabaceae) reveals a trend towards small thin indehiscent pods. *Botanical Journal of the Linnean Society* 176:260-276.

Subramaniam, S., Pandey, A.K., Geeta, R. and Mort, M.M. (2013). Molecular systematics of Indian *Crotalaria* (Fabaceae) based on analyses of nrITS DNA sequences. *Plant Systematics and Evolution* 299:1089-1106.

Research Guidance: Ph.D. 28; M.Phil. 5

Publications :129



Phylogenetic Biology

Molecular and genome evolution

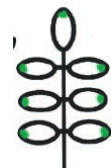
Evolution of leaf form and development

Systematics and evolution of angiosperms



Katherine Esau Fellow, University of California, Davis, USA (1994)
Mellon Foundation Fellowship (1991)
Panchanan Maheshwari Memorial Prize, University of Delhi, India (1974)

My research is focused on tracing the historical path of biological diversification. My goal is to integrate understanding of multiple processes (developmental, morphogenetic, physiological) at multiple levels (molecular, cellular, organismal) to obtain a comprehensive understanding of evolving biological systems (plants). This work involves the marriage of multiple disciplines, e.g., traditional botany, modern molecular genetics and, critically, phylogenetics (reconstruction of evolutionary relationships among taxa and using the phylogenetic framework to analyse data from many species). The taxonomic scope of this work includes monocotyledons, *Dioscorea*, *Crotalaria* and fungi; phylogenetic and developmental studies use both molecular and morphological data. My collaborators and I have studied developmental and evolutionary patterns of variation in characters at different levels of organization: morphological (leaf development and evolution), cellular (reproductive development), subcellular (relocalization of duplicate proteins), genomic (nuclear DNA amount and phenotypic correlates), and molecular (Knox, a homeobox multigene family) and through integrative phylogenetic analyses. Our studies have also extended into evolutionary ecology and historical analysis (presence of *Datura* in Asia). (rgeeta@botany.du.ac.in)



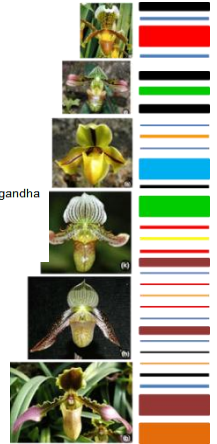
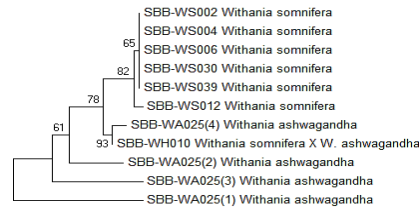
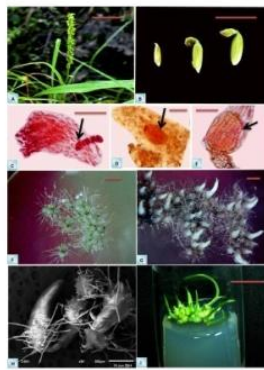
SELECTED PUBLICATIONS

- Berry, E., Sharma, S.K., Pandit, M.K. and Geeta, R. (2017). Evolutionary correlation between floral monosymmetry and corolla pigmentation patterns in *Rhododendron*. *Plant Systematics and Evolution* DOI10.1007/s00606-017-1467-y.
- Puri, R., Barman, P., Geeta, R. (2016). A phylogenetic approach toward the understanding of disjunct distributions of plant taxa in Western Ghats and northeastern India. *Rheedea* 26:17-32.
- Geeta, R., Davalos, L.M., Levy, A., et al. (2012). Keeping it simple: flowering plants tend to retain, and revert to, simple leaves. *New Phytologist*. 193: 481-493. DOI: 10.1111/j.1469-8137.2011.03951.x
- Byun-McKay, S.A. and Geeta, R. (2007). Protein subcellular relocalization: a new perspective on the origin of novel genes. *Trends in Ecology and Evolution* 22:338-344.
- Bharathan, G., Goliber, T., Moore, C., Kessler, S., Pham, T. and Sinha, N. (2002). Homologies in leaf development inferred from KNOX1 gene expression. *Science* 296: 1858-1860.
- Bharathan, G., Janssen, B.-J. Kellogg, E. A. and Sinha, N. (1997). Did homeodomain proteins duplicate before the origin of angiosperms, fungi, and metazoa? *Proc. Natl. Acad. Sci.* 94:13749-13753.

Research Guidance: Ph.D. 1; M.Phil. 3

Publications : 56

S.B. Babbar, Ph.D.
Professor



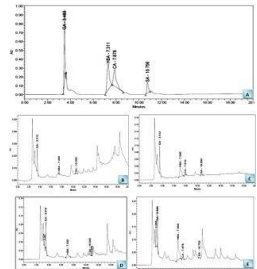
In Vitro Plant Morphogenesis DNA Barcoding of Plants

Role of Nitric Oxide in Plant Growth and Development

I began my research career with interest in physiology and ontogeny of in vitro androgenesis, demonstrated the dispensability of the culture medium for the induction process and the role of ethylene, charcoal, iron, etc. in microspore embryogenesis, besides extending the technique, with variable success, to *Brassica nigra*, *Iberis amara* and *Psidium guajava*. Developed in vitro multiplication protocols for ligneous taxa, *Syzygium cuminii* and *Crataeva nurvala*, and medicinal plants, *Anacyclus pyrethrum*, *Satyrium lanceum* and *Herminium lanceum*. Tested and demonstrated the usefulness of isubgol, gum katira, guar gum and xanthan gum as less expensive alternative gelling agents for plant and microbial culture media. Initiating the research on DNA barcoding at a time when its applicability to plants was doubtful and the barcode loci unidentified, provided the proof-of-concept for its effectiveness in plants by barcoding more than 200 plant species including 140 orchids. Have so far developed barcodes for about 150 medicinal plants of commercial importance and have demonstrated their efficacy in checking the authenticity of market samples of some of these. Research on nitric oxide, revealed the hitherto unknown promotory effect of this gaseous growth regulator on flowering and caulogenesis. (sbbabbar@gmail.com; babbars@rediffmail.com).

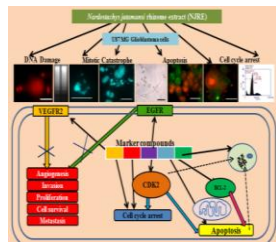
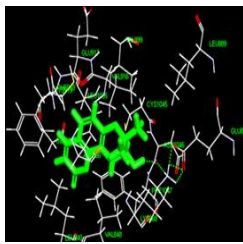
SELECTED PUBLICATIONS

- Parveen, I., Singh, H.K., Malik, S., Raghuvanshi, S. and Babbar, S.B. (2017). Evaluating five different loci (rbcL, rpoB, rpoC1, matK and ITS) for DNA barcoding of Indian orchids. *Genome* DOI: 10.1139/gen-2016-0215
- Singh, D.S., Nirwan, S. and Babbar, S.B. (2015). Micropropagation of *Anacyclus pyrethrum* and chemical profiling of the regenerated plants for pellitorine, the active principle. *Plant Cell, Tissue & Organ Culture* 122: 249-255.
- Singh, H., Parveen, I., Raghuvanshi, S., Babbar, S.B. (2012). The loci recommended as universal barcodes for plants on the basis of floristic studies may not work with congeneric species as exemplified by DNA barcoding of *Dendrobium* species *BMC Research Notes* 5: art. no. 42
- Parveen, I., Singh, H.K., Raghuvanshi, S., Pradhan, U.C., Babbar, S.B. (2012). DNA barcoding of endangered Indian *Paphiopedilum* species. *Molecular Ecology Resource*. 12: 82-90.
- Khurana, A., Khurana, J.P. and Babbar, S.B. (2011). Nitric oxide induces flowering in the duckweed, *Lemna aquinoctialis* Welw. (Syn. *L. paucicostata* Hegelm.), under noninductive conditions. *J Plant Growth Regul* 30: 378-385.
- Babbar, S.B. and Jain, N. (1998). 'Isubgol' as an alternative gelling agent for plant tissue culture media. *Plant Cell Reports* 17: 318-322.



Research Guidance: Ph.D. 15; M.Phil. 12

Publications : 70



Veena Agrawal, Ph.D.
Professor

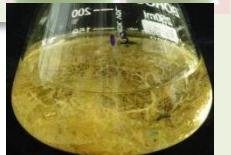
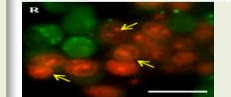
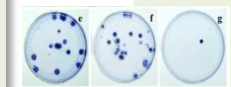
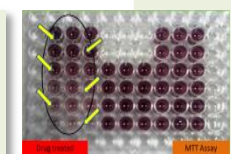


Applied plant biotechnology, metabolic engineering
Biosynthesis of Herbal bioactive compounds, bio-nanoparticles and their bio-efficacy against cancers, malaria, filarial & dengue vectors
Development of sex-linked markers & genetic diversity analysis in dioecious crops
Metal stress-induced phytotoxicity and its amelioration



Fellow of Linnean Society of London, 2017
Scientist of Eminence Award, 2016
Fellow of International Society of Plant Morphology, 2014
Fellow of Indian Society for Plant Physiology, 2013

The major research areas of my work pertain to Plant biotechnology (micro-propagation & genetic transformation), genetic diversity analysis and sex linked molecular markers for dioecious plant taxa. Two male specific STS (Sequence Tagged Sites), 3 ISSR, 1 RAPD and 1 SRAP markers have been developed in Jojoba and validated on its larger populations under a DST/SERB project (2013-2017). Evaluation, isolation and elicitation of natural bioactive compounds using metabolic engineering is yet another area of our ongoing research. Bioassays are being carried out using natural compounds and herbal extract synthesized nano-particles against different cancer cell lines (*under SERB major project; 2017-2020*) and mosquito vectors causing malaria, filaria and dengue. In addition, my research students are also involved in alleviation of heavy metal induced phytotoxicity using glutathione antioxidant and *Piriformospora indica* - a symbiotic fungus. In collaboration with ICGEB, New Delhi, attempts are being made to develop transgenic plants incorporating pro-insuline synthesizing gene in the carrot for making edible vaccines. (drveena_du@yahoo.co.in)



SELECTED PUBLICATIONS

Nanda, R. and Agrawal, V. (2018). *Piriformospora indica*, an excellent system for heavy metal sequestration and amelioration of oxidative stress and DNA damage in *Cassia angustifolia* Vahl under copper stress. *Ecotoxicol. & Environ. Safety* 156:409-419.

Kapoor, H., Yadav, N., Chopra, M., Mahapatra, S.C. and Agrawal, V. (2017). Strong anti-tumorous potential of *Nardostachys jatamansi* rhizome extract on glioblastoma and in silico analysis of its molecular drug targets. *Curr. Can. Drug Tar.* 17: 74-88.

Kumar, D., Kumar, G., Das, R. and Agrawal, V. (2018). Strong larvicidal potential of silver nanoparticles (AgNPs) synthesized using *Holarrhena antidysenterica* bark extract against malarial vector, *Anopheles stephensi*. *Process Saf. Environ. Prot.* 116:137-1489.

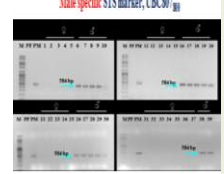
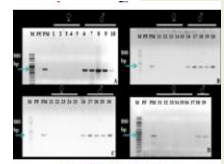
Nanda, R. and Agrawal, V. (2016). Elucidation of zinc and copper induced oxidative stress, DNA damage and activation of defence system during seed germination in *Cassia angustifolia* Vahl. *Environ. Exp. Bot.* 125: 31-41.

Kumar, J. and Agrawal, V. (2017). Analysis of genetic diversity and population genetic structure in *Simarouba glauca* DC. (an important bio-energy crop) employing ISSR and SRAP markers. *Ind. Crops Prod.* 100: 198-207.

Kumar, D., Al Hassan, M., Naranjo, M. A., Agrawal, V., Boscaiu, M. and Vicente, O. (2017). Effects of salinity and drought on growth, ionic relations, compatible solutes and activation of antioxidant systems in oleander (*Nerium oleander* L.). *PLoS One*, 12(9), e0185017

Parast, B. M., Chetri, S. K., Sharma, K. and Agrawal, V. (2011). *In vitro* isolation, elicitation of psoralen in callus cultures of *Psoralea corylifolia* and cloning of psoralen synthase gene. *Pl. Physiol. Biochem.* 49: 1138-1146.

Patent filed: 5. Granted: 1 by Govt. of India No. 2 789 34, Dated: 4.01.2017 Entitled "A process for Extraction of psoralen Bioactive compound" inventor; Veena Agrawal



Research Guidance: Ph.D. 17 +06 (on going); M.Phil. 20+1 Publications : 100

D. B. Sahoo, Ph.D.
Professor



Carbon Sequestration

Biofuel From Algae

Marine Biotechnology

Algal Nutraceuticals

Science & Technology For Societal Benefit

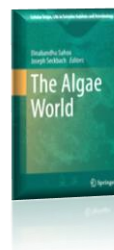
Fellow, National Academy of Sciences, India

M. P. Purohit Memorial Award (Orissa)

Young Scientist award by Aus-Aid 1998

INSA Young Scientist Award, 1997

Zahoor Qasim Gold medal, 1997



DR. D.B. Sahoo obtained his Ph.D from DoB, Delhi University (1989) and is the first student researcher to visit Anartarica Research station. His major research teaching interests are carbon sequestration, biofuel production from algae, marine biotechnology and marine environment, application of science & technology for societal benefit. Dr. Sahoo is presently on deputation to IBSD, Imphal, Manipur as Director.

Chilika: The Untold Story (A 25 minutes documentary film about Chilika lake and the scientific intervention to provide livelihood). This was the opening film at the 4th National Film Festival on Art & Artists held at Bhubaneswar. The film was also screened in USA, Brazil, Vietnam and a few other countries. To see the preview of this documentary visit <https://www.youtube.com/watch?v=ey2P5hGRjPc>.
(dbsahoo@hotmail.com; director.ibsd@nic.in)

SELECTED PUBLICATIONS

Kumar, S., Gupta, R., Kumar, G., Sahoo, D. and Kuhad, R.C. (2013). Bioethanol production from *Gracilaria verrucosa*, a red alga, in a biorefinery approach. *Bioresource Technology* 135: 150-156.

Chung, I.K., Beardall, J., Mehta, S., Sahoo, D. and Stojkovic, S. (2011). Using marine macroalgae for carbon sequestration: A critical appraisal. *Journal of Applied Phycology* 23: 877-886.

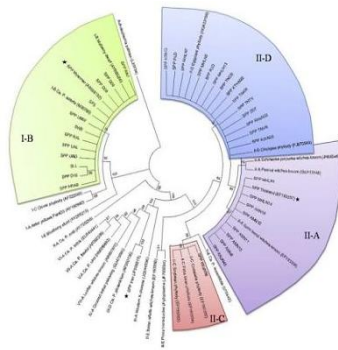
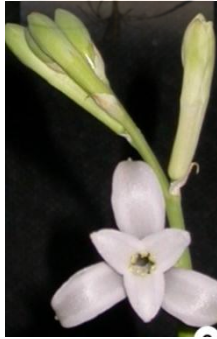
Yang, E.C., Kim, M.S., Geraldino, P.J.L., Sahoo, D., Shin, J.-A. and Boo, S.M. (2008). Mitochondrial *cox1* and plastid *rbcl* genes of *Gracilaria vermiculophylla* (Gracilariaceae, Rhodophyta). *Journal of Applied Phycology* 20: 161-168.

Kumar, G. and Sahoo, D. (2011). Effect of seaweed liquid extract on growth and yield of *Triticum aestivum* var. Pusa Gold. *Journal of Applied Phycology* 23: 251-255.

Baweja, P., Sahoo, D., García-Jiménez, P. and Robaina, R.R. (2009). Review: Seaweed tissue culture as applied to biotechnology: Problems, achievements and prospects. *Phycological Research* 57: 45-58.

Research Guidance: Ph.D. 11; M.Phil 15

Publications: 65



Suman Lakhanpaul, Ph.D.
Professor

Crop Genetics

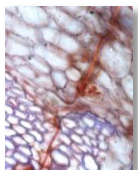
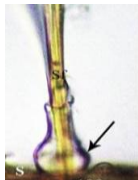
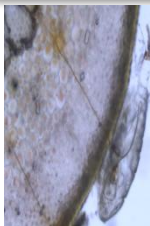
Plant molecular genetics

Plant-insect-endosymbiont interactions

Molecular analysis of biological diversity



Has worked on different aspects of conservation and management of plant genetic resources mainly aimed at analysis of genetic diversity at population and species level using molecular markers in taxa such as *Vigna* spp., *Allium cepa*, *Colocasia*, *Sesamum*, *Musa*, *Ipomoea*, *Pennisetum* etc. Another area of interest is delineating the biological and molecular basis of selected economically important multi-partner interactions (microbe-plant-insect) particularly where alterations of developmental pattern of the host organism is involved. Detection and characterization of hitherto unreported endosymbionts involved in the lac insect-host plant association reported for the first time. Presently, working extensively on the molecular characterization of Phytoplasma associated with diseases in sesame and the mechanism involved with developmental alterations such as conversion of flowers to leafy structures (phyllody) and other peculiar developmental alterations. (sumanlp2001@yahoo.com)



SELECTED PUBLICATIONS

Singh, V. Kumar, S., Bharat Reddy, N.S., Naik, M.K., Bhat, K.V. and Lakhanpaul, S. (2016). Devastation of sesame (*Sesamum indicum* L.) crops in different agroclimatic zones of India by genetically diverse subgroups of phytoplasma. *Crop Protection* 86: 24-30.

Chakraborty, A., Mitra, J., Bhattacharyya, J., Sikdar, N., Chakraborty S., Kumar S., Lakhanpaul, S. and Sen, S.K. (2015). Transgenic expression of an unedited mitochondrial orfB gene product from wild abortive (WA) cytoplasm of rice (*Oryza sativa* L.) generates male sterility in fertile rice lines. *Planta* 241: 1463-1479.

Vashishtha, A., Sharma, K.K. and Lakhanpaul, S. (2011). Co-existence, phylogeny and putative role of *Wolabchia* and yeast like Symbiont (YLS) in *Kerria lacca*. *Current Microbiology* 63: 206-212.

Kumar S., Singh, V. and Lakhanpaul, S. (2011). Molecular evaluation and phylogeny of a phytoplasma associated with bunchy top disease in its new host Okra (*Abelmoschus esculentus*) in India reveals an evolving lineage within the 16SrI group. *European Journal of Plant Pathology*, DOI 10.1007/s10658-011-9910-3.

Lakhanpaul, S., Chadha, S. and Bhat, K.V. (2000). Random Amplified Polymorphic DNA (RAPD) analysis in Indian mungbean [*Vigna radiata* (L.) Wilczek] cultivars. *Genetica* 109: 227-234.

Research Guidance: Ph.D. 9; M.Phil 8

Publications : 45

Renu Deswal, Ph.D.
Professor



Nitric oxide and cold stress signaling
Functional Genomics
Nanobiotechnology

National Award by Seabuckthorn Association of India, 2015.



Our research group is dissecting nitric oxide (NO) and cold stress signaling in Brassica (Indian mustard) and seabuckthorn (a Himalayan shrub). Mostly proteomics tools are being employed for this analysis. Redox proteomics is another area of interest. Nitrosylation, a NO based post translational modification is also being analysed to understand its contribution to cold stress. A major contribution of our group was to show nitrosylation of RuBisCo leading to its inhibition by cold stress. Recently, green synthesis of gold and silver nano particles was done to utilize these for various biotechnological applications (waste water purification, antimicrobial and anticancer agent). (deswal@hotmail.com)

SELECTED PUBLICATIONS

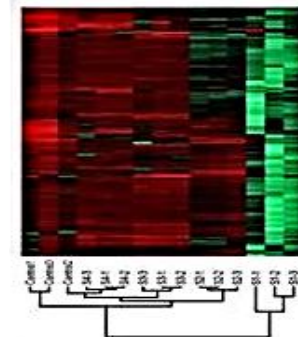
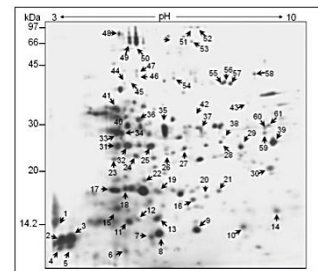
Sharma B. and Deswal, R. (2018). Single pot synthesised gold nanoparticles using *Hippophae rhamnoides* leaf and berry extract showed shape dependent differential nanobiotechnological applications. *Artificial Cells, Nanomedicine, and Biotechnology* 10.1080/21691401.2018.1458034

Sharma, S., Sehrawat, A. and Deswal, R. (2016). Asada-Halliwell pathway maintains redox status in *Dioscorea alata* tuber which helps in germination. *Plant Science* 250: 20-29.

Kashyap, P., Sehrawat, A. and Deswal, R. (2015). Nitric oxide modulates *Lycopersicon esculentum* C-repeat binding factor 1 (LeCBF1) transcriptionally as well as post-translationally by nitrosylation. *Plant Physiology and Biochemistry* 96: 115-123.

Sehrawat, A., Abat, J.K. and Deswal, R. (2013). RuBisCO depletion improved proteome coverage of cold responsive S-nitrosylated targets in Brassica juncea. *Frontiers in Plant Science* 4: 342.

Gupta, R. and Deswal, R. (2012). Low temperature modulated secretome analysis and purification of antifreeze protein from *Hippophae rhamnoides*-a Himalayan wonder plant. *Journal of Proteome Research* 1: 2684-96.



Research Guidance: Ph.D. 10; M.Phil. 16

Publications: 78



Rajesh Tandon, Ph.D.
Professor

Conservation Biology
Developmental Biology

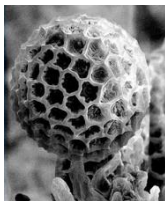
Reproductive Biology of Flowering plants



Dr. Y.S. Murthy Young Scientist Award (2008)

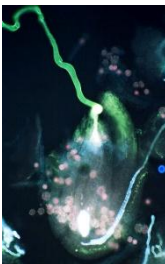
My research interests are reproductive biological studies and conservation of flowering plants. The main aspects of studies include phenological patterns, floral biology, pollen-pistil interaction and pollination ecology. Detailed studies on the reproductive biology of many tree species of commercial importance such as *Acacia senegal*, *Butea monosperma*, *Crateva adansonii*, *Oroxylum indicum*, *Azadirachta indica*, *Aegle marmelos*, *Anogeissus sericea*, *Tecomella undulata*, *Salvadora oleoides*, and *Wrightia tomentosa* have shown that most of them are self-incompatible and interact with pollinators ranging from specialists to generalists. Our recent studies on *Hippophae rhamnoides*, has shown the species to be subdioecious and can be used as an excellent model system to investigate evolution of dioecy. In *Elaeis guineensis*, pollen grains can be suitably conserved under cryo-preserved conditions for over prolonged duration and can be effectively used for assisted pollination. Major pollination systems in various plant species have established the role of bees, birds, bats, moths, flies, and snails. Developmental studies on post-fertilization events in Podostemaceae have given plausible explanation for the absence of double fertilization. (tandon.raj@gmail.com)

SELECTED PUBLICATIONS



Tandon, R., Shivanna, K.R. and Mohan Ram, H.Y. (2003). Reproductive Biology of *Butea monosperma* (Fabaceae). *Annals of Botany* 92 (11): 715-723

Tandon, R., Shivanna, K.R. and Mohan Ram, H.Y. (2001). Pollination biology and breeding system of *Acacia senegal*. *Botanical Journal of the Linnean Society* 135 (3): 251-262.



Vikas, Gautam, M., Tandon, R. and Mohan Ram, H.Y. (2009). Pollination biology and breeding system of *Oroxylum indicum* in Western Himalaya. *Journal of Tropical Ecology*. 25: 93-96

Singh, V.K., Barman, C. and Tandon, R. (2014). Nectar robbing positively Influences the reproductive success of *Tecomella undulata* (Bignoniaceae). *PLoS ONE* 9(7): e102607. doi:10.1371/journal.pone.0102607

Khanduri, P., Tandon, R., Uniyal, P.L., Bhat, V., Pandey, A.K. (2015). Comparative morphology and molecular systematics of Indian Podostemaceae. *Plant Systematics and Evolution* 301: 861-882

Research Guidance: Ph.D. 10; M.Phil. 5

Publications : 50



Biosystematics and Ecology of Bryophytes

Developmental Biology and Reproduction

Conservation Biology of Ferns and Gymnosperms



I have been working on taxonomy, cytology and ecology of bryophytes to understanding their diversification and evolution. Conservation strategy of some of the endangered species has been formulated. Heavy metal accumulation and pollution monitoring studies are being made. Morphological variations in the populations have been assessed and three new species of *Ephedra* are identified. The ecological requirements for establishment of *Taxus wallichiana* have been established and its population enhancement being done through micro- and macro-propagation and reintroduction of plantlets in natural habitat. The developmental biology of Podostemaceae has been traced and seed morphology, germination and origin of thallus, root-shoot morphology, pollination and flowering have been investigated. Species recovery efforts have been made for threatened medicinal plants such as *Lilium polyphyllum*, *Skimmia laureola*, *Malaxis acuminata*, *Pittosporum eriocarpum* and *Ephedra gerardiana*. (uniyalpl@rediffmail.com)

SELECTED PUBLICATIONS

Thakur, J., Dwivedi, M.D., Sourabh, P., Uniyal, P.L., Pandey, A.K. (2016). Genetic Homogeneity Revealed Using SCoT, ISSR and RAPD Markers in Micropropagated *Pittosporum eriocarpum* Royle- An Endemic and Endangered Medicinal Plant. PLOS ONE, DOI:10.1371/Journal.one.0159050

Bahuguna, Y.M., Sanavar, Gairola, S., Semwal, D.P. and Uniyal, P.L. (2014). Species diversity and composition of bryophytic vegetation in Garhwal Himalaya with special reference to Kedarnath wildlife sanctuary (KWLS), Uttarakhand, India. International Journal of Ecology and Environmental Sciences 40:75-85.

Sood, S., Kalra, C., Pabbi, S. and Uniyal, P.L. (2012). Differential responses of hydrogen peroxide, lipid peroxidation and antioxidant enzymes in *Azolla microphylla* exposed to paraquat and nitric oxide. Biologia 67: 1119-1128.

Goel, M., Dureja, P., Rani, A., Uniyal, P.L. and Laatsch, H. (2011). Isolation, characterization and antifungal activity of major constituents of the Himalayan lichen *Parmelia reticulata* Tayl. Agricultural and Food Chemistry 59: 2299-2307

Gupta, A., Thakur, S.S., Uniyal, P.L. and Gupta, R. (2001). A survey of bryophytes for presence of cholinesterase activity. American Journal of Botany 88:2133-2135.



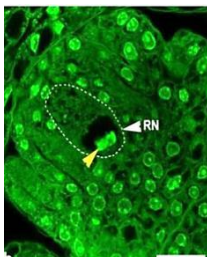
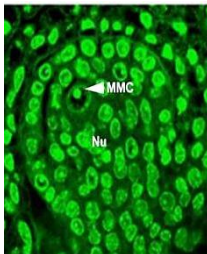
Developmental Biology

Molecular basis of Apomixis

Reproductive Biology of Flowering Plants



Our laboratory focuses on understanding the molecular and genetic mechanisms of apomixis in *Cenchrus ciliaris*. Apomixis is an asexual mode of reproduction through seeds and it occurs in many angiosperm families. Using apomixis, it is possible to fix heterosis in crop plants. *Cenchrus ciliaris* predominantly reproduces through apomixis and using a rare sexual plant, segregating generations were raised and apomixis locus is mapped using AFLP, retrotransposon, intron and microsatellite markers. Several putative candidate genes are being studied using in situ hybridization technique and a Receptor-like kinase has been found exclusively expressing in the ovules of apomictic plants. A *NUCELLIN* gene promoter isolated from *Hordeum vulgare* has shown ovule-specific expression in *Arabidopsis thaliana*. (bhatv64@rediffmail.com)



SELECTED PUBLICATIONS

Sharma, R., Geeta, R. and Bhat, V. (2014). Asynchronous male/female gametophyte development in facultative apomictic plants of *Cenchrus ciliaris* (Poaceae) *South African Journal of Botany* 91: 19-31.

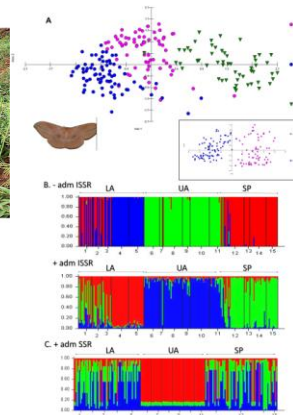
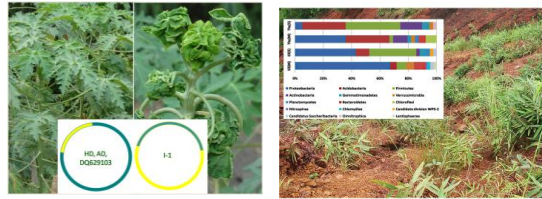
Yadav, C.B., Anuj, Kumar, S., Gupta, M.G. and Bhat, V. (2012). Genetic linkage maps of the chromosomal regions associated with apomictic and sexual modes of reproduction in *Cenchrus ciliaris*. *Molecular Breeding*,30: 239-250.

Jha, P., Shashi, Rustagi, A., Agnihotri, P.K., Kulkarni, V.M. and Bhat, V. (2011). Efficient *Agrobacterium*-mediated transformation of *Pennisetum glaucum* (L.) R. Br. using shoot apices as explant source. *Plant Cell, Tissue and Organ Culture*,107: 501-512.

Dwivedi, K.K., Bhat, S.R., Bhat, V., Bhat, B.V. and Gupta, M.G. (2007). Identification of a SCAR marker linked to apomixis in buffelgrass (*Cenchrus ciliaris* L.). *Plant Science*,172: 788-795.

Bhat, V., Dalton, S.J., Kumar, S., Bhat, B.V., Gupta, M.G. and Morris, P. (2001). Particle-inflow-gun-mediated genetic transformation of buffel grass (*Cenchrus ciliaris* L.): Optimizing biological and physical parameters. *Journal of Applied Genetics* 42: 405-412.

Sudeshna Mazumdar-Leighton, *Ph.D.*
Professor



Plant-Biotic Interactions
Sustainable Plant Biotechnology

Distinguished Alumna Award 2017 from Miranda House

We are interested in the biotic milieu of plants and mechanisms that shape outcomes of interactions relevant to the endeavor and enterprise of Man. Research from our group produced a first report on the molecular biology of digestive adaptations to host plant choice in *Antheraea assamensis* (the iconic 'Muga' silkworm) reared in North-east India for cocoon silk. Cryptic polymorphism produced by transposable elements makes a strong case for *in situ* conservation of wild 'Muga' populations and their host trees (www.mugadbase.com). Similar investigations into Cabbage white butterflies, recurrent pests of cultivated crucifers are underway. Inspired by research on transgenic virus-resistant papaya from NYSAES, Cornell University, USA, we have been tracking the emergence of begomoviruses in feral papaya from North India. A first report is available on expanding host range and emergence of novel recombinants, with implications for production virus-resistant papaya. Ongoing research also focuses on rhizospheric microbes that restore plant productivity in mined-out areas in Central India. My students and I use field data with biochemical, molecular, and bioinformatic tools to address research questions relating to digestive physiology and nutrition in herbivores; population genetics; plant virus epidemiology and rhizospheric metagenomics of our myriad experimental systems. (smceres21@yahoo.co.in, smazumdar@botany.du.ac.in)

SELECTED PUBLICATIONS

Singh-Pant, P., Pant, P., Mukherjee, S.K. and Mazumdar-Leighton, S. (2012). Spatial and temporal diversity of begomovirus complexes in papayas with leaf curl disease. *Archives of Virology* 157: 1217-1232.

Saikia, M., Singh, Y.T., Bhattacharya, A. and Mazumdar-Leighton, S. (2011). Expression of diverse midgut serine proteinases in the sericigenous Lepidoptera *Antheraea assamensis* (Helfer) is influenced by choice of host plant species. *Insect Molecular Biology* 20:1-13. Online September 2010. *Selected by Journal for Open Access in Virtual Issue XXIV International Congress of Entomology 2012 and cited as a "sample... demonstrating the strength and scope of researchemanating from Asia"*.

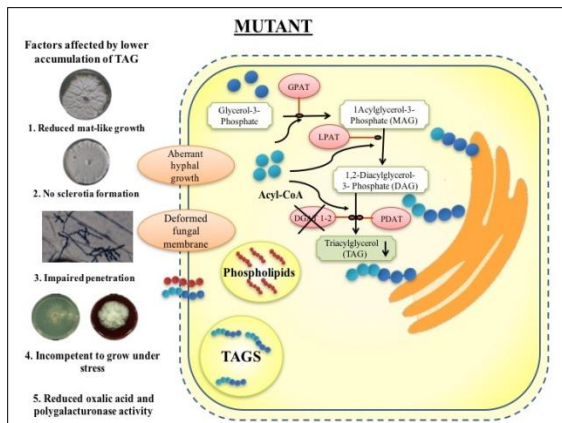
Shah, D.A., Dillard, H.R., Mazumdar-Leighton, S., Gonsalves, D. and Nault, B. (2006). Incidence, Spatial patterns, and Associations among Viruses in Snap Bean and Alfalfa in New York. *Plant Disease* 90: 203-210.

Mazumdar-Leighton, S. and Broadway, R.M. (2001). Transcriptional induction of diverse midgut trypsins from larval *Helicoverpa zea* (corn earworm) and *Agrotis ipsilon* (black cutworm) feeding on the soybean trypsin inhibitor. *Insect Biochemistry and Molecular Biology* 31: 645-657.

Mazumdar-Leighton, S., Babu, C.R. and Bennett, J. (2000). Identification of novel serine proteinase gene transcripts in the midguts of two tropical insect pests, *Scirpophaga incertulas* (Wk.) and *Helicoverpa armigera* (Hb.). *Insect Biochemistry and Molecular Biology* 30: 57-68.

Research Guidance: Ph.D. 8; ongoing 5; M.Phil. 3

Publications : 21



Rupam Kapoor, Ph.D.
Professor



Plant Pathology
Stress Physiology

Plant-Fungus Interactions

Fellow, Mycological Society of India, 2015

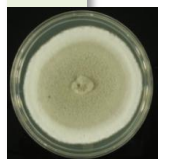
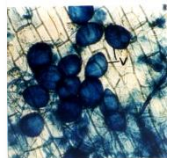
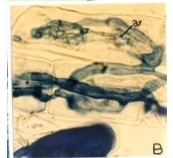
Y. S. Murty Medal - 2010 for Young Scientist by Indian Botanical Society, India

DST-BOYSCAST Fellow. 2008-09

My broad area of research is plant-fungus interactions (both symbiotic and pathogenic)

- We are interested in elucidating various physiological and molecular mechanisms by which arbuscular mycorrhizal fungi (AMF) enhance the concentration of medicinally valuable terpenoids in plants. We are also working on evaluating the role of AMF in amelioration of abiotic stress (salt and arsenic) in plants.
- We are also interested in characterising the genetic and pathogenic variability in two important pathogens of safflower i.e. *Fusarium oxysporium* f.sp. *carthami* and *Alternaria carthami*.
- We have generated T-DNA mutant library using *Agrobacterium tumefaciens*-mediated transformation in *Botrytis cinerea* and have identified some mutants that exhibit attenuated virulence. We wish to discover novel genes that mediate pathogenesis in *B. cinerea*.
- We are investigating effects of climate change (enhanced carbon dioxide) on plant-pathogen interactions.

(kapoor_rupam@yahoo.com)



SELECTED PUBLICATIONS

Sharma, E., Tayal, P., Anand, G., Mathur, P. and Kapoor, R. (2018). Functional analysis of diacylglycerol O-acyl transferase 2 gene to decipher its role in virulence of *Botrytis cinerea*. *Current Genetics* 64: 443-457.

Sharma, S., Anand, G., Singh, N. and Kapoor, R. (2017). Arbuscular mycorrhiza augments arsenic tolerance in wheat (*Triticum aestivum* L.) by strengthening antioxidant defense system and thiol metabolism. *Frontiers in Plant Science* 8: 906.

Sharma, E., Anand, G. and Kapoor, R. (2017). Terpenoids in plant and arbuscular mycorrhiza-reinforced defence against herbivorous insects. *Annals of Botany* 119: 791-801.

Mathur, P., Singh, V. P. and Kapoor, R. (2017). Interactive effects of CO₂ concentrations and *Alternaria brassicae* (Berk.) Sacc. infection on defense signalling in *Brassica juncea* (L.) Czern. & Coss. *European Journal of Plant Pathology*. DOI : 10.1007/s10658-017-1382-7

Mandal, S., Upadhyay, S., Wajid, S., Ram, M., Jain, D. C., Singh, V. P. and Kapoor, R. (2015). Arbuscular mycorrhiza increase artemisinin accumulation in *Artemisia annua* by higher expression of key biosynthesis genes via enhanced jasmonic acid levels. *Mycorrhiza* 25: 345-357.



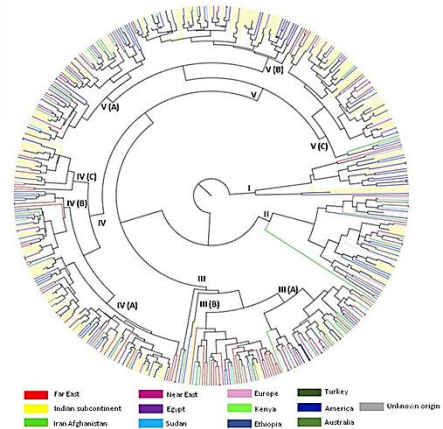
Research Guidance: Ph.D. 8; M.Phil. 8

Publications: 44

Shailendra Goel, Ph.D.
Professor



Plant Developmental Biology
Plant Genetics and Genomics
Crop improvement



I am a geneticist by training and employ genomic tools for crop improvement. I work on different genus including *Pennisetum* (contains Pearl Millet), *Carthamus* (contains Safflower) and *Hippophae* (contains Lebberry). I use *Pennisetum* as the model system to study underlying mechanism of apomixis. Presently I am investigating the role of smRNA in regulation of apomixis using Next Generation Sequencing. Our work on *Carthamus* has led to generation of genomic resources for safflower and identified a core collection based on genetic characterization and agronomical traits of a large set of germplasm. We are using *Hippophae rhamnoides* as a model system to explore the evolution of sex in this plant. We have identified male-specific loci that exhibit accumulation of repeat sequences and transposons, suggesting onset of sequence degeneration. Interestingly, there is significant similarity between X and Y-chromosomes, permitting recombination in polygamomonoecious plants. (shailendragoel@yahoo.com)

SELECTED PUBLICATIONS

Mangla, Y., Das, K., Bali, S., Ambreen, H., Raina, S.N., Tandon, R. and Goel, S. (2018). Occurrence of polygamomonoecious individuals and scarcity of gender-specific markers in Himalayan seabuckthorn (*Hippophae rhamnoides* ssp. *turkestanica*) reveal an ongoing transition to dioecy. *Heredity* (Accepted).

Ambreen, H., Kumar, S., Kumar, A., Agarwal, M., Jagannath, A. And Goel, S. (2018). Association mapping for important agronomic traits in safflower (*Carthamus tinctorius* L.) core collection using microsatellite markers. *Frontiers in Plant Sciences* doi.org/10.3389/fpls.2018.00402.

Kumar, S., Ambreen, H., Variath, M.T., Rao, A.R., Agarwal, M., Kumar, A., Goel, S. And Jagannath, A. (2016). Utilization of molecular, phenotypic, and geographical diversity to develop compact composite core collection in the oilseed crop, safflower (*Carthamus tinctorius* L.) through maximization strategy. *Frontiers in Plant Sciences* 7: 1.

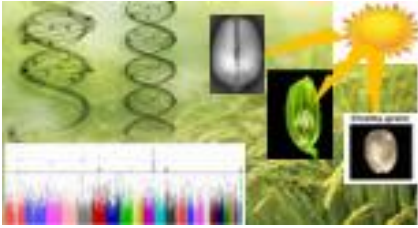
Goel, S., Akiyama, Y., Conner, J.A., Hanna, W.W., Yamada-Akiyama, H. And Ozias-Akins, P. (2011). Evolution of the apomixis transmitting chromosome in *Pennisetum*. *BMC Evolutionary Biology* 11: 289.

Singh, M., Goel, S., Meeley, R.B., Dantec, C., Parrinello, H., Michaud, C., Leblanc, O. And Grimanelli, D. (2011). Production of viable gametes without meiosis in maize deficient for an ARGONAUTE protein. *The Plant Cell*. 23: 443-458.

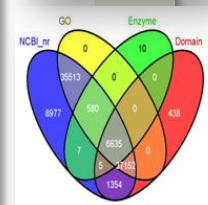
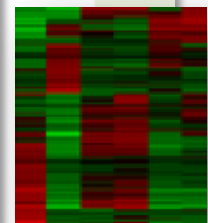
Research Guidance: Ph.D. 6; M.Phil. 1

Publications: 40

Manu Agrawal, Ph.D.
Professor



Genetics and genomics
Abiotic stresses in plants
Biotic stresses in plants



The work in my laboratory revolves around two major themes:

1. Understanding the basis of high temperature tolerance and utilize the findings as inputs for mitigating effects of terminal heat stress in plants.
2. Deciphering the molecular basis of wilting caused by the fungal pathogen *Fusarium* in the oil seed crop Safflower.

For finding the critical determinants of high temperature tolerance we use genomic approaches and genetic screens in model plants like *Arabidopsis* and Rice. In future we would like to use GWAS for identifying the allelic variants contributing to two important traits i.e., spikelet fertility and grain chalkiness that are affected by high temperature in rice plants.

We have developed a hydroponics based screening method to phenotype Safflower germplasm infected with *Fusarium oxysporum carthamii* (Foc) and identified germplasm that showed contrasting phenotypes. These germplasms were utilized to understand the genome wide transcriptional changes and metabolite differences. We are also developing bi-parental mapping populations to map the locus responsible for providing resistance to Safflower against Foc. (agarwalm71@gmail.com)

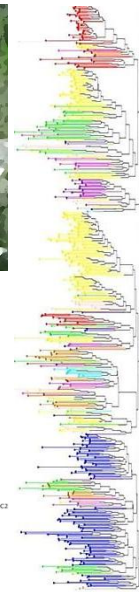
SELECTED PUBLICATIONS

- Bhardwaj, A.R., Joshi, G., Kukreja, B., Malik, V., Arora, P., Pandey, P., Shukla, R.N., Bankar, K.G., Katiyar-Agarwal, S., Goel, S., Jagannath, A., Kumar, A. and Agarwal, M. (2015). Global insights into high temperature and drought stress regulated genes by RNA-Seq in the economically important oilseed crop, *Brassica juncea*. *BMC Plant Biology*. 15:9;
- Sinha, S., Raxwal, V.K., Joshi, B., Jagannath, A., Katiyar-Agarwal, S., Goel, S., Kumar, A. and Agarwal, M. (2015). De novo transcriptome profiling of cold-stressed siliques during pod filling stages of Indian mustard (*Brassica juncea* L.). *Frontiers in Plant Sciences* 6: 932.
- Bhardwaj, A.R., Joshi, G., Pandey, R., Kukreja, B., Goel, S., Jagannath, A., Kumar, A., Katiyar-Agarwal, S. and Agarwal, M. (2014). A genome-wide perspective of miRNAome in response to high temperature, salinity and drought stresses in *Brassica juncea* (Czern) L. *PLoS-ONE* DOI: 10.1371/journal.pone.0092456.
- Agarwal, M., Hao, Y., Kapoor, A., Dong, C.H., Fujii, H., Zheng, X., Zhu, J.K. (2006). A R2R3 type MYB transcription factor is involved in the cold regulation of CBF genes and in acquired freezing tolerance. *J Biol Chem*: 281:37636-37645.
- Kapoor, A., Agarwal, M., Andreucci, A., Zheng, X., Gong, Z., Hasegawa, P.M., Bressan, R.A. and Zhu, J.K. (2005). Mutations in a conserved replication protein suppress transcriptional gene silencing in a DNA-methylation-independent manner in *Arabidopsis*. *Curr Biol*. 15: 1912-1918.

Research Guidance: Ph.D. 4

Publications : 40

Arun Jagannath, Ph.D.
Professor



Transgenics for crop improvement

Crop genetics and genomics

Genes influencing agronomic traits

Aphid biology and genomics

Our laboratory uses a combination of genetic, genomic and transgenic technologies to study the molecular basis of important agronomic traits in two different oilseed crops, *Brassica juncea* (Indian mustard) and *Carthamus tinctorius* (Safflower). In mustard, we work on identification and validation of genes influencing seed size and oil content and development of transgenics using lectin genes and RNAi for resistance to mustard aphid (*Lipaphis erysimi*). Our initial work on safflower focused on analysis of genetic diversity and population structure of the crop, development of core collections and association mapping. Current thrust areas include development of molecular markers, generation of mapping populations, construction of linkage maps and mapping traits of agronomic value, and genetic transformation for crop improvement. (jagannatharun@yahoo.co.in)

SELECTED PUBLICATIONS

Ambreen, H., Kumar, S., Kumar, A., Agarwal, M., Jagannath, A. and Goel, S. (2018). Association mapping for important agronomic traits in safflower (*Carthamus tinctorius* L.) core collection using microsatellite markers. *Frontiers in Plant Science* (In Press/Accepted)

Kumar, S., Ambreen, H., Murali, T.V., Rao, A.R., Agarwal, M., Kumar, A., Goel, S. and Jagannath, A. (2016). Utilization of molecular, phenotypic and geographical diversity to develop compact composite core collection in the oilseed crop, Safflower (*Carthamus tinctorius* L.) through maximization strategy. *Frontiers in Plant Science* 7:1554. doi: 10.3389/fpls.2016.01554.

Patial, V., Krishna, R., Arya, G., Singh, V.K., Agarwal, M., Goel, S., Jagannath, A. and Kumar, A. (2016). Development of an efficient, genotype independent plant regeneration and transformation protocol using cotyledonary nodes in safflower (*Carthamus tinctorius* L.). *Journal of Plant Biochemistry and Biotechnology* DOI 10.1007/s13562-016-0354-x.

Ambreen, H., Kumar, S., Murali, T.V., Joshi, G., Bali, S., Agarwal, M., Kumar, A., Jagannath, A. and Goel, S. (2015). Development of genomic microsatellite markers in *Carthamus tinctorius* L. (safflower) using next generation sequencing and assessment of their cross-species transferability and utility for diversity analysis. *PLoS-ONE* DOI:10.1371/journal.pone.0135443.

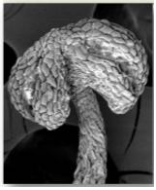
Kumar, S., Ambreen, H., Murali, T.V., Bali, S., Agarwal, M., Kumar, A., Goel, S. and Jagannath, A. (2014). Assessment of genetic diversity and population structure in a global reference collection of 531 accessions of *Carthamus tinctorius* L. (safflower) using AFLP markers. *Plant Molecular Biology Reporter*. DOI: 10.1007/s11105-014-0828-8.

Research Guidance: Ph.D. 4; M.Phil. 1

Publications : 23

Patents: 7

Sandip Das, M.Phil., Ph.D.
Associate Professor

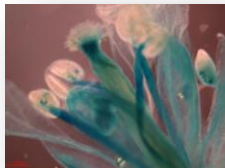


Molecular and Functional diversity
Impact of Polyploidy
Plant Development and Evolution
Genome organisation
Crop improvement



Our research interests are to understand the impact of polyploidisation on genome organisation, sequence and functional diversification, and genetic diversity. Our biological system of choice are species of *Brassica*, and members of Brassicaceae. We employ a range of computational, bioinformatics, and experimental strategies to investigate the role of several key regulatory elements such as miRNA genes, transcription factors, and associated cis-elements in modulating development (anther, gynoecium, leaf, cuticular waxes) and adaptation. We are also interested in identifying components of regulatory networks and understand their diversification and evolution. Some of our key findings include

- Extensive sequence, structural and functional diversification including sub-functionalization, and neo-functionalization exists in cis-elements, miRNA genes, and transcription factors and these are copy number dependent
- Functional analysis of candidate miRNA genes reveal their role in organ development and potential for crop improvement (sandipdas04@gmail.com; sdas@botany.du.ac.in)



SELECTED PUBLICATIONS

Jain, A., Anand, S., Singh, N.K. and Das, S. (2018). Sequence and Functional Characterization of MIRNA164 Promoters from *Brassica* Shows Copy Number Dependent Regulatory Diversification Among Homeologs. *Functional and Integrative Genomics* (DOI: 10.1007/s10142-018-0598-8)

Rathore, P., Geeta, R. and Das, S. (2016). Microsynteny and phylogenetic analysis of tandemly organized miRNA families across five members of Brassicaceae reveals complex retention and loss history. *Plant Science*. 247: 35-48

Deans, A.R., Das, S. and Mabee, P.M. (2015). Finding our way through phenotypes. *PLoS Biology* 13: e1002033.

Guo, Y-L., Todesco, M., Hagemann, J., Das, S. and Weigel, D. (2012). Independent FLC Mutations as Causes of Flowering-Time Variation in *Arabidopsis thaliana* and *Capsella rubella*. *Genetics* 192: 729-739.

Norman, W., Das, S., Lanz, C. and Weigel, D. (2008). Comparative analysis of miR319A locus in *Arabidopsis* and related Brassicaceae. *Molecular Biology and Evolution*. 25: 892-902

Research Guidance: Ph.D. 8; M.Phil. 6

Publications : 60

Ratul Baishya, Ph.D.
Assistant Professor



Carbon Sequestration
Climate Change Impact Assessment
Ecology and Biodiversity Conservation

My research group is focused on the ecology, climate change effects, soil nutrition, soil enzymes, carbon sequestration potential and biomass and carbon stock estimation in various terrestrial ecosystems of Central Himalaya and Semi-arid Delhi Ridge forests. Part of my research also involves use of Remote sensing and GIS technology for estimation of biomass and vegetation change and land use/land cover change over time. Focus is also on determining the role of Phosphate solubilizing bacteria in agricultural crops and its potential to act as biofertilizers. My research interest also involves studying the effect of salt stress and its amelioration using various types of biofertilizers in agricultural crops and medicinal plants. The effect of abiotic factors in driving the vital ecosystem process is also underway. My future research interest is on identifying the Phosphate solubilizing bacteria at the molecular level and its application in phosphate deficient agriculture system in India and a move towards conservative agriculture for environmental sustainability. (rbaishyadu@gmail.com)

SELECTED PUBLICATIONS

Saikia, R. and Baishya, R. (2018). Phosphate Solubilizing Bacteria in Certain Agricultural Crop Soils of Delhi. *International Journal of Plant and Environment* (in press; DOI: <https://doi.org/10.18811/ijpen.v4i01.11613>).

Baishya, R. and Barik, S.K. (2015). Ecosystem level carbon and net primary productivity of old-growth and regenerating humid tropical forest of North-Eastern India. *International Journal of Plant and Environment* 1: 85-98. DOI No. : 10.18811/ijpen.v1i1.7117

Baishya, R. and Barik, S.K. (2011). Estimation of tree biomass, carbon pool and net primary production of an old-growth *Pinus kesiya* Royle ex. Gordon forest in north-eastern India. *Annals of Forest Science*. 68: 727-736.

Thapa, N., Upadhaya, K., Baishya, R. and Barik, S.K. (2011). Effect of Plantation on Plant Diversity and Soil Status of Tropical Forest Ecosystems in Meghalaya, Northeast India. *International Journal of Ecology and Environmental Sciences* 37: 61-73.

Baishya, R., Barik, S.K. and Upadhaya, K. (2009). Distribution pattern of aboveground biomass in natural and plantation forests of humid tropics in northeast India. *Tropical Ecology* 50: 295-304.



Research Guidance: Ph.D. 4 (Ongoing); M.Phil. 2

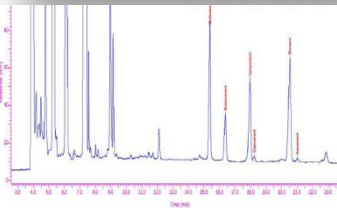
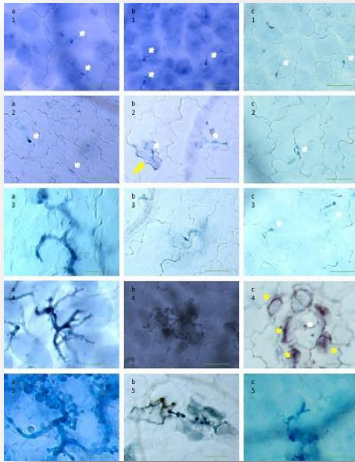
Publications : 12

Priya Panjabi-Massand, Ph.D.
Assistant Professor

Plant Genetics and Genomics
Plant-Pathogen interactions



INSA Young Scientist Award in the year 2007
University Gold Medal, M.Sc. (Genetics)



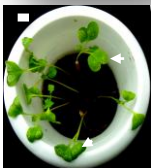
The major thrust areas of our group include: genetic mapping and characterization of (1) genes conferring white rust resistance in *Brassica rapa* and (2) genes involved in phytosterol biosynthesis in *B. juncea*. White rust (caused by *Albugo candida*) is a major disease of Brassica crops while, phytosterols are secondary metabolites that help in reducing blood cholesterol levels and possess anticancerous and antioxidation properties. The laboratory focuses on development of molecular markers (Intron Polymorphism based and SSRs) and generation of mapping populations for construction of linkage maps that are being utilized for identification of loci involved in the two traits. Comparative genomic approaches would be used for identification of candidate genes that can be validated through expression studies and transgenic technology. (ppriyagen@yahoo.com)

SELECTED PUBLICATIONS



Yadava, S.K., Kumar, P., Panjabi-Massand, P., Gupta, V., Chandra, A., Sodhi, Y. S., Pradhan, A. K. and Pental, D. (2014). Tetralocular ovary and high silique width in yellow sarson lines of *Brassica rapa* (subspecies *trilocularis*) are due to a mutation in Bra034340 gene, a homologue of *CLAVATA3* in *Arabidopsis*. *Theoretical and Applied Genetics* 127: 2359-2369.

Kumar, P., Yadava, S.K., Gupta, V., Panjabi-Massand, P., Sodhi, Y.S., Pradhan, A.K. and Pental, D. (2013). RNA-seq based SNPs in some agronomically important oleiferous lines of *Brassica rapa* and their use for genome-wide linkage mapping and specific-region fine mapping *BMC Genomics* 14: 463



Panjabi-Massand, P., Yadava, S.K., Sharma, P., Kaur, A., Kumar, A., Arumugam, N., Sodhi, Y.S., Mukhopadhyay, A., Gupta, V., Pradhan, A.K. and Pental, D. (2010). Molecular mapping reveals two independent loci conferring resistance to *Albugo candida* in the east European germplasm of oilseed mustard *Brassica juncea*. *Theoretical and Applied Genetics* 121: 137-45

Panjabi, P., Jagannath, A., Bisht, N.C., Padmaa, K.L., Sharma, S., Gupta, V., Pradhan, A.K. and Pental, D. (2008). Comparative mapping of *Brassica juncea* and *Arabidopsis thaliana* using Intron Polymorphism (IP) markers: homeologous relationships, diversification and evolution of the A, B and C Brassica genomes. *BMC Genomics* 9: 113

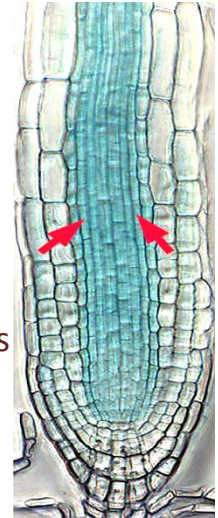
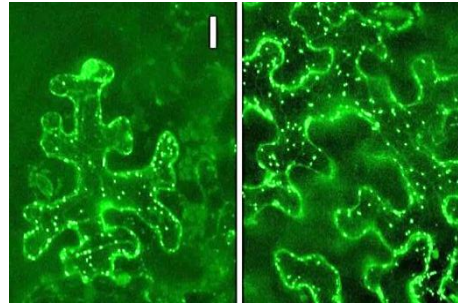
Research Guidance: Ph.D. 3 ongoing; M.Phil. 1

Publications : 5

Yashwanti Mudgil, Ph.D.
Assistant Professor



Cell signaling networks and adaptive responses
Hormonal Regulation of plant growth and development



DBT-CREST Award (2012)

My overall research interests are in studying signal transduction networks in plant cells. Currently I am working on the heterotrimeric G-protein beta gamma ($G\beta\gamma$) subunit mediated signaling pathways. This requires a better understanding of the signals coupled by the heterotrimeric G-protein complex and its downstream components. My specific interest include $G\beta\gamma$ downstream protein effectors I had identified NDL proteins as cognate $G\beta\gamma$ downstream effectors playing important role in auxin mediated root growth and development by modulating root auxin transport and auxin gradients in part by affecting the levels of auxin transport facilitators. I had been part of the G protein interactome initiative and discovered NDL interactome and now working on the NDL interacting partners to further dissect out the complete molecular mechanism involved in the AGB1-NDL1 mediated processes. (ymudgil@gmail.com)

SELECTED PUBLICATIONS

Khatri, N., Singh, S., Hakim, N. and Mudgil, Y. (2017). Comparative expression profiling of AtRAD5B and AtNDL1: Hints towards a role in G protein mediated signaling. *Gene Expression Patterns* 25-26: 167-174.

Mudgil, Y., Karve, A., Teixeira, P.J., Jiang, K., Tunc-Ozdemir, M. and Jones, A.M. (2016). Photosynthate Regulation of the Root System Architecture Mediated by the Heterotrimeric G Protein Complex in Arabidopsis. *Front Plant Sci.* 7:1255. doi: 10.3389/fpls.2016.01255.

Mudgil, Y., Ghawana, S. and Jones, A.M. (2013). N-MYC DOWN-REGULATED-LIKE Proteins Regulate Meristem Initiation by Modulating Auxin Transport and MAX2 Expression. *PLoS ONE*, 8: e7863/ doi: 10.1371/journal.pone.0078633

Klopfleisch, K., Phan, N., Augustin, K., Bayne, R.S., Booker, K.S., Botella, J.R., Carpita, N.C., Carr, T., Chen, J.G., Cooke, T.R., Frick-Cheng, A., Friedman, E.J., Fulk, B., Hahn, M.G., Jiang, K., Jorda, L., Kruppe, L., Liu, C., Lorek, J., McCann, M.C., Molina, A., Moriyama, E.N., Mukhtar, M.S., Mudgil, Y., Pattathil, S., Schwarz, J., Seta, S., Tan, M., Temp, U., Trusov, Y., Urano, D., Welter, B., Yang, J., Panstruga, R., Uhrig, J.F. and Jones, A.M. (2011). Arabidopsis G-protein interactome reveals connections to cell wall carbohydrates and morphogenesis. *Molecular systems Biology*, 7:532. doi: 10.1038/msb.2011.66.

Mudgil, Y., Uhrig, J., Zhou, J., Temple, B. and Jones, A.M. (2009). Arabidopsis N-MYC DOWN-REGULATED-LIKE1, a Novel Sugar Regulated Downstream Effector of $G\beta\gamma$ -Mediated Auxin Transport in the Root. *Plant Cell* 21: 3591-609.



Research Guidance: Ph.D. 1, M.Phil. 1

Publications : 23



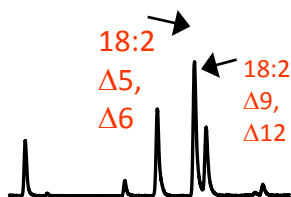
Girish Mishra, Ph.D.
Assistant Professor

Plant Lipid Biochemistry
Metabolic engineering



DBT-Ramalingaswami Fellow (2009)

Our research group works towards understanding the multifaceted roles of plant lipids. Major effort is made to understand biosynthesis of unusual plant lipids such as Laballenic acid from Lamiacea members and Isoricinoleic acid from *Wrightia* spp. We have identified various lipid modifying genes from these and are currently working to elucidate the biosynthetic pathway. On the other hand we are working on enhancing the quantity and quality of oil in microalgae either by use of elicitors or through genetic mutations. Besides these, research is ongoing to elucidate the role of Phosphatidic acid, an important lipid molecule involved in signaling. We have identified a variety of PA binding proteins and are working on several involved in abiotic stress. (girishmishra@yahoo.com)



SELECTED PUBLICATIONS

Choudhary, A.K., Sunojkumar, P. and Mishra, G. (2017). Fatty acid profiling and multivariate analysis in the genus *Leucas* reveals its nutritional, pharmaceutical and chemotaxonomic significance. *Phytochemistry*. 143:72-80. doi: 10.1016/j.phytochem.

Cooper, H.L.R., Mishra, G., Huang, X., Pender-Cudlip, M., Austin, R.N., Shanklin, J. and Groves, J.T. (2012). Parallel and Competitive Pathways for Substrate Desaturation, Hydroxylation and Radical Rearrangement by the Non-heme Diiron Hydroxylase AlkB. *J. Am. Chem. Soc.* 134(50), 20365-20375.

Nguyen, H.T., Mishra, G., Whittle, E., Bevan, S.A., Merlo, A.O., Walsh, T.A. and Shanklin, J. (2010). Metabolic engineering of seeds can achieve Levels of ω -7 Fatty Acids Comparable with the Highest Levels found in natural plant sources *J. Plant Physiol.* 154(4):1897-904.

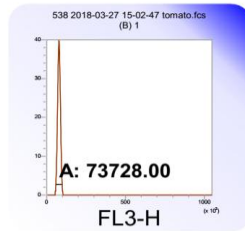
Shanklin, J., Guy, J.E., Mishra, G. and Lindqvist, Y. (2009). Desaturases: Emerging models for understanding functional diversification of diiron-containing enzymes. *J Biol Chem* 284: 18559-18563

Mishra, G., Zhang, W., Deng, F., Zhao, J. and Wang, X. (2006). A bifurcating pathway directs abscisic acid effects on stomatal closure and opening in *Arabidopsis*. *Science*. 312: 264-266

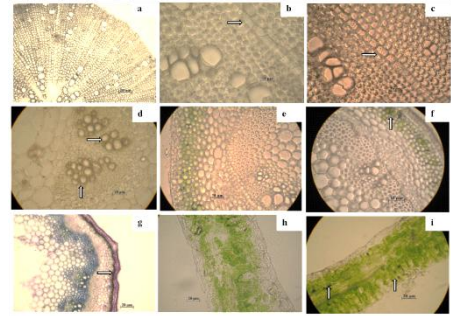
Research Guidance: Ph.D. 1, M.Phil. 3

Publications : 14

C.S. Seth, Ph.D.
Assistant Professor



X Parameter	Y Parameter	Gate	Region	Count	%Gated	X Median	X %CV
FL3-H	B	A		872	100.00	73728.00	3.80



Phytohormones and NO assisted abiotic stresses management
Photosynthesis and Nitrogen metabolism under abiotic stresses
Role of Nanoparticles under abiotic stresses in plants

Indian mustard (*Brassica juncea* L.), Sunflower (*Helianthus annuus* L.), Giant Duckweed (*Spirodela polyrrhiza* L.) and Coontail (*Ceratophyllum demersum* L.) have proven their potential in remediation of Cd, As and Pb from contaminated soil and/or water. Antioxidants and phytochelatins play a potential role in combating metal induced lipid peroxidation as well as improvement of tolerance and detoxification in *Brassica juncea* L. and *Ceratophyllum demersum* L. Cadmium induces genotoxicity in root meristem cells of *Allium cepa*: Cytogenetic and Comet assay approach. 24-Epibrassinolide and Sodium Nitroprusside alleviate the salinity in *Brassica juncea* L. cv. Varuna through cross talk among proline, nitrogen metabolism and abscisic acid. Salicylic acid counteracts lead aggravated oxidative damages in *Brassica juncea* (L.) Czern. cv. Varuna. (seth_bhu@yahoo.co.in)

SELECTED PUBLICATIONS

- Agnihotri, A., Gupta, P., Dwivedi, A. and Seth, C.S. (2018). Counteractive mechanism (s) of salicylic acid in response to lead toxicity In *Brassica juncea* (L.) Czern. cv. Varuna. *Planta* D.O.I. <https://doi.org/10.1007/s00425-018-2867-0>
- Gupta, P., Srivastava, S. and Seth, C.S. (2017). 24-Epibrassinolide and Sodium Nitroprusside alleviate the salinity stress in *Brassica juncea* L. cv. Varuna through cross talk among proline, nitrogen metabolism and abscisic acid. *Plant and Soil* 411: 483-498 DOI 10.1007/s11104-016-3043-6
- Agnihotri, A. and Seth, C.S. (2016). Exogenously applied nitrate improves the photosynthetic performance and Nitrogen metabolism in Tomato (*Solanum lycopersicum* L. cv Pusa Rohini) under Arsenic (V) toxicity. *Physiology and Molecular Biology of Plants* 2016; 22(3): 341-349
- Seth, C.S., Remans, T., Keunen, E., Jozefczak, M., Gielen, H., Opendakker, K., Weyens, N., Vangronsveld, J. and Cuypers, A. (2012). Phytoextraction of Toxic Metals: a Central Role for Glutathione. *Plant Cell and Environment* 35: 334-346.
- Seth, C.S., Misra, V., Singh, R.R. and Zolla, L. (2011). EDTA-enhanced lead phytoremediation in sunflower (*Helianthus annuus* L.) hydroponic culture. *Plant and Soil* 347: 231-242

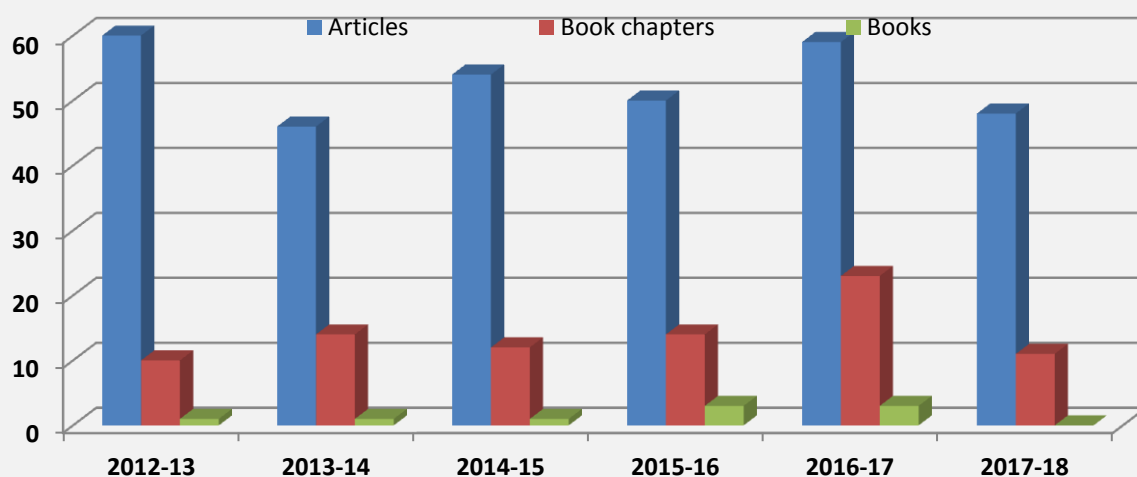
Research Guidance: Ph.D. 3 ongoing

Publications : 20

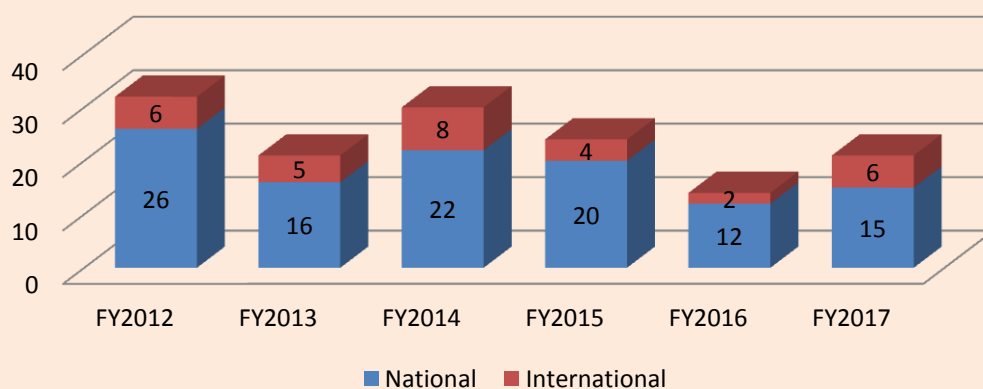
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Research support and output: summary (2012-13 TO 2017-18)

	Program	year	Grant
1	UGC-SAP	2011-2015	37 Lakhs
2	DST-FIST	2012-2016	150 Lakhs
3	EMR	2012-2017	1705 Lakhs



Collaborative publications



Impact Factor – range 0.2-13

Departmental h-index = 19

Average i10-index = 19.24

Patents Granted (national): One

Patents Granted (International): One Pending

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SIGNIFICANT RESEARCH CONTRIBUTIONS AND RECOGNITION

Patents published:

- Agrawal, Veena & Kumar, Y.: No. 1786/DEL/2010. "Novel herbal extract of *Psoralea corylifolia* possessing strong antitumorous activity against various human cancer cell lines and methods there of". Published and Request for examination filed. Publication Date: 17/02/2012,
- Agrawal, Veena & Kumar, Y.: No.1787/DEL/2010. "Novel herbal fraction of *Psoralea corylifolia* possessing strong anticancerous activity against various human cancer cell lines and methods thereof". Published and Request for examination filed. Publication Date: 23/08/2013,
- Agrawal, Veena & Sharma, G.: No. 3229/DEL/2012 Novel herbal extract of *Artemisia annua* possessing strong anticancerous activity against oral human cancer cell lines. Published request for examination filed.
- Agrawal, Veena: Sharma, G. & Kumar, K.. No. 566/DEL/2012 . "A novel herbal formulation for biocontrol of filarial(*Culex quinquefasciatus*) and Japanese encephalitis(*Culex tritaeniorhynchus*) vectors using leaf chloroform extract of *Artemisia annua* L. and method thereof, Published and application for examination filed.
- 2013. US patent application filed vide US Patent Application No:13/704,176.

Patent granted: Govt. of India No. 2 789 34, Dated: 4.01.2017 Entitled " A process for Extraction of psoralen Bioactive compound" inventor; Veena Agrwal

23 students have won awards for poster presentations in various international and national conferences in the last five years

Fellow, Alexander von Humboldt Foundation (Germany)	Prof. S.C. Bhatla
Fellow, National Academy of Sciences, India	Prof. S.C. Bhatla Prof. A.K. Pandey Prof. D.B. Sahoo
Fellow Linnean Society, UK	Prof. K.S. Rao Prof. V.P. Singh Prof. Veena Agrawal Prof. Shailendra Goel
Fellow, Andhra Pradesh Akademi of Sciences, India	Prof. K.S. Rao
YS Murty medal of the Indian Botanical Society	Prof. Rajesh Tandon Prof. Rupam Kapoor
Ramalingaswami fellow	Dr. Girish Mishra
INSA Young Scientist Award	Dr. Priya Panjabi-Massand

OTHER ACTIVITIES: SOCIETIES AND JOURNAL

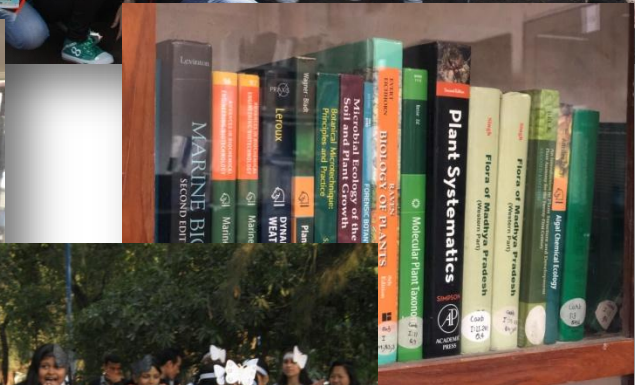
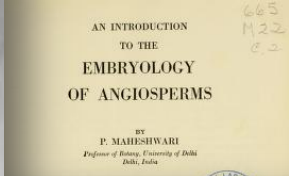
International Society of Plant Morphologists (ISPM)

The Society* was founded in 1951 to promote "International cooperation in the study of, and diffusion of useful knowledge in, the fields of Plant Morphology, Anatomy and Embryology". Past presidents include illuminaries of the field, such as P. Maheshwari, I. W. Bailey, B.M. Johri, A.S. Foster, V. Puri, J. Heslop-harrison and H. Y. Mohan Ram. Coverage of disciplines has now been expanded to plant sciences in general and interdisciplinary studies in particular. The office of the Society is located in the premises of the Department of Botany.

*Registered under the Societies Registration Act XXI of 1860 (Registration No. S/6/8 of 1953-1954, dated 28 April 1953)



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