CALL V

Project title: Understanding the mechanisms of tolerance to low light intensity in rice

Project Code	**:**	5001
Duration of the project	**:**	April 2016 – March 2019
PI Name	**:**	Dr. Prasanta Dash
CCPI Names	**:**	Dr. Bhagawan Bharali
	:	Dr. Renu Pandey
	:	Dr. M.J. Baig
Lead Centre	**:**	ICAR-NRCPB, New Delhi
Cooperating centres	**:**	AAU, Jorhat
	:	ICAR-IARI, New Delhi
	:	ICAR-CRRI, Cuttack

Objectives:

- To evaluate rice germplasm for tolerance to lowlight intensity traits using physiological and biochemical markers.
- Precision screening of the rice genotypes in LED chambers.
- Analysis of candidate genes for trait correction in rice.
- Developing mapping population and phenotyping for Low-light tolerance.

Achievements:

- Identified low-light tolerant rice germplasm, developed mapping populations for associated genetic polymorphisms, and elucidated key physiological and molecular mechanisms underlying low-radiation stress tolerance to support future crop improvement.

Project title: Understanding cellular and genetic mechanisms and identifying molecular markers for seed viability in soybean

Project Code	**:**	5002
Duration of the project	**:**	July 2015 – June 2018
PI Name	**:**	Dr. Akshay Talukdar
CCPI Name	**:**	Dr. Kishore Gaikwad
Lead Centre	**:**	ICAR-IARI, New Delhi
Cooperating centres	**:**	ICAR-NRCPB, New Delhi

Objectives:

- To understand the structural and biochemical mechanisms of seed viability in soybean.
- To identify gene(s) involved in seed viability mechanism.
- To identify molecular markers linked with seed viability.

Achievements:

a) Publications:

- Kumar A, Chandra S, Talukdar A, Yadav RR, Saini M, Poonia S, Lal SK (2019) Genetic studies on seed coat permeability and viability in RILs derived from an inter-specific cross of soybean [*Glycine max* (L) Merrill]. Indian J Genet. 79(1): 48-55. DOI: https://doi.org/10.31742/IJGPB.79.1.7.

- Yadav S, Talukdar A, Gupta S, Chandra S, Gaikwad K, Lal SK and Yadav SK (2018) Effect of ageing on oxidative stress and ascorbate-glutathione cycle in various RILs of soybean. Seed Res. 46(1): 48-53.

- Ramakrishna G, Kaur P, Nigam D, Chaduvula PK, Yadav S, Talukdar A, Singh NK, Gaikwad K (2018) Genome-wide identification and characterisation of InDels and SNPs in Glycine max and Glycine soja for contrasting seed permeability traits. BMC Plant Biology 18:141. DOI https://doi.org/10.1186/s12870-018-1341-2.

Project title: Developing high oleic safflower genotypes through functional genomics

Project Code	**:**	5003
Duration of the project	**:**	July 2015 – June 2018
PI Name	**:**	Dr. N.Y. Kadoo
CCPI Names	**:**	Dr. Vrijendra Singh
	:	Dr. Prakash Ghorpade
Lead Centre	**:**	NCL, Pune
Cooperating centres	**:**	ICAR-NARI, Phaltan
	:	Bharati Vidyapeeth University (BVU), Pune

Objectives:

- Fatty acid profiling of the Indian safflower germplasm and identifying oleic acid rich natural variants of FAD2 genes
- Developing high oleic safflower genotypes by the non-transgenic TILLING approach.

Achievements:

a) Publications:

- Chirmade *et al*. (2016) Balancing Omega-6: Omega-3 ratios in oilseeds. In: Omega-3 Fatty Acids: Keys to Nutritional Health (Eds. Hegde *et al.*) Springer-Verlag, New York. pp. 203-220 (DOI: 10.1007/978-3-319-40458-5_15)

Project title: Genetic Transformation and Development of Elite Transgenic Maize (*Zea mays* L.) for Biotic and Abiotic Stresses Tolerance

Project Code	**:**	5004
Duration of the project	**:**	July 2015 – December 2018
PI Name	**:**	Dr. Tanushree Kaul
CCPI Names	**:**	Dr. Krishan Kumar
	:	Dr. Rakesh Bhowmick
Lead Centre	**:**	ICGEB, New Delhi
Cooperating centres	**:**	ICAR-IIMR, New Delhi
	:	ICAR-VPKAS, Almora

Objectives:

- Development of novel transformation constructs for herbicide tolerance and phosphorus use efficiency
- Transformation of maize for herbicide tolerance and insect resistance
- Molecular analysis, phenotyping and bioassay of transgenics
- Conversion of elite maize inbreds with transgenes and pyramiding of transgenes in the elite inbred backgrounds

Achievements:

a) Publications:

- Agarwal A, Yadava P, Kumar K, Singh I, Kaul T, Pattanayak A and Agrawal PA (2018) Insights into maize genome editing via CRISPR/Cas9. Physiol Mol Biol Plants, 24(2):175–183. doi: 10.1007/s12298-017-0502-3.
- Yadava P, Abhishek A, Singh R, Singh I, Kaul T. Pattanayah A, Agrawal PK (2017) Advances in Maize Transformation Technologies and Development of Transgenic
- A, Kumari R, Karjagi CG, Kumar P, Kumar B, Dass S, Kumar RS, Ramteke PW (2016) Tissue Culture Independent Agrobacterium tumefaciens Mediated In Planta Transformation Method for Tropical Maize (*Zea mays*. L). Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. 86(2):375-84. https://doi.org/10.1007/s40011-014-0454-0

b) Patent:

- CRISPR/Cas9 edited maize for glyphosate tolerance.

c) Technology Developed:

- Plant genome editing technology using CRISPR/Cas9 and maize transformation protocol.

Project title: Lactation stress association with postpartum anestrus SNP array in buffaloes

Project Code	**:**	5005
Duration of the project	**:**	July 2015 – June 2018
PI Name	**:**	Dr. Suneel Onteru
CCPI Names	**:**	Dr. T.S. Keshava Prasad
	:	Dr. R.K. Sharma
Lead Centre	**:**	ICAR-NDRI, Karnal
Cooperating centres	**:**	IOB, Bangalore
	:	ICAR-CIRB, Hissar

Objectives:

- To identify the differentially expressed genes (DEG) in liver, adipose and granulosa cells during lactation stress.

- Identification of SNPs in the DEG and their association with postpartum anestrus.

Achievements:

a) Publications:

- Behera A, Sravanthi K, Kumar LK, Vedamurthy GV, Singh D, Onteru SK (2021) Association of taurine with ovarian follicular steroids and post-partum anestrus in Murrah buffaloes. Domestic Animal Endocrinology 74: 106511.

- Sharma Y, Verma SK, Kumar LK, Surla GN, Vedamurthy GV, Singh D, Onteru SK (2020) Apolipoprotein A1 and ceruloplasmin, the key crosstalk players between the liver and adipose tissue during early postpartum of buffaloes: An in-Silico transcriptome-based network analysis. Computers in Biology and Medicine. 126:104024. DOI: 10.1016/j.compbiomed.2020.104024.

- Chaitanya Kumar T.V, Sharma D, Surla GN, Vedamurthy GV, Singh D, Onteru S.K (2020) Body condition score, girth, parity, shelter cleanliness, male proximity and concentrate feeding during early post-partum: associated non-genetic factors with post-partum anestrus of Murrah buffaloes in the field conditions. Animal Reproduction Science.106282. doi.org/10.1016/j.anireprosci.2020.106282.

- Golla N, Chopra A, Boya S, Kumar TVC, Onteru SK, Singh D (2019) High serum free fatty acids and low leptin levels: Plausible metabolic indicators of negative energy balance in early lactating Murrah buffaloes. Journal of Cellular Physiology 234(6):7725-7733.

- Sharma D, Golla N, Singh S, Singh PK, Singh D, Onteru SK (2019) An efficient method for extracting next-generation sequencing quality RNA from liver tissue of recalcitrant animal species. Journal of Cellular Physiology Jan 29. doi: 10.1002/jcp.28226.

- Singh S, Golla N, Sharma D, Singh D, Onteru S. (2019). Buffalo liver transcriptome analysis suggests immune tolerance as its key adaptive mechanism during early postpartum negative energy balance. Functional & Integrative Genomics. May 9. doi: 10.1007/s10142-019-00676-1.

- Sharma D, Golla G, Singh D, Onteru SK. (2018) A highly efficient method for extracting next-generation sequencing quality RNA from adipose tissue of recalcitrant species. Journal of Cellular Physiology 233(3): 1971-1974.

- Nayan V, Onteru SK, Singh D (2018) Mangifera indica flower extract mediated biogenic green gold nanoparticles: Efficient nanocatalyst for reduction of 4-nitrophenol. Environmental Progress & Sustainable Energy 37: 283–294.

Project title: Elucidating the mechanism of Pashmina fibre development: An OMICS approach

Project Code	**:**	5006
Duration of the project	**:**	July 2015–December 2018
PI Name	**:**	Dr. Nazir Ganai
CCPI Names	**:**	Dr. Jai Kaushik
	:	Dr. A.R. Rao
Lead Centre	**:**	SKUAST, Kashmir, J&K
Cooperating centres	**:**	ICAR-NDRI, Karnal
	:	ICAR-IASRI, New Delhi

Objectives:

- Phenotyping of the pashmina goats for identification of the resource population.
- Generate the proteomic map of Pashmina fibre and of follicles to understand growth phases of the fibre development
- Identify the markers for the yield of fibre by comparative proteome profiling under varying climatic conditions
- Generate the transcriptome map of Pashmina hair follicles to decipher the genetic control of fibre growth
- Comparative analysis of the transcriptomic data for identification of Pashmina fibre specific marker genes.

Achievements:

a) Publications:

- Bhat B, Singh A, Iqbal Z, Kaushik JK, Rao AR, Ahmad SM, Bhat H, Ayaz A, Sheikh FD, Kalra S, Shanaz S, Mir MS, Agarwal PK, Mohapatra T, Ganai NA (2019) Comparative transcriptome analysis reveals the genetic basis of coat colour variation in Pashmina goat. Scientific Reports, 9:6361, DOI: 10.1038/s41598-019-42676-y), 1-9.
- Bhat B, Ganai NA, Andrabi SM, Shah RA, Singh A (2017) TM-Aligner: Multiple sequence alignment tool for transmembrane proteins with reduced time and improved accuracy. Scientific reports. 7(1):12543. doi: 10.1038/s41598-017-13083-y.

Project title: Leukemia Inhibitory Factor: Pluripotency in Buffalo Stem Cells

Project Code	**:**	5008
Duration of the project	**:**	July 2015– June 2018
PI Name	**:**	Dr. Sudarshan Kumar
Lead Centre	**:**	ICAR-NDRI, Karnal

Objectives:

- To produce recombinant buffalo Leukemia Inhibitory Factor (rBuLIF)
- To evaluate the effect of rBuLIF on buffalo stem cell for the maintenance of pluripotency.

Achievements:

a) Publications:

- Ali SA, Malakar D, Kaushik JK, Mohanty AK, Kumar S (2018) Recombinant purified buffalo leukemia inhibitory factor plays an inhibitory role in cell growth. PLoS ONE 13(6): e0198523. https://doi.org/10.1371/journal.pone.0198523.
- Ali SA, Kaur G, Malakar D, Kaushik JK, Mohanty AK, Kumar S (2017) Examination of pathways involved in leukemia inhibitory factor (LIF)-induced cell growth arrest using label-free proteomics approach. Journal of Proteomics, https://doi.org/10.1016/j.jprot.2017.07.014.
- Kaur G, Ali SA, Pachauri S, Malakar D, Kaushik JK, Mohanty AK, Kumar S (2017). Buffalo Leukemia Inhibitory Factor Induces Differentiation and Dome-Like Secondary Structures in COS-1 Cells. Cytogenet Genome Res. 151:119-130. doi: 10.1159/000465507.

Project title: Molecular cross-talk between defence pathways in rice: Antagonism to synergism

Project Code	**:**	5009
Duration of the project	**:**	July 2015 – June 2018
PI Name	**:**	Dr. J.S. Bentur
CCPI Names	**:**	Dr. Hitendra Kumar Patel
	:	Dr. M. Srinivas Prasad
Lead Centre	**:**	Agri Biotech Foundation (ABF), Hyderabad
Cooperating centres	**:**	CCMB, Hyderabad
	:	ICAR-DRR, Hyderabad

Objectives:

- To identify and characterize specific instances of synergism and antagonism in rice lines carrying bacterial blight (BB) resistance genes *xa5*, *xa13*, *Xa21*; blast resistance genes *Pi1*, *Pi54* and gall midge resistance genes *Gm4*, *Gm8* in different combinations in an uniform background of BPT5204.

- To identify common sets of genes, gene networks and specific candidate genes that play role in specified cases of synergism and antagonism involving combined deployment of *Xa21*, *Pi54* and *Gm8* genes

- To determine how *Xa21*, *Pi54* and *Gm8* genes can complement each other in conferring BB, blast and gall midge resistance simultaneously

Achievements:

a) Publications:

- Divya D, Ratna Madhavi K, Dass MA, Maku VR, Mallikarjuna G, Sundaram RM, Laha GS, Padmakumari AP, Patel HK, Prasad MS, Sonti RV, Bentur JS (2018) Expression profile of defence genes in rice lines pyramided with resistance genes against bacterial blight, fungal blast and insect gall midge. Rice (Springer) 11(1):40. DOI: 10.1186/s12284-018-0231-4.

Project title: Low ovule-to seed ration in range grasses: genetical and physio-chemical basis

Project Code	**:**	5010
Duration of the project	**:**	July 2015 – June 2018
PI Name	**:**	Dr. C. K. Gupta
Lead Centre	**:**	ICAR-IGFRI, Jhansi

Objectives:

- To analyze hormonal interplay in relation to source and sink.
- To determine the effect of ploidy based EBN (Endosperm Balance Number) ratio on seed development.
- To decipher the endosperm-embryo cross talk at biochemical and molecular level.

Achievements:

a) Publications:

- D. Vijay, C.K. Gupta and D.R. Malaviya (2017) Innovative technologies for quality seed production and vegetative multiplication in forage grasses. Curr. Sci. 114 (1). 148-154.

B) Technology developed:

- Foliar application of kinetin (100 ppm) just before booting stage improves seed setting in Cenchrus ciliaris (IG99 124) by 10-15%. This also improves seed yielding attributes leading to overall increase in seed yield.

Project title: CctA and hyaluronidase gene mutants of *Clostridium chauvoei*: Construction and evaluation of vaccine potential

Project Code	**:**	5011
Duration of the project	**:**	July 2015 – December 2018
PI Name	**:**	Dr. K.N. Viswas
Lead Centre	**:**	ICAR-IVRI, Izatnagar

Objectives:

- To identify toxic motifs of cctA gene of *C. chauvoei*.
- To create *C. chauvoei* mutant harbouring attenuated cctA gene and inactivated hyaluronidase gene.
- To evaluate the protective efficacy of the constructed mutants.

Achievements:

a) Publications:

- Dangi SK, Yadav PK, Mashooq M, Karthik K, Nagaleekar VK (2019) Cloning and Expression of Carboxyl-terminal Region of cctA Gene of *Clostridium chauvoei*. Journal of Immunology and Immunopathology. 21(1):47-49**.**
- Karthik K, Mashooq M, Nagaleekar VK (2019) Expression of Amino-terminal Fragment of *Clostridium chauvoei* toxin A. Journal of Immunology and Immunopathology. 21(1):43-46.
- Kumar S, Mashooq M, Gandham RK, Alavandi SV and Nagaleekar VK (2018) Characterization of quorum sensing system in *Clostridium chauvoei*. Anaerobe. 52:92-99.
- Dangi SK, Yadav PK, Mashooq M, Karthik K, Nagaleekar VK (2018) Cloning and expression analysis of nagJ hyaluronidase gene of *Clostridium chauvoei*. Indian Journal of Animal Sciences. 88 (3): 304–306.
- Dangi SK, Yadav PK, Tiwari A and Nagaleekar VK (2017) Cloning and sequence analysis of nagH gene of *Clostridium chauvoei*. Veterinary World. 10(9):1104-1107.

Project title: Delineating Beta Casein Variants in Indian Cows and Potential Health Implications of A1 A2 Milk

Project Code	**:**	5012
Duration of the project	**:**	July 2015 – December 2018
PI Name	**:**	Dr. Monika Sodhi
CCPI Names	**:**	Dr A.K. Mohanty
	:	Dr. Rajat Sandhir
Lead Centre	**:**	ICAR-NBAGR, Karnal
Cooperating centres	**:**	ICAR-NDRI, Karnal
	:	Punjab University, Chandigarh

Objectives:

- To ascertain allelic distribution of different β-CN variants in Indian native, exotic and crossbred cattle populations.
- To identify β-CN protein variants in milk from selected genotypes using high resolution mass spectrometry.
- To establish experimental evidence for the cause-and-effect relationship of BCM-7 peptide, A1, A2 and A1A2 milk with disease progression in mice model.

Achievements:

a) Technology Developed:

- Development of an LC-MS-based method for the identification of A1/A2 beta casein variants in cow milk.
- Development of a quick and cost-effective methodology to detect the presence of A1 or A2 allele of beta casein in milk, blood or semen has been standardised.

b) Commercialization of technologies:

- Facility of ascertaining the status of A1/A2 allele of beta casein being extended to farmers as well as the semen centre. More than 500 samples have been.

Project title: Eliciting soil microbiome responses of rice for enhanced water and nutrient use efficiency under anticipated climate changes

Project Code	:	5013
Duration of the project	:	July 2015 – June 2018
PI Name	:	Dr. Pratap Bhattacharya
CCPI Names	:	Dr. S. Karthikeyan
	:	Dr. P. Raha
Lead Centre	:	ICAR-CRRI, Cuttack Odisha
Cooperating centres	:	TNAU, Coimbatore, Tamilnadu
	:	BHU, Varanasi

Objectives:

- To elucidate the interactive effect of elevated carbon dioxide and temperature on carbon and nitrogen use efficiency under moisture stress condition in rice.
- To study the dynamics of root exudation pattern in relation to P transformation in rice soils under elevated CO_2 and moisture stress condition.
- To predict and up-scaling of yield, nutrient and water uptake and GHGs emissions in anticipated climate changed scenario by processed based modeling.
- To frame out intervention strategies to cope up with water stress situation under anticipated elevated CO_2 in rice.

Achievements:

a) Publications:

- Nedunchezhiyan V, Velusamy M, Subburamu K (2020) Seed priming to mitigate the impact of elevated carbon dioxide associated temperature stress on germination in rice (*Oryza sativa* L.), Archives of Agronomy and Soil Science. doi: 10.1080/03650340.2019.1599864.
- Vinothini N, V Manonmani, S Sundareswaran, S Karthikeyan, N Maragatham and S Srinivasan. (2019) Biochemical changes associated with elevated carbon dioxide in rice (*Oryza sativa* L.). International Journal of Chemical Studies, 7 (3): 738-741.
- Panneerselvam P, Kumar U, Senapati A, Parameswaran C, Anandan A, Kumar A, Jahan A, Padhy SR and Nayak AK (2019) Influence of elevated CO2 on arbuscular mycorrhizal fungal community elucidated using Illumina MiSeq platform in sub-humid tropical paddy soil. Applied Soil Ecology. doi: 10.1016/j.apsoil.2019.08.006.
- Bhattacharyya P, Roy KS, Das M, Ray S, Balachandar D, Karthikeyan S, Nayak AK, Mohapatra T (2016) Elucidation of rice rhizosphere metagenome in relation to methane and nitrogen metabolism under elevated carbon dioxide and temperature using whole genome metagenomic approach. Science of the Total Environment, 542, 886-898. https://doi.org/10.1016/j.scitotenv.2015.10.154.

Project title: Simulating the effect of elevated CO2 and temperature on crop yield, water productivity and produce quality under varied water and nitrogen stress in soyabean-wheat cropping system

Project Code	**:**	5014
Duration of the project	**:**	July 2015 – June 2019
PI Name	**:**	Dr. Narendra Lenka
CCPI Names	**:**	Dr. Punit Chandra
	:	Dr. K. K. Singh
Lead Centre	**:**	ICAR-IISS, Bhopal
Cooperating centres	**:**	ICAR-CIAE, Bhopal
	:	IMD, Delhi

Objectives:

- To determine the impact of nitrogen stress on water productivity, nutrient uptake and selected soil properties under elevated CO_2 and temperature conditions
- To simulate and develop projections for crop growth, nutrient and water requirement for varied CO_2 and temperature conditions using crop simulation models and weather generator
- To investigate the effect of elevated CO_2 and temperature on biochemical attributes of grain and crop residues

Achievements:

a) Publications:

- Lenka NK, Lenka S, Yashona DS, Shukla AK, Elanchezhian R, Dey P, Agrawal PK, Biswas AK, Patra AK (2021) Carbon dioxide and/or temperature elevation effect on yield response, nutrient partitioning and use efficiency of applied nitrogen in wheat crop in central India, Field Crops Research 264, 108084.
- Lenka NK, Lenka S, Yashona DS, Jat D (2021) Elevated temperature and low nitrogen partially offset the yield, evapotranspiration, and water use efficiency of winter wheat under carbon dioxide enrichment. Agricultural Water Management, 250, 106856.
- Kumar NK, Lenka S, Thakur JK, Yashona DS, Shukla AK, Elanchezhian R, Singh KK, Biswas AK, Patra AK (2020) Carbon dioxide and temperature elevation effects on crop evapotranspiration and water use efficiency in soybean as affected by different nitrogen levels. Agricultural Water Management 230, doi: j.agwat.2019.105936.
- Lenka NK, Lenka S, Mahapatra P, Sharma N, Kumar S, Aher SB, Yashona DS (2019) The fate of 15N labeled urea in a soybean-wheat cropping sequence under elevated CO2 and/or temperature. Agriculture, Ecosystems and Environment, 282, 23-29. doi.org/10.1016/j.agee.2019.04.033.

- Lenka NK, Lenka S, Singh KK, Kumar A, Aher SB, Yashona DS, Dey P, Agrawal PK, Biswas AK, Patra AK (2019) Effect of elevated CO2 on plant growth, nutrient partitioning and uptake of major plant nutrients in soybean under varied nitrogen application levels. Journal of Plant Nutrition and Soil Science 182, 509-514.

- Lenka NK, S Lenka, JK Thakur, R Elanchezhian, SB Aher, V Simaiya, DS Yashona, AK Biswas, PK Agrawal, AK Patra (2017) Interactive effect of elevated carbon dioxide and elevated temperature on growth and yield of soybean. Current Science. 113(12):2305.

Project title: Investigation of effect of structure of jute products on its sound insulation property

Project Code	**:**	5016
Duration of the project	**:**	July 2015 – June 2018
PI Name	**:**	Dr. Gautam Bose
CCPI Names	**:**	Ms. Mallika Datta
	:	Dr. Sampad Mukherjee
Lead Centre	**:**	ICAR-NIRJAFT, Kolkata
Cooperating centres	**:**	GCETT, Serampore, W.B
	:	IIEST, Shibpur, W.B

Objectives:

- Understanding of science of acoustical and non-acoustical properties of jute and allied fibres assembly in relation to its structure.
- Study the effect of engineered fibrous structure(s) on frequency dependent sound propagation
- Effect of surface modification of natural fibre on sound insulation.
- Study the effect of temperature, heat tolerance and climatic condition on acoustic behaviour.

Achievements:

a) Publications:

- Samanta KK, Mustafa I, Debnath S, Das E, Basu G, Ghosh SK (2021) Study of Thermal Insulation Performance of Layered Jute Nonwoven: A Sustainable Material. Journal of Natural Fibers. https://doi.org/10.1080/15440478.2020.1856274.
- Sengupta S, Basu G, Datta M, Debnath S, Nath D (2020) Noise control material using jute (*Corchorus olitorius*): effect of bulk density and thickness. Journal of the Textile Institute (Taylor & Francis). doi.org/10.1080/00405000.2020.1744222.
- Nath D, Debnath S, Datta M, Saha S, Ghosh S, Ghosh B (2019) Poly (vinyl acetate) coated jute fabric reinforced polyester composite with enhanced mechanical performance: Interfacial hydrogen bond and auto adhesion mechanism. Journal of Industrial Textiles (SAGE), doi.org/10.1177/1528083719894737.

b) Technology Developed:

- Developed jute (agro-renewable) felt, Noise Reduction is comparable to that of commercially available glass wool, rock wool-based material in terms of Noise Reduction Co-efficient (NRC).

Project title: Expression of Resistance to Diapausing and Nondiapausing Spotted Stem Borer, *Chilo partellus* in Sorghum and Maize: Implications for Crop Improvement and IPM

Project Code	**:**	5017
Duration of the project	**:**	May 2016 – April 2019
PI Name	**:**	Dr. Jaba Jagdish
CCPI Names	**:**	Dr. M. K. Dhillon
	:	Dr. G. Shyam Prasad
Lead Centre	**:**	ICRISAT, Hyderabad
Cooperating centres	**:**	ICAR-IARI, New Delhi
	:	ICAR-IIMR, Hyderabad

Objectives:

- Genetic and biochemical variation in diapausing and nondiapausing populations of spotted stem borer, *C. partellus* in India.
- Role of environmental factors and host plants on induction and termination of diapause in *C. partellus*.
- Variation in expression of resistance in sorghum and maize to diapausing and nondiapausing populations of *C. partellus* across seasons and locations.

Achievements:

a) Publications:

- Dhillon MK, Hasan F (2018) Consequences of diapause on post-diapause development, reproductive physiology and population growth of *Chilo partellus* (Swinhoe). Physiological Entomology. 43: 196-206.
- Dhillon MK, Tanwar AK, Hasan F (2018) Fitness consequences of delayed mating on reproductive performance of *Chilo partellus* (Swinhoe). Journal of Experimental Zoology-A: Ecological and Integrative Physiology. 331(3): 161-167 https://doi.org/10.1002/jez.2249.

Project title: Identification and molecular tagging of gene (s) controlling resistance to chilli leaf curl virus infection in chilli (*Capsicum annuum* L.)

Project Code	:	5018
Duration of the project	:	October 2016 – September 2019
PI Name	:	Dr. Arpita Srivastava
CCPI Names	:	Dr. Salesh Jindal
	:	Dr. P. K. Jain
	:	Dr. C. Venkata Ramana
Lead Centre	:	ICAR-IARI, New Delhi
Cooperating centres	:	Punjab Agriculture University, Ludhiana
	:	ICAR-NRCPB, New Delhi
	:	Dr. YSR Horticulture University

Objectives:

- To determine the level of resistance in the promising genotypes of chilli against predominant isolates of chilli leaf curl virus (ChLCV).
- To determine genetics of resistance in chilli to ChLCV.
- To identify molecular markers linked to gene(s) conferring resistance to ChLCV.
- To analyse the transcriptome of resistant and susceptible genotypes following infection by ChLCV.

Achievements:

a) Publications:

- Thakur H, Jindal S K, Sharma A and Dhaliwal M S (2019). A monogenic dominant resistance for leaf curl virus disease in chilli pepper (*Capsicum annuum* L.). Crop Protection 116:115-120.
- Thakur H, Jindal S K, Sharma A and Dhaliwal M S (2019). Genetic control of leaf curl virus disease, horticultural and biochemical traits in chilli (*Capsicum annuum* L.). Int J Chemi Stud 7(4): 1970-1976.
- Mangal M, Srivastava A, Sharma R, Kalia P (2017) Conservation and dispersion of genes conferring resistance to tomato begomoviruses between tomato and pepper genomes. Frontiers in plant science doi.org/10.3389/fpls.2017.01803.
- Thakur H, Jindal S K, Sharma A and Dhaliwal M S (2018). Chilli leaf curl disease: a serious threat for chilli cultivation. J Plant Dis Protection 125 (3): 239-249.
- Srivastava A, Mangal M, Saritha RK, Kalia P (2017) Screening of chilli pepper (*Capsicum* spp.) lines for resistance to the bbegomoviruses causing chilli leaf curl disease in India. Crop Protection 100:177-185. https://doi.org/10.1016/j.cropro.2017.06.015

Project title: Biofortification of Wheat and Maize with Zinc and Iron Using Endophytic Microorganisms

Project Code	**:**	5019
Duration of the project	**:**	March 2017 - February 2020
PI Name	**:**	Prof. Dr. Ajit Varma
CCPI Name	**:**	Dr. Hillol Chakdar
Lead Centre	**:**	Amity University Uttar Pradesh, Noida
Cooperating centre	**:**	ICAR- NBAIM, Mau UP

Objectives:

- Selection of potential endophytes for acquisition and transportation of Zn and Fe in cultivars of wheat and maize.
- To decipher the mechanism involved in plant translocation and distribution of Zn and Fe in wheat and maize.

Achievements:

a) Publications:

- Verma S, Chakdar H, Kumar M, Varma A, Saxena AK (2021) Microorganisms as a Sustainable Alternative to Traditional Biofortification of Iron and Zinc: Status and Prospect to Combat Hidden Hunger. Journal of Soil Science and Plant Nutrition. https://doi.org/10.1007/s42729-021-00473-5.

Project title: Nano-Based Detection of Organophosphate Pesticides Using Metal-Organic Framework Conjugates

Project Code	:	5020
Duration of the project	:	January 2017 – November 2020
PI Name	:	Dr. Lalit M Bharadwaj
CCPI Names	:	Dr. Irani Mukherjee
	:	Prof. Sunil Bhand
Lead Centre	:	Amity University Uttar Pradesh, Noida
Cooperating centres	:	ICAR-IARI, New Delhi
	:	BITS Pilani, Goa Campus

Objectives:

- To develop transition metal (Cu++, Zn++ and Ni++) organic framework (MOF) bio-conjugate (for total OPs conjugate with Acetylcholinesterase (AChE) and specific Ops conjugate with antibodies)
- To detect and estimate (electrochemically/optically) total OPs pesticides from soil and plants using bioconjugates. Integration of MOF-bioconjugates on the screen-printed device for the ease of detection of OPs
- To develop a portable field-applicable laboratory prototype for the detection of total OPs in soil and plants
- To develop antibody based bioconjugates for specific detection of particular organophosphate (OP) pesticide using MOF on screen printed device.

Achievements:

a) Publications:

- Nagabooshanam S, Roy S, Wadhwa S, Mathur A, Krishnamurthy S, Bharadwaj LM (2022). Ultra-Sensitive Immuno-Sensing Platform Based on Gold-Coated Interdigitated Electrodes for the Detection of Parathion. Surfaces 5(1):165-175. https://doi.org/10.3390/surfaces5010009
- Nagabooshanam S, Talluri B, Thomas T, Krishnamurthy S, Mathur A (2022) Ultra-Sensitive Impedimetric Immunosensor Using Copper Oxide Quantum Dots Grafted on the Gold Microelectrode for the Detection of Parathion. Micromachines 13, 1385. https://doi.org/10.3390/mi13091385.
- Chaudhary SC, Mani A, Bharadwaj LM, Basu T (2022) A mobile app integrated portable Electrochemical sensor for rapid detection of Organophosphate pesticides in vegetable extract, Materials Letters 309, 131319, ISSN 0167-577X, https://doi.org/10.1016/j.matlet.2021.131319.
- Nagabooshanam S, Sharma S, Roy S, Mathur A, Krishnamurthy S, Bharadwaj LM (2021) "Development of Field Deployable Sensor for Detection of Pesticide From Food Chain," in IEEE Sensors Journal, 21(4) pp. 4129-4134 doi: 10.1109/JSEN.2020.3030034

- Chansi PRR, Mukherjee I, Basu T, Bharadwaj LM (2020) Metal Organic Framework steered electrosynthesis of anisotropic gold nanorods for specific sensing of organophosphate pesticides in vegetables collected from the field, Nanoscale. 12 21719–21733. https://doi.org/10.1039/D0NR04480F.

- Chansi RB, Rao P, Mukherjee I, Agrawal PK, Basu T, Bharadwaj LM (2020) Layered construction of nano immuno-hybrid embedded MOF as an electrochemical sensor for rapid quantification of total pesticides load in vegetable extract, Journal of Electroanalytical Chemistry 873: 114386,ISSN 1572-6657, https://doi.org/10.1016/j.jelechem.2020.114386.

- Nagabooshanam S, John AT, Wadhwa S, Mathur A, Krishnamurthy S, Bharadwaj LM (2020) Electro-deposited nano-webbed structures based on polyaniline/multi walled carbon nanotubes for enzymatic detection of organophosphates. Food Chemistry 323,126784,ISSN 0308-8146,https://doi.org/10.1016/j.foodchem.2020.126784.

- Nagabooshanam S. *et al.*, (2020) "Microfluidic Affinity Sensor Based on a Molecularly Imprinted Polymer for Ultrasensitive Detection of Chlorpyrifos," *ACS Omega* 5(49) pp. 31765–31773doi: 10.1021/acsomega.0c04436.

- Nagabooshanam S, Roy S, Mathur A. *et al.* (2019) Electrochemical micro analytical device interfaced with portable potentiostat for rapid detection of chlorpyrifos using acetylcholinesterase conjugated metal organic framework using Internet of things. Sci Rep 9, 19862. https://doi.org/10.1038/s41598-019-56510-y5.

b) Patent:

- Ultrasensitive novel electrode for rapid detection of pesticides in vegetable extract (Application No: 201811006552, Granted).

- An immunosensor for ultra-low detection of total pesticide concentration in vegetable extract (Application No: 201811034534).

- Rapid and direct electrochemical growth of multi-colored electrochromic film of Zinc Naphthalene metal organic framework (MOF) for display devices (Application No: 201911040726).

- A hand-held Amperometric sensor for rapid and ultra-low detection of organophosphates in vegetable extract (Application No: 202011014611)

c) Technology Developed:

- Amity has developed a metal organic framework (MOF) conjugate based bioprobe relied mobile app-integrated miniaturised device for detection of organophosphate pesticides (OP) - range 10-100ng/L, and 600- 1400ng/L in fruits and vegetables suitable for unskilled or semi-skilled person, including farmers.