



From The Director's Desk

Transboundary Plant Pests: A threat to Global Food Security

The ICAR-National Institute of Biotic Stress Management, Raipur was established during 12th plan period to pursue basic and strategic research on biotic stress mitigation through four schools concept. Monitoring, early detection and mitigation of Transboundary Plant Pests (TPPs) has been identified as one of the programmes under the school of crop health policy support research (SCHPR).

TPPs are those migratory insects, plant diseases and weeds that can spread to several countries and reach epidemic proportions, cause significant losses to crops, threaten food security, damage the local biodiversity and environment and create serious socio-economic and public health consequences. TPPs-induced decline in agricultural productivity contribute to poverty and hunger, particularly of small farmers, besides acting as barriers to trade. Three major reasons for the increased risk of TPPs spread to challenge the world's food security are reported to be i) Global movement of agricultural goods ii) Global movement of tourists and migration, and iii) Global climate change.

TPPs contribute substantially in pest and disease-induced global food loss which is approximately 1/3rd of annual food production. Across the world, more specifically the Asia-Pacific region, faces severe threats from a number of TPPs that occur as epidemics or are endemic in national boundaries. Climate change is creating new ecological platform for the entry and establishment of pests and diseases from one geographical region to another. This expansion will continue to result in huge financial losses, therefore require large eradication programmes and effective control measures.

Some of the important transboundary diseases and pests include brown streak virus, banana bunchy top disease, greening disease of citrus, powdery rust of coffee, soybean downy mildew, blue mould of tobacco, rust of maize, cassava diseases and wheat rusts; locusts, fall armyworm, fruit flies and vector-borne bacterium. In India, desert locust, carambola fruit fly, fall armyworm and wheat stem rust (UG 99) and blast are reported to be the major TPPs which are under surveillance in co-ordination with FAO.

FAO established an Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) in

1994, with the goal of addressing world food security and fighting transboundary animal and plant pests and diseases. The core principles of the EMPRES programme are: i) early warning, detection and reaction ii) contingency planning iii) promotion of environmentally sound control technologies, and vi) close collaboration and partnership with affected countries, national and international agricultural research centres and other international institutions.

During the annual Meeting of G20 Agricultural Chief Scientists (MACS-G20) in April 2019, three major decisions were taken to monitor and management of TPPs across the world which include i) Designation of National Reference Laboratories (NRLs) for early detection and correct diagnosis of TPPs and the establishment of networks among them ii) Improvements in Biovigilance or global surveillance systems for identification and mitigation of potential threats before they impact the agricultural sector, and iii) The challenges and future directions of research collaborations, and contributions to the International Year of Plant Health, 2020.

With this backdrop, a long-term flagship programme on 'National Strategic Crop Health Monitoring Network' has been flagged in EFC 2021-26 at ICAR-NIBSM to develop policies towards the monitoring and mitigation of TPPs in co-ordination with institutes/organizations like, National Institute of Plant Health Management, Telangana, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, ICAR-National Bureau of Plant Genetic Resources, New Delhi, ICAR-National Centre for Integrated Pest Management, New Delhi, ICAR-National Bureau of Agriculturally Important Microorganisms, Mau, Directorate of Plant Protection, Quarantine and Storage (GOI) etc.



(P. K. Ghosh)
Founder Director and Vice-chancellor
ICAR-NIBSM, Raipur

Research Highlights

Agricultural Biotechnology

Isolation of promoter/ upstream region of isoflavone synthase gene in resistant and susceptible soybean

(P.N. Sivalingam, S. K. Jain, V. Kumar, L. L. Kharbikar, Ashish Marathe)

Isoflavone synthase (ifs) gene is reported to express upon begomovirus infection in soybean and other legumes. Therefore, 2 Kb upstream region to *isoflavone synthase* gene in *mungbean* from Legume Information System (LIS) has been identified and the primers were designed for amplification through Phusion polymerase. The primer sequences are Vr-FP- C G G G A T C C C G T C T C T A G C C T G A C T T T C A A G G G and Vr - R P - A C G C G T C G A C G T C G G C T T A T G T T T G T T T C T G C C A A T A C C T G A A G. Using these primers, approximately 2 kb upstream sequence to *ifs* was amplified from resistance and susceptible genotypes of soybean and *mungbean*. These amplified fragments cloned in the promoterless transformation vector, pORE-R2 and transformed to *Agrobacterium tumefaciens* EHA105.

Infectious clones of Tomato leaf curl Karnataka virus (ToLCKV) infecting tomato

(P. N. Sivalingam, V. Kumar, J. Sridhar, L. L. Kharbikar)

To identify host factors involving during the infection of begomovirus infecting tomato, the development of infectious clones of the genomic components of begomovirus are essential for inoculation. During the period of report, DNA A of ToLCKV dimerized in *Hind*III site in pUC18 vector and betasatellite in *Bam*HI. These tandem oriented dimer clones of DNA A and betasatellite were sub-cloned into pCAMBIA2301 vector and transferred to *Agrobacterium tumefaciens* strain EHA105 by liquid nitrogen method. The agroinoculation of these constructs on tomato and *Nicotiana benthamiana* produced typical symptoms of leaf curl. These viral constructs will be used for identifying non-hosts and host factors essential for infection of these viruses in the susceptible host plants.

Genetic groups of whitefly, Bemisia tabaci

(J. Sridhar, R. K. Murali Baskaran)

Whitefly (*Bemisia tabaci*) is a polyphagous sucking pest, attacking crops directly by desaping and indirectly by transmitting begomovirus induced diseases. Genetic groups of *B.tabaci* are dangerous which vary in efficiency of transmitting virus in crops. In order to map the diversity of genetic groups in unmapped state, Chhattisgarh, samples of whitefly collected in 22 districts were analysed for the distribution of genetic groups. The surveys indicated the presence of three new genetic groups, Asia II-3, Asia II-6 and Asia III from Chhattisgarh. The studies on transmission of begomovirus are in progress.

Super donors in rice carrying tolerance to multiple stresses

(Vinay Kumar, S. K. Jain, P. N. Sivalingam, Mallikarjuna, J.)

To introgress bacterial leaf blight (BLB), blast and brown plant hopper (BPH) resistance genes from the pre-breeding lines or wild rice lines/ were crossed during the *kharif* season and their harvested seeds were sown in the pots for raising nursery. Marker assisted

selection was performed for selection of plants containing desired resistance gene of interest to further deployment in breeding and generation advancement programme. Crosses were made between MTU 1010 and rice having five genes for BLB resistance (*Xa4+xa5+Xa7+xa13+Xa21*) and F₁ seed were developed. The presence of BLB resistance genes were confirmed using gene linked molecular markers. The back-crossed seeds were developed and it's being tested to presence of BLB resistance gene using molecular makers for further advancement of generations. Crosses were made to introgress blast and Brown Plant hopper resistance genes for from wild rice germplasm and the rice lines containing introgressed resistance genes.

Biological Control

Lipopeptide genes in the bacterial endophytes isolated from pigeonpea

(Vinay Kumar, Lata Jain, S. K. Jain)

The antimicrobial peptides (AMPs) or lipopeptides are novel class of potent versatile weapon to control a variety of phytopathogens. In order to confirm the presence of lipopeptide genes in the bacterial endophytes of pigeonpea having antagonistic activities against soil borne fungal pathogens namely *Sclerotium*, *Fusarium* and *Rhizoctonia*. PCR based detection showed the presence of *surfactin* and antifungal *iturin* genes in the isolates (Fig. 1). This suggested that endophytes might secrete these lipopeptides inside plant tissues or on their surfaces to protect them from phytopathogens. These lipopeptides seem to be promising biopesticides in agriculture practices for replacing harmful chemical pesticide and thus, can be considered as potent alternative tools to overcome increasing chemical resistance of phytopathogens.



Fig 1. Agarose gel showing PCR amplification of Lipopeptide genes from pigeonpea bacterial endophytes, M: 100 bp ladder, 1-8, bacterial isolates

Characterization of bacteriophages

(Lata Jain, V. Kumar, S. K. Jain)

Bacteriophages are best alternative to pesticides in managing rice BLB, *Xanthomonas oryzae* pv. *oryzae* (*Xoo*).

Effect of pH on viability of phage

The viability of phages was 99-100% at pH 6-8; 80% at pH 5 & 9; 40% at pH 4 and 20% at pH 10 while it is less than 1% at

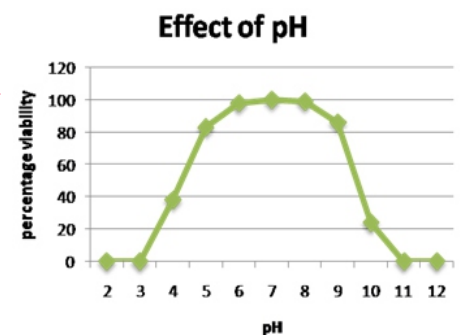


Fig 2. Effect of pH on viability of phage

pH 2, 3, 11 & 12 (Fig. 2). Nineteen phages isolated did not have bactericidal effect against *Bacillus cereus*, *B. subtilis*, *B. thuringiensis*, *Serratia*, *Salmonella*, *Escherichia coli* and *Staphylococcus*.

Effect of chemicals on viability of phage

Phages were treated with 5% aqueous phenol, 10% chloroform, 40% formalin, 1% SDS solutions for 1 hour at 28 °C. It was found that 40% formalin has maximum lethal effect on phage up to 99.99% followed by 1% SDS (90-97%); 10% chloroform and 5% aqueous phenol (80-90%).

Molecular characterization of phage

Viral nucleic acid extraction procedure was standardized to remove the bacterial genome from lysate and to get maximum viral nucleic acid. Nucleic acid was extracted from all the phages (Fig. 3). Further molecular and morphological characterization of phages is under progress.

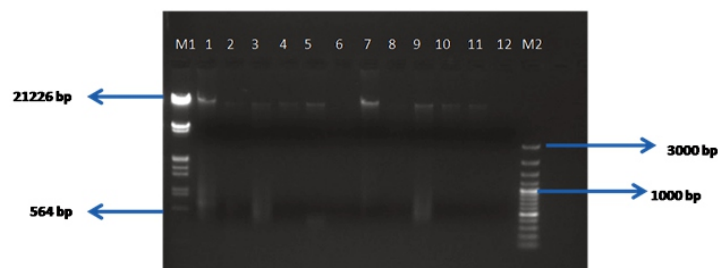


Fig 3. Agarose gel electrophoresis of nucleic acid of bacteriophage (1-12) M1: Lambda Hind III EcoRI Marker; M2: 100 bp Ladder

Native *Trichogramma* spp.

(R. K. Murali Baskaran, K. C. Sharma, J. Sridhar, Lata Jain)

Among 20 eco-types of *Trichogramma* subject to the foraging activity on eggs of *Corcyra* under laboratory condition, NTj 1 and NTc 19 have shown the highest foraging activity, resulting 86% and 85% parasitization, respectively while it was 82 and 76% in NBAIR strains of *T. japonicum* and *T. chilonis*, respectively. The per cent parasitization of NTj 1-11 ranged from 78% to 86% while it ranged from 66% to 85% in NTc 12-20.

Native *Bacillus thuringiensis*

A total of 89 soil samples from various crop and non-crop eco-systems of 22 districts of Chhattisgarh and north eastern states including Assam, odisha, Tripura and Meghalaya were collected for isolation of native *B. thuringiensis*. The isolated colonies were grown on nutrient agar media and were further confirmed by Gram's staining, growth on *Bacillus cereus* agar and hichrome *Bacillus* agar; thereafter they subject to PCR for presence of *cry1* and *cry2* gene. A total of 26 isolates of *Bt* were identified and bioassayed under laboratory condition against 3rd instar *Spodoptera litura*. Out of 26 isolates, NBT 18 caused the maximum mortality of 86.7% to 3rd instar of *S. litura* at 5×10^8 CFU/ml which was on par with NBT 27, NBT 31 and VLBt.

HOST PLANT RESISTANCE

Differential screening and pathotyping of BLB under artificial inoculation

The *Xanthomonas oryzae* bacterial isolates recovered were different samples were evaluated for their pathogenicity through artificial inoculated on rice (TN1) leaves using leaf clip method. On the basis of pathogenicity test five isolates from Chhattisgarh

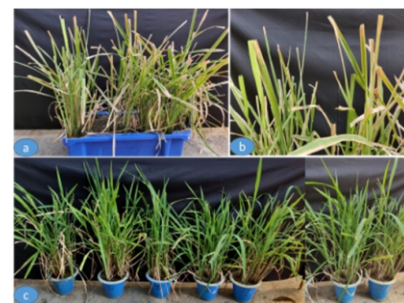


Fig 4. (a) Differential screening; (b) appearance of BLB symptoms; and (c) BLB isolates screening

were identified as *Xoo*. A total of four different isolates of *Xoo* were used for the differential screening using differential rice lines containing individual and combination of BLB resistance genes. The different isolates showed variable response to the different BLB resistance genes individually and in combinations (Fig. 4a,b,c). It was found that the isolates tested showed resistance reaction to (*Xa4+xa5+Xa7+xa13+Xa21*) combination. While genes *xa5*, *Xa7* showed susceptibility of one isolate. Gene *xa5* showed susceptibility all isolates except one showed which showed moderately resistance reaction.

Plant Germplasm Registration

(Rukmini Mishra, G. J. N. Rao, R. N. Rao, M. J. Baig, Vinay Kumar, Pankaj Kaushal)

Rice induced tetraploid line Rice Tetra 5-40 (2n=4x=48) has been registered as novel genetic stock by Plant Germplasm Registration Committee (PGRC), New Delhi with the Registration number (INGR 20004).

Rice lines with potential source of novel bacterial blight disease resistance genes

(Vinay Kumar, S. K. Jain)

A total of 226 rice lines/ germplasm containing (local landraces, varieties and gene introgressed lines) obtained from National Rice Research Institute (NRI), Cuttack were screened for Bacterial Blight (BB) disease. The rice germplasm were transplanted in paired row and artificially inoculated using bacterial blight causing pathogen (*Xanthomonas oryzae* pv *oryzae*) Raipur isolate under field condition for multi-location screening. After 2 year screening, 10 lines (NIBSM_R1 to R10) were identified as highly resistant to BLB, however these lines do not contains any previously reported BLB resistance genes as revealed by molecular analysis. These lines are being evaluated under replicated trials for further confirmation and the highly resistance lines will be identified which can be explored as source for identification and isolation of novel BLB resistance genes.

Capacity building programmes conducted under Farmer FIRST Project from July to December, 2020

Particulars	No. of training	No. of villages covered	Male	Female
Demonstration of Ambika paddy weeder, pheromone trap, line sowing of rice fallow pulses	08	11	65	28
Training conducted on Seed treatment of rice, plant propagation, plant protection, PHT of vegetables, oyster mushroom	14	19	128	71
Awareness programme on plant protection in rice and vegetables	02	04	27	11
Group discussion on the cleanliness and management of goat and poultry shed	03	03	18	6
Farmers scientist interface on occasion of "Mahila Kisan Diwas" through video conferencing	01	05	04	10

Summary of externally funded project's achievements (July – December 2020)

(PI: P. Mooventhan)

S. No.	Contents	FFP	DBT – Biotech-KISAN	DST-SYST - Foldscope
1.	Training	10	18	1
2.	Demonstration	18	17	3
3.	Technology Popularized	6	13	-
4.	Seed material/ Variety introduced	4	9	-
5.	Germplasm / Seed Produced	1	-	-
6.	Farmers Interest Group (FIG)	3	15	1
7.	Women Empowered/ Involved	82	-	39
8.	Youth Trained/ Involved	126	-	12
9.	SC farmers benefited	31	-	51
10.	ST farmers benefited	365	-	17
11.	Concept developed	-	-	1
12.	Methodology developed	-	1	-
13.	Database management	1	1	1
14.	Expert system developed	-	-	-
15.	Spread adoption of variety/ planting materials/ tools/ machinery/ technology developed	8	6	-
16.	Area covered under the field trial	110 acres	150 acres	-
17.	Adoption of technology and package of practices by farmers (Nos.)	272	150	-
18.	Technology inventory prepared	3	1	27
19.	Technology evaluated	1	3	-
20.	Monitoring of field/adaption trials	2	1	1
21.	Feedback reported	47	150	-
22.	Success stories documented	-	6	12
23.	Germplasm collected/ conserved	-	-	-
24.	Service provided related to production, processing, and distribution of seed and planting materials	4	5	-
25.	Front line demonstration organized	4	18	3
26.	Inter institutional HRD programmes organized/ coordinated/ assisted	-	4	-
27.	Commodity interest group organized	-	3	-
28.	Activity organized related to e-extension services, mobile advisory system	3	1	1
29.	Field day organized	-	5	-
30.	Research - Extension - Farmers - Interface meetings organized	2	1	-

Institute Activities

6th Institute Research Committee (IRC) (July 13-16, 2020)

The 6th institute research committee (IRC) meeting was held during July 13-16, 2020 in virtual mode. During the four-days meeting, presentations on progress of various research projects were made by the PIs of projects. The progress of 14 in-house projects and four externally funded projects was discussed. Completed and two new project proposals were also discussed. New programme concepts (09) included in the EFC 2021-26 were discussed in detail and changes were suggested.



Independence Day (August 15, 2020)

Independence day was celebrated at ICAR-NIBSM by all scientists and labourers.

Teachers' Day (September 05, 2020)

The ICAR-NIBSM, Raipur invited Dr. Seema Srivastava, Principal, Government Senior Higher Secondary School, Saragaon, Raipur, Chhattisgarh to deliver a talk on the eve of Teachers' day using virtual mode platform. Dr. P. K. Ghosh, Director inaugurated the Teachers' Day with remarks on this auspicious day. Dr. Seema Srivastava has delivered a talk highlighting importance of teachers' day and role of teachers in sculpturing students for betterment of nation.



150th birthday of the father of the nation Mahatma Gandhi during week-long programme (September 21 to October 02, 2020)



Dr. P. K. Ghosh, Director, ICAR-NIBSM, narrated four philosophies of rural developments especially on the sustainable agriculture and alleviation of poverty in India and abroad during the

celebration of a week-long celebration of 150th birthday of the father of the nation Mahatma Gandhi on 25.09.2020. Two events including essay and quiz competition related to Gandhi Ji's life were organised for all the staff.

9th Institute Foundation Day (October 07, 2020)

Dr. Tilak Raj Sharma, Deputy Director General (Crop Science), ICAR, New Delhi delivered a lecture on biotechnological intervention in biotic stress during the occasion of 9th NIBSM



foundation day. A panel discussion on "Policy Perspective Issues on Biotic Stress Management" was organized. Dr. P. K. Ghosh, Director, ICAR-NIBSM, Raipur stressed on the importance of biotic stress management in agriculture, current scenario, research activities and future strategies.

Mahila Kisan Diwas (October 07, 2020)

Dr. P. K. Ghosh, Director, ICAR-NIBSM, Raipur has addressed the gathering of women farmers on Mahila Kisan Diwas and emphasised multiple role of women in the society in general and agriculture in particular. An interactive session of scientists and women farmers was organised for deliberation of various issues pertaining to agricultural activities including poultry.

Vigilance Awareness Week & Rashtriya Ekta Diwas (October 27 to November 02, 2020)



Dr. Sushil K. Sharma, Nodal Officer, briefed about the importance of observing vigilance awareness week during 27.10.2020 to 02.11.2021. Dr. Pankaj Kaushal, JD(R) in his speech sensitized all the staff members for

prevention of corruption in the office. On October 31, 2020, Dr. S. K. Jain, Vigilance Officer, ICAR-NIBSM, Raipur has delivered a talk on 'Preventive vigilance measures' and Dr. P. K. Ghosh, Director, ICAR-NIBSM, Raipur has administered Rashtriya Ekta Diwas pledge to all the staff to commemorate birth anniversary of Sardar Vallabhbai Patel.

Swachhta Abhiyan

Swachhta drives were carried out in the villages by the staff of MGMG for spreading advantage of in personal and environmental hygiene. In this COVID-19 pandemic situation,



some cleanliness programmes were specially organised in the premises on the eve of 151st birth centenary of Mahatma Gandhi Ji.

5th Research Advisory Committee (RAC) meeting (November 21, 2020)

The 5th RAC meeting of the ICAR-NIBSM, Raipur was held on 21.11.2020 under the Chairmanship of Dr. C. D. Mayee, former Chairman, ASRB, New Delhi. The committee discussed in-depth the ATR of the 4th RAC meeting and various research, teaching and development issues. An interactive session on research and teaching collaborations was conducted including Dr. P. K. Chakrabarty, Member, ASRB, New Delhi, Dr. Himanshu Pathak, Director, ICAR-NIASM, Baramati, Dr. Arunava Pattanayak, and Dr. T. R. Sharma, Director Acting and JD(R), ICAR-IIAB, Ranchi and Dr. Jitendra Kumar, Director, Institute of Pesticide Formulation Technology, Gurugram as special invitees.



Annual Advisory committee meeting of ICAR-NASF project (December 22, 2020)

The annual advisory committee meeting of ICAR-NASF project on “Identification of host factors responsible for infection and development of nano-particle based dsRNA delivery system for imparting resistance to begomoviruses” was conducted on 22.12.2020 to review the progress of the project.

Swachhta Pakhwada (December 16-31, 2020)

ICAR-NIBSM, Raipur celebrated the Swachhta Pakhwada from 16-31 December, 2020.



Measures taken to contain COVID-19 pandemic

- Everyone is wearing face mask, washing/sanitizing hands and maintaining social distancing to prevent COVID-19 spread.
- A thermal scanning of all the staff members and labourers including labourers of CPWD are routinely done.
- Sanitization of premise with sodium hypochlorite solution is being performed regularly. All the vehicles are also being sanitized from time to time.
- Two wash basins were installed at both the main gates for frequent hand washing by labourers working in the premises.
- Awareness programmes were organised to contain COVID-19 in nearby villages of our institute during visit to farmer's fields, Swachh Bharat Abhiyan and under MGMG programme.



Monthly seminar

S. No.	Topic of seminar	Date	Delivered by institute scientist/international scientist
1.	Insect immune defence to stresses	24.10.2020	J. Sridhar
2.	Epigenetic regulations and biotic stress management	28.11.2020	Lalit L. Kharbikar
3.	Interactions between Pseudomonas species and their host plants	09.11.2020	Dr. Jacob Malone, Group Leader (Plant Health), The John Innes Centre, Norwich Research Park, Norwich, NR4 7UH, UK
4.	Innovative Detection methods to support plant health diagnostics	18.11.2020	Dr. Peter Bonants, Team manager (Health) Biointeractions and Plant Health, Wageningen University and Research, Netherlands

Workshops/Symposia/Seminars/Trainings/Webinars

Workshops/Symposium/Seminar/Conference/other fora attended

S. No.	Symposia/seminar/training attended	Period	Venue/organized by	Name of scientist
1.	National Conference on Agriculture Resource Management for Atmanirbhar Bharat	17-19.7.2020	CAU, Imphal	P. N. Sivalingam
2.	Digital Discourse Series - 2020 on Gender and Pandemic: Challenges and Opportunities	10-12.08.2020	ICAR-ATARI, Bengaluru and Farmer FIRST Programme (FFP) of ICAR-CPCRI, Kayamkulam, ICAR-NIANP, Bengaluru and ICAR-IIHR, Bengaluru and ICAR-CIFT, Kochi.	P. Mooventhan

S. No.	Symposia/seminar/training attended	Period	Venue/organized by	Name of scientist
3.	Regional Expert Consultation on Agriculturally Important Microorganisms	28.10.2020	APARI, Bangkok, Thailand and NBAIM, Mau, India	Sushil. K. Sharma
4.	Wild Life Health Management	10-11.11.2020	Veterinary Science and Animal Husbandry, OAUT, Bhubaneswar, Odisha	Mamta Choudhary
5.	MANAGE Dialogue 2020: Future of Agricultural Extension and Advisory Services	18-20.11.2020	MANAGE, Hyderabad	P. Mooventhan
6.	Role of Technology in Community Level Disaster Mitigation for Scientists & Technologists	23-27.11.2020	Centre for Disaster Management, Lal Bahadur Shastri National Academy of Administration, Mussoorie, Uttarakhand	Anil Dixit, S. K. Jain

Webinars attended (virtual meeting)

S. No.	Title of webinars	Period	Venue/organized by	Name of scientist
1.	Emerging scenario of zoonoses and its public health significance	6.7.2020	College of Veterinary Science & A. H., SDAU, Sardarkrushinagar, Gujarat	Lata Jain
2.	MDP on Implementation of Access and Benefit Sharing Regulations in Agriculture Research: Awareness cum Sensitization	7-10.7.2020	ICAR-NAARM, Hyderabad	S. K. Jain
3.	Technological Advances to Revolutionize Cancer Diagnosis	7.7.2020	CGKV, Durg	B. K. Choudhary Mamta Choudhary
4.	Export challenges and mitigation strategies for fresh and processed F & V in COVID-19	8.8.2020	Department of Agriculture and Environmental Sciences, NIFTEM, Sonipat	R. K. Murali Baskaran P. Mooventhan
5.	Hematopathology and field diagnosis of commonly prevalent tick-borne diseases of bovines in India	8.8.2020	GADVASU, Punjab and Carus laboratories	B. K. Choudhary Mamta Choudhary
6.	Immunology in 21 st century for improvising one health	8.8.2020	Society of Immunology and Immunopathology, India; SVPUAT, Meerut, India; and DAHD, GOI, New Delhi, India	Lata Jain
7.	World Humanitarian day and the international locust crisis	19.8.2020	FAO, Geneva	R. K. Murali Baskaran
8.	Intellectual property rights in agricultural research and education in India	12-18.9.2020	NAHEP and IP&TM Unit, ICAR Hqrs, Pusa Campus, New Delhi	P. N. Sivalingam, Binod Choudhary, Lalit L. Kharbikar
9.	One Health Approach to control and elimination of Rabies in India	29.9.2020	Department of Veterinary Public Health and Epidemiology, College of Veterinary Sci. & A. H., Anand	Mamta Choudhary
10.	A Climate for Change's 2020 Annual General Meeting	29.11.2020	Climate for Change Australia	Lalit L. Kharbikar
11.	9 th Agrochemicals Conference 2020	1.12.2020	FICCI Agrochemicals, New Delhi	R. K. Murali Baskaran
12.	Gene editing for agriculture, society and sustainable development: Prospects and perspectives	15.12.2020	Tata Institute for Genetics and Society (TIGS), Bengaluru in partnership with Biotech Consortium India Limited, New Delhi	Sushil K. Sharma, R. K. Murali Baskaran, J. Sridhar, Ashish Marathe

Publications

Research/Review papers

- Jain, L. and V. Kumar. 2020. Leptospirosis as neglected re-emerging zoonoses in India: An overview. *Journal of Animal Research* 10(6): 853-858.
- Murali-Baskaran, R. K., K. C. Sharma, J. Sridhar, J. Lata and J. Kumar. 2020. Multiple release of *Trichogramma japonicum* Ashmead for biocontrol of rice yellow stem borer *Scirpophaga incertulas* (Walker). *Crop Protection*. doi.org//10.1016/j.cropro.2020.105471
- Murali-Baskaran, R. K., S. Senthil-Nathan and W. B. Hunter. 2020. Anti-herbivore activity of soluble silicon for crop protection in agriculture: a review. *Environmental Science and Pollution Research*. doi.org/10.1007/s11356-020-11453-0
- Sahu, P. K., R. Sao, S. Mondal, G. Vishwakarma, S. K. Gupta, V. Kumar, S. Singh, D. Sharma and B. K. Das. 2020. Next Generation Sequencing based forward genetic approaches for identification and mapping of causal mutations in crop plants: a comprehensive Review. *Plants* 9:1355.

Book chapters

- Choudhary, M., B. K. Choudhary and R. C. Ghosh. 2020. Pathological Changes Associated with Natural Outbreak of Swine Pasteurellosis, Intech Open Limited, 5 Princes Gate Court, London, SW7 2QJ, UK. doi: 10.5772/intechopen.94849
- Kumar, V., L. Jain, P. Kaushal and R. Soni. 2020. Fungal endophytes and their applications as growth promoters and biological control agents. In: V. K. Sharma, M. P. Shah, S. Parmar, A. Kumar (eds.), *Fungi Bio-Prospects in Sustainable Agriculture, Environment and Nano-Technology*, Academic Press, pp. 315-337, ISBN 9780128213940, doi.org/10.1016/B978-0-12-821394-0.00012-3.
- Sridhar, J., K. K. Kumar, R. K. Murali-Baskaran, S. Senthil-Nathan, S. Sharma, M. Nagesh, P. Kaushal and J. Kumar. 2020. Impact of climate change on communities, response and

migration of insects, nematodes, vectors and natural enemies in diverse ecosystems. In: V. Venkataramanan et al. (eds.), *Global Climate Change: Resilient and Smart Agriculture*, Springer Nature Singapore Pte. Ltd., pp. 69-93. doi.org://10.1007/978-981-329856-9_4.

Abstracts

- Sahu, B., N. Dokka, A. Marathe, K. C. Sharma, P. Mooventhan, J. Sridhar, V. Kumar, P.N. Sivalingam and P. Kaushal. 2020. Occurrence and distribution of begomoviruses in various pulses and vegetable crops in Chhattisgarh In: National Conference on Agriculture Resource Management for Atmanirbhar bharat” held from July 17-19, 2020 at CAU, Imphal, 94p.
- Sridhar, J., R. K. Murali-Baskaran, P. N. Sivalingam and J. Kumar. 2020. Emerging biotic stresses and their impact on seed potato production in India. In: *Book of Abstracts of Global Potato Conclave held at Mahatma Mandir, Gandhinagar, Gujarat during 28-31, January 2020*.

Germplasm registration

- Mishra, R., G.J.N. Rao, R.N. Rao, M.J. Baig, V. Kumar and P. Kaushal. 2020. Rice Tetra 5-40: a tetraploid (2n=4x=48) rice line, registered by Plant Germplasm Registration Committee (PGRC), New Delhi (Registration no. INGR 20004)

NCBI Genbank submissions

S. No.	Items	NCBI Accession number	Authors
1.	16S ribosomal DNA sequences: <i>Lathyrus sativus</i> bacterial endophytes: (30 numbers)	MW423828- MW423857	Vinay Kumar, Lata Jain
2.	16S ribosoma DNA sequences: Pigeonpea bacterial endophytes: (14 numbers)	MW423421- MW423434	Vinay Kumar, Lata Jain

Awards and Recognition received by NIBSM scientists

S. No.	Awards/Recognition/ Membership in Professional Societies	Year/ Period	Offered/organized by	Scientist (Dr.)
1.	Outstanding Agricultural Scientist Award	2020	Dr. B. Vasantharaj David Foundation, Chennai	Anil Dixit
2.	Excellence Award	2020	ICAR-NIBSM 9 th Foundation Day	Anil Dixit
3.	Best Research Paper Award	2020	ICAR-NIBSM 9 th Foundation Day	R. K Murali Baskaran, K. C. Sharma, J. Sridhar, Lata Jain
4.	Best Scientist Award	2019-2020	ICAR-NIBSM 9 th Foundation Day	P. Mooventhan

Compiled & Edited : R. K. Murali Baskaran, P. N. Sivalingam, Mamta Choudhary, P. Mooventhan

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Telefax: 0771-2277333, Email: director.nibsm@icar.gov.in, Website: nibsm.icar.gov.in