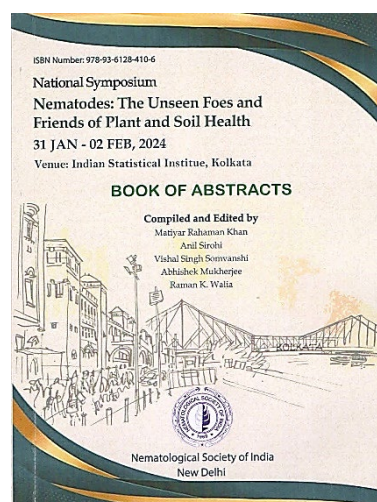




Nematological Society of India

Summary and Recommendations of the National Symposium on “Nematodes: The Unseen Foes and Friends of Plant and Soil Health” 31 January to 2 February 2024

The National Symposium of the Nematological Society of India (NSI) was organized from 31 January to 2 February 2024 at the Indian Statistical Institute, Kolkata. The proceedings of the symposium focussed on the theme “**Nematodes: The Unseen Foes and Friends of Plant and Soil Health**”. In total, 10 technical sessions were held over three days. An overwhelming response of more than 150 delegates involving scientists, researchers, students, and representatives from industry was received through their physical participation from across the country. The proceedings of the symposium (in part) were also telecast live on YouTube to enable participation from abroad. Three plenary lectures, 17 invited lead talks, presentation of G.I. D’Souza Memorial Award Lecture by the recipient, competitions for Prof. D.J. Raski Academic Merit Award and Dr. Mrs. Sudarshan Ganguly Young Scientists Presentation Award were also organized, besides 70 poster presentations in two split sessions. The abstracts of all the presentations were published in a “Book of Abstracts” that was made available to all the delegates as soft and hard copies.



Proceedings of the Symposium

Inaugural Session: The symposium was formally inaugurated by the Chief Guest, Professor Swapan Datta, Former Deputy Director General (Crop Science) ICAR, Former Vice Chancellor Biswa Bharati, and Founder Vice Chancellor Biswa Bangla Viswavidyalaya, Birbhum. Other dignitaries on the dais included - Professor Sanghamitra Bandyopadhyay, Director Indian Statistical Institute, Kolkata; Professor Hari Shankar Gaur, Former Dean and Joint Director (Education) Indian Agricultural Research Institute, Former Vice Chancellor Sardar Vallabhbhai Patel University of Agriculture & Technology Modipuram, and Distinguished Professor Galgotias University, Greater Noida; and Dr Anil Sirohi, President, Nematological Society of India. The General Secretary NSI and Organizing Secretary of the Symposium Dr. Matiyar Rahaman Khan and the local Organizing Secretary Dr. Abhishek Mukherjee conducted the proceedings of the session. All the eminent speakers emphasized the need for such a Symposium while explaining the role of nematodes in Plant and Soil Health.

Prof. Datta in his address mentioned the references to nematodes in the Vedic era. He also emphasized the importance of nematodes in basic research covering the fields of genetics, gerontology, pharmaceuticals etc. He expressed serious concerns about the economic importance and increasing crop losses in modern agriculture by the plant parasitic nematodes. He urged the nematologists to indulge in serious deliberations and wished tangible nematode management solutions would emerge during discussions. Prof. Sanghamitra suggested joint research programmes in the fields of developing statistical models for nematode populations, ecological research and artificial intelligence where expertise exists in ISI. Prof. Gaur also

exhorted the nematologists to work with dedication to address the forthcoming challenges due to climatic changes that are likely to accentuate the nematode problems in future.

Session I. Lecture by the recipient of the G.I. D'Souza Memorial Award

Chairman: S. Lingaraju

Co-Chairman: A. Shanti

DR. HEMCHANDRA R. PATEL (Retd. Research Scientist & Assoc. Director of Research (Agri.), Anand Agricultural University, Anand, Gujarat), the recipient of the D'Souza Memorial Award for the year 2024, presented his lifetime research on “*Nematode problems in bidi tobacco fields and their management*” over a zoom meeting online from Canada. The highlight of his research covered the development of economically viable technologies such as planting dates, organic amendments of soil, green manuring, rabbing, soil solarization, and chemical treatments for the management of root-knot nematodes in tobacco nurseries and fields. The highlight of his research is the development of a highly resistant variety ABT-10 of bidi tobacco against the root-knot nematode. He was honoured with a memento, a shawl, and a cash award of Rs. 6000, for his life-long dedication to the cause of Nematology in India.



Session 2. Plenary lectures

Chairman: H.S. Gaur

Co-Chairman: A.K. Chaubey

Three lectures were delivered in this session.

Dr. S.B. Sharma presented a thought-provoking talk on “*A Visionary Perspective for Nematology in 2050 and Beyond*”. He mentioned that the driving factors to the futuristic nematological research may be governed by factors such as population growth, urbanization, climate change, technological advancements, depletion of natural resources etc. He also anticipated that the metamorphosis of nematology is to strike a balance between beneficial and harmful nematodes.

Prof. H.S. Gaur presented an interesting lecture on “*Nematology down the memory lane – The Generational Transformation*”. He traced the various milestones in nematological research through the past decades, shifts in approaches in various aspects of fundamental and applied nematology, also lamenting some imbalances. He remarked that due to the continuing poor awareness about nematodes, the present and future generations of nematologists will contribute to convincing the farmers, administrators and policymakers of the importance of nematodes and nematology in the foreseeable future.

Dr. R.K. Walia narrated the historical events leading to the introduction of potato cyst in India, with special reference to its recent interceptions in the north Indian hilly states in his lecture “*Potato cyst nematodes – The policy paralysis*”. His talk generated a lot of discussion on the possible ways to contain the further spread of the nematode with inputs from Dr. S.B. Sharma based on his experience in Australia, who joined the deliberations online.

Session 3. Advances in Nematode Identification

Chairman: H.K. Bajaj
Co-Chairman: Matiyar R. Khan
Rapporteur: Rashid Pervez

In this session, there were three lead lectures.

Dr Bajaj spoke in the “*Integrative approach for nematode identification - A case study*” in which he highlighted the recent controversies on the sequence-based misidentification of *Xiphinema brevicollum* as an etiological agent for abdominal pain in humans.

Dr Abhishek Mukherjee presented a talk on “*Artificial Intelligence in Nematology – Making inroads*” He discussed the prospects of Machine Learning for nematode identification using image datasets.

Dr Rajan Salalia gave a comprehensive overview of the nematode diversity and damage of plant parasitic nematodes in major crops in Jammu & Kashmir.

The major recommendations of the session are:

1. Development of a Nematode Identification Centre, well-equipped with personnel trained in conventional and molecular diagnostic techniques.
2. Nematologists should be encouraged to do the molecular analysis themselves and not to rely solely on private companies.
3. A project should be formulated for preparing a database of digital images enabling nematode identification using artificial intelligence.
4. Image dataset for all type specimens should be submitted to the National Nematode Collection of India (NNCI), New Delhi. All research institutions and Projects completed in India by the funding agencies (Government/Private/NGOs etc.) should mandatorily deposit the image dataset (all nematode specimens under study) to the NNCI. Images (as the supplementary data file in JPEG/TIFF format) published in IJN also be preserved in the NSI Image dataset repository for future reference.

Session 4. Advances in Molecular Nematology

Chairman: Anil Sirohi
Co-Chairman: Vishal Somvanshi
Rapporteur: Chaitra G. Bhat

There were four lectures in the session; two by the scientists, and two selected presentations from among the students.

Lectures highlighted the advanced molecular technologies that can be included in the nematology tool kit for specific nematode identification, studying detailed biology of plant parasitic nematodes to use them as model systems to understand all aspects of plant-nematode interactions, genetic engineering technologies along with resistance pyramiding to enhance plant resistance against nematode enemies.

The major recommendations from the session are:

1. Use of ‘omics’ information for the development of novel and specific methods for the management of nematodes, including but not limited to RNAi, genome-edited crops, and molecular biopesticides should be promoted.
2. Encourage the development of advanced molecular tools for nematode detection and diagnosis which does need sophisticated lab. setup, and work at the field level.
3. More studies and projects should be carried out for the identification of nematode resistance in crops, and use that germplasm for QTL mapping and development of nematode-resistant varieties.

Session 5. Nematodes as indicators for soil and plant health

Chairperson: Qudsia Tahseen

Co-Chairman: Anju Kamra

Rapporteur: Hemraj Gurjar

Two lectures were delivered in the session. Dr. Qudsia Tahseen delivered on ‘Good nematodes v/s bad nematodes - Can we tilt the balance?’ and Dr. Anju Kamra on ‘Nematode Management in Polyhouse Cultivations’

Dr. Tahseen discussed the diverse nature of nematodes, their impact on plant and animal health, their economic significance, and the economic losses caused by plant parasitic nematodes. It also discusses the adaptability of both animal and plant parasitic nematodes, their role in the environment, and their potential as biological agents for managing insects.

Dr. Kamra discussed the major nematodes such as root-knot, reniform, and lesion nematodes infecting crops in polyhouses. She emphasized that complex diseases are more severe due to fungus interaction in polyhouses. *Fusarium* and *Ralstonia* spp. are major pathogens involved. She suggested management measures include cultural measures, soil solarization, biological, botanical, and chemical methods for controlling plant parasitic nematodes.

The major recommendations from the session are:

1. Adoption of nematode management approaches should include methods and tools that enhance the population of the beneficial nematodes.
2. Nematode management in the polyhouses should include integrated approaches rather than relying on a single method. Also, multiple pathogens and disease complexes should be targeted as a whole and not as single independent entities.

Session 6. Practical and Sustainable Nematode Management

Chairperson: Gautam Chawla

Co-Chairman: Debanand Das

Rapporteur: Rajan Salalia

Dr Pankaj focused on the challenges posed by the rice root-knot nematode (RRKN), *Meloidogyne graminicola* in South and Southeast Asia. The impact on rice yield, economic losses, and current management practices were discussed. Pankaj emphasized the significance of using resistant crops and provided a comprehensive overview of resistance breeding programs, QTL mapping, and the identification of marker-associated resistant loci. In conclusion, he highlighted that much of the research has been confined to screening varieties

without significant progress for solutions. Nevertheless, he instilled hope for the future by highlighting ongoing breeding programs as promising avenues for the development of resilient rice varieties against RRKN.

Nisha M. S. delved into the intricacies of nematode management within the mixed cropping systems of Kerala, emphasizing the challenges posed by various nematode species in coconut-based cultivation. She provided a comprehensive overview of nematode management challenges in Kerala's mixed cropping systems, offering eco-friendly solutions and paving the way for future research avenues. The current emphasis was on sustainable practices aligned with the need for environmentally safe and economically viable nematode control in plantation crops.

Debanand Das provided a comprehensive overview of the deeply mysterious *ufra* disease, shedding light on its symptoms, classification, biology and effective management strategies. The talk stands as a valuable contribution to understanding *Ditylenchus angustus* and its management, crucial for the sustainability of deep-water rice agriculture. Dr. B. Bhagawati suggested studying the infestation of *ufra* in the present scenario of climate change, flood patterns etc.

Session 7. New chemicals for nematode control

Chairman: Pankaj

Co-Chaired: A.K. Mukhopadhyay

Rapporteur: J. Berliner

In this session out of two presentations scheduled, only one presentation was delivered by Dr. A. Shanti on "*Microbial Biomolecules: Illuminating the Hidden Arsenal against Plant Parasitic Nematodes*", wherein she explained various novel molecules of bacterial and fungal origins that have the potential to mitigate the loss caused by plant parasitic nematodes.

It was recommended that the research must focus on the formulation of such anti-nematode molecules from microbial origin.

Session 8. Biocontrol of nematodes and Entomopathogenic Nematodes for Pest Management

Chairman: Bhabesh Bhagawati

Co-Chairman: C. Sankaranarayanan

The key recommendations are:

1. Entomopathogenic nematodes (EPNs) can be exploited for control of insect pests especially white grubs and several other important insect pests for crops.
2. More studies are needed on the survival strategies of EPNs which is important for the commercialization of target-specific EPN.
3. Quality standards should be given importance for the sustainable impact of EPN on yield.
4. Non-EPN specialists should be discouraged from working on EPN formulation technology. All EPN specialists in the country should join together to take EPN research forward.

5. Development of liquid fermentation technology for EPN mass production should be given priority.

Session 9. Industry-Scientist Interface

Chairman: R. K. Walia

Co-Chairmen: Edwin Rogbell, Alpesh Zalavadia

Rapporteur: M.S. Nisha

Representatives from four companies participated in the session. Edwin Rogwell from Corteva Agriscience made a presentation on “*SalibroTM – A Novel Sulfonamide Nematicide and Soil Health*”, Lokesh Kadu from Bayer CropScience spoke on “*Velum Prime – A Revolutionary Novel Nematicide*”, and Kiran Morya from Syngenta introduced “*Tymirium® Technology: A New Innovation for Sustainable Nematode Control in Crop Plants*”. All three speakers presented the chemistry, efficacy, unique characteristics, label claims and other features of their products. The representatives were requested to address the student participants and apprise them about the job prospects, job requirements, and process of recruitment in the corporate sector. Edwin Rogwell (Corteva), Alpesh Zalavadia (Bayer), Kiran Morya (Syngenta) and Chakradhar Pal (PI Industries) addressed the students.

The key recommendations of this session are:

1. Industry-scientist interface sessions should be made a regular feature during the symposia of the NSI in future.
2. NSI may play a proactive role and facilitate the recruitment process by the corporate sector through periodic placement events.

Session 10. Plenary session

Chairman: H. S. Gaur

Co-Chairman: R.K. Walia

Rapporteur: Vishal Singh Somvanshi

The Chairman of this session presented a brief outlook on the theme of the Symposium and appreciated the organizers for successfully conducting the different sessions. He appreciated the quality of the presentations and the keen interest and interaction of the delegates. He invited all the session chairs to present the recommendations for the respective sessions.

Professor D.J. Raski Academic Merit Award

Chairman: Lingaraju, S.

There were three contestants for this competitive award. Two contestants were adjudged joint winners of the award.

DR. CHAITRA G. BHAT

Assistant Professor

Department of Nematology,
CCS Haryana Agricultural University, Hisar

Topic: *‘Development of Omics Data and Genetic Interrogation Techniques in Entomopathogenic Nematode Heterorhabditis and its Implications in Deciphering Biocontrol Traits’.*



DR. MANORANJAN DASH

Scientist (Guest)

Department of Nematology,
Orissa University of Agriculture & Technology, Bhubaneswar

Topic: *‘Understanding Molecular Responses of Rice and Meloidogyne graminicola during Compatible and Incompatible Interactions’.*



**Dr. (Mrs.) Sudershan Ganguly Memorial Young Scientist Research
Presentation Award**

Chairman: H.S. Gaur

Seven contestants participated in this competitive award. First, second and third positions were awarded to the following candidates.

First position: **ARTHA KUNDU**

Topic: *“Expression Profiling of Nematode Chemosensory GPCRs in Heterorhabditis bacteriophora against Insect-emitted Odor Molecules”*



Second position: **SUVASRI DUTTA**

Topic: *“Biological Control of Meloidogyne graminicola using Root Gall Associated Endophytic Fungus”*



Third position: SWATHI KARTHIKA, K.S.

Topic: “Efficacy of Andrographis paniculata (Burm. F.) Nees in Mitigating Root-knot Nematode Infestation in Ginger”



Poster Presentation Awards

Judges: H.S. Gaur and R.K. Walia

Out of 70 poster presentations, one was awarded first position, two as joint winners for second position and two as joint winners for third position

First position: ADHUNA, K.P.

Topic: “Comparative Analysis of Root-knot Nematode Species Meloidogyne enterolobii and Meloidogyne incognita to Understand Factors Contributing to Differences in Plant Pathogenesis”



Second position: UDAY KURULKAR

Topic: “Isolation, Characterization and In Vitro Efficacy of Native Bacterial Antagonists against Meloidogyne incognita”



Second position (joint winner): BERLINER, J.

Topic: “Assessing the Impact of Non-Mulched Mustard Crops on Nematodes in High-Altitude Nilgiris”



Third position: **CHAITRA G. BHAT**

Topic: “Assessment of Pathogenicity of Native Entomopathogenic Nematode Strains against Above-ground Lepidopteran Pests”



Third position (joint winner): **DEPAK KUMAR**

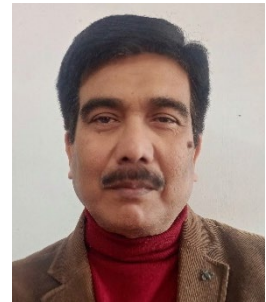
Topic: “Impact of Various Antidesiccants on Survival and Efficacy of Locally Isolated Strains of Heterorhabditis indica from Haryana, India”



Fellows – Nematological Society of India, 2024

DR. BHABESH BHAGAWATI

Professor
Department of Nematology
Assam Agricultural Nematology
Jorhat, Assam



DR. BHARAT H. GAWADE

Senior Scientist
ICAR- National Bureau of Plant Genetic Resources
New Delhi



General Recommendations of the Symposium

- A Nematode Identification Centre should be established, equipped with scientists skilled in both traditional and molecular techniques.
- The NNCI and NSI should create a nematode image dataset to apply machine learning and artificial intelligence capabilities in the future to automate nematode identification.
- To create a reliable and robust identification system, integrated methods for nematode identification should be utilized.

- Promote the creation of cutting-edge molecular methods for field-based nematode diagnostics and detection.
- More research and initiatives should be made to identify crop nematode resistance, and use that germplasm for QTL mapping, and create nematode-resistant cultivars.
- The creation of a nation-wide network focused primarily on the development of entomopathogenic nematode (EPN) formulations with improved IJ survival and guaranteed efficacy at the field level.
- Beneficial nematodes and their role in soil health and crop protection should be investigated and demonstrated for the sustainability of the production system.
- Practical nematode management technologies should be developed and transferred from lab. to land and from one area to other areas through Information and Communication Technology (ICT) or other modern extension networks.
- Develop a system for mandatory periodic inspection and certifying plant (horticultural) nurseries as being free of nematodes and to notify the relevant authorities for implementation.
- A special project should be instituted for reducing and containing the spread of potato cyst nematodes in the potato growing states of northern India.
- The ICAR, SAUs, KVKs and other organizations dealing with plant protection should include Nematology in the essential qualifications of SMS-Plant Protection and plant protection scientists besides Entomology and Plant Pathology.
- All the UG curricula in Agriculture and Horticulture should be taught a course on plant nematology, so that they may be able to diagnose, report and deal with nematode problems also.
- Increased dialogues with industry for the placement of students trained in nematology in the pest management drive in agriculture.

Matiyar Rahaman Khan
General Secretary

Anil Sirohi
President