

## Genetics and Molecular Biology Division

Group name: **Computational Biology**

Group works on:

- **Assembly annotation and analysis of Transcriptom and Genomes**
- **Regulatory Motifs search and analysis**
- **Identification and functional characterisation of SNPs**
- **Metabolic Pathways construction and analysis**
- **Tools development**

Objectives:

- **To filter out biologically relevant information from the Transcriptomic and genomic data being analysed.**
- **To develop new bioinformatics tools for the analysis of large scale sequencing data**

Achievements:

**up to 11th Five year Plan:**

- ✓ *Analysis of microarray and transcriptomic data of drought tolerant and resistant varieties of cotton.*
- ✓ *Analysis of the transcriptome of two germplasms of poppy and identification of genes involved in papaver biosynthesis pathway.*
- ✓ *Analysis of the transcriptomic data of Withania somnifera for the identification of genes involved in withanolide biosynthesis pathway.*
- ✓ *Analysis of transcriptomic data Azadirachta indica (Neem) for the identification of genes putatively involved in the Azadirachtin biosynthesis pathway.*
- ✓ *Complete assembly of the Chloroplast genome of Jatropha curcas.*
- ✓ *Development of DNA barcoding software OFR.*

**In 12th five year plan:**

- ✓ *Analysis of cotton HMPR libraries for diversity analysis and development of the Cotton Database ( <http://www.ncgd.nbri.res.in>)*
- ✓ *Analysis of two stages of banana fruit transcriptome to identify genes and pathways involved in banana fruit ripening.*

#### **Ongoing projects: NBRI In house projects:**

- ❖ **Genomics of Medicinal plants and Agronomically Important Traits (PlantGen)**
- ❖ **Root biology and its correlation to sustainable plant development and soil fertility (RootSF)**

#### **Outside agencies like DBT / DST / MOEF etc.:**

#### **Foreign Collaborations: None**

#### **Areas open for collaboration:**

#### **Transcriptome and genome analysis**

#### **Lab Publications:**

1. Chakrabarty D, Trivedi PK, Manju Shri, Misra P, **Asif MH**, Dubey S, Kumar S, Rai A, Tiwari M, Shukla D, Pandey A, Nigam D, Tuli R (**2009**) Differential transcriptional expression following thidiazuron induced shoot primordia developmental shift in rice. Plant Biology doi:10.1111/j.1438-8677.2009.00213.x
2. Amol Ranjan , Suraiya A. Ansari , Rakesh Srivastava , Shrikant Mantri , **Mehar H. Asif** , Samir V. Sawant , and Rakesh Tuli (**2009**).A T9G Mutation in the Prototype TATA-box TCACTATATATAG Determines Nucleosome Formation and Synergy with Upstream Activator Sequences in Plant Promoters. Plant Physiology,10.1104/pp.109.148064
3. Narendra Tuteja, Sarvajeet Singh, Prabodh Kumar Trivedi, **Mehar Hasan Asif**, Pravendra Nath (India) Plant Growth Regulators and their Role in Stress Tolerance in SPECIAL ISSUES: PLANT NUTRITION AND ABIOTIC STRESS TOLERANCE (Guest Editor: Naser A. Anjum (Aligarh Muslim University, India)) 2010 in press
4. Prashant Misra, Ashutosh Pandey, Manish Tiwari, K. Chandrashekar, Om Prakash Sidhu, **Mehar Hasan Asif**, Debasis Chakrabarty, Pradhyumna Kumar Singh, Prabodh Kumar Trivedi, Pravendra Nath, and Rakesh Tuli (**2010**). Modulation of transcriptome and metabolome of tobacco by Arabidopsis transcription factor, AtMyb12, leads to insect resistance.Plant Physiology 152(4):2258-68
5. **Mehar H. Asif**, Shrikant S. Mantri, Ayush Sharma, Anukool Srivastava, Ila Trivedi, Priya Gupta, Chandra S. Mohanty, Samir V. Sawant and Rakesh Tuli (**2010**). Complete sequence and organisation of the Jatropha curcas (Euphorbiaceae) chloroplast genome Tree Genetics and Genomes 10.1007/s11295-010-0303-0
6. Hemant Kumar Yadav, Alok Ranjan, **Mehar Hasan Asif**, Shrikant Mantri, Samir V. Sawant and Rakesh Tuli (**2010**) EST-derived SSR markers in Jatropha curcas L.:development, characterization, polymorphism,and transferability across the species/genera Tree Genetics and Genomes DOI 10.1007/s11295-010-0326-6
7. Sonali Dubey, Prashant Misra, Sanjay Dwivedi, Sandipan Chatterjee, **Sumit K Bag**, Shrikant Mantri, **Mehar H Asif**, Arti Rai, Smita Kumar, Manju Shri, Preeti Tripathi, Rudra D Tripathi, Prabodh K Trivedi\*, Debasis Chakrabarty\* and

Rakesh Tuli (2010) Transcriptomic and metabolomic shifts in rice roots in response to Cr (VI) stress. BMC Genomics 11:648 doi:10.1186/1471-2164-11-648

8. S. K. Raj, S. K. Snehi, M. S. Khan, **M. H. Asif, S. K. Bag**, R. K. Roy and A. K. Goel (2010) Molecular characterization of a new isolate of phytoplasma associated with malformation and twisting of floral spikes of *Gladiolus* in India. J Gen Plant Pathol 76:389–394 DOI 10.1007/s10327-010-0259-9
9. A. Tyagi, **S.K. Bag**, V. Shukla, S. Roy, R. Tuli, Oligonucleotide frequencies of barcoding loci can discriminate species across kingdoms, PLoS One 5 (2010) e12330.
10. S. Roy, A. Tyagi, V. Shukla, A. Kumar, U.M. Singh, L.B. Chaudhary, B. Datt, **S.K. Bag**, P.K. Singh, N.K. Nair, T. Husain, R. Tuli, Universal plant DNA barcode loci may not work in complex groups: a case study with Indian berberis species, PLoS One 5 (2010) e13674
11. Kumar S, **Asif MH**, Chakrabarty D, Tripathi RD, Trivedi PK (2011). Differential expression and alternative splicing of rice sulphate transporter family members regulate sulphur status during plant growth, development and stress conditions. Funct Integr Genomics.(2):259-73.
12. Jena SN, Srivastava A, Rai KM, Ranjan A, Singh SK, Nisar T, Srivastava M, Bag SK, Mantri S, **Asif MH**, Yadav HK, Tuli R, Sawant SV (2012). Development and characterization of genomic and expressed SSRs for levant cotton (*Gossypium herbaceum* L.). Theor Appl Genet (3):565-76.
13. Ranjan A, Nigam D, **Asif MH**, Singh R, Ranjan S, Mantri S, Pandey N, Trivedi I, Rai KM, Jena SN, Koul B, Tuli R, Pathre UV, Sawant SV (2012). Genome wide expression profiling of two accession of *G. herbaceum* L. in response to drought. BMC Genomics 13:94.
14. Priya Gupta, Asif Idris, Shrikant Mantri, **Mehar Hasan Asif**, Hemant Kumar Yadav, Joy Kumar Roy, Rakesh Tuli, Chandra Sekhar Mohanty, Samir Vishwanath Sawant (2012). Discovery and use of single nucleotide polymorphic (SNP) markers in *Jatropha curcas* L. Mol Breeding DOI 10.1007/s11032-012-9719-6
15. Smita Kumar, **Mehar Hasan Asif**, Debasis Chakrabarty, Rudra Deo Tripathi, Rama Shanker Dubey and Prabodh Kumar Trivedi (2012) Differential Expression of Rice Lambda Class GST Gene Family Members During Plant Growth, Development, and in Response to Stress Conditions. Plant Mol Biol Rep DOI 10.1007/s11105-012-0524-5
16. K.M. Rai, S.K. Singh, A. Bhardwaj, V. Kumar, D. Lakhwani, A. Srivastava, S.N. Jena, H.K. Yadav, **S.K. Bag**, S.V. Sawant, Large-scale resource development in *Gossypium hirsutum* L. by 454 sequencing of genic-enriched libraries from six diverse genotypes, Plant Biotechnol J 11 (2013) 953-963
17. Smita Kumar, **Mehar Hasan Asif**, Debasis Chakrabarty, Rudra Deo Tripathi, Rama Shanker Dubey, Prabodh Kumar Trivedi (2013) Expression of a rice Lambda class of glutathione S-transferase, OsGSTL2, in *Arabidopsis* provides tolerance to heavy metal and other abiotic stresses. Journal of Hazardous Materials (248-249) 228-237.
18. Chandra Shekhar Nautiyal, Suchi Srivastava, Sandhya Mishra, **Mehar Hasan Asif**, Puneet Singh Chauhan, Poonam C. Singh, Pravendra Nath (2013) Reduced cell wall degradation plays a role in cow dung-mediated management of wilt complex disease of chickpea. Biol Fertil Soils DOI 10.1007/s00374-013-0782-x
19. N.K. Dubey, R. Goel, A. Ranjan, A. Idris, S.K. Singh, **S.K. Bag**, K. Chandrashekar, K.D. Pandey, P.K. Singh, S.V. Sawant, Comparative transcriptome analysis of *Gossypium hirsutum* L. in response to sap sucking insects: aphid and whitefly, BMC Genomics 14 (2013) 241
20. **Mehar Hasan Asif**, Deepika Lakhwani, Sumya Pathak, Sweta Bhambhani, **Sumit K. Bag**, Prabodh Kumar Trivedi (2013) Genome-wide identification and expression analysis of the mitogen-activated protein kinase gene family from banana suggest involvement of specific members in different stages of fruit ripening. Funct. Integ. Geno. DOI 10.1007/s10142-013-0349-9
21. Gupta P, Goel R, Pathak S, Srivastava A, Singh SP, Sangwan RS, **Asif MH**, Trivedi PK De novo assembly, functional annotation and comparative analysis of *Withania somnifera* leaf and root transcriptomes to identify putative genes involved in the withanolides biosynthesis (2013) PLoS One 8: e62714
22. Chaudhry V, Chauhan PS, Mishra A, Goel R, **Asif MH**, Mantri SS, **Bag SK**, Singh SK, Sawant SV, Nautiyal CS Insights from the draft genome of *Paenibacillus lentimorbus* NRRL B-30488, a promising plant growth promoting bacterium 2013 Journal of Biotechnology Volume 168, Issue 4, December (2013), Pages 737–738
23. Srivastava A, Jena SN, Ranjan A, Kavita P, **Asif MH**, **Bag SK**, Shukla RP, Yadav HK and Sawant SV Development of molecular markers from Indian genotypes of two *Gossypium* L. species 2013 Plant Breeding Volume 132, Issue 5, pages 506–513, October (2013) DOI: 10.1111/pbr.12087
24. Chaudhry V, **Asif MH**, **Bag S**, Goel R, Mantri SS, Singh SK, Chauhan PS, Sawant SV, Nautiyal CS Draft genome sequence of *Pseudomonas putida* strain MTCC5279 (2013) Genome Announcement 1(4):e00560-13. doi:10.1128/genomeA.00560-13.
25. Pathak S, Lakhwani D, Gupta P, Mishra BK, Shukla S, **Asif MH**, Trivedi PK Comparative Transcriptome Analysis Using High Papaverine Mutant of *Papaver somniferum* Reveals Pathway and Uncharacterized Steps of Papaverine Biosynthesis. (2013) PLoS ONE 8(5): e65622. doi:10.1371/journal.pone.0065622

26. **Asif MH**, Lakhwani D, Pathak S, Bhambhani S, **Bag SK**, Trivedi PK Genome-wide identification and expression analysis of the mitogen-activated protein kinase gene family from banana suggest involvement of specific members in different stages of fruit ripening (2014) *Functional & Integrative Genomics* Volume 14, Issue 1, pp 161-175
27. Dubey S, Shri M, Misra P, Lakhwani D, **Bag SK**, **Asif MH**, Trivedi PK, Tripathi RD, Chakrabarty D Heavy metals induce oxidative stress and genome-wide modulation in transcriptome of rice root (2014) *Functional & Integrative Genomics* DOI10.1007/s10142-014-0361-8
28. Nigam D, Kavita P, Tripathi RK, Ranjan A, Goel R, **Asif MH**, Shukla A, Singh G, Rana D and Sawant SV Transcriptome dynamics during fibre development in contrasting genotypes of *Gossypium hirsutum* L. (2014) *Plant Biotechnology Journal* Volume 12, Issue 2, pages 204–218,
29. R. Srivastava, K.M. Rai, M. Srivastava, V. Kumar, B. Pandey, S.P. Singh, **S.K. Bag**, B.D. Singh, R. Tuli, S.V. Sawant, Distinct Role of Core Promoter Architecture in Regulation of Light-Mediated Responses in Plant Genes, *Mol Plant* (2014) 7(4): 626-641

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