

The Division of Biotechnology came into existence on 13.01.1993 to take up focused and state of the art research in the field of horticultural biotechnology to address various challenges and opportunities that are ahead of us. Different laboratories in the Division are engaged in specific research activities under following thematic areas:

- ✚ Gene discovery, regeneration and transgenics
- ✚ Molecular markers, Marker Assisted Selection & Functional Genomics
- ✚ Bioinformatics
- ✚ Microbiology

The division has released 20 technologies on the above themes and another 20 technologies are in pipe line. Besides this Division is as first venture ready to take up the **Joint venture** projects with the private companies on the above themes.

The division has full fledged programmes on molecular markers. Number of SSR markers have been developed using NGS. Technology on allele mining, Identification of gene for biotic stress and introgression of these genes using MAS in Mango, Banana, Tomato, Pomegranate, Okra Brinjal, Chilli, cucumber, muskmelon, watermelon, bitter gourd etc. have been accomplished. The division has developed markers to identify the male sterility in onion, carrot and chilli. It also developed nuclear (ITS2) and mitochondrial (mtCOI) markers for identification of various insect pests and virus vectors

Micropropagation technology is available with IIHR are: Banana (Grande Naine, Elakki and Rasthali), grapes (including rootstocks), seedless triploid watermelon; hybrid cabbage and tomato, pointed gourd; orchids, anthurium, gerbera, gladiolus, lilies, carnation and chrysanthemum. Specific-Pathogen Free (SPF) technology is available in citrus (through STG – Shoot Tip Grafting), in banana and caladium through ‘meristem’ culture. Hybrid embryo rescue for interspecific / intergeneric /intervarietal crosses in seedless grape and lime, in mango, papaya, banana, brinjal, capsicum, onion and tomato has been standardized and successfully produced the plants.

The division has cloned its own genes and produced transgenics of many crops: Coat protein and/or N genes for resistance; TLCV & Tospo in tomato; WBNV in watermelon; PRSV in papaya, Chitinase, PGIP, AMP, PFLP genes have been used for fungal disease resistance; Alternaria in tomato, & onion; fruit rot in chilli, Fusarium wilt in banana, AMP & defensin genes for bacterial disease resistance; Bacterial nodal blight in pomegranate. Cry1/2A Bt genes; Fruit borer in tomato; Shoot and fruit borer in eggplant, *Helicoverpa armigera* genes. Rd29A::DREB1A; tomato and chilli, CaMV35S::DREB2;

The division has done in depth studies on Isolation, identification and characterization of covert and endophytic bacteria from *in vitro* cultures of different horticultural crops, Screening and utilization of endophytes as PGPRs and developing microbial consortia for plant growth promotion, nutrient mobilization and biocontrol agents. Methodology for large scale inoculum development of mycorrhizal fungi has also been developed. Technologies were developed for Diagnostic indexing procedure for the detection of covert contaminants in plant tissue culture and to minimize/manage microbial contamination in micropropagation tissue culture units.

Diagnostics antibody kits are available for identification of Citrus Tristeza Virus, Downy mildew of Grapes, *Colletotricum capsici* of chillies, *Ralstonia solanacearum*, Peanut bud necrosis virus, *Colletotrichum gloeosporioides* of papaya. Further, we have a diagnostic kits for identification of root stocks in citrus.

Bioinformatics research at IIHR is being carried out in a number of areas. *In silico* mining of markers like simple sequence repeats, single nucleotide polymorphisms, etc. from expressed sequence tags obtained from public molecular databases is being done along with functional annotation and primer designing. Data mining techniques are being applied for classification/prediction problems like protein function prediction, miRNA detection etc. Identification of differentially expressed genes in biotic/abiotic stress conditions in horticultural crops is another area of interest.

In addition to these, the division has developed a technology for mass rearing of brinjal shoot and fruit borer. This technology will be useful for development and screening of chemical and bio-pesticides and resistant phenotype analysis of BT Brinjal.

Services offered in Division

1. Trait specific markers for any biotic stresses
2. Molecular markers for Male sterility,
3. QTL's for quality and yield
4. Validation of molecular markers and gene pyramiding
5. Developing custom microsatellite markers and SNPs
6. DNA fingerprinting of varieties and hybrids
7. In silico mining of SSR's and SNP's
8. DNA barcoding of insects. Species-specific using our standardized barcoding protocols. Barcode is already available for many insects.
9. Detection of covert and endophytic bacteria in tissue culture
10. Molecular characterization of Mycorrhizal fungi
11. Molecular characterization of bacteria involved in nutrient mobilization, plant growth and biocontrol
12. Mass rearing technology for brinjal shoot and fruit borer, *Leucinodes orbonalis*