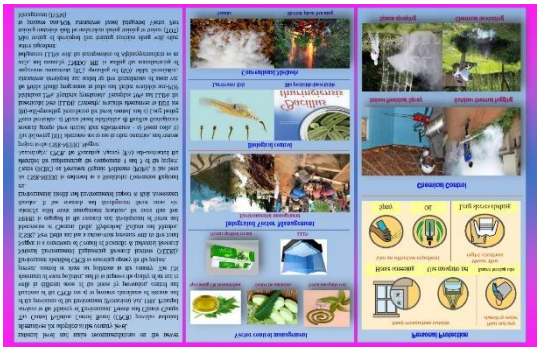
CSIR – National Environmental Engineering Research Institute
Nehru Marg, Nagpur – 440020.

6th Training Programme Report

On

Ten days online Training Programme for Pilot testing of Modules and ToT (Entomologists / Biologist & DMO from Maharashtra State) to promote non-POPs alternatives based Integrated Vector Pest Management

Date: 06/12/2021 to 17/12/2021
Time: 02:30 PM to 05:30PM



Ministry of Environment, Forest and Climate Change

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List of Abbreviations

BCC	Behaviour Change Communication
Bti	*Bacillus thuringiensis var. israelensis*
CCHF	Crimean-Congo Haemorrhagic Fever
CPCB	Central Pollution Control Board
CSIR	Council of Scientific & Industrial Research
DDT	Dichlorodiphenyltrichloroethane
EC	Emulsifiable Concentrate
FFS	Farmer Field School
GEF	Global Environment Facility
GoI	Government of India
HIL	Hindustan Insecticide Limited
ICMR	Indian Council of Medical Research
IEC	Information Education and Communication
IGRs	Insect Growth Regulators
IRS	Indoor Residual Spraying
IVM	Integrated Vector Management
IVPM	Integrated Vector and Pest Management
JE	Japanese Encephalitis
KFD	Kyasanur Forest Disease
LLINs	Long Lasting Insecticidal Nets
MoCF	Ministry of Chemicals and Fertilizers
MoEF&CC	Ministry of Environment Forests and Climate Change
NEERI	National Environmental Engineering Research Institute
NIP	National Implementation Plan
NVBDCP	National Vector Borne Disease Control Programme
POPs	Persistent Organic Pollutants
RMRIMS	Rajendra Memorial Research Institute of Medical Sciences
RNA	Ribonucleic Acid
RPU	Rational Pesticide Use
SC POPs	Stockholm Convention on Persistent Organic Pollutants
SIT	Sterile Insect Techniques
UNEP	United Nations Environment Programme
VBD	Vector-Borne Disease
WDP	Water Dispersible Powder
WHO	World Health Organization
WP	Wettable Powder
ZIKV	Zika Virus

1. Introduction

Stockholm Convention (SC) is an international treaty works for the protection of human health and environment from harmful Persistent Organic Pollutants (POPs). The Government of India (GoI) signed the Stockholm Convention on POPs and the Ministry of Environment, Forests and Climate Change (MoEFCC) was assigned as the National Focal Point. India has committed to fulfilling its obligations under the Convention, prepared its National Implementation Plan (NIP) and submitted it to the Secretariat of the Stockholm Convention on 21st April 2011. India assured in the NIP, that the development and promotion of non-POPs alternatives to DDT is one of the top priorities that require immediate action. Accordingly, the project entitled "**Development and promotion of non-POPs alternatives to DDT**" was jointly developed by United Nations Environment Programme (UNEP) and United Nations Industrial Development Organization (UNIDO). The project was approved by Global Environmental Facility (GEF) in April 2015 with two GEF implementing agencies *i.e.,* United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP), which are responsible for supporting delivery of specific project components. Following are the major project components to be implemented under the project:

I. Legislation, policy framework and institutional capacity (UNEP)
II. Alternatives to vector control (UNIDO)
III. Promotion and propagation of new cultivars of Neem (UNIDO)
IV. Development and Promotion of Integrated Vector Pest Management (IVPM)
V. Monitoring and evaluation of results (UNIDO / UNEP)

For components I and IV, MoEF&CC has nominated Central Pollution Control Board (CPCB) as a national Executing Agency to look after a partial execution of the project. As per the project document, the other part will be executed by the UNEP Law Division. The components of UNEP prescribe broadly Legislative framework and development, and pilot application of a set of Guidelines for Integrated Vector and Pest Management. UNIDO is working on the development of non-POPs alternatives to DDT viz. Long-Lasting Insecticidal Nets (LLIN), Neem based insecticides, *Bti* based pesticides under its two components.

The Global Environment Facility (GEF) was established to tackle our planet's most pressing environmental problems. The GEF supports countries to build capacity for the implementation of the Stockholm Convention through introduction and demonstration of viable, cost-effective and sustainable alternatives to eliminate dependency on DDT and other POPs chemicals.

The United Nations Environment Programme (UNEP) is the voice for the environment and the primary driving force for international activities related to the sound management of chemicals in the United Nations system. The UNEP promotes chemical safety by providing policy advice, technical guidance and capacity building to the developing countries. UNEP Chemicals Branch has the leadership of the Global Alliance for the Development and Deployment of Alternatives to DDT. As such, UNEP is a well-placed partner with other organizations to phase out current use and avoid future practices of DDT use in India.

The Directorate of NVBDCP, central agency responsible for guidelines, policy for prevention and control of vector-borne diseases in India has been implementing the Integrated Vector Pest Management (IVPM) strategy for effective management of vectors. It recommends Indoor

Residual Spray (IRS) and Insecticide Treated Bed Nets (ITNs)/Long lasting Insecticide Net (LLIN) for vector control in rural areas and anti-larval measures in urban areas.

IVPM is a tool for managing vector population to reduce or interrupt transmission of disease. IVPM is a way forward to improve cost-effectiveness, ecological soundness and sustainability of disease vector control. It emphasizes that the insecticides used in the programme must have negligible adverse human health effects, must be effective against the target species, must have minimal effect on non-target species and natural environment and their use must take into account the need to prevent the development of resistance. Key stakeholders involved in the project are the three Ministries viz. Ministry of Environment, Forests and Climate Change (MoEF&CC), Ministry of Chemicals and Fertilizers (MoCF), and Ministry of Health and Family Welfare (MoHF&W) whose mandates and roles are given below:

The Ministry of Environment, Forests and Climate Change (MoEF&CC) is the nodal ministry for planning, promoting and coordinating environmental programmes including the management of chemical disasters in India. The Ministry is mandated to protect the land, air and water systems and is responsible for the prevention and control of pollution including hazardous substances. MoEFCC is the GEF and Stockholm Convention focal point in the country, which coordinates activities and cooperation between relevant stakeholders of the NIP.

The Ministry of Chemicals and Fertilizers (MoCF) is mandated to control the production and scaling up of alternatives to chemical pesticides. The Department of Chemicals and Petrochemicals of MoCF is entrusted with the responsibility of policy, planning, development and regulations of chemicals and petrochemicals. The public sector named HIL under the MoCF is involved in the production, scaling up and setting up of the facility for industrial production of the alternatives, viz. production of synthetic pyrethroids, production of Long-Lasting Insecticidal Nets (LLINs), neem-based botanical pesticides and *Bti*-based biopesticides.

The MoHF&W mainly performs advisory role for matters related to public health including vector control programme in the country. The Ministry is responsible for the application, assessment and adoption of alternatives in public health activities; the State Health Departments coordinate and implement the project activities at the respective state level for the evaluation and assessment of newer alternatives to DDT in the field on the target pest; the National Vector Borne Disease Control Programme (NVBDCP), National Institute of Malaria Research (NIMR) and the National Centre for Disease Control (NCDC) undertake activities at the national level and make recommendations on the newer alternatives for adoption at the country level.

The Central Pollution Control Board (CPCB) provides technical services to the Ministry of Environment, Forests and Climate Change of the provisions of the Environment (Protection) Act, 1986. Principal functions of the CPCB are a) to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution and b) to improve the quality of air and to prevent, control or abate air pollution in the country. The United Nations Environment programme (UNEP) identified CPCB as executing agency for the project.

National Environmental Engineering Research Institute (NEERI), Nagpur is a constituent of Council of Scientific & Industrial Research (CSIR), New Delhi and has a nationwide presence with its five zonal laboratories at Chennai, Delhi, Hyderabad, Kolkata and Mumbai. NEERI is engaged in the research and development of better and scientific solid waste management practices, for more than four decades. It has research and development thrust areas viz. Environmental Health and Environmental Impact & Risk Assessment, etc. As CSIR-NEERI is

endorsed as a Stockholm Convention Regional Centre (SCRC) on Persistent Organic Pollutants (POPs), it has been identified for implementing the components IV and V of the project. Accordingly, CPCB, the executing agency (EA) sub-contracted the project to the CSIR-NEERI, Nagpur.

2. Training Objectives

At the end of the training programme, the participants should be trained to:

- Define the vector, describe the morphological characteristics of adult and immature stages of mosquitoes and about the biology and ecology of vectors.
- Describe the vectors and their role in Vector-Borne Diseases, the basic information about vector-borne diseases, how vector-borne diseases are transmitted, transmission cycle for respective vector-borne diseases and global distribution as well as the burden of the diseases in India.
- Promotions and development of locally safe, effective, affordable and environmentally sound alternatives to DDT, Environment management methods for vector control: Biological control methods, Genetic control methods, Control of vectors by chemical, non-chemical methods, Natural and conventional vector control management strategies.
- Learn the role of Integrated Vector and Pest Management (IVPM), describe different control measures used to control vectors and pests, learn organization and management of IVM in different sectors including FFS and how IVM improves the awareness in the community through BCC.

3. Training Programme

This online training programme was conducted for 10 days for a period from 06/12/2021 to 17/12/2021, the total number of the training sessions were 10 and each session has 3 or 6 training parts. 36 participants from Maharashtra states were selected including Biologists, DMOs and State Entomologists participated in the training programme. Dr. L. J. Kanhekar coordinated all the training sessions and Dr. Gujju Gandhi welcomed all the speakers/training experts. The training content covered from Training module-1: DDT and Vector-borne disease, Training module-2: Vector morphology and bionomics, Training module-3: Alternatives to DDT in vector control management and Training module-4: Integrated vector and pest management developed by CSIR-NEERI under the project "Development and promotion of non-POPs alternatives to DDT".

4.0 Training programme - Inaugural Function

Welcome Address

Inaugural function of the 6th online training for Training of Trainers (ToTs- SPO/Entomologists, DMOs and Biologists from Maharashtra State) and pilot testing of modules to promote non-POPs alternatives based Integrated Vector and Pest Management was held on 6th of December 2021, in an online mode via MS Teams between 02.30 to 03.00 PM by CSIR-NEERI, Nagpur (Fig.-1). **Dr. A. Ramesh Kumar** (Project Leader and Senior Scientist, CHWMD) welcomed all the participants and briefed on regular online training programme and requested to the Director, CSIR-NEERI to welcome and for opening remarks. **Dr. A. N. Vaidya**, Director, CSIR-NEERI welcomed all the participants, dignitaries - **Dr**. **Jitendra Sharma,** Programme Management Officer, UNEP-Geneva; **Dr. N. Subramanyam** (Chief Guest), Scientist 'D', HSMD, MoEF & CC, Govt. of India; **Dr. A. Ramesh Kumar** and **Dr. L J Kanhekar,** who are organising this

training program. He briefly introduced about this training of trainers and pilot testing of modules to promote non-POPs alternative & best practices Integrated Vector and Pest Management. He also discussed about the Stockholm Convention (SC) and India is a party to SC, allowed to restricted use of DDT- Persistent Organic Pollutants (POP's) and in coming years, we will completely be phase out DDT and its use but vectors will still be there, so we always work for alternatives. UNIDO has done work on non-POPs alternative and NEERI has given responsibility to make four training modules to train the trainers. Our target is to conduct at least 10 offline training programs but due to pandemic we are restricted to online program. As & when situation permits, we also go for offline training which will be more interacting. He requested all the participants from Maharashtra State to be very interactive and ask questions, give suggestion or criticize it because at the end of the day, everything is going to make the modules perfect.

Figure-1: Inaugural Session

Dr. Jitendra Sharma, Programme Management Officer, UNEP, welcomed all the team members as well as all the participants from Maharashtra state. He briefly introduced about the pilot testing of modules. As we are bound to Stockholm Convention, we will have to phase out DDT and its use. We have been fortunate to work with so many experts in the field of Entomology, vector control etc. based on the practical experiences, there is still hope of improvement of these modules & also expect that the modules not only serve India but many other Countries. GEF's requirement regarding document shall be expected and these modules as well as training material shall be revised by receiving inputs for these training programme & pilot testing, and shall be submitted to NVBDCP for further consideration and approval. In long run these modules will be extremely helpful for NVBDCP not only for malaria but also VBDs and also for capacity building and these will be translated in certain local languages. He requested to all participants to being interactive, ask questions and point out mistakes.

Dr. N. Subramanyam (Chief Guest), Sc.'D', HSMD, MoEF&CC, Govt. of India. MoEF&CC is the focal point of all these International Convention like SC, Rotterdam as well as Rome convention. MoEF&CC is the nodal agency for implementing all these conventions. He welcomed all dignitaries, Director, CSIR-NEERI and representative from UNEP, organizing

committee and all participants from Maharashtra State. Under the Stockholm Convention, DDT production & consumption is banned except the vector control programme. At present Hindustan Insecticide Ltd. is the sole producer in India and DDT production & consumption is around 1990 MT. He also discussed about the aim of this GEF funded project is 'to develop & promote non-PoPs alternatives to DDT' and components assigned to UNIDO. He requested to all the participants to give their inputs so these modules will be revised/ upgraded. **Dr. A. Ramesh Kumar** proposed the vote of thanks at the end of inaugural training session.

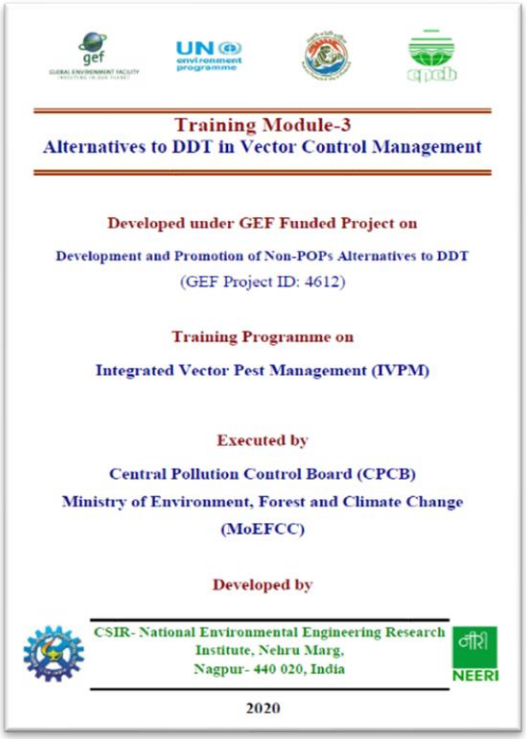
5.0 Training sessions

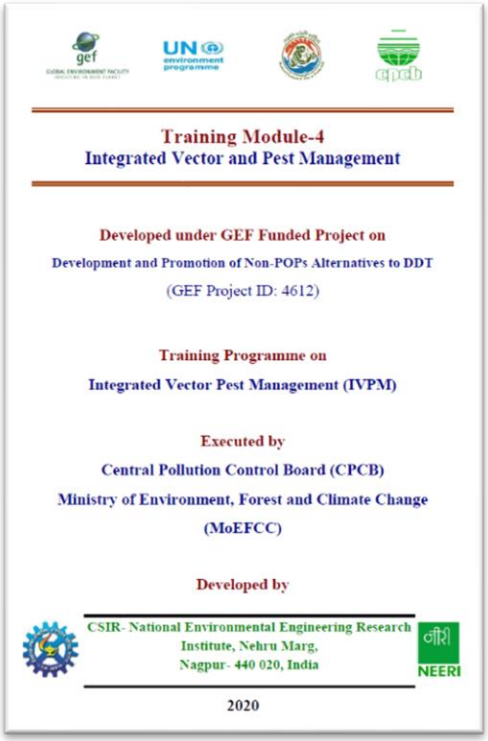
The total training sessions were 10, each session covered several parts and each part was conducted for approximately 30-40 minutes, the time was managed depending on a questionary discussion in end of the session. Every session was conducted in the afternoon from 2.30 pm to 5.30 pm.

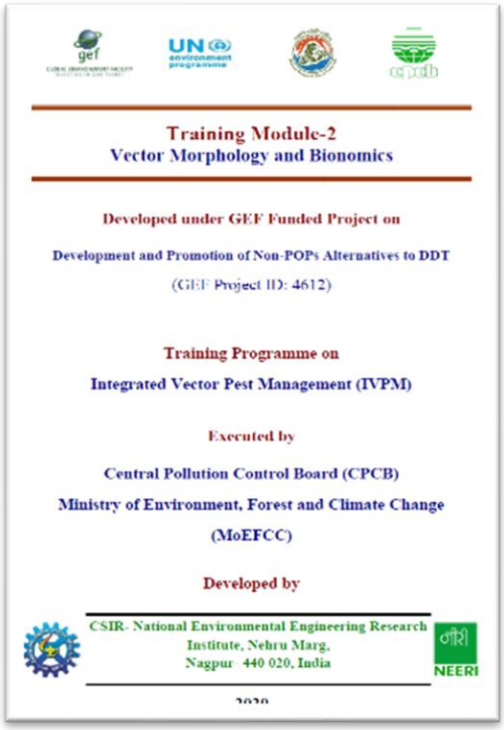
5.1 Training session-1 (Day – 1 (Monday) 06/12/2021)

Training part - 1: Introduction to Modules 1 to 4

Dr. L. J. Kanhekar briefly introduced about the training modules 1-4 and its content. He informed that training modules were made available to all the participants in form of training module booklets, PPT on each module & its content, IEC materials, awareness brochures and FAQ's. He deliberated the focus of CSIR-NEERI on successful implementation of pilot testing of these training modules (1-4). He suggested to all the participants to provide suggestion/ comments as far as to make these training modules more usable/ effective.







Training Modules 1 to 4

Training part - 2: Introduction to DDT and its use in vector control

Dr. A. Ramesh Kumar briefly explained regarding this GEF funded project & its five component and role of CSIR-NEERI in implementing two of the five components (Fig.-2). During his training session the contents covered were introduction regarding Stockholm convention on POPs., what is DDT, its structure (Ortho-Ortho, Ortho-Para & Para-Para isomers); physicochemical and its current production status (drastic change in DDT production from more than 10000 MT/year to 2000 MT/year; currently, Hindustan Insecticides Ltd., Maharashtra is the sole manufacturer of DDT in India) and usage in vector control management (Technical grade DDT 50 % for use in India and DDT 75% for export purposes mostly African countries). State-wise (North-East states, Jharkhand, Chhattisgarh, Punjab, Rajasthan, UP, West Bengal) supply of DDT in the year 2019-2020 in India was discussed. He also discussed the overall objective of UNIDO/UNEP in this project is to introduced bio & botanical pesticides and other locally appropriate, cost-effective alternatives to DDT by ensuring reduction/ elimination of dependence on DDT, ensuring food safety, enhancing livelihood & protecting human environment. UNIDO has developed alternatives to DDT such as Neem coils, neem larvicides, LLIN's, *Bti* based pesticides etc. He also discussed about Integrated Vector and Pest Management adapted by several countries to minimize/ reduce the use of POP's. He requested to all the participants to get maximum benefit of this training, it is not just a training programme but a capacity building programme and also requested to attend the lectures carefully & raise questions/ queries/ comments/ suggestions.

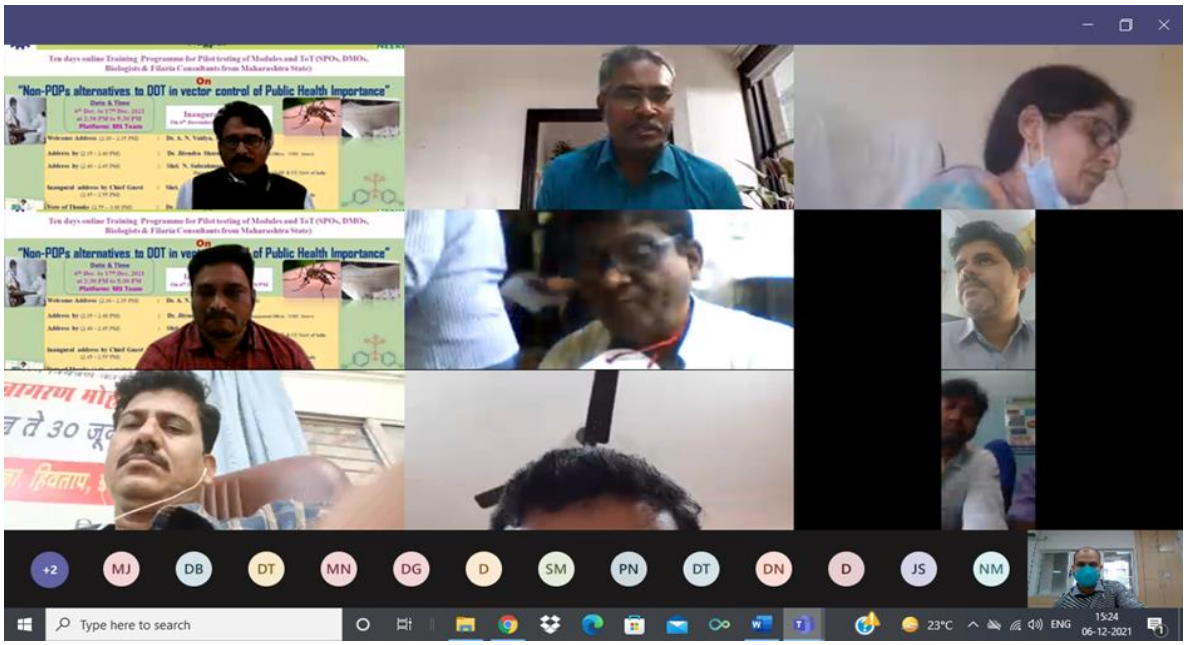


Figure -2: Discussion photograph of Training session - 1

Training part - 3: Introduction to vector borne diseases: Malaria

Dr. R. S. Sharma has appreciated CSIR-NEERI for developing teaching material in the form of modules for training programme. He deliberated this training session, a brief introduction about the vector borne diseases (Malaria: Global public health problem) and its impact. Causative agents of Malaria: *Plasmodium* Parasite (*P. Falciparum, P. vivax, P. ovale, P. malariae*) & its life cycle: Asexual & Sexual cycle; Vectors: Female Anopheles Mosquitoes (9 vectors in India (6- primary & 3- secondary vectors); Host: Human; Current status according to National Strategic Plan, Global disease burden and burden in India: India has contributed 70% of cases in the South Asian region which is 3-4 % of total contribution globally, signs & symptoms and transmission of Malaria (Extra domestic and Urban); Malaria ecosystem: Malaria system & Malaria sub system (Abiotic factor: Temperature, rainfall, Humidity & Biotic factors: Parasite & Mosquitoes & their interaction); He deliberated regarding WHO documentation on Malaria elimination framework for Urban area; He conducted an interactive session with the participants.

Training part - 4: Introduction to vector borne disease: Leishmaniasis (Kala-azar)

Dr. Vijay Kumar (consultant ICMR) gave brief introduction of Leishmaniasis (Kala-azar) and its causes: Cutaneous Leishmaniasis, Muccocutaneous Leishmaniasis and Visceral Leishmaniasis & post kala azar dermal leishmaniasis (PKDL); Causative agent: Protozoa Leishmaniasis (*L. Donovani*- in India only, *L. Infantum* and *L. Chagasi*); Vector: only *Phlebotomus argentipes*, sand fly vector of kala-azar in India; Life cycle within human (Amastigote) and Sand fly (Promastigate/ flagellate), Environment factors: altitude, season, rural areas, development projects; Burden in India and global burden.

5.2 Training session - 2 (Day - 2 (Tuesday) 07/12/2021)

Training part - 1: Introduction to vector borne disease: Dengue, Chikungunya & Zika

This training part was introduced by **Dr Kalpana Baruah** content covered was learning objectives of training module-1, brief explanation about the introduction of VBD's like Dengue,

Chikungunya and Zika; What is Dengue? It's form (Dengue fever and severe dengue), Sign and symptoms; Causative agent: Flavivirus (Four strain- DEN-1, DEN-2, DEN-3 & DEN-4); Vector: *Aedes* Mosquitoes (Primary- Aegypti & Secondary- Albopictus); Transmission cycle of Dengue: Forest/Enzootic, Rural/Epidemic & Urban/Endemic/Epidemic; Burden in India and global burden (Fig.-3).Introduction to Chikungunya & its symptoms: fever, chills, headache, nausea, vomiting, severe joint pain, rashes; Causative agent: Alphavirus; Vectors: Aedes Mosquitoes (*aegypti, albopictus, furcifer & africanus*); Transmission cycle of Chikungunya: Sylvatic CHIKV transmission and Urban CHIKV transmission; Burden in India and global burden. Introduction to Zika, History and its sign & symptoms: high fever, Malaise, stomach ache, Diarrhoea, conjunctivitis, Dizziness, Anorexia; Causative agent: Flavivirus; Vectors: Aedes Mosquitoes (*aegypti, albopictus, vitattus, furcifer, africanus* & *apicoargenteus*); Birth complications: Microcephaly, Gulllain-Barre syndrome; Incubation and Viremia- incubation period of zika virus 3 to 14 days; Transmission of Zika virus: Vector transmission and Non vector transmission; Burden in India and global burden.

Training part - 2: Introduction to vector borne disease: Lymphatic Filariasis

Dr. P. K. Srivastava covered this training part, contents covered were introduction of VBDs and associated vectors; Introduction to Lymphatic Filariasis, Causative agent (Filarial worm: *Wuchereria bancrofti, Brugia malayi*), Micro Filaria periodicity (Nocturnal Periodicity, Diurnal Periodicity), Transmission and life cycle (in human and mosquito body), external

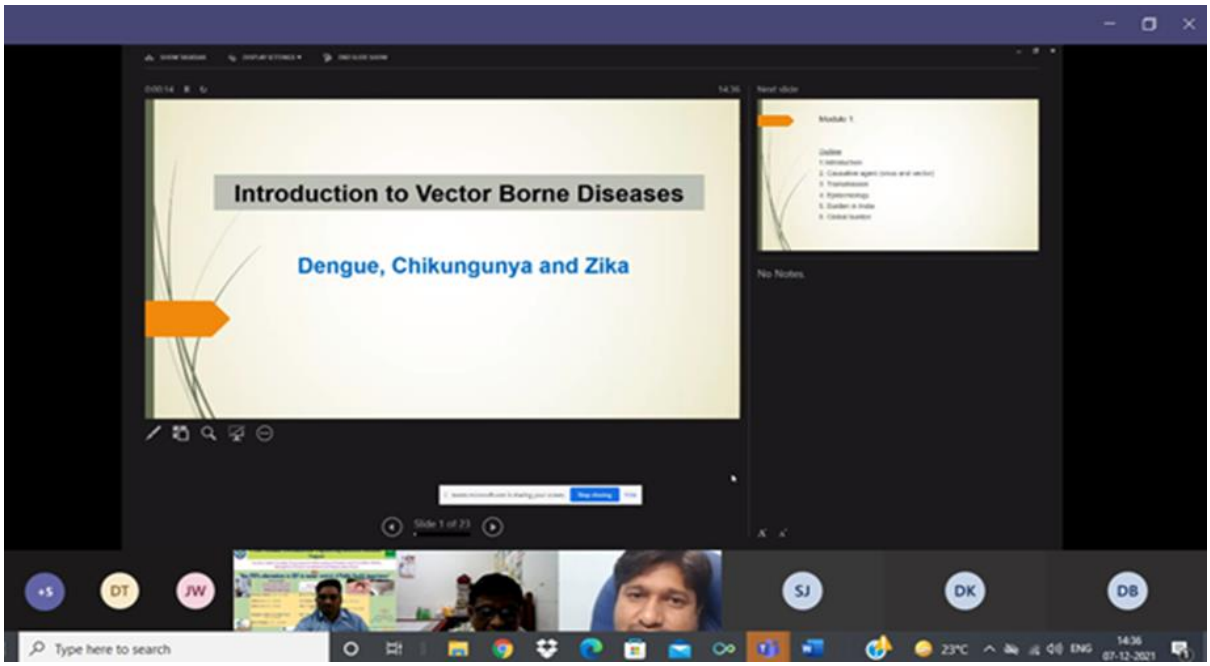


Figure-3: Screenshot of training session - 2

morphology of the vector (egg, larva, pupa and adult), Vector: *Culex quinquefasciatus, Mansonia annulifera, Mn. uniformis*. He also discussed national and global burden of Filariasis, its history in India, salient features of the vector life cycle, elimination of Lymphatic Filariasis, Species of filarial infections prevalent in India, current status of Lymphatic Filariasis in India, Differences between *W. bancrofti* and *B. malayi* species, Filariasis disease manifestation (acute & chronic), Paradigm shift in LF control, Elimination strategy: 1997 and guidelines about elimination of

Lymphatic Filariasis in India and Endemic urban & Rural area- 2019 Triple Drug Therapy with IDA were discussed.

Training part - 3: Introduction to vector borne disease: Scrub Typhus

Dr. T Ratna Joseph (Medical Entomologist) gave lecture on Section-9 (Scrub Typhus) of Chapter-2 of Training module-1. Brief introduction of Scrub typhus: History; Causative agent: a gram-negative, obligate intracellular bacterium Orientia; Vector: Mites genus- *Leptotrombidium Diliense*; Transmission: Trans-stadial and trans-ovarial transmission; Life cycle of mites: Egg→Larva→Nymph→Adult; Sign & symptoms; Diagnosis & treatment: diagnosis bases on bacterial culture, serology, molecular methods-rapid ICT, ELISA, PCR test, Antibiotics such as Azithromycin, Doxycycline are prescribed drugs & other effective drugs: chloramphenicol and tetracycline; Epidemiology & control; prevention & control using topical application of DMP, DEET etc. Burden in India and global burden.

Training part-4: Introduction to vector borne diseases: Japanese Encephalitis

This training part was covered by **Dr. P.T. Joshi** content covered was learning objectives of training module-1, brief explanation about the introduction of Japanese Encephalitis, Causative agents: a virus (Flavivirus); Vectors: *Culex Tritaeniorhyncus, Cx. Vishnui* etc.); signs & symptoms (According to WHO, a headache, high fever, tremors, nausea, vomiting); Host: primarily animal, birds & human incidentally and transmission of vector borne diseases (Natural transmission, horizontal & vertical transmission); Epidemiology; Indian and global disease burden; Prevention & Control were discussed.

Training part - 5: Introduction to vector borne disease: Crimean Congo Haemorrhagic Fever (CCHF)

The training part was lectured by **Dr. K. Regu**, the contents covered were introduction about CCHF, History of CCHF; Causative agent (Nairovirus of the family Bunyaviridae and vector- *Hyalomma* ticks), transmission (Transovarial and Transstadial transmission), Epidemiology and risk factor; Tick life cycle: Egg→Larva→Nymph→Adult; *H. Anatolicum, H. asiaticum, H. dromedarii, H. impeltatum, H. marginatum, H. rufipes, H. truncatum, H. turanicum* recognised as potential vectors for acquiring, maintenance and transmission of CCHFV; Clinical manifestation & Symptoms; Prevention and Control; Burden in India & Global burden were discussed.

Training part - 6: Introduction to vector borne disease: Kyasanur Forest Disease

Dr. N. Balakrishnan (Joint Director retd., NCDC) gave a lecture on Kyasanur Forest Disease (KFD). He deliberated about history of KFD; Causative agent: Group Toga virus/ flavivirus, its natural host (Rodent/ small mammals) and Vector (*Haemophysalis Spinigera* & *H. turturis*), amplifying host (*Presbytis entellus/ Macaca radiata*), reservoirs: cattle, dogs & other domestic animals; Life cycle of ticks: Egg→Larva→Nymph→Adult; Transmission: trans stadial mode (nymphal stage ticks), incubation period- 3 to 8 days; Environmental factors; Symptoms and Detection; Preventive measures & Control: advise not to go to the forest where monkey death reported, Hot spot spray- Malathion powder, use of tick repellent- DMP (dimethyl phthlate) oil, KFD vaccine; National burden and Global burden were discussed.

5.3 Training session-3 Day 3 (Wednesday) 08/12/2021

Training part - 1: Introduction to vector borne disease: Plague

On the third day, **Dr. N. Balakrishnan** brief Introduction to vector borne diseases: Plague; Causative agent: *Yersinia pestis*- Gram -ve bacteria); Vectors: *Xenopsylla Cheopis, X. brasiliensis*; Reservoirs: *Tatera indica, Bandicota bengalensis*; Susceptible hosts: *Rattus rattus, Mus musculus, Bandicota indica*; History; Transmission cycle; its current global status and types of plague (Bubonic plague, Pneumonic plague, Septicemic plague). He also deliberated on current status of plague in India, cases and deaths, plague surveillance network (Rodent, Blood, Organ, Dog sera, Human blood, fleas; surveillance methodology (bacteriology, Serology, molecular & entomological), surveillance-investigation of seas and airports and endemic plague foci in India (1951), treatment, vector control, etc. were discussed.

Training part - 2: Morphology of Vector Mosquitoes

Dr. L. J. Kanhekar deliberated in this training part, before starting the lecture he was discussed (Fig.-4) the learning objectives of training module-2, Introduction to mosquito vectors: *Anopheles, Culex, Aedes and Mansonia* spp.; Classification of mosquitos; Morphological characters of mosquitos. He gave a brief lecture on vectors of malaria: *Anopheles* mosquito (*Anopheles culicifacies, An. stephensi, An. fluviatilis, An. minimus,*

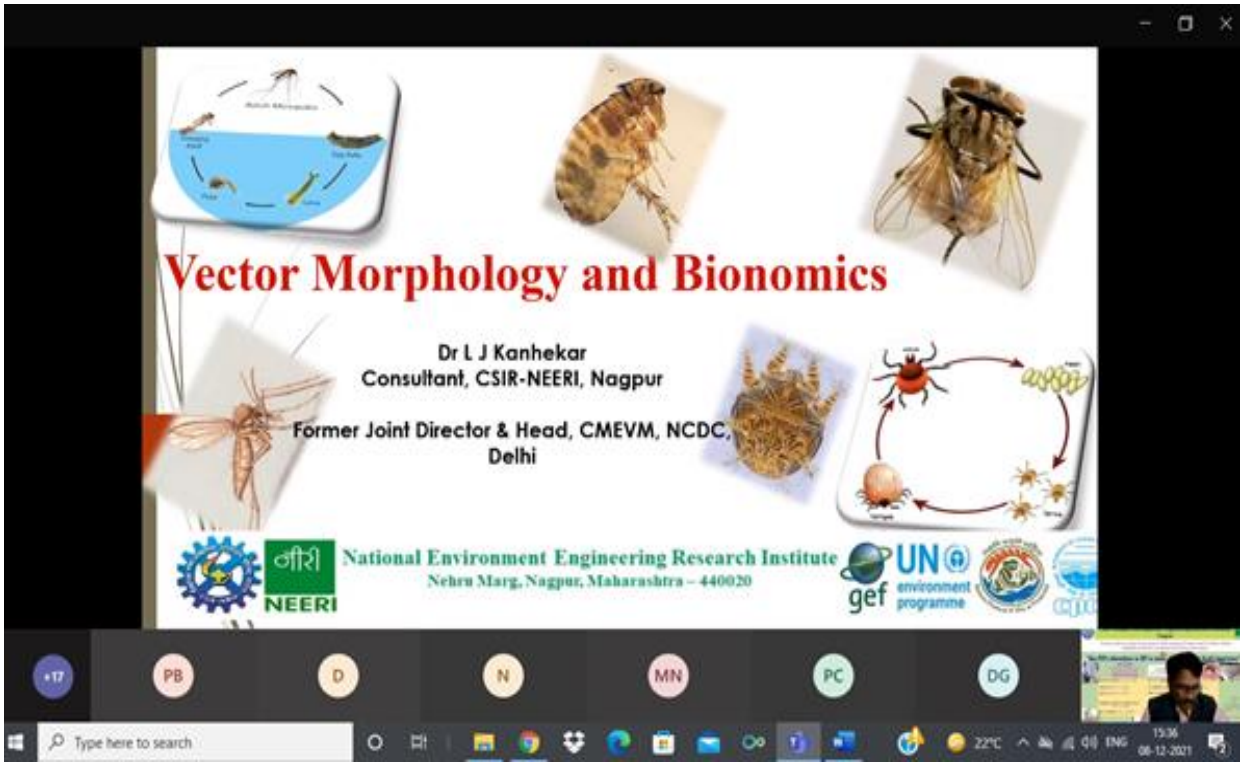


Figure-4: Screenshot of training session – 3

An. dirus, An. epiroticus, An. Varuna, An, Annularis, An. Philippinesis); Morphological characters, classification (egg, larva, pupa and adult), vector biology (life cycle of vector mosquitoes) and ecology (Distribution, breeding places etc.); Vectors of lymphatic filariasis / Japanese Encephalitis: *Culex* spp. Most important vector of LF and arboviral disease such as JE, *Culex* vector; External morphology- Adult, egg, larvae, pupa; Vector of Brugian filariasis

transmitted by *Mansonia* Mosquito & its external morphology (egg, larva, pupa, adult); Vectors of Dengue, Chikungunya, and Zika: Two medically important species viz *Aedes aegypti* & *Ae. Albopictus* and external morphology of vector were also discussed.

Training part-3: Morphology and bionomics of Sand flies

Dr. Vijay Kumar, has deliberated this training session with a brief introduction of vector of kala-azar/ Leishmaniasis disease: Causative agent: protozoan parasite; *Phlebotomus Argentipes* only known vector of visceral leishmaniasis or kala-azar in India and *Phlebotomus Papatasi*-vector of cutaneous leishmaniasis for human; Classification of Sand Fly; external morphology; Vector biology: complete life cycle of sand fly in insectarium; Vector ecology: Distribution, Breeding places, resting habits, feeding habit, biting habit, flight range; Types of parasite development were discussed (Fig.-5).

Figure -5: Discussion photograph of Training session - 3

5.4 Training session - 4 (Day - 4 (Thursday) 09/12/2021)

Training part –1: Morphology and Bionomics of Ticks and Mites

Dr. T Ratna Joseph (Medical Entomologist) deliberated about the training modules-II: Vector morphology and bionomics of Ticks and Mites (Fig.-6). He introduced about Ticks and its classification; capable of transmitting diseases: mainly Crimean-Congo Hemorrhagic Fever (CCHF), Kyasanur Forest disease (KFD); Type of ticks: Soft ticks and Hard ticks; life span (soft ticks- 15 yrs & hard ticks- about 3 yrs.), Soft Ticks: Introduction; External morphology; Biology & Ecology- Life cycle of soft ticks: Eggs→Larvae (6 legged)→Nymph (8 legged)– 4 instar→Adult; Population depends on various factors: climate, hosts, predators & competitors; Hard ticks (Ixodid); External Morphology; Life cycle of hard ticks: Eggs→Larvae (6 legged)→Nymph (8 legged)→Adult (life span- about 3 years); key differences between soft ticks and hard ticks; tick-borne diseases in India. He also lectured on topics: Introduction of Mites and its Classification; Life span is about 6 months, transmit Rickettsial Pox, Scrub Typhus,

Dermatoses, chiggers and scabies; External morphology; *Leptotrombidium* is medically important species which is the vector of Scrub Typhus. Biology and Ecology of Mites; Life cycle: Egg→Larva (Prelarva)→Nymph- 3 instar→Adult (Life cycle takes 40-75 days but may differ due to environment) were discussed.

Training part - 2: Entomological surveillance of VBDs

Dr. Himmat Singh, Sc.'D' ICMR-NIMR has deliberated about training module- 4: Integrated Vector and Pest Management (IVPM). During his lecture he covered topics such as Entomological Surveillance of VBD's & its key elements: Introduction to Entomological Surveillance- Regular and systematic collection, analysis and interpretation of entomological data for risk assessment, planning, implementation, monitoring and evaluation of vector control intervention; Methods: detection & monitoring of larval and adult population- Collection of

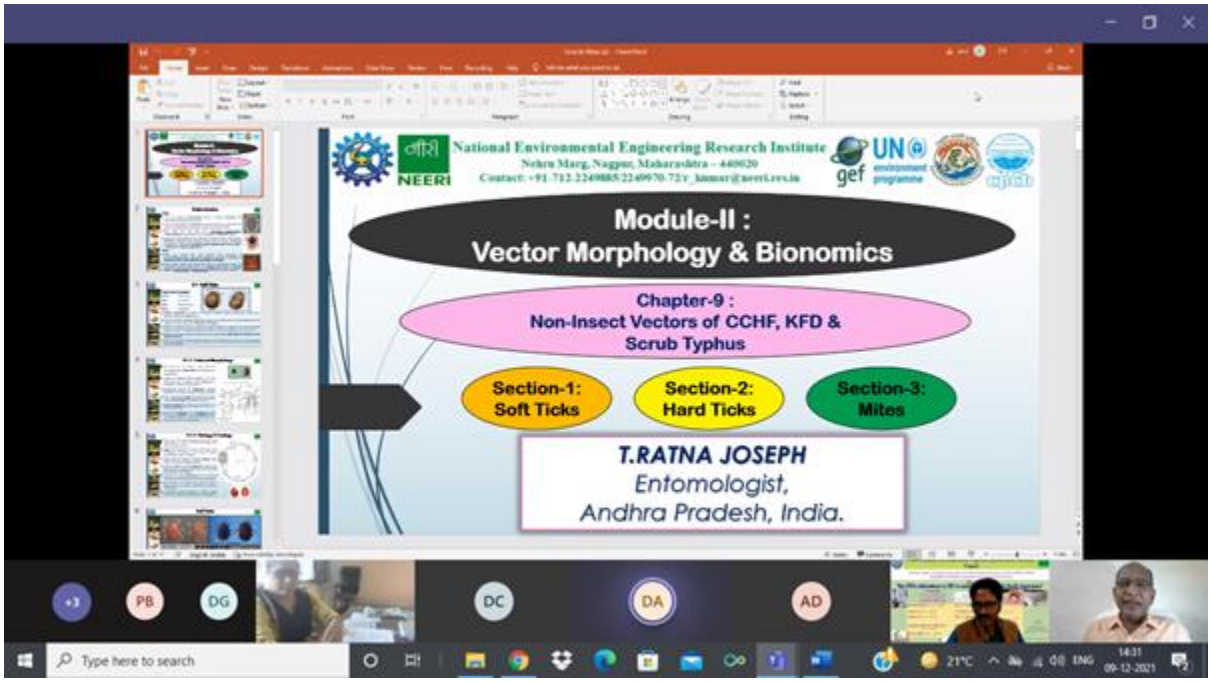


Figure-6: Screenshot of training session – 4

Adult mosquito: 1) Hand collection, 2) Collection of adult Sand fly, 3)Larval collection methods; Collection of inactive stage of Sand fly; Purpose of Collection; Types of collection: Adult collection, Larval collection & Eggs; Methods- Qualitative and Quantitative; Hand Collection; Spray Sheet Collection; Landing Collection; Trap Collections: Types of Traps; Vector Traps for disease surveillance & Surveillance tools; Sampling methods of larval collection: Qualitative & Quantitative methods- Netting method (surface collection), Dipping method; Larval collection method: Siphoning method (Tree hole), well net collection, Larva collection by dropper/ pipettes were discussed.

Training part - 3: Alternatives to DDT in vector control: Environment Modification and Manipulation (EMM)

Dr. R. S. Sharma, has deliberated this training session, the content covered was Introduction to NVBDCP vector management; DDT Alternatives: Vector Control Tools; Learning Objectives of Environmental Management; Introduction to Environmental Management, Environmental Manipulation & its types and Environmental Modification & its types; Environmental and

Engineering methods; EMM Source reduction: *Ae. aegypti*, *An. stephensi*; EEM technology Irrigation malaria; Environmental approach to vector control pre DDT; Community based vector management; Vector control in Delhi 1936-1940; Urban Malaria Control with EEM Technology and legislative vector control in 1928, EMM in Mumbai- Malaria control; Environmental control Sabarmati River's changing scenirio, Environmental modification Urban Malaria in Delhi 1961-2011; Risk factor Urbanization, Construction activities, without HIA, Outbreak of Malaria (1996, 2005) Mangalore city; Petroleum project, IT & BT projects, Konkan Railway project were discussed.

Training part-4: Morphology and bionomics of Fleas & Flies

In the last training session of the day, **Dr. Gujju Gandhi** deliberated lecture about the morphology and bionomics of vectors of the enteric diseases. He briefly explained about fleas,

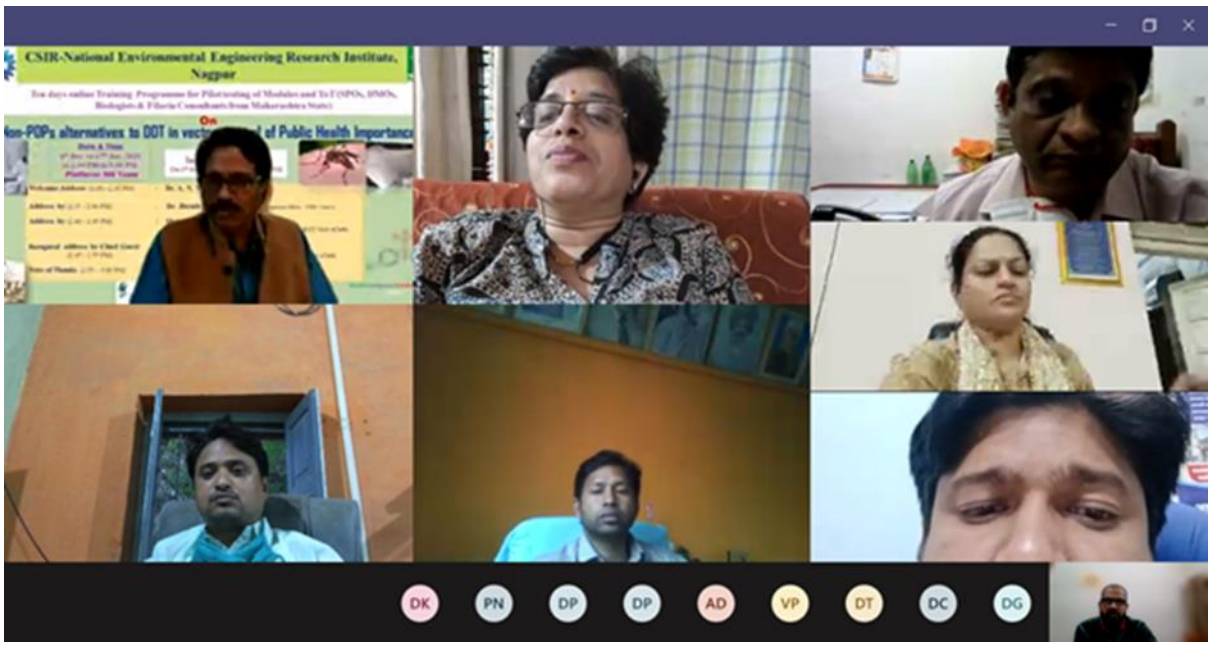


Figure -7: Discussion photograph of Training session - 4

about 2500 species in about 220 genera, 37 species known to occur in India; *Xenopsylla spp.* Medically important flea (vector of plague and murine typhus); Plague: an infectious disease caused by *Yersinia Pestis*; classification and external morphology; Difference between male & female vector; Bionomics of Fleas: Life cycle- Egg→Larva→Pupa→Adult; He also deliberated introduction on House Fly (Musca), can be a vector of Helminths, faecal bacteria, protozoan & viruses resulting in the spread of enteric diseases- gastrointestinal tract; classification of House fly: 4200 species, 190 genera, almost 70 species of house flies belonging to genus Musca; morphology of the house fly and its life cycle: Egg→Larva (Maggot)→Pupa→Adult, Breeding places were discussed (Fig.-7)

5.5 Training session - 5 (Day - 5 (Friday) 10/12/2021)

Training part –1: Entomological Parameters and their Importance

Dr. Himmat Singh deliberated this training part and gave brief introduction about Entomological Surveillance and their importance: Dengue Larval survey- a) House Index, b)

Container Index, c) Breteau Index, d) Pupae Index; Surveillance of Malaria vector; Entomological Survey of Lymphatic Filariasis: Ten Man- hour Vector density, infectivity rate, infection rate, mean number of L3/infective mosquito); Epidemiological Surveillance: i) Incidence & ii) Prevalence: a) Point prevalence and b) Period prevalence; Epidemiological parameters of Malaria: i) Annual Parasite Incidence, ii) Annual Blood Examination rate, iii) Annual Falciparum Incidence (A*f*I) & iv) Slide Positivity Rate; Epidemiological parameters of Filariasis: a) Microfilaria rate, b) Microfilaria density, c) Filarial Endemicity rate were discussed.

Training part - 2: Alternative to DDT vector control: Biological and Genetic Control

Dr. Ratna Joseph, deliberated this training part and gave brief introduction on the control of Pests/ vectors; Different Biological agents used in vector control: 1) Copepods, 2) Nematodes, 3) Flatworms, 4) Fungi, 5) Invertebrates Predators, 6) Anuran Predators, 7) Bacteria (Bt) & Protozoans, 8) Larvivorous Fishes; Desirable attributes of Bio-control agents and Advantages of Biological Control.

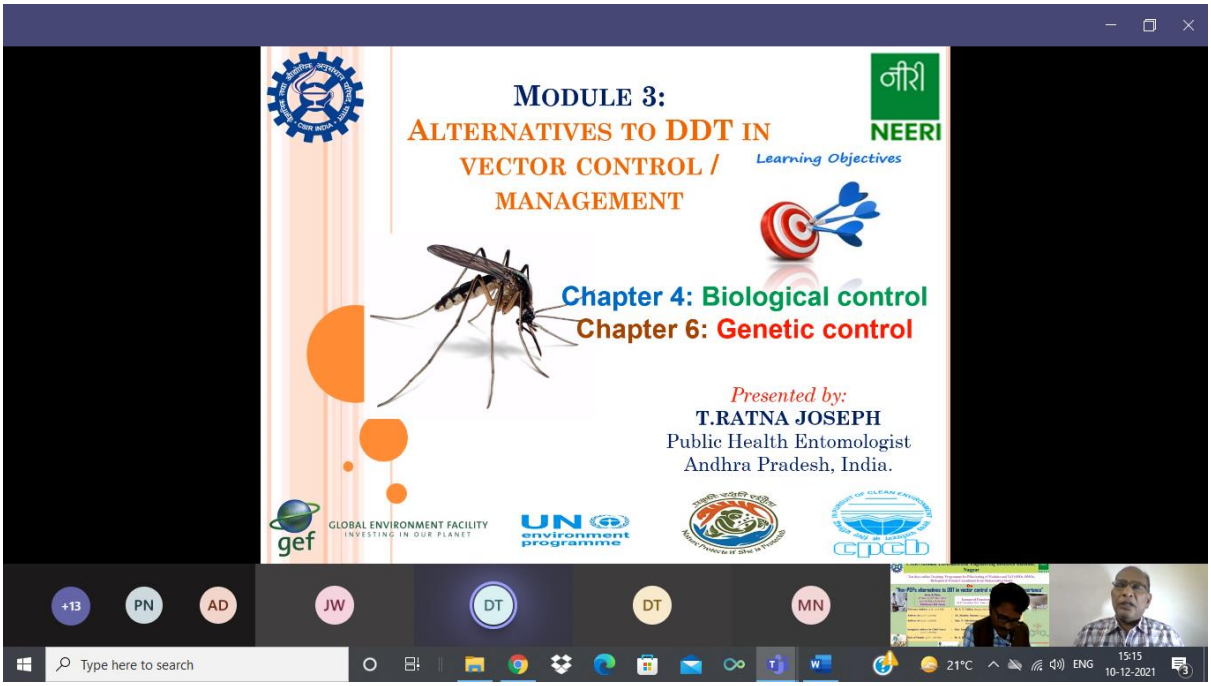


Figure – 8: Photograph of training session – 5

He also gave Introduction to Genetic Control; Sterile Insect Techniques: 1. Conventional SIT, 2. Translocation of Heterozygotes; 3. Genetic sexing; 4. Cytoplasmic Incompatibility; 5. Hybrid Sterility; Refractoriness to disease transmission; Population replacement using Wolbachia; Gene Silencing using RNA interference; Gene drive (fig.-8).

Training part - 3: Vector control measures/ Management: Chemical control methods

Dr. P. K. Srivastava covered this training part, the content covered was an introduction of chemical control for malaria, chemical control methods: Plant products including pyrethrum, neem derived products, synthetic chemicals and its classification (organophosphorus, organochlorine, synthetic pyrethroids and carbamates), Larval source management: Mosquito Larvicidal Oils (MLOs), Temephos 50% EC, Insect growth regulators (IGRs)- Pyriproxyfen 0.5% & Diflubenzuron 25%; Dosage & formulation of different chemical larvicide (NVBDCP); Adult Vector Control: Indoor residual spray (DDT 50%, Malathion 25% and Sunthetic

pyrethroid); Long Lasting Insecticidal Nets (LLINs); Indoor space spray: outside fogging (thermal fogs or cold fogs); Preparation of ready to use suspension & application of insecticides for IRS (NVBDCP) were discussed.

Training part - 4: IVPM- Behavioural Change Communication (BCC)

Dr. L. J. Kanhekar deliberated this training session, a brief introduction about Behavioural Change Communication- IEC strategies: IPC between community & Health workers, Social & Community; Objective of BCC; Outcomes of interventions; Tools of BCC: Four tools- Media Information (Radio/ TV Broadcast), Education & Communication, Communication for behavioural impact, and Farmer Field schools; Accredited Social Health Activist (ASHA) trained under National Health Mission (NHM); Multipurpose Health Workers (MPHW) were discussed (Fig.-9).

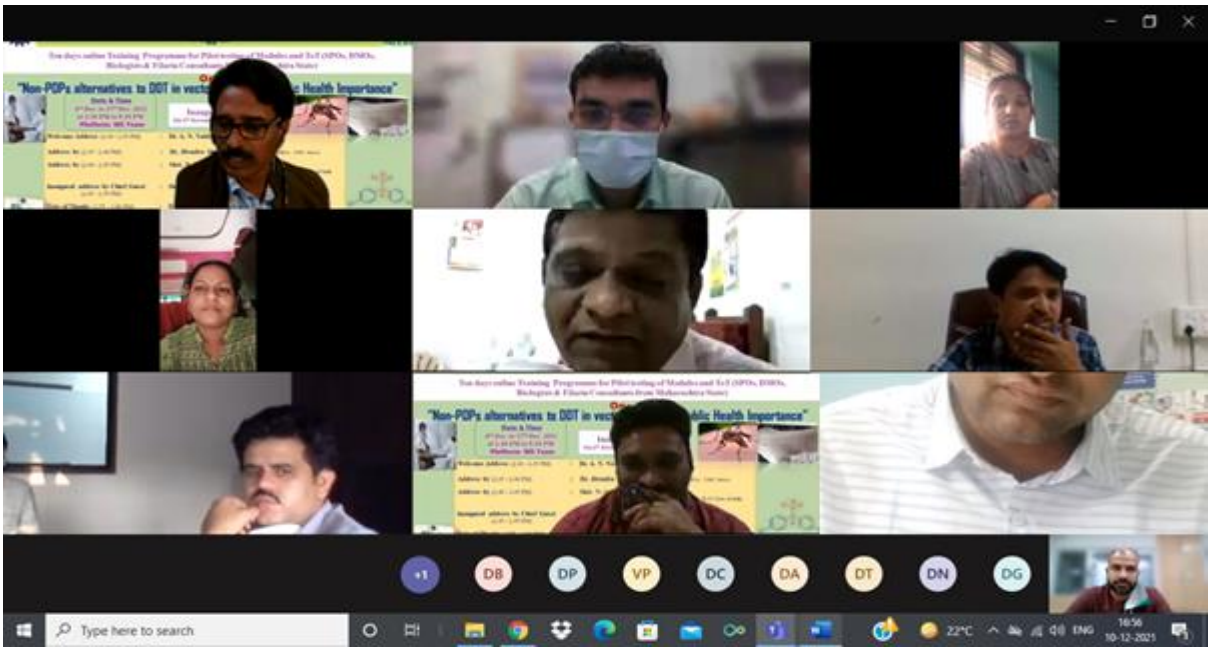


Figure -9: Discussion photograph of Training session - 5

5.6 Training session - 6 (Day - 6 (Monday) 13/12/2021)

Training part - 1: Equipment for Larviciding and Adulticiding:

This training part was introduced by **Dr P. K. Srivastava** content covered were equipment/ tools for Larvicide and Adulticide (Fig.-10); Various tools have been currently in practices: 1. Knapsack Sprayer (larvicides); 2. Hand Compression pump- Standard equipment for residual spray (Both Adulticide & Larvicide); 3. Stirrup Pump; 4. Fogging Machines: a) Portable thermal fogging machine, b) Ultra Low Volume (ULV); 5. Vehicle Mounted Fogging Machines: used in urban or sub-urban areas; 6. Vehicle Mounted Cold Fogging Machines were discussed.

Figure-10. Screenshot of Training session - 6

Training part - 2: Integrated Vector Management (IVM)

Dr. R. S. Sharma deliberated this training session, a brief introduction about IVM: What is IVM, IPM & IVPM; Key elements of IVM: Evidence based decision making, Integrated approach, Collaboration within health & other sectors, Advocacy Social mobilization and Capacity Building; IVC methods: improves the efficacy, cost effectiveness, ecological soundness and establish sustainable disease-vector management- Environment Management→ Personal Protection, Environment Modification→ Chemical Control, Environment Manipulation→ Biological Control, Changes to human habitat/ behaviour→ Genetic Control. IVM in different situation: Epidemic and Endemic; Organization & Management→ People & Institution, Technology and Process; Collaboration of Health Sector- at central level & at local level; Intersectoral Collaboration and the role of partnership were discussed.

Training part - 3: Bionomics of vector mosquitoes

Dr. R. S. Sharma has deliberated this training session and covered topics an introduction to bionomics of vector mosquitoes: Rational (Insecticides based interventions mainly- LLIN's & IRS) & Bionomics (feeding, resting, biting habits, breeding, distribution, site of transmission (intra, peri, extra, domiciliary sites), gonotropic cycle, insecticide resistance; Eco-Epidemiological aspects:- Entomological factors (Vector density, frequency of biting man, longevity) & Environmental factors (Temperature, Relative humidity, Rainfall); variable endemicity (hypo, meso, hyper, halo). He also discussed about malaria transmission: basic factors- Malaria parasite←→Vector←→Human Host; Concept of ecosystem: Terrestrial & aquatic ecosystem (adaptation, interdependence, carrying capacity & Interaction); Morphological adaptation: Thermophilic species and Hydrophilic species; Epidemiological & Ecological consequences; morphology of eggs, life cycle of mosquitos, feeding behaviour; climate zones and natural distribution of malaria vectors in India; Epidemiology of diseases, vector composition, susceptibility, target population and environment; Vector Succession and Vector Disappearance.

Training part - 4: Monitoring & Evaluation of Integrated Vector and Pest Management

Dr. Amit Katewa briefly introduced about the IVPM: Monitoring & Evaluation and its methods; Methods of Monitoring and Evaluation: Outcome Indicators- Process, Outcomes & impacts; Outcomes indicators followed though- Planning and implementation, Organization and Management: Structure of Monitoring & Evaluation within health sector- At Central level, At Local Level, Inter-Sectoral collaboration; Behaviour Change Communication (BCC): Planning & Implementation of IVPM: Indicators to monitor and evaluate progress in Organization and Management of IVM; Indicators to monitor and evaluate progress in advocacy and communication of IVM; Entomological Surveillance: The distribution, Population density, Larval Habitats & Insecticide Resistance monitoring through susceptibility test: i) Adult Susceptibility & ii) Larval Susceptibility; Adult Aedes Survey: Landing/biting Collection; Resting Collection; Oviposition traps; Aedes Larval Indices & Significance; Surveillance of Malaria Vector; Entomological Surveillance of Lymphatic Filariasis: Ten Man- hour Vector density, infectivity rate, infection rate, mean number of L3/infective mosquito) were also discussed.

Training part - 5: Alternatives to DDT: Neem derived products for Vector Control

Dr. Amrish Aggrawal, has deliberated this training session with brief introduction about non-POPs alternative to DDT: Problem associated with use of Synthetic Pesticide; Promote effective alternatives to DDT and synthetic pesticides: Neem (*Azadirachta* spp.) & Bacillus thuringiensis (Bt) as Bio-botanical pesticides; Objective of the Project; Mosquito Life Cycle; He also discussed about progress made in project: Neem based formulations developed and process standardized for pilot plant production: 1. Process for coil formulation; 2. Process for Cream formulation; 3. Process for Suspension Concentrates formulation; 4. Process for spreading oil formulation; 5. Process for Tablet production; Bio-efficacy of neem based Spreading formulation/ SC/Tablets/Cream; Technology, Transfer & Training; Bacillus thuringiensis (Bt) based formulation were discussed.

5.7 Training session-7 (Day – 7 (Tuesday) 14/12/2021)

Training part - 1: NVBDCP Recommended Insecticides: Larval Source Management and Adult Vector Control

This training part was introduced by **Dr Kalpana Baruah,** content covered were Larval Source Management (Figure-11): refers to the targeted management of mosquito breeding sites, with the objective to reduce the number of mosquito larvae and pupae; Environment Management for Source reduction: 1. Habitat Modification (Physical transformation of Land, Water and vegetation), 2. Habitat Manipulation (Temporary changes in vector habitats); She deliberated on Chemical Control (Larviciding): Chemical Larvicides in areas where disease and vector surveillance indicate the high risks and in localities where outbreaks might occur; Dosage and formulation of different larvicides (NVBDCP); Mosquitos Larvicidal Oil (MLO)- classical larvicide (petroleum product); Temephos: An Organo-phosphorous compound for larval control, used as 50% emulsion concentration; Insect Growth Regulators (IGRs): Interfere with the development of the immature stages of the mosquitoes by interference of chitin synthesis e.g. Pyriproxyfen 0.5 % GR, Diflubenzuron 25 % WP; Biological Control: *Bacillus Thuringiensis* var *israelensis* (*Bti*), Bacteria used as 'Biocontrol agent', target specific: used in both clean and

polluted water, 5 % wettable powder & Aqueous suspension; Larvivorous fishes: Gambusia and Guppy; other Bio-control agents for mosquito larvae: Copepods, Nematodes, Flatworms, Fungi, Invertebrates Predators, Anuran Predators; Adult Vector Control: Adulticides are used to kill adult mosquito.

Fig.-11 Screenshot of training session- 7

For Indoor Residual Spray (IRS), Insecticides used are- DDT 50 % WP, Malathion 25 % WP and synthetic pyrethroid (SP); Indoor Space Spray: recommended only in emergency situations Outdoor fogging- fog is liquid insecticide, dispersed into the air in the form of hundreds & millions of tiny droplets; Thermal fogs or cold fogs; Long Lasting Insecticidal Nets (LLINs): Bed nets treated by a process that binds or incorporates insecticides into the fibres, LLINs provide better effective protection by keeping away mosquitoes as well as killing them; Formulation, Preparation & application of Synthetic Insecticides for IRS (NVBDCP).

Training part - 2: IVPM: Vector Management through Farmer Field School (FFS)

Dr. R. S. Sharma, deliberated this training session, a brief introduction about IVPM Background: it builds upon the successful experience in Integrated Pest Management, which is based on the practical field-based education of groups of rice farmers in weekly sessions of the farmer field school (FFS). IVPM project- Sri Lanka- 2002, with support of FAO & UNEP thus involving rural communities in reducing the health risks of VBDs. Rational of IVPM: Malaria and other VBDs like LF, Leishmaniasis/ JE, Dengue is a major health problem in the South East Asia region; Objective of IVPM: Enhancing the role of local communities in sound ecosystem management. Goals- 1. Raise agricultural productivity & 2. Reduce risks of VBDs; Concept of IVPM: VBDs occur where there is a close interaction between host, parasite & vector; Agricultural Environment; IPM & IVM are increasingly introduce and promoted in agricultural and as part of vector- borne disease control, respectively. He also discussed Pyrethroid Resistance in Malaria Endemic states- Chhattisgarh, Madhya Pradesh, Odisha & Andhra Pradesh (*An. culicifacies* vector resistant to deltamethrin-SP); Farmer Field School (FFS): is a group-based learning process that has been used by number of Government, NGO's and International agencies

to promote IPM; Evolution of the FFS approach: Asia (1989)→ 2016 (90+ Countries); Farmer Approach towards VBD's; Vector Management through the FFS approach; Health risks associated with agriculture: irrigated agricultural eminent provide breeding habitats for vectors of Malaria, LF, JE, Dengue etc., Use of insecticides in agriculture can cause resistance in disease-transmitting vectors breeding in agricultural environment there by reducing the effectiveness of insecticide- based vector control methods; e. g. Outbreak of Malaria due to Indira Gandhi Canal for Irrigation- Jaisalmer District, Rajasthan, 2001; Spraying of Insecticides causes occupational poisoning; Role of FFS at the Field Level; Rice Field and Japanese Encephalitis- Outbreak of JE in Assam State in 2018; Mosquito breeding and rice field: a study of breeding of mosquito in the rice field agro-ecosystem was carried out in Madhya Pradesh, during 1987-88; Effect of irrigated rice agricultural on JE; Success Story: Malaria Mosquito control in rice paddy farms using bio-larvicides mixed with fertilizer in Tanzania.

Training part - 3: IVPM: Planning & Implementation

Dr. R.S. Sharma covered this training session; discussed about Planning & Implementation under IVPM: Learning objectives; Introduction: Planning & Implementation- depends on intervention, management, resources & stakeholders Participation; Epidemiological Assessment: It is a process to determine actual burden of disease- 1. Measures of disease occurrence- a) Prevalence: Point & Period Prevalence, b) Incidence: Risk & Incidence; 2) Estimation of disease occurrence: a) Case Study, b) Primary survey, c) Cohort Study, d) Sampling; Entomological Assessment: it is one of the tools used in monitoring and controlling vector borne diseases; Collection of Adult mosquitoes is made for a) Qualitative studies & b) Quantitative studies; Determinants of Local diseases: can be divided into 4 categories related to the: i) Parasite, ii) Vector, iii) Human activities & iv) Environment; Selection of vector control methods: can be Environmental, Mechanical, Biological and Chemical to reduce vector population or to reduce human vector contact. Selection criteria of vector control method (WHO); IVM implementation Strategy: Entomological Surveillance in sentinel and random sites at monthly/ quarterly/ annual intervals; Promote source reduction; Scaling-up use of LLINs; Appropriate use of insecticide for supervised IRS etc. He also discussed roles of various sectors in IVPM implementation: Agriculture, Water resources development, Water supply, Road & building sector, Urban development, Industry/ mining, Railways, Environment/ Forest, Fisheries Institutional, Remote sensing; Private Pest control Agencies, Planning departments, Sea/ air ports, Education, Mass media, Village councils, Local Governments; Role of Health trainers and trainers in coordinating IVM & IPM: SIMA- System-wide, Initiative on Malaria and Agriculture; Evaluation of IVPM project in Sri Lanka were discussed.

Training part - 4: IVPM: Epidemiological Surveillance

Dr. T. Ratna Joseph briefly introduced about the IVPM: Epidemiological surveillance; Epidemiology (Figure-12): The study (scientific, systematic and data-driven) of distribution (frequency, patterns) and determinants (causes/risk factors) of health-related states and events (not just diseases) in specified population; Epidemiological triads of VBD's: Host←→Vector←→Pathogen; He also covered topics include Malaria Classification: Indigenous (cases contracted locally with no importance), Imported (infection acquired outside the designated area where it was diagnosed) and Induced (cases which can be traced by blood transfusion or other form of parental inoculation of the parasite); Malaria Paradigms:

Demography, Topography & Ecology based Urban Malaria, Rural Malaria, Hill Tract Malaria, Plains Malaria, Irrigation Malaria, Island Malaria, Coastal Malaria, Industrial Malaria. IDSP-Integrated Health Information Platform (IHIP): Surveillance units established at all States/Districts (SSU/DSU), Central Surveillance Unit (CSU) and integrated in NCDC, Delhi; Presumptive (P) form consists of 22 diseases including Malaria, Dengue, Chikungunya, AES, PUO etc.; Laboratory (L) form consists of 12 diseases including Dengue, Chikungunya, JE, Malaria etc.; NVBDCP: Blood Smear, Rapid Diagnostic Test (Antigen/ Antibody) Source: Active & Passive case detection, mass & contact detection, sentinel sites and surveys; Epidemiological surveillance: Incidence (no. of new cases occurring in a defined population during a specified period of time) and Prevalence (to all current old and new cases existing at a given point of time or over a period of time)- Point prevalence & Period prevalence;

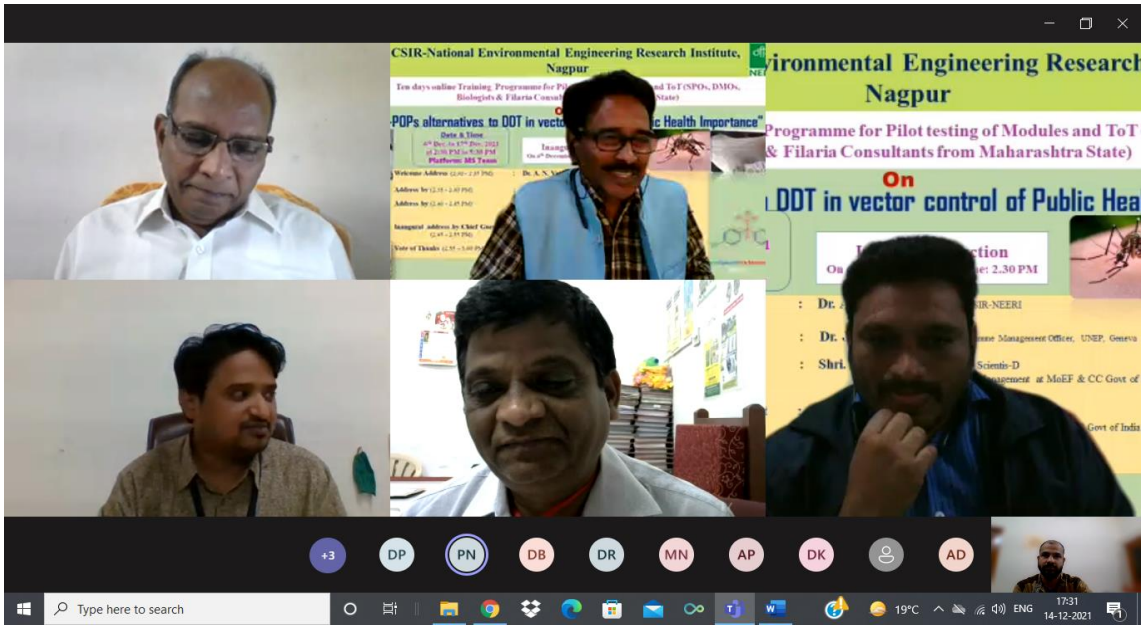


Fig. -12: Discussion photograph of Training session – 7

Parameters of Malaria: Annual Blood Examination Rate (ABER), Annual Parasite Index (API), Annual *falcipuram* Incidence (AFI), Slide positivity rate, Slide *falcipuram* rate; Other parameters- Pf%- P. *falcipuram* cases among total malaria cases; Infant Parasite: Children below 1 year of age positive for Malaria; Case Fatality: Deaths confirmed due to Malaria; Drug Resistance: The ability of a parasite strain to survive/ multiply despite the absorption of a medicine given in the doses; Severe & complicated; Economic injury; Source of Infection: Primary, Secondary, Migration/Immigration, Relapse/recrudescence and Induced; Parameters of Lymphatic Filariasis: Filarial Endemicity Rate, Microfilaria Rate and Microfilaria density- Frequency: Weekly interval for Viral disease (DEN/CHK/JE), Fortnightly interval for Malaria, Quarterly interval for Filariasis; Parameter for other VBDs: 1. Dengue, 2. Chikungunya, 3. JE, 4. KFD, 5. Zika, 6. Plague. He ends the lecture with conclusion on epidemiological surveillance outcomes: Sporadic (cases occur irregularly), Outbreak (local/ focal)- disease occurs suddenly in a relatively confined geographic area, Epidemic- unusual occurrence in a community or region – specific health-related events, Endemic- constant presence of a disease/ infectious agent within a given geographic area or population group and Pandemic- an epidemic usually affecting a large proportion of the population over a wide geographic area.

5.8 Training session-8 (Day – 8 (Wednesday) 15/12/2021)

Training part - 1: Integrated Pest Management (IPM)

Dr. V.J. Tambe was covered this training session; discussed about IPM Pyramid: Control, Surveillance & Avoidance, History of IPM. He deliberated this training session, a brief introduction about Integrated Pest Management: "IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health and environmental risks". Principles and Strategies of IPM: 1. Monitoring of insect, pests and natural enemies; 2. Concepts of injury levels; 3. Integration of pest control: a) Preventive practices- can be used irrespective of low level of pest incidence, it can be followed as routine, even if the pest is at low level; b) Curative practices: have to followed only when the pest attains economic threshold level (ETL). Integration of different components of IPM: Selection of appropriate method; Integration of Pest Control Method. Major components of IPM: **1**. Cultural Practices, **2**. Physical Methods, **3.** Mechanical Methods, 4**.** Biological Control, **5.** Chemical Control, **6.** Legal Methods and **7.** Genetic Control (Figure 13).

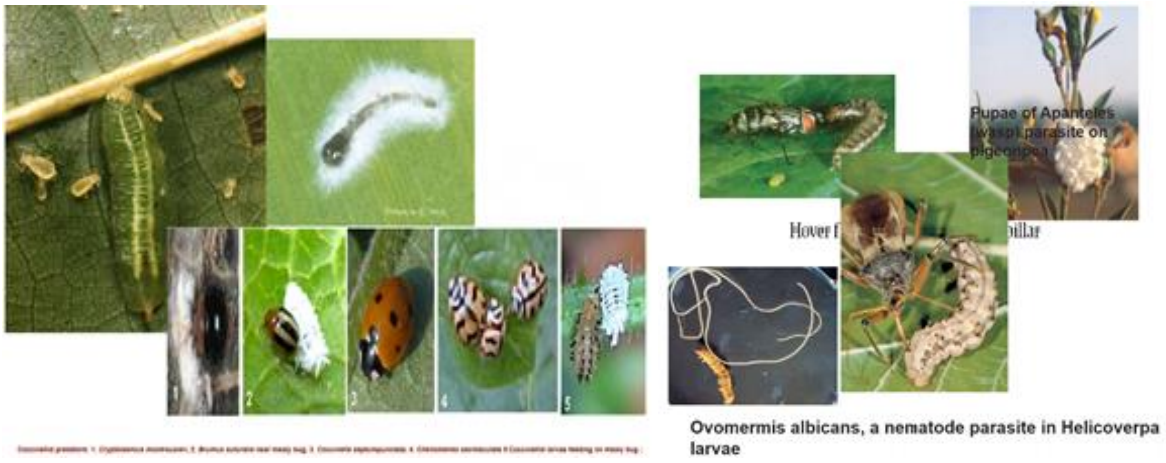


Fig.-13 Screenshot of Pest Control

Training part - 2: Inputs from participant trainees on Pilot testing Module – 1

Dr. R S Sharma/ Dr. L J Kanhekar, deliberated this training session, a brief introduction about Module-1: DDT and Vector Borne Diseases and all the contents included in the training module and asked the participant trainees from Maharashtra state to give their valuable responses and provide inputs to make the module more effective in capacity building.

Training Part 3: Input from participant trainees on Pilot testing Module –2

The training session on Day-8 came to an end with the feedback of the participants. **Dr. Amit Katewa/ Dr. L. J. Kanhekar** gave a brief introduction about module –2: Vector morphology and Bionomics and all the contents included in the training module. He asked the participants to give their valuable responses and inputs on the training module. Participants has raised queries, suggestions, and also healthy discussion with **Dr. Amit Katewa** on various topics of module 2. **Dr. L.J. Kanhekar** asked all the participants to provide feedback via e-mail, if any.

5.9 Training session-9 (Day – 9 (Thursday) 16/12/2021)

Training part - 1: Pilot testing Module – 3 inputs from participant trainees

Dr. T Ratna Joseph/ Dr. L J Kanhekar, deliberated this training session, a brief introduction about Module-3: DDT alternatives to Vector Control Management and all the contents included in the training module and asked the participant trainees (DMOs, entomologists etc.) from Maharashtra state to provide feedback/inputs, suggestions to make it useful for community (Fig. 14).

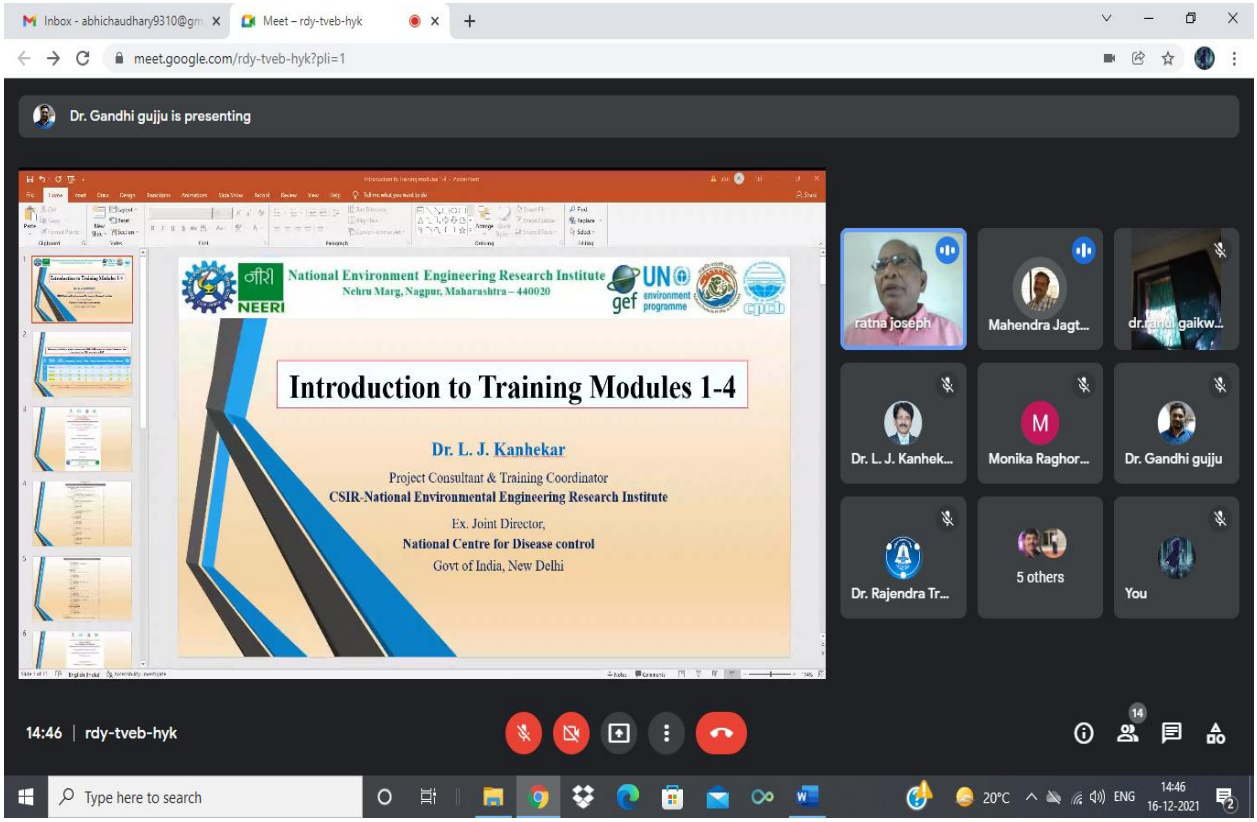


Figure - 14: Screenshot of Training session – 9

Training part - 2: Pilot testing Module – 4 inputs from participant trainees

Dr. R.S. Sharma/ Dr. P.T. Joshi/ Dr. L.J. Kanhekar has deliberated this training session, a brief introduction to training module-4: Integrated Vector and Pest Management and all the contents included in the training module. He asked the participants to give their valuable responses and inputs on the training module. Participants has raised queries, suggestions, and also healthy discussion with **Dr. R.S. Sharma/ Dr. P.T. Joshi** on various topics of module-4 (Fig 15).

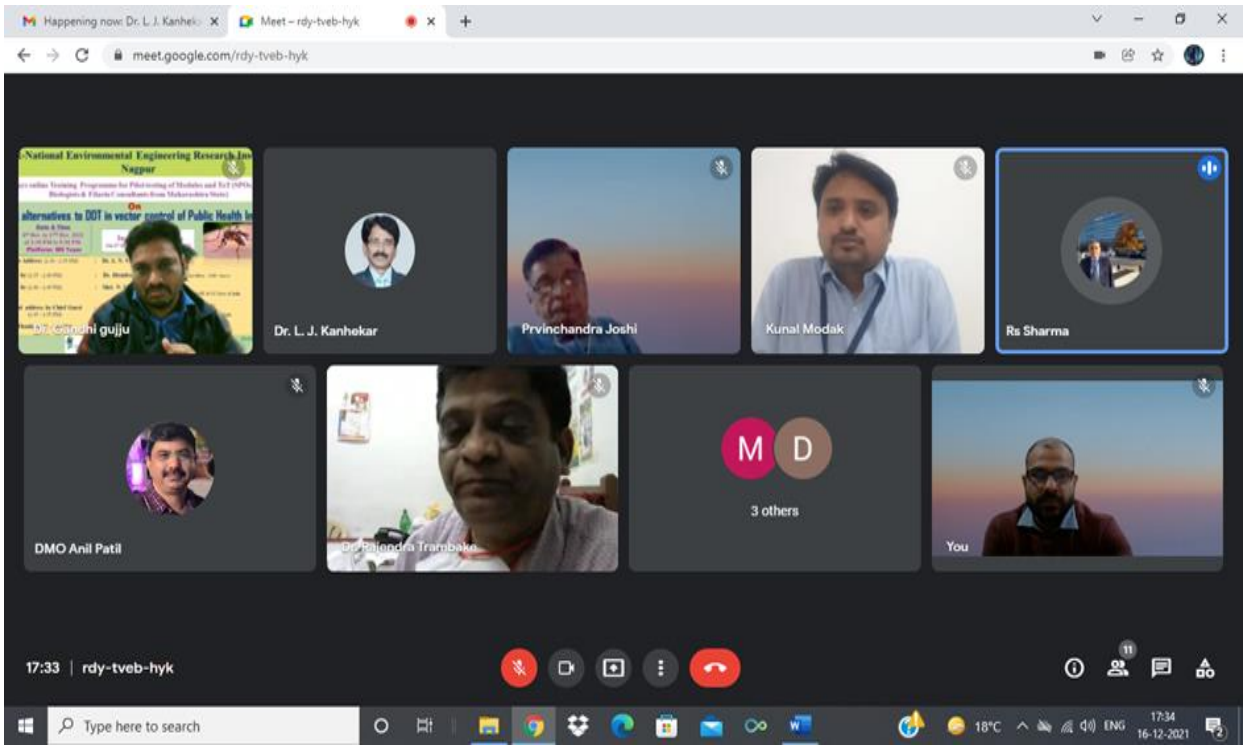


Fig.-15 Screenshot of training session-9

5.10 Training session-10 (Day – 10 (Friday) 17/12/2021)

Training part - 1: Lecture/Discussion on FAQs Materials

Dr. T Ratna Joseph deliberated this training session, a brief introduction about FAQs material on Vector Borne Diseases and Modules 1 to 4 and its content and asked the participant trainees from Maharashtra state to provide inputs on FAQs material (Figure 16). The inputs were noted down for editing the modules.

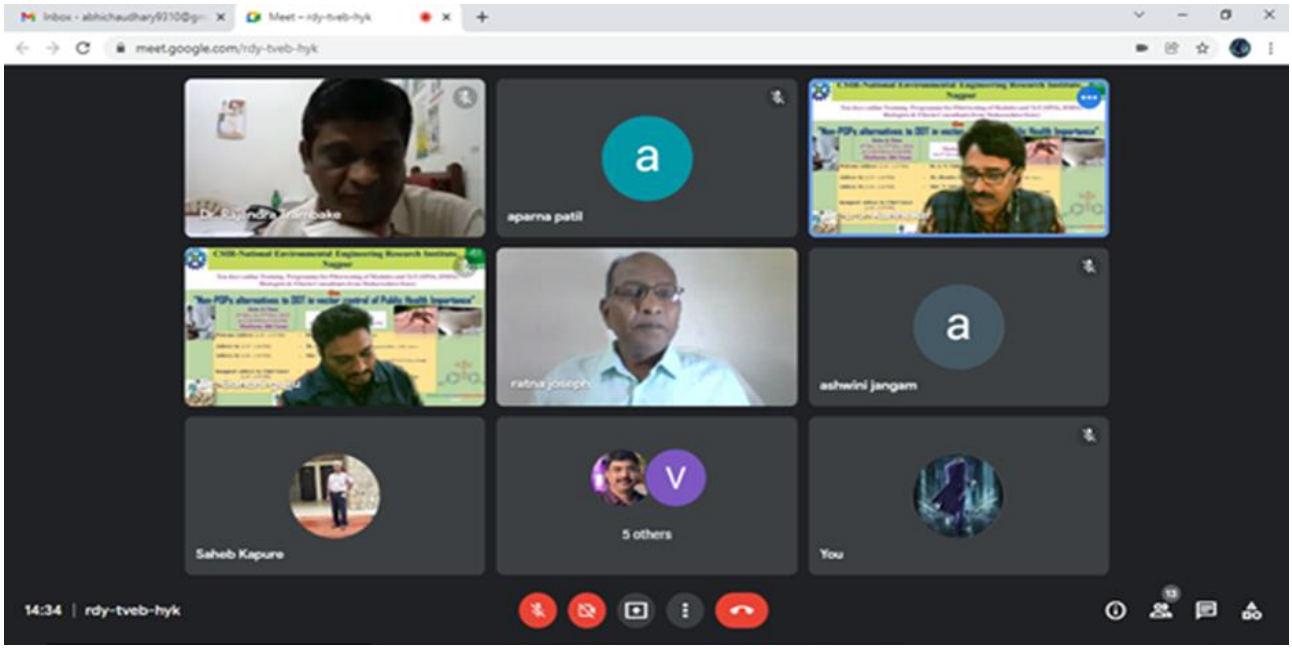


Figure-16: Screenshot of training session – 1

Training part - 2: Lecture/ Discussion on IEC Materials

Dr. P T Joshi deliberated this training session, a brief introduction about Information, Education & Communication (IEC) materials and its importance for IVPM. IEC materials provided in the form of posters, pamphlets, stickers etc. are of great importance for awareness programme. IEC material included following topics: Mosquito life cycle *Aedes*, *Anopheles*, *Culex*; Mosquito transmitted diseases; How to use insecticide treated nets (ITNs); Awareness on insecticide treated nets (ITNs), ways to prevent mosquito bite; diseases caused by mosquito bite; Awareness poster; Introduction, Vectors and its life cycle, Sign & Symptoms, breeding sites, Transmission, Transmission cycle, and preventative measures of VBDs (Malaria, Chikungunya, Dengue, Filaria, Japanese Encephalitis and Zika); Kyasanur Forest Disease: Introduction, Vectors and its life cycle, Sign & Symptoms, Transmission, Transmission cycle, and prevention. **Dr. Amit Katewa** discussed importance of these IEC material to make awareness in the community about VBDs programme- what are the preventive measures and how to protect themselves from mosquito bite. Community should be sensitized- how these methods can be applied and community should be mobilized, when community starts participation then we should take the community in our activities. After sensitization, mobilization, participation & community enrolment, our final goal is community ownership. He also congratulates CSIR-NEERI team for their hard-work and efforts to make these training more effective.

Training Part-3: Feedback from participants/trainees on modules

The 6th online training programme came to an end on 17th of December with the feedback of the participants. **Dr. L. J. Kanhekar** asked the participants to give their valuable responses and inputs on the training modules, booklets, PPTs and the IEC material provided to them via filling the Feedback forms (Part A- Pilot testing feedback, Part B- Training feedback and Part C- for reimbursement form) sent to them via e-mail.

Training Part-4: Virtual valedictory session

Dr. L. J. Kanhekar conducted a virtual valedictory session and proposed the vote of thanks to all the participants and experts, thus summing-up the training programme. He also asked the participants for their opinions on the training programme by filling the feedback form provided to them (Figure - 17).

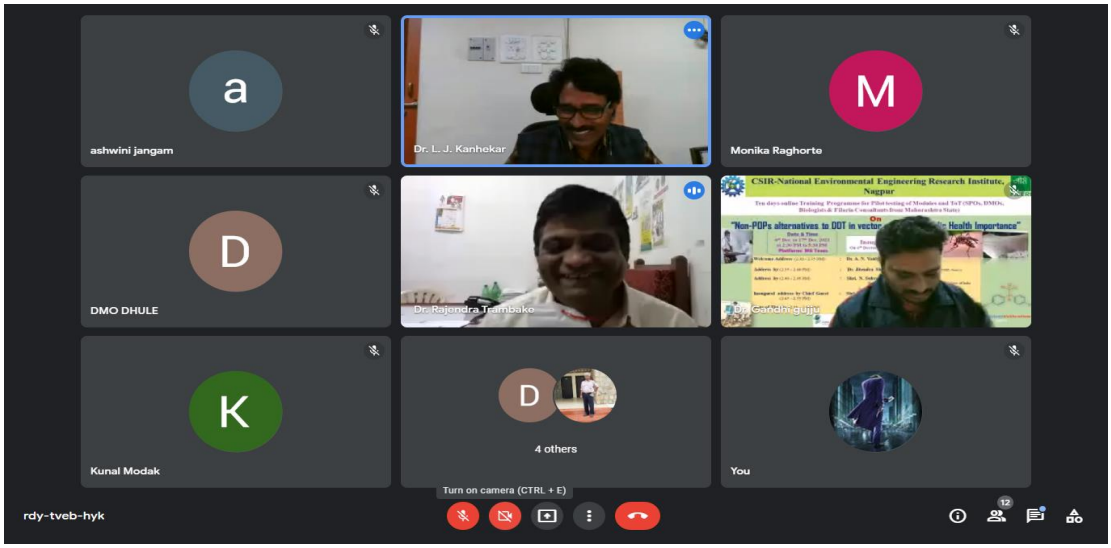


Figure - 17: Photograph of end of Training Programme

6.0 Annexures

6.1. List of organizing members

1. **Dr. A. N. Vaidya,**
   Coordinator, Stockholm Convention Regional Centre,
   HOD, Chemical and Hazardous Waste Management Division,
   CSIR – National Environmental Engineering Research Institute
   Nagpur

2. **Dr. A. Ramesh Kumar,**
   Sr. Scientist, (Project Leader),
   Chemical and Hazardous Waste Management Division,
   CSIR – National Environmental Engineering Research Institute
   Nagpur

3. **Dr. L. J. Kanhekar,**
   Project Consultant & Training Coordinator,
   CSIR – National Environmental Engineering Research Institute
   Nagpur

4. **Dr. Gujju Gandhi,**
   Research Associate-II,
   CSIR – National Environmental Engineering Research Institute
   Nagpur

5. **Mr. Abhishek Chaudhary,**
   Project Associate-II
   CSIR – National Environmental Engineering Research Institute
   Nagpur

6.2. List of faculties

1. **Dr. R. S. Sharma,**
   Ex. Additional Director,
   National Centre for Disease Control

2. **Dr. P. K. Srivastava,**
   Ex-Joint Director,
   Directorate of National Vector Borne Disease Control Programme

3. **Dr. Kalpana Baruah,**
   Ex. Additional Director,
   Directorate of National Vector Borne Disease Control Programme

4. **Dr. Amit Katewa,**
   National Consultant,
   Directorate of National Vector Borne Disease Control Programme.

5. **Dr. Himmat Singh,**
   Scientist – D,
   ICMR - National Institute of Malaria Research.

6. **Dr. Vijay Kumar,**
   ICMR- Consultant, (Ex- Scientist E),
   ICMR-Rajendra Memorial Research Institute of Medical Sciences.

7. **Dr. N. Balakrishnan,**
   Ex-Joint Director,
   National Centre for Disease Control.

8. **Dr. P. T. Joshi,**
   Ex-State Entomologist, Gujarat state.

9. **Dr. T. Ratna Joseph,**
   Ex-Deputy Director,
   Government of Andhra Pradesh.

10. **Dr. Y.P. Ramdev,**
    National Technical Adviser,
    United National Industrial Development Organization.

11. **Dr. Regu,**
    Additional Director,
    National Centre for Disease Control Branch, Kozikode

12. **Dr Vilas J. Tambe**
    Prof. & Head, Dept. of Entomology, Agriculture College, Nagpur

6.3. List of Participants – Maharashtra State

S. No	Name of Participants	Designation	Location
1	Dr. Mahendra Jagtap	State Entomologist	Pune
2	Mehrunisa M. Raje	State Entomologist	Pune
3	Dr. Mahesh Dinkar Nagare	DMO	Thane
4	Dr. Sagar P. Patil	DMO	Palghar
5	Vaishali Dagadu Patil	DMO	Raigad
6	Dr. V. D. Patil	DMO	Nashik
7	Mr. Anil Ramkrishna Patil	DMO	Dhule
8	Aparna Anu Pątil	DMO	Nandurbar
9	Dr. A. S. Bendre	DMO	Pune
10	Dr. Ashwini Jangam	DMO	Satara
11	Dr. Eknąth Prabhakar Bodhale	DMO	Solapur
12	Dr. Vinod Laxman More	DMO	Kolhapur
13	Smt. Shubhangi Tukaram Adhatrao	DMO	Sangli
14	Dr. Ramesh Subarao Kartask	DMO	Sindudurg
15	Dr.Yadav S.Y.	DMO	Ratagiri
16	Shri. Ravindra Dhole	DMO	Aurangabad
17	Dr. R. R.Shaikh	DMO	Latur
18	Dr. Aditya Ashok Mahankar	DMO	Akola
19	Dr. Santosh Borse	DMO	Washim
20	Dr. Sharad Jogi	DMO	Amaravati
21	Shivraj Chavan	DMO	Buldhana
22	Dr. Vijay Akolkar	DMO	Yavatmal
23	Dr. Rahul Gaikwad	DMO	Nagpur
24	Mrs. Jayshri Gagan Thote	DMO	Wardha
25	Dr. Aditi Atul Tyadi	DMO	Bhandara
26	Dr. Vedprakash Chouragade	DMO	Gondia
27	Dr. Pratik Suryabhan Borkar	DMO	Chandrapur
28	Dr. Kunal Suresh Modak	DMO	Gadchiroli
29	Dr. Neelam Kadam	Health Officer	Gr. Mumbai
30	Dr. Vivek Pendharkar	Filaria Officer	Akola
31	Monika Charmode Raghorte	Filaria Officer	Nagpur
32	Dr. Saheb Pemaji Kapure	Filaria Officer	Chandrapur
33	Dr. M. B. Deolikar	Filaria Officer	Gadchiroli
34	Pooja Nakka Shrinivas	Biologist	Solapur
35	Dr. Rajendra Rambhau Tryambake	Biologist	Nashik
36	Dr. Rahul Kannamwar	Medical Officer RCDC	Nagpur

6.4 Training Schedule

CSIR-National Environmental Engineering Research Institute, Nagpur

Training of Trainers (TOT) and pilot testing of modules to promote non-POPs alternatives based Integrated Vector and Pest Management

Time Table: 10 days online Training Programme to SPO/Entomologists, VBD Consultants DMOs and Biologists from Maharashtra State.

Time	Topic (Lecture discussion)	Faculty
All Participant Trainees are requested to join daily by 02.20 PM **Day 1 (Monday) 06/12/2021**		
1430-1500	**Inaugural Function** **Welcome Address** : **Dr. A. N. Vaidya**, Director, CSIR-NEERI **Address by** : **Dr. Jitendra Sharma**, Programme Management Officer, UNEP, Geneva **Chief Guest** : **Shri. Satyendra Kumar,** Director, Hazardous Substances Management at Ministry of Environment, Forest & Climate Change, Govt of India **Vote of Thanks** : **Dr. A. Ramesh Kumar**, Sr. Scientist, CSIR-NEERI	
1500-1525	Introduction to Modules 1 to 4	Dr L J Kanhekar
1525-1600	Introduction to DDT and its use in Vector Control	Dr A Ramesh Kumar/ All participant
1600-1645	Introduction to vector borne diseases: Malaria	Dr R S Sharma / All participant
1645-1730	Introduction to vector borne diseases: Leishmaniasis (Kala-azar)	Dr Vijay Kumar/ All participant
Day 2 (Tuesday) 07/12/2021		
1430-1500	Introduction to vector borne disease: Japanese Encephalitis	Dr P T Joshi/ All participant
1500-1530	Introduction to vector borne diseases: Lymphatic Filariasis	Dr. P K Srivastava / All participant
1530-1600	Introduction to vector borne disease: Scrub Typhus	Dr T Ratna Joseph / All participant
1600-1630	Introduction to Crimean Congo Hemorrhagic Fever	Dr. K. Regu / All participant
1630-1700	Introduction to vector borne diseases: Dengue, Chikungunya and Zika	Dr Kalpana Baruah/ All participant

1700-1730	Introduction to Kyasanur Forest Disease	Dr N Balakrishnan / All participant
Day 3 (Wednesday) 08/12/2021		
1430-1500	Introduction to vector borne diseases: Plague	Dr N Balakrishnan/ All participant
1500-1530	Morphology of vector mosquito	Dr L J Kanhekar/ All participant
1530-1600	Bionomics of vector mosquitoes	Dr L J Kanhekar / All participant
1600-1630	Morphology and Bionomics of sandflies	Dr Vijay Kumar / All participant
1630-1720	Morphology and bionomics of flies and fleas	Dr. Gujju Gandhi/ All participant
1720-1730	Feedback on Modules 1	Dr L J Kanhekar/ All Participants
Day 4 (Thursday) 09/12/2021		
1430-1520	Morphology and bionomics of Ticks and mites	Dr T Ratna Joseph / All participant
1520-1620	Entomological surveillance of VBDs	Dr Himmat Singh/ All participant
1620-1710	Alternatives to DDT in Vector Control Management – Conventional Methods & Environmental Management	Dr R S Sharma / All participant
1710-1730	Feedback on Modules 2	Dr L J Kanhekar/ Dr G Gandhi/ All participant
Day 5 (Friday) 10/12/2021		
1430-1515	Entomological parameters and its importance	Dr Himmat Singh/ All participant
1515-1535	Vector control measures/ management: Biological	Dr T Ratna Joseph / All participant
1535-1600	Vector control measures/ management: Genetic	Dr T Ratna Joseph / All participant
1600-1645	Vector control measures/ management: Chemical Methods	Dr P. K. Srivastava /All participant
1645-1730	IVPM: Behavior Change Communication	Dr P T Joshi/ All participant
Day 6 (Monday) 13/12/2021		
1430-1500	Equipment for larviciding and adulticiding	Dr P. K. Srivastava / All participant
1500-1530	Integrated Vector Pest Management: IVM	Dr R S Sharma / All participant
1530-1600	Monitoring and evaluation of IVPM	Dr Amit Katewa / All participant
1600-1630	Disease transmission in varies eco-epidemiological setup and bionomics of mosquito	Dr R S Sharma / All participant
1630-1700	Neem derived products for vector control	Dr Y P Ramdev/Dr. Amirish Agarwal/All participant
1700-1730	Feedback on Module-1 and Module-2	Dr L J Kanhekar/ Dr G Gandhi/ All participant
Day 7 (Tuesday) 14/12/2021		

1430-1515	NVBDCP Recommended Insecticide: Larval Source Management and Adult Vector Control	Dr Kalpana Baruah / All participant
1515-1600	IVPM: Vector management through Farmer Field School approach	Dr R S Sharma/ All participant
1600-1645	Planning and implementation of IVPM	Dr R S Sharma/ All participant
1645-1730	Epidemiological surveillance and parameters	Dr T Ratna Joseph / All participant
Day 8 (Wednesday) 15/12/2021		
1430-1500	Integrated Vector Pest Management: IPM	Dr Vilas Tambe / All participant
1500-1615	Pilot testing Module – 1 input from participant trainees	Dr R S Sharma / Dr L J Kanhekar/Participants
1615-1730	Pilot testing Module – 2 inputs from participant trainees	Dr Amit Katewa / Dr L J Kanhekar/Participants
Day 9 (Thursday) 16/12/2021		
1430-1600	Pilot testing Module – 3 inputs from participant trainees	Dr T Ratna Joseph / Dr L J Kanhekar/All Participants
1600-1800	Pilot testing Module – 4 inputs from participant trainees	Dr R S Sharma/ Dr L J Kanhekar/Dr P T Joshi /All Participants
Day 10 (Friday) 17/12/2021		
1430-1530	Lecture/Discussion on FAQs materials	Dr T Ratna Joseph / All Participant
1530-1630	Lecture/Discussion on IEC materials	Dr Amit Katewa / Dr P T Joshi /All Participant
1630-1715	Feedback from Participant trainees & instructions	Dr L J Kanhekar/ Dr Gujju Gandhi
1715-1730	**Virtual Valedictory session**	Dr Ramesh Kumar/ Dr L J Kanhekar /

(Dr L J Kanhekar)
Project Consultant & Training Coordinator
CSIR-NEERI, Nagpur

Copy to: 1. **All Participant Trainees**

2. **State Programme Officers** I/c,
Jr Director Health Services (Malaria, Filaria/VBDs)
Arogya Bhavan, Alandi Road
Vishrantwadi, Pune-411006(Maharashtra State)