ISSN 2581-6330 (Online)

Indian Phytopath News

A quarterly Newsletter of Indian Phytopathological Society

http://ipsdis.org/ Volume 4 • Issue 2 • April - June 2021

From President's Desk

Impact of COVID 19 and opportunistic human pathogens

At the outset, I thank all our Indian Phytopathological Society members to give this nobility and prerogative to serve you . Despite my all efforts to write exclusively on the Plant Pathology aspects, my mind is focusing to human health and impact of COVID-19 on humanity. Since 2020, we have been continuously facing pandemic crisis, and I understand how deep concern is this scary situation. We all are affected and lost our loved ones, and unfortunately not having the proper space and time to grieve. Words are not sufficient to express the sorrow and sadness for the loss of our colleagues. My all-heartfelt tributes to each one of them, personally and on behalf of our IPS members.

At this juncture while our medical scientists are busy solving the medical crisis caused due to COVID-19 virus, suddenly the month of May 2021 has witnessed another agony caused by black and white fungus in Diabetic patients or COVID recovered patients. The fungal infections have been reported in the COVID-19 patients and immunologically suppressed or immunocompromised individuals. This class of fungi belongs to Mucoromycetes and are common mold present in the environments, air, soil, water, compost, decaying vegetables, and fruits. The fungus invades the sinus and makes its way into the infraorbital and intracranial regions. COVID-19 patients who have received steroids are particularly at risk because steroids suppress the immune system. The number of opportunistic and pathogenic fungi in compromised patients, caused by *Candida* spp., *Aspergillus* spp., *Cryptococcus neoformans*, *Histoplasma capsulatum* and *Coccidioides immitis*, occur as saprophytes in the environment and were non-pathogenic are now being encountered human pathogens. Important progress has been achieved in understanding fungal pathogenicity including the mechanisms of adherence to host tissues, penetration of tissues, multiplication within the host, and the interaction of fungal cells with host effector cells.

As a plant pathologist we cannot forget how the great Irish famine caused by the Oomycete *Phytophthora infestans* during 1843-45 left a million people dead, which wiped out the country's staple potato crop. Today, we are experiencing a pandemic situation due to a virus and epidemic of fungi like Mucor in humans. This fungus is reported to produce millions of microscopic spherical, dark-hued spores, which disperse by air and when they land on moist surfaces, like soil or plant material, begin to germinate and produce thread like structures called mycelia, which feed on sugars in their surroundings and grow. In tropical areas like India, spore counts are generally higher during the summer than during the monsoons. But compared to the 1,000-5,000 spores per cubic meter outdoors, the count inside homes is typically 100-250 only. The hospital air could carry many opportunistic pathogenic fungi like Candida, Aspergillus, Penicillium and Rhizopus. A patient with a weak immune system inhales the Mucor spores develop mucormycosis. This is a rare, non-contagious

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disease – but it can be debilitating or fatal if not treated quickly. The organ transplantation in humans has predisposed the human body to mucormycosis infections principally because of the dependence on immunosuppressant drugs. The occurrence of such infections has led to revisit the investigation of fungal infections, choice of treatment, diagnosis, identification thus leading to appropriate treatment.

As an Agriculture and Plant Pathology fraternity, what we understood as Mucor rot was a common problem on pome fruits (apples and pears) as well as on other commercial crops including stone fruits (cherry, peach, nectarine, prune, plum), raspberries, and citrus fruits. This becomes a challenge because of the non-applicability of postharvest fungicides against Mucor. Only cultural practices like burning of orchard debris, sanitization of bins, clean storage houses, hot water treatment, dry treatment, ventilated areas are practiced. Times have come where medical scientist and plant pathologist can work hand in hand and deal with such problematic fungi. We need to widen our vision so that plant and human health issues are well understood. The advances of modern medicine have made millions of people susceptible to fungal infections by disrupting immune defenses. The medical scientists need to understand and take lessons from the pesticide misuse in the crops which brought affinity towards organic crops. The side effects of medicines in human body or use of pesticides and fertilizers in crops, the challenge is same. This is high time to work on such saprophytic fungi which have become opportunistic pathogen. It is not only the medical labs, or hospitals which must be saved, we need to be careful about our human or plant pathology, microbiology labs also. Areas like epidemiology and environment of opportunistic pathogens, advance medicine or pesticide residues, crop fertilizers and human nutrition need to be prioritized. Today we cannot ignore our lifestyles, food, and health management to develop a strong physical, emotional, and spiritual health. Today more than ever before, life must be characterized by universal responsibility, not only nation to nation and human to human, but also other forms of life.

Pratibha Sharma
President
Indian Phytopathological Society

Editorial

Impact of Climate Change on Plant Pathogens

The climate changes associated with global warming i.e., increased temperatures, changes in the quantity and pattern of precipitation, increased CO_2 and ozone levels, drought, etc. may affect the incidence and severity of plant diseases and further influence the coevolution of plants and their pathogens. Plant disease occurrence is generally driven by synchronous interaction of three factors: a susceptible host, the presence of a competent pathogen and conducive environment. The quantification and application of these interactions as a disease prediction models has also facilitated the simulation of potential impacts of climate change. Inoculum production and dispersal are critical for disease epidemics in field crops. Some examples are cited here. Wind can disperse fungal spores over thousands of kilometers, as has been observed for the wheat stem rust pathogen, *Puccinia graminis* as a critical part of its disease cycle. In maize, *Cercospora zeae-maydis* requires humidity higher than 95% for profuse sporulation. Pathogen dispersal is another aspect of epidemiology that can be influenced by climate change. Pathogens such as rust fungi often overwinter in warmer regions and migrate annually *via* wind to cooler regions during crop production. New virulent fungal lineages with adaptations suggested to have evolved in response to climate change. Wheat yellow rust, caused by *Puccinia striiformis* f. sp. *tritici* (*Pst*), has previously shown preference for cold areas but has recently been seen to invade warmer regions. Since 2000, *Pst* has been reported to have adapted to increased temperatures, with novel strains Pst1, Pst2, and "Warrior," which are more aggressive and thermotolerant, replacing older strains and spreading to new regions. These strains have now been reported worldwide, with major outbreaks occurring in south central United States and Australia. Similarly, in India, strains like 238S119 and 110S119 of Pst are reported to be high temperature loving. Sexual and asexual spore production in *Fusarium graminearum* requires the protein-refolding chaperone HSP90, which suggests a possible mechanistic connection between temperature response and sporulation. Asexual zoospore production in the oomycete *Phytophthora infestans* requires low temperatures. *Bipolaris sorokiniana* attacks different cereals, including wheat, and causes common root rot, spot blotch, and black point diseases. The incidence of black point disease is affected by many factors, most importantly lower temperature and higher humidity. Studies in India and Brazil have shown that spot blotch is usually favored by warm weather and high humidity. In addition, water stress and terminal heat stress have negative effects on the resistance of wheat to *B. sorokiniana*. Some pathogens depend on flower tissues as a point of entry to the host. For example, Fusarium head or ear blight, which causes large yield losses, reductions in grain quality and contamination with mycotoxins. Fusarium head blight (FHB) caused by *Fusarium graminearum* species, outbreaks occur particularly in years with warm and humid weather conditions, resulting in wheat yield losses of up to 75%. Over the past approximately 20 years, some temperate regions have seen a shift from *Fusarium culmorum*, which is associated with cooler and wetter conditions, to *F. graminearum*, which favours warmer, humid conditions. *F. graminearum* is more aggressive than *F. culmorum* and is associated with higher yield loss. Certain hosts become more resistant after a particular developmental stage, exhibiting a trait referred to as adult plant resistance. There are many examples of genes that follow this pattern in wheat, including leaf rust caused by *Puccinia triticina* resistance genes *Lr*13 and *Lr*34, and stripe rust caused by *Puccinia striiformis f. sp. tritici* resistance gene *Yr*39. These genes are activated by a combination of wheat developmental stage and temperature changes.

There are very many challenges in understanding the impact of climate change on plant pathogens as Climatic elements are intertwined, generating a multifactorial phenomenon of climate change. Interactions among the elements may be equally or even more important, primarily attributable to trade-offs in species adaptation. Lack of an adequate understanding of the adaptive patterns and mechanisms of plants pathogens, and their interactions to climate change is a major barrier. Species adaptation to fluctuating or directional climate changes is likely to be driven by a combination of quasi-genetic and genetic mechanisms leading to selection for plasticity or novel mutations. There is then an urgent need to empirically study the adaptive responses of pathogens and their hosts to climate changes using cutting-edge technologies with a combination of approaches under laboratory and field conditions.

Rashmi Aggarwal
Chief Editor, IPS Newsletter

Research Highlights

Multilocus sequence typing and single nucleotide polymorphism analysis in *Tilletia indica* isolates

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Karnal bunt of wheat is an internationally quarantined disease affecting trade, quality and production of wheat. The present study was undertaken to decipher genetic variations in Indian isolates of *Tilletia indica* collected from different locations (Fig. 1). Seven multilocus sequence fragments were selected to differentiate and characterize these *T. indica* isolates. A phylogenetic tree constructed based on pooled sequences of actin-related protein 2 (ARP2), β-tubulin (TUB), eukaryotic translation initiation factor 3 subunit A (EIF3A), glyceraldehyde-3-phosphate dehydrogenase (GAPDH), histone 2B (H2B), phosphoglycerate kinase (PGK), and serine/threonine-protein kinase (STPK) showed that isolate KB-11 (Kaithal, Haryana) was highly conserved as it was located in cluster 1 and has the maximum sequence similarity with the reference strain. Other isolates in cluster 1 included KB-16 and KB-17, both from Uttar Pradesh, and KB-19 from Haryana. Isolates KB-07 (Jind, Haryana) and KB-18 (Mujaffar Nagar, Uttar Pradesh) were the most diverse and grouped in a subgroup of cluster 2 (Fig. 2). Maximum numbers of single nucleotide polymorphisms (SNPs) were in the PGK gene (675) across the *T. indica* isolates. The minimum numbers of SNPs (67) were in KB-11 (Kaithal, Haryana), while the maximum number of SNPs (165) was identified in KB-18, followed by 164 SNPs in KB-14. KB-18 isolate was found to be the most diverse amongst all *T. indica* isolates. This first study on multilocus sequence typing (MLST) revealed that the population of *T. indica* was highly diverse.

(**Source:** https://doi.org/10.3390/jof7020103)

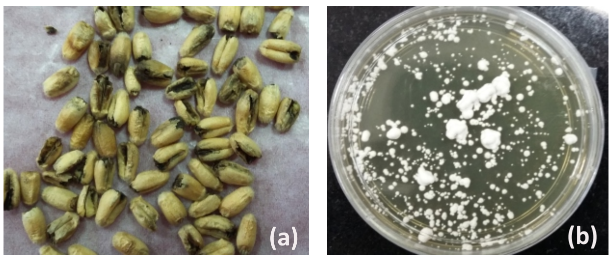

Fig. 1. Karnal Bunt disease (a) Infected wheat grains (b) Mycelial growth of *Tilletia indica*

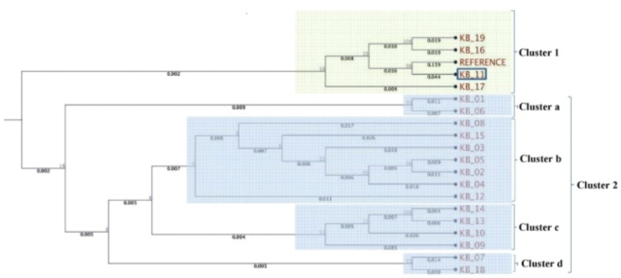

Fig. 2. Phylogenetic analysis of *T. indica* isolates using seven gene sequences

Bacterial antagonists against *Ganoderma lucidum* the incitant of root rot of Indian Mesquite

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Ganoderma lucidum is well known to causes extensive heart rots of standing trees by growing in the central, non-living woody tissue decomposing lignin and cellulose. Recently Indian arid regions witnessed large scale mortality in the Indian mesquite {*Prosopis cineraria* Druce}, locally known as Khejri tree, due to root rot caused by *Ganoderma.* Therefore, efforts were made to isolate antagonistic bacterial isolates from infected trees of *P. cineraria*. Several soil samples were analyzed and two bacterial isolates: strains AZAC-1 and AZ-11 were selected as potential antagonists against *G. lucidum* from arid soils. Dual culture showed highest percent inhibition of radial growth against *G. lucidum*. The bacterial strain, *Bacillus* sp. AZ-11 was also found as effective as AZAC-1 where an inhibition zone of more than 5 mm between the strain AZ-11and test pathogen was recorded with 35.6% reduction in *Ganoderma* growth compared to control Petri dishes. Taxonomic identity of the two strains was ascertained using 16S rRNA in EzBioCloud. The strains showed over 99.7% similarity and were identified as *Streptomyces* sp. strain AZAC-1 (MK459414) and *Bacillus* sp. strain AZ-11(MH304296). In arid region, one strain of *B. firmus* has also been reported as specific antagonist to *Macrophomina phaseolina* in earlier studies. Therefore, the isolated antagonistic bacterial strains will be potentially very useful and yield effective results in further field studies for management of this terrific pathogen.

(**Source:** https://doi.org/10.1007/s42360-021-00327-1)

Discovery and molecular morphometric analyses of *Waitea circinata* var. *prodigus* as the causal agent of a novel sheath spot disease of maize in India

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In India, maize is the third most important food crop after rice and wheat. A new disease was recurrently detected during the All India Coordinated Research Project (AICRP) surveys on maize conducted from 2013 to 2019 in the three North Eastern states of Assam, Meghalaya, and Manipur and the two Eastern states of Jharkhand and Odisha. The disease was named as maize brown sheath spot (MBSS). Unlike the banded leaf and sheath blight (BLSB) of maize caused by *Rhizoctonia solani*, the MBSS symptoms were discrete and limited to sheaths only (Fig. 1). Symptoms of MBSS in the field initially developed as water soaked necrotic lesions of 1 to 2 cm in diameter on lowermost leaf

Fig. 1. Symptom of maize brown sheath spot (MBSS)

sheaths, which progressed to upper sheaths. Lesions subsequently coalesced and covered approximately 2 to 5% of the sheath area. Infected dried lower leaves were shed while infected upper leaves remained on the stem. The causal agent was isolated, and the Internal Transcribed Spacer sequence 2 (ITS2) homology and phylogeny-based methods identified it as *Waitea circinata* var. *prodigus* (*Wcp*), a basidiomycetous fungus known to cause basal leaf blight of seashore paspalum. The pathogenicity of *Wcp* was proven by Koch's postulates on maize seedlings. Further comparative investigations were undertaken to differentiate the *Wcp* isolates from four other known varieties of *W. circinata* namely, var. *oryzae* var. *zeae*, var. *circinata*, and var. *agrostis*. Molecular morphometric analysis of the ITS2 regions of the five known varieties of *W. circinata* detected characteristic variations in GC content, compensatory base changes (CBCs), hemi-compensatory base changes (hCBCs), indels, and altered base-pairing of helices. Variations in those characteristics may indicate that the *W. circinata* varieties are distinct biological species morphologically grouped under the umbrella of *W. circinata* (sensu lato). The wide geographical distribution and potential impacts of MBSS on maize crop in India underscore the need for further investigations on the disease and its management.

(**Source:** doi: 10.1094/PDIS-05-21-0951-RE)

Invasive/Emerging Pests/New Reports

New report of *Pantoea stewartii subspecies indologenes* causing bacterial blight disease on *pearl millet* in India

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Pearl millet (*Cenchrus americanus* L.) cv. 7042S shown unusual water-soaked lesions on leaf tips spreading towards the leaf base from Manasagangothri region of Karnataka. Yellowish, circular, mucoid single bacterial colonies (PPi-M1) with regular margin were recovered from infected leaves after 24 hours of incubation at 28°C, and the same were used for further biochemical and molecular characterization. The isolate was characterized as Gram-ve rods, gelatin, starch hydrolysis negative, and catalase, indole production positive. The partial sequence of *16S rRNA* gene of the isolate PPi-M1 shown 99.5% nucleotide matching similarity (1410bp) with other *Pantoea stewartii* subspecies *indologenes* strains (MF163274; NR_104928) at NCBI database. In phylogenetic analysis using the maximum likelihood method PPi-M1 formed a distinct cluster with other *Pantoea stewartii* strains with bootstrap value >95 and it was distant from *P. allii*, *P. ananatis*, *P. agglomerans*, and *P. dispera*. Besides, the subspecies-specific PCR assay and subsequent sequencing of *galE* and *recA* genes also confirmed the identity of the isolate as *Pantoea stewartii* subspecies *indologenes*. Further, the pathogenicity test was performed *in-planta* on 21 days old seedlings of pearl millet cv. CO-10 by leaf clipping method. Re-isolated bacterial colonies from infected leaves shared similar morphological characters and molecular identity with inoculated culture, thus proving Koch's postulates. This study will supplement future pearl millet breeding programs, and to our knowledge, this is the first report of *P. s.* subsp. *indologenes* inciting pearl millet leaf blight disease in India.

(**Source:** doi: https://doi.org/10.1094/PDIS-03-21-0669-PDN

Symposia/Workshop/Training: Organized

- **Two days "National Webinar on Plant Diseases in Eastern and Northeastern India: Current Dynamics and Proposed Action Plan for their Management" (24-25, June, 2021)** organized by Department of Plant Pathology, College of Agriculture, Tripura (CAT) in collaboration with All India Coordinated Research Project on Pigeonpea (Tripura Centre), CAT and in association with ICAR-National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru

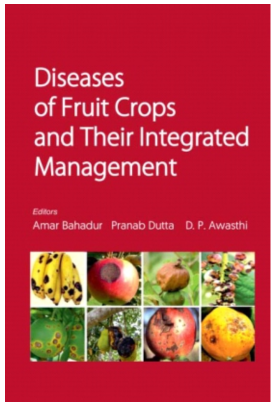
- **National Webinar on "Microbial Biopesticides: Next Generation Preparedness"** in pursuit of the Hon'ble Prime Minister's call for initiative on "*Azadi ka Amrut Mahotsava*", the DBT-North East Centre for Agricultural Biotechnology (DBT-NECAB) operating through Assam Agricultural University, Jorhat in collaboration with Departmennt of Plant Pathology, AAU, Jorhat has organized national webinar on *"Microbial Biopesticides : Next Generation Preparedness"* on July 2, 2021. The webinar was funded by the Department of Biotechnology, GoI. An overwhelming response in terms of 1500 registrations from across the country and abroad was received.

Awards/Honours/Promotions

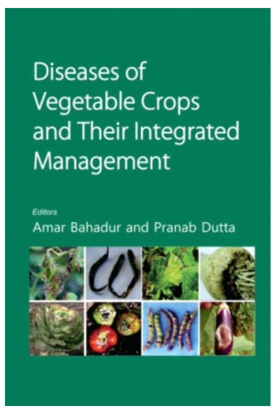
- **Dr. C.D. Mayee**, life member of IPS and past president of the society has a distinguished career in plant protection. The Federation of Indian Chambers of Commerce (FICCI), New Delhi has awarded Prof. Dr. Mayee with Distinguished Life Time Contribution (individual) Award in the Agrochemical sector during the FICCI Chemicals and Petrochemicals Award ceremony held in Delhi on 17th March 2021. Dr. Mayee is currently serving as President South Asia Biotechnology Center (SABC) and Advisor to Agrovision Foundation, Nagpur as well as the AgroSpectrum publication.
- **Dr. Amar Bahadur**, Assistant Professor, Department of Plant Pathology, College of Agriculture, Tripura, Lembucherra, Agartala, has been awarded "Best Senior Scientist" by Novel Research Academy, Puducherry, India and Fellow of Scholars Academic and Scientific Society (FSASS Society), Assam, India.
- **Prof. R.N. Kharwar**, was conferred Prof. P.C. Jain Memorial Award by Mycological Society of India, Chennai, in a three days National webinar and its 47th Annual Meeting held at Patiala from February 22-24, 2021.
- **Dr. N.N. Khune**, Ex. Professor of Plant Pathology, Nagpur received the prestigious "Bharat Ratna Mother Teresa Gold Medal Award" on 22nd May 2021 on his Phytopathological and other achievements from the Global Economic Progress and Research Association at Chennai, Tamil Nadu.
- **Dr. Nareshkumar M. Gohel,** Associate Professor, Department of Plant Pathology, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat has been selected as a member of the American Phytopathological Society (APS) for two years of complimentary membership w.e.f. July 1st, 2021. This program is managed collaboratively by APS Foundation and the APS Office of International Programs.
- **Mr. Pravin Babasaheb Khaire** has been awarded Young Plant Pathologist Award by Academy for Environment and Life Science, Agra for outstanding contribution in the field of Plant Pathology during National Conference on "Recent Trends and New Frontiers in Biotechnology, Agriculture, Science and Environment", Feb 22-23, 2020. He was also awarded Best Master Thesis Award 2020 entitled "Investigations on mungbean leaf blight caused by *Macrophomina phaseolina* (Tassi.) Goid". on the occasion of 4th International Conference "Global Approaches in Natural Resource Management for Climate Smart Agriculture During Pandemic Era of COVID-19". February 26-28, 2021.
- **Dr. Dilip Ghosh** has taken charge as Director, ICAR-Central Citrus Research Institute, Nagpur on 28th April 2021.
- **Dr. Dileep Kumar B.S.,** has been promoted to Chief Scientist from 4th September 2017 onwards at CSIR-National statute for Interdisciplinary Scientific and Technology (NIIST), Thiruvananthapuram, Kerala.
- **Dr. H.B. Singh** has been appointed as Chairman, State Level Expert Appraisal Committee, Uttar Pradesh vide The Gazette of India notification, New Delhi the 11th June 2021 by Ministry of Environment, Forest and Climate Change for a period of 3 years.
- **Ms. T.S.S. Chandana** working under the supervision of Dr. K. Sesha Kiran, Assoc. Prof, CoH, V.R. Gudem, Dr. Y.S.R. Horticultural University, Andhra Pradesh received student scholarship from International Society of Molecular Plant Microbe Interactions, USA for presenting during International e-Symposium of on "Evaluation of the efficacy of Bio fungicides, Plant extracts and Chemical fungicides in the management of *Fusarium incarnatum equiseti* species complex infecting bottle gourd".

Books Published

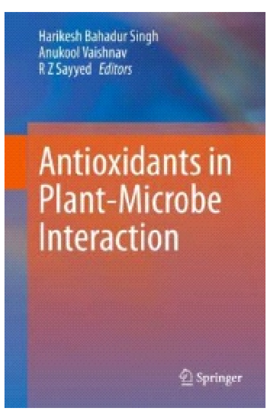
1. **Diseases of Fruit Crops and their Integrated Management**
   Editors: Amar Bahadur, Pranab Dutta, D.P. Awasthi
   Published by: New India Publishing Agency (NIPA), New Delhi
   Published: 2021
   Page Count: 312
   ISBN: 9789390175901



2. **Diseases of Vegetable Crops and their Integrated Management**
   Editors: Amar Bahadur, Pranab Dutta
   Published by: New India Publishing Agency (NIPA), New Delhi
   Published: 2021
   Page Count: 370
   ISBN: 9789390591091



3. **Antioxidants in Plant-Microbe Interaction**
   Editors: H.B. Singh, Anukool Vaishnav, R.Z. Sayyed
   Published: 2021
   Page Count: 665
   Paperback ISBN: 978-981-16-1349-4
   eBook ISBN: 978-981-16-1350-0



Necrology

The Society is distressed at sad demise of following members of the Society and expressed condolence to the bereaved family:

- **Dr. N. Srinivasa**, Scientist, Division of Plant Pathology, ICAR-IARI, New Delhi on 22nd April 2021.
- **Dr. D.B. Parakh**, former Principal Scientist, ICAR-NBPGR, Pusa Campus, New Delhi on 28th April 2021.
- **Dr. Vineeta Singh**, Associate Professor, Department of Mycology and Plant Pathology, BHU, Varanasi, Uttar Pradesh on 30th April 2021.
- **Dr. R. Sudeep Toppo**, Assistant Chief Technical Officer, Division of Plant Pathology, ICAR-IARI, New Delhi on 12th May 2021.

Plant Protection Medley

Policy issues, major decision, new product registration

Exotic pathogens intercepted in germplasm into India during 2013-19 and are not reported from India

Exotic Pest Intercepted	Crops	Source
Fungi		
Fusarium nivale	*Titicum aestivum*	UK
F. oxysporum f. sp. *cucumerinum*	*Cucumis sativus*	USA
Peronospora manshurica	*Glycine max*	Canada, Colombia, Japan, Taiwan
Phomopsis eres	*Robinia pseudoacacia*	Hungary
P. longicolla	*Helianthus annuus*	USA
Viruses		
Bean mild mosaic virus	*Glycine max*	Canada, Columbia
	Phaseolus vulgaris	USA
Bean pod mottle virus	*G. max*	AVRDC (Taiwan)
	P. lunatus	AVRDC (Taiwan)
	Vigna unguiculata	Italy, IITA (Nigeria)
Broad bean mottle virus	*P. vulgaris*	AVRDC (Taiwan)
Broad bean stain virus	*G. max*	AVRDC (Taiwan), Costa Rica
	V. radiata	AVRDC (Taiwan)
	V. unguiculata	IITA (Nigeria)
Cherry leaf roll virus	*G. max*	AVRDC (Taiwan), Canada, Columbia, Costa Rica
	V. unguiculata	IITA (Nigeria), USA
Cowpea mottle virus	*P. vulgaris*	USA
	V. faba	Lebanon
	V. sativa	USA
	V. unguiculata	IITA (Nigeria)
Cowpea severe mosaic virus	*G. max*	AVRDC (Taiwan), Canada, Costa Rica
High plains virus	*Zea mays*	Thailand
Maize chlorotic mottle virus	*Z. mays*	Thailand
Pea enation mosaic virus	*G. max*	Costa Rica
	V. unguiculata	Italy
Peanut stunt virus	*G. max*	AVRDC (Taiwan), Canada, Costa Rica
	V. sativa	USA
	Vigna radiata	AVRDC (Taiwan), Costa Rica
	V. unguiculata	IITA (Nigeria), Italy
Pepino mosaic virus	*C. annuum*	Republic of Korea
	S. lycopersicum	Netherlands, Thailand, USA
Raspberry ringspot virus	*G. max*	AVRDC (Taiwan), Costa Rica, USA
	V. unguiculata	IITA (Nigeria)
	V. unguiculata ssp. sesquipedalis	Philippines
Tomato ringspot virus	*G. max*	AVRDC (Taiwan), Canada, Costa Rica
	V. radiata	AVRDC (Taiwan)
	V. unguiculata	Italy, IITA (Nigeria)

Source: http://www.nbpgr.ernet.in/Divisions_and_Units/Plant_Quarantine.aspx

Editorial Board - Newsletter

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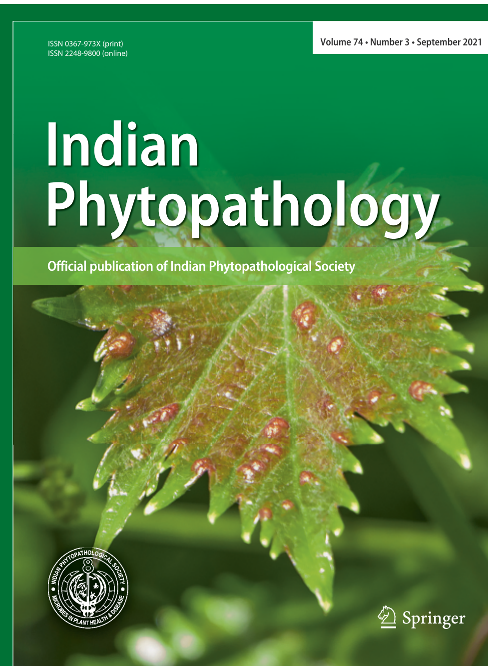
Published by
Indian Phytopathological Society
Division of Plant Pathology
ICAR-Indian Agricultural Research Institute
New Delhi – 110 012, India
Tel: +91-11-25840023
E-mail: ipsdis@yahoo.com, website: http://ipsdis.org



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