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From President's Desk

Biotechnological tools for developing disease-resistance in agri crops

Global warming has had a direct impact on climate change which has indirectly or directly affected the crop yield caused by a variety of pests and pathogens. To minimize crop losses, the use of chemical weapons has increased at an alarming rate to feed our growing population. However, these chemicals will certainly have a great s impact on human and environmental health in days to come. Plant breeding and genetic engineering approaches were also exploited for developing resistant crop varieties to combat with different pests and pathogens. Subsequently, exploration for new and stable methods of disease management has led us to genome editing tools like Mega nucleases, Zinc Finger Nucleases (ZFN), Transcription Activation Like Effector Nucleases (TALENs), and CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats)-Cas9. These methods have emerged as alternative biotechnological tools for editing genes at the desired loci in the genome. Among them, clustered regularly interspaced short palindromic repeat CRISPR-associated protein 9 (CRISPR/Cas9) has become more sought and highly useful for future research for developing plant resistance against pests and pathogens. CRISPR/Cas9 technology for gene editing is more precise in knocking out gene function, gene tagging, specific mutation, promoter study, to improve resistance and gene function in plants. To meet our country's challenges in agriculture, we have to change the direction of our research and increase funds in this area by creating more facilities in agricultural Institutes, universities, and research Institutions for the usage of such innovative technologies by a large number of researchers and academicians needs to be encouraged. Through gene editing technology, one can easily develop desirable traits in crops and reduce the time period for achieving the goals. This is one of the most well organized and sustainable approaches for managing a wide range of plant diseases in agri crops. The application of such biotechnological tools and techniques can potentially improve food availability and security in a country like India in the near future by raising crop resistance to pests and pathogens in agri crops, including medicinal and aromatic crops. In India, researchers are using this technology to develop disease-resistant agri crops for more yields and play a significant part in enhancing the Indian economy. This technology should also be applied in maximizing the medicinal and aromatic (M&A) crop yield M & A crops also play a pivotal role in Indian agriculture for creating more employments and income especially for farmer communities. An aggravated goal for the future is to continue uniting science-based information with biotechnological tools and techniques to develop agri crops with higher resilience to biotic and abiotic stresses. Such technologies will enable Indian farmers to produce high yields while decreasing the use of chemicals and water.

Rakesh Pandey
President
Indian Phytopathological Society

IN THIS ISSUE

Editorial

Exploiting Epigenetic Variations for Disease Resistance in crops

Developing disease-resistant crop varieties is essential to secure and enhance crop production in sustainable agriculture. In this endeavour, it is essential to decipher the molecular mechanisms underlying the plant host-pathogen interactions. During the long-term co-evolution with host-adapted pathogens, plants have acquired a sophisticated induced defense system to cope with pathogen infections. Recognition of pathogen-associated molecular patterns (PAMPs) or damage-associated molecular patterns (DAMPs) by plant pattern recognition receptors (PRRs) activates the pattern-triggered immunity (PTI), whereas detection of pathogen-secreted effectors by plant resistance (R) proteins initiates the effector-triggered immunity (ETI). Although PTI and ETI differ in the magnitude and duration of downstream defense responses, but both have potential in triggering plant immunity. Both PTI and ETI are also associated with transcriptional reprogramming of defense-related genes. Recent evidences have revealed that epigenetic processes such as DNA methylation, histone post-translational modifications, chromatin assembly and remodelling govern this defense-related transcriptional reprogramming and play key role in the regulation of crop disease resistance against a wide range of phytopathogens, including viruses, bacteria, fungi, oomycetes, netamodes, and herbivorous insects. Contribution of techniques like generation of DNA (de)methylation mutants and advanced DNA methylation profiling techniques such as methylation-sensitive amplified fragment length polymorphism (MSAP) analysis, whole-genome bisulfite sequencing (WGBS), methylated DNA immunoprecipitation sequencing (MeDIP-seq), and methyl-CpG binding domain protein capture sequencing (MBDCap-seq), in understanding the dynamics and biological functions of DNA (de)methylation in plant-pathogen interactions have been extensively utilized in many crop plants including model crops such as *Arabidopsis thaliana*, Oryza sativa, Nicotiana tabacum, *Glycine max*, *Brassica rapa*, *Citrullus lanatus*, and *Aegilops tauschii*. A similar DNA hypomethylation is observed upon application of bacterial PAMP flg22, nematode PAMP "NemaWater," and plant defense hormone salicylic acid (SA) in model and crop plants. In addition to these sequencing and *in silico* evidences, genetic studies also provide important implications for the involvement of DNA (de)methylation in plant defense response to pathogenic microbes. In Arabidopsis, DNA hypomethylation mutant nrpe1, met1-3, and ddc (drm1-2 drm2-2 cmt3-11) exhibited potential resistance against the biotrophic oomycete pathogen, *Hyaloperonospora arabidopsidis* (Hpa) and hemibiotrophic bacterial pathogen, *Pseudomonas syringae* pv. *tomato* DC3000 (Pst DC3000) but enhanced susceptibility against necrotrophic fungal pathogen, *Plectosphaerella cucumerina* (Pc), whereas DNA hypermethylation mutant *ros1-4* showed attenuated resistance against Pst DC3000 and Hpa but enhanced resistance against Pc. These studies shed light on the important roles of DNA (de)methylation in the regulation of plant-pathogen interactions as well as its great potential in crop disease resistance enhancement.

Rashmi Aggarwal
Chief Editor, IPS Newsletter

New Disease Report

Black rot disease incited by Indian race 1 of *Xanthomonas campestris* pv. *campestris* in *Brassica juncea* L. cv. Pusa Bold in India

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Xanthomonas campestris pv. *campestris* (Pammel) Dowson is a Gram-negative bacterium that causes black rot disease in crucifer crops. Mustard (*Brassica juncea* L.) is an important oil seed crop in the *Brassicaceae* family. First time reported the typical

symptoms of black rot disease in resistant cultivar of *Brassica juncea* cv. Pusa Bold by Xcc. The genus of strain was identified by using 16S ribosomal RNA gene. The species and race were characterized by type 3 secretion system (T3SS) genes and race 1 specific marker namely xcc-b100_4389 respectively. The sequences were deposited in GenBank (16S rRNA: OM839780; *AvrBs1*: OM994397*; AvrGf1*: OM994398; xcc-b100_4389: OM994399). The XccAK1 strain (ITCCBH_0014) was deposited in Indian Type Culture Collection, ICAR-IARI, New Delhi, India.
(https://doi.org/10.1094/PDIS-04-22-0738-PDN)

Awards/Honours/Promotions

- **Dr. S.I. Harlapur,** Principal Scientist (Plant Pathology), AICRP on Maize, MARS, UAS, Dharwad, have been awarded "Fellow of Maize Technologists Association of India (FMTAI) in recognition of significant contributions in the field of maize pathology by Maize Technologist Association of India, ICAR-IARI, New Delhi during the National conference on maize for Resource Sustainability, Industrial Growth and Farmers Prosperity held during February 23-25, 2022 at Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan.
- **Prof. Pratibha Sharma**, ICAR Emeritus Scientist, SKNAU, Jaipur-Jobner, Rajasthan received "Life time Achievement Award" awarded during Krishi Evam Swasthya Amrit Mahotsav & Mega Agri Expo-2022 and "International Conference on Agricultural Development its Challenges and Future Needs" organized by S.K. Chaudhary Educational Trust's - Krishi Vigyan Kendra, Madhubani, Bihar on 9th April 2022.
- **Mr. Amit Kumar Kesharwani**, Scientist, Department of Microbiology, Absolute Foods, Gurgaon, Haryana has been awarded International Travel Support (ITS) by Science and Engineering Research Board, Government of India for participating in "7th Xanthomonas Genomics Conference Florida 2022" organized by University of Florida at Sheraton Sand Key Resort, Clearwater, Florida, USA held on 13-17th June 2022. He has also been awarded Best Poster Presentation Award during National E-Conference on Biotic Stress Management Strategies for Achieving Sustainable Crop Production and Climate Resilience organized by ICAR, NCIPM, SPPS, IARI at New Delhi, India held during 19-21 May 2022.
- **Dr. P. Madhusudhan**, Senior Scientist (Plant Pathology), Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Nellore, Andhra Pradesh has been awarded with Sri Veerapaneni Narasimham Memorial Gold Medal for the year 2018-19.
- **Dr. Shamarao Jahagirdar**, Professor of Plant Pathology, University of Agricultural Sciences, Dharwad, India visited Tampere University, Finland from 10-24 May 2022, and undergone the international training and exposure on Product development and commercialization with reference to plant protection and AI based diagnostics under ICAR-NAHEP-IDP Project, UAS, Dharwad. He has also participated (online) in Agri Science Congress organised by University of Heilsinki, Finland from 14-15th June, 2022.
- **Dr. D.J. Bagyaraj**, NASI Honorary Scientist and Chairman, Centre for Natural Biological Resources and Community Development, Bengaluru, Karnataka conferred with Honorary Fellowship by Karnataka Science and Technology Academy on August 2, 2022 for his contributions to Agricultural Microbiology, especially Mycorrhizal Fungi.
- **Dr. Sudisha Jogaiah**, Assistant Professor, PG Department of Biotechnology & Microbiology, Karnatak University, Dharwad, Karnataka has been received Bridge Fellow, Government of Japan (2022).
- **Dr. Dinesh Singh**, Principal Scientist, ICAR-Indian Agricultural Research Institute, New Delhi, has received B.P. Pal Memorial lecture Award from the National Academy Biological Sciences, Chennai.

- **Dr. Gururaj Sunkad** has assumed the post of Dean (Post-Graduate Studies), University of Agricultural Sciences, Raichur, Karnataka from 1st June 2022.
- **Dr. (Smt.) Om Gupta** joined as Visiting/Emeritus Professor, Plant Pathology at Rani Laxmi Bai Central Agricultural University, Jhansi, Uttar Pradesh on 15th June 2022.
- **Dr. Krishna Kumar**, Dean, Pandit Deen Dayal Upadhyay College of Horticulture & Forestry, Piprakothi, RPCAU, Pusa has assumed the additional charge of the Vice Chancellor of Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar with effect from 1st July 2022.
- **Dr. B. Anjaneya Reddy** has been promoted to Associate Professor of Plant Pathology, in the University of Horticultural Sciences, Bagalkot Karnataka and Posted at Regional Horticultural Research and Extension Centre, UHS Campus GKVK, Bengaluru, Karnataka.
- **Dr. Phatik Tamuli**, Associate Professor, PG Department of Botany, Darrang College (Gauhati University), Tezpur, Assam, India has joined as Principal, Lanka Mahavidyalaya, Lanka, Assam.

Symposia/Workshop: Organized

National e-conference on "Biotic stress management strategies for achieving sustainable crop production and climate resilience" was organized by the Society of Plant Protection Sciences in collaboration with ICAR-NCIPM and ICAR-IARI, New Delhi during May 19-21, 2022 at ICAR-NCIPM, New Delhi.

Books Published

Management of Postharvest Diseases and Value Addition of Horticultural Crops

Editors: Dinesh Singh, V. Devappa, S. Jahagirdar, H.R. Gautam and Rashmi Aggarwal
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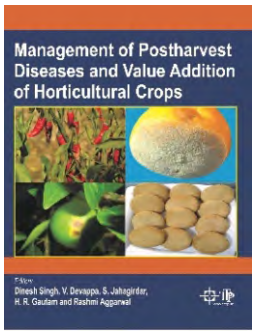

Editorial Board - Newsletter

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