



From President's Desk

Removing Recalcitrance to Use Diagnostic Tools in Decision Support Systems for Disease Management

Crop losses due to infections with pathogens such as bacteria, viruses and fungi are persistent threats to crop biosecurity. Hence, precise diagnosis and timely detection of plant pathogens within the source are the most important steps in control of plant diseases and mitigating the economic losses.



Advancements in science have revolutionized the protocols for diagnosis of plant diseases. Precise tools and techniques developed for rapid detection of pests and plant pathogens include various methods based on polymerase chain reaction (PCR), including Real time-PCR, and most recently – lateral flow strip based recombinase polymerase amplification (LF-RPA) and serological methods including immunofluorescence, fluorescence *in situ* hybridization (FISH) and enzyme-linked immunosorbent assay (ELISA), etc. Application of infrared thermal and hyperspectral imaging for the rapid diagnosis of crop diseases have been a recent development. Optical imagery in the visible and near-infrared (Vis-NIR) wave-lengths have been potentially used to detect changes in crop traits caused by pathogens. Recent developments also include use of highly sensitive sensors and multiple data analysis pipelines in various patho-systems, such as Optical Sensors: RGB-imaging, multispectral, thermal, chlorophyll fluorescence and 3D sensors for plant disease detection. Non-invasive field-deployable sensors based device called electronic nose (e-nose), has been perfected and successfully used for detection Volatile Organic Compounds (VOC) specific to a variety of host-pathosystems. While these next-generation diagnostics have been perfected and/or are already employed in other countries, their development is yet to be initiated in our country for pathogen detection and disease diagnosis.

PCR and serology based diagnostics have been developed in several plant pathology labs across the

country in India. However, I rarely see their deployment in fields as a part of decision support system for crop disease management. In present form, these are hardly used to detect the presence of pathogens, overwintering as inoculum in soil, crop residues, seeds, etc. Presence of pathogens from the previous seasons as resting propagules in crop residues and infected seeds, serve as primary inoculum. Timely detection of the pathogens and their threshold within the sources of perennation holds key to mount management practices, enabling judicious use of pesticides, environmentally safe good agricultural practices (GAP) and protecting avoidable crop losses. Recalcitrance of users in the use of diagnostic tools as decision support system may be due to obvious and valid reasons. The diagnostic tools need to be simple and user-friendly that enable quick and timely detection. Besides, infested soils used for PCR detection may have PCR inhibitors that may interfere with detection of pathogens. Similarly, serological methods need antigens in relatively pure form and thus *in situ* detection of pathogen could pose limitations. Researchers thus must work to make diagnostic methods amenable for detection of pathogen in fields or other sources of perennation. E-noses that can detect patho-system based VOC and other sensor based devices thus can be a potential gadgets in this regard.

P.K. Chakrabarty

President

Indian Phytopathological Society

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Editorial

Transcriptomics unravels biocontrol mechanisms

Biological control of plant diseases using fungal and bacterial biocontrol agents (BCAs) has many advantages, including rapid growth, environmental friendliness, and broad-spectrum resistance. To determine the mechanisms of biocontrol, it is important to examine the interactions between a plant pathogenic fungus, the host plant, and the environmental components. The transcriptome studies in biocontrol agents have been particularly useful in terms of providing a better understanding of how these BCAs act and of the complex gene regulation sustaining the effect of biocontrol agents on the pathogenesis. More specifically the transcriptome results highlight the genes involved in wide adaptation, competition for nutrients and space, the genes involved in pathogen cell wall degradation (glucanases, chitinases, glucosidase, cellulases proteases etc) and in antifungal metabolite production. Historically, transcriptomic studies on BCAs were carried out with hybridization and sequence-based targeted approach on candidate genes. This approach now has been progressively superseded by novel high-throughput RNA sequencing which has several advantages over previous approaches. It has already been applied in many biocontrol agents more so in *Trichoderma* to explore the mechanisms of biocontrol.



It has been observed that *Trichoderma* spp. exert antimicrobial effects through a variety of biocontrol mechanisms, including competition, mycoparasitism, secretion of resistant proteins, and induction of plant systemic resistance. The mycoparasitism mechanism in *T. harzianum* is related to the specific recognition between the α -agglutinin anchorage subunit of pathogenic fungi and the α -agglutinin core protein AGA1 of the *T. harzianum* cell wall. After recognizing pathogenic fungi, *T. harzianum* induces a series of signal transduction pathways, including signal transducer heterotrimeric proteins (G proteins) and MAPK motif during the process of mycoparasitism. Polyketides are the main antibiotic

metabolites produced by *Trichoderma* and other BCAs. Transcriptomics data has shown that there are 402 biocontrol genes in *T. harzianum* ACCC30371, including 14 related to competition, 311 to mycoparasitism, 76 to antibiosis, and one gene related to eliciting plant response. *T. harzianum* exerts antimicrobial effects through these biocontrol mechanisms, which depended on expression of genes related to biocontrol functions. Similarly recent transcriptome profiling of *Chaetomium globosum* strain Cg2 during interaction with *Bipolaris sorokiniana* using RNA-seq led to identification of 6109 unique DEGs. The predominant transcripts identified as genes were involved in catalytic activity, and metabolic activity. Heat map and cluster categorization suggested an increase in the expression levels of genes encoding secondary metabolites such as polyketide synthase, S-hydroxymethyl glutathione dehydrogenase, terpene cyclase and other hydrolytic CAZymes such as glycosyl hydrolase family, chitinases, β 1 3 glucanases, glucan endo-1,3-beta-glucanases, proteases etc. Such novel data set generated will further help in better understanding of genomics of BCAs and crop health management.

Rashmi Aggarwal
Chief Editor, IPS Newsletter

Research Highlights

Mass multiplication of *Ustilaginoidea virens* conidia using rice leaf as a substrate

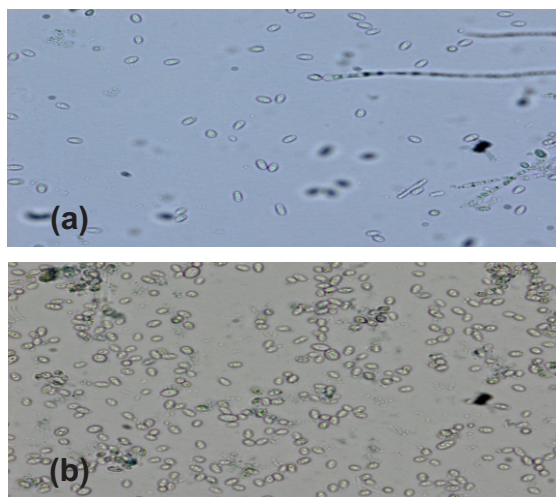
D. Ladhalakshmi*, M. Bhaskar, G.S. Laha, V. Prakasam and M. Srinivas Prasad

ICAR-Indian Institute of Rice Research, Hyderabad - 500030, Telangana

*Correspondence: Dladha.lakshmi@icar.gov.in

In India, rice false smut disease incited by *Ustilaginoidea virens* (Cooke) Takahashi is gaining significant importance because it affects the grain yield and quality of grain. To identify the resistant sources, mass multiplication of inoculum is the important step to evaluate the germplasm. Hence, rice leaf extract (with or without filtering), either singly or in combination with sucrose was tested for its ability to induce sporulation of false smut pathogen. In comparison to potato sucrose broth, both filtered and

unfiltered rice leaf extract broth, without adding of sucrose enhanced the conidiation in *U. virens*. However, unfiltered rice leaf extract (6g/100ml) recorded more number of conidial production (32.83×10^6 conidia/ml) in *U. virens* compared to filtered rice leaf broth (16.35×10^6 conidia/ml) and potato sucrose broth (1.08×10^6). The study will be helpful to develop resistant varieties against false smut disease of rice.



Conidiation in *Ustilaginoidea virens* on rice leaf substrate amended media (a: Potato Sucrose broth; b: Unfiltered rice leaf broth)

Invasive/Emerging Pests/New Reports

New report of *Dickeya fangzhongdai* causing bacterial soft rot disease on *Dendrobium nobile* in India

A. Balamurugan¹, A. Kumar², K. Sakthivel³, M. Ashajyothi^{4*}, Kuleshwar Prasad Sahu² and M. Karthikeyan¹

¹Department of Plant Pathology, TNAU, Coimbatore - 641003, Tamil Nadu, India; ²Division of Plant Pathology, ICAR-IARI, New Delhi - 110012, India; ³Crop Protection Section, ICAR-Indian Institute of Oilseed Research, Hyderabad - 500030, Telangana, India; ⁴Seed Pathology Lab, ICAR-Indian Institute of Seed Science, Mau - 275103, Uttar Pradesh, India

*Correspondence: aashjyo18@gmail.com

Soft-rot disease on *Dendrobium nobile* (Noble dendrobium) was found in a commercial farm in the Nilgiris and Kotagiri districts of Tamil Nadu, India. The disease incidence was more than 70%. Milky exudation on the cut end of infected leaves indicated the bacterial etiology of the disease. Phenotypic and 16S rRNA based

molecular characterization confirmed the pathogen as *Dickeya fangzhongdai*. Phylogenetic analysis of all three isolates DDf_Kot1, DDf_Kot2, and DDf_Kot5 were clustered with strains of *D. fangzhongdai*. It is first report from India.

(DOI: <https://doi.org/10.1007/s10658-020-02094-7>)



New report of 16Srl-D group phytoplasma strain associated with mango malformation and witches' broom disease in Punjab

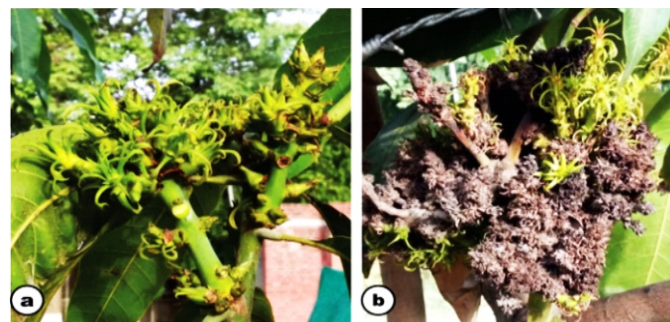
Prasenjit Debnath¹, Surabhi Mitra², Amar Bahadur¹ and G.P. Rao^{2*}

¹College of Agriculture, Tripura, Lembucherra - 799210, West Tripura, India; ²Division of Plant Pathology, ICAR-Indian Agricultural Research Institute, New Delhi - 110012, India

*Correspondence: gpao_gor@rediffmail.com

Mango malformation and witches' broom affected mango samples were collected from orchards from Ludhiana, Punjab, India during 2020. Phytoplasma was found associated with the symptomatic mango using 16S rRNA and *secA* genes specific primers. Pair wise sequence comparison, phylogenetic analysis and virtual RFLP analysis of 16S rRNA and *secA* gene sequences of mango phytoplasma strains confirmed association of aster yellow group related phytoplasma strain into 16Srl-D subgroup. This is first report of 16Srl-D subgroup occurrence with mango malformation and witches' broom disease in world.

(DOI: [10.5958/2249-4677.2020.00008.0](https://doi.org/10.5958/2249-4677.2020.00008.0))



(a) Malformation and witches' broom, and (b) shoot necrosis in malformed branches

New reports of *Candidatus Phytoplasma asteris* (16Srl-B subgroup) and *Ca. P. oryzae* (16SrXI-B subgroup) associated with leaf yellowing and declining diseases of pomegranate and grapevine in Maharashtra

Govind Pratap Rao^{1*}, Ashutosh Rao¹, Manish Kumar², Hemavati Ranebennur¹, Surabhi Mitra¹ and Ashok Kumar Singh³

¹Division of Plant Pathology, ICAR-Indian Agricultural Research Institute, New Delhi - 110012, India, ²Division of Plant Pathology, Agricultural Research Station, Mandor, Agriculture University, Jodhpur - 342304, Rajasthan, India, ³Division of Plant Pathology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Chatha - 180009, Jammu, India

*Correspondence: gprao_gor@rediffmail.com

Symptoms of leaf yellowing and reddening were observed in pomegranate and grapevine orchards at Baramati, Pune. Phytoplasmas belonging to two different groups were detected in symptomatic samples in PCR using phytoplasma specific primer pairs amplifying 16S rRNA and *secA* genes. The pair-wise sequence comparison and phylogenetic analysis confirmed the presence of '*Candidatus Phytoplasma asteris*' (16Srl-B) in grapevine and *Ca. P. oryzae* (16SrXI-B) subgroups - related strains in symptomatic pomegranate samples from different orchards at Baramati, Pune.

(DOI: <https://doi.org/10.1007/s10658-020-01949-3>)



a: Leaf yellowing and reddening in grapevine

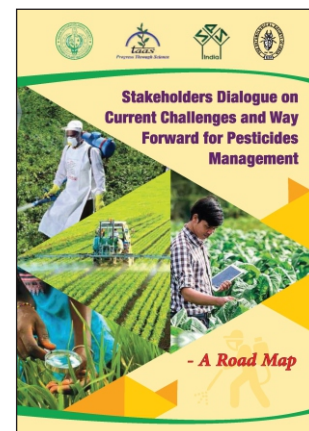


b: leaf yellowing in pomegranate

Symposia/Workshop: Organized/Attended

- **“Stakeholders Dialogue on Current Challenges and Way Forward for Pesticides Management”**

The Trust for Advancement in Agricultural Sciences (TAAS), a neutral Think Tank for strengthening agricultural research and innovation for development (ARI4D), in collaboration with the Society of Pesticide Science (SPS) India, the I n d i a n



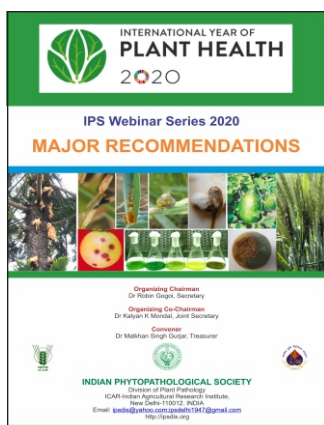
Phytopathological

Society (IPS), and the Entomological Society of India (ESI) organized a webinar on “Stakeholders Dialogue on Current Challenges and Way Forward for Pesticides Management” on 24 July, 2020. The mega meet was attended by 78 participants including eminent experts, senior research managers, government officials representing diverse stakeholder groups, viz., central and state governments, scientific societies and institutions, pesticide industry and farmers. The main objectives of the dialogue were: i) to discuss major constraints and explore solutions for phasing out of certain pesticides test proposed by Government, ii) to seek views of stakeholders on proposed 'Pesticides Management Bill 2020' and suggest possible alternatives for accelerated growth of pesticides in India, and iii) to review and suggest reorientation of pesticides management, present regulatory system, existing policies and enabling environment for growth of pesticide industry to promote botanicals and agrochemical R&D in the country. During the dialogue, in-depth discussions were held on constraints and challenges, banning of pesticides, provisions in Pesticide Management Bill 2020, research and innovation for development of pesticides, policy implications and understanding pesticides industry's perspectives. It was strongly

felt that there is an urgent need to develop a clear Road Map for disruptive innovation in the field of chemical pesticides and botanicals through greater investment in R&D, both by public and private sector, and through creation of centres of excellence to achieve desired goals. IPS strongly preferred the need for science-led decisions and stake holder dialogues before any pesticides are approved for ban.

• **IPS Webinar Series 2020-21**

The IPS webinar series 2020-21 was organized by the Society including all aspects of plant pathology. All the 8 zones of the Society participated in the webinar series. A total 15 lectures were delivered by the renowned plant pathologists of the country as well as from abroad. The webinar series received a keen interest and enthusiastic response, and appreciation from the members, faculty, students as well as plant pathology fraternity and IPS members. Total 10,486 participants registered for these lectures. Out of these, more than 4,500 have attended these lectures. The Society is thankful to all the zonal presidents and councilors for organizing such wonderful lectures from respective zones. The major recommendations emerged from the webinar series have been compiled in the bulletin form and are available on IPS Website.



• **International Webinar at Bundelkhand University, Jhansi Uttar Pradesh, June 26-27, 2020**

Department of Botany, Bundelkhand University, Jhansi Uttar Pradesh, organized an International Webinar on “Recent advances in disease management of vegetable crops” on 26th & 27th June, 2020.

- **Dr. Touseef Hussain**, DST/SERB-NPDF, AMU, Aligarh INDIA participated in training on (i) Crop Pest

diagnosis course powered by Plantwise and CAB International, U.K, on 24th April, 2020; (ii) One week Webinar cum faculty development program series on current progress and future prospects on Biotechnology organized by Department of Biotechnology CBIT in association with Andhra Pradesh Akademi of Sciences from 8-13th June, 2020, and (iii) 5 days online training program on “Entrepreneurship development in pest management for youth” organised by College of Agricultural, Iroisemba, Central Agricultural University, Imphal, Manipur from 29th to 3rd July, 2020 under NAHEP project.

Awards/Honours/Promotions

- **Dr. Rashmi Aggarwal**, Head, Division of Plant Pathology and Dean & Joint Director (Education) received Panjabrao Deshmukh Outstanding Women Scientist Award of ICAR for the year 2020.
- **Dr. Kalyan K. Mondal**, Principal Scientist, Division of Plant Pathology, ICAR-IARI, New Delhi is recognized as an expert reviewer for EuroXanth DokuWiki (<http://internet.myds.me/dokuwiki>). This Wikipedia-like profiles covers *Xanthomonas* virulence factors (i.e. type III effectors) and for plant resistance genes against *Xanthomonas* or *Xylella*. This is under the COST (Collaboration On Science and Technology) action, called “EuroXanth that aims at integrating science on Xanthomonadaceae for integrated plant disease management in Europe” involving partners from 36 countries.
- **Dr. Madhvi Soni**, NPDF (DST-SERB Project code: PDF/2016/002322) working under the mentorship of Dr. Kalyan K. Mondal at Division of Plant Pathology, ICAR-IARI, New Delhi ranked among the Top 15 Percent candidates for Merit Certificate award of NPDF Poster competition. The competition was organized by Science and Engineering Research Board & American Chemical Society Publications. Dr. Madhavi scored 8/10 and ranked 21 among the contestants.
- **Dr. Neeraj Srivastava** (Associate Professor of Botany, St. Andrew's Post-Graduate College, Gorakhpur, U.P.) was elected as "Associate Fellow of Mycological Society of India (AFMSI)" for the year

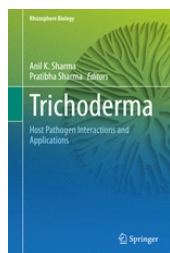
2019 in recognition of his contribution in the field of Mycology, by the Mycological Society of India. He is Life Member of Indian Phytopathological Society, Indian Botanical Society, Mycological Society of India and The Indian Science Congress Association.

- **Dr. A.K. Pandey**, Head, Department of Life Science, R.D. University, Jabalpur has taken over as Vice Chancellor, Vikram University, Ujjain, Madhya Pradesh on 13th September 2020.
- **Dr. (Smt) Om Gupta**, Director Extension JNKVV, Jabalpur, Madhya Pradesh has been nominated by ICAR Member of the Research Advisory Committee of ICAR-Indian Institute of Pulses Research, Kanpur for a period of three years (19.7.2020 to 18.07.2023).

Books Published

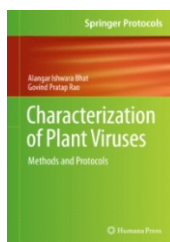
1. Trichoderma- Host Pathogen Interactions and Applications

Editors: Anil K. Sharma and Pratibha Sharma
Published by: Springer Nature Singapore Pte Ltd.
June 2020



2. Characterization of Plant Viruses: Methods and Protocols

Authors: Bhat, Alangar Ishwara, Rao, Govind Pratap,
Published by: Humana Press, USA
ISBN: 978-1-0716-0333-8; doi: 10.1007/978-1-0716-0334-5



3. PLANT DOCTOR

Author: Dr. Vasanth Kumar Thimakapura
Publisher: SPRINGSON PUBLICATIONS, Mysore, Karnataka



4. Laboratory Techniques in Plant Bacteriology

Author: Suresh G. Borkar
Publisher: CRC Press, USA.
ISBN -13:978-1-138-63405-3

5. Bacterial Diseases of Crop Plants

Author: Suresh G. Borkar
Rupert Anand Yumlembam
Publisher: CRC Press, USA
ISBN – 13-978-1-4987-5598-6 (Hardback)

IPS Zonal Symposia (Virtual) 2020-21

Southern Zone: Dec. 1-2, 2020

Topic: Advances in Crop Health Management
Contact: Dr. P Nallathambi, Zonal President, (scientist_thambi@yahoo.co.in),
Dr. C. Umamaheswari, Zonal Councillor (maheswari_ars@yahoo.co.in)

North Eastern Zone: Dec. 7-8, 2020

Topic: Plant disease management- experiences and aspirations
Contact: Dr. N. Tiameren Ao, Zonal President (ntiamerenao@asia.com)
Dr. Susanta Banik, Zonal Councillor (susanta.iari@gmail.com, baniksus@yahoo.com)

Delhi Zone: Dec. 16, 2020

Topic: Modern trends in systematics and bio-prospecting of fungi
Contact: Dr. T. Prameela Devi, Zonal President (prameelancha@yahoo.co.in)
Dr. Deeba Kamil, Zonal Councillor (deebakamil@gmail.com)

Northern Zone: Dec. 18-19, 2021

Topic: Combatting rusts and Karnal Bunt of wheat: past and future strategies
Contact: Dr. Jaspal Kaur, Zonal President (jassu75@pau.edu)
Dr. Abhishek Sharma, Zonal Councillor (abhishek@pau.edu)

Central Zone: Jan. 6-7, 2021

Topic: Advances in Phytopathology
Contact: Dr. B. Srinivasulu, Zonal President (beyyalas@gmail.com; de@drysrhu.edu.in)
Dr. K. Sessa Kiran Zonal Councillor (seshakiran.kollipara@gmail.com, seshakiran@hotmail.com)

Eastern Zone: Jan. 19-20, 2021

Topic: Robust plant protection strategies for sustainable agriculture
Contact: Dr. A.K. Mukherjee, Zonal President (arupmukherjee@yahoo.com, titirtua@gmail.com)
Dr. M.K. Bag, Zonal Councillor (manas.bag@gmail.com)

Western Zone: Jan. 21-23, 2021

Topic: Probing beneficial microbes for next green revolution
Contact: Dr. R.M. Gade, Zonal President (gadermg@gmail.com)
Dr. Y.V. Ingle, Zonal Councillor (yog_ingle@rediffmail.com; nitiningle02@gmail.com)

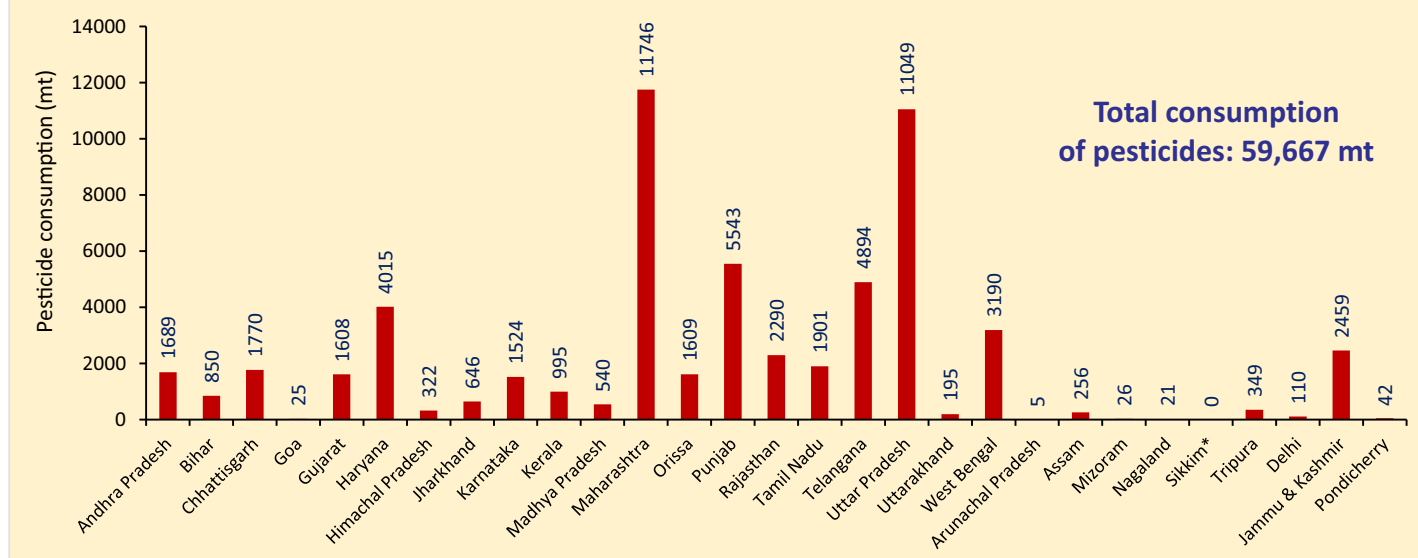
Mid-Eastern Zone: Jan. 27-28, 2021

Topic: Biocontrol of plant diseases under current scenario of pesticide restriction
Contact: Dr. M.R. Khan, Zonal President (mrkhan777in@yahoo.co.in)
Dr. M.R. Siddiqui, Zonal Councillor (mansoor_bot@yahoo.co.in; smansoorbot@gmail.com)

Plant Protection Medley

Policy issues, major decision, new product registration

Consumption of Pesticides in States & UTs during 2018-19 (as on 13.04.2020)



*Sikkim: Organic state; Source: States/UTs Zonal Conferences on Inputs (Plant Protection) for Rabi & Kharif Seasons.

<http://www.ppgs.gov.in/statistical-database>.

The recent endorsement (label expansion) was made for the following products:

Industries	Products	Crops	Diseases	MRL
M/s Parijat Industries (India) Pvt. Ltd.	Difenoconazole 25 % EC	Cumin	Blight & Powdery mildew	0.01
		Onion	Purple blotch	0.05
M/s Anu Products Limited	Hexaconazole 5% SC	Grape	Powdery mildew disease	0.10
M/s Parijat Industries (India) Pvt. Ltd.	Azoxystrobin 11% + Tebuconazole 18.3% SC	Grape	Powdery mildew and Downy mildew	0.50 -Azoxystrobin 0.01 -Tebuconazole
		Apple	Scab, Powdery mildew & Premature leaf fall	0.20- Azoxystrobin 1.00-Tebuconazole
M/s FIL INDUSTRIES LIMITED	Carbendazim 25 % + Mancozeb 50% WS	Maize	Seed rot & Seedling blight	0.5- Carbendazim 0.2-Mancozeb
		Black gram	Root rot & Collar rot	ST- Carbendazim ST- Mancozeb
		Bengal gram	Dry root rot and Collar rot	ST- Carbendazim ST- Mancozeb
		Soybean	Root rot & Collar rot	ST- Carbendazim ST- Mancozeb
		Onion	Damping off	ST- Carbendazim ST- Mancozeb

*ST-Seed treatment

Source: <http://www.ppgs.gov.in/statistical-database>.

Editorial Board - Newsletter



Dr. Rashmi Aggarwal
Chief Editor
rashmi.aggarwal2@gmail.com



Dr. Kalyan K. Mondal
Senior Editor
kalyanmondal@yahoo.com



Dr. Robin Gogoi
Ex-officio
r.gogoi@rediffmail.com



Dr. Malkhan Singh Gurjar
Managing Editor
malkhan_iari@yahoo.com

Editors



Dr. T. Prameela Devi
prameelancha@yahoo.co.in



Dr. Deeba Kamil
deebakamil@gmail.com



Dr. Jaspal Kaur
jassu75@pau.edu



Dr. Abhishek Sharma
abhishek@pau.edu



Dr. M.R. Khan
mrkhan777in@yahoo.co.in



Dr. M.A. Siddiqui
mansoor_bot@yahoo.co.in



Dr. B. Srinivasulu
beyyalas@gmail.com



Dr. K. Sessa Kiran
seshakiran.kollipara@gmail.com



Dr. R.M. Gade
gademg@gmail.com



Dr. D.L. Wasule
dhirajwasule@yahoo.com



Dr. Arup K. Mukherjee
arupmukherjee@yahoo.com



Dr. M.K. Bag
manas.bag@gmail.com



Dr. P. Nallathambi
scientist_thambi@yahoo.co.immaheswari_ars@yahoo.co.in



Dr. C. Uma Maheswari
ntiamerena@yahoo.co.in



Dr. N. Tiameren Ao
ntiamerena@asia.com



Dr. Susanta Banik
susanta.iari@gmail.com

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Indian Phytopathological Society

Division of Plant Pathology
ICAR-Indian Agricultural Research Institute
New Delhi – 110 012, India,
Tel: +91-11-25840023

E-mail: ipsdis@yahoo.com, website: <http://ipsdis.org>

Necrology

The Society is distressed at sad demise of following three life members of the Society, namely and expresses condolence to the bereaved family:

- **Dr. B.B.S. Raizada**, ex-Director, College Development Council, U.P., on 16th July 2020 at 3.00 PM at the age of 90 at his residence in Paschim Vihar, New Delhi.
- **Dr. K.P. Srivastava**, ex-Principal Scientist in Division of Entomology, IARI, New Delhi, on 29th June 2020 at the age of 82.
- **Dr. D.P. Thakur**, former Director (Extension Education), CCSHAU, Hisar, Haryana on 7th August 2020 at the age of 83.



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<https://link.springer.com/journal/42360/online>
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