World Organisation for Animal Health

Vinayagamurthy Balamurugan - -

WOAH Reference Laboratory Reports Activities 2024

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LABORATORY INFORMATION

***Name of disease (or topic) for which you are a designated WOAH Reference Laboratory:**	Peste des petits ruminants
***Address of laboratory:**	ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI), Yelahanka, Bengaluru, 560119 INDIA
***Tel:**	+91-80-23093136 ; 23093111
***E-mail address:**	b.vinayagamurthy@icar.gov.in; director.nivedi@icar.gov.in
Website:	https://www.nivedi.res.in/
***Name (including Title) of Head of Laboratory (Responsible Official):**	Dr. Baldev Raj Gulati, Director , Head of the Institute
***Name (including Title and Position) of WOAH Reference Expert:**	Dr. Balamurugan Vinayagamurthy , Principal Scientist, Designated Expert, ICAR-NIVEDI
***Which of the following defines your laboratory? Check all that apply:**	Governmental Research agency Academic institution

TOR1: DIAGNOSTIC METHODS

1. Did your laboratory perform diagnostic tests for the specified disease/topic for purposes such as disease diagnosis, screening of animals for export, surveillance, etc.? (Not for quality control, proficiency testing or staff training)

Yes

Diagnostic Test	Indicated in WOAH Manual (Yes/No)	Total number of test performed last year	
Indirect diagnostic tests		Nationally	Internationally
Competitive ELISA	Yes	55625	0
Virus Neutralization Test	Yes	146	0
Direct diagnostic tests		Nationally	Internationally
RT-PCR	Yes	54	

			0
Sandwich ELISA	Yes	946	0
Serum Neutralization Test	Yes	9	0

TOR2: REFERENCE MATERIAL

2. Did your laboratory produce or supply imported standard reference reagents officially recognised by WOAH?

No

3. Did your laboratory supply standard reference reagents (nonWOAH-approved) and/or other diagnostic reagents to WOAH Members?

No

4. Did your laboratory produce vaccines?

No

5. Did your laboratory supply vaccines to WOAH Members?

No

TOR3: NEW PROCEDURES

6. Did your laboratory develop new diagnostic methods for the designated pathogen or disease?

Yes

7. Did your laboratory validate diagnostic methods according to WOAH Standards for the designated pathogen or disease?

Yes

Name of the new test or diagnostic method developed	Description and References (Publication, website, etc.)
PPR Ab Chek Kit for the detection of PPRV antibodies in serum samples of sheep and goats	Balamurugan V, Bokade PP, Kumar KV, SowjanyaKumari S, Nagalingam M, Hemadri D, Shome BR. Comparative diagnostic efficacy of Avidin-Biotin recombinant nucleoprotein competitive ELISA for serosurveillance and monitoring of peste des petits ruminants in sheep and goats. J Immunol Methods. 2023 Jan;512:113409. doi: 10.1016/j.jim.2022.113409. Balamurugan V, Varghese B, SowjanyaKumari S, Vinod Kumar K, Muthuchelvan D, Nagalingam M, Hemadri D, Roy P, Shome BR. Avidin-Biotin recombinant nucleoprotein competitive ELISA for the detection of peste des petits ruminants virus antibodies in sheep and goats. J Virol Methods. 2021 Sep; 295:114213. doi: 10.1016/j.jviromet.2021.114213.

8. Did your laboratory develop new vaccines for the designated pathogen or disease?

No

9. Did your laboratory validate vaccines according to WOAH Standards for the designated pathogen or disease?

No

TOR4: DIAGNOSTIC TESTING FACILITIES

10. Did your laboratory carry out diagnostic testing for other WOAH Members?

No

11. Did your laboratory provide expert advice in technical consultancies on the request of an WOAH Member?

Yes

Name of the WOAH Member Country receiving a technical consultancy	Purpose	How the advice was provided
CHINA (PEOPLE'S REP. OF)	Virus isolation technique for PPR and assistance in information about PPR Vaccine strains	Through email communication to the concerned requested officer, Dr. Kuo-Jung Tsai, Associate Researcher, Veterinary Research Institute, Ministry of Agriculture, Taiwan, krtsai@mail.nvri.gov.tw
INDIA	NSP-2030, Diagnostics and Surveillance of PPR as per GCES, WOAH/FAO guidelines	As an Expert by acting as a core committee member for NSP for PPR eradication 2030 constituted by Animal Husbandry Commissioner (CVO) of India, DAHD, GOI

TOR5: COLLABORATIVE SCIENTIFIC AND TECHNICAL STUDIES

12. Did your laboratory participate in international scientific studies in collaboration with WOAH Members other than the own?

No

13. In exercising your activities, have you identified any regulatory research needs* relevant for WOAH?

No

TOR6: EPIZOOLOGICAL DATA

14. Did your Laboratory collect epidemiological data relevant to international disease control?

Yes

If the answer is yes, please provide details of the data collected:
1) Collection of outbreak data-collection of passive PPR outbreak data, attack, death and susceptible population, month and year, GPS location of epiunits (villages). 2) Seroprevalence study- data collection related to host factors (GPS location of epiunits (village), species, age, sex, breed, rearing status of animal husbandry system, vaccination status and disease status of animals) 3) Seromonitoring study for vaccine efficacy-data collection related to host factors (GPS location of epiunits (village), species, age, sex, breed, rearing status of animal husbandry system, nature of vaccine, date of vaccination, Batch of vaccine, Vaccine manufacturer,) 4) Population immunity study- data collection related to host factors (GPS location of epiunits (village), species, age, sex, breed, rearing status of animal husbandry system, status of vaccination (round), animal husbandry system, nature of vaccine, date of vaccination, batch of vaccine, Vaccine manufacturer)

15. Did your laboratory disseminate epidemiological data that had been processed and analysed?

Yes

If the answer is yes, please provide details of the data collected:
A.Publications in peer-reviewed journals and

B. Institute Annual Reports

1. Prevalence status of PPR virus antibodies in goat and sheep Populations before mass vaccination implementation in India's PPR EP. Epidemiological data on the prevalence of PPR virus antibodies in sheep and goat populations were collected across 31 states and Union Territories of India before the implementation of mass vaccination under the PPR EP in 2023 and 2024. A total of 80,192 serum samples from 3,026 epi-units were tested using the PPR-Competitive ELISA kit, revealing a national seroprevalence of 41.83%.

2. Field Efficacy of the PPR Sungri 96 Strain Vaccine for Achieving Desired Vaccine Effectiveness and Population Immunity for Eradication of PPR in India. Analysis of 12,079 samples from 1,229 villages across 11 states revealed a 73.8% seroconversion rate, confirming the efficacy of the PPR Sungri 96 vaccine.

3.Molecular Insights from 2023 and 2024 Outbreaks Reveal Exclusive Circulation of PPRV Lineage IV in India and Whole Genome Sequencing of PPR Virus to Uncover Epidemiological Insights in the Eastern Himalayan Region (Northeastern Episystem) of India: In 2023 and 2024, 17 laboratory-confirmed outbreaks of PPR were documented in sheep and goat flocks across various states, with detailed characterization (PP789545–PP789555) performed for 12 outbreaks Whole-genome sequencing of PPRV isolates from Arunachal Pradesh and Mizoram (PQ310779-780) confirmed their classification as Lineage IV.

16. What method of dissemination of information is most often used by your laboratory? (Indicate in the appropriate box the number by category and list the details in the box)

a) Articles published in peer-reviewed journals:

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1. Balamurugan, V., Ojha, R., Kumar, K. V., Asha, A., Ashraf, S., Dsouza, A. H., Pal, A., Bokade, P. P., Harshitha, S. K., Deshpande, R., Swathi, M., Suresh, K. P., Govindaraj, G., Hasnadka, S. P., ChandraSekar, S., Hemadri, D., Guha, A., Felix, N., Parida, S., & Gulati, B. R. (2024). Post-vaccination sero-monitoring of Peste des Petits Ruminants in sheep and goats in Karnataka: Progress towards PPR eradication in India. Viruses, 16, 333. https://doi.org/10.3390/v16030333

2. Ramesh, V., Suresh, K. P., Mambully, S., Rani, S., Ojha, R., Kumar, K. V., & Balamurugan, V. (2024). Dynamic evolution of Peste des Petits Ruminants virus in sheep and goat hosts across India reveals the swift surge of F gene. Virus Disease, 35(3), 505–519. https://doi.org/10.1007/s13337-024-00890-x

3. Govindaraj, G. N., Balamurugan, V., Mohanty, B. S., Kumari, S., Tapase, J., Naveenkumar, G. S., Roy, P., & Shome, B. R. (2024). Flock-level socio-economic and other associated risk factors for Peste des Petits Ruminants (PPR) exposure in sheep and goats in Madhya Pradesh state, India. Tropical Animal Health and Production, 56(4), 127. https://doi.org/10.1007/s11250-024-03974-4

4. Gurrappanaidu, G., Subbanna, N. K. G., Wanyoike, F., Bahta, S., Reddy, Y. R., Bardhan, D., Vinayagamurthy, B., Vijayalakshmy, K., & Habibur, R. (2025). Assessment of vaccination impact in PPR-control program implemented in southern states of India: A system dynamics model approach. Viruses, 17(1), 23. https://doi.org/10.3390/v17010023

b) International conferences:

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1. Dr, V. Balamurugan Participated in the Episystem workshop for PPR eradication in the Lake Chad Basin and Regional Advisory Group for Central Africa organized by the Food and Agriculture of the United Nations and World Organization for Animal Health (WOAH) at Yaounde, Cameroon held from 3rd to 4th April 2024 and presented an invited talk on "Episystem -based epidemiology approaches for the control and eradication of PPR in sheep and goats in India in line with CGES plan for PPR-GEP"

2. Dr, V. Balamurugan Participated in the 7th PPR Advisory Committee Meeting and the GREN vaccination thematic group meeting-organised by FAO and WOAH at FAO Hqrs, Rome, Italy held from 25th-28th June 2024 and presented an invited talk on "PPR Vaccination and Control Strategies in India: Lessons Learned for NSP for Eradication"

3. Dr, V. Balamurugan Participated in the, Epidemiology and Laboratory Network Consultation Meeting and training on the South Asian Cross-border Harmonization Meetings of the PPR Monitoring and Assessment Tool (PMAT) held from July 7 - 11, 2024 at Dhaka,

Bangladesh and Presented an invited talk on "Status and Progress Towards Eradication of Peste des Petits Ruminants in India with specific reference to Epidemiology Network of PPR"
4. Dr. B.R. Gulati participated WOAH Vet Lab Focal Point Seminar, and WOAH 4th Regional Meeting for Reference Centres in Asia and the Pacific held from 16-19th July at Japan and delivered a short presentation on ICAR-NIVEDI laboratory activities during "Introduction of newly designated RCs" session on 19th July 2024.
5. Dr. V. Balamurugan attended WOAH Vet Lab Focal Point Seminar, organized by WOAH held from 16-18th July, 2024 at Japan (attended in hybrid mode via Zoom) and delivered a short presentation on "ICAR-NIVEDI laboratory activities" during "RC initiatives and collaboration opportunities" session on 18th July 2024.

c) National conferences:

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1. Dr. V. Balamurugan Participated and presented a invited lead talk on "Comprehensive Strategies and Initiatives for Peste des Petits Ruminants Eradication in India" during the VIROCON-2024: International Conference on Emerging Viruses: Pandemic and Biosecurity Perspectives, held at the Defence Research & Development Establishment (DRDE), Gwalior, Madhya Pradesh, from 11th to 13th November 2024. pp. 17-20
2. Dr. K. Vinod Kumar Participated and presented the following posters entitled:
o "Seromonitoring of PPR in Sheep and Goats in the North-Eastern Ecosystem of the Eastern Himalayan Region of India"
o "Isolation and Molecular Characterization of Peste des Petits Ruminants in Goats"
o "Persistence of Peste des Petits Ruminants Vaccine-Induced Maternal Antibodies in Yeanlings from Vaccinated Sheep and Goats in Karnataka"
o "Validation of Native ELISA Kits for Specific Peste des Petits Ruminants Virus Antibody Detection in Swine and Seroprevalence" during the VIROCON-2024: International Conference on Emerging Viruses: Pandemic and Biosecurity Perspectives, held at the Defence Research & Development Establishment (DRDE), Gwalior, Madhya Pradesh, from 11th to 13th November 2024. pp. 270-275

3. Dr. V. Balamurugan Participated and presented a invited a lead talk on "Pre-vaccination Seroprevalence of Peste des Petits Ruminants (PPR) Virus Antibodies in Sheep and Goats across India: A Baseline Study for the National PPR Eradication Programme" during the IAVMICON-2024: XXXVI Annual Convention of IAVMI. The conference, themed "Impact of Animal Health on One Health and National Prosperity," was organized by the Department of Veterinary Microbiology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan, India, from 6th to 7th June 2024. pp. 66
4. Dr. Rakshit Ojha Participated and delivered an oral presentation titled "Molecular Characterization of Peste des Petits Ruminants Viruses from Sheep and Goat Outbreaks in 2023-2024" during the IAVMICON-2024: XXXVI Annual Convention of IAVMI. The conference, themed "Impact of Animal Health on One Health and National Prosperity," was organized by the Department of Veterinary Microbiology, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur, Rajasthan, India, from 6th to 7th June 2024 pp. 21-22
5. Dr. V. Balamurugan Participated and presented an invited lecture titled "Status of PPR in Sheep and Goats in Karnataka State: Towards Eradication of Peste des Petits Ruminants" to veterinary officers of the Animal Husbandry and Veterinary Services Department in the Government of India-sponsored ASCAD programme held on 19th March 2024 at the Karnataka Veterinary Council Auditorium, Hebbal, Bengaluru.

6. Dr. V. Balamurugan Participated and presented a invited plenary lecture on "Strategies and Initiatives for Eradicating Peste-des-Petits Ruminants in India by 2030: A Comprehensive Approach to Combating Small Ruminant Plague" at the International Symposium on Animal Viruses, Vaccines, and Immunity (AVVI 2024), held from 9th to 11th February 2024 at Institute of Veterinary Science and Animal Husbandry, Siksha 'O' Anusandhan Campus - 4, Bhubaneswar, India

d) Other (Provide website address or link to appropriate information):

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Sampling Plan for PPR surveillance and monitoring
NADCP(LH-DCP): Sampling plan for strengthening livestock disease surveillance- NADCP(LH-DCP)-PPR
Sampling Plan for Serosurveillance, Seromonitoring and Population Immunity Assessment at ICAR-NIVEDI Website
https://www.nivedi.res.in/Nadres_v2/samplingplan.php

Web portal for database maintenance
Livestock Health & Disease Control Programme (LH-DCP), Livestock Health & Disease Control (LH & DC) scheme: Peste des Petits Ruminants Eradication Programme- PPR Monitoring and Surveillance---Database for tested samples.
https://www.nivedi.res.in/Nadres_v2/lhdcp/

Book Chapters:
1. Balamurugan V., Rakshit Ojha, K Vinod Kumar, G Govindaraj, R. P. Singh, Baldev R Gulati (2024). Eradication of PPR in India: A Comprehensive Strategy, Challenges, and Ways Forward In: Realization of One Health Concept Through New Age Research Technologies (Eds. Sharma DK, Singathia R). Yash Publishing House, Rajasthan, India. pp. 16-42. ISBN no. 978-81-86882-51-0

2. G Govindaraj and Balamurugan V., (2024): Socioeconomic Dynamics of PPR in Developing Countries. Book: Peste des Petits Ruminants Virus. DOI: 10.1007/978-3-031-82214-8. Spingers publications.

Status Paper: Balamurugan V, Kumar KV, Govindaraj G, Suresh KP, Shome BR, Gulati B: Status Paper on Peste des petits ruminants Indian Perspective. In.: ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI); 2023: 1-47.
https://nivedi.res.in/Nadres_v2/pdf/PPR/2023/PPR/Status%20paper%20PPR%20Indian%20Perspective.pdf

TOR7: SCIENTIFIC AND TECHNICAL TRAINING

17. Did your laboratory provide scientific and technical training to laboratory personnel from other WOAH Members?

No

TOR8: QUALITY ASSURANCE

18. Does your laboratory have a Quality Management System?

Yes

Quality management system adopted	Certificate scan (PDF, JPG, PNG format)	
ISO 17025:2017	PDF	ICAR-NIVEDI_NABL+SCOPE Certificate.pdf
ISO 9001:2015	PDF	IRCCLASS CERTIFICATE EXP2026.pdf

19. Is your quality management system accredited?

Yes

Test for which your laboratory is accredited	Accreditation body
Detection of PPRV antibodies by PPR c-ELISA	National Accreditation Board for Testing and Calibration Laboratories (NABL), India
Detection of PPRV antigen by PPR s-ELISA	National Accreditation Board for Testing and Calibration Laboratories (NABL), India

Detection of PPRV RNA by RT-PCR	National Accreditation Board for Testing and Calibration Laboratories (NABL), India
Detection of PPRV RNA by qRT-PCR	National Accreditation Board for Testing and Calibration Laboratories (NABL), India
Detection of PPRV antibodies in the serum to neutralize the infectivity of the virus by Virus Neutralization Test (VNT)	National Accreditation Board for Testing and Calibration Laboratories (NABL), India

20. Does your laboratory maintain a "biorisk management system" for the pathogen and the disease concerned?

Yes

ICAR-NIVEDI's facilities are NABL accredited to store and handle selected agents, including PPRV. All laboratory activities are carried out in the facility at BSL-2 biocontainment.

TOR9: SCIENTIFIC MEETINGS

21. Did your laboratory organise scientific meetings related to the pathogen in question on behalf of WOAH?

No

22. Did your laboratory participate in scientific meetings related to the pathogen in question on behalf of WOAH?

Yes

Title of event	Date	location	Role (speaker, presenting poster, short communications)	Title of the work presented
Episystem workshop for PPR eradication in the Lake Chad Basin and Regional Advisory Group for Central Africa organized by the Food and Agriculture of the United Nations and World Organization for Animal Health (WOAH) at Yaounde, Cameroon held from 3-4th April 2024 (Dr, V. Balamurugan Participated)	2024-04-02	Yaounde, Cameroon	Invited Speaker	Episystem -based epidemiology approaches for the control and eradication of PPR in sheep and goats in India in line with CGES plan for PPR-GEP
7th PPR Advisory Committee Meeting and the GREN vaccination thematic group meeting-organised by FAO and WOAH at FAO Hqrs, Rome, Italy held from 25th-28th June 2024 (Dr, V. Balamurugan Participated)	2024-06-24	Rome, Italy	Invited Speaker	PPR Vaccination and Control Strategies in India: Lessons Learned for NSP for Eradication

Epidemiology and Laboratory Network Consultation Meeting and training on the South Asian Cross-border Harmonization Meetings of the PPR Monitoring and Assessment Tool (PMAT) held from July 7 - 11, 2024 at Dhaka, Bangladesh (Dr, V. Balamurugan Participated)	2024-07-06	Dhaka, Bangladesh	Speaker	Status and Progress Towards Eradication of Peste des Petits Ruminants in India with specific reference to Epidemiology Network of PPR
Virtual training workshop on peste des petits ruminants (PPR) in wildlife 9(Dr, V. Balamurugan and dr. Vinod Kumar Participated)	2024-03-19	Virtual	Participant	-NA-
Animal infectious diseases on prioritization workshop" organised by FAO India and USAID held from 27-30th August,2024 at New Delhi, India (Dr. V. Balamurugan Participated)	2024-08-26	New Delhi, India	Participant as Expert	-NA-
WOAH 4th Regional Meeting for Reference Centres in Asia and the Pacific held from 18-19th July 2024 at Tokyo, Japan (attended in Virtual mode via Zoom). (Dr. V. Balamurugan attended)	2024-07-17	Tokyo, Japan	Designated Expert	WOAH Reference Laboratory activities
WOAH Vet Lab Focal Point Seminar, and WOAH 4th Regional Meeting for Reference Centres in Asia and the Pacific held from 16-19th July at Tokyo, Japan (Dr. B.R. Gulati participated)	2024-07-18	Tokyo, Japan	Short Presentation	ICAR-NIVEDI's, WOAH Reference Laboratories activities during "Introduction of newly designated RCs" session
"PPR in Europe-Emergency preparedness and response" conducted by EuFMD and PPR GEP secretariat through virtual	2024-09-10	Virtual	Participant	-NA-

mode (Dr. V. Balamurugan Attended)				

TOR10: NETWORK WITH WOAH REFERENCE LABORATORIES

23. Did your laboratory exchange information with other WOAH Reference Laboratories designated for the same pathogen or disease?

Yes

24. Do you network (collaborate or share information) with other WOAH Reference Laboratories designated for the same pathogen?

Yes

NETWORK/DISEASE	ROLE OF YOUR LABORATORY (PARTICIPANT, ORGANISER, ETC)	NO. PARTICIPANTS	PARTICIPATING WOAH REF. LABS
WOAH Reference Laboratory Network for PPR	Participant/Member	1	WOAH/FAO reference laboratory for PPR, CIRAD, FRANCE

25. Did you organise or participate in inter-laboratory proficiency tests with WOAH Reference Laboratories designated for the same pathogen during the past 2 years?

Yes

Purpose of the proficiency test:	Role of your Reference Laboratory (organiser/ participant)	No. participating Laboratories	Participating WOAH Ref. Labs/ organising WOAH Ref Lab
Validation and to achieve competency of the tests performed	Participant	20	WOAH/FAO Reference Laboratory for PPR, CIRAD, FRANCE
Validation and to achieve competency of the tests performed	Participant	7	WOAH Collaboration Centre for Camel Diseases & WOAH Collaborating Centre for Quality Management Systems at Abu Dhabi Agriculture & Food Safety Authority (ADAFSA), Biosecurity Affairs Division (BSAD), Abu Dhabi, United Arab Emirates

26. Did your laboratory collaborate with other WOAH Reference Laboratories for the same disease on scientific research projects for the diagnosis or control of the pathogen of interest?

No

TOR11: OTHER INTERLABORATORY PROFICIENCY TESTING

27. Did your laboratory organise or participate in inter-laboratory proficiency tests with laboratories other than WOAH Reference Laboratories for the same pathogen during the past 2 years?

Yes

Purpose for inter-laboratory test comparisons1	**Role of your reference laboratory (organizer/participant)**	**No. participating laboratories**	**Name of the test**	**WOAH Member Countries**

Validation and intra laboratory comparison performed	Participant	65	PPR competitiveELISA (c-ELISA), RT-PCR conducted by FAO/IAEA Laboratory, Vienna	AUSTRIA,

TOR12: EXPERT CONSULTANTS

28. Did your laboratory place expert consultants at the disposal of WOAH?

No

29. Additional comments regarding your report:

Yes

1. ICAR-NIVEDI as a local host organized the 6th Annual PPR-GREN Meeting of FAO/WOAH- PPR secretariat in 28-30th November 2023 at Bengaluru, India

2. ICAR-NIVEDI as a local host organized the 6th Annual PPR-AC meeting of FAO/WOAH- PPR secretariat in 1-2nd December, 2023 at Bengaluru, India

3. Dr. V. Balamurugan Member of the PPR-Global Research and Expert Network (GREN) Bureau, FAO PPR Secretariat, Rome, Italy since 1st December 2023

4. Dr. G. Govindaraj Socio economics thematic group-Focal point-, GREN Bureau, FAO PPR Secretariat, Rome, Italy since 1st December 2023

5. Dr. K. Vinod Kumar Wildlife thematic group-Focal point-GREN Bureau, FAO PPR Secretariat, Rome, Italy since 1st December 2023

6. ICAR-NIVEDI is the PPR Reference Laboratory Network for PPR (South India) Since 2021.

7. The ICAR-NIVEDI's WOAH Reference Laboratory for PPR was inaugurated officially on 17th October 2024 by Dr. Abhijit Mitra, Animal Husbandry Commissioner (CVO, of India), DAHD, GoI.

8. As a newly designated WOAH Reference Laboratory for PPR, we are ready to undertake sample screening for both WOAH member and non-member countries. We request WOAH's and /or FAO's facilitation to streamline and support this initiative to receive the samples at ICAR-NIVEDI from ASIAN/SAARC or other region countries

9. We are also keen in organizing international training programs-both virtual and hands-on for WOAH member and non-member countries in the upcoming reporting year (2025). We kindly seek WOAH's and/or FAO assistance in facilitating these trainings, including organizational and financial support.

10. ICAR-NIVEDI's WOAH reference laboratories actively participate in online meetings/seminars/conferences organized by FAO, WOAH, and the PPR Secretariat at different points in time, as and when required as per subject matter, to acquire knowledge, enhance expertise, collaborate effectively, and share our expertise with global communities.