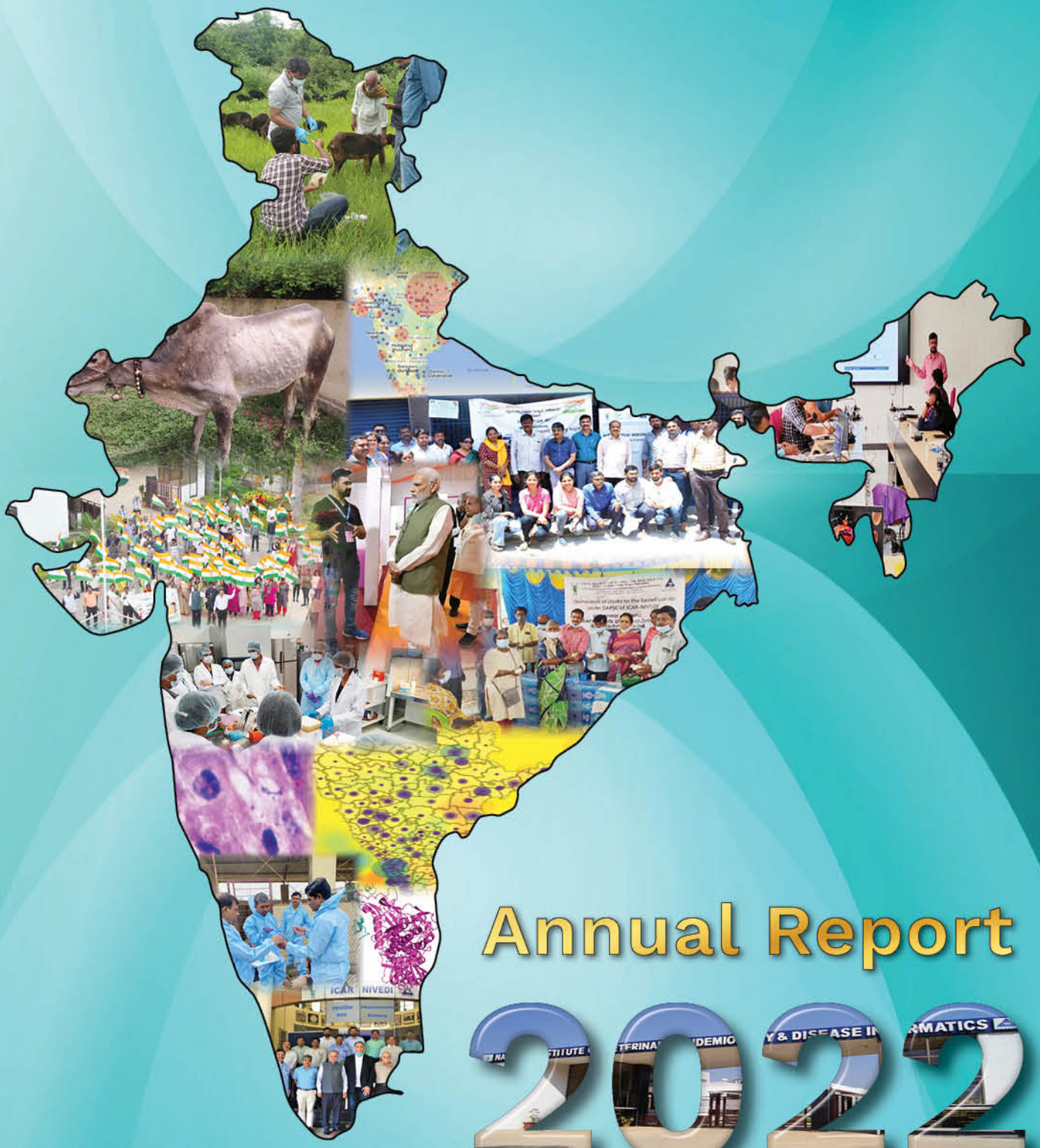

Annual Report 2022

भाकृअनुप
ICAR

ICAR-National Institute of Veterinary Epidemiology and Disease Informatics

रापजासूविसं
NIVEDI


ICAR NIVEDI
प्रशासनिक भवन
Administrative Building

Annual Report
2022

ICAR-National Institute of Veterinary Epidemiology and Disease Informatics

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About the cover page :

Front cover page : Collage depicting various activities undertaken from the national perspective by ICAR-NIVEDI, Bengaluru

Back cover page : Representation of ICAR-NIVEDI Mandates

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TABLE OF CONTENTS


IGAR-NIVEDI
TRAINING CUM
FARMERS' HOSTEL

Director's **Foreword**

"During the year 2022, ICAR-NIVEDI was recognized as national referral laboratory by DAHD, GoI for diagnosis of LSDV. PPR Ab Chek kit developed by ICAR-NIVEDI for sero-surveillance and sero-monitoring of PPR in sheep and goats was released by ICAR on 26 March 2022 in 92 AGB meeting. Further, ICAR-NIVEDI was bestowed with Swachhta Pakhwada Award 2021 (First Prize)."

It gives me immense pleasure to publish the annual report 2022 of ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI), Bengaluru. ICAR-NIVEDI is a premier national institute catering to the needs of surveillance and monitoring of livestock diseases and animal health information in the country and focusing on epidemiology, surveillance, forecasting & forewarning, and economics of livestock diseases including zoonoses in one-health aspects. ICAR-NIVEDI is involved in the National Animal Disease Control Programmes under Livestock Health & Disease Control Programme (LH&DCP) scheme of the Department of Animal Husbandry and Dairying, Government of India, for developing nation-wide surveillance plans and sero-monitoring of major economically important livestock diseases (Foot and mouth disease, Brucellosis, Peste des petits ruminants and Classical swine fever). The Institute is actively involved in forewarning the outbreak risk of 13 major economically important livestock diseases at district level two months in advance, utilizing artificial intelligence and machine learning models. Identification of the disease-specific zones and their depiction on maps is important for disease control and mitigation in the country.

ICAR-NIVEDI expresses its sincere gratitude to Hon'ble Secretary, DARE and Director General, ICAR, Dr. Himanshu Pathak, for his vision, constant guidance and generous support. ICAR-NIVEDI also thanks Deputy Director General (Animal Science), ICAR, Dr. B.N. Tripathi for his support to the Institute and interest in the field of epidemiology and disease informatics research. We profusely thank Assistant Director General (Animal Health), ICAR, Dr. Ashok Kumar for his cooperation, encouragement and support. We also thank Dr. Jyoti Misri, Principal Scientist (Animal Health), ICAR for her constant administrative and technical support and guidance. The institute conveys sincere thanks to all PIs, Co-PIs and the staff of National Animal Disease Epidemiology Network (NADEN) centres located in different states/ UT's and their respective Animal Husbandry Departments / Universities for their valuable inputs, suggestions, and consistent co-operation. The feedback on this year annual report from all our stakeholders and readers on livestock disease epidemiology and informatics is solicited for improving the national livestock health and thereby the income of livestock farmers in the country.

(Baldev Raj Gulati)
Director, ICAR-NIVEDI

01

Executive Summary

ICAR-NIVEDI is a pioneering research institute working with the mandate of R&D in the field of veterinary epidemiology and disease informatics and carrying out disease surveillance, monitoring and impact analysis of livestock diseases in India through collaborative centers located in different states of the country. Its role is significant in developing disease models, risk analysis, animal disease forecasting & forewarning and the development of population assay surveillance diagnostic kits for epidemiological serosurvey for field diagnosis. The institute has national and international collaborations with various organizations and stakeholders, for collaborative research, laboratory capacity building and human resource development.

The Institute was recognized as national referral laboratory by DAHD, GoI for diagnosis of LSDV. During the period, conventional PCR, probe-based real-time PCR and a recombinant immune-blot assay were developed to detect LSDV infection. More than 1500 clinical samples submitted by different states and the samples collected by NIVEDI team during outbreak investigations were screened. On investigation, the highest incidence of LSD was observed in the cattle aged above 5 years (37.42%) followed by those in 2-5 years (36.76%) and least in cattle below 2 years (25.82 %). The *Haematobia* spp flies and *Amblioma* spp ticks were found to be the major vectors responsible for the transmission of the LSDV. Sequencing and phylogenetic anlysis of *P32* and *RPO30* genes of 30 field isolates revealed circulation of genetically similar LSD virus in India. Screening of buffalo serum samples (n=2590) for infectious bovine rhinotracheitis (IBR) revealed an overall seropositivity of 12.5% whereas screening of buffalo serum samples (n=5683) for brucellosis revealed overall positivity of 7.44%. Serum samples (n=21,412) received under brucellosis vaccination programme (phase-I and II) tested by indirect ELISA to detect vaccinal antibodies revealed highest sero-positivity in Goa (92.12%) and Karnataka (70.47%) in phase-I and phase-II, respectively. The seropositivity for ovine brucellosis in Karnataka revealed 16.6 % smooth *Brucella* spp. and 11.07 % *B. ovis*. Further, a study on sero-prevalence of brucellosis among veterinary health care staff of Karnataka revealed a prevalence of 8.02% with significant difference between the para veterinary staff and veterinary doctors. DIVA test developed for brucellosis was validated using serum samples from buffaloes and in-house IgM/IgG based lateral flow assay for sero-diagnosis of human brucellosis also evaluated.

Prevalence of anti-leptospiral antibodies using microscopic agglutination test among the 555 buffalo serum samples received from three states, viz., Kerala (n=115), Tamil

Nadu (n=197), Gujarat (n=243) revealed overall sero-prevalence of 16% (89/555). Out of 89 reacted sera, 40 samples showed reactivity with more than one serovars representing 45% prevalence of multiple serovars. Further, Recombinant *Leptospira* proteins based latex agglutination test for detection of the anti-leptospiral antibodies was developed. On screening of 3040 bovine serum samples (n=2653 buffaloes; n= 387 cattle) for *Trypanosoma evansi* by using *Surravey* indirect ELISA revealed overall sero-prevalence 54.24%. Further exploring genetic diversity of *Theleria orientalis* detected from the fatal outbreaks samples in bovines in Karnataka revealed that Type 7 genotype of *T. orientalis* in crossbred cattle whereas Chitose B genotype in the affected indigenous bulls implying the potential of Type 7 and Chitose genotypes of *T. orientalis* in causing the death of bovines.

Meta-analysis of pasteurellosis prevalence in small ruminants revelaed the 5% prevalence in sheep and goat. Draft genome sequence analysis of *C. chauvoei* NIVEDIBQ1 strain isolated from clinical case of black quarter in cattle indicated that genome had 2653 predicted coding DNA sequences, harbored numerous genes, mobile genetic elements for pathogenesis and virulence factors. During the period, a total of 1458 whole genome sequencing of pathogens from the isolates recovered from animals, humans, aquaculture, environment and foods of animal origin from three study sites of Guwahati and Assam was carried out and more than 1000 WGS submissions at NCBI-GenBank were made under the Bioprojects ID viz., PRJNA636233 and PRJNA718071. Further bioinformatics analysis of *Klebsiella pneumoniae* isolated from fresh fishes at retail outlets revealed a rare serotype O3b, a high-risk clone ST37 and *S. aureus* strain ST672-MRSA-IVa/t1309 is an emerging Indian clone among pathogens isolated from food fishes.

ICAR-NIVEDI has developed PPR Ab Chek kit for serosurveillance, and seromonitoring of PPR to detect N specific PPR antibodies in sheep and goats at the eradication /post-eradication phase. In a pilot study, the observed sero-positivity of PPRV antibodies in large ruminants was 45.3% for both H and N-specific antibodies, with detection of N specific antibodies in more animals (45%) compared to H specific (28%) antibodies. The serotype distribution of bluetongue virus in Karnataka revealed variation across the districts and the dominant serotypes observed during 2022 outbreaks were BTV16, BTV 1 and BTV2. The immune response of pig, an amplifying host for JEV depends on age and tissue. Further molecular assay for detection of JEV and TGEV genome was developed. A total of 342 pig serum samples were screened for TGEV and PRCV of which 54 sera from Assam were positive for TGEV and one sample was positive for PRCV.

The disease alerts two months in advance for 13 important livestock diseases were communicated to animal husbandry departments to take appropriate prevention and control measures. In addition, in collaboration with NIC, Govt. of Karnataka, the disease alerts were communicated directly to farmers through SMS (1, 79, 57,084 SMS alerts) registered in FRUITS (Farmers Registration and Unified Beneficiary Information System), Karnataka. The Cattle Disease Diagnosis Expert System (CaDDES), a web application was developed which will be useful for the field veterinarians in the diagnosis of thirteen cattle diseases. The study on modeling the effects of climate variability showed that the temperature of the land's surface has risen in 2021 when compared to 2001 and 2011. The sampling plan for FMD, PPR, Brucellosis, CSF and one-health diseases including Avian influenza for sero monitoring and surveillance has been prepared and communicated to stakeholders.

Spatial and temporal analysis of Crimean Congo Hemorrhagic Fever data from 2011 to 2020 in Gujarat state revealed highest reported deaths were during September, followed by November and August and

prevalence varied across the districts. Further, a decrease in area of grasslands over the years has favoured CCHF incidence and spread within the geography of Gujarat.

The risk map for JE was developed for Assam. Barpeta, Nalbari, Darrang. Marigaon, Lakhimpur, Karimkanj, Jorhat and Sibsagar were identified as high-risk areas for JE. Further, high rainfall (>600 mm) correlates with occurrence of JE in Assam. During the period, the risk maps for CCHF for Gujarat state and All India maps for CCHF and avian influenza has been developed. Further, cluster maps for avian influenza, bluetongue, FMD, CSF and LSD and hotspot and risk maps for ASF in the north eastern states were developed.

The estimated median milk loss, mortality loss and treatment cost per farm due to LSD in cattle in Rajasthan state was Rs. 14,400, Rs. 30,000 and Rs.4,000, respectively whereas the estimated milk loss, calf loss due to abortion, treatment cost and opportunity cost of labour per animal due to Brucellosis were Rs. 12,064, Rs. 3,000, Rs. 2,100, and Rs. 2,625, respectively in aborted crossbred cattle in Karnataka. The projected loss due to BTV in Karnataka and Andhra Pradesh was Rs.85.47 crore and Rs.125.24 crore.

The biosecurity measures adoption study in Andhra Pradesh revealed majority of the farmers do not practice the key biosecurity measures such as timely vaccination (82%) and quarantining the newly purchased animal (97%). The impact of Kalinga Brown poultry compared to native chicken rearing was significant in terms of weight gain and egg weight with overall benefit cost ratio 2.08 compared to 1.3 in native chicken. The Osmanabadi goat rearing (2+1) by the farmers realized a net profit of Rs.35156/-.

The PPR Ab and Ag Chek kits for surveillanc and monitoring of PPR were released by the Hon'ble Union Minister of Agriculture and Farmers Welfare during the 93 Annual General Meeting of ICAR. During the year under report, seven copyright applications have been registered/filed and filed one patent to its credit in disease diagnostics. The scientists of the institute have published 52 research papers in reputed national and international journals which includes 20 research papers published in collaboration with other institutes. During the year 2022, ICAR-NIVEDI submitted 41 cultures of *Pasteurella multocida*, two cultures of *Clostridium chouvei* and five isolates of lumpy skin disease virus to NCVTC, Hisar. ICAR-NIVEDI also organized more than 75 capacity building programs for various stakeholders, namely students, academicians, veterinarians, medical and para-medical professionals in the field on biosafety, animal health emergency, zoonotic disease diagnosis, descriptive epidemiology, and disease modelling, animal health managements, outreach and extension activirites, awareness programme, etc. ICAR-NIVEDI also promotes Agri start-ups through NaaVic, ABI under the NEO and NEST & NEXUS and NOVICE programmes through selection, mentoring, providing Grant-in-aid funds for the identified agri-entreprenuers. The Fyllo' startup incubated at NaaViC was shortlisted by the Ministry of Agriculture & Farmers Welfare for interaction with Honorable Prime Minister on 17th Oct, 2022. The scientists of the institute received more than 30 awards and recognition for their scientic contributions in terms of best oral/ poster presentation / significant contribution in the field of their expertise in various scientific meetings, conference, workshops, symphosia/ other fora. Further, ICAR-NIVEDI was bestowed with Swachhta Pakhwada Award 2021 (First Prize) by Hon'ble Shri. Narender Singh Tomar, Union Minister for Agriculture and Family Welfare during Director's conference at NASC Complex, New Delhi.

कार्यकारी सारांश

भाकृ.अनु.प. - राष्ट्रीय पशुरोग जानपदिक और रोगसूचना विज्ञान संस्थान (भाकृअनुप-निवेदी) पशु रोग महामारी और रोग सूचना के क्षेत्र में अनुसंधान एवं विकास के जनादेश के साथ कार्य करने वाला एक अग्रणी अनुसंधान संस्थान है जो देश के विभिन्न राज्यों में स्थित सहयोगी केंद्रों के माध्यम से भारत में पशुधन रोगों की संवीक्षण, निगरानी और प्रभाव विश्लेषण पर कार्य कर रहा है। संस्थान की पशुरोग मॉडलिंग, जोखिम विश्लेषण, पशु रोग पूर्वानुमान एवं पूर्व चेतावनी और महामारी निदान के लिए सीरो संवीक्षण व नैदानिक किट के विकास मे महत्वपूर्ण भूमिका है। संस्थान अनुसंधान, प्रयोगशाला क्षमता निर्माण और मानव संसाधन विकास के लिए विभिन्न संगठनों और हितधारकों के साथ राष्ट्रीय और अंतर्राष्ट्रीय सहयोग के साथ कार्य कर रहा है। प्रतिवेदित अवधि में लंपी त्वचा रोग (LSD) के लिए संदिग्ध नमूनों के निदान के लिए संस्थान को पशुपालन और डेयरी विभाग, भारत सरकार द्वारा राष्ट्रीय रेफरल प्रयोगशाला के रूप में मान्यता दी गई।

इस अवधि के दौरान, लंपी त्वचा रोग संक्रमण के निदान के लिए पारंपरिक पीसीआर, वास्तविक समय पीसीआर जांच-आधारित और एक पुनः संयोजक प्रतिरक्षा ब्लाट परख को विकसित किया गया तथा विभिन्न राज्यों के 1500 से अधिक नैदानिक नमूने तथा प्रकोप जांच के दौरान एकत्र किए गए नमूनों की जांच की गई। रोग प्रकोप के विष्लेषण करने पर, एलएसडी की सबसे अधिक घटना 5 वर्ष से (37.42%) अधिक आयु के मवेशियों में देखी गई, उसके बाद 2-5 वर्ष (36.76%) और सबसे कम <2 वर्ष (25.82%) में देखी गई। एलएसडीवी के संचरण के लिए प्रमुख वैक्टर में हेमेटोबिया प्रजाति की मक्खियों और एंबलियोमा प्रजाति की चीचड को प्रमुख रूप से जिम्मेदार पाया गया। 30 फील्ड आइसोलेट्स के P32 और RPO30 जीन के सीक्वेंसिंग और वंशावली विश्लेषण से भारत में आनुवंशिक रूप से समान एलएसडीवी वायरस के प्रचलन का पता चला। संक्रामक गोजातीय रैनोट्रेकीयईटिस (IBR) के लिए भैंस सीरम के नमूनों की स्क्रीनिंग (n= 2590) में 12.5% (325/2590) समग्र सीरो-सकारात्मकता का पता चला, जबकि ब्रुसेलोसिस के लिए भैंस सीरम के नमूनों (n = 5683) की स्क्रीनिंग से 7.44% (4235683/) की समग्र सीरो-सकारात्मकता का पता चला.

ब्रुसेलोसिस टीकाकरण कार्यक्रम (चरण- I और II टीकाकरण) के तहत प्राप्त सीरम नमूनों (n = 21,412) में वैक्सीन एंटीबॉडी का पता लगाने के लिए अप्रत्यक्ष एलिसा द्वारा परीक्षण किए गए, जिसमें चरण-I तथा चरण- II में क्रमश: गोवा (92.12%) और कर्नाटक (70.47%) में उच्चतम सीरो-पॉजिटिविटी का पता चला। कर्नाटक राज्य के भेड़ों में ब्रुसेलोसिस के लिए किए गए सीरों संवीक्षण में 16.6% स्मूथ ब्रुसेला प्रजाति और 11.07% बी. ओविस का पता चला। इसके साथ ही कर्नाटक के पशु चिकित्सा स्वास्थ्य कर्मचारियों के बीच ब्रुसेलोसिस सीरो-प्रसार पर किए गए अध्ययन ने पैरा पशु चिकित्सा कर्मचारियों और पशु चिकित्सकों के बीच महत्वपूर्ण अंतर के साथ 8.02% का सीरों प्रसार को देखा गया। ब्रुसेलोसिस के लिए विकसित DIVA परीक्षण को भैंसों से सीरम के नमूनों का उपयोग करके मान्य किया गया था और मानव ब्रुसेलोसिस के सीरो-निदान के लिए स्वदेशी विकसित IgM/IgG आधारित पार्श्व प्रवाह परख का भी मूल्यांकन किया गया।

तीन राज्यों केरल (n=115), तमिलनाडु (n=197), गुजरात (n=243) से प्राप्त 555 भैंस सीरम के नमूनों की माइक्रोस्कोपिक एग्लूटिनेशन परीक्षण से 16% (89/555) एंटी-लेप्टोस्पाइरल एंटीबॉडी की समग्र सीरो-प्रसार का रिकार्ड किया गया। 89 प्रतिक्रियाशील सीरम नमूनों में, 40 (45%) नमूनों में एक से अधिक सेरोवर्स के साथ प्रतिक्रियाशीलता देखी गई। इसके अलावा, एंटी-लेप्टोस्पाइरल एंटीबॉडी का पता लगाने के लिए रिकॉम्बिनेंट लेप्टोस्पाइरा प्रोटीन आधारित लेटेक्स एग्लूटिनेशन टेस्ट विकसित किया गया। सुर्वेय अप्रत्यक्ष एलिसा का उपयोग करके 3040 गोजातीय सीरम नमूनों (n = 2653 भैंस; n = 387 गायों) की स्क्रीनिंग पर ट्रिपैनोसोमा इवांसी के 54.24% समग्र सीरो-प्रसार का पता चला। कर्नाटक में बोवाइनों में घातक प्रकोप के नमूनों से थेलेरिया ओरिएंटलिस की आनुवंशिक विविधता की खोज से संकरित नस्ल के मवेशियों में टी. ओरिएंटलिस 7 जीनोटाइप जबकि प्रभावित स्वदेशी सांडों में चिटोज़ बी जीनोटाइप 7 का पता चला जो जीनोटाइप 7 और चिटोज़ जीनोटाइप के गोजातीय मृत्यु से सहसंबध को दर्शाता है.

छोटे जुगाली करने वाले पशुओं में पास्ट्यूरेलोसिस के मेटा-विश्लेषण से इसके 5% प्रसार का पाया गया। भारत से पहली बार मवेशियों के लंगड़ा ज्वर के क्लिनिकल मामले से अलग किए गए जीवाणु सी. चौवोई स्ट्रेन निवेदिबक्यू1 के खंडित पूर्ण जीनोम को अनुक्रमित किया गया। अनुक्रम विश्लेषण से जीनोम में 2653 कोडिंग डीएनए अनुक्रमों की भविष्यवाणी की गई तथा, रोगजनन और विषाणु कारकों के लिए मोबाइल आनुवंशिक तत्व को भी देखा गया। गुवाहाटी और असम के तीन अध्ययन स्थलों से पशुओं, मनुष्यों, मछलियों, पर्यावरण और पशु मूल के खाद्य पदार्थों से प्राप्त कुल 1458 रोगाणुरोधी प्रतिरोध (ए.एम.आर.) रोगजनकों के संपूर्ण जीनोम को अनुक्रमित किया गया। इसके साथ ही एनसीबीआई-जेनबैंक में बायोप्रोजेक्ट जैसे पीआरजेएनए 636233 और पीआरजेएनए 718071 में 1000 से अधिक संपूर्ण जीनोम को जमा किया गया। खुदरा दुकानों के ताजी मछलियों से अलग किए गए एएमआर जीवाणु क्लेबसिएला न्यूमोनिया के जीनोम विश्लेषण से एक दुर्लभ सीरोटाइप O3b तथा एक उच्च जोखिम क्लोन ST37 का और एस ऑरियस स्ट्रेन ST672-MRSA-IVa/t1309 का पता चला, जो भारतीय खाद्य मछलियों में प्रतिरोधी रोगजनकों के बीच एक उभरता हुआ क्लोन है।

भेड़ और बकरियों में बकरी प्लेग रोग उन्मूलन और उन्मूलन के बाद के चरण में सीरो संवीक्षण और सीरो निगरानी के लिए एन प्रतिजन

आधारित पीपीआर विशिष्ट एंटीबॉडी का पता लगाने के लिए पीपीआर एब चेक किट को विकसित किया गया । एक पायलट अध्ययन में, बड़े जुगाली करने वाले पशुओं में 45.3% पीपीआर विशिष्ट सीरो-पॉजिटिविटी दर्ज की गई जिसमें एन विशिष्ट एंटीबॉडी (45%), एच विशिष्ट एंटीबॉडी (28%) से अधिक थी । कर्नाटक में ब्लुटंग वायरस के सीरोटाइप वितरण ने जिलों में भिन्नता प्रकट की और 2022 के प्रकोप के दौरान बीटीवी 16, बीटीवी1 और बीटीवी 2 सीरोटाइप को प्रमुख रूप से देखा गया । जपानी मस्तिश्क ज्वर के लिए सुअर की प्रतिरक्षा प्रतिक्रिया, मेजबान की आयु और संक्रमित ऊतक पर निर्भर करती है। जेईवी और टीजीईवी जीनोम का पता लगाने के लिए आणविक परख को विकसित किया गया ।

पशुपालन विभागों को 13 महत्वपूर्ण पशुधन रोगों के लिए रोग पूर्वानुमान सूचना दो महीने पहले प्रदान की गई ताकि उचित रोकथाम और नियंत्रण के उपाय किए जा सकें। इसके अलावा, एनआईसी, कर्नाटक सरकार के सहयोग से फ्रूट्स (किसान पंजीकरण और एकीकृत लाभार्थी सूचना प्रणाली), में पंजीकृत किसानों को 1,79,57,084 एसएमएस अलर्ट के माध्यम से सीधे रोग अलर्ट की सूचना भेजी गई। मवेशी में रोगों निदान के लिए मवेशी रोग निदान विशेषज्ञ प्रणाली (सीएडीडीईएस) नामक एक वेब अनुप्रयोग को विकसित किया गया जो 13 पशु रोगों के निदान में पशु चिकित्सकों के लिए उपयोगी सिद्ध होगा। जलवायु परिवर्तनशीलता के प्रभाव पर मॉडलिंग अध्ययन से पता चला है कि 2001 और 2011 की तुलना में 2021 में भूमि की सतह का तापमान बढ़ गया है। सीरो निगरानी के लिए एफएमडी, पीपीआर, ब्रुसेलोसिस, सीएसएफ, एवियन इन्फ्लूएंजा और एकीकृत स्वास्थ्य रोगों के संवीक्षण और निगरानी लिए नमूना योजना तैयार की गई और हितधारकों को सूचित किया गया। गुजरात राज्य में 2011 से 2020 तक क्रीमियन कांगो रक्तस्रावी बुखार के स्थानिक और अस्थायी विश्लेषण से पता चला है कि मृत्यु दर सितंबर में सबसे अधिक थी, उसके बाद नवंबर और अगस्त में रिकार्ड की गई । इसके साथ ही विभिन्न जिलों में रोग की व्यापकता अलग-अलग थी। इसके अलावा, पिछले कुछ वर्षों में घास के मैदानी क्षेत्रों की कमी ने भी कांगो ज्वर (CCHF) प्रकोप को बढ़ाया है।

असम राज्य में जपानी मस्तिश्क ज्वर के प्रकोप के लिए जोखिम मानचित्र को विकसित किया गया जिसमे बारपेटा, नलबाड़ी, दरंग, मरीगांव, लखीमपुर, करीमकंज, जोरहाट और सिबसागर को उच्च जोखिम वाले क्षेत्रों के रूप में चिन्हित किया गया। इसके अलावा, असम में उच्च वर्षा (>600 मिमी) और जेई प्रकोप में सह संबंध पाया गया। गुजरात राज्य के लिए कांगो ज्वर (CCHF) जोखिम मानचित्र और अखिल भारतीय स्तर पर कांगो ज्वर (CCHF) और एवियन इन्फ्लूएंजा के लिए जोखिम मानचित्र विकसित किए गए। इसके अलावा, उत्तर पूर्वी राज्यों में एवियन इन्फ्लुएंजा, ब्लू टंग, एफएमडी, सीएसएफ और एलएसडी के लिए क्लस्टर मानचित्र और एएसएफ के लिए हॉटस्पॉट और जोखिम मानचित्र विकसित किए गए।

राजस्थान राज्य में मवेशियों में लम्पी त्वचा रोग के प्रकोप के कारण दूध उत्पादन हानि, मृत्यु दर हानि, उपचार लागत का अनुमानित क्षति औसत क्रमशः रुपये 14,400 रु. 30,000 और 4,000 रुपये, जबकि कर्नाटक में ब्रुसेलोसिस के कारण हुए मवेशियों में गर्भपात के कारण हुए अनुमानित दूध हानि, गर्भपात के कारण बछड़ा नुकसान, उपचार लागत और प्रति पशु श्रम की अवसर लागत के कारण हुई क्षति को क्रमशः 12,064 रुपये, 3,000 रुपये, 2,100 रुपये और 2,625 रु आँका गया। जबकि कर्नाटक और आंध्र प्रदेश में ब्लू टंग के कारण हुए अनुमानित क्षति क्रमशः 85.47 करोड़ रुपये और 125.24 करोड़ रुपये थी। आंध्र प्रदेश में जैव सुरक्षा उपायों को अपनाने के अध्ययन से पता चला है कि अधिकांश किसान समय पर टीकाकरण (82%) और नए खरीदे गए पशु (97%) को क्वारंटाइन करने जैसे प्रमुख जैव सुरक्षा उपायों का अभ्यास नहीं करते हैं। देशी मुर्गी पालन की तुलना में कलिंगा ब्राउन पोल्ट्री का प्रभाव वजन बढ़ाने और अंडे के वजन के मामले में देशी चिकन में 1.3 की तुलना में समग्र लाभ लागत अनुपात 2.08 के साथ महत्वपूर्ण था। अध्ययन में किसानों द्वारा उस्मानाबादी बकरी पालन (2+1) से 35156/- रूपए का शुद्ध लाभ प्राप्ति को रिकार्ड किया गया।

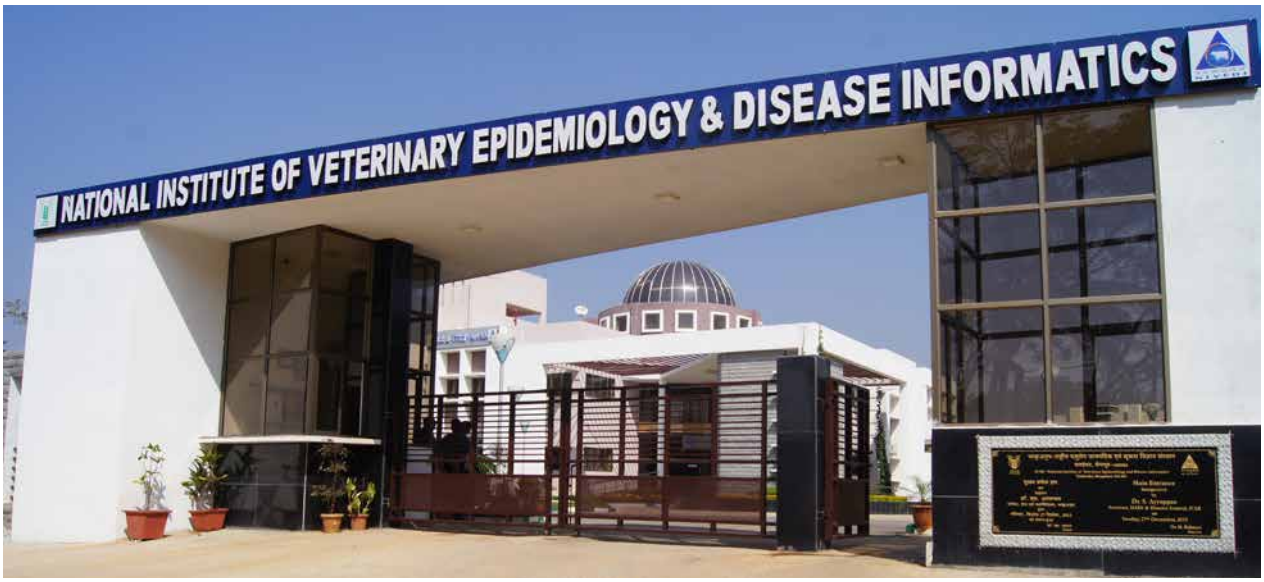
भा.कृ.अनु.प. की 93वीं वार्षिक आम बैठक के दौरान माननीय केंद्रीय कृषि और किसान कल्याण मंत्री द्वारा पीपीआर रोग संवीक्षण और निगरानी के लिए पीपीआर एबी और एजी चेक किट जारी किए गए। सात कॉपीराइट आवेदन पंजीकृत/दाखिल किए गए हैं और रोग निदान किट के लिए एक पेटेंट दाखिल किया गया है। संस्थान के वैज्ञानिकों ने प्रतिष्ठित राष्ट्रीय और अंतर्राष्ट्रीय शोध पत्रिकाओं में 52 शोध पत्र प्रकाशित किए हैं. वर्ष 2022 के दौरान, भाकृअनुप-निवेदी ने एनसीवीटीसी, हिसार को पाश्चुरेला मल्टोसिडा के 41 कल्चर, क्लॉस्ट्रिडियम चौवेई के दो कल्चर और गांठदार त्वचा रोग वायरस के पांच आइसोलेट्स को जमा किया। भाकृअनुप-निवेदी ने जैव सुरक्षा, पशु स्वास्थ्य आपातकाल, जूनोटिक रोग निदान, वर्णनात्मक महामारी विज्ञान, और रोग मॉडलिंग, प्रबंधन, पशु स्वास्थ्य के क्षेत्र में आउटरीच और विस्तार गतिविधियाँ, जागरूकता कार्यक्रम, आदि विषयों पर छात्रों, शिक्षाविदों, पशु चिकित्सकों, चिकित्सा और पैरा-मेडिकल पेशेवरों जैसे विभिन्न हितधारकों के लिए 75 से अधिक क्षमता निर्माण कार्यक्रम भी आयोजित किए।

भाकृअनुप-निवेदी के एग्री बिजनेस इकाई नाविक (NaaViC) व एबीआई (ABI) के तहत नियो, नेस्ट, एनईएसटी, नेक्सस और नोविस जैसे कार्यक्रमों के माध्यम से चयनित कृषि-उद्यमियों को चयन, सलाह, अनुदान सहायता निधि प्रदान करके कृषि स्टार्ट-अप को बढ़ावा दिया गया । 17 अक्टूबर 2022 को माननीय प्रधान मंत्री के साथ वार्ता के लिए कृषि और किसान कल्याण मंत्रालय द्वारा NaaViC में संवर्धित स्टार्टअप फाइलो का चयन किया गया। संस्थान के वैज्ञानिकों को उनके वैज्ञानिक योगदान के लिए सर्वश्रेष्ठ मौखिक, पोस्टर प्रस्तुति के रूप में विभिन्न वैज्ञानिक बैठकों, सम्मेलन, कार्यशालाओं, सिम्फोसिया व अन्य मंचों पर 30 से भी अधिक विभिन्न पुरस्कार / मान्यतायों की प्राप्त हुई। इसके अलावा, संस्थान को नई दिल्ली में आयोजित निदेशक सम्मेलन में माननीय केंद्रीय कृषि और कृषक कल्याण मंत्री श्री नरेंद्र सिंह तोमर द्वारा स्वच्छता पखवाड़ा पुरस्कार 2021 (प्रथम पुरस्कार) से सम्मानित किया गया।

Genesis of ICAR-NIVEDI

02

Introduction



ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI), (Formerly Project Directorate on Animal Disease Monitoring and Surveillance, PD-ADMAS) has been set up under the aegis of the Indian Council of Agricultural Research (ICAR), Department of Agricultural Research and Education, Ministry of Agriculture and Farmer Welfare, Government of India. ICAR-NIVEDI is a pioneering research institute working with the mandate of R&D in the field of veterinary epidemiology and disease informatics and carrying out disease surveillance, monitoring and impact analysis of livestock diseases in India through collaborative centers located in different states of the country. The Institute has a long successful history of delivering predicted informatics and epidemiological solutions for various animal diseases.

Located in Karnataka, ICAR-NIVEDI had its humble beginning as the All India Coordinated Research Project (AICRP) on Animal Disease Monitoring and Surveillance (ADMAS) in 1987, up-graded to Project Directorate on Animal Disease Monitoring and Surveillance (PDADMAS) in 2000 and finally in the year 2013 it was rechristened as ICAR-NIVEDI. The coordinating units of AICRP-ADMAS continued to grow from four in 1987 to 31 till 2021. From April 2021 onwards, this has been rechristened as National Animal Disease Epidemiology Network (NADEN) with forty-four centers at present. The Institute has a state-of-

the-art Bio-safety Level 2 laboratory, which is managed as per the national guidelines for laboratory biosafety and biosecurity practices.

The role of ICAR- NIVEDI is significant in developing disease models, risk analysis, animal disease forecasting & forewarning. It is also working on the development of population assays and surveillance diagnostic kits for epidemiological serosurvey. ICAR-NIVEDI is also working on the development of spreadsheet modules for economic impact analysis of important endemic livestock diseases viz., FMD, PPR, BT, Brucellosis, HS, and LSD in the country. The role of this institute in the eradication of Rinderpest from India and the development of the National Animal Disease Referral Expert System (NADRES), interactive software for animal disease forecasting is noteworthy.

The institute has six patents granted to its credit and another four patents have been filed in the area of disease diagnostics. With regard to copyright, three applications have been registered and four applications were filed. Six applications were submitted for no objection certificate and one application has been filed for trademark. The scientists of the institute have published more than 250 research papers in reputed national and international journals in the last five years. ICAR-NIVEDI also organized capacity-building programs for students, academicians, veterinarians, and medical and para-medical professionals in the field of biosafety, animal health emergency, zoonotic disease diagnosis, descriptive epidemiology, and disease modelling.

ICAR-NIVEDI has established an excellent National Livestock Serum Repository consisting of randomly collected serum samples from different livestock species. Currently, more than one lakh serum samples of various livestock species have been catalogued and stored. The said repository acts as a storehouse for a retrospective screening of livestock diseases and for the development and validation of diagnostic assays. The Institute has national and international funded with various organizations and stakeholders, including DBT, ICMR, NCDC, NIE, NIMHANS, CDC, FAO, WHO, WOAH, ILRI, BBSRC, MRC-UK, etc., for collaborative research, laboratory capacity building and human resource development. The institute has conducted more than 50 capacity-building training programmes on epidemiology, economic impact, sampling frame, GIS and RS and disease diagnosis including biosafety and biosecurity. Naavic, the Agri-business incubation center, is a unique facility of NIVEDI, nurturing the startups/entrepreneurs in the field of animal husbandry and veterinary services through identification, incubation, promotion and funding. This centre has provided need-based physical space for administrative and laboratory work, technical, business and networking support, facilities and services to test and validate their venture before the successful establishment of enterprises.

VISION
Achieving freedom from animal diseases, animal welfare, food and nutritional security through healthy foods of animal origin, poverty alleviation and economic growth of rural India.
MISSION
Capacity building in frontier areas of Veterinary Epidemiology: dynamics of animal diseases including zoonosis and animal healthcare intelligence.
MANDATE
• Epidemiology, informatics and economics of animal diseases including zoonosis • Surveillance, forecasting and forewarning for management of animal diseases including Zoonosis • Repository and Capacity Development

ICAR-NIVEDI is at the forefront of the societal development of scheduled caste and schedule tribe communities through DAPSC and TSP programs. Under these GoI initiatives, goats, chickens feed, medicines and training programs have been provided to ensure economic, and social upliftment and nutritional security for the children, rural women and youth.

The future priority areas for NIVEDI include improvement and strengthening of the existing disease forecasting system through the development of a quality database using village/ block level livestock disease data, a database on climatic and non-climatic risk factors, research on animal disease simulation modelling for effective forecasting, improving the precision of forecasting models and validation, risk analysis and risk assessment of endemic, emerging and re-emerging diseases, development of risk map for optimal utilization of available resources and for better management of diseases. NIVEDI participation is noteworthy in the National Digital Livestock Mission (NDLM) of DAHD, GoI, and /or other organizations/ stakeholders for carrying out disease modelling, surveillance, monitoring and forewarning of livestock diseases, need-based diagnostics, population surveillance assay kits for the epidemiological survey and field diagnosis, organizing capacity buildings programme, etc., including the integrated one health surveillance, epidemiological investigations of outbreaks, one health supporting unit's capacity buildings and forecasting and forewarning of zoonoses. The estimation of country-wide economic losses due to important livestock diseases, public health issues and the economic burden of zoonotic diseases, impact of climate changes on animal disease incidence and emergence of new pathogens through modelling are the niche areas for NIVEDI.

FOCUS
• Improving disease monitoring and surveillance through the development of population assays and pen-side diagnostics • Risk assessment for the occurrence of economically important animal diseases • Adapting strategies to improve animal disease data quality • Understanding the threat from animal diseases in the background of climate change and globalization • Developing early warning system and disease modeling/forecasting • Understanding the economic impacts of animal diseases and the management strategies • Promoting innovations and improving human resource capacity • Fostering linkages and collaborations with public and private, national and international organizations • Improving the knowledge management system

THRUST AREAS
• Development of robust forecasting & forewarning models for important livestock • diseases along with risk analysis. • Epidemiological investigation, surveillance and monitoring of endemic, and re-emerging diseases of animals including zoonosis. • Development of diagnostics for population survey of economically important diseases including zoonosis. • Molecular epidemiology of pathogens, disease outbreaks and detection and control of infectious diseases. • Socio-economic impact and policy analysis of prioritized diseases.

Infrastucture Facilities

ICAR-NIVEDI has state of art containment facility of biosafety level 2++ category, unique facility in the country. Institute has a training hall equipped with state of art audio-visual aids for organising training cum awareness programmes. Apart from this, the institute has a committee room for conducting regular meetings and farmer's cum traning hostel for accommodating trainees. Further, the institute has a spatial epidemiology and GIS lab, disease informatics lab and lab for routine disease investigation. Institute is maintaining National Livestock Serum Repository (NLSR) consisting of randomly collected serum samples of various livestock species from different states and UTs of India.

National Animal Disease Epidemiology Network (NADEN)

The National Animal Disease Epidemiology Network (NADEN) is a newly established network of collobrative centres involved in animal disease epidemiology across every state of India. The network came into existence after the closure of All India Coordinated Research Project on Animal Disease Monitoring and Surveillance (AICRP on ADMAS) on 31st March 2021. As an internal network, ICAR-NIVEDI, plans to function with forty-plus collaborative centers, as compared to the existing 31 centres of AICRP_ADMAS. NADEN includes 6 Regional Disease Diagnostic Laboratories (RDDLs), 6 AQCS (Animal Quarantine and Certification Service), a center from Ladakh and an additional center each from the state of Uttar Pradesh, Rajasthan in addition to existing 31 centers. The focus of NADEN would be on understanding the nationwide animal disease epidemiology to better inform control strategies.

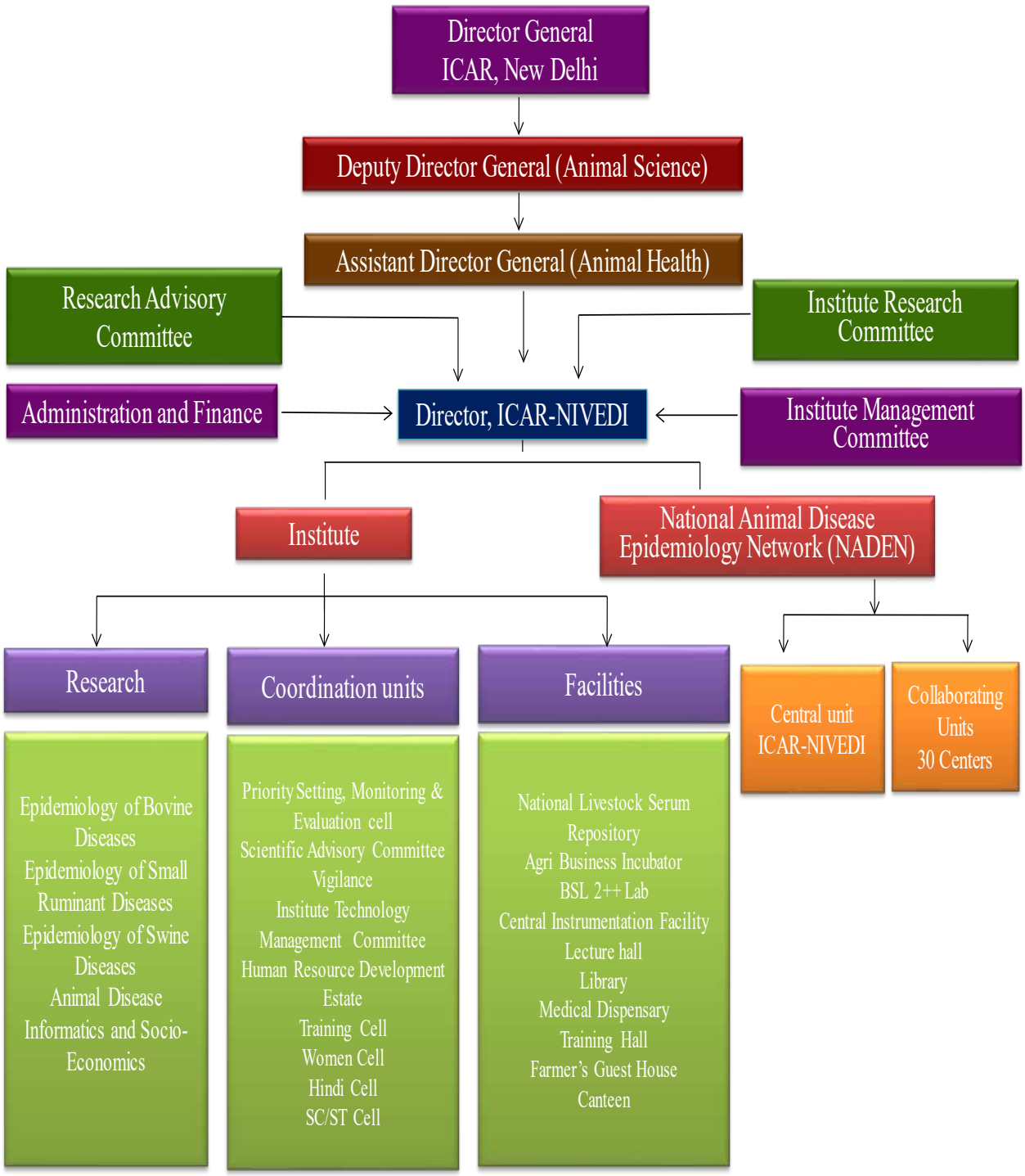
OBJECTIVES OF NADEN

- To participate in R & D in animal disease epidemiology and informatics by collecting / generating and collating livestock disease data and systematic outbreak investigation.
- To analyse disease data for risk mapping, epidemiological trends, and forewarning for taking appropriate intervention strategies for disease control
- To undertake seroepidemiological studies
- To devise epidemiological solutions for effective control of animal diseases.

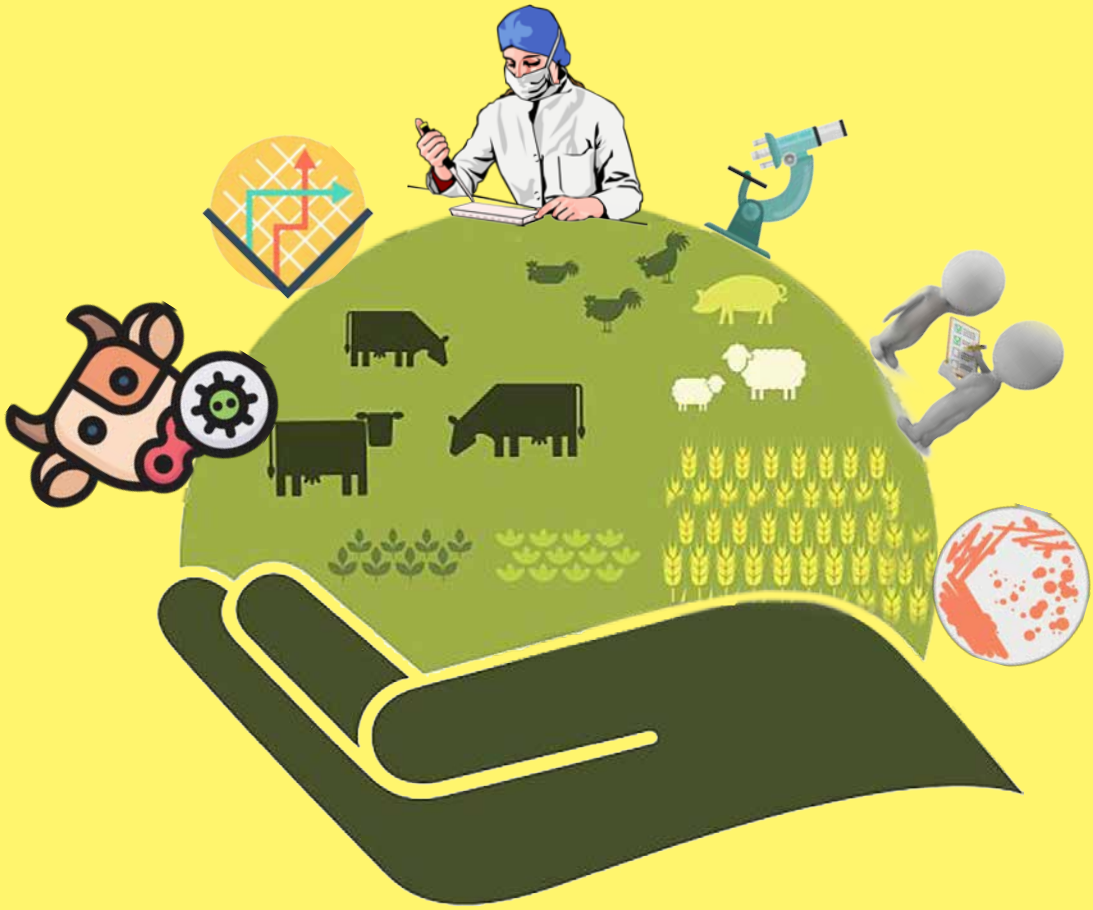
MANDATES OF NADEN

- Strengthening of the National Animal Biological Repository
- Effective updating of NADRES with active disease data, climatic and non-climatic factors
- Surveillance of diseases/pathogens in domestic companions, laboratory and wild animals
- Analysis of economic losses due to animal diseases and impact of control measures adopted for their management.
- Sero-monitoring of animal diseases based on strategic sampling
- Investigation of endemic, emerging and reemerging animal disease outbreaks using innovative technologies.
- Working with all stakeholders in the public and private domain for the welfare and health care of animals.

Organogram


Director General
ICAR, New Delhi
Deputy Director General (Animal Science)
Assistant Director General (Animal Health)
Research Advisory Committee
Institute Research Committee
Administration and Finance
Director, ICAR-NIVEDI
Institute Management Committee
Institute
National Animal Disease Epidemiology Network (NADEN)
Research
Coordination units
Facilities
Central unit ICAR-NIVEDI
Collaborating Units 30 Centers
Epidemiology of Bovine Diseases
Epidemiology of Small Ruminant Diseases
Epidemiology of Swine Diseases
Animal Disease Informatics and Socio-Economics
Priority Setting, Monitoring & Evaluation cell
Scientific Advisory Committee
Vigilance
Institute Technology Management Committee
Human Resource Development
Estate
Training Cell
Women Cell
Hindi Cell
SC/ST Cell
National Livestock Serum Repository
Agri Business Incubator
BSL 2++ Lab
Central Instrumentation Facility
Lecture hall
Library
Medical Dispensary
Training Hall
Farmer's Guest House
Canteen

ICAR-NIVEDI Milestones

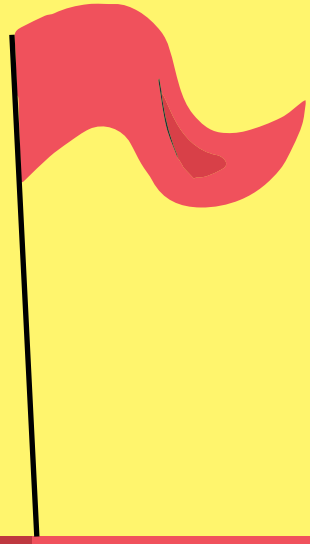


1987-2000

- 1 July 1987: AICRP on animal disease monitoring and surveillance (AICRP-ADMAS) initiated with four Regional Research Units (RRUs) at Bengaluru, Hyderabad, Pune and Ludhiana
- The institute worked under National Project on Rinderpest Eradication (NPRE) in collaboration with investigation laboratories in the country
- Project Directorate on Animal Disease Monitoring and Surveillance (PD_ ADMAS) established with ten collaborating units.

2001-2010

- Sardar Patel Outstanding ICAR Institution Award for outstanding contribution in the field of animal disease monitoring and surveillance
- ICAR Awards for Team Research for the Biennium 1999-2000 for outstanding research contribution in the field of animal disease management
- DBT Biotech Product Process Development and Commercialization Award for the development of software based veterinary ELISA diagnostic kits for IBR, bovine brucellosis and RP.
- International OIE Meritorious Award in 2002 for RP eradication.



2011-2020

- FAO Gold Medal, for outstanding contribution to global rinderpest eradication programme
- Seventeen additional collaborating units covering other states were added under AICRP_ADMAS component
- Patent Granted on “A Kit for diagnosis of Brucellosis” (Patent No.250709)
- PD-ADMAS promoted to National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI)
- ISO 9001:2008 certificate awarded to ICAR-NIVEDI
- Administrative Building and Biosafety Laboratory (BSL-2) dedicated to the nation by Shri Radha Mohan Singh, Hon’ble Union Minister for Agriculture
- Utility Building inaugurated by Hon’ble Dr. S. Ayyappan, Secretary (DARE) and Director General (ICAR).
- DBT Biotech Product Process Development and Commercialization Award for development of Brucellosis diagnostic kits
- Best Stall Award for ICAR-NIVEDI during National Sheep and Farmers Fair at ICAR-CSWRI, Avikanagar
- ISO 9001:2015 certificate awarded to ICAR-NIVEDI
- Livestock Disease Forewarning- APP (English version) -Released by Hon’ble Shri Radha Mohan Singh.
- Livestock Disease Forewarning- APP (Hindi version) -Released by Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR
- Training cum Farmers Hostel and Laboratory Block inaugurated by Hon’ble Dr. Trilochan Mohapatra, Secretary (DARE) and Director General (ICAR).
- Agribusiness Incubation Centre for Animal Husbandry and Veterinary Services (NaaViC) established
- CSF Ab Chek kit for the detection of CSF virus antibodies in the serum samples released by the Hon’ble Union Minister of Agriculture and Farmers Welfare.
- Patent granted on “Diagnosis of human brucellosis by IgG and IgM based combo lateral flow assay” (Patent No. 354817)

2021-2022

- Patent granted on “Recombinant VSG and monoclonal antibody based competitive inhibition enzyme linked immunosorbent assay for the detection of antibodies against Trypanosoma evansi” (Patent No. 361741)
- Patent granted on “Monoclonal Antibody based double antibody sandwich ELISA for the detection of Trypanosoma evansi antigen in animals” (Patent No. 369790)
- PPR research lab of NIVEDI recognised as WOAH Reference Laboratory for PPR –South India
- ABrC-ELISA (PPR Ab Chek kit) for PPR antibodies and ABrAC-ELISA kits (PPR Ag Chek kit) for PPR Virus in sheep and goats released by the Hon’ble Union Minister of Agriculture and Farmers Welfare
- Copyright Registered: Bluetongue forewarning mobile application (BT Mobile App)
- Copyright Registered: ANIP on GIP Mobile Application
- Copyright Registered: Advanced animal disease diagnosis and management consortium (ADMaC Mobile App)
- Patent Granted on “Recombinant non-structural proteins NS1 and NS3 as fusion protein (rNS1-NS3) based immuno-diagnostic assay for bluetongue” (Patent No. 419435)

Summary of Expenditure

Major Heads	Expenditure (₹)
Grant for the creation of capital assets (Capital)	0.00
Works	0.00
Equipment	1458323
Information Technology	454234
Library books and journals	0.00
Vehicles and vessels	1026406
Furniture & Fixtures	61037
Grant in Aid salaries (Revenue)	
Esteblishement expemses (Salaries)	91891000
Grant in Aid General (Revenue)	
Traveling allowances	1199852
Research & operational expenses	16793890
Administrative expenses	13387913
Miscellaneous expenses	1118345
North Eastern Hill Region fund	
Capital	500000
General	550000
Scheduled Caste Sub-Plan fund	
Capital	1499981
General	4500000
Grand Total	**149390981**

*Rs 9875000 utilised for pension and retirement benefits

Revenue Receipts (2022- 23)

Description	Amount (₹)
License fee	603769
Interest earned from loans & advances	0.00
Interestt from short term deposit	772653
Interest earned from training	884817
Income generated from sales of kits	238631
Miscellaneous receipts	3480381
TOTAL	**5980251**

Staff Position at ICAR-NIVEDI (as on 31 December 2022)

Name of the post	Sanctioned	Filled	Vacant
Director	01	01	00
Scientific	22	20	02
Technical	02	02	00
Administrative	14	07	07
Supporting	03	01	02

03

Research Achievements

The research activities conducted at ICAR-NIVEDI have been categorized into four research groups viz., epidemiology of bovine diseases, epidemiology of small ruminant diseases, epidemiology of swine diseases and animal disease informatics and socio-economics.

EPIDEMIOLOGY OF BOVINE DISEASES

Epidemiology of lumpy skin disease (LSD) in cattle and buffaloes

The lumpy skin disease (LSD) in cattle and buffaloes is caused by the lumpy skin disease virus (LSDV) belonging to *Capripoxvirus* genus under the family *Poxviridae*. During the period, conventional PCR, real-time probe-based PCR and a recombinant immune blot assay were developed and standardized to detect LSDV infection. ICAR-NIVEDI was recognized as national referral laboratory by DAHD, GoI for confirming the samples suspected for LSDV. More than 1500 clinical samples submitted by different states and the samples collected during outbreak investigations were screened. On investigation, the highest incidence of LSD was observed in the cattle aged above 5 years (37.42%) followed by those in 2-5 years (36.76%) and least in less than 2 years (25.82 %) age group. The *Haematobia* spp flies and *Amblioma* spp ticks were found to be the major vectors responsible for the transmission of the LSDV. In the affected cattle, anemia and leucopenia were observed in the early stage of the disease followed by leukocytosis and a significant increase in AST and GGT levels along with decreased albumin and creatinine values. The pathological findings revealed gunshot wounds in different organs and intracytoplasmic inclusion bodies in skin lesions **(Fig 1)**.

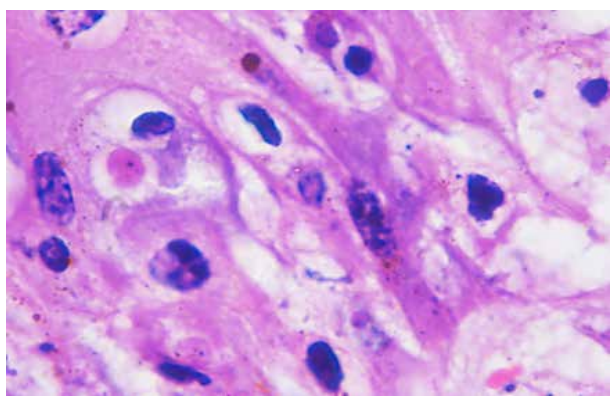


Fig 1: Skin lesions showing intracytoplasmic inclusion bodies due to LSDV infection

Significant variation was observed in the clinical and pathological form of disease without much variation at genetic level, which needs further studies. Molecular epidemiological studies based on *P32* and *RPO30* gene sequences revealed that the

LSDV isolates circulating across the regions for the past three years were genetically similar. A total of 15 LSDV isolates were recovered from different field outbreaks and five LSDV isolates were deposited at NCVTC, Hisar.

(GB Manjunatha Reddy, N Shivasharanappa, HB Chethan Kumar and R Yogisharadhya)

Sero-epidemiology of infectious bovine rhinotracheitis (IBR)

Infectious bovine rhinotracheitis (IBR) commonly referred as Red nose disease in bovines is a highly contagious, infectious respiratory disease caused by Bovine alphaherpesvirus-1 (BoHV-1). During the period, a total of 2590 buffalo serum samples received from nine states (Himachal Pradesh, Kerala, Mizoram, Odisha, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand and Madhya Pradesh) were tested using in-house developed IBR AB ELISA kit. The overall seropositivity for IBR was 12.5% (325/2590) with highest positivity in Uttar Pradesh [43.37% (131/303)] followed by Himachal Pradesh [28.75% (46/200)], Odisha[11.51% (19/165)], Tamil Nadu [11.22% (22/197)], Kerala [8.69% (10/115)], Uttarakhand [7.88% (32/431)], Madhya Pradesh [5.87% (64/1091)], Mizoram [5% (1/48)] and all the samples from Sikkim were negative. Further, 19 BoHV-1 isolates were revived and being maintained.

(SS Patil, KP Suresh, J Hiremath and D Hemadri)

Serological and molecular epidemiology of brucellosis in livestock

Brucellosis caused by various species of the genus *Brucella* is one of the most important zoonotic diseases of global importance with veterinary, public health, and economic concerns. ICAR-NIVEDI is providing diagnostic services using battery of tests for the diagnosis of brucellosis to the various states and farmers. During the period, a total of 1747 animal samples [large ruminants (n=689), small ruminants (n=1042) and swine (n=16)] received from organized and unorganized farms of nine states were tested for brucellosis by RBPT and iELISA. Sero-positivity among bovine was 53.8%, 33.3%, 10.3%, 29.4%, 13.3%, 19.1% and 30.1% in Chhattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Sikkim and Telangana states, respectively. Similarly, in small ruminants, 12.5% and 44.2% sero-positivity was observed in Karnataka and Jammu and Kashmir, respectively. Swine samples from Karnataka and Tamil Nadu showed 100% sero-positivity **(Table 1)**.

Table 1 State-wise details of brucellosis sero-positivity in livestock

Sl. No	State/UT	Species	No. tested	No. positive	% positivity
1	Chhattisgarh	Buffalo	52	28	53.8
2	Gujarat	Bovine	3	1	33.3
3	Karnataka	Cattle	462	48	10.3
		Sheep	947	119	12.5
		Swine	13	13	100.0
4	Jammu and Kashmir	Sheep	95	42	44.2
5	Madhya Pradesh	Bovine	17	5	29.4
6	Maharashtra	Bovine	30	4	13.3
7	Sikkim	Bovine	42	8	19.1
8	Tamil Nadu	Swine	3	3	100.0
9	Telangana	Buffalo	83	25	30.1
Total			**1747**	**296**	**16.9**

Further, the PCR was carried out for few swine and sheep farm samples from of Karnataka experiencing abortion. Out of 18 seropositive swine samples, 4 (22.2%) showed positivity by genus *bcsp* PCR and AMOS PCR *(B. suis)*. Seropositivity along with detection of *B. suis* by PCR confirmed abortions in swine due to brucellosis. Similarly, out of 495 sheep samples processed by PCR, 5.1% animals were positive for brucella genome by genus PCR. The farm owners were advised to segregate positive animals from healthy animals, to follow biosecurity measures in the farm to prevent spread of infection and also to avoid frequent selling or purchase of animals in to the farms.

Identification of brucellosis among buffaloes will help the states to implement vaccination in buffaloes and to create awareness among farmers and veterinary health care staff. Through national animal disease epidemiology network (NADEN) centers, efforts were made to collect countrywide stratified random buffalo serum samples to understand brucellosis burden in buffaloes. A total of 5683 buffalo serum samples received from 13 NADEN centers were tested by in-house recombinant protein G based indirect ELISA (patent no: 335659). Overall, sero-prevalence recorded was 7.44% with highest sero-prevalence of 35.48% in Manipur followed by other states. Samples from Sikkim, Mizoram, Uttar Pradesh and Kerala were negative for anti-*Brucella* antibodies **(Table 2)**.

Table 2 **Sero-prevalence of brucellosis in buffalo**

State	No. of samples screened	No. of positives	Percent positivity (%)
Manipur	124	44	35.4
Madhya Pradesh	1707	200	11.7
Punjab	293	32	10.9
Odisha	165	15	9.1
Uttarakhand	406	34	8.3
Gujarat	2001	89	4.4
Chhattisgarh	144	6	4.1
Himachal Pradesh	160	2	1.2
Tamil Nadu	196	1	0.5
Sikkim	41	0	-
Mizoram	28	0	-
Uttar Pradesh	303	0	-
Kerala	115	0	-
Total	**5683**	**423**	**7.4**

The species-specific brucellosis status emerged out of the study will aid to initiate appropriate control measures to curb the spread of the brucellosis in buffaloes in the country.

(R Shome and M Nagalingam)

Brucellosis in veterinary health care staff of Karnataka

The study was conducted to assess brucellosis among occupationally exposed population of veterinary staff (n=1047) of seven districts of Karnataka state using RBPT, SAT and IgG and IgM iELISA/LFA. The overall sero-prevalence was 8.02% with highest sero-prevalence of 10.2% each in Davanagere and Tumkur districts followed by 8.21%, 7.40% and 6.93%, 4.76% and 3.57% in Mangaluru, Bengaluru rural, Shivamogga, Haveri and Udupi districts, respectively **(Fig 2)**. Significantly higher sero-prevalence was observed among para veterinary staff compared to veterinary doctors ($p<0.01$) **(Table 3).**

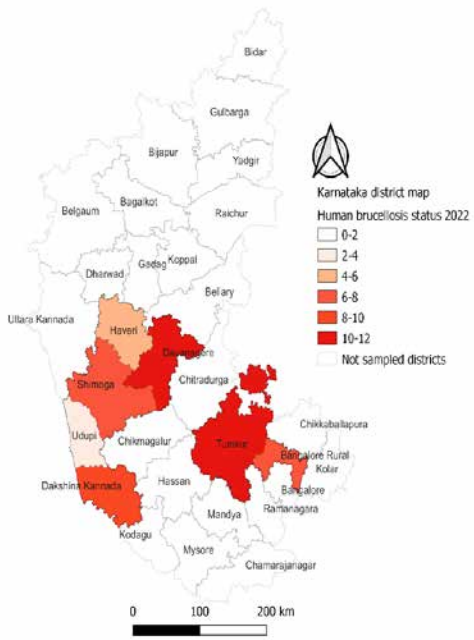


Fig 2: Map depicting sero-prevalence of brucellosis in veterinary health care staff of Karnataka

Table 3 **Occupation wise sero-positivity of brucellosis**

Occupation	Number of samples	Positives	Suspect	Total Positives	Negatives	Percent Positivity (%)	$\chi 2$ value	P value
Veterinary Doctors	265	3	8	11	254	4.15	6.52	0.0107
Veterinary Staff	782	27	46	73	709	9.33		
Total	**1047**	**30**	**54**	**84**	**963**	**8.02**		

Holistic implementation of intervention policies for livestock species, adoption of protective measures for persons engaged in animal husbandry and allied industries and strengthening facilities for brucellosis diagnosis are recommended.

(R Shome and M Nagalingam)

Sero-monitoring of *Brucella* S-19 vaccination in calves

Brucellosis affects livestock and human health and causes huge economic burden and hence its control is inevitable. Government of India launched national

animal disease control program (NADCP) for brucellosis during 2019 with the main focus of vaccinating 4-8 months old bovine calves. The sero-monitoring, a component under NADCP was carried out at ICAR-NIVEDI using structured two stage stratified random sampling for the five year brucellosis control program in different phases (Phase-I to V). During the current year, a total of 21,412 serum samples received under phase-I and II vaccination from different states/UTs were tested by indirect ELISA to detect post-vaccinal antibodies. Under phase-I, a total of 18,388 serum samples received from 15 states and two UTs and in phase-II, a total of 3024 serum samples were received from two states and two UTs **(Table 4).**

Table 4 **Details of post vaccination sera samples under Phase-I & II**

State	No. of target samples	No. of samples received	No. of samples Positive	% Positivity
Phase-I				
Uttar Pradesh	4316	3243	2586	79.74
Madhya Pradesh	2145	2438	1449	59.30
Maharashtra	2145	380	341	89.73
Odisha	1430	1423	1009	70.91
Andhra Pradesh	1430	1417	1038	73.25
Jharkhand	1430	883	653	73.95
Chhattisgarh	1066	1315	1034	78.63
Gujarat	1066	1313	1052	80.18
Telangana	1066	1146	811	70.76
Haryana	1066	956	639	66.84
Uttarakhand	1066	841	545	64.80
Manipur	1066	809	693	85.66
Jammu & Kashmir	1066	791	577	72.94
Meghalaya	1066	439	266	60.59
Ladakh	1066	424	347	81.83
Sikkim	1066	354	280	79.09
Goa	1066	216	199	92.12
Total	24525	18388	13519	73.52
Phase-II				
Jharkhand	4104	831	528	63.53
Karnataka	2052	1863	1313	70.47
Delhi	1349	148	102	68.91
Chandigarh	196	182	125	68.68
Total	**7701**	**3024**	**2068**	**68.38**

The highest sero-positivity was recorded in Goa (92.12%) and Karnataka (70.47%) in phase-I and phase-II, respectively. Though program is implemented throughout the country, some states are proactively have implemented vaccination program.

Monthly data of countrywide brucellosis vaccination for the period January-December, 2022 were collected from information network for animal productivity & health (INAPH) to understand the vaccination coverage. During the period, 20 states have implemented the vaccination with the overall 88. 51 lakh vaccinations which has benefitted 56. 81 lakh farmers. The continuous brucellosis vaccination data monitoring in INAPH is essential to extract first- hand information on ongoing vaccination status in different states which in-turn can be compared with sero-monitoring results of NIVEDI.

(R Shome and M Nagalingam)

Validation of DIVA test for brucellosis using serum sample from buffaloes

The DIVA compliant monoclonal antibody based competitive ELISA (cELISA) developed in-house was used to record the sero-prevalence of brucellosis in buffaloes from organized farms as the test is capable of detecting anti-*Brucella* antibodies in the infected animals. Ten states having a highest buffalo population representing the four regions of the country were selected in the study with approximately 100 samples per state. A total of 1086 serum samples collected from sexually matured female buffalo from 62 districts, 104 blocks and 242 villages were tested by cELISA. Of 1086 buffaloes tested, 167 samples were positive by cELISA with overall apparent prevalence of 15.38% [CI- 95%; (13.35-17.64) and true prevalence of 15.85% (CI-95%; 13.77-18.19)]. Among the states, highest seroprevalence was recorded in Punjab (57%) followed by Haryana, Uttar Pradesh, Maharashtra, Andhra Pradesh and Tamil Nadu. Prevalence was also found highly skewed at district level as it was observed that Patiala and Amritsar districts of Punjab had 90% and 70% sero-prevalence, respectively and 71.43% in Nuh district of Haryana compared to Ambala and Kurukshetra districts each with 33.33% prevalence rate **(Fig 3)**.

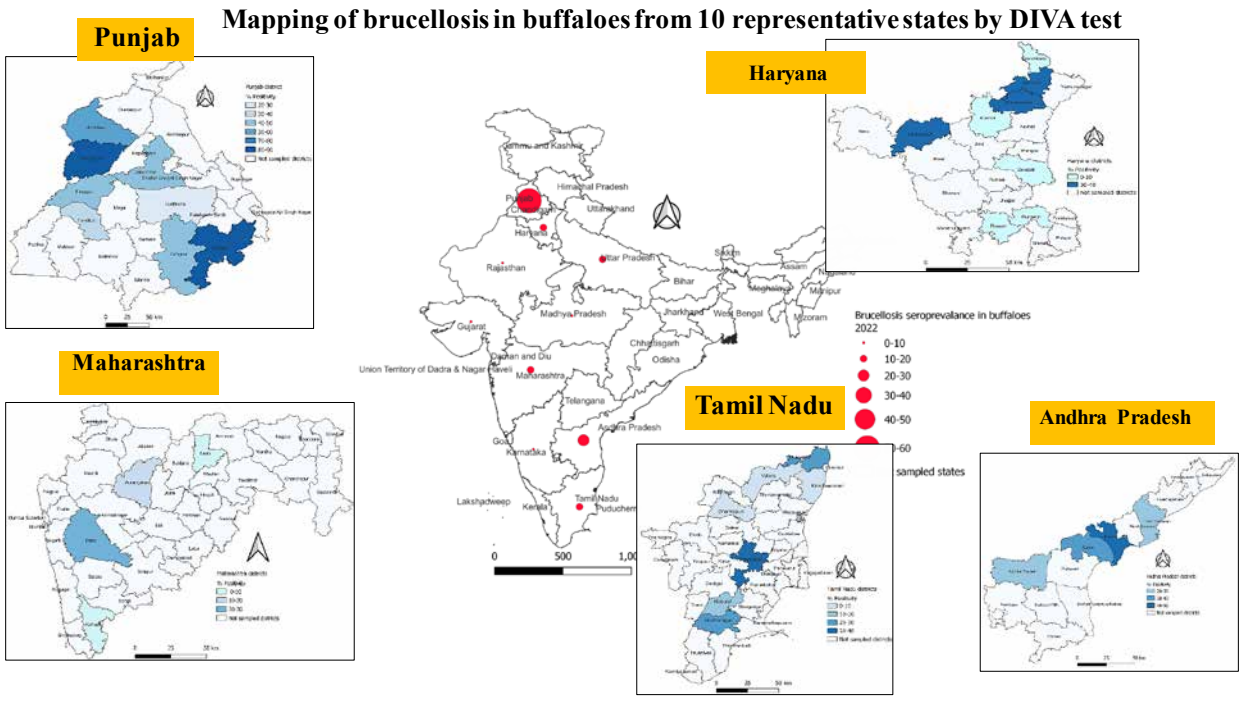


Fig 3: Brucellosis sero-prevalence in buffaloes in the study states

Significant (p<0.0001) association to brucellosis seropositivity was observed in states in the northern region with 28.06% sero-prevalence. Similarly, significant association (p<0.001) was established for buffalo breeds with 28.79% and 20.67%, respectively in Nagpuri and Murrah breeds compared to Mehsana (7.85%) and Bhadawadi (6.70%). With respect to age, significantly (p<0.01) higher sero-prevalence of 32.23% was observed in the age group of 8 to 11 years. The study highlights brucellosis status in organized buffalo's farms which can be compared with brucellosis surveillance in buffaloes. This will help to identify brucellosis endemicity and to initiate appropriate control measures to prevent the spread of the brucellosis in buffaloes in the study areas.

(R Shome and M Nagalingam)

Evaluation of in-house IgM/IgG based lateral flow assay for serodiagnosis of human brucellosis

This study was aimed to assess the diagnostic efficacy of in-house lateral flow assay (LFA) developed for the detection of IgM/IgG anti-*Brucella* antibodies for rapid sero-diagnosis of human brucellosis. Serum samples from three groups *viz*., high-risk individuals such as veterinary health care staff (n=476), culture-confirmed patients (n=27) and healthy blood donors (n=43) were used for evaluation of LFA tests. Out of 27 culture-confirmed cases, 92.6%, 77.8% and 70.4% samples showed positive for IgG LFA, IgM LFA, and both IgG and IgM LFA, respectively. The diagnostic sensitivity, specificity and accuracy of LFA in compared with IELISA and RBPT. DSe and DSp of LFA were shown to be more than 95% and 99%, respectively in comparison to iELISA. With RBPT DSe and DSp for LFA was reported to be 85.3% and 100%, respectively **(Fig 4 and Table 5)**.

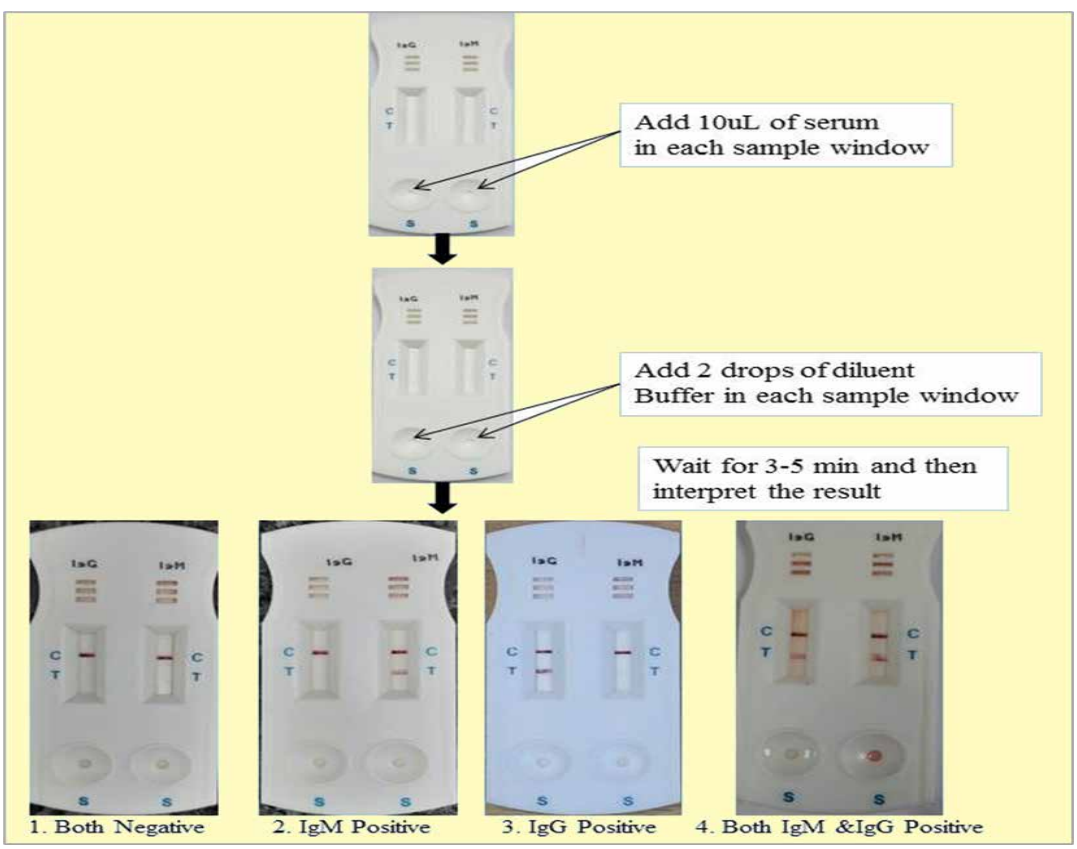


Fig 4: Assay procedure and interpretation for human IgM and IgG LFA for diagnosis of human brucellosis

Table 5 Diagnostic performance of IgM and IgG LFA with IgM-IgG iELISA and RBPT

Test/ Assay	Relative Diagnostic Sensitivity (DSn)(%)	Relative Diagnostic Specificity (DSp)(%)	Positive Predictive value (%)	Negative predictive value (%)	Accuracy (%)	Kappa (%)
IgM iELISA v/s IgM LFA	95.35 (84.2-99.4)*	100 (99.2–100)	100	99.76 (99.1 - 99.9)	99.77 (98.8-99.9)	0.97 (0.94–1)
IgG iELISA v/s IgG LFA	96.55 (88.1-99.6)	99.54 (98.36–99.9)	91.76 (73.6–97.8)	99.82 (99.3 - 99.9)	99.4 (98.2-99.8)	0.96 (0.92–0.99)
RBPT v/s LFA	85.3 (74.6-92.7)	100 (99.2-100)	100	99.23 (98.6-99.6)	99.3 (98.1-99.8)	0.91 (0.85-0.96)

*values in parenthesis are at 95% confidence interval; iELISA: indirect enzyme linked immunosorbent assay; LFA: lateral flow assay; RBPT: rose bengal plate test

PPV for LFA varied between 91.7% and 100% and NPV of LFA was found to be >99% with respect to all reference tests. Test accuracy was found to be >99% in comparison to different reference tests. The intra institute validation of LFAs was carried out at ICAR-NIVEDI and all the validators have stated that the test is easy to perform, results were found satisfactory and the inter-rater agreement kappa has revealed test as excellent. The external validation has been initiated.

(*R Shome*)

One health-integrated surveillance for leptospirosis in Dakshina Kannada district, Karnataka

Leptospirosis is endemic in the coastal region of India, with frequent annual upsurges and outbreaks in the rainy season. It can infect various mammals and present as a febrile illness, ranging from a mild subclinical infection to fulminant multi-organ dysfunction in humans, like other hemorrhagic fevers such as dengue fever. Dakshina Kannada (DK), a coastal district of the state of Karnataka, has been identified as one of the endemic districts for leptospirosis with upsurge in cases every year. This study was undertaken to determine leptospirosis seroprevalence and serovars distribution among humans and animals in the DK district of Karnataka. Further possible involvement of transmission through environmental water samples was explored by detecting pathogenic *Leptospira* DNA by PCR. A total of 945 human serum samples from clinically febrile cases suspected for leptospirosis were referred from the Government Health Center from seven different Taluk/Blocks of DK district to ICAR-NIVEDI, Bengaluru, during 2020-2022. These samples were subjected to Microscopic Agglutination Test (MAT) using a reference panel of 20 *Leptospira* serovars. In addition, a total of 59 bovine serum samples collected from the study area were also screened by MAT. Besides, 46 environmental water samples (grey and sewage) collected from places/ neighbouring households from where confirmed leptospirosis cases reported. These water samples were screened for detection of *Leptospira* DNA in PCR using LipL32 and Lep1 & Lep2 specific primers and also subjected for isolation of *Leptospira* organism by culturing in EMJH medium.

The overall seropositivity was 9.4% (89/945) in human with anti-*Leptospira* antibodies against major reactive serovars namely Djasiman, Javanica, Hurstbridge, Icterohaemorrhagiae, Hebdomadis and Grippotyphosa. Among different taluks, the high seropositivity was in Kadaba (80%) Taluks followed by Moodabidre (30.8%), Sulya (23.8%), Puttur (21.43%), Belthangady (17.2%), Bantwal (15.8%), and Mangalore (5.5%) **(Fig 5)**.

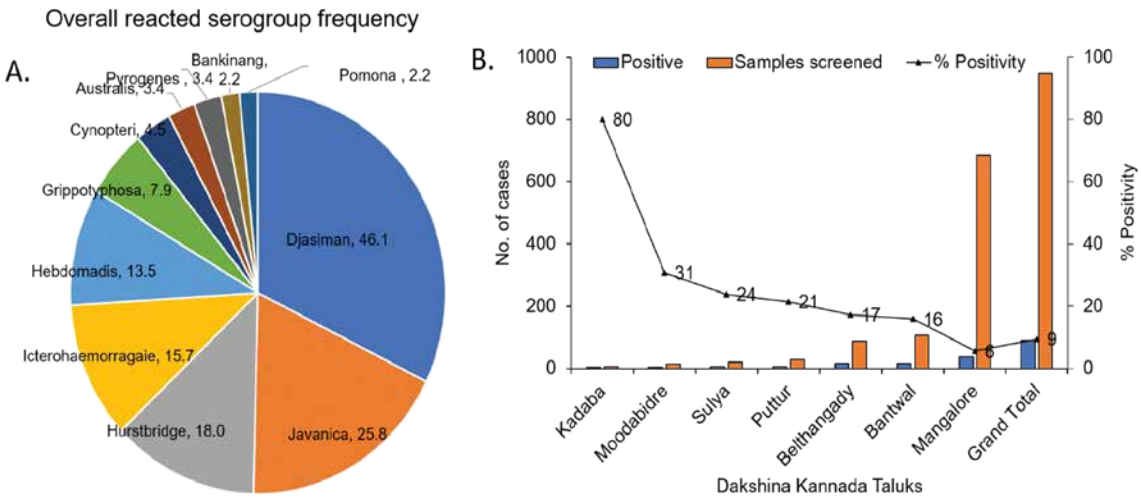


Fig 5: Frequency distribution of the reacted serovars representing the specific serogroup in Dakshina Kannada district of Karnataka. A. Overall percentage frequency distribution of prevalent serogroups antibodies. B. Taluk-wise seropositivity (%) of human leptospirosis cases

Further, in bovine overall seropositivity of 13.6% (8/59) with Hebdomadis (83%) and Celledoni (17%) serogroups was observed. Furthermore, molecular analysis of environmental water samples revealed 39% and 45.6% positivity with *LipL32* gene and *16S rRNA* gene-based PCR, respectively. Seven pathogenic isolates were successfully recovered from the 46 PCR positive water samples and whole genome characterization of these isolates is in progress. The presence of pathogenic leptospires in different water sources reveals the role of the environment in the organism's endemicity in the study area. GIS mapping of the positive human cases showed clustering in urban/populated areas. The present study provides insight into the leptospirosis prevalence and the possible association of serovars of livestock and environment in human leptospirosis. This type of integrated one-health surveillance study will help to mitigate the disease burden in DK district by prevention and control strategies through different management stakeholders.

(V Balamurugan, HB Chethan Kumar, BR Gulati)

Prevalence of anti-leptospiral antibodies and frequency distribution of *Leptospira* serovars in buffaloes in enzootic states of India

Leptospirosis is an emerging, re-emerging, and neglected anthropozoonosis with worldwide distribution in a wide range of animal hosts and is caused by different serovars of the pathogenic spirochetes belonging to the genus *Leptospira*. Among the livestock, buffaloes play an important role in maintaining and transmitting the infection. Leptospirosis in water buffaloes is neglected due to a lack of awareness about the extent of the problem. Determining the prevalence of specific serovars in the particular geographical area is of paramount importance to diagnose human leptospirosis. With this background, the present study was undertaken to determine the sero-prevalence of leptospirosis and frequency distribution of *Leptospira* serovars in buffaloes in enzootic states of India. During July to December 2022, a total of 555 serum samples were received from 19 districts of three states of India, *viz*., Kerala (n=115), Tamil Nadu (n=197), Gujarat (n=243) and tested at 1:100 dilution in microscopic agglutination test (MAT) using five to seven-day-old *Leptospira* reference

serovars (n=20) at a concentration of 1-2x10^8 organisms/ml. The overall sero-prevalence of 16% (89/555) with 60.9% (70/115) in Kerala, 4.1% (8/197) in Tamil Nadu, and 5% (11/243) in Gujarat were observed in the study. Out of 89 reacted sera, 40 samples showed reactivity with more than one serovars representing 45% prevalence of multiple serovars. The predominant reactive serovars observed were Pomona (28.1%), Grippotyphosa (24.7%), Hardjo (23.6%), followed by Kaup (16.9%), Manhao 3 (13.5%), Icterohaemorrhagiae (12.4%) **(Fig 6).**

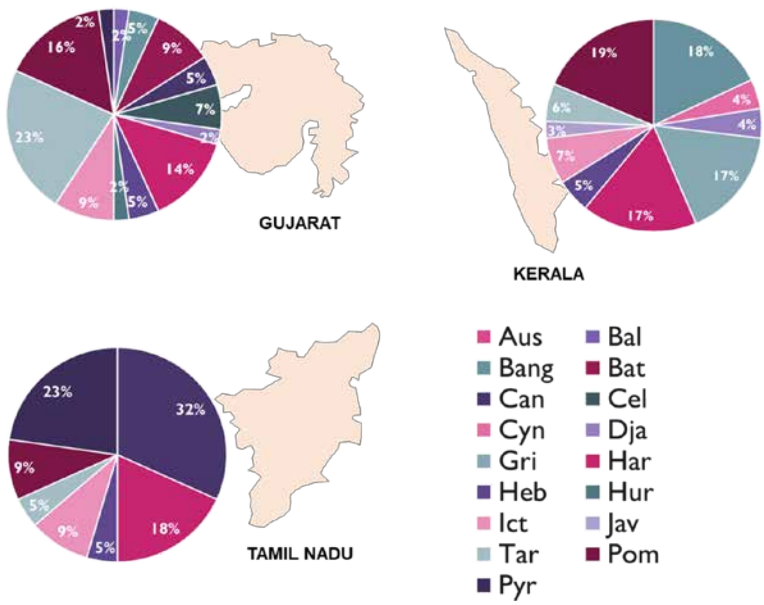


Fig 6: State-wise distribution of *Leptospira* serovars in buffaloes

This study indicates alarmingly high seroprevalence of leptospirosis in buffaloes in the state of Kerala. The above prevalent serovars in buffaloes and the major prevalent serovars in other livestock species in the particular region may be of use in the reference panels of *Leptospira* antigens in MAT in humans and animal disease diagnostic laboratories for providing an accurate diagnosis for leptospirosis.

(V Balamurugan)

Development of recombinant proteins based latex agglutination test for detection of the anti-leptospiral antibodies in animals

Leptospirosis is a bacterial anthrapozoonotic disease caused by the *Leptospira* and affects large number of animals and humans worldwide. For the detection of *Leptospira* specific antibody, recombinant outer membrane protein(s) (OMPs) is a suitable antigenic candidate. The development of a recombinant chimeric/fusion protein(s) antigens-based test either alone or in combination with other leptospiral OMPs protein(s) in the multi antigenic approach to acquire better sensitivity and specificity is need of the hour in the form of point of care diagnostic. The latex agglutination test, which is an extremely simple and rapid test that can be applied at the field level. Hence, this study was designed to develop a latex agglutination test (LAT) using the recombinant protein(s) and compared its diagnostic efficacy with microscopic agglutination test (MAT).

The target/selected genes were amplified, cloned into pETite vector, and expressed in *E. coli* by using standard recombinant DNA Techniques. The expressed recombinant proteins were successfully characterized by SDS-PAGE and confirmed by Western blot, which was further purified by Ni-NTA method **(Fig 7).**

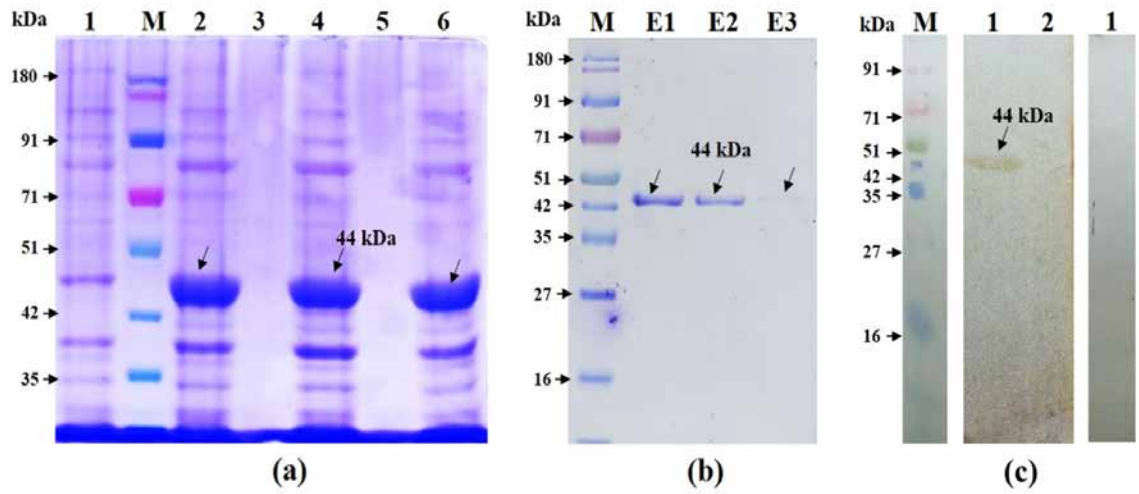


Fig 7: Cloning and expression of gene (a) and (b) SDS-PAGE analysis of expressed rLsa44, (c) Immunoblot analysis of expressed rLsa44

The purified recombinant proteins were coated on the latex beads and were assessed as antigens using standard control panel sera for developing LAT. A total of 847 serum samples received/collected from different states of India available in the laboratory were employed in the study. Further, evaluation of recombinant protein(s) based LAT was carried out with known MAT positive and negative animal sera to detect anti-leptospiral antibodies in the given samples based on agglutination reaction **(Table 6)**.

Table 6 **Evaluation of recombinant antigens-based LAT versus microscopic agglutination test for the detection of anti-leptospiral antibodies**

Recombinant protein-based LAT	No. of samples employed for evaluation	Relative diagnostic sensitivity (DSn) (%)	Relative diagnostic specificity (DSp) (%)	Accuracy (%)	Agreement with Kappa value
rGroEL LAT	184	89.09 (CI: 81.72 to 94.23)	93.24 (CI: 84.93 to 97.77)	90.76 (CI: 85.62 to 94.53)	0.81 ± 0.04 SE (CI: 72.51 to 89.65)
rErpY-LAT	102	93.2 (CI: 81.34 to 98.57)	96.6 (CI: 88.09 to 99.58)	95.1 (CI: 88.93 to 98.39)	0.89 ± 0.04 SE (CI: 81.4 to 98.5)
rLsa44-LAT	291	90.44 (CI: 84.21 to 94.81)	86.45 (CI: 80.04 to 91.41)	88.32 (CI: 84.06 to 91.77)	0.77 ± 0.04 SE (CI: 69.23 to 84.01)
Chimeric protein LAT	272	88.00 (CI: 81.70 to 92.73)	98.36 (CI: 94.20 to 99.80)	92.65 (CI: 88.87 to 95.45)	0.85 ±0.03 SE (CI: 79.13 to 91.51)

(Confidence Interval calculated at 95% level)

In conclusion, the developed recombinant protein(s) based LAT are extremely simple and rapid test that can be used as a diagnostic tool in resource-limited diagnostic laboratories, especially at the field level and it will complement existing serodiagnosis tests. Standardization of Bovine Lepto LAT in kit format for serodiagnosis of bovine leptospirosis is in progress.

(V Balamurugan, M Nagalingam and BR Shome)

Isolation of causative organism from hemorrhagic septicemia and Pasteurellosis

Pasteurellosis occurs in wide range of domestic animals. During the period, a total 49 clinical samples (blood, nasal swabs and tissues) from suspected haemorrhagic septicaemia in Cattlle (27), and pasteurellosis in Sheep (13) and Pig (9) were received from different places were received from different parts of the country. Of which, two samples were positive for *P. multocida* by conventional microbiological techniques and PCR assays. From the PCR positive clinical samples, two *P. multocida* strains each one from pig and sheep were isolated. Further, previously characterized 41 *P. multocida* strains were submitted to NCVTC repository, Hisar for centralized storage and accession.

(SB Shivachandra, MM Chanda, Yogisharadhya R and A Prajapati)

Whole genome sequence analysis of *Clostridium chauvoei*

Black quarter is a major anaerobic infection that causes sudden death in large ruminants within a few hours of appearance of clinical signs. A total of 31 clinical samples (blood, exudates, muscle tissue) were screened for detection of *Clostridium chauvoei* by conventional microbiological techniques and PCR assays. Ten samples were found positive for *C. chauvoei* by PCR from which four *C. chauvoei* isolates were successfully recovered. Further, previously characterized two *C. chauvoei* strains were submitted to NCVTC repository, Hisar for centralized storage and accession.

A draft genome sequence of *C. chauvoei* NIVEDIBQ1 strain isolated from clinical case of black quarter in cattle from Mysuru district, Karnataka, India, was analyzed **(Fig 8)**.

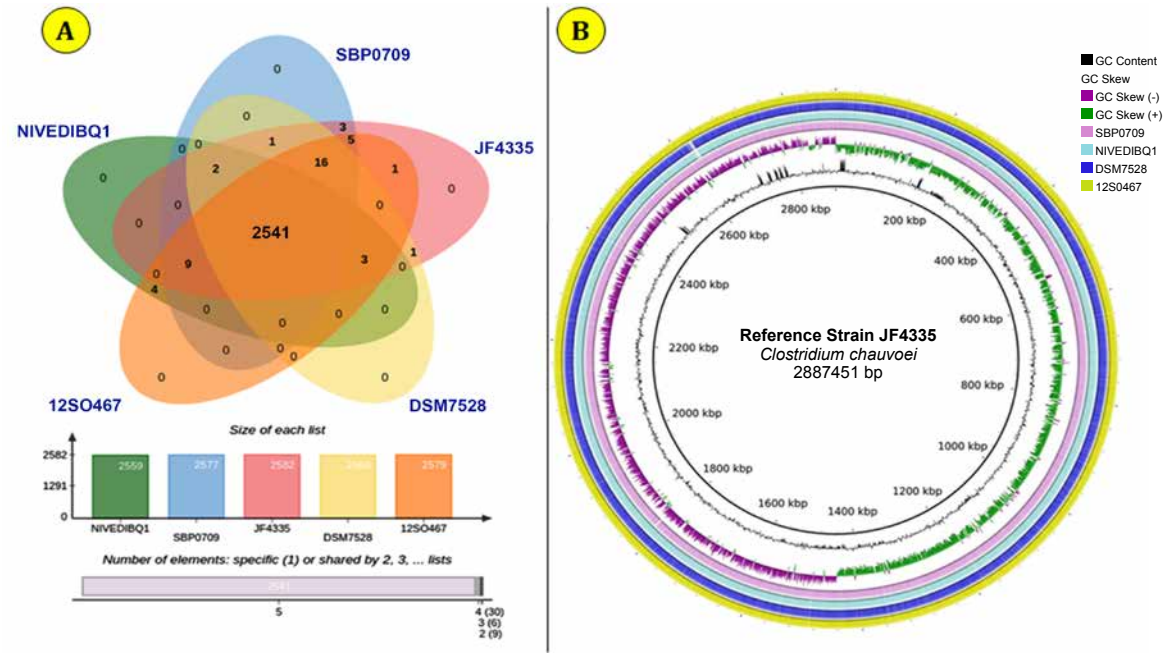


Fig 8: Venn diagrams (*Panel* A) showing orthologous clusters and comparative circular genome visualization (*Panel* B) of *C. chauvoei* strain NIVEDIBQ1 along with other strains SBP0709, DSM7528, 12S0467 and a reference genome strain JF4335^T

Sequence analysis indicated that genome had 2653 predicted coding DNA sequences, harbored numerous genes, mobile genetic elements for pathogenesis and virulence factors. Computational analysis revealed that strain contained

30 virulence associated genes. An intact genomic region highly similar to the *Clostridium* phage was present in the genome. Presence of CRISPR systems and the transposon components likely contributed to the genome plasticity. Strain encoded for diverse spectrum of degradative carbohydrate-active enzymes (CAZymes). Comparative SNP analysis revealed that the genomes of the *C. chauvoei* strains analyzed were highly conserved. Phylogenetic analysis of strains and available genome (n=21) based on whole genome multi-locus sequence typing (wgMLST) and core orthologous genes showed the clustering of strains into two different clusters suggesting geographical links **(Fig 9).**

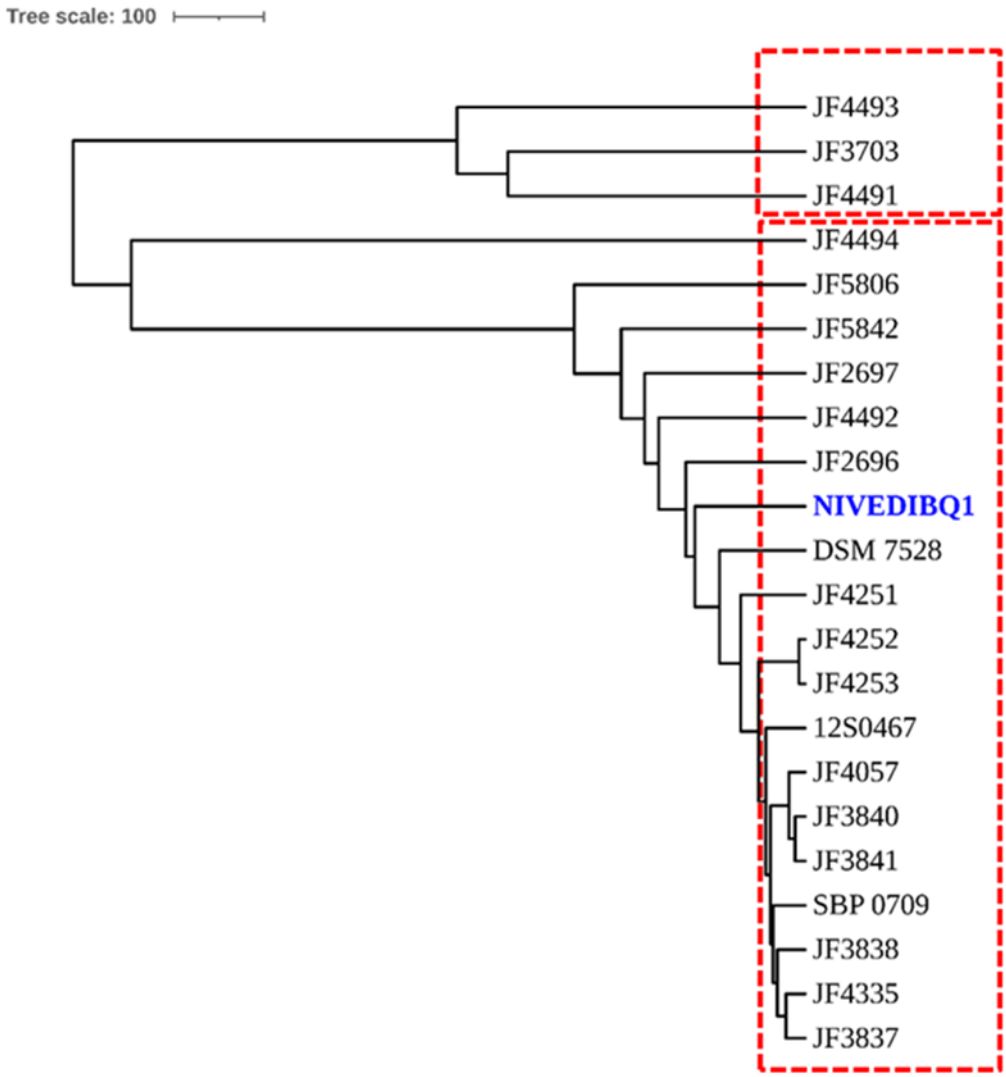


Fig 9: wgMLST tree was constructed from *Clostridium chauvoei* genome (n=22) using the pipeline phylogeny accessible through PGAdb-builder (http://wgmlstdb.imst.nsysu.edu.tw) including NIVEDIBQ1 strains. A dendrogram was constructed from allelic sequences through use of UPGMA clustering algorithm

Cluster-I comprised the strains belonging to different geographical region including Indian strain (NIVEDIBQ1), while the Cluster-II comprised strains from Australia and New Zealand. The SNP analysis among the genomes had demonstrated the high degree of homologization within the species that might reflect a slower evolutionary rate in *C. chauvoei*.

(SB Shivachandra, MM Chanda, Yogisharadhya R and A Prajapati)

Whole genome sequencing of pathogens in livestock for antimicrobial resistance patterns

A total of 1458 whole genome sequences have been generated from the isolates recovered from animals, humans, aquaculture, environment and foods of animal origin from three study sites of Guwahati, Assam. More than 1000 WGS submissions at NCBI-GenBank were made in Bioprojects viz., PRJNA636233 and PRJNA718071. Bioinformatics analysis of *Klebsiella pneumoniae* revealed a rare serotype O3b, a high-risk clone ST37 isolated from fresh fishes at retail outlets. ST672-MRSA-IVa/t1309 is an emerging Indian clone among food fishes. The genomic characterization of *Klebsiella quasipneumoniae* subsp. *similipneumoniae* (India 238 strain) isolated from fish (**Fig 10**) revealed the presence of AMR *blaCTX-M-15*, *blaOKP-B-1*, *fosA5*, *oqxAB* and virulence genes.

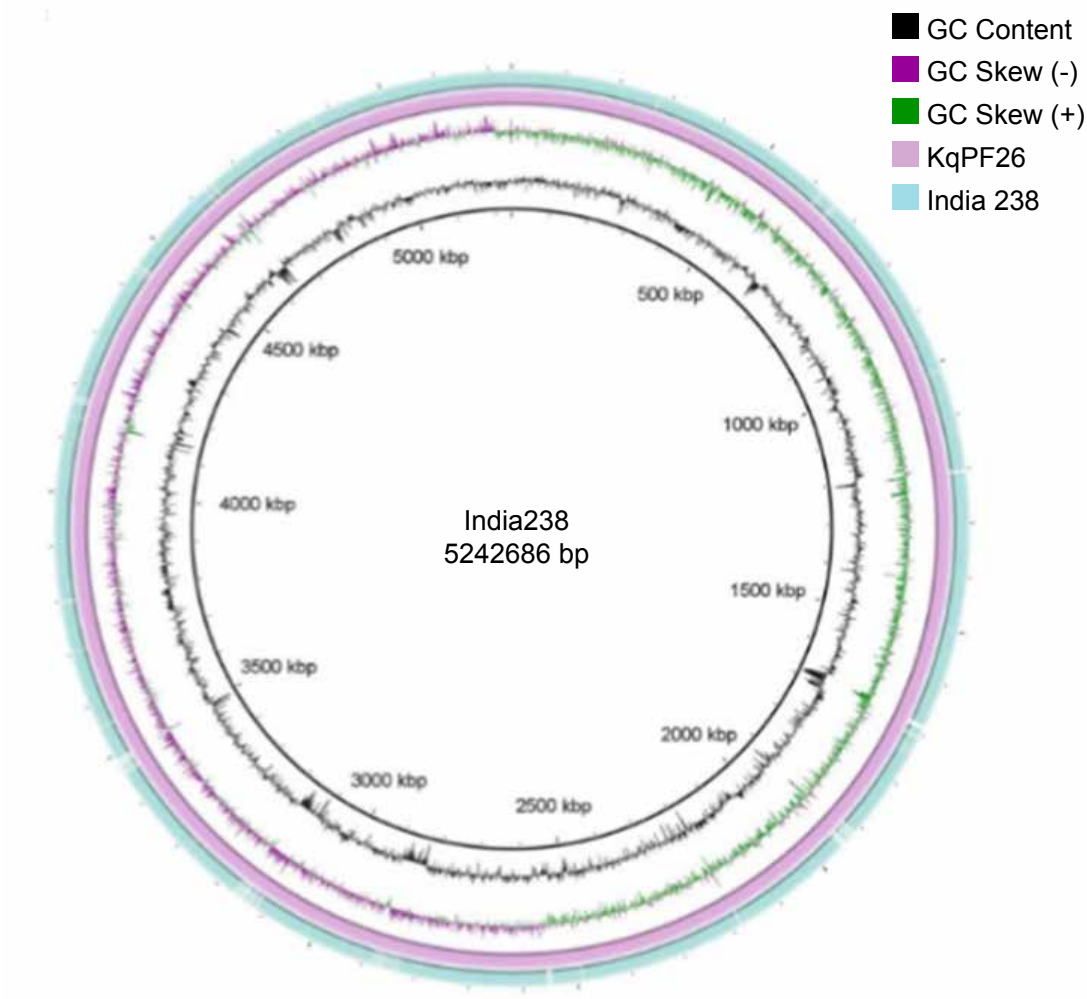


Fig 10: Draft Genome of *K. quasipneumoniae* isolate India238 genome size 5.2MB, the draft genome compared with the reference genome KqPF26 using BRIG. The innermost purple and green colour shows the GC skew and the black ring represents the GC content

The strain with ST1699 and serotypes KL52 and OL103 also harboured insertion sequences (ISs) (*ISKpn26* and *ISEc9*) and three prophage sequences (Salmon_SEN34_NC_028699; Entero_mEp237_NC_019704; Salmon_SSU5_NC_018843) were also detected in India 238 isolate. Phage a and phage b were detected in contig-1, while phage c in contig-6 of the bacterial genome (**Fig 11**).

Fig 11: Linear genomic map of three intact prophage sequences obtained using PHASTER found in *K. quasipneumoniae* India238. (a) Salmon_SEN34_ NC_028699; (b) Entero_mEp237_ NC_019704; (c) Salmon_SSU5_ NC_018843. Phage a and phage b were detected in contig-1, while phage c in contig-6 of the bacterial genome. Different functional groups of phage Entero_mEp237_NC_019704 are denoted by different colours according to their function

Further, whole genome analysis of bacterial isolates (n=281) resulted in identification of methicillin resistant and vancomycin resistant isolates. Five out of 126 coagulase negative Staphylococci isolates harboring mecA genes whereas three identified out of 49 *Enterococcus* spp. isolates found harboring VanC gene.

(BR Shome, G K Sivaraman and MA Holmes)

Isolation and characterization of antibiotic resistant *Staphylococcus spp* and *E. coli*

During August to December 2022, a total of 45 livestock samples (24 cow/buffalo milk, 12 goat/sheep rectal swabs and 9 poultry cloacal swabs) collected from three villages in Bengaluru rural district to isolate and characterize *Staphylococcus* and *E.coli*. *Staphylococcus* spp were characterized based on cultural, biochemical and species-specific multiplex PCR. Methicillin resistance was detected by PCR based screening for mecA and mecC resistance determinants. A total of 24 *Staphylococcus*

isolates were obtained from 24 milk samples subjected for antibiotic sensitivity test (AST) against nine antibiotics. All the isolates were negative for *mecA/ mecC* which are classified as coagulase negative (CoNS) except one isolate which is categorized as *mec*A positive MRSA. AST profile showed 3 *Staphylococcus* isolates resistant to Cefoxitin, two for tetracycline and 18 isolates were resistant to Penicillin. Similarly, 45 *E. coli* isolates were obtained from 45 samples (24-milk, 7-sheep, 5-goats and 9-poultry) and AST profile against 16 antibiotics was recorded. Out of 24 *E. coli* isolates from milk, 15 showed 100% resistance to ampicillin and amoxicillin followed by 14 to cefoxitin and 12 to cefpodoxime (**Fig 12 and 13**).

Fig 12: AST profile of *E. coli* showing resistance (zone of inhibition) against ampicillin, amoxicillin and tetracycline

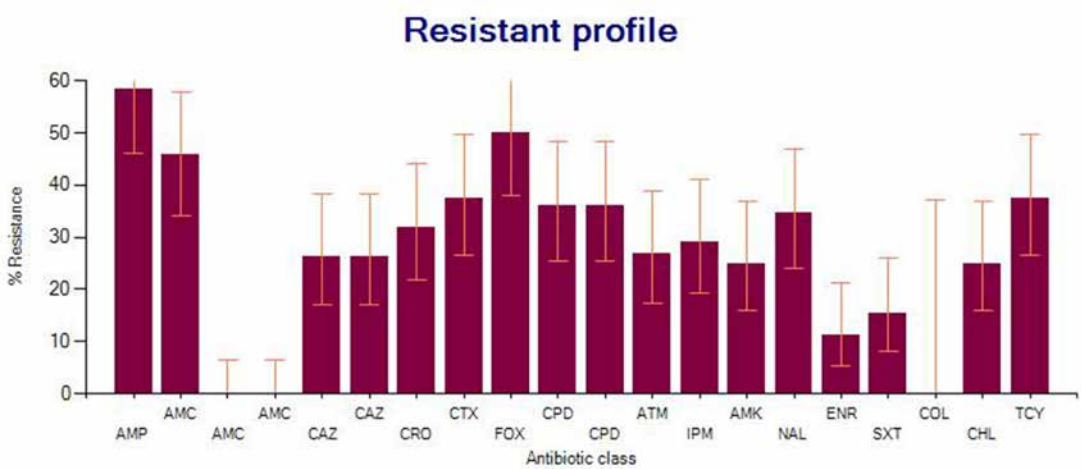


Fig 13: Resistance pattern of *E. coli* isolates showing to ampicillin, ceftriaxone, aztreonam, amikacin, Co-trimoxazole, cefoxitin (WHONET data analysis)

Out of 7 *E. coli* isolates from sheep, six showed resistances to ampicillin and cefoxitin followed by four to cefotaxime, imipenem and amikacin. Out of five *E. coli* isolates from goat, two isolates were resistant to ampicillin, cefotaxime and tetracyclin. Out of nine *E. coli* from poultry, seven isolates were resistant to ampicillin followed by six to amoxicillin and tetracycline and four were resistant to cefoxitin, cefotaxime and nalidixic acid. This shows there is a difference among livestock species exhibiting the resistance to different antibiotics.

(*N Shivasharanappa, R Shome, P Krishnamoorthy and A Prajapati*)

Seroprevalence of surra in bovines

In bovines, the disease surra is caused by unicellular haemoflagelated extracellular parasite, *Trypanosoma evansi*. The disease causes severe production losses and even death, if untreated. A total of 3040 bovine serum samples (n=2653, buffaloes; n=387, cattle) received from 13 states were screened by the recombinant variable surface glycoprotein based indirect ELISA. An overall 54.24% sero-prevalence was observed. Highest sero-prevalence was observed in Kerala (85.22%) followed by Chhattisgarh (80.74%), Himachal Pradesh (73.34%), U.P (68.65%) whereas least sero-prevalence was observed in Odisha (4.24%) (**Fig 14**).

(*PP Sengupta and SS Jacob*)

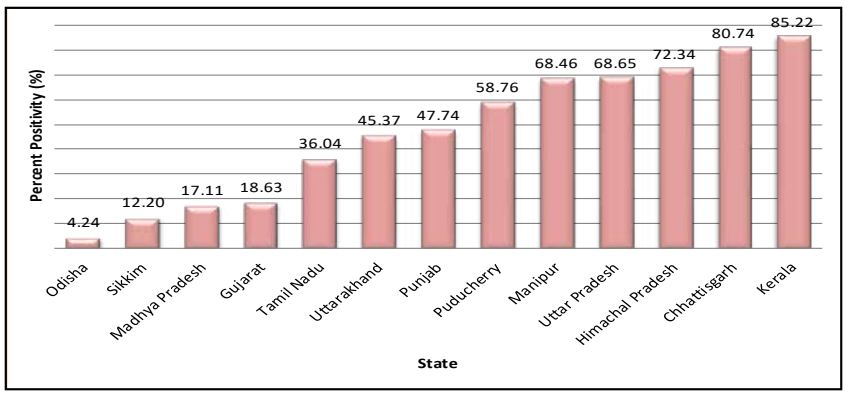


Fig 14: Sero-prevalence of surra in bovines in different states

Identification of ticks from cattle in Karnataka

Ticks are responsible for transmission of different pathogens including haemoprotozoan parasites among livestock. Understanding about the distribution of different species of ticks is important for management of tick-borne diseases. A total of 192 ticks from cattle were collected from Kolar, Ramanagara, Chikkaballapura, Bengaluru rural and Vijayapura districts of Karnataka and the major tick genus/species identified were *Rhipicephalus microplus*, *R. haemaphysaloides*, *Hyalomma* spp. based on the morphological characteristics. *Rhiphicephalus (B) microplus* was found to be the most predominant tick species in the study area. Further, the 87 ticks were screened for the presence of haemoprotozoan parasites (*Theileria orientalis*, *T.annulata*, *Babesia* spp., *Anaplasma* spp. and *Ehrlichia* spp.) by PCR using genus/species specific primers and sequencing (**Fig 15**).

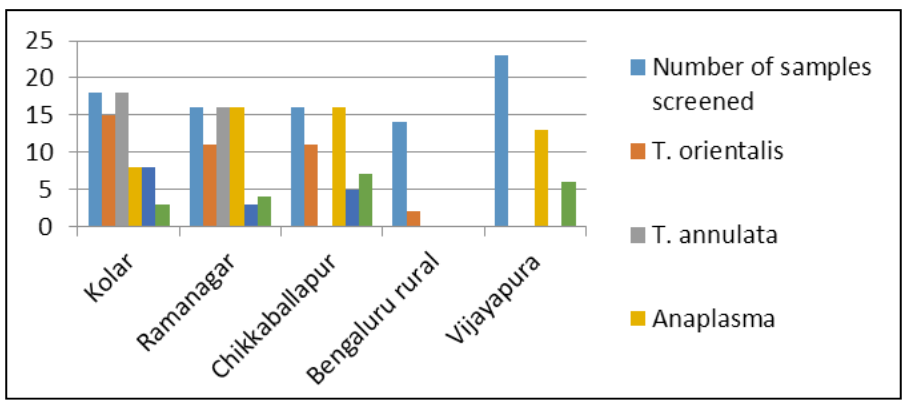


Fig 15: The distribution of haemoprotozoan parasites in the ticks in Karnataka

Out of 87 ticks, 53 ticks (60.9%) were carrying *Anaplasma* species, 39 ticks (44.8%) were harbouring *T. orientalis*, and 34 ticks (39.1%) were carrying *T. annulata*

Further, the ticks harbouring *T. orientalis* was found to be *Rhipicephalus* spp. Since the ticks were harbouring major haemoprotozoon parasites that are capable of potential disease transmission, tick control measures need to be adopted to prevent the loss due to haemoprotozoan parasites in the study area.

(SS Jacob and PP Sengupta)

Exploring genetic diversity of *Theileria orientalis* in bovines in Karnataka

Oriental theileriosis caused by *Theileria orientalis* complex is an emerging tick-borne haemoprotozoan parasitic disease of cattle and buffaloes. Even though *T. orientalis* is known to cause benign disease, recent fatal outbreaks in southern states of India in the susceptible population is a matter of concern. Within the *T. orientalis* species, 11 well-defined genotypes identified and documented based on genetic diversity studies. The present study deals with investigations of three *T.orientalis* outbreaks that caused mortality among crossbred adult cattle and indigenous bulls and the genetic characterization of the parasite based on ribosomal DNA (18S rDNA, ITS 1 and ITS 2) and major piroplasm surface protein (MPSP) gene. The PCR amplified amplicons were cloned and sequenced. The phylogenetic tree was constructed by Maximum likelihood method using MEGA 11 software (**Fig 16**).

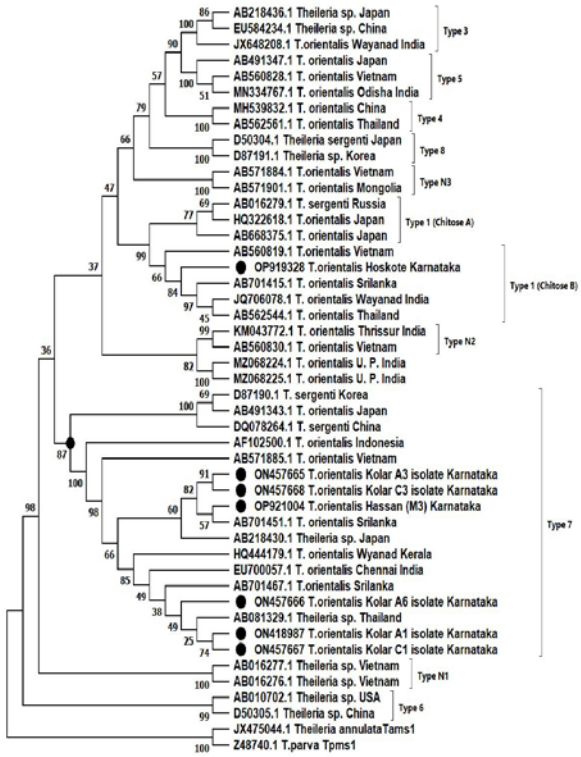


Fig 16: Phylogenetic analysis of *T. orientalis* MPSP gene (black circles denote the *T. orientalis* genotypes of the present study). The evolutionary history was inferred using Tamura 3-parameter model using a discrete Gamma distribution (T92+G) model

MPSP sequence of seven isolates of the present study was compared with that of other isolates available in GenBank database. The parasite identified in the fatal outbreak was characterized as Type 7 genotype of *T. orientalis* in crossbred cattle whereas Chitose B genotype was identified in the affected indigenous bulls. The study reaffirms the potential of Type 7 as well as Chitose genotypes of *T. orientalis* to cause fatal outbreaks in bovines.

(SS Jacob, PP Sengupta, HB Chethan Kumar and GB Manjunatha Reddy)

EPIDEMIOLOGY OF SMALL RUMINANT DISEASES

Seroprevalence of Peste des Petits Ruminants virus antibodies in bovines in Telangana

This study was undertaken to investigate the possible involvement of cattle and buffaloes in the disease dynamics of PPR in the long term vaccinated Telangana state. The exposure of PPR virus in the bovine population either as subclinical or inapparent infection was studied where immune protection generated in the natural hosts (sheep and goats) due to continuous intensive mass vaccination. A total of 424 serum samples [cattle = 268, buffaloes = 156] were randomly collected from 22 districts of Telangana during 2021-22 covering 65 cattle farms and were screened for PPRV-H and N-specific antibodies by using an indigenous H protein-specific PPR competitive ELISA kit and N protein-specific PPR Avidin-Biotin recombinant Competitive (ABrC) ELISA kit. The total seropositivity of 45.3% [46.6% in cattle and 42.9% in buffaloes] was observed for both H and N-specific antibodies. N specific antibodies were detected in more animals (45%) compared to H specific (28%) antibodies. Hence, the present study showed serological evidence of PPRV-specific antibodies in apparently healthy livestock (cattle and buffaloes) which are exposed to PPRV without clinical manifestations, under natural situations, possibly through direct or indirect transmission from the infected sheep or goats. Further, it implies the importance of bovines as subclinical dead-end hosts for the PPR virus besides widespread presence of the disease in the natural hosts. The transmission of PPR from small ruminants to cattle may be dependent on the type of farming systems and PPRV circulation in disease-controlled geographical areas as some of the farms have sheep and goats rearing together with bovines. Furthermore, it necessitates the inclusion of these unnatural hosts along with other atypical hosts in the active surveillance of the disease during the eradication phase of PPR in India, and subsequently inclusion of the bovine calves in the sentinel surveillance. Hence, further systematic surveillance may be required to understand their significance by systematic studies on seroepidemiological aspects using a defined sampling plan to examine these factors in the precipitation of disease in large ruminants and its dynamic transmission in disease spread.

(V Balamurugan)

Comparative diagnostic efficacy of Avidin-Biotin recombinant competitive ELISA for serosurveillance and monitoring of PPR in sheep and goats

Peste des petits ruminants (PPR) is a highly contagious, economically important, notifiable, transboundary animal viral disease of sheep and goats. In the present scenario of the control and eradication stage of PPR (stage 2 of GEP-PPR) in India, the recombinant antigen based ELISA would be the most sought assay for its large-scale application and would be an important tool for surveillance at the eradication and post-eradication phases. During the eradication, where the sustainable source of safe recombinant antigens and/or antibodies-based diagnostics without the need for the live virus is always highly desirable for the detection of infected and vaccinated animals. In this study, PPR Ab Chek kit developed by ICAR-NIVEDI was evaluated with the well-established existing indigenous haemagglutinin specific PPR c-ELISA kit using a large number of sera to ensure that the performance characteristics of the assay which are best suited to the intended application for the detection of PPRV nucleoprotein antibodies in sheep and goats for serosurveillance and

seromonitoring. The recombinant PPR virus (PPRV) nucleoprotein was overexpressed in *E. coli*, Ni-NTA affinity-purified, and characterized and used as coating diagnostic antigen in Avidin-Biotin(AB)rC-ELISA, and evaluated using the field sera from animals. Diagnostic efficacy of the ABrC-ELISA in comparison with indigenous PPR c-ELISA kit for the detection of the PPRV antibodies in sheep and goats presented in **Table 7**.

Table 7 **Diagnostic efficacy of the ABrC-ELISA in comparison with indigenous PPR c-ELISA kit for the detection of the PPRV antibodies in sheep and goats**

Assays		Indigenous PPR competitive ELISA kit		Total
		Positive	Negative	
ABrC-ELISA/PPR Ab Chek Kit	Positive	477	71	548
	Negative	70	819	889
	Total	547	890	1437

The ABrC-ELISA showed a relative diagnostic sensitivity of 87.2% (95% CI: 84.1–90%) and diagnostic specificity of 92.0% (95% CI: 90—93.7%), against well-established existing indigenous H protein-specific PPR competitive ELISA kit. These findings suggest that the ABrC-ELISA is a potential additional diagnostic tool of a rapid, sensitive, and specific assay for the detection of the PPRV nucleoprotein antibodies in sera of sheep and goats. This PPR Ab Chek kit can be used extensively under field conditions for serosurveillance, and seromonitoring of PPR in sheep and goats at the eradication /post-eradication phase in disease-controlled countries or PPR non-enzootic countries.

(V Balamurugan)

Potential diagnostic application of the baculovirus-expressed recombinant truncated nucleo-capsid protein of PPRV in ELISA

The recombinant antigen-based assays is an important tool for surveillance/ monitoring not only at the eradication and post-eradication phases in the endemic countries but also in the PPR non-endemic countries. To increase the antigenicity of the recombinant protein on its reactivity in the ELISA without downstream process and to get higher protein expression yields for easy scaling-up of the recombinant antigen, the present study attempted the expression of the truncated recombinant nucleoprotein (NP) of PPRV in the baculovirus system. The PPRV N-terminal immunogenic region of the NP coding sequence was amplified and cloned into the pFastBac HT A vector. The PPRV-rBNP with a molecular weight of ~30 kDa was expressed in an insect cell system using generated recombinant baculovirus in Bac-to-Bac®Baculovirus expression system. The crude PPRV-rBNP and/or Ni-NTA affinity-purified NP was characterized by SDS-PAGE and immunoblot using standard PPRV-specific sera **(Fig 17)**.

The PPRV-rBNP reacted well with PPRV anti-N specific monoclonal and polyclonal antibodies and PPRV-specific antiserum, suggesting that the expressed PPRV protein is in its native form. The expressed crude protein as harvested insect cell lysate without purification was assessed for its potential use as a diagnostic antigen (standard positive control antigen and/or coating antigen) in the recombinant Avidin-Biotin ELISA format using the standards. The study also showed its potential capability to replace *E. coli*-expressed PPRV-NPN protein and/or PPRV antigen in the employed ELISA. Diagnostic efficacy of the PPR rBNP-c-ELISA in comparison with

indigenous PPRc-ELISA kit and PPR ABrC-ELSIA kit for the detection of the PPRV antibodies are presented in **Table 8**.

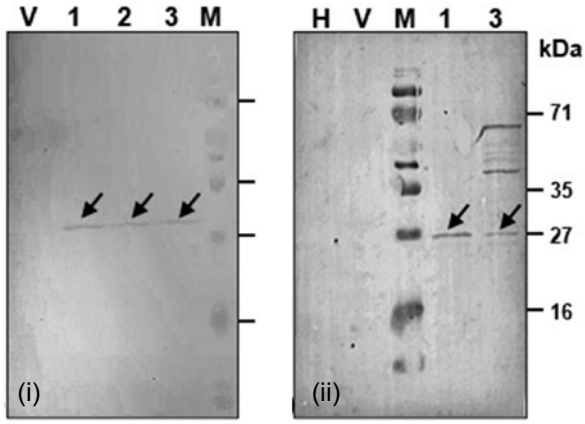


Fig 17: Characterization of the expressed recombinant protein in the baculovirus system

Immunoblot analysis of the Sf-21 cell lysates. (i) PPRV Rabbit hyperimmune serum (ii) Guinea pig rPPRV-NPN polyclonal antibodies. Lane V, H, 1, 2, 3: Cell pellet lysate from the vector control clone (5), Sf-21 Host control and recombinant baculovirus clones NPC2, NPC3, and NPC6, respectively.

Table 8 **Diagnostic efficacy of the PPR rBNP-c-ELISA in comparison with indigenous PPR c-ELSIA kits for the detection of the PPRV antibodies in sheep and goats**

Assays		Indigenous PPR competitive ELISA kit / Indigenous PPR ABrC-ELISA kit		Total
		Positive	Negative	
PPR rBNP-c-ELISA	Positive	118 / 118	3 / 7	121 / 125
	Negative	17 / 13	82 / 82	99 / 95
	Total	135 / 131	85 / 89	220 / 220

The relative diagnostic sensitivity (DSn) and diagnostic specificity (DSp) of PPR rBNP-c-ELISA (PPR rBNP-c-ELISA relative to PPR c-ELISA kit) are 87.41% (95% CI: 80.61% to 92.49%) and 96.47% (95% CI: 90.03% to 99.27%), respectively. The relative diagnostic sensitivity (DSn) and diagnostic specificity (DSp) of PPR rBNP-c-ELISA (PPR rBNP-c-ELISA relative to PPR ABrc-ELISA kit) are 90.08% (95% CI: 83.63% to 94.61%) and 92.13% (95% CI: 84.46% to 96.78%), respectively.

Hence, this allows scope in the future for large-scale field application of these Baculovirus expressed recombinant antigen-based assays for diagnosis/ surveillance and monitoring of PPR.

(*V Balamurugan*)

Dynamics of serotype distribution of bluetongue virus in Karnataka

Bluetongue (BT) is an economically important culicoides borne disease of domestic and wild ruminants, particularly sheep. The causative agent bluetongue virus, an *orbivirus*, exists in 29 antigenically and genetically different types. Therefore, continuous monitoring of the field situation is important to understand the circulating serotypes and disease dynamics. During the period, suspected bluetongue outbreaks in 56 villages in eight districts of Karnataka were attended and epidemiological data

and clinical samples were collected from 150 sheep flocks and four goat flocks using Epicollect 5 software and analyzed. Out of 56 outbreaks attended, it was found that sheep within the one year of age were most commonly affected (75%) indicating that the affected group probably had no previous exposure and in that, 33% of the affected population are under six months of age. The most common symptoms observed in the BT affected animals were high fever (8%), moistness of nares, nasal discharge (with or without blood mixed, 82%), swelling of face and eyelids (2%), and lameness. The median flock morbidity rate was 7.8%.

All the 154 clinical samples were subjected to virus isolation with four rounds of blind passes in cell culture and 68 isolates were recovered of which 48 virus isolates were subjected to serotyping. Given below is districwise details of serotype. Among the various serotypes BTV16, BTV 1 and BTV2 were the dominant serotypes causing the outbreaks **(Fig 18)**. Analysis of the results showed that infection with multiple serotypes is common in the field and at least eight serotypes circulated during the period.

(D Hemadri, MM Chanda, J Hiremath, GB Manjunatha Reddy)

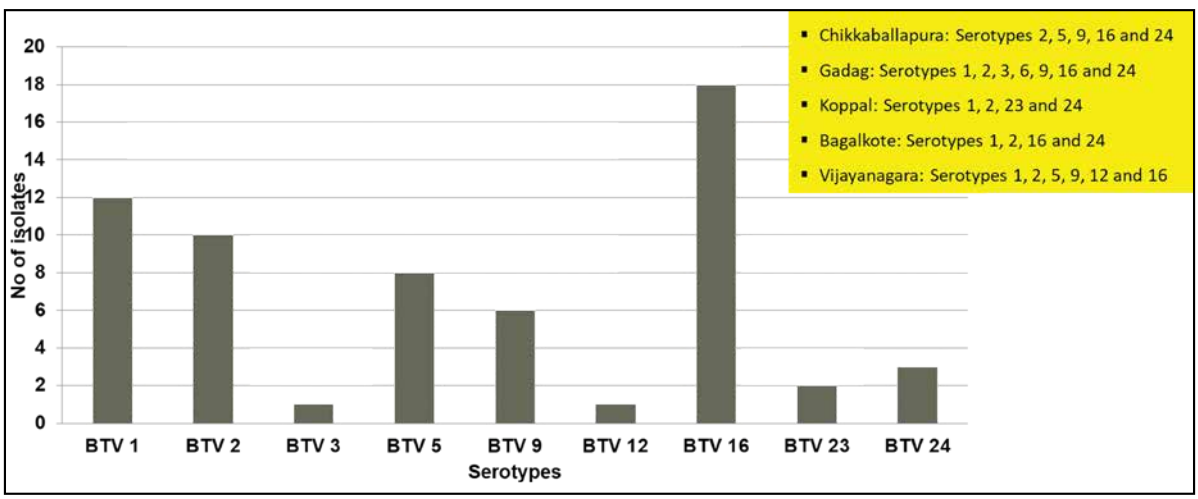


Fig 18: Details of BTV serotypes detected and districtwise distribution

Characterization of bluetongue virus strains/serotypes for their suitability as vaccine candidates

Bluetongue is an economically important culicoides borne disease of domestic and wild ruminants, particualarly sheep. The causative agent bluetongue virus, an *orbivirus*, exists in 29 antigenically and genetically different types. Therefore, continuous monitoring of the field situation is important to keep the disease in check. The project was undertaken with objective of identifying a panel of candidate vaccine strain within each existing BTV serotypes in India. The research work on the above project was started from April 2022 onwards. The project involved 3 partners and during the period efforts were made optimize uniform SOP for serum neutralization, RNA isolation, RNA PAGE, cDNA preparation and PCR. About 100 retrospective samples were also serotyped so as to determine the number isolates belonging to a particular serotype available within the repository. During the period under report isolates belonging serotypes of BTV group A (BTV4, 24 and 10) were taken up characterization using serum neutralization, virus titration and bioinformatic analysis.

Among the members of BTV group A, information about regions on the VP2 that contribute for formation of antigenic epitope serotype 4 is not available. Therefore, an effort was made to identify B cell epitopes present on the BTV2 using

bioinformatic approaches. This approach involves modelling the 3D structure of the protein first and then identifying the epitopes using various algorithams. To model of 3D structure of VP2 of BTV4 we used that of BTV1, which is available in PDB (39JD, modelled using Cryo-EM). VP2 protein of BTV4 shares 39.9% identity and 50% similarity with that of BTV1. Unfortunately, a stretch of amino acid from 199–406 has not been modelled in this protein. Therefore, homology modelling and threading based approach using two servers, mainly I-Tasser server and Robetta server failed to model the complete protein leaving the stretch in coiled form. Subsequently, using *ab-initio* modelling (robetta server, Rosettafold algorithm) approach, the protein was modelled and all the models were assessed on Swissmodel structure assessment server (**Fig 19**). After assessment, using clash score (190.70) and Ramachandran plot score (94.97) model 1 was chosen for further studies.

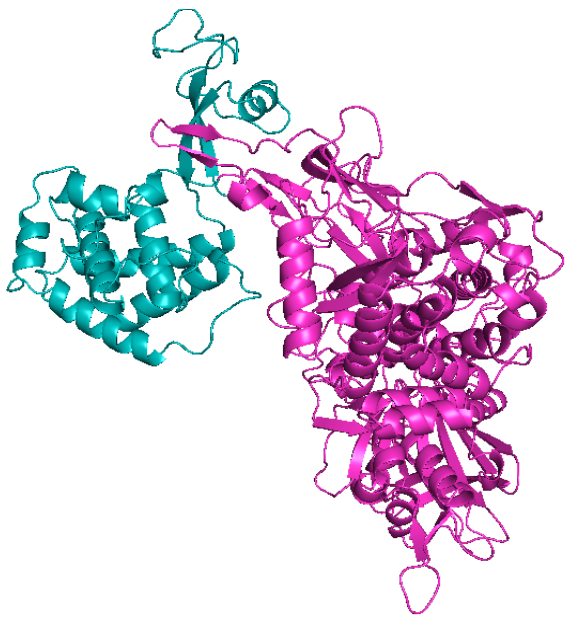


Fig 19: 3D model of VP2 of BTV4 using swiss model

Antibody epitope prediction was done using Ellipro (IEDB) server, which predicted 18 linear regions of different lengths with plausible epitope characteristics. Subsequently, these were then subjected to additional selection criteria to check whether they met certain essential properties to be recognized as putative epitopes. Preliminary analysis identified two linear epitopes and one discontinuous epitope are present on the exposed area of the VP2 protein suggesting, they might interact with the B cells.

(D Hemadri, MM Chanda, K Putty, V Ganji and S Hegde)

Epidemiology of ovine brucellosis in Karnataka

Brucellosis in sheep is caused by *Brucella melitensis* and *B. ovis* which are smooth and rough strains of *Brucella,* respectively. Many studies in India have documented estimation of prevalence of brucellosis in sheep caused by smooth *Brucella* spp. However, prevalence studies due to *Brucella ovis* in sheep is scanty in India. This study focused on estimating the sero-prevalence of *Brucella* antibodies in sheep due to both smooth and rough *Brucella* spp. Sheep sera (n=235) were collected from 19 flocks from Belgaum, Davanagere, Vijayapura, Hassan and Bidar districts of Karnataka. The samples were screened by serological tests such as Rose Bengal Plate Test (RBPT), in-house indirect ELISA for detecting antibodies against

smooth *Brucella* spp. and commercial indirect ELISA for detecting antibodies against *B. ovis*. Analysis revealed that the percent positivity due to smooth *Brucella* spp. is 16.6% (39/235) and *B.ovis* is 11.07% (39/235). The sero-positivity in male sheep (rams) was 8.7% due to smooth *Brucella* spp. and 13.04% due to *B. ovis*. Among the female sheep, 11.15% have aborted during one year causing huge economic loss to the sheep farmers. Out of the aborted females, 67 animals were screened with serological tests for brucellosis in which 32.84% females were showing antibodies against smooth *Brucella* spp. and 8.96% were showing antibodies against *B. ovis*. This study warrants the need for the control program for small ruminant brucellosis.

(M Nagalingam, R Shome, V Balamurugan, R Sridevi and GB Manjunatha Reddy)

Whole genome analysis of *Pasteurella multocida* strains from sheep

Pneumonic or septicemic pasteurellosis caused by serogroup-A strains of *P. multocida* is endemic among sheep and goats in several tropical countries including India. Genetic and genomic analyses have shown that serogroup-A is heterogenous and perhaps the most diverse among the five serogroups of *P. multocida*. In repository of *P. multocida* (n=41 strains) at ICAR-NIVEDI, majority are of serogroup-A (85%) which were obtained from sheep and goats. The genomes of eight *P. multocida* serogroup-A strains have been sequenced and compared with a serogroup A strain from India (NIVEDI/PMS-1) (**Fig 20**).

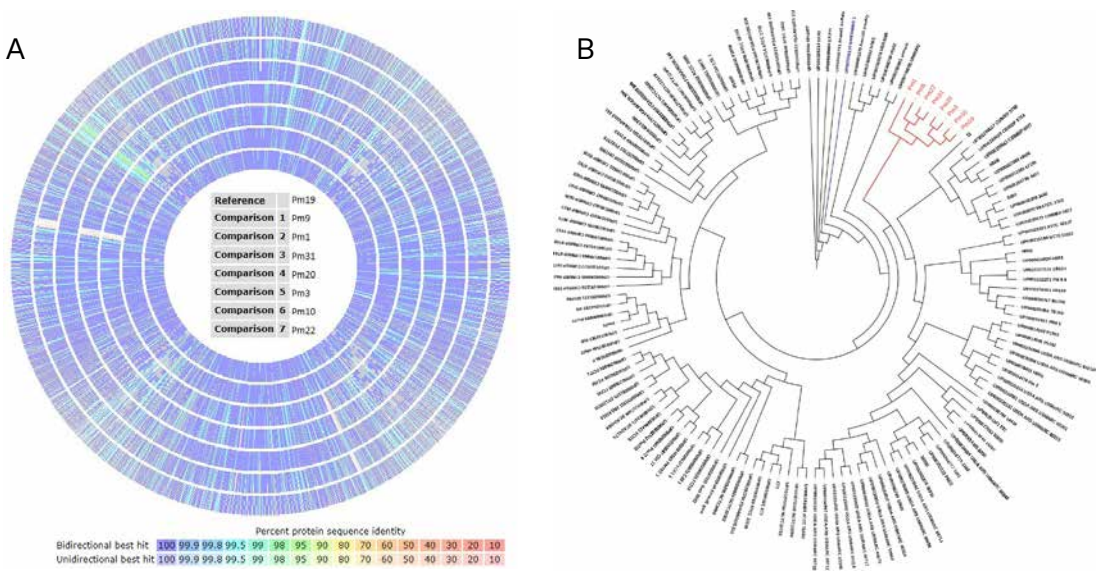


Fig 20: Comparative circular genome visualization (*Panel* A) of sheep origin *P. multocida* NIVEDIPm strains 1, 3, 9, 10, 20, 22, 31, and reference genome strain Pm19, and phylogenetic tree (*Panel* B) based on proteome of *P. multocida* strains (n=133) of small ruminants

The presence of 23 virulence-associated genes has been assessed using BLASTP, gene profiling and phylogenomic analysis which revealed that all the strains are closely related to each other but are distinct from strain NIVEDI/PMS-1 with devoid of prophages and putative *toxA* gene. It has been found that the type I-C CRISPR–Cas system occurs less frequently and the type I-F CRISPR–Cas system is pervasive in the genomes of *P. multocida* strains. It remains to be determined if the strains characterized in this study represent a novel serotype, sequence type, or LPS genotype of serogroup A.

(*SB Shivachandra, MM Chanda, Yogisharadhya R and A Prajapati*)

Meta-analysis of pasteurellosis prevalence among small ruminants

Pasteurellosis caused by *Pasteurella multocida* in large and small ruminants impacts productivity and performance of the animals and represent a major threat to economical status of farming community. Despite the considerable impacts caused by the disease, prevalence estimates of pasteurellosis are lacking in many countries. To estimate pooled prevalence, relevant research publications were collected on pasteurellosis prevalence from 1980 to 2022 from worldwide. Data were extracted by following certain inclusion and exclusion criteria and meta-analysis was performed using R-software and analyzed the results for overall prevalence, subgroup prevalence among the species, period, different diagnostic methods and country prevalence. The overall pooled prevalence estimates in small ruminants was 7% (4-11) at 95% confidence interval with tau square value of 1.4465 with p<0.01 (**Fig 21)**.

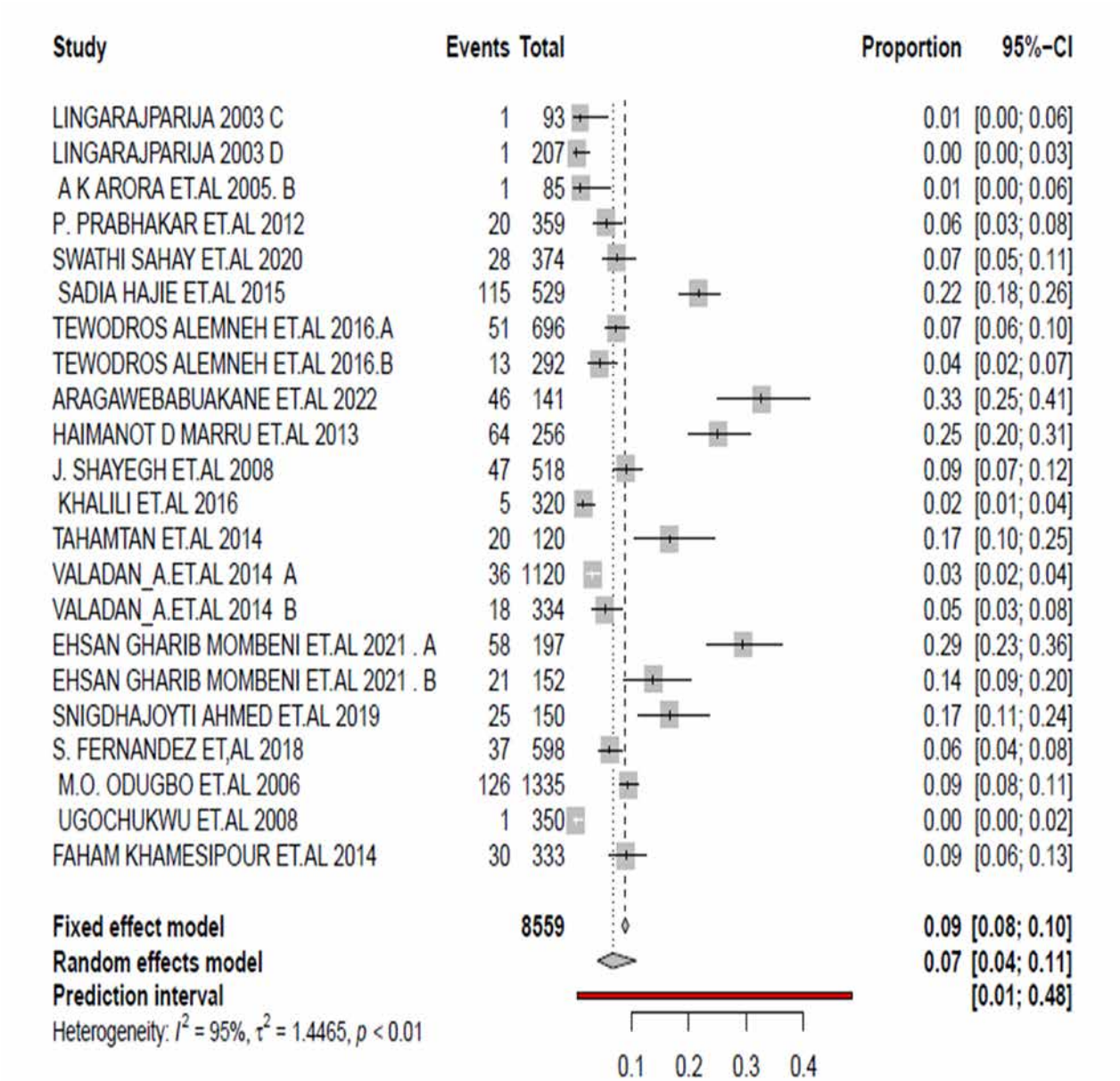


Fig 21: Overall prevalence estimate of pasteurellosis in small ruminants

(*R Sridevi, SS Jacob, P Krishnamoorthy and KP Suresh*)

Molecular detection and characterization of *Pasteurella multocida* from apparently healthy and ailing small ruminants with respiratory illness

Bacterial respiratory infections caused by *Pasteurella multocida* among sheep and goats is of significant importance among the small and medium holder farmers community leading to reduction in performance and delay in productivity. In this study, the nasal swabs were collected from animals which were showing respiratory symptoms of nasal discharge, cough, drowsiness, sneezing including apparently healthy animals from different villages of Karnataka and tested by KMT PCR for genomic detection of *P. multocida.* Among 221 samples collected from sheep and goats, 12 samples from symptomatic animals were positive for *P. multocida*. A total of five *P. multocida* isolates (capsular type A) were sequence typed for seven genes (*adk, aroA, deoD, gdhA, g6pd, mdh* and *pgi*) and analysed in PubMLST website for best matching allele loci. Further, *P. multocida* isolates were further sequence typed by housekeeping genes to find the circulating sequence type (ST) and BURST analysis shown sequence type ST101. It was concluded that circulating *P. multocida* in the sheep of Karnataka probably belongs to the sequence type ST101.

(R Sridevi, M Nagalingam and GB Manjunatha Reddy)

Isolation of *Mannheimia* spp. from sheep and goats and characterization of isolates for antibiotic resistance

Among the *Pasteurellaceae* family, *Pasteurella* and *Mannheimia* are the major pathogens causing respiratory infections in small ruminants. There is raising concern of antibiotic resistance among the various bacteria including *Mannheimia*. To investigate antibiotic resistance among the *Mannheimia* isolates, nasal swabs were collected from sheep and goats from Karnataka. The samples were streaked onto blood agar plates and isolates were characterized by preliminary conventional growth differentiation methods. The suspected cultures showing haemolysis and growth on MacConkey agar initially were screened by *rpoB* based PCR for *Pasteurellaceae* family followed by *M. haemolytica* specific PCR. A total of 256 samples were collected and 20 isolates were found positive by *rpoB*PCR and by *M. haemolytica* PCR and also by sequencing of *rpoB* gene. The identified pure cultures were subjected to PCR for antibiotic resistant genes (*ParC* and *tetb)*. Eleven isolates were found positive for antibiotic resistant genes. The pure cultures were subjected to antibiotic susceptibility testing by Kirby-Buer Disc diffusion methods with commonly used antibiotics and zone of inhibition was measured. Antibiotic susceptibility testing method revealed all isolates were resistant against ampicillin, amoxyclauv, chloremphenicol, co-trimoxazole and tetracycline. It was concluded that 7.8% of the sampled sheep and goats were showing *Mannheimia* species infections and presence of antibiotic resistance.

(R Sridevi, M Nagalingam and P Krishnamoorthy)

Antibiotic resistance of extended spectrum ß-lactamases producing *Klebsiella pneumoniae*

Extended Spectrum ß-lactamases (ESBL) producing *Klebsiella pneumoniae* and carbapenem-resistant Enterobacteriaceae (CREs) are emerging threat to animals and of serious public health concern. Isolation, identification and PCR detection of ESBL *Klebsiella pneumoniae* and CRE from slaughterhouse lung specimens of sheep/goats and apparently healthy sheep/goats in south Karnataka (Chikkaballapur and Bengaluru rural districts) were carried out. A total of 399 samples (nasal

swabs-182, lungs-103, blood-58, faecal-36, feed-10, water-10) were collected and processed for isolation and identification of *Klebsiella pneumoniae* on MacConkey agar. A characteristic single pink mucoid colony presumptive of *Klebsiella* spp. was identified by PCR targeting *GyrA* (genus specific) and *rpoB* gene (species-specific) of *K. pneumoniae*. Overall positivity of *K. pneumoniae* from sheep was 16% (64/399). Further, antibiogram profile of isolates showed 42% (27/64) resistance to cefotaxime (ESBLs) and 10.9% (7/64) to imipenem. Furthermore, mPCR assay targeting CTXM, TEM and SHV of ESBL showed 21 isolates positive for *CTXM* gene. The study has significance in identifying healthy animals as carriers of ESBL and carbapenem resistant *K. pneumoniae* and their possible dissemination via food chain to humans.

(N Shivasharanappa, GB Manjunatha Reddy, SS Patil and R Sridevi)

Pathological studies of ovine pulmonary adenocarcinoma (OPA) in sheep

Ovine pulmonary adenocarcinoma is a chronic pulmonary neoplastic disease of sheep which leads to progressive respiratory distress and weight loss in affected animals. Slaughterhouse study was conducted for the diagnosis of OPA based on gross and histopathology of lung samples. A total of 103 lung samples were collected from Bengaluru based abattoir and subjected for histopathological studies. Histopathological evaluation of lung lesions revealed overall positivity of typical Ovine pulmonary adenocarcinoma (OPA) in 9.7% (10/103) and atypical form in 27% (28/103) cases. Lung parenchyma showed extensive hyperplasia of alveolar epithelial cells converted to cuboidal or columnar cells. The acinar and papillary growth type projections of adenocarcinomatous lesions were present, which was indicative of typical form of OPA (**Fig 22a**).

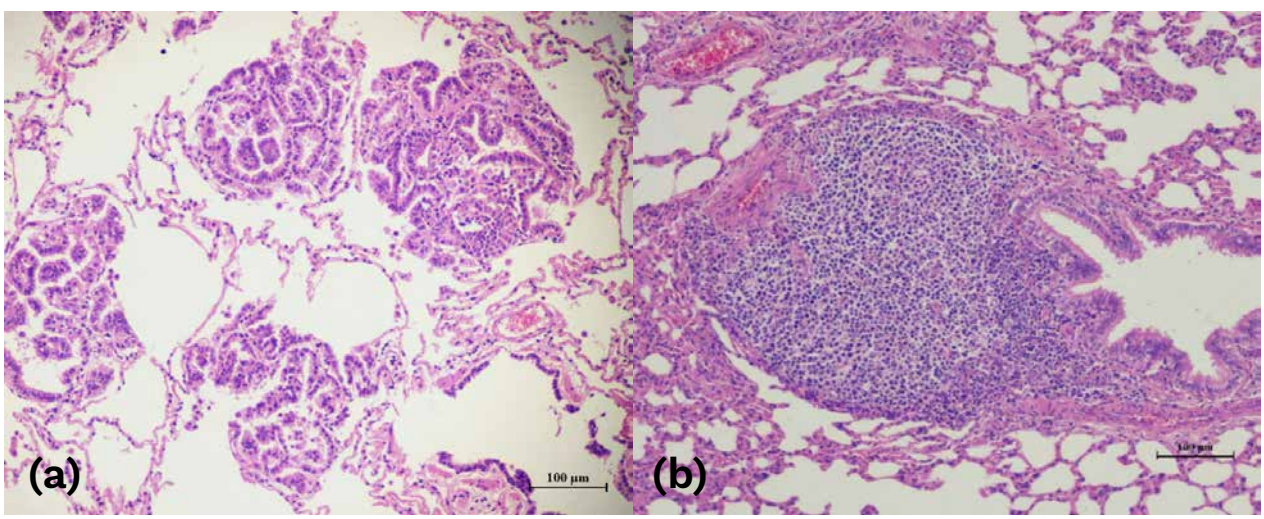


Fig 22: Ovine pulmonary adenocarcinoma-**(a)** Typical form: Extensive acinar type proliferation of lung epithelial cells 100x, H&E. **(b)** Atypical form of OPA – Extensive proliferation of BALT in lungs 100x, H&E

The excessive proliferation of Bronchiolar-associated lymphoid tissue (BALT) was observed around bronchioles which is a form of atypical form of OPA **(Fig 22b)**. PCR assay showed positive for 291 bp of LTR region from two cases. The study showed that, abattoir survey based on pathological screening of OPA can be an important tool to know the burden of OPA in small ruminants.

(N Shivasharanappa, GB Manjunatha Reddy, SS Patil and R Sridevi)

EPIDEMIOLOGY OF SWINE DISEASES

Development of PCR/qPCR for surveillance of major porcine corona viruses

Understanding the infectious cycle of SARS-COV-2 and role of other species of animals in either emergence or possible maintenance of the virus in nonhuman host is critical for prevention or control of COVID19. The subgroup-1a of family *Coronaviridae* has two major pig coronaviruses *viz*., transmissible gastroenteritis virus (TGEV) and porcine respiratory coronavirus (PRCV) whereas subgroup-1b includes certain human coronaviruses, porcine epidemic diarrhoea virus (PEDV), and bat coronaviruses. The sub-grouping of these viruses was done based on genetic and serological properties. This suggests that the coronaviruses from pig and human may have certain degree of similarity. Hence, it is important to carryout surveillance of pig population for porcine coronaviruses. Further, there is need for sensitive diagnostic assays to screen the suspected clinical samples. The study was aimed at sero-surveillance for porcine respiratory (PRCV) and enteric coronaviruses (PEDV & TGEV) and development of qPCR assay for TGEV surveillance. A total of 342 [(Karnataka (n=190), Assam (n=140) and Jharkhand (n=12)] serum samples were screened for TGEV and PRCV using commercial ELISA kit **(Table 9)**.

Table 9 Screening of serum samples and their seropositivity

Porcine Coronaviruses	Serum Samples	Number of Positives
TGEV	342	55 (13.5%)
PRCV	342	10 (2.45%)

Out of total samples tested 54 sera from Assam were positive for TGEV and one sample was positive for PRCV. A qPCR assay was also standardized which was specific (100%) and sensitive with efficiency of 99.5% and limit of detection was 0.01613 fg/µl (Copy Number-20). The intra-assay variation was in acceptable range (CV<10%) **(Fig 23)**.

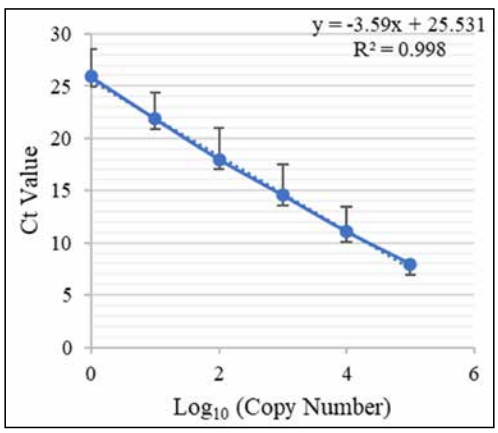


Fig 23: Standard curve depicting the linear relationship between Ct values and viral copy number

Hence in conclusion, the serological detection of TGEV and PRCV in pig population of Assam was observed and a sensitive and specific qPCR for TGEV detection was standardized.

(J Hiremath and KP Suresh)

Immuno-epidemiological characterization of pig as an amplifying host of Japanese encephalitis virus

Japanese encephalitis virus (JEV) causes severe encephalitis in humans and abortion in pigs. The disease is endemic in India and so far, the role of pigs as an amplifying host is explored limiting only to detection of antibodies/viral RNA in endemic areas. This study investigated the effect of amplifying host factors (age and sex) on sero-prevalence of JE and characterize the humoral and cell mediated immune response in correlation with viral RNA/antibody in endemic states of South India. Evaluation of JE seropositive pigs for tissue specific changes in spleen, blood and tonsil was carried out. The results show that the CD4+IFNg+, CD8+IFNg+ and CD4+CD8+ IFNg+ cell population were varying in blood, spleen and tonsils among the seropositive pigs but the variation was not significant when compared to seronegative pigs **(Fig 24)**.

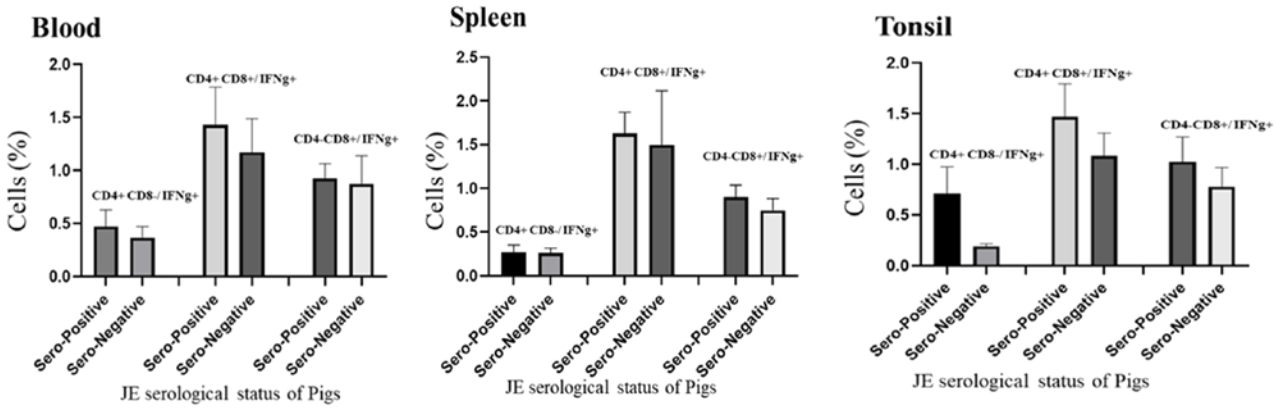


Fig 24: Immunophenotyping of activated lymphocyte subsets in blood, tonsil and spleen of JE sero-positive and JE sero-negative pigs

Further, there is need for a controlled study to discern the relationship between the activated T cells and JEV infection.

(J Hiremath, GB Manjunatha Reddy, MM Chanda, SS Patil and SB Shivachandra)

Standardization of qPCR for Japanese encephalitis virus

A SYBR Green-I based RT-qPCR protocol for the detection of Japanese encephalitis virus (JEV) RNA was standardized by targeting NS3 gene. For standardization of the RT-qPCR, RNA extracted from JEV vaccine strain SA-14-14-2 was used as positive control which resulted in specific amplification of 162bp region **(Fig 25)**. Further, to determine the limit of detection a plasmid containing the target gene (copy number 10^7 to 10) were tested and it was found that the protocol was able to detect up to 10 copies of target.

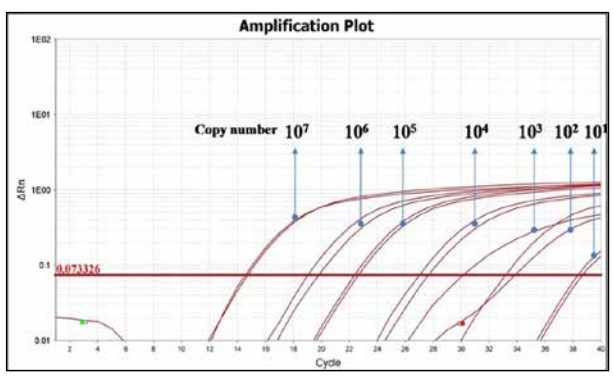


Fig 25: Amplification plot of SYBR Green-I based RT-qPCR for detecting JEV

(HB Chethan Kumar, J Hiremath, GB Manjunatha Reddy, D Hemadri and SS Patil)

ANIMAL DISEASE INFORMATICS & SOCIO-ECONOMICS

Development of forecasting and forewarning models for predicting the risk of livestock infectious diseases (NADRES v2)

NADRES v2 *(https://nivedi.res.in/Nadres_v2/index.php)* is an early warning system powered by Artificial Intelligence with set of capacities needed to generate and disseminate timely and meaningful warning information that enables farmers and organizations to prepare and act appropriately and in sufficient time to reduce the livestock disease incidence with the following objectives: Development of forecasting model for the major livestock diseases and predicting the risk of livestock diseases in advance of two months and development of state of art of communication models to communicate risk of livestock diseases to the stake holders.

Generated state, district and village level shape files of India and is made available for the users. In addition, through collaboration with NIC, Govt. of Karnataka, the disease alerts are communicated directly to farmers through SMS who have registered in FRUITS, Karnataka (Farmers Registration and Unified Beneficiary Information System). A total of 1,79,57,084 SMS alerts were sent to farmers through FRUITS from January to December 2022 **(Table 10)**.

Table 10 Number of SMS alerts sent to farmers through FRUITS application

Month /Year	Total number of SMS sent				
	Anthrax	FMD	BQ	BT	Theileriosis
Jan-22	167974	544565	367560	-	-
Feb-22	181292	520086	238009	-	-
Mar-22	248167	215968	322810	-	-
Apr-22	264461	555795	517610	-	-
May-22	501586	573988	384887	-	-
Jun-22	244791	827769	316523	-	-
July-22	214164	968375	396820	-	-
Aug-22	329798	905422	329466	135959	-
Sep-22	414104	937485	260908	224221	184953
Oct-22	431831	559144	609919	373294	-
Nov-22	171070	647002	521180	477667	-
Dec-22	223548	687735	612462	346716	-
Total	**3392786**	**7943334**	**4878154**	**1557857**	**184953**

The farmer's feedback about the SMS alert system has been recorded. The Karnataka veterinary hospital help-line details have been provided to benefit the farmers. Updated the livestock census, state & disease wise livestock disease forecast, research publications on meta-analysis and bioinformatics. Developed and implemented machine learning models to predict risk of 13 livestock diseases in India **(Fig 26)**.

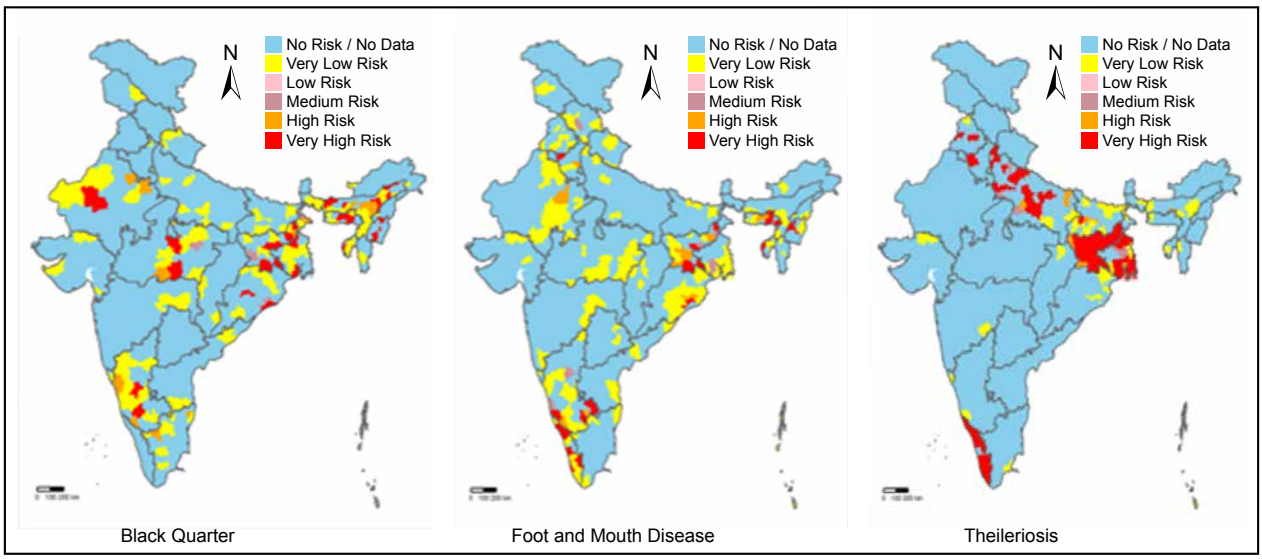


Fig 26: NADRES v2 Web application implemented with Artificial intelligence for risk prediction and creation of livestock disease forewarning maps

Village shape file was generated for India. Data was collected from Survey of India. Individual District level shape file was downloaded for each state and later it was merged into each state shape file. Later all State shape files was merged into one village level file **(Fig 27).**

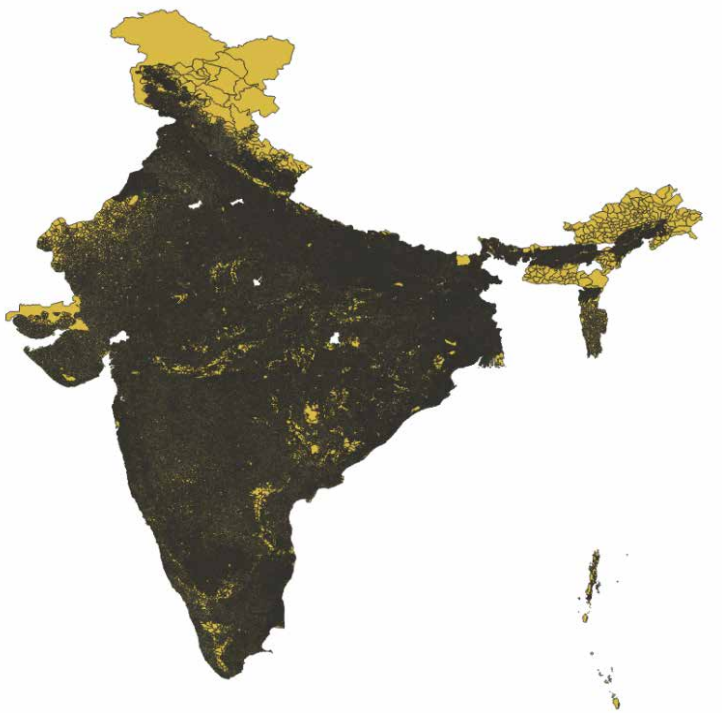


Fig 27: Generated the village level boundary shape file of India

Shape files at village boundaries for 766 districts covering 28 states and 8 UTs with 662510 villages were generated and merged as India (village) boundaries for the purpose of advanced epidemiological analysis.

On an average disease risk has been predicted in 587 districts for 13 diseases over 12 months. 11 years (2011-2022) of data was collected for 13 animal diseases in 23 meteorological parameters approximately around 23907120 data points were extracted in order to develop prediction for infectious diseases.

Livestock disease data for previous 11 years was retrieved from the NADRESv2 database linked with Risk factors data and the population data (10394400) at village level for five major livestock species viz., cattle, buffalo, sheep, goat and pigs were obtained from 20th Livestock census (2019) from Department of statistics, DAHD, GOI.

Total of 15 risk maps were generated/ updated for various diseases such as ASF, CSF, Haemonchosis, Bluetongue, Theileriosis, Babesiosis, Anthrax, LSD, Avian influenza, and Trypanosomiasis which helps policy makers and planners to improve the risk management and governance by prioritizing risk management efforts.

(KP Suresh, D Hemadri, SS Patil, P Krishnamoorthy and SS Jacob)

Development of cattle disease diagnosis expert system (CaDDES)

The Cattle Disease Diagnosis Expert System (CaDDES), a web application was developed and it will be useful for the field veterinarians in the diagnosis of thirteen cattle diseases based on the symptoms. Application is developed using PHP, HTML, CSS and MySQL database. The home page of the web application is shown in **Fig 28**.

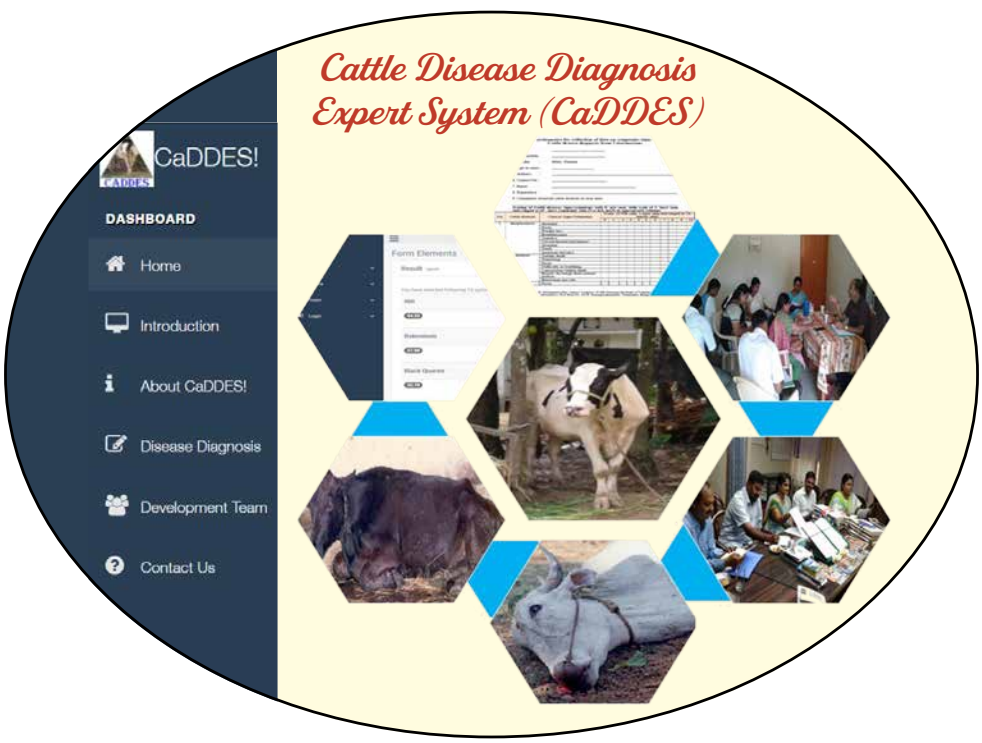


Fig 28: The home page of the CaDDES web application

The web application has been updated with new features and added the "samples to be collected for laboratory confirmation of the 13 cattle diseases".

(P Krishnamoorthy and KP Suresh)

Application of kriging interpolation to model the effects of temperature humidity index (THI) on disease transmission in southern India.

The aim of this study was to investigate the relative influence of environmental factors and epidemiological parameters on disease transmission and to develop an artificial intelligence system to model vector-disease-climate interactions. To achieve this, we used Temperature Humidity Index (THI) data from selected locations in India and applied the Kriging method to extrapolate this data across southern states. THI is a weather safety index that combines air temperature and humidity to estimate thermal stress levels, with the goal of reducing losses caused by heat stress. The formula used to calculate THI is: THI = (1.8*AT+32) - [(0.0055-0.055*RH) (1.8*AT-26)] where AT represents air temperature and RH represents relative humidity.

We can observe from the maps in (**Fig 29),** how THI has evolved through time. THI has fluctuated every ten years, and since the pattern was anticipated for 2031, it suggests that there will be even more changes in THI.

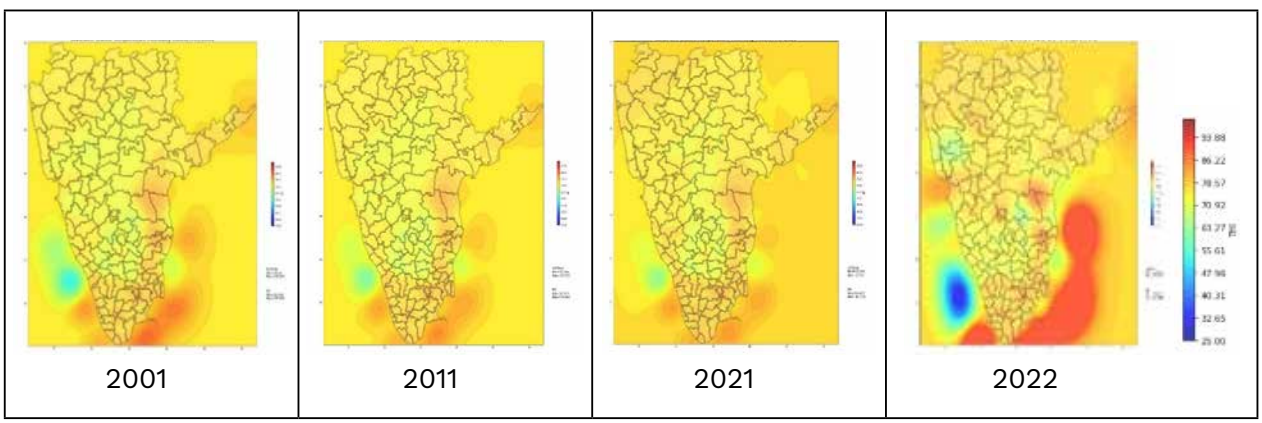


Fig 29: Assessing the Decadal Impact of Temperature Humidity Index (THI) using Kriging Interpolation for Southern States

Following the THI computation, we evaluated how this THI will affect different major diseases for Southern India. The results are shown in **Fig 30**. The THI on various diseases in 2021 is represented in the images below. If the THI is about 70 or higher we are witnessing the diseases.

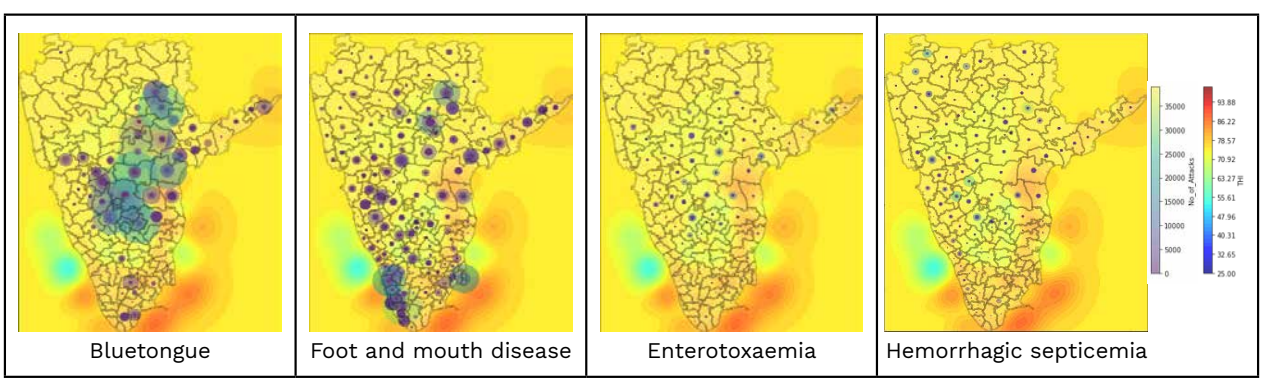


Fig 30: Assessing the impact of temperature humidity index (THI) on disease transmission using kriging interpolation for southern states

Kriging was carried out for 5 parameters such as Temperature Humidity Index (THI), NDVI (Normalized Difference Vegetation Index), LST (Land Surface temperature), Rainfall and cloud cover from 2001 to 2032 to understand the changes in the climate.

Documentation on the climatic events was recorded from the farmers aged above 60 years from the villages of Chikkaballapur, Tumkur and Ramanagara districts. Data from total of 67 farmers were collected from 13 villages of 3 districts to validate the results obtained from the kriging models.

(KP Suresh)

Modelling the variation in various climatic conditions in southern India using Kriging interpolation

I. Normalized Difference Vegetation Index (NDVI)

The NDVI measures the greenness and the density of the vegetation captured in a satellite image. NDVI can reveal where vegetation is thriving and where it is under stress, as well as changes in vegetation due to human activities such as deforestation, natural disturbances such as wildfires, or changes in plants' phenological stage. Interpolation was carried out for NDVI to assess the vegetation over years. Data from MODIS website was collected for 2001 to 2022 and using the actual data it was predicted for 2031. From the below maps in **Fig 31** we can see that vegetation is being increase over the years from 2001 to 2021 and in 2031 we see that there is little loss in vegetation when compared to last decade.

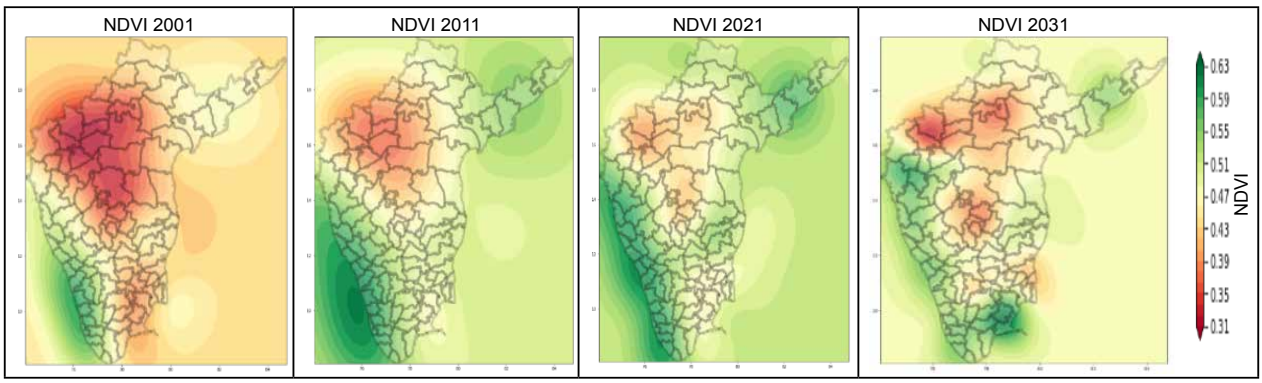


Fig 31: Normalized Difference Vegetation Index (NDVI) for South India

II. Land Surface Temperature (LST)

LST measures the emission of thermal radiance from the land surface where the incoming solar energy interacts with and heats the ground, or the surface of the canopy in vegetated areas. The results showed in the **Fig 32** that the temperature of the land's surface has risen in 2021 as compared to 2001 and 2011.

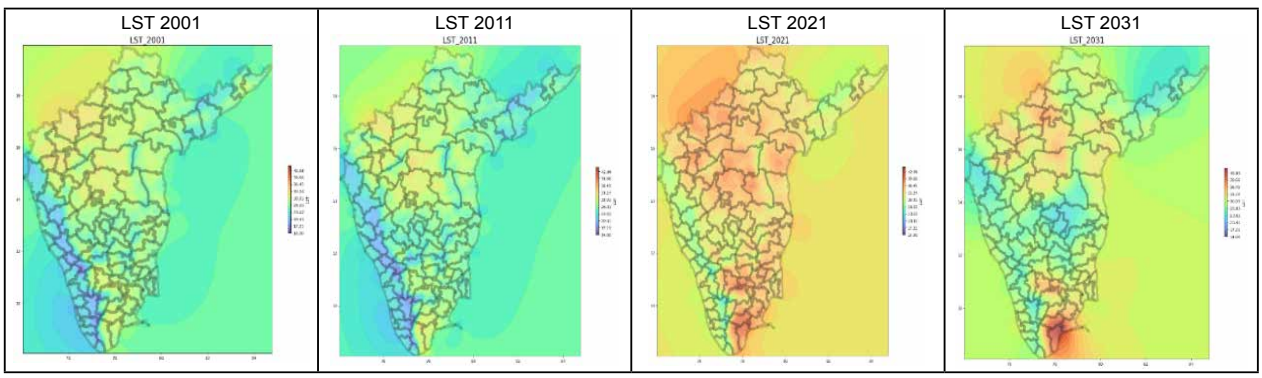


Fig 32: Land Surface Temperature (LST) for South India

Though it is slightly lower when compared to 2021, we can see that the temperature is rising in 2031 when compared to 2001 and 2011.

(KP Suresh and P Krishnamoorthy)

Development of a strategic sampling plan for sero-surveillance & sero-monitoring of FMD, Brucellosis, CSF, PPR and other diseases

All form of epidemiological investigations requires the scientific sampling plan for collection of data on health problems. Estimation of prevalence of a disease is a prerequisite to establish the disease control program, hence sampling the populations in order to estimate the level of disease prevalence is common task for epidemiologists. Simple random sampling, systematic or stratified random samplings are the most commonly used sampling methods in which the animal is sampling unit, provides the precise estimates of disease frequency. Data on the prevalence of various animal diseases is collected and recorded. In sampling, we ensure that animals are typical of the target population that the estimate of disease frequency is unbiased and precise (low standard error).

Strategic, Two-Stage, stratified random sampling plan for sero-surveillance and sero-monitoring under NADCP for FMD, CSF, Brucellosis and PPR was developed and uploaded in the NADRESv2 website.

District-wise sampling plan for 14 one health zoonotic diseases was done through a systematic review and meta-analysis.

Sampling Plan for FMD

FMD-serosurveillance 2022, the number of samples estimated was 89,499 covering 2905 blocks and 707 districts. FMD-Monitoring Round III 2022, the number of samples estimated was 71776 covering 3091 blocks and 711 districts.

Sampling Plan for Brucellosis

Brucellosis -Monitoring Phase II 2022, the number of samples estimated was 46398 covering 2291 blocks and 697 districts.

Sampling scheme for avian influenza (LPAI H9N2)

For avian influenza surveillance during 2022, the number of samples estimated was 119455 covering 3371 blocks and 691 districts with 3371 villages.

Sampling scheme for coronavirus in various animal species

For coronavirus surveillance during 2022, the number of samples estimated was 3292 covering 40 districts with 460 villages.

Sampling plan for other livestock and zoonotic diseases

To know the prevalence rate, we have employed meta-regression for the data collected from the research articles. The prevalence of 14 diseases viz., Brucellosis, Coxiella/Q-fever, Cysticercosis, CCHF, Scrub typhus, Swine influenza, Tuberculosis, Japanese encephalitis, Listeriosis, Cryptosporidiosis, Salmonella, PRRS, LSD, and ASF was obtained from various studies and databases for the period 2000 to 2021. Electronic database searches include PubMed, Google Scholars, Science Direct, Springer's, Biomed Central, Consortium of e-Resources in Agriculture [CeRA], research proceedings/ compendium of conferences, seminars, symposia, Krishikosh, and unpublished sources like thesis data for all 14 identified diseases to record their prevalence in India for meta-analysis. This systematic literature review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Additional articles were also identified manually from the reference lists of downloaded articles by 'back-reference' search.

The estimated prevalence of 14 diseases employing meta-analysis is presented in **table 11**. The same was used to develop a robust sampling plan for surveillance to know the current status of each disease.

Table 11 Summary of sampling for zoonotic and other livestock diseases in India

Sl No.	Disease	No. of Studies	Overall prevalences (%)	Species to be covered	No. of sampled villages	No. of Samples	No. of samples per village/ herd
1	Brucellosis	228	12	Cattle, Buffalo, Sheep, Goat, Pig	160	3228	18-21
2	Coxiella/Q-fever	44	10	Cattle, Buffalo	185	4517	21-25
3	Cysticercosis	64	18	Pig	152	2205	13-15
4	CCHF	38	11	Cattle, Goat, Buffalo	154	3695	20-23
5	Scrub typus	11	22	Rodents	134	1553	11-12
6	Swine influenza	3	28	Pig	105	1075	09-10
7	Tuberculosis	30	12	Cattle, Buffalo	158	3230	18-21
8	Japanese encephalitis	49	14	Pig	134	2389	16-18
9	Listeriosis	24	9	Food	156	4183	23-27
10	Cryptosporidiosis	24	27	Cattle, buffaloe (calf)	116	1161	09-10
11	Salmonella	25	14	Cattle, Pig, Chicken, Duck	133	2341	16-18
12	PRRS	4	29	Pig	128	1173	8-9
13	LSD	4	18	Cattle	157	2250	13-15
14	ASF	5	19	Pig	146	1975	12-14
	Total		**-**	**-**	**2018**	**34975**	**-**

The minimum number of samples taken in each premises (herd/flock) reflected the degree of confidence we have set (e.g. 90%). We have considered 90 percent confidence interval, sensitivity and specificity each and herd level 10-20 percent. Confidence level describes the extent to which a number or other assumption is likely to be true. In this case, it is the probability of finding at least one positive animal from those tested from each premises chosen to be sampled **(Fig 33).**

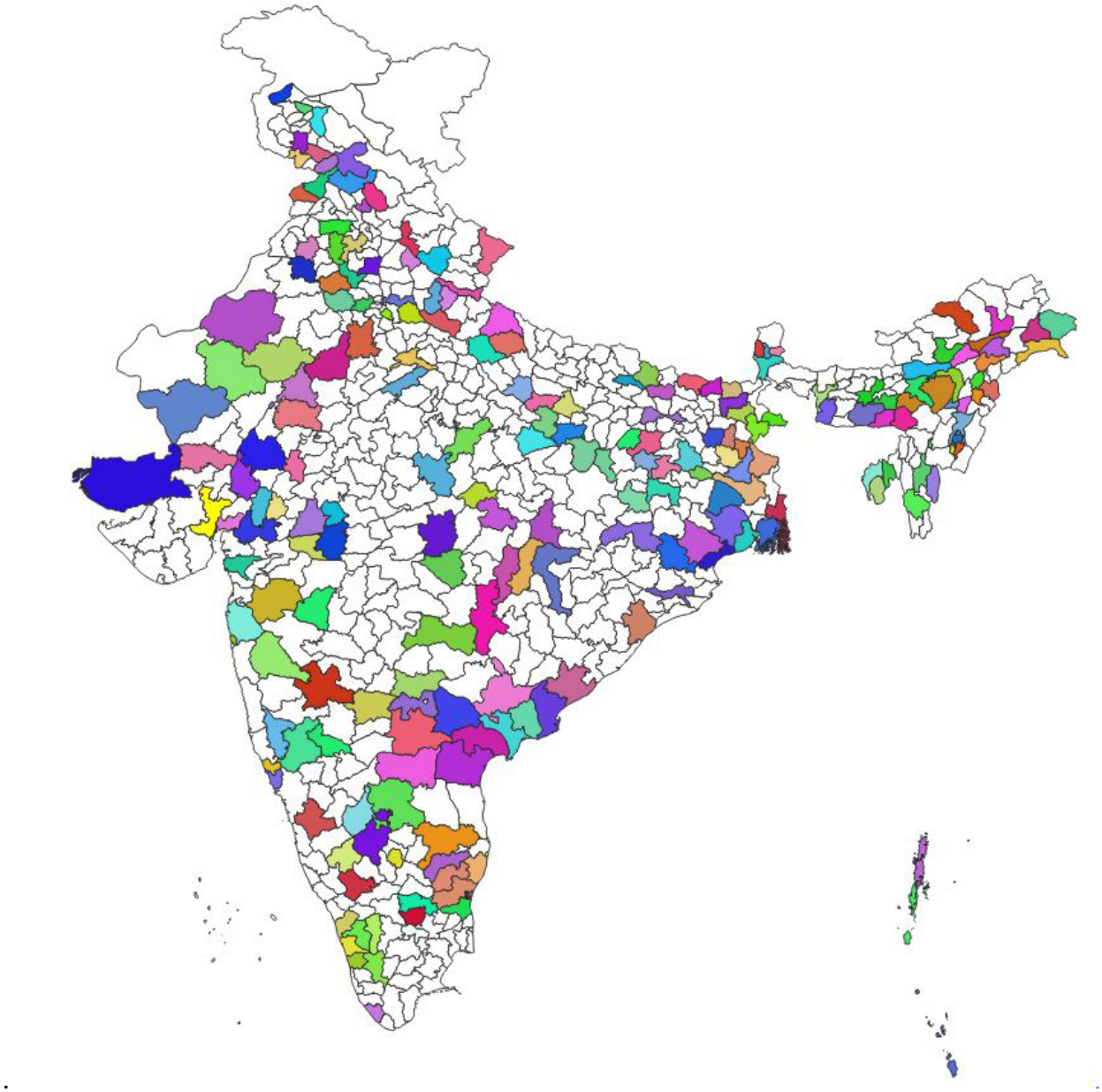


Fig 33: Map of India showing sampling location

(KP Suresh, SS Patil, D Hemadri and V Balamurugan)

Generation of cluster maps for livestock diseases using SaTScan

To identify the ecological, environmental, and other risk factors responsible for the major cluster development after the space-time cluster model identified significant disease clusters. To identify important risk factors (climate, soil profiles, remote sensing, and host) essential for the formation of disease clusters for data. The determining risk factors were then applied to the modeling and prediction of the spatial risks. Below mentioned specifications were developed for modelling various hotspot maps. Space-Time Poisson models with circle radius of 1km for 1-year duration was specified and clusters were formed. The output is generated using SaTScan v 9. 6. Cluster maps of Avian Influenza, CSF, FMD, LSD, and Bluetongue using the SaTScan (Poisson model) in India **(Fig 34-35).**

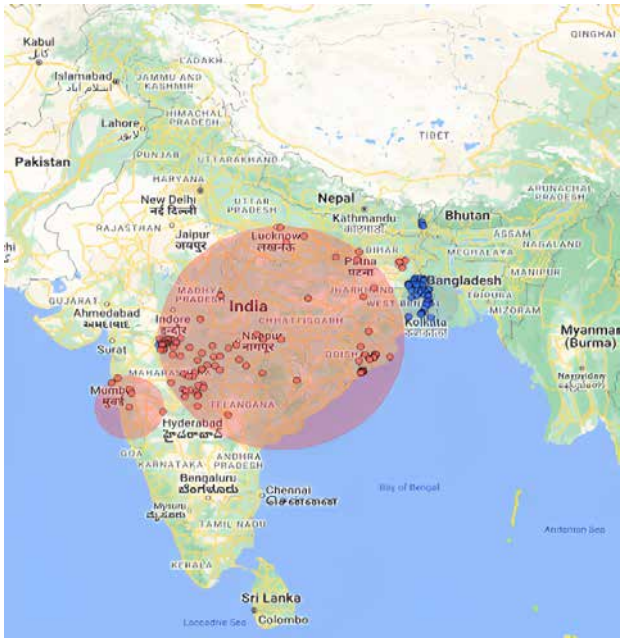


Fig 34: Bluetongue cluster map (Total hotspots-14; High-7; Low-7)

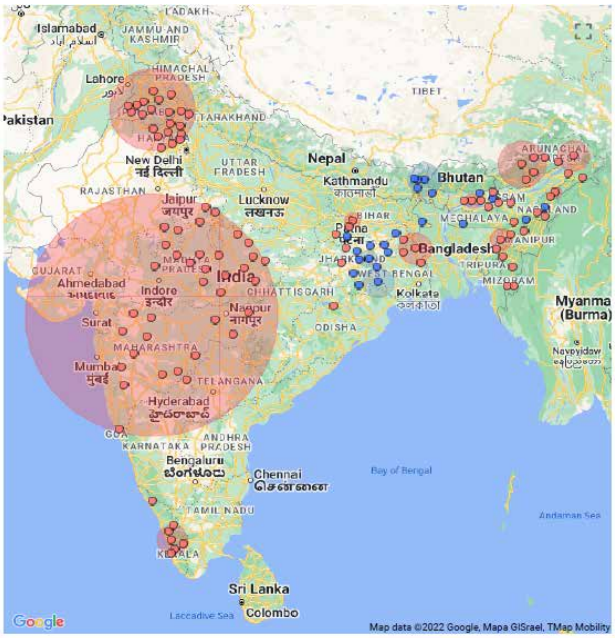


Fig 35: CSF cluster map (Total Hotspots-46; High-29; Low-17)

(KP Suresh)

Generation of hotspot and risk prediction maps

Risk prediction and maps developed to serve as beneficial tools for policymakers, veterinarians, and livestock farmers to take necessary healthcare measures against the spread of the disease. Hotspot analysis was performed in the present study to address the problems associated with spatial units that are associated with weather and climate. The hotspot and risk prediction maps were generated for ASF, avian influenza, CSF, and LSD **(Fig 36-37).**

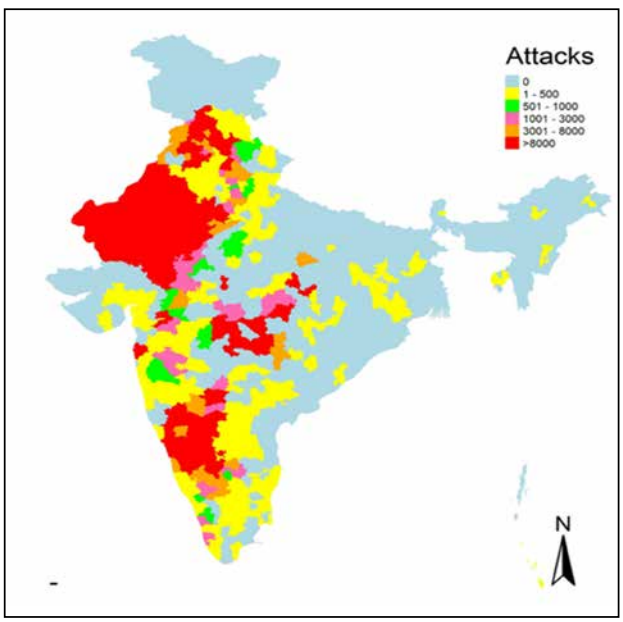


Fig 36: Map representing the distribution of attacks of LSD

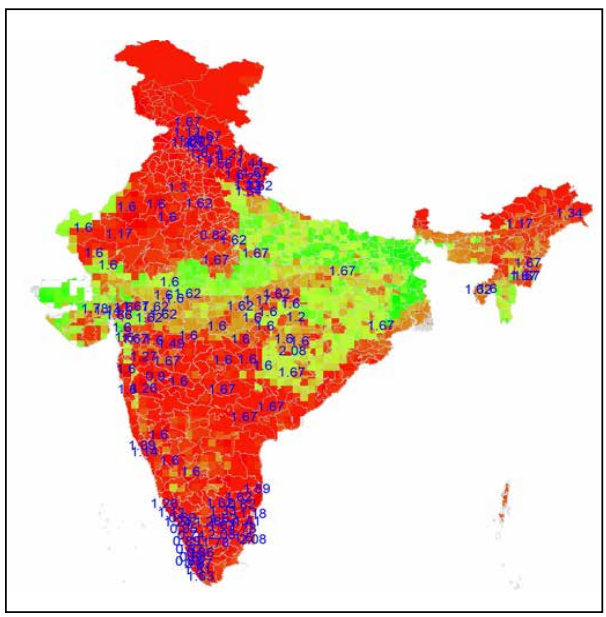


Fig 37: The R0 superimposition on the Risk map for LSD in India

(KP Suresh)

Study on transmission dynamics of lumpy skin disease (LSD)

Data on LSD was captured from various states, around 2926039 cases from 5557 outbreaks having 159208 deaths were tabulated and analyzed.

Significant climatic drivers affecting LSD were Air Temperature, EVI (Enhanced Vegetation Index), LAI (Leaf Area Index), LST (Land Surface Tempreature), PET (Potential Evapo-Transpiration), Potential evaporation rate, Rain precipitation rate, Soil moisture, Specific humidity, and Surface Pressure.

Reproduction number (R0) for LSD

Number of districts R0 was generated (LSD)	No. of districts R0>1	No. of districts R0>1.5	No. of districts R0>2	No. of districts R0>3
108	30	75	3	0

Time-Varying reproduction number (Rt)

A time-varying effective reproductive number Rt can provide more information because it tracks the subsequent evolution of transmission.

The time-varying reproduction number Rt shows the transmission dynamics, epidemic peaks, trends, and Periodic regression of LSD cases during the period of the outbreaks in Karnataka state is presented **(Fig 38 and 39)**.

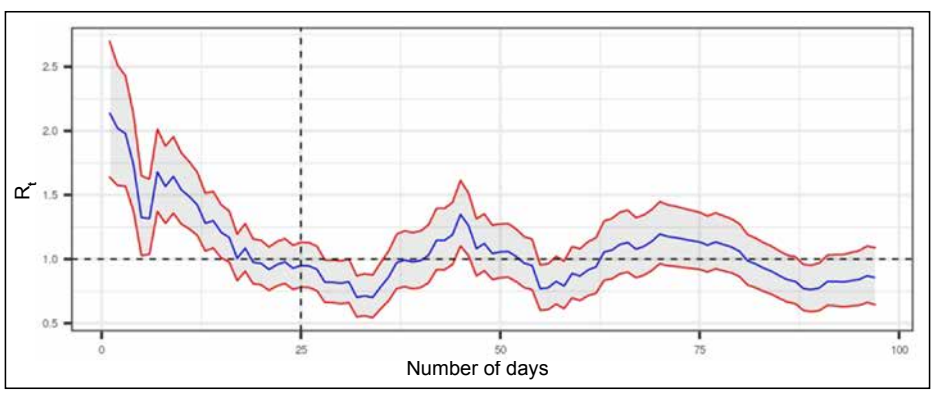


Fig 38: Transmission dynamics of LSD in Karnataka

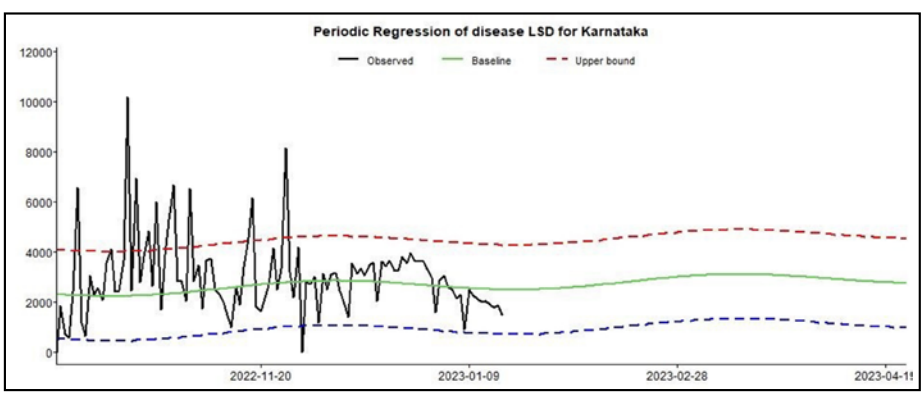


Fig 39: Periodic regression of LSD in Karnataka

(KP Suresh)

Spatial-temporal and risk analysis of JE outbreaks in Assam

Japanese Encephalitis (JE) is a vector (mosquito) borne viral zoonosis caused by the Japanese Encephalitis virus of the family Flaviviridae and genus Flavivirus. The JE virus is transmitted from animals to humans through bite of infected mosquito (*Culex tritaeniorhynchus*). Pigs act as amplifying host and play and important role in virus maintenance. In India, for last 6-7 years has seen an increase in number of JE cases particularly from north-eastern state of Assam, which is now also identified as a JE hotspot which might be affected by the changes in climatic conditions. The Japanese encephalitis outbreaks data along with its determinants was compiled from 2009 to 2020 and risk map for its occurrence was developed for Assam. The Barpeta, Nalbari, Darrang. Marigaon, Lakhimpur, Karimkanj, Jorhat and Sibsagar districts were identified as high-risk areas in Assam. Further, temporal analysis of JE outbreaks in Assam and other endemic states was analysed using time series models. Temporal pattern of JE in India showed that year 2019 followed by year 2014 and 2011 witnessed more outbreaks. It was observed that high rainfall (more than 600 mm) was associated with more the number of JE cases in Assam and pigs were positively associated with occurrence of JE across states of India. Forecasting models were developed to forecast the occurrence of JE cases in Assam using climatic parameters. Furthermore, all India risk map for JE was also developed.

(MM Chanda)

Farm-level economic impact of LSD in Rajasthan

Lumpy skin disease (LSD) is a severe systemic disease of cattle caused by the lumpy skin disease virus, which belongs to the genus *Capripoxvirus*, family *Poxviridae*. In India, the disease was first reported in 2019 in Odisha and later reported in other states and UT's. In order to assess the economic impact of LSD in cattle, a survey was undertaken in Rajasthan covering 363 cattle and buffalo rearing households. The survey was undertaken in two districts, viz., Jaipur and Kota using the pre-tested schedules. The primary data on socio-economic characteristics of farmers, animal asset pattern, clinical symptoms of LSD observed by the farmer, mortality and morbidity due to LSD, production parameters, treatment cost and labour cost, vaccination details and other epidemiological parameters were collected. The estimated median milk loss, mortality loss and treatment cost per farm was Rs.14400, Rs.30000 and Rs.4000, respectively. It implies LSD caused severe economic burden to the cattle rearing farmers in Rajasthan.

(G Govindaraj, GB Manjunatha Reddy, CS Sathish Gowda and G Narayanan)

Economic impact of Bluetongue in Sheep

Bluetongue (BT) is one of the important viral diseases of domestic and wild ruminants. It causes significant economic loss in terms of high morbidity, mortality, abortion, fatal death and deformities as well as meat and wool loss. Therefore, measurement of economic losses caused by this important disease would provide information useful in determining research priorities and in drawing attention to the effects of Bluetongue virus (BTV) on sheep economy. During 2022, Karnataka and Andhra Pradesh field survey was conducted to know the incidence, death and economic loss. In Karnataka, Chitradurga, Bellary, and Koppal districts were surveyed and in Andhra Pradesh, Anantapur, Kurnool, and Guntur districts were surveyed to assess the incidence, deaths and economic losses due to BTV outbreaks. The field survey results indicated that incidence of BTV was 5.61% and 5.57% in Karnataka and Andhra Pradesh states respectively. In Karnataka, estimated economic loss due to BTV disease was Rs.

85.47 crore, of which, major loss was due to mortality losses (Rs.37.49 crore). In Andhra Pradesh, the estimated loss due to BTV disease was Rs. 125.24 crore out of which major loss was due to mortality losses (Rs. 54.07 crore) **(Table 12).**

Table 12 **Estimated economic loss due to BTV (Rs. in Crore)**

Study States	Mortality loss cost	Weight Loss cost	Distress sale cost	Treatment cost	Opportunity cost	Total projected loss/year
Karnataka	37.49	30.63	1.93	2.54	12.88	85.47
Andhra Pradesh	54.07	44.05	2.13	4.07	20.92	125.24

(CS Sathish Gowda, D Hemadri, G Govindaraj and G Narayanan)

Farm-level impact of Brucellosis in Karnataka

The assessment of economic burden of Brucellosis is vital for informed policy making. During the reported period, to assess the farm-level economic loss due to brucellosis in cattle and buffaloes in Karnataka, a questionnaire-based survey was undertaken covering 146 cattle and buffalo rearing farmers using multistage random sampling procedure. Further, to confirm the disease presence in the animals, 327 blood samples from crossbred cattle (n=281), indigenous cattle (n= 25) and buffalo (n=21) were also screened using RBPT and iELISA. The deterministic models were applied to assess the farm-level loss due to brucellosis. Out of 327 samples, 17 (5.2%) were positive for brucellosis, of which, 16 were from crossbred cattle [aborted (1) and non-aborted (15)] and one non-aborted buffalo. Based on the survey data, various loss components, viz., milk loss, abortion, treatment cost and opportunity cost of labour were calculated. The estimated milk loss, calf loss due to abortion, treatment cost and opportunity cost of labour per animal were Rs.12064, Rs.3000, Rs.2100, and Rs.2625, respectively in aborted crossbred cattle. In non-aborted crossbred cattle, the estimated milk loss per animal was Rs.8726 per lactation and in buffalos (non-aborted) the estimated milk loss per animal was Rs.12255 per lactation.

(G Govindaraj, V Balamurugan, R Shome, M Nagalingam and P Krishnamoorthy)

Impact of adopting preventive interventions on rural livestock farmers in Odisha

To assess the impact of vaccination and the practice of need-based deworming, a *quasi-experimental technique* in real field situations was implemented in selected districts in Odisha. The disease monitoring after implementing vaccination against PPR, ET and Pox in selected villages in Balangir and kalahandi districts revealed less diseases incidence in treatment villages (0.6%) than control villages (3.6%). The faecal samples screening revealed the presence of strongyle eggs and ova of *Eimeria spp.* (Coccidia). Fenbendazole treatment reduced fecal egg count from 81% to 86% after 14 days of treatment whereas, coccidiostat treatment showed reduction of faecal oocyst count between 91% to 94% after 14 days of treatment. Further, the blood parameter results after coccidiostat treatment revealed increase in the mean haemoglobin level, neutrophil, eosinophil and monocyte count in the treated animals. Among the coccidiostat treated animals, the weight gain recorded after two months of treatment was more pronounced in young male animals of three months (40.0%) and

four months age (45.2%) compared to the control animals. Among the animals treated with Fenbendazole against gastrointestinal nematodes, the highest weight gain was observed in young male animals of three months of age group (52.1%). Hence, in the study area it is suggested to follow deworming with coccidiostats to increase the sheep and goat productivity.

(G Govindaraj, GC Bal, M Nagalingam, V Balamurugan and SS Jacob)

Application of social network analysis on knowledge on BTV vector in Karnataka

The Social Network Analysis (SNA) on disease risk communication, vector management, knowledge acquisition and sharing among shepherds was studied in Karnataka. The SNA revealed the presence of 83 unique edges that shepherds were actively interact with farmers-to-farmers group mode for gaining disease knowledge followed by farmers to veterinarians and no self-loops reveals that they intract with respect to disease risk communication. Further, the presence of weak modularity in disease communication network explains the existing of one-way communication with respect to disease risk identification at outbreak time. The same scenario was observed with respect to BTV vector management **(Fig 40)**.

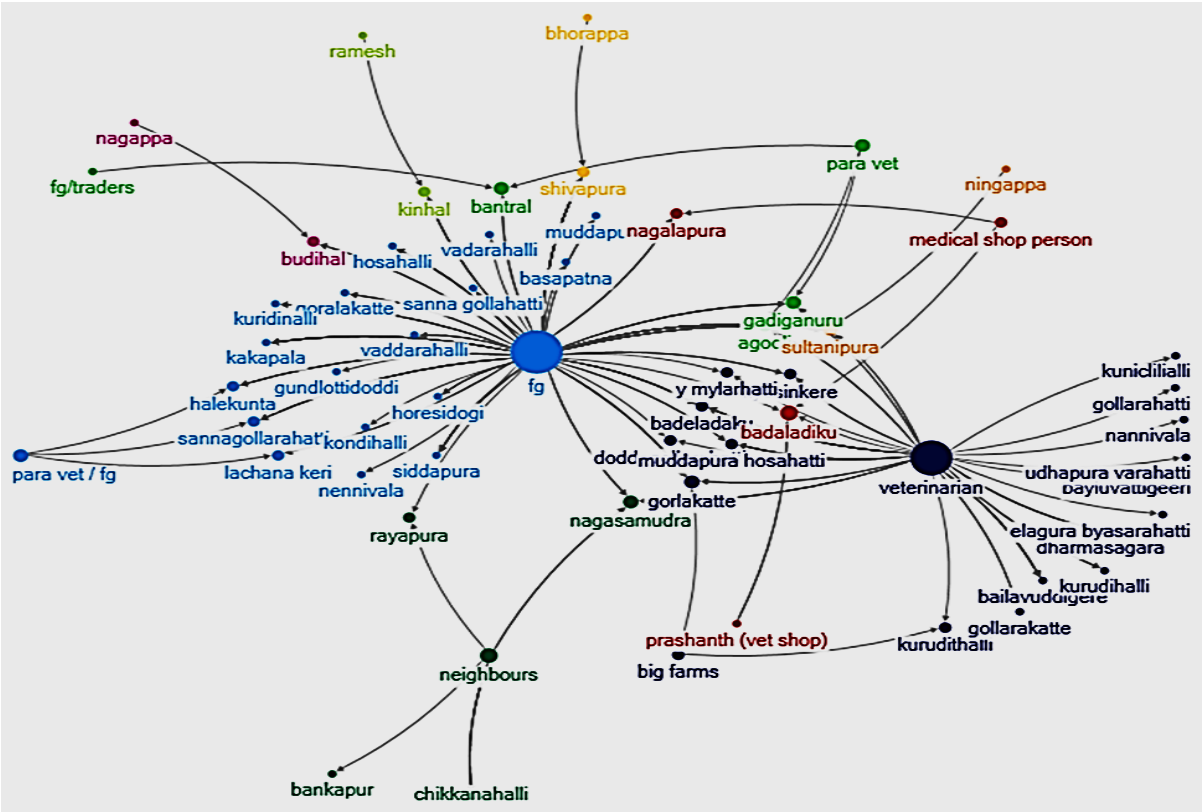


Fig 40: Identification pathways on knowledge sharing on BTV vectors

Hence, it is difficult to control BTV vector population without strengthening the communication among the shepherds and field veterinarians by forming Disease Preventive Community Health (DPCH) Groups. It was also observed that majority of the shepherds' exchange information on vector management, which is minimal and were within <5 km.

(G Narayanan, CS Sathish Gowda, G Govindaraj and M Nagalingam)

BTV outbreak in Andhra Pradesh: Assessing biosecurity management practices

The concept 'Biosecurity management' is being advocated for preventing the risk of emergence of diseases and its spread. For better application of this concept at field level and creating a movement for its wider adoption immense effort is required from animal health care givers. Hence, to understand the biosecurity adoption level by sheep farmers for preventing BTV outbreaks a survey was undertaken in three districts, viz., Anantapur, Guntur and Kurnool covering 295 sheep rearing farmers. The results revealed that majority of the farmers do not practice the key biosecurity measures such as timely vaccination (82.0%) and quarantining the newly purchased animal (97.0%). Majority of the farmers had housing for animals but two third of them do not adopted any vector control measures such as fumigation, netting etc to mitigate the BTV infection. It was also observed that 80% of the surveyed flocks housed in poor drainage surroundings which may harbor the BTV vector population.

(G Narayanan, G Govindaraj, M Nagalingam and CS Sathish Gowda)

Poultry and Osmanabadi goat distribution to increase income and livelihood of socio-economically weaker group

Kalinga Brown poultry was distributed to resource poor Scheduled Caste (SC) to create sustainable livelihood security. Among the 380 poultry beneficiaries more than one-third of them falls under the age group of 45-60, completed primary education and landless labourers. To assess the impact of introduced Kalinga Brown poultry, body weight gain and egg weight native chicks in a set of twenty chicks each compared among 30 beneficiaries. It was found that at the end of 36 weeks, the mean body weight gain of Kalinga brown was 1.29 ±0.18 kg/bird compared to country chicks (0.91±0.05kg/bird). At 52 weeks, the mean body weight of Kalinga brown recorded was 1.81±0.05kg/bird compared to the native chicks (1.21±0.05kg/bird). The average egg weight at 36th week was 45±0.5g in Kalinga brown, whereas in native chicken it was 36±0.7g. Similar results of increased weight gain were observed in Kalinga brown at 52 weeks. The highest B:C ratio realised by rearing Kalinga brown was 2.08 and in indigenous chicken it was 1.30. Thus, the introduced Kalinga brown chicks' enterprise was sustainable in terms of adaption and economic benefits. Further, under this programme Osmanabadi goat units (2 female + 1 male) were distributed among chosen marginalized beneficiaries during 2021. As a mid-term assessment, survey was conducted among 40 beneficiaries for its profitability and sustainability. The results revealed that the average net profit of Rs.35156 was realized by the beneficiaries and the estimated B:C ratio was 1.64. On surveying the sustainability factors for rearing goat in the village it was revealed through focused group discussion that 'training on scientific goat rearing practices by local veterinarian', existing of goat rearing system in the village, and availing of 'veterinary services at their door step' found to be the top three sustaining factors.

(G Narayanan, CS Sathish Gowda, R Sridevi, M Nagalingam, HB Chethan Kumar and R Yogisharadhya)

ICAR-NIVEDI Annual Report 2022

04

Capacity Development, Education and Trainings

Entrepreneurship development

Promotion of Agri-startups by NaaViC Grant-in-Aid support

NIVEDI's Agri-business Incubation Centre for Animal Husbandry and Veterinary Sciences (NaaViC), is nique institution for Startups on animal health with significant strength and strong network across India. NaaViC continued its promotion of agri-startup activities under the two flagship prgrammes (NEO and NEST) for the fourth year. During the period, physical verification of 2nd Cohort Grant-in-aid winning startups and progress of 1st Cohort were carried out. For the First Cohort, renewed previously signed MoU with startups (8) for the release of 2nd Tranche Grant-in-aid amount (Rs.40 lakhs). For the Second Cohort, signing of MoU with 7 startups for release of Grant-in-aid amount (Rs.29 lakhs) was carried out. For the third and fourth Cohort entrepreneurs, mentoring sessions were carried out and processed for release of grant-in-aid amount. In 5th Cohort, 1st RIC selected and recommended a total of 30 startups out of 254 business proposals for two months Agripreneurship Orientation Program. In RC meeting (10th Aug, 2022) for 5th Cohort held in association with MANAGE, Hyderabad and UAS, Dharwad, a total of 10 startups were recommended for Grant-in-aid to the tune of Rs.102 lakhs **(Fig 41).**

Fig 41: Entrepreneurial promotional activities conducted under RKVY-RAFTAAR scheme

In the month of May-2022, we launched 6th Cohort call for business proposals under NEO and NEST scheme, which received 169 business proposals (NEO-85; NEST-74). Upon screening, 51 were short-listed and finally trained 27 entrepreneurs in two-month long training. Further, in the month of September, launched 7th Cohort for business proposals under NEO and NEST scheme which received overwhelming 224 business proposals (NEO-147; NEST-77). Of them, 50 were short-listed and finally 29 entrepreneurs were recommended for two months agripreneurship-orientation training in order to enhance their ability to secure the Grant-in-aid support **(Table 13)**.

Table 13 **Events organized by NaaVic during the year**

Event details	Participants/ benificiaries	Total
No. of Workshops organized	Students, Research Scholars Faculty	11
No. of Sensitization programs in Colleges/ Universities	Students, Research Scholars Faculty	48
No. of Promotional fair attended for the Promotion of Agripreneurship	Startups, Students, Research Scholars Faculty	3
No. of Entrepreneurial training session organized	Students, Research Scholars Faculty	4
No. of Farmers Oriented towards the Entrepreneurship scheme	Farmers	120
No. of the Trainees attended in all workshops/ webinars	Students, Faculty, Research Scholars	1158
Types of participants attended the various workshops	Students, Research Scholars Faculty, Startups, Bureaucrats, Industry, Scientists, Farmers	8
Total FPO visit	Farmers	2
Social Media Outreach	Social	25000

During the period, team NaaVic attended annual review meeting as well as Agri-startup conclave & PM Kisan Samman Sammelan, in which Fyllo' startup incubated at NaaViC was shortlisted (one among top 5 startups) by the Ministry of Agriculture & Farmers Welfare for interaction with Honorable Prime Minister on 17th Oct, 2022 during the inaugural ceremony of the event at ICAR-IARI Mela Grounds, Pusa, New Delhi **(Fig 42)**.

Fig 42: NaaVic incubated startup Fyllo interacting with Hon'ble Prime Minister Shri Narendra Modi during PM Kisan samman sammelan at New Delhi

(R Yogisharadhya, A Prajapti, GB Manjunatha Reddy, MM Chanda and SB Shivachandra)

Promotion of Agri-entrepreneurship through flagship programmes of NaaViC

ABI (NaaViC) of ICAR-NIVEDI continued its entrepreneurial promotional activities under its flagship progrmmes (NEXUS and NOVICE) by conducting year-round knowledge enriching webinars/workshops. ABI signed a total of four MoUs with various institutes/organizations strengthen the ecosystem, and trained more than 1000+ youths & start-ups through workshops (11), sensitization programs (30), Ideathons, Hackathons and masterclasses towards taking the Agri entrepreneurship and various opportunities in the sector.

A total of four Entrepreneurship Development programmes (EDP) organized by NaaViC in collaboration with various institutions, and participants were provided with essential information regarding the various opportunities available in the Agri & Allied Sectors **(Fig 43).**

Fig 43: Entrepreneurial promotional activities organized by NaaViC under flagship programmes

The first virtual EDP was with MANAGE Hyderabad, and it lasted for five days and had 82 people signed up to take part in it. The second EDP was held at the Dairy Science College in Hebbal, and it was attended by a total of 90 people. Third EDP was with Veterinary College, Gadag and 25 participants attended the program. The fourth EDP was held at the Karnataka Science and Technology Academy (KSTA), which had a total of 100 participants. NaaViC actively participated in trade fairs held at Krishi Mela, Tech Bharat, UAS Bengaluru, and Bengaluru Tech Summit to promote startups and various schemes of NaaViC. More than 1,300 young entrepreneurs and 120 farmers were oriented towards entrepreneurship development. Promotional activities were also carried out through various social media platforms with a reach of more than 25000 across India. NaaViC generated a revenue of Rs.80,500/- through incubation charges to startups. Additionally, as a first of its kind, Team NaaViC analyzed various aspects of startup ecosystem and presented noteworthy findings as posters (6) in various national/international conferences for a greater reach. By now, Team NaaViC managed to nurture >150 agri-preneurs by handholding through mentoring till they received Grant-in-aid to the tune of >4 crores. In the process, it generated >80 direct and >6000 indirect employment opportunities to Indian youth. At present, cumulatively 44 stratups (both pre-seed / seed stage) are being incubated at NaaViC with a grant-in-aid support from the Ministry of A & FW, GoI **(Table 14)**.

(R Yogisharadhya, A Prajapti,
GB Manjunatha Reddy,
MM Chanda and SB Shivachandra)

Table 14 Capacity Developement Programmes organized by NaaVic

Name of Seminar /Workshop /Training	Venue	Date
Entrepreneurship Opportunities in Agriculture and allied sciences with special emphasis on the Biotechnology sector	ICAR-NIVEDI	1 April 2022
Entrepreneurship Opportunities in Animal husbandry and livestock sector	Veterinary College, Hebbal, Bengaluru	30 April 2022
Emerging Trends in Agri-Tech	Siddaganga Institute of Technology, Tumakuru	03 June 2022
Skill Vigyan in Biotechnology	ICAR-NIVEDI	30 June 2022
Various Govt Schemes for Ideapreneurs	UAS, Bengaluru	22 September 2022
Various opportunities for Ideapreneurs in Agri and Allied Sector	Veterinary College Shimoga	7 December 2022
Opportunities in Agri and Allied Sectors	DSATM	26 September 2022
Entrepreneurship Opportunities in Agri and Allied sectors and Various Govt Schemes	Atria Institute of Technology	10 October 2022
Entrepreneurship opportunities in Animal Husbandry & Livestock sectors	ICAR-NIVEDI	21 October 2022
Scope of Agri-preneurship	RC College of Commerce and Management	03 November 2022
Entrepreneurship opportunities in Agri and allied sectors for the engineering students	PESIT & M Shimoga	12 November 2022
Fostering Entrepreneurship Development in Livestock & Fisheries Sector	Virtual (MANAGE, Hyderabad)	22-26 August 2022
Livestock Entrepreneurship Development Programme for Youth	Veterinary College, Gadag	16-18 December 2022
Fostering Entrepreneuship Development in Dairy Sector	Dairy Science College, Bengaluru	08 December 2022
Augmenting Technologies for Transforming the Future of Animal Husbandry, Agriculture and Fisheries Sciences	KSTA, Bengaluru	28–29 December 2022

(R Yogisharadhya, A Prajapti, GB Manjunatha Reddy, MM Chanda and SB Shivachandra)

Human Resource Development

Institute has established collaborative linkages with various international and national organizations/ Institutions including NGOs for research and development activities, training, outreach activities etc. The institute has conducted need-based training programmes for scientists/ academicians/ field Veterinarians etc., working at various levels and trained on modern laboratory techniques, epidemiological investigations, NADRES software, EpiInfo software, epidemiological

analysis, forecasting of livestock diseases, GIS data analysis, diagnostics, research methodologies, the economic impact of diseases, sensitization programme on disease control, etc., These trainings were imparted to veterinary officers in the departments of animal husbandry, medical officers/ IDSP officers, field veterinarians, Assistant professors from SAU's, students from various disciplines of life sciences on the above-said areas

Awareness/Sensitization/other programs organized

Topic	Venue	Date
Sensitization meeting on Assessment of economic impact of priority animal disease and the cost effectiveness of their control strategies in India-Brucellosis	Department of Animal Husbandry, Bagalkote	4 January 2022
Sensitization program to school children on major zoonotic diseases	Government Lower Primary School, Ramagondanahalli, Bengaluru	6 July 2022
Sensitization program to farmers and general public on major zoonotic diseases	Suttahalli village, Doddaballapur (T)	7 July 2022
Awareness program for farmers to protect their rights in areas of farm innovations, breeding and protection of varieties	KVK, Kolar	19 July 2022
Campaign on 16th Parthenium Awareness Week	ICAR-NIVEDI	16-22 August 2022
Awareness program on Rabies for livestock farmers	Suttahalli, Doddaballapur (T)	28 September 2022
Rabies awareness program for pet owners and general public	Veterinary Clinical Complex, Yelahanka	28 September 2022
Outreach Awareness programme on Rabies for school children	Government Higher Primary School, Attur, Bengaluru	28 September 2022
Anti-rabies vaccination drive for dogs/ cats	Veterinary Clinical Complex, Yelahanka	28 September to 4 October 2022
Outreach Awareness program for livestock farmers on Rabies	Bhairapuratanda, Doddaballapura (T)	30 September 2022
Hands-on training on Handling *Leptospira* culture and Microscopic Agglutination Test (MAT) for diagnosis of leptospirosis	ICAR-NIVEDI	19-21 October 2022
A Comprehensive Immuno-informatics Study to design & Evaluate a Multi-epitope Vaccine against the Japanese Encephalitis	Spatial Epidemiology Laboratory, ICAR-NIVEDI	3 November 2022
World antimicrobial awareness week	ICAR-NIVEDI	18-24 November 2022
National Kisan Diwas: Doubling farmer's income	Farmers Training Center, Devanahalli	23 December 2022

Seminar / Webinar Organized

Topic	Venue	Date
Webinar on Q fever and Listeriosis	Virtual	25 June 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India for Himachal Pradesh veterinarians	ICAR-NIVEDI	5 July 2022
Webinar on Major zoonotic diseases transmitted from sheep and goats	Online	6 July 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India for Madhya Pradesh veterinarians	ICAR-NIVEDI	22 July 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India for Rajasthan veterinarians	ICAR-NIVEDI	23 July 2022
Webinar on Monkeypox: An emerging public health threat	ICAR NIVEDI	4 August 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India for Jammu and Kashmir veterinarians	ICAR-NIVEDI	5 August 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India for Madhya Pradesh veterinarians	ICAR-NIVEDI	7 August 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India to veterinarians of Karnataka state	ICAR-NIVEDI	9 August 2022
Webinar on Lumpy Skin Disease – control and containment to veterinarians of Rajasthan state	ICAR-NIVEDI	10 August 2022
Webinar on Epidemiology of Lumpy Skin Disease virus in India to veterinarians of Andhra Pradesh state	ICAR-NIVEDI	15 August 2022
Technical seminar on Clinical diagnosis, sample collection, treatment, prevention and control of Lumpy Skin Disease, Kolar, Karnataka State	ICAR-NIVEDI	18 August 2022
Diagnostic sampling procedures, control strategy and clinical management of Lumpy skin disease for Uttar Pradesh veterinary staff	ICAR-NIVEDI	31 August 2022
Technical Seminar on Brucellosis and Health Camp	Davanagere	7 September 2022
Webinar on Epidemiology of lumpy skin disease virus in India to veterinary staff of Chhattisgarh state	ICAR-NIVEDI	16 September 2022
Webinar on epidemiology of Lumpy Skin Disease for Kerala	ICAR-NIVEDI	17 October 2022
Webinar on epidemiology of Lumpy Skin Disease for Tamil Nadu	ICAR-NIVEDI	20 October 2022

Training / Workshop Organized

Topic	Venue	Date
Hybrid (online and offline) training programme on laboratory diagnosis of Leptospirosis under NCDC-NOHPPCZ programme	ICAR-NIVEDI	1-5 February 2022
DBT-ADMaC Phase II lecture series on Outbreak Investigation of emerging Viral Diseases of Pigs	ICAR-NIVEDI	7 March 2022
ICAR sponsored short course training on National Animal Disease Emergency Preparedness: An Animal Health Contingency Plan	ICAR-NIVEDI	14-23 March 2022
Hands-on training Programme on Laboratory Biosafety and Biosecurity practices in handling zoonotic pathogens	ICAR-NIVEDI	28-30 March 2022
Validation Parameters of Analytical Methods - LOB, LOD, LOQ	ICAR-NIVEDI	8 June 2022
In-silico identification of mutational & stability analysis of spike protein in SARS-CoV-2	ICAR-NIVEDI	9 June 2022
Codon usage bias analysis on Bovine Respiratory Syncytial Virus	ICAR-NIVEDI	9 June 2022
In silico validation of potential phytochemicals from Acacia Farnesia, a ACE2 inhibitor against SARS-CoV-2 Spike Protein	ICAR-NIVEDI	10 June 2022
An Immunoinformatics study to predict in infections Bovine Rhinotracheitis Surface Lycoprotein	ICAR-NIVEDI	10 June 2022
Immunoinformatics study to design Multi Epitope Subunit Vaccine against Bovine Coronavirus (BCoV)	ICAR-NIVEDI	14 June 2022
In silico identification of natural products from Calotropis gigantea as SARS - CoV-2 inhibitor	ICAR-NIVEDI	15 June 2022
High end workshop on Spatial and Temporal Modeling of Zoonotic Diseases using R	ICAR-NIVEDI	22-31 July 2022
Markov Chain, Hidden Markov Chain and its application	ICAR-NIVEDI	29 July 2022
Project workshop on Disease Burden Quantification in Small Ruminants and Impact of Adopting Preventive Interventions on Rural Livestock Farmers in Odisha	NADEN centre, ADRI, Cuttack, Odisha	17 August 2022
Computational Analysis to predict epitope candidates of S&N Proteins against Bovine coronavirus (BCOV) & Design a Multi numeric peptide based vaccine for Bovine - An intergraded approach of Reverse Vaccinology & Immuno-informatics	ICAR-NIVEDI	7 September 2022
Regional Workshop on State Action Plan for Dog Mediated Rabies Elimination by 2030	Bengaluru	14-15 October 2022
Hands-on training on Handling Leptospira culture and Microscopic Agglutination Test (MAT) for diagnosis of leptospirosis	ICAR-NIVEDI	19-21 October 2022
Protein Protein Interactions (PPI)	ICAR-NIVEDI	2 November 2022
A Comprehensive Immuno-informatics Study to design & Evaluate a Multi-epitope Vaccine against the JE	ICAR-NIVEDI	3 November 2022
Introduction to R Shiny	ICAR-NIVEDI	4 November 2022
SNP Identification	ICAR-NIVEDI	23 November 2022
LSD Evolutionary Models	ICAR-NIVEDI	24 November 2022

Training programme on Tools in descriptive veterinary epidemiology for Veterinarians

ICAR-NIVEDI organized hands on training programme on Tools in descriptive veterinary epidemiology for Veterinarians, Department of Animal Husbandry and Veterinary Services, Government of Karnataka in three batches during 3-5 and 10-12 January, and 14-16 February, 2022. During the training participants were taught about basic principles of veterinary epidemiology, describing the disease event in terms of place, time and host. During the training participants were provided hands on exercise on disease mapping using QGIS software and creating questionnaire and data analysis using EpiInfo software.

Training programme on Laboratory diagnosis of Leptospirosis

NCDC sponsored training programme on Laboratory diagnosis of Leptospirosis for the benefit of laboratory personnel involved in Leptospirosis diagnosis organized at ICAR-NIVEDI during 1-5 February 2022. During the training participants were trained on laboratory requirement for Leptospira diagnosis, isolation, dark field microscopy, microscopic agglutination test (MAT), sero-screening of the samples by ELISA, Latex Agglutination Test, Lateral Flow Assay and molecular diagnosis by PCR.

Training programme on laboratory biosafety and biosecurity practices in handling zoonotic pathogens

ICAR-NIVEDI organized training programme on laboratory biosafety and biosecurity practices in handling zoonotic pathogens during 28-30 March, 2022. In the aforementioned training program participants were made aware of introduction to biosafety and biosecurity, biosafety regulations in India, formulating agent specific laboratory biosafety practices for different zoonotic pathogens, biosafety laboratories facility design and validation, personal protective equipment, laboratory waste management.

ICAR short course on national animal health emergencies preparedness-an animal health contingency plan

ICAR-NIVEDI organized ICAR sponsored short course on “National Animal Health Emergencies Preparedness-An animal health contingency plan” during 14-23 March, 2022. During the training participants were trained on animal disease emergency preparedness planning, biosecurity risk analysis, sample size estimation for risk-based surveillance, creating maps using Qgis, and collecting and analysing data using epiinfo software.

Workshop on Tuberculosis and Anthrax

ICAR-NIVEDI organized a workshop on Tuberculosis and Anthrax on 19 December, 2022. Dr. Vivek Kapur from Penn State University, USA, Dr. M. Rajasekhar, Former Director, PDADMAS, Dr. Pallab Chaudhuri, Joint Director, ICAR-IVRI and the Scientists of ICAR-NIVEDI participated. Dr. Vivek Kapur elaborated the importance of tuberculosis and anthrax in India and highlighted the need for future research collaborations with NIVEDI for the control of bovine tuberculosis.

Invited lecture/talk/presentation/expert

1. Dr. D. Hemadri Principal Scientist, delivered an invited lecture on Bluetongue in India- an overview in the webinar organised by Sathya zerograzing on 28 May, 2022.

2. Dr. M. Nagalingam, Senior Scientist, delivered a lecture on “Latest development in *Brucella* diagnosis” and practical component on “Diagnosis of Brucellosis” on 20 December, 2022 under ICAR sponsored winter school 21 days training programme on “Recent Molecular Approaches in Diagnosis of Livestock and Poultry Diseases” from 2 December to 22 December, 2022 organized by State Level Diagnostic Laboratory (SLDL), Sri Venkateswara Veterinary University (SVVU), Tirupati.

3. Dr. M. Nagalingam, Senior Scientist, participated as a panelist in the one-day Brainstorming Session on 12 December 2022 on the topic “Brucellosis and Policy Intervention for its Control” organized by the Department of Veterinary Microbiology, DUVASU, Mathura.

4. Dr. M.M. Chanda Senior Scientist, delivered an invited lecture on JEV at the nexus of humans, animals, and the environment in India in webinar "to explore international perspectives on Japanese Encephalitis virus as a One Health challenge" organised by The University of Sydney Institute for Infectious Diseases (Sydney ID), Australasian Society of Infectious Diseases (ASID) Zoonoses Special Interest Group (ZooSIG), and Australian Veterinary Association (AVA) Veterinary Public Health Special Interest group (AVPH-SIG) on 21 April, 2022.

5. Dr. M.M. Chanda Senior Scientist, delivered an invited lecture on Crimean Congo Hemorrhagic Fever: An Emerging Zoonoses in India. Guest speaker in the International

webinar on World Zoonoses day organised by Manipal Institute of Virology (MIV), Manipal Academy of Higher Education on 6 July 2022.

6. Dr. M.M. Chanda Senior Scientist, delivered an invited lecture on Development of Questionnaires. In National Workshop on Epidemiological tools for antimicrobial resistance surveillance in veterinary medicine, held at Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Tirupati during 14–18 November, 2022.
7. Dr. M.M. Chanda Senior Scientist, delivered an invited lecture on Overview of Veterinary Epidemiology. In National Workshop on Epidemiological tools for antimicrobial resistance surveillance in veterinary medicine, held at Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Tirupati during 14– 18 November, 2022.
8. Dr. M.M. Chanda Senior Scientist, delivered an invited lecture on Risk factor identification. In National Workshop on Epidemiological tools for antimicrobial resistance surveillance in veterinary medicine, held at Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Tirupati during 14–18 November, 2022.
9. Dr. M.M. Chanda Senior Scientist, delivered an invited lecture on Systematic outbreak Investigation for effective prevention and control, Organised by Sathya zerograzing, held in online mode during 17 April, 2022.
10. Dr. M.M. Chanda, Senior Scientist, delivered an invited lecture on An Introduction to GIS (Geographical Information System) and application in Epidemiology. In National Workshop on Epidemiological tools for antimicrobial resistance surveillance in veterinary medicine, held at Department of Veterinary Public Health & Epidemiology, College of Veterinary Science, Tirupati during 14–18 November, 2022.
11. Dr. P. Krishnamoorthy. Senior Scientist, delivered a talk on Epidemiological terms used to describe the disease events. In ICAR sponsored short course training on Animal disease emergency preparedness: An Animal Health Contingency Plan held at ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, India during 14 to 23 March 2022.
12. Dr. V. Balamurugan, Principal Scientist as a Nodal Officer, delivered a lecture on “Leptospirosis” to 60 medical professionals from Dakshina Kannada in one-day sensitization workshop organized by the District IDSP unit, Dakshina Kannada, Karnataka on 28 October 2022.
13. Dr. V. Balamurugan, Principal Scientist delivered a invited lecture on updation on the laboratory activities in the Annual workshop of the WOAH reference laboratory network for PPR on 1 December 2022 -organized by CIRAD, Montpellier, FRANCE, online.
14. Dr. V. Balamurugan, Principal Scientist delivered a lecture on “PPR-Eradication Programme and National Strategic Plan for Eradication of PPR”. in a “Technical Workshop” for field veterinarians organized by the Department of Animal Husbandry and Veterinary Services, Bengaluru Rural District, GoK & ICAR- NIVEDI in association with Karnataka Veterinary Association Bangalore Rural Chapter at ICAR-NIVEDI, Bengaluru on 21 September 2022.
15. Dr. V. Balamurugan, Principal Scientist delivered an online invited lecture on PPR success story in the Fifth PPR Global Eradication Programme Advisory Committee Rome, Italy, 02-03 November 2022 organized by the FAO- FAO/WOAH -PPR secretariate, Italy.
16. Dr. V. Balamurugan, Principal Scientist delivered an online invited lecture on updation on the laboratory activities in the Annual workshop of the WOAH reference laboratory network for PPR on 1 December 2022 -organized by CIRAD, Montpellier, FRANCE.

17. Dr. V. Balamurugan, Principal Scientist Delivered an invited lecture on on Recent trends in immunodiagnosis of animal diseases to the participants of winter school on 14 December 2022 under ICAR sponsored winter school 21 days training programme on "Recent Molecular Approaches in Diagnosis of Livestock and Poultry Diseases" from 2 December to 22 December, 2022 organized by State Level Diagnostic Laboratory (SLDL), Sri Venkateswara Veterinary University (SVVU), Tirupati.

18. Dr. V. Balamurugan, Principal Scientist Delivered an Invited Speaker talk on Zoonoses Diseases in the World Zoonoses day State level Meeting Organized by SSU, Karnataka IDSP at Arogya Soudha, Bangalore on 6 July, 2022.

19. Dr. V. Balamurugan, Principal Scientist Delivered an invited specker lecture on PPR vaccination control Strategy adopted in the Indian States and lessons for the implementation of the national strategic plan for PPR eradication (NPPE) in India. in the fifth PPR Global Research and Expertise Network (PPR-GREN) meeting, held at Montpelier, France during 7-9 December, 2022.

20. Dr. V. Balamurugan, Principal Scientist Delivered Invited Speaker talk on PPR in Sheep and Goats in the National Webinar Joined organized by the ICAR-NIVEDI and Sathya zerograzing on 18 June, 2022.

21. Dr. V. Balamurugan, Principal Scientist delivered Invited talk on Status of Leptospirosis in India and future plan for the control of leptospirosis. In the NIAB, Hyderabad organized a zoonotic diseases workshop with special reference to Japanese Encephalitis (JE) and Leptospirosis under an umbrella of the DBT-flagship program entitled "Genomics assisted pathobiology to identify novel targets for diagnosis and therapeutic intervention(s) of Japanese encephalitis and Leptospirosis on 10 March, 2022.

22. Dr. V. Balamurugan, Principal Scientist invited as a Guest Speaker at the "3rd Conference of the Clinical Scientists on Research in Basic Medical Sciences and Annual General Body Meeting 2022" Organized by "National M.Sc Medical Teacher's Association(NMMTA)" on 11 September, 2022 at Wings Events, Bengaluru.

23. Dr. V. Balamurugan, Principal Scientist Invited as a Guest Speaker at the "3rd Conference of the Clinical Scientists on Research in Basic Medical Sciences and Annual General Body Meeting 2022" Organized by "National M.Sc Medical Teacher's Association(NMMTA)" on 11 September 2022 at Wings Events, Bengaluru.

24. Dr. V. Balamurugan, Principal Scientist Invited to deliver a lecture on "PPR-Eradication Programme and National Strategic Plan for Eradication of PPR". in a "Technical Workshop" for field veterinarians organized by the Department of Animal Husbandry and Veterinary Services, Bengaluru Rural District, GoK & ICAR- NIVEDI in association with Karnataka Veterinary Association Bangalore Rural Chapter at ICAR-NIVEDI, Bengaluru on 21 September 2022.

25. Dr. V. Balamurugan, Principal Scientist, Invited Guest lecture/Lead paper on the current status of PPR and its control and eradication strategy plan presented in VIROCON-2021 held on 26-28 March 2022.

26. Dr. V. Balamurugan, Principal Scinetist, presented a invited talk on PPR vaccination control Strategy adopted in the Indian States and lessons for the implementation of the national strategic plan for PPR eradication (NPPE) in India in the 5th PPR GREN meeting, held at Montpellier, France during 7-9 December, 2022.

Post Graduate Teaching and Research

The Institute has established memorandum of understanding (MoU) with various Universities / Organizations of mutual interest in the area of R & D activities, including post-graduate research, exchange of faculties for training, research, and study as per the guidelines of ICAR. Institute provided exposure, and training and facilitated the project/dissertation work of post-graduate students in the field of animal health. The following institutes/ Universities were in MoU with ICAR-NIVEDI during 2022.

MoUs for facilitating collaborative & contract Research

MoU signed with Institution	Date of Signing	Validity till
CCS National Institute of Animal Health, Baghpat	16 August 2022	15 August 2027/ 5 Years
Hassan Institute of Medical Sciences, Hassan	25 July 2022	24 July 2027/ 5 Years
Faunatech solutions private Ltd, Bengaluru	02 September 2022	01 September 2024/ 2 Years

Students guided by NIVEDI faculties for their M.Sc. dissertation work

Name of the Student	Name of the College/ University	Name of the Supervisor	Duration (Months)
Ms. Annett Helcita Dsouza	Dayananad Sagar University-Bengaluru	Dr. G B Manjunatha Reddy	6
Ms. Lincy Bernard	Reva University-Bengaluru	Dr. R Sridevi	3
Mr. Madhab Maharana	Reva University-Bengaluru	Dr. SS Jacob	3
Mr. Mannant Mehta	Reva University-Bengaluru	Dr. M Nagalingam	3
Mr. Nahid Praveen	Reva University-Bengaluru	Dr. P Krishnamoorthy	3
Ms. P. Rutuparna	Reva University-Bengaluru	Dr. R Sridevi	3
Ms. Priyanka Pradhan	Reva University-Bengaluru	Dr.N Shivasharanappa	3
Ms. Swathi Rani	Sri Krishna Arts and Science College-Coimbatore	Dr. KP Suresh	6
Ms. Apoorva K. N	Yuvaraja's college-Mysuru University-Bengaluru	Dr. N Shivasharanappa	6
Ms. Sinchana	Yuvaraja's college-Mysuru University- Bengaluru	Dr. KP Suresh	3
Ms. Sheethal U. M	Yuvaraja's college-Mysuru University-Bengaluru	Dr. KP Suresh	3
Mr. K. Venkatesh	Vijayanagara Sri Krishnadevaraya University-Ballari	Dr. GB Manjunatha Reddy	3
Ms. Madhumita	Sri Krishna Arts and Science College-Coimbatore	Dr. KP Suresh	6

ICAR-NIVEDI Annual Report 2022

05

Participation in Training/ Workshop/Conference/Meeting

Webinars attended

Topic	Venue/ organizers	Date	Attended by
Metagenomic data analysis (Virtual Mode)	ICAR-IASRI, New Delhi	19-24 January 2022	Dr. M Nagalingam
Webinar on JEV Outbreak in Australia - important insights for clinicians (Online)	The University of Sydney Institute for Infectious Diseases	17 March 2022	Dr. HB Chethan Kumar
Webinar on Japanese encephalitis information session for horse vets (Online)	Animal health Australia and Agriculture Victoria	5 April 2022	Dr. HB Chethan Kumar
Webinar on Japanese encephalitis virus – International One Health perspectives (online)	Sydney ID, ASID Zoo-SIG,AVAAVPH-SIG	21 April 2022	Dr. HB Chethan Kumar
Webinar on Genome Editing in Vegetable Crops for Improvement of Quality & Stress Tolerance (Online)	ICAR-IIVR, Varanasi	26 April 2022	Dr. KP Suresh
National webinar on Advances of Veterinary Sciences	CMSET and GADVASU, Ludhiana	30 May 2022	Dr. P Krishnamoorthy
Webinar on Japanese encephalitis: One Health in Action (Online)	CIDM-PH	3 June 2022	Dr. HB Chethan Kumar
Genomics in precision medicine (Online)	CDFD, Hyderabad	15 June 2022	Dr. M Nagalingam

Conference/Symposium/Conclave attended

Name of Conference/Symposium/ Conclave	Venue/ organizers	Date	Attended by
International Conference (Virtual Mode) on Transforming Livestock Economy through Innovations in immunology and Biotechnology	ISVIB, GADVASU, Ludhiana	4-5 February 2022	Dr. R Sridevi
Bio-economy India Conclave-2022	Bengaluru	22 Mar 2022	Dr. GB Manjunatha Reddy
National conference VIROCON 2021 on Emerging and Re-emerging Viral Diseases – Climate Change Impacts and Mitigation (Online)	AIIMS, Hyderabad	26-28 March 2022	Dr. V Balamurugan
22nd Indian Veterinary Congress, XXIX Annual Conference of IAAVR & National Symposium on Advancements in veterinary medical research contributing to one health for betterment of animal and public health	Udaipur, Rajasthan	8-9 April 2022	Dr. M Nagalingam
National Symposium on Self-Reliant Coastal Agriculture	ICAR-CCARI, Goa	11-13 May 2022	Dr. N Shivasharanappa
10th International conference of Laboratory Animal Scientists Association (LASA) India	ICAR-NAARM, Hyderabad	2-4 June 2022	Dr. P Krishnamoorthy
XX- NAVS Convocation cum Scientific Convention	Vet. College, Nagpur	20-21 June 2022	Dr. R. Shome
Orientation and launch of One Health pilot of One Health Support Unit, Department of Animal Husbandry and Dairying	ICAR-NIANP, Bengaluru, Karnataka	28 June 2022	Dr. V Balamurugan Dr. HB Chethan Kumar
International conference on Advances in Agriculture and & food system towards Sustainable Development Goals	UAS, Bengaluru	22-24 August 2022	Dr. PP Sengupta Dr. V Balamurugan Dr. SB Shivachandra Dr. R Sridevi Dr. GBM Reddy Dr. G Narayanan Dr. SS Jacob Dr. CS Sathish Gowda Dr. R Yogisharadhya Dr. A Prajapati
National seminar on Nutrition models and ethics for laboratory animals used in biomedical research	Vet. College and Research Institute, Namakkal	12 September 2022	Dr. P Krishnamoorthy
Agri-startup conclave and PM Kisan Samman Sammelan	ICAR-IARI, New Delhi	17-18 October 2022	Dr. SB Shivachandra
7th international conference on opportunities and challenges in agriculture, environmental and bio sciences for global development	Goa	29-31 October 2022	Dr. SS Patil, Dr. G Narayanan Dr. CS Sathish Gowda
International Veterinary Pathology congress 2022	College of Vet. Sciences, Hyderabad	17-20 November 2022	Dr. P Krishnamoorthy Dr. GBM Reddy
International Symposium on Zoonotic and Transboundary Diseases: Breaking the chain through Multidisciplinary Approach and XVIIIth Annual conference of IAVPHS	ICAR-NEH Complex, Umiam, Meghalaya	1-2 December 2022	Dr. N Shivasharanappa Dr. HB Chethan Kumar
31st National Congress of Veterinary Parasitology	College of Vet. Science and Animal Husbandry, Bhubaneswar	6-8 December 2022	Dr. PP Sengupta Dr. P Krishnamoorthy
Brain storming session on brucellosis and policy intervention for its control	DUVASU, Mathura	12 December 2022	Dr. M Nagalingam

Trainings attended

Name of Training	Venue/ organizers	Date	Attended by
Virtual Training on Collection of Brain Sample & Laboratory Diagnosis of Rabies in Animals	Veterinary College, Bengaluru	17-18 February 2022	Dr. V Balamurugan
One-day training under NVBDCP for district VBDC officers, entomologists, epidemiologists	Arogya Soudha, Bengaluru	19 March 2022	Dr. HB Chethan Kumar
181st training programme on Public Procurement (Basic)	Arun Jaitley National Institute of Financial Management, Faridabad	27 Jun to 2 July 2022	Dr. P Krishnamoorthy
Training program on National intellectual property Awareness Mission (Online)	Intellectual Property Office, India	12 July 2022	Dr. KP Suresh Dr. V Balamurugan Dr. P Krishnamoorthy Dr. R Sridevi Dr. G Narayanan Dr. SS Jacob Dr. CS Sathish Gowda
IP Awareness/Training program under National Intellectual Property Awareness Mission (Online)	Intellectual property Office, India	5 August 2022	Dr. SS Jacob
IP awareness/Training program under national intellectual property awareness mission (Online)	Intellectual Property Office, India	5 September 2022	Dr. GB Manjunatha Reddy
DST sponsored Building competencies for professional excellence	Art of Living International Centre, Bengaluru	5-9 September 2022	Dr. P Krishnamoorthy
18th MDP on Public Procurement (Advanced)	Arun Jaitley National Institute of Financial Management, Faridabad	17-21 October 2022	Dr. P Krishnamoorthy
Training programme on Metagenomic Data Analysis (Online)	ICAR-IASRI, New Delhi	18-21 October 2022	Dr. R Sridevi Dr. SS Jacob
Training programme on National facilitator development programme	MANAGE, Hyderabad	31 October to 5 November 2022	Dr. G Narayanan

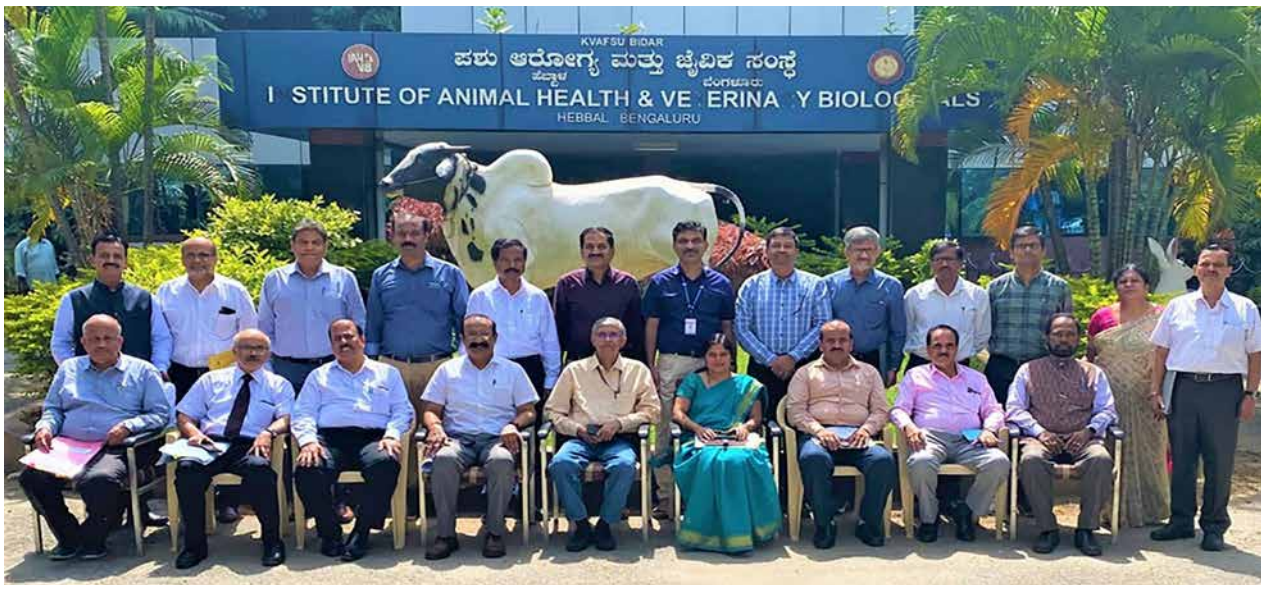
Workshop attended

Name of Workshop	Venue/ organizers	Date	Attended by
Workshop on National Animal Health Emergency Preparedness: An Animal health contingency	ICAR-NIVEDI	14-23 March 2022	Dr. S S Jacob Dr. CS Sathish Gowda
Workshop on zoonotic diseases with special reference to Japanese Encephalitis (JE) and Leptospirosis	NIAB, Hyderabad	10 March 2022	Dr. V Balamurugan
International Workshop on Antimicrobial resistance in food borne pathogens: Safety concern	Virtual Mode	14-16 March 2022	Dr. P Krishnamoorthy Dr. M Nagalingam
Workshop on Secure Trade and Transfers of Biotechnology: Regulations & Good Practices in India	Bengaluru	26 April 2022	Dr. GB Manjunatha Reddy
2nd Quadripartite One Health Intelligence Scoping Study External Advisory Group virtual workshop	Online workshop	13 July 2022	Dr. D Hemadri
SAMARTH Workshop and Annual Review meeting of ABIs	ICAR-IARI, New Delhi	4-5 August 2022	Dr. SB Shivachandra
Training workshop for vigilance officers of ICAR institutes	ICAR NAARM, Hyderabad	24-26 August 2022	Dr. G Govindaraj
Online Training workshop on Life Science meets Programming	IISR, Kozhikode	13-15 September 2022	Dr. R Sridevi
Regional Workshop on State Action Plan for Dog Mediated Rabies Elimination by 2030	Bengaluru	14-15 October 2022	Dr. GBM Reddy Dr. HB Chethan Kumar
Workshop on simulation interface for livestock systems	ILRI Tanzania country office, Dar es Salaam, Tanzania	17-20 October 2022	Dr. G Govindaraj
Online workshop of KRISHI Portal	ICAR-IASRI, New Delhi	10 November 2022	Dr. P Krishnamoorthy
NAVSI-GADVASU National workshop	Virtual mode	14-15 November 2022	Dr. KP Suresh

Meetings Participated

Topic	Venue/ organizers	Date	Attended by
PPR consultation meeting for South Asia (Virtual Video Conference mode)	OIE/FAO	20-21 January 2022	Dr. V Balamurugan
Minutes of 25th One Health Consortium Meeting (Online)	College of Vet. Science, AAU, Guwahati	22 April 2022	Dr. KP Suresh
One Health Consortium Meeting - (A) Veterinary Group; One Health Consortium Meeting - (B) Medical Group (Online)	NIAB Hyderabad	26 April 2022	Dr. KP Suresh
One Health Consortium (Interactive online meeting of MAFSU & NIVEDI)	NIAB, Hyderabad	4 May 2022	Dr. KP Suresh
IIC Regional Meet-22, Round Table Interaction Session on Innovation and Entrepreneurship Ecosystem	REVA University, Bengaluru	16 September 2022	Dr. SB Shivachandra
State monitoring committee online meeting-LHDCP (Regarding Implementation if III Round FMD Vaccination Programme under NADCP)	Vikasasoudh, Bengaluru	19 October 2022	Dr. KP Suresh
WHONET refresher course and 5th annual review meeting of INFAAR organized by ICAR and FAO, New Delhi	Kolkata	5-7 December 2022	Dr. N Shivasharanappa
5th PPR Global Research And Expertise Network (PPR-GREN) meeting	Montpellier, France	7-9 December 2022	Dr. V Balamurugan Dr. G Govindaraj

Interface Meeting



Scientists of the institute attended the interface meeting chaired by Shri Upamanyu Basu, Joint Secretary, DAHD, New Delhi, held at Institute of Animal Health and Veterinary Biologicals, Bengaluru on 17 August, 2022. The implementation and monitoring of National Animal Disease Control Program (NADCP) for Foot and Mouth disease, brucellosis, PPR and CSF in India was discussed.

Interactive meeting with Hon'ble Chief Minister of Karnataka

ICAR-NIVEDI Scientist participated in the meeting on Lumpy Skin Disease (LSD) control strategies for Karnataka state chaired by Hon'ble Chief Minister of Karnataka Shri Basavaraj Bommai held at Vidhana Soudha, Bengaluru on 14 October, 2022. Dr. GBM Reddy, Senior Scientist, ICAR-NIVEDI presented the status and control of LSD in Karnataka.

Interactive meeting with Dept. of AH&VS, Bagalkot, Karnataka

ICAR-ILRI project on "Assessment of the economic impact of priority animal diseases and the cost-effectiveness of their control strategies in India- Brucellosis survey" implementation meeting held at Deputy Directors Office, Dept. of AH&VS, Bagalkot, Karnataka on 4 January 2022.

Interation with Commissioner, Dept. of AH&VS, Govt. of Karnataka on LSD status in Karnataka

Mrs S Aswathi, IAS, Commissioner, AH&VS visited ICAR-NIVEDI on 3 December, 2022 and interacted with Director and scientists on the status of lumpy skin disease in Karnataka. During the meeting the strategies for control of LSD in the state of Karnataka were discussed.

Participation in the orientation and launch of DAHD One Health Pilot programme

ICAR-NIVEDI Scientists participated in the orientation and launch of One Health Pilot programme of DAHD held at ICAR NIANP, Bengaluru on 28 June 2022. Officials from department of Health and Family Welfare, Department of animal husbandry and veterinary services, Forsest participated. The One Health India programme will work to improve the health of livestock, human, wildlife and environment.

National Milk Day

ICAR-NIVEDI participated and exhibited the research activities during the National Milk day celebration jointly organized by Karnataka Milk Federation, State Animal Husbandry Department, DAHD GoI and NDDB, on 26 November 2022. Hon'ble Minister of State for Animal Husbandry, Fisheries and Dairying Dr. Sanjeev Kumar Balyan visited the NIVEDI stall and appreciated the contributions of NIVEDI in national livestock disease control programmes.

Scientists Participation in International events

Dr G Govindaraj, Principal Scientist participated in the workshop on Simulation interface for livestock systems held at ILRI, Tanzania during 17-20 October, 2022. The workshop aimed to improve the application of simulation interface for livestock systems to inform policy, planning and investment prioritization.

Dr. V Balamurugan, Principal Scientist and Dr. G. Govindaraj, Principal Scientist Participated in the fifth PPR Global Research and Expertise Network (PPR-GREN) meeting, held at Montpelier, France during 7-9 December, 2022.

06

Outreach, Extension and Institutional Activities

Mera Gaon Mera Gaurav (MGMG)

NaaViC R-ABI of ICAR-NIVEDI, Bengaluru organized the Kisan Bhagidari Prathmikta Hamari Campaign at MGMG village on 26 April 2022. The program was attended by 100 farmers and six startups. In the meeting, the importance of startups in agriculture sector how startups can solve the farmers day to day problems were discussed. Further, the different schemes launched by Govt. of India and the role of ICAR-NIVEDI in promoting the statups in veterinary sector were explained. The Bioprobe Labs Pvt ltd, Mysuru and Smart technologies, Bengaluru startups briefed about their products that are helpful to farmers. Dr. Umesh Yadav, a practicing field veterinarian briefed the farmers about the best practices to increase the milk yield.

Activities under Azadi ka Amrit Mahotsav

In consonance with India@75, “Azadi Ka Amrut Mahotsav” celebration guidelines ICAR-ICAR-NIVEDI organized extensive far reaching lecture series, webinars, awareness programs, scientists’-farmers’ interaction meet and health camps. The week 58 (18-24 April 2022) was exclusively assigned to ICAR-NIVEDI to organize weeklong events under the theme Animal Health Care for Better Productivity and sub-theme “Awareness Campaign” related to animal health and production sector. Four campaigns including three workshops were organized and 2100 participants were benifitted.

Animal health camp

Animal Health Camp was organised by ICAR-NIVEDI, in collaboration with Bengaluru Milk Union (BAMUL) and Veterinary Dispensary, Doddatumkur, Department of Animal Husbandry and Veterinary Services, Government of Karnataka at Gowdahalli village, Doddaballapur Taluk, Bengaluru rural district on 21 April 2022. The health check-up was conducted for dairy cattle, necessary treatment and advice were provided. Further, clinical and serum samples were collected and screened for various diseases. The health camp benefited 57 households.

Awareness campaign on scientific poultry rearing

ICAR-NIVEDI under DAPSC program, a campaign on scientific rearing of poultry was organized at Suthahalli village, Doddabalapur taluk, Bengaluru rural district on 22 April 2022. ICAR-NIVEDI scientists and Mr. Siddanayak, Member, Gram Panchayat, and farmers participated in the campaign. Further, the scientific literature (pamphlets) on 'Kalinga Brown: A Boon for Rural Poultry Farming' and 'Nutritional requirement for healthy life: Infant to old age under rural condition' were distributed to the farmers.

Annadata Devo Bhava Campaign

The Annadata Devo Bhava campaign was initiated by ICAR-NIVEDI at Jalige village, Devanahalli taluk, Bengaluru rural district on 12 April 2022. During the campaign the clinical samples from livestock were collected and diagnostic service was provided for the benefit of farmers. Further, a questionnaire based survey was undertaken to know the constraints faced by the livestock farmers. On the concluding day of the campaign i.e 23 April 2022 the scientist-farmers interface meet was conducted.

Kisan Bhagidari, Prathmikta Hamari

In line with "Kisan Bhagidari, Prathmikta Hamari' campaign, ICAR-NIVEDI had organized awareness campaign on "Crop Diversification and Integrated Farming System for doubling farmers income on 28 April 2022 at Channarayapatna village, Devenahalli taluk, Bengaluru rural district, Karnataka. Dr. Hanumanthappa, Professor, Dept. of Agronomy, GKVK, Bengaluru insisted the farmers to adopt crop diversification and Integrated Farming System model to increase productivity and profitability. Further, ICAR-NIVEDI organized farmers-scientist interaction meeting on animal health management with respect to LSD and Brucellosis and 50 farmers benefitted. The literature on brucellosis, leptospirosis were distributed to the farmers during the meet and the programme were disseminated through social media platforms like Facebook, Instagram, twitter and LinkedIn.

National webinar on advanced tools in outbreak investigation/animal husbandry practices

An expert talk on 'Systematic Outbreak Investigation in Sheep & Goats for Effective prevention and control' was delivered by Dr. Md. Mudassar Chanda, Senior Scientist, ICAR-NIVEDI.

Radio talk on Lumpy Skin Disease (LSD) and its management

Dr. Manjunatha Reddy GB, Senior Scientist, ICAR-NIVEDI delivered a radio talk on All India Radio about LSD etiology and created awareness about its management for the benefit of veterinary professionals and farmers in the state of Karnataka on 19 April 2022.

Radio talk on Role and importance of biosecurity in livestock disease control

Dr. Jagadish Hiremath, Senior Scientist, ICAR-NIVEDI delivered a radio talk on All India Radio about the 'Role and importance of biosecurity in livestock disease control' for the benefit of farmers in Karnataka on 20 April 2022.

Swachh Bharat Abhiyan-2022

Under Swachh Bharat Abhiyan, a cleanliness drive by GoI, ICAR-NIVEDI organised various programs *viz.,* special swachhta drive, parthenium awareness week, Rashtriya kisan diwas.

Special Swachhta drive at ICAR-NIVEDI campus

A special Swachhta campaign was organized on 9 April 2022 at ICAR-NIVEDI to kick start the Swachh Bharat Abhiyan programme in the new financial year. A day long programme was organized with a talk on personal hygiene and lessons learned through COVID-19: implications on healthy life, cleaning activities at parking, residential areas, weeding out of obsolete/redundant files, disposal of scrap of engineering section, STP, Cleaning of personal office premises and disposal of old materials/ surrendering to the store.

Parthenium Awareness Week 16-22 August 2022

The 17th Parthenium awareness week was organized at ICAR-NIVEDI. In this event the estate workers were sensitized on harmful effects of parthenium weed and conducted parthenium eradication drive to achieve the 'Parthenium-free ICAR-NIVEDI campus'.

Rashtriya Kisan Diwas

As part of *Swachhta Pakhwada* from 16 to 31 December 2022, Rashtriya Kisan Diwas was organized on 23 December 2022. In association with Department of Agriculture, Government of Karnataka at Sidlaghatta taluk, Chikkaballapur district, Karnataka. During the meeting, the existing schemes in agriculture and animal husbandry and services provided by ICAR-NIVEDI were explained and also distributed mineral mixture to the farmers. 82 progressive farmers including farm women benefited.

Awareness Programmes

World Rabies Day

On the occasion of 'World Rabies Day 2022', ICAR-NIVEDI organized an Outreach Awareness programme on Rabies for Govt. School students. During the program among the children awareness was created on etiology of rabies, transmission, symptoms in animals and humans, care and management of dog bite wounds and prevention and control of the disease.

World Antimicrobial Awareness Week

The World Antimicrobial Awareness Week was celebrated in the institute during 18-24 November, 2022. The theme for this year was 'Preventing Antimicrobial Resistance Together'. On this occasion, NIVEDI staff members took the pledge on prudent use of antibiotics in animal and humans. In addition, awareness programme on antimicrobial resistance among the school children in Ananya public school, Doddabellekere was conducted. Farmers-Scientists interactive meeting was also organized at Narayanpura, Devanahalli, Bengaluru rural district with special focus on subclinical mastitis in dairy cows and its prevention.

Awareness Programme on Farmers Rights

Awareness program for farmers to protect their rights in areas of farm innovations, breeding and protection of varieties was conducted by ITMU and scientists of ICAR-NIVEDI in collaboration with KVK, Kolar at Krishi Vigyan Kendra, Kolar on 19 July 2022.

Har Ghar Tiranga Campaign

On the occasion of 75th year of independence ICAR-NIVEDI on 7 June, 2022, initiated a month-long "Har Ghar Tiranga" campaign. During the event Awareness on 'History of National Flag' was created among the all the staff of ICAR-NIVEDI. During the event national flag badges were distributed to all the staff and motivated to hoist the national flag in their home.

Yoga session during International Yoga Day

ICAR-NIVEDI celebrated the International Yoga Day on 21 June, 2022 with the theme "Yoga for humanity". During the event Dr. B.R. Shome stressed upon the importance of practicing yoga and its benefit on mental and physical health. It was followed by yoga sessions for the staff members by the yoga trainer Mr. Ashvik on 21 June 2022.

ICAR-NIVEDI Foundation Day

The 35th Institute foundation day of the institute was celebrated on 1 July, 2022. On this occasion, the institute flag was hoisted by Dr B.R. Shome, Director (A). During the foundation day plantation drive was held in the institute premises. Dr. Rajeswari Shome presented the journey of the institute from AICRP on ADMAS to ICAR-NIVEDI. A lecture on physical, mental & emotional stability was delivered by Sister Brahma Kumari Kala. During the event eye checkup camp was organized for the staff in association with-Dr. Agarwals Eye Hospital, Yelahanka.

Celebration of Independence Day

On 15 August, 2022, ICAR-NIVEDI celebrated 76th Independence Day (75th Anniversary) with pride. Dr. B.R. Shome, Director, ICAR-NIVEDI hoisted the tricolor. In his speech, Dr. B.R. Shome paid tribute and respect to the martyrs and freedom fighters who fought for Independent India. He also further underscored the importance of research in animal disease epidemiology for betterment of health and productivity through effective forewarning, and evidence based preventive control measures.

Observance of National Unity Day

ICAR-NIVEDI celebrated National Unity Day on 31 October, 2022 to mark the birth anniversary of Shri Sardar Vallabhbhai Patel. During the event pledge was taken by the staff to preserve the unity, integrity and security of the nation.

Celebration of Vigilance Awareness Week

ICAR-NIVEDI celebrated Vigilance Awareness Week 2022 during 31 October to 6 November, 2022. On this occasion, quiz competition, essay competition for the staff members and vigilance awareness and quiz programme for the students was organized at International Institute of Business Studies, Devanahalli, Bengaluru.

Karnataka Rajyotsava at ICAR-NIVEDI

Karnataka Rajyotsava day was celebrated at ICAR-NIVEDI on 30 November 2022. During the event the Karnataka flag was hoisted by the Director and appreciated the staff for taking the effort to preserve and promote the rich heritage of Karnataka State and Kannada language. The speech was followed by culrutral programs.

Observation of Constitution Day

As a part of the Constitution Day celebration on 26 November, 2022, all the staff of ICAR-NIVEDI have read the preamble of the constitution.

Sister Brahma kumari Kala Spoke on role of women in the family during International Women's Day

ICAR-NIVEDI celebrated the International Women's Day on 8 March, 2022. Sister Brahma Kumari Kala, Brahma Kumari Centre, addressed the critical role need to be played by the women in the family and the importance of considering the working place as own family.

Celebration of Hindi Week

ICAR-NIVEDI celebrated Hindi week during 14-20 September, 2022 and on this occasion, various hindi literary events, viz., extempore, letter writing, quiz competition, translation and singing competions were organized for the NIVEDI staff members.

Outbreak Investigations

Dr. Jagadish Hiremath, Dr M Nagalingam, Dr G.B. Manjunatha Reddy and Dr. H.B. Chethan Kumar, Scientists investigated reproductive failure and piglet mortality in a pig farm in Shilubepura, Bengaluru on 27 January, 8 February, and 5 March 2022. During the investigation clinical history, farm management practice and other important information was collected by interviewing the farmer followed by collection of various clinical and necropsy specimen from affected pigs. The tissue and blood samples were found positive for *Brucella suis* by PCR and the serum samples were positive for anti-*Brucella* antibodies by RBPT and iELISA.

Dr. P. Krishnamoorthy visited Gadag district, Karnataka on 3-4 March, 2022 to study the epidemiology of cattle ticks and tick-borne pathogens. During the study a total of 839 ticks were collected and the morphological identification revealed the presence of *Haemaphysalis* spp. [48.6%], *Hyalomma* spp. [3.0%] and *Rhipicephalus* spp. [48.4%] ticks. The prevalence of *Anaplasma marginale, Babesia* spp., and *Rickettsia rickettsii* in ticks were 8.0%, 6.4% and 6.4%, respectively.

Dr. HB Chethan Kumar and Dr. Vinod Kumar conducted investigation of a suspected anthrax outbreak in humans and animals in Koppal district, Karnataka on 27 April, 2022. During the visit whole blood samples of sheep and goat and soil samples and one bone sample was collected for laboratory investigation. The team discussed and collected relevant information from the farmer, local veterinarian, assistant director, deputy director, department of Animal Husbandry and Veterinary Services and Department of Health and Family Welfare, Government of Karnataka. In the laboratory investigation using isolation and molecular techniques, the samples were found negative for *Bacillus anthracis*.

07

Research Projects

Project Title	Start Date	End Date	Project Team
Epidemiology of Bovine Diseases			
Indian network for fisheries and animal antimicrobial resistance (INFAAR) (Surveillance of AMR in animal species – under INFAAR Network initiated by ICAR) **(Institute Project)**	November 2018	Continuing	BR Shome* (31 January 2023) N Shivasharanappa* (w.e.f. 1 February 2023), R Shome P Krishnamoorthy A Prajapati (w.e.f. 30 December 2021)
Sero-epidemiology of Brucellosis (Service Project) **(Institute Project)**	April 2013	Continuing	Rajeswari Shome* BR Shome M Nagalingam
Sero-monitoring of Brucellosis control programme under National Animal Disease Control Programme (NADCP) for control of FMD and Brucellosis- ELISA kit supply and capacity building **(DAHD-NADCP)**	January 2021	January 2026	Rajeswari Shome* M Nagalingam
Validation and field testing of DIVA test developed in ADMac phase – I project for surveillance of brucellosis in North Eastern region of India under ADMac: Phase II Validation and translation of the vaccines as well as diagnostic technologies developed in Phase I of ADMac **(DBT- ADMac: Phase II)**	March 2021	March 2024	Rajeswari Shome* M Nagalingam
Prevalence study of leptospirosis in animals (Service Project) **(Institute Project)**	July 2022	Continuing	V Balamurugan*
Study on Sero-surveillance of surra in bovines **(Institute Project)**	April 2021	March 2024	PP Sengupta* SS Jacob

*Principal Investigator

Project Title	Start Date	End Date	Project Team
Development of recombinant multi-antigenic and fusion proteins based immune diagnostics for the surveillance of Leptospirosis **(Institute Project)**	April 2020	March 2023	V Balamurugan* M Nagalingam
National One health program for prevention and control of zoonotic diseases (NOHPPCZ), Intersectoral Coordination for prevention and control of zoonotic diseases **(NCDC-GoI)**	May 2019	March 2026	V Balamurugan* HB Chethan Kumar M Nagalingam SS Jacob Jagadish Hiremath MM Chanda KP Suresh D Hemadri GB Manjunatha Reddy
Seroepidemiology of Infectious Bovine Rhinotracheitis (IBR) in India (Service Project) **(Institute Project)**	April 2012	Continuing	SS Patil*, D Hemadri KP Suresh (w.e.f. 04 July 2022)
Epidemiological Investigation of Haemorrhagicsepticaema (HS)/ Pasteurellosis outbreak in Livestock (Service Project) **(Institute Project)**	January 2022	Continuing	SB Shivachandra* MM Chanda R Yogisharadhya A Prajapati
Epidemiology of Anaerobic Infection in Ruminants **(Institute Project)**	January 2022	January 2025	SB Shivachandra* MM Chanda R Yogisharadhya A Prajapati
Epidemiology of Lumpy Skin Disease in cattle and Buffaloes **(Institute Project)**	September 2021	September 2024	GB Manjunatha Reddy* N Shivasharanappa D Hemadri HB Chethan Kumar R Yogisharadhya
Does antimicrobial resistance (AMR) in livestock contribute to AMR in people in NE India. An interdisciplinary study investigating antibiotic use, drivers of AMR, and transmission dynamics **(Indo-UK AMR)**	November 2018	November 2022	BR Shome* G Govindaraj P Krishnamoorthy M Nagalingam R Sridevi R Yogisharadhya
Development of population assay for detection of LSD in cattle and buffaloes **(ICAR-CRP&VD)**	December 2022	November 2025	GB Manjunatha Reddy*, SS Patil N Shivasharanappa HB Chethan Kumar
Epidemiology of Small Ruminant Diseases			
Understanding nucleotide sequence variation and dynamics of serotype distribution in the epidemiology of bluetongue in Karnataka **(Institute Project)**	September 2020	August 2023	Divakar Hemadri* MM Chanda GB Manjunatha Reddy J Hiremath

*Principal Investigator

Project Title	Start Date	End Date	Project Team
ICAR-NIVEDI Network Center of National Center for Veterinary Type Cultures- under Veterinary Microbe Component **(ICAR)**	July 2021	Continuing	Divakar Hemadri* GB Manjunatha Reddy M Nagalingam
Characterization of bluetongue virus strains/serotypes and assessment of their suitability as vaccine candidates to the current field scenario **(NLM, DAHD-GoI)**	March 2022	March 2025	Divakar Hemadri* MM Chanda, PVNR Telangana, IAHVB Bengaluru, IBAB Bengaluru
Maintenance and updating of Livestock serum repository- NLSR **(Service Project)** **(Institute Project)**	August 2011	Continuing	Divakar Hemadri* KP Suresh, SS Patil
Action Plan for Surveillance and Monitoring of PPR in India under PPR-EP **(LH&DCP, DAHD-GoI)**	September 2022	March 2026	V Balamurugan* KP Suresh G Govindaraj D Hemadri N Shivasharanappa M Nagalingam G Narayanan HB Chethan Kumar SS Jacob, A Prajapati R Yogisharadhya
Epidemiology of respiratory Mycoplasmal infections in small ruminants **(Institute Project)**	November 2022	October 2025	R. Sridevi* D Hemadri N Shivasharanappa M Nagalingam A Prajapati
Monitoring and Surveillance of Sheep pox and Goat pox Diseases **(Institute Project)**	April 2017	March 2023	GB Manjunatha Reddy* V Balamurugan SB Shivachandra M Nagalingam R Yogisharadhya
Evaluation of status of anthelmintic and acaricide resistance in parasites of ruminants in India **(Institute Project)**	April 2022	March 2025	Siju S Jacob* PP Sengupta P Krishnamoorthy R Sridevi
Understanding the carrier status of small Ruminants (Sheep and Goats) in endemic areas with respect to *Pasteurella multocida* **(Institute Project)**	November 2018	September 2022	R Sridevi* M Nagalingam P Krishnamoorthy GB Manjunatha Reddy R Yogisharadhya A Prajapati (w.e.f. November, 2021)

*Principal Investigator

Project Title	Start Date	End Date	Project Team
Surveillance of ovine brucellosis with reference to *Brucella ovis* **(Institute Project)**	October 2018	September 2022	M Nagalingam* R Shome V Balamurugan GB Manjunatha Reddy R Sridevi
Evaluation of in-house population assay for surveillance of Peste des petits ruminants (PPR) **(Institute Project)**	July 2020	June 2022	V Balamurugan*
Patho-Epidemiology of Respiratory Diseases in Small Ruminants in India **(Institute Project)**	December 2021	December 2026	N Shivasharanappa* GB Manjunatha Reddy SS Patil, R Sridevi
Development of recombinant non-structural protein (NS1-NS3) based DIVA compliant competitive ELISA kit for population survey of bluetongue **(ICAR-CRP&VD)**	December 2022	November 2025	Divakar Hemadri*
Epidemiology of Swine Diseases			
Epidemiology and anti-viral therapeutic development-optimal sampling strategies for detecting animal COVs and risk analysis and surveillance for porcine respiratory and enteric coronaviruses **(ICAR-NASF Project)**	March 2021	March 2024	KP Suresh* J Hiremath
Action Plan for Surveillance and Monitoring of Classical swine fever during implementation of control programme (CSF-CP) **(LH&DCP, DAHD-GoI)**	September 2022	March 2026	SS Patil*, KP Suresh J Hiremath N Shivasharanappa R Sridevi G Narayanan HB Chethan Kumar
Immuno-epidemiological characterization of respiratory viral persistence in pigs **(Institute Project)**	October 2019	September 2022	Jagadish Hiremath* MM Chanda GB Manjunatha Reddy SS Patil, D Hemadri
Immuno-epidemiological characterization of Pig as an amplifying host of Japanese Encephalitis **(DST- SERB)**	December 2018	December 2021	Jagadish Hiremath* GB Manjunatha Reddy MM Chanda, SS Patil SB Shivachandra
Standardization of serological and molecular tests and surveillance of Japanese encephalitis virus infection in pigs in Southern part of Karnataka state **(Institute Project)**	October 2020	September 2023	HB Chethan Kumar* J Hiremath GB Manjunatha Reddy
Development of recombinant antigen-based ELISA for Serosurveillance of porcine cysticercosis **(ICAR-CRP&VD)**	December 2022	November 2025	Siju S Jacob* PP Sengupta

*Principal Investigator

Project Title	Start Date	End Date	Project Team
Animal Disease Informatics and Socio-economics			
National Animal Disease Referral Expert System- NADRES (Service Project) **(Institute Project)**	April 2011	March 2023	KP Suresh* D Hemadri, SS Patil P Krishnamoorthy SS Jacob
National Initiative on Climate Resilient Agriculture (NICRA) **(ICAR)**	February 2015	March 2024	KP Suresh* P Krishnamoorthy SS Jacob
Upgradation and Implementation of knowledge-based system (KBS) in NER of India an extended activity of advanced animal disease diagnosis and management consortium (ADMac) under ADMac: Phase II Validation and translation of the vaccines as well as diagnostic technologies developed in Phase I of ADMac **(DBT- ADMac: Phase II)**	March 2021	March 2024	KP Suresh*, SS Patil D Hemadri G Narayanan
Sampling plan generation for carrying out sero-surveillance and sero-monitoring and data analytics for FMD and Brucellosis **(DAHD-NADCP)**	January 2021	January 2026	KP Suresh* SS Patil D Hemadri
Establishment of a consortium for one Health to address Zoonotic and Transboundary diseases in India, Including the Northeast Region. (Development of Artificial Intelligence enabled early warning system for zoonotic and Transboundary Diseases in India including NER) **(DBT-One Health)**	August 2021	August 2024	KP Suresh*, SS Patil D Hemadri V Balamurugan
Development of an expert system for cattle diseases diagnosis: A participatory approach **(Institute Project)**	April 2017	March 2023	P. Krishnamoorthy* KP Suresh G Govindaraj
Molecular platform for epidemiology, disease mapping and development of diagnostics for economically important diseases of duck **(DBT Twinning programme for NER)**	September 2018	August 2021	SS Patil*, KP Suresh PP Sengupta
Quantifying ecological drivers for emerging zoonotic diseases in India **(Institute Project)**	January 2021	December 2023	MM Chanda* SB Shivachandra R Yogisharadhya A Prajapati
Integrating participatory approaches and traditional models to strengthen One Health responses to zoonotic diseases in India's changing environments **(UK Center for Ecology and Hydrology, UK)**	November 2021	November 2023	Bethan Purse* MM Chanda

*Principal Investigator

Project Title	Start Date	End Date	Project Team
Estimation of Economic Loss of Lumpy Skin Disease (LSD) in Cattle and Buffalo in Endemic states of India **(Institute Project)**	April 2022	March 2024	G Govindaraj* GB Manjunatha Reddy G Narayanan CS Sathish Gowda
Disease Burden Quantification in Small Ruminants and Impact of Adopting Preventive Interventions on Rural Livestock Farmers in Odisha **(DST)**	August 2019	August 2022	G Govindaraj* GC Bal M Nagalingam V Balamurugan SS Jacob
Assessment of the economic impact of priority animal diseases and the cost-effectiveness of their control strategies in India (ICAR-ILRI) **(ILRI)**	January 2019	December 2022	G. Govindaraj* V Balamurugan R Shome M Nagalingam P Krishnamoorthy
The economic impact of Bluetongue Virus (BTV) in sheep **(Institute Project)**	April 2020	December 2022	Sathish Gowda* D Hemadri G Govindaraj G Narayanan
Assessment of adoption of biosecurity practices for prevention of major infectious diseases of ruminants in Southern India **(Institute Project)**	April 2020	March 2023	G Narayanan* G Govindaraj M Nagalingam CS Sathish Gowda
Socioeconomic upliftment of the Scheduled caste livestock farmers and farm women in rural areas through improved livestock production technologies **(Institute Project)**	September 2020	September 2024	G Narayanan* CS Sathish Gowda R Sridevi M Nagalingam HB Chethan Kumar R Yogisharadhya
NaaViC			
R-Agri-Business incubator (ABI)-RKVY-RAFTAAR funded MoAFW, GOI **(DAHD-GoI)**	April 2019	March 2025	SB Shivachandra* GB Manjunatha Reddy R Yogisharadhya MM Chanda (w.e.f. 20 April 2021), A Prajapati (w.e.f. 20 April 2021)
ICAR- Agri-Business incubator (ABI)- ICAR funded NAIF-IP-and TM Division, ICAR, GOI **(ICAR)**	January 2020	Continuing	S.B. Shivachandra* GB Manjunatha Reddy R Yogisharadhya MM Chanda (w.e.f. 20 April 2021), A Prajapati (w.e.f. 20 April 2021)

*Principal Investigator

08

Technology Development and Commercialization

Consultancy/Contractual Research project

Contractual Research project entitled "Detection of Subclinical Mastitis and Disease Management programme at farm level for dairy farmers" with Faunatech solutions private Ltd, Bengaluru was initiated with the request form the company and executed MoU for the period of 2 Years up to 01.09.2024 with the offer and support from Biotechnology Industry Research Assistance Council (BIRAC), Department of Biotechnology, GoI.

Patent filed

Recombinant chimeric protein for detection of anti-leptospiral antibodies and methods thereof. (Application No. 202241064802; Date of filing 11.11.2022; Inventors: V Balamurugan, PrajJakta P Bokade, Vinodkumar K, M Nagalingam and BR Shome)

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Cattle disease diagnosis expert system – web application- CaDDES. (Application No. 2989/2022-CO/SW; Date of filing 10.02.2022; Date of registration 06.02.2023; RoC No- SW-15961/2023; Authors: P Krishnamoorthy, KP Suresh, D Ramesh, H V Dharshan and P Roy).

Advanced animal disease diagnosis and management consortium (ADMaC Mobile App). (Application No. 6652/2022-CO/SW, Date of filing 28.03.2022; Date of registration 24.08.2022; RoC No –SW-15777/2022; Authors: KP Suresh, D Hemadri, SS Patil and Kiran Kumar).

Bluetongue forewarning mobile application (BT Mobile App). (Application No. 6659/2022-CO/SW,Date of filing 28.03.2022; Date of registration 24.08.2022; RoC No – SW 15777/2022; Authors: KP Suresh, D Hemadri, P Krishnamoorthy, SS Jacob and Dharshan H V).

ANIP on GIP Mobile Application. (Application No. 6659/2022-CO/SW,Date of filing 28.03.2022; Date of registration 24.08.2022; RoC No – SW-15776/2022; Authors: PP Senugupta, KP Suresh,S S Jacob and GS Mohan Kumar).

Epidemiological calculator (EPI CAL) Web Application. (Application No. 6659/2022-CO/SW,Date of filing 28.03.2022; Date of registration 09.02.2023; RoC No SW-16034/202309-02-2023;Authors: KP Sureh and GS Mohan Kumar).

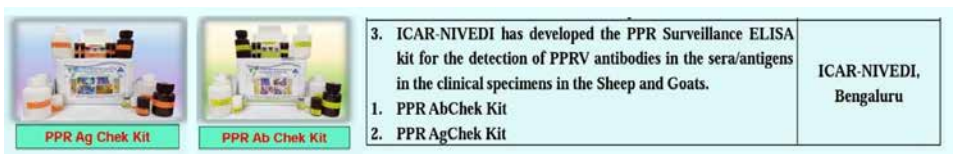
Copyrights filed

National animal disease referral expert system version 2 (NADRES v2 Web App). (Application No. 6651/2022-CO/SW, Date of filing 28.03. 2022; Authors: KP Suresh, D Hemadri, SS Patil, P Krishnamoorthy and SS Jacob).

Livestock disease forewarning (LDF Mobile App). (Application No. 6659/2022-CO/SW; Date of filing 28.03.2022; Authors: KP Suresh, D Hemadri, SS Patil and TM Chandrashekhar).

Technologies released

ABrC-ELISA (PPR Ab Chek kit) for the detection of PPR Virus Nucleocapsid protein antibodies in the serum samples and ABrAC-ELISA kits (PPR Ag Chek kit) for the detection of PPR Virus in Clinical Specimens of sheep and goats, was released by the Hon'ble Union Minister of Agriculture and Farmers Welfare in the presence of Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying during the 93 Annual General Meeting of ICAR on 26 March 2022.



Revenue generation

ICAR-NIVEDI generates revenue through sale of diagnostic kits and by providing diagnostic services. During the year a total of Rs.2,38,631.00 was generated through sale of various diagnostic kits.

09

Publications

Research Publications

1. Balamurugan V, Bokade PP, Kumar KV, SowjanyaKumari S, Nagalingam M, Hemadri D and Shome BR. (2022). Comparative diagnostic efficacy of Avidin-Biotin recombinant nucleoprotein competitive ELISA for serosurveillance and monitoring of peste des petits ruminants in sheep and goats. Journal of Immunological Methods, 512: 113409. http://krishi.icar.gov.in/jspui/handle/123456789/76822.

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1. Yogisharadhya R, Chethan Kumar HB, Jagadish B Hiremath, Manjunatha Reddy GB, Md. Mudassar Chanda, Shivasharanappa N, Patil SS and Sathish B Shivachandra. (2022). Jaanuvaru Swasthya Samhithe: Roga Niyantrana, Nirvahane Haagu Jaivika Bhadrate. Edition: First, Published by ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, India. pp 1-104. ISBN 978-93-5777-246-4.
2. Yogisharadhya R, Chethan Kumar HB, Jagadish B Hiremath, Manjunatha Reddy GB, Md. Mudassar Chanda, Shivasharanappa N, Patil SS and Sathish B Shivachandra. (2022). Jaanuvaru Sankramika Rogagalu: Nigraha, Niyantrana, Nirvahane. Edition: First, Published by ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, India. pp 1-114. ISBN 978-93-5777-722-3.

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2. Balamurugan V (2022). PPR Avidin-Biotin AC ELISA (PPR ABrAC ELISA- PPR Ag Chek Kit) for the detection of PPR Virus in Clinical Specimens. ICAR-NIVEDI, Bengaluru, Karnataka.
3. Balamurugan V (2022). PPR Avidin-Biotin C ELISA (PPR ABrC ELISA- PPR Ab Chek Kit) for the detection of PPR Virus antibodies serum samples of sheep and goats. ICAR-NIVEDI, Bengaluru, Karnataka.
4. Chanda MM (2022). Epidemiology of *Culicoides* borne diseases (CBDs) in domestic and wild ruminants. In: DST-SERB sponsored two-day training for research scholars on “Morphological and molecular identification of Culicoides, vectors of bluetongue virus”, organized by Entomology Research Unit, Department of Zoology, Burdwan University, West Bengal. pp 3.
5. Diwakar Hemadri, Sathish Gowda CS, Narayanan G, Patil SS, Abhijithnaik S and Shome B R. (2022). Bluetongue Virus in Sheep: Clinical Signs and Disease Control Measures. ICAR-NIVEDI, Benagluru, Karnataka.

6. Krishnamoorthy P (2022). Importance of pathology in Nutrition studies involving laboratory animals. In: National seminar on “Nutrition models and ethics for laboratory animals used in biomedical research” organized by Veterinary College and Research Institute, Namakkal, Tamil Nadu held on 12th August 2022. pp: 29-32.

7. Krishnamoorthy P and Suresh KP. (2022). Application of Artificial Intelligence in Animal Health. In: Compendium on “Startup opportunities in Animal Husbandry” organized by SKUAST, Jammu during 26-27th March 2022.

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10. Manjunatha Reddy GB, Chethan Kumar HB, Sudeep N, Shivasharanappa N and Yogeshardhya R. (2022). LSD - First Hand Information for Farmers. (F.No.13/NIVEDI / PMEC/EM & TB /2021-22/2223-10) (English).

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12. Manunatha Reddy GB, Avadesh Prajapati, Yogisharadhya R, Chethan HB and Jagadish Hiremath. (2021). Japanese encephalitis an important zoonotic disease. In: Rajbhasha Alok, Indian Council of Agricultural Research, New Delhi. pp 36-38.

13. Narayanan G, Sathish Gowda CS, Nagalingam M, Sridevi R, Govindaraj G and Abhishek SS. (2022). Creating awareness on Protection of Plant Varieties and Farmers& Rights Act, (PPV&FRA) 2001 among livestock farmers. ICAR-NIVEDI, Bengaluru, Karnataka.

14. Patil SS, Suresh KP, Hiremath J, Shivasharanappa N, Sridevi R, Narayanan G and Chethan Kumar HB. (2022). Handbook on action plan for monitoring of classical swine fever during implementation of control programme (CSF-CP) under NADCP/ LH&DC (2021-22 to 2025-26). Edition: First, Published by ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Bengaluru, Karnataka. pp 1-111.

15. Suresh KP, Hemadri D, Patil SS, Krishnamoorthy P, Siju SJ (2022). Livestock disease forewarning monthly Bulletin [January to December 2022, Vol 12 (1-12)]. http:// krishi.icar.gov.in/jspui/handle/123456789/ 69263; 69731; 70234; 71547; 72281; 72857; 73592; 73815; 74082; 74688; 75033; 75188

16. Yogisharadhya R, Prajapati A, Manjunath Reddy GB, Chanda MM and Shivachandra SB. (2022). NaaViC News Letter, Volume-6, ICAR-NIVEDI, Bengaluru, Karnataka.

17. Yogisharadhya, R., Prajapati, A., Manjunath Reddy, G. B., Chanda M. M and Shivachandra, S.B. (2022). NaaViC News Letter, Volume-7, ICAR-NIVEDI, Bengaluru, Karnataka.

18. डॉ. मजंनुाथरेड्डी जी. बी., डॉ. चेतन कुमार, एच. बी., डॉ. शिवशरणपा, एन., डॉ. योगशारया आर. 2022. लपी वायरस रोग (एलएसडी) पर अ/सर पछू जानेवाले (एफए/य) (2022)

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1. Training manual on spatial and temporal modeling of zoonotic diseases using R. (Ed. Chanda MM and Shivachandra SB) (2022). ICAR-NIVEDI, Bengaluru, Karnataka. pp. 1-100.
2. Training Manual on Animal Disease Emergency Preparedness (Ed. Jagadish Hiremath Chethan Kumar HB, Manjunatha Reddy GB*).* (2022). ICAR-NIVEDI, Bengaluru, Karnataka. pp. 12-16.
3. Training Manual on Laboratory Biosafety and Biosecurity Practices in Handling Zoonotic Pathogens (Ed. Jagadish Hiremath, R Sridevi, Chetan Kumar HB, Yogisharadhya, Manjunatha Reddy GB). (2022). ICAR-NIVEDI, Bengaluru, Karnataka. pp 3-4.
4. Training Manual on Laboratory Diagnosis of Leptospirosis (Ed. Balamurugan V, Vinod Kumar K, Nagalingam M. Sridevi R, Chethan Kumar H.B). (2022). First Edition, ICAR-NIVEDI, Bengaluru, Karnataka. pp. 64-66. ISBN 978-93-5607—534-4

10

Awards, Recognitions and Personal Milestones

Awards and Recognitions

1. Dr. KP Suresh, Principal Scientist received Prof. PC Mahalanobis National Award from Ministry of Statitistics and Programme Implementation, Government of India, New Delhi on the occasion of Statistics Day held on 29 June, 2022.

2. Dr. SS Patil, Principal Scientist received Fellow IAVMI 2022 in the 34th Annual Convention of IAVMI and National Conference on Current Trends in Immunodiagnostics &Vaccinology for health of Livestock and Poultry organized by LUVAS, Hisar, Haryana during 27-28 May, 2022.

3. ICAR-NIVEDI received 1st Prize in Swachhta Pakwada-2021 from the Hon'ble Shri. Narendra Singh Tomarji, Minister of Agriculture and Farmers Welfare, GoI, New Delhi at NASC, New Delhi on 13 April, 2022.

4. Dr. P Krishnamoorthy, Senior Scientist received the De Facto Diplomate of Indian College of Laboratory Animal Medicine for his contributions in the field of Laboratory Animal Science in the 10th International Conference of LASA India held on 2 June, 2022.

5. Dr. G.B.M. Reddy, Senior Scientist received Best Farm Animal Pathologists award 2022 for his contributions in the field of Farm animal pathology in the International Veterinary Pathology Congress 2022 held on 19 November, 2022.

6. Dr. P Krishnamoorthy, Senior Scientist received Best Laboratory Animal Pathologists award 2022 for his contributions in the field of Laboratory animal pathology in the International Veterinary Pathology Congress 2022 held on 19 November, 2022.

7. Dr. V. Balamurugan, Principal scientists received NAVS (I) Associate Fellowship Award 2021 in the 20th NAVS Convocation-cum- Scientific Convention held at Maharashtra Animal and Fishery Sciences University, Nagpur during 20-21 June, 2022.

8. Dr. S.S. Patil, Principal scientists received NAVS (I) Associate Fellowship Award 2021 in the 20th NAVS Convocation-cum- Scientific Convention held at Maharashtra Animal and Fishery Sciences University, Nagpur during 20-21 June, 2022.

9. Dr. Narayanan G received Young Scientist Award in Agricultural Extension in the 7th international conference on opportunities and challenges in Agriculture, Environmental and Bio sciences for Global Development held at Goa during 29-31 October, 2022.

10. Dr. Sathish Gowda CS received "Best Ph.D. thesis Award" in the 7th international conference on opportunities and challenges in Agriculture, Environmental, and Biosciences for Global Development held in Goa during 29-31 October, 2022.

11. Dr. Sridevi R received best poster award (3rd prize) for the presentation on "Antibiotic resistance among the Mannheimia sp. Isolates from Karnataka" in the International Conference (virtual mode) on Transforming Livestock Economy through Innovations in Immunology and Biotechnology organized by ISVIB & GADVASU, Ludhiana during 4-5 February, 2022.

12. Dr. Nagalingam M received best oral presentation award (3rd prize) for the presentation on "A cross sectional study for sero-prevalence and risk factors of brucellosis in sheep and goats of Odisha, Eastern India" in the 22nd Indian Veterinary Congress, XXIX Annual Conference of IAAVR & National Symposium on Advancements in Veterinary Medical Research Contributing to One Health for Betterment of Animal and Public Health and Their Welfare organized by College of Veterinary and Animal Sciences, Navania, Vallabhnagar, Udaipur during 8-9 April, 2022.

13. Dr. Kharkwal received best poster presentation award (1st prize) for the presentation 'Identification of risk factors and spatial risk mapping of Crimean Congo Hemorrhagic Fever (CCHF) disease in the state of Gujarat' in the XXXIV Annual Convention of Indian Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases and Annual Conference organized by LUVAS, Hisar during 27-28 May, 2022.

14. Dr. Shivachandra SB received best poster presentation award for the presentation "Isolation and partial characterization of *Clostridium chauvoei* strain from clinical case" in the XXXIVth Annual Convention of Indian Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases (IAVMI) & National Conference organised by LUVAS, Hisar, during 27-28 May, 2022.

15. Dr. Jagadish Hiremath received best oral presentation award for the presentation 'Risk based surveillance for Porcine Respiratory and Enteric Corona viruses' in the International Conference on Corona virus: Past, Present and Future organized by SKUASK, Jammu and Kashmir during 10-11 May, 2022.

16. Dr. Manjunatha Reddy GB received best oral presentation award (2nd prize) for the presentation "Molecular diagnosis and epidemiology of recently emerged lumpy skin disease in India" in the International Conference on Advances in Agriculture & Food System Towards Sustainable Development Goals organised by UAS, Bengaluru during 22-24 August, 2022.

17. Dr. Shivachandra SB received best poster award for the presentation "Spatial risk map for black quarter in Karnataka using remote sensing variables and statistical models" in the International Conference on Advances in Agriculture and Food System Towards Sustainable Development Goals (AAFS-2022) organised by UAS, Bengaluru during 22-24 August, 2022.

18. Dr. Shivachandra SB received best poster presentation award for the presentation "Isolation, identification and whole genome analysis of *Clostridium chauvoei*" in the International Conference on Biotechnology Trends and Future Prospects organised by UAS, Bengaluru during 13-15 September, 2022.

19. Dr. Narayanan G received best presentation award for the presentation "Animal Disease Control and Prevention: Biosecurity Preparedness Index to Implement On-Fram Biosecurity Practices for Maintaining Disease Free Livestock" in the 7th International Conference on Opportunities and Challenges in Agriculture, Environmental and Bio-sciences for Global Development organised by Don Bosco College of Agriculture, Goa

and College of Horticulture and Forestry, Pasighat-Arunachal Pradesh during 29-31 October, 2022.

20. Dr. Sathish Gowda CS received best presentation award for the presentation " Economic Impact Assessment of Bluetongue Disease in Sheep: A Study in Karnataka" in the 7th International Conference on Opportunities and Challenges in Agriculture, Environmental and Bio-sciences for Global Development organised by Don Bosco College of Agriculture, Goa and College of Horticulture and Forestry, Pasighat-Arunachal Pradesh during 29-31 October, 2022.

21. Dr. Patil SS received best oral presentation award (3rd prize) for the presentation "Seropositivity of Infectious Bovine Rhinotracheitis (IBR) in Indian Buffaloes" in 7th International Conference on Opportunities and Challenges in Agriculture, Environmental & Biosciences for Global Development organised by Don Bosco College of Agriculture, Goa and College of Horticulture and Forestry, Pasighat-Arunachal Pradesh during 29-31 October, 2022.

22. Dr. Nikhil received best poster award (3rd prize) for the presentation "Molecular characterization of gastro-intestinal protozoa of pigs from southern parts of Karnataka" in the 31st National Congress of Parasitology organized by Tamil Nadu Veterinary and Animal Sciences University, Chennai during 10-12 November, 2022.

23. Dr. Sunitha received best oral presentation award (3rd prize) for the presentation "In-vitro assessment of acaricidal property of piperine and nano-piperine on brown dog tick – *Rhipicephalus sanguinus"* in the 31st National Congress of Parasitology organized by Tamil Nadu Veterinary and Animal Sciences University, Chennai during 10-12 November, 2022.

24. Dr. Yuvaraja received best poster award (3rd prize) for the presentation "Assessment of acaricidal activity of curcumin and nano-curcumin against cattle tick *Rhipicephalus microplus"* in the 31st National Congress of Parasitology organized by Tamil Nadu Veterinary and Animal Sciences University, Chennai during 10-12 November, 2022.

25. Dr. Jayasri received best oral presentation award (1st prize) for the presentation "Molecular characterization and phylogenetic analysis of intestinal protozoa of cats from Bengaluru region of Karnataka" in the 31st National Congress of Parasitology organized by Tamil Nadu Veterinary and Animal Sciences University, Chennai during 10-12 November, 2022.

26. Dr. Manjunatha Reddy GB received best poster presentation award for the presentation "Pathological and molecular diagnosis of lumpy skin disease in cattle in Karnataka" in the International Veterinary Pathology Congress organized by College of Veterinary Science, PVNRTVU, Rajendaranagar, Hyderabad during 17-20 November, 2022.

27. Dr. Chethan Kumar HB received best oral presentation award (2nd prize) for the presentation "Veterinary surveillance of Japanese encephalitis virus in pigs through molecular detection" in the International Symposium on "Zoonotic and Transboundary Diseases: Breaking the Chain through Multidisciplinary Approach" and XVIIIth Annual Conference of Indian Association of Veterinary Public Health Specialists (IAVPHS) organized by ICAR Research Complex for NEH Region, Umiam, Meghalaya during 1-2 December, 2022.

28. Dr. Bhimanagoud received best poster presentation award (3rd prize) for the

presentation "Detection of Kyasanur Forest Disease virus in different tick species during an outbreak in Shimoga district of Karnataka" in the International Symposium on "Zoonotic and Transboundary Diseases: Breaking the chain through Multidisciplinary Approach" "XVIIIth Annual conference of Indian Association of Veterinary Public Health Specialists (IAVPHS) organized by ICAR Research Complex for NEH Region, Umiam, Meghalaya during 1-2 December, 2022.

29. Dr. Vinod Kumar received best poster presentation award (1st prize) for the presentation "Metabolic Remodelling during Biofilm Development of Pathogenic and Intermediate leptospires" in the International Symposium on "Zoonotic and Transboundary Diseases: Breaking the Chain through Multidisciplinary Approach" and XVIIIth Annual Conference of Indian Association of Veterinary Public Health Specialists (IAVPHS) organized by ICAR Research Complex for NEH Region, Umiam, Meghalaya during 1-2 December, 2022.

30. Dr. Sunitha received best poster presentation award (2nd prize) for the presentation "Molecular epidemiology of tick-borne parasitic diseases of dogs from Bengaluru region of Karnataka" in the 31st National Congress of Veterinary Parasitology organized by OUAT, Bhubaneswar during 6-8 December, 2022.

31. Ms. Veena received best oral presentation award for the presentation "Prevalence of leptospirosis among suspected pyrexia of unknown origin cases in Dakshina Kannada district, Karnataka, India in the year 2022" in the International Conference on Biomedical and Clinical Research organized by Shri Dharmashala Manjunathaeshwara University, Dharwad, Karnataka during 21- 22 November, 2022.

32. Leptospirosis Research Laboratory-ICAR-NIVEDI has received the certificate for participating in International Leptospirosis MAT Proficiency Testing Scheme in Round 18 (2021-2022).

33. Fyllo' startup (working on precision agriculture) incubated at NaaViC was shortlisted (one among top 5 startups) by the Ministry of Agriculture & Farmers Welfare for interaction with Honorable Prime Minister on 17 October 2022 during the inaugural ceremony of the event at ICAR-IARI Mela Grounds, Pusa, New Delhi.

Staff Joined /Transferred /Promoted /Superannuated

- Dr. Shivasharanappa N, Senior Scientist promoted to Pay level-13A w.e.f. 15th December, 2021
- Mrs. Saranya A, Steno Gr. III got promotion as Personal Assistant (PA) w.e.f. 1st January, 2022
- Shri. Gangadhareshwara L, Lower Division Clerk transferred on Deputation / Permanent absorption from ICAR-NIVEDI to ICAR-IIHR as Upper Division Clerk on 19th January, 2022
- Repatriation /reversion of Shri Santosh Kumar from the post of Assistant Administrative Officer, ICAR-NIVEDI to his parent cadre at ICAR-CMFRI, Kochi w.e.f. 7th February, 2022 (A/N)
- Dr. Mohd. Mudassar Chanda, Senior Scientist promoted to Pay level-13A w.e.f. 10th February, 2022
- Dr. G B Manjunatha Reddy, Senior Scientist promoted to Pay level-13A w.e.f 20th April, 2022

- Dr. M Nagalingam, Senior Scientist promoted to Pay level-13A w.e.f 21st April, 2022
- Shri. B Hanumantharaju, Skilled Supporting Staff (SSS) got promoted as Lower Division Clerk (LDC) w.e.f. 16th July, 2022 (F/N)
- Shri. Umesh H S, Skilled Supporting Staff (SSS) got promoted as Lower Division Clerk (LDC) w.e.f. 27th October 2022 (A/N)

Dr. B R Gulati, taken over the charge of Director, ICAR-NIVEDI w.e.f. 14 November 2022

Dr. Baldev Raj Gulati has assumed the charge of Director, ICAR-NIVEDI on 14 November, 2022 (AN). The staff extended warm welcome to Dr. B. R. Gulati. Later Dr. B. R. Gulati, Director held an introductory meeting with the staff of ICAR-NIVEDI.

Staff position as on 31 December 2022

Name of the Officers & Staff	Designation
Dr. Baldev Raj Gulati	Director w.e.f. 14 November 2022 (A/N)
Dr. B. R. Shome	Director (Actg.) (RMP) till 14 November 2022 (F/N) & Principal Scientist
Scientific Staff	
Dr. (Mrs.) Rajeswari Shome	Principal Scientist
Dr. D. Hemadri	Principal Scientist
Dr. P. P. Sengupta	Principal Scientist
Dr. K. P. Suresh	Principal Scientist
Dr. V. Balamurugan	Principal Scientist
Dr. S. S. Patil	Principal Scientist
Dr. Sathish B Shivachandra	Principal Scientist
Dr. G. Govindaraj	Principal Scientist
Dr. Jagadish Hiremath	Senior Scientist
Dr. P. Krishnamoorthy	Senior Scientist
Dr. (Mrs.) R. Sridevi	Senior Scientist
Dr. Shivasharanappa. N	Senior Scientist
Dr. Mohd. Mudassar Chanda	Senior Scientist
Dr. G. B. Manjunatha Reddy	Senior Scientist
Dr. M. Nagalingam	Senior Scientist
Dr. Narayanan G	Senior Scientist
Dr. (Mrs.) Siju Susan Jacob	Scientist
Dr. Chethan Kumar H.B	Scientist
Dr. C. S. Sathish Gowda	Scientist
Technical Staff	
Dr. R. Yogisharadhya	ACTO
Dr. Awadhesh Prajapati	ACTO
Administrative Staff	
Sh. P. Muraleedharan	AO
Sh. A. Vijaya Kumar	AF&AO
Sh. Santosh Kumar	AAO on deputation till 7 February 2022
Mrs. Saranya A	PA
Sh. K. Vijayaraj	Steno Gr-III
Mrs. Sridevi G. C.	UDC
Sh. Gangadhareshwara L	LDC till 19 Jauary 2022
Mr. B. Hanumantharaju	LDC
Mr. Umesh H. S.	LDC
Skilled Supporting Staff (SSS)	
Mr. M. K. Ramu	SSS

11

IRC, RAC and other Review Meetings

Quinquennial Review Team meeting

The 3rd meeting of 5th Quinquennial Review Team (QRT) of ICAR-NIVEDI was held during 5-6 September, 2022.

QRT Members of ICAR-NIVEDI
Dr. B.B. Mallik, Former VC, WBAFSU, Chairman
Dr. Lal Krishna, Former AHC & ADG (AH), ICAR, Member
Dr. V.A. Srinivasan, Former Director, IIL, Hyderabad, Member
Dr. A. Chakraborty, Former Director (Research), AAU, Member
Dr. J.R. Rao, Former Head, Division of Parasitology, ICAR-IVRI, Member
Dr. B.R. Shome, Director(A), ICAR-NIVEDI, Member
Dr. P.P. Sengupta, Principal Scientist, ICAR-NIVEDI, Member Secretary

The important recommendations of the QRT are to develop NIVEDI as an institute of excellence in animal disease modelling and epidemiology, to establish linkages with national and international agencies, need to create separate divisions of surveillance, epidemiology, economics and informatics and capacity building of NIVEDI faculty in modern trends of epidemiology.

Research Advisory Committee meeting

The 14th Research Advisory Committee (RAC) meeting of ICAR-NIVEDI was held on 14 September 2022.

Members of 14th RAC
Dr. Ashok Kumar, ADG(AH), ICAR
Dr. S.C. Dubey, Former JD, HSADL, Bhopal
Dr. Rajendra Singh, Former Head, Division of Pathology, ICAR-IVRI
Dr. C. Madhan Mohan, Principal Scientist, ICAR-IVRI
Dr. B.R. Shome, Director(A), ICAR-NIVEDI
Dr. S.S. Patil, Principal Scientist, ICAR-NIVEDI

The committee appreciated the efforts of NIVEDI in surveillance and monitoring of important livestock diseases in the country. The important recommendations of the RAC are establishment of cloud computing facility, disease prioritization and inclusion of LSD and ASF in forecasting, to disseminate the disease forewarning results to the farmers in the form of advisories and active surveillance of important infectious diseases. The RAC emphasised that NIVEDI should play a key role in economic loss assessment and providing technical inputs for national policies for animal disease control.

Institute Research Committee meeting

The 16th Institute Research Committee (IRC) meeting of ICAR-NIVEDI was held on 4 July 2022 under the Chairmanship of Dr B.R. Shome, Director (A).

The committee reviewed the research progress of ongoing institute research projects in the area of animal disease informatics, animal disease epidemiology, one health, animal disease socioeconomics and capacity building. Further, four new research project proposals were discussed in the meeting.

Institute Technology Management Committee meetings

Institute Technology Management Committee meetings of ICAR-NIVEDI were organized on 28 July and 1 December, 2022.

During the meeting on 28 July, a new patent proposal on "Recombinant *Leptospira* outer membrane chimeric protein(s)–based immuno–diagnostics for leptospirosis", copyright proposals on word art and logo of NaaViC, NEO, NEST, NOVICE, NEXUS logos and trademark of NaaViC were approved. During the meeting on 1 December, the technologies, *viz.,* ELISA based Surravey kit, Protein-G based indirect ELISA kit for bovine brucellosis, Indirect ELISA kit for sheep & goat brucellosis and IBR avidin biotin ELISA (AB-ELISA) kit were recommended for commercialization through Agrinnovate.

Institutional Animal Ethics Committee Meeting

The 19th Institutional Animal Ethics Committee (IAEC) meeting of ICAR-NIVEDI was held on 15 February 2022 under the Chairmanship of Dr B.R. Shome, Director (A).

During the meeting the project proposals requiring animal experiments were reviewed by the committee members. After thorough discussion two project proposals were approved with the use of 10 New Zealand white rabbits and 20 C57/BL/J6 mice, respectively.

Institutional One Health Ethics Committee Meeting

The meeting of the Institutional One Health Ethics Committee (IOHEC) was held on 12 October, 2022 in ICAR-NIVEDI, Bengaluru under the chairmanship of Dr. B. R. Shome, Director (A), ICAR-NIVEDI, Bengaluru.

The meeting of the Institutional One Health Ethics Committee (IOHEC) was held on 12 October 2022 in ICAR-NIVEDI, Bengaluru under the chairmanship of Dr. B. R. Shome, Director (A), ICAR-NIVEDI, Bengaluru. The important recommendations of the committee were to register the IOHEC with appropriate registering agency, provide training for the members of the IOHEC regarding relevant guidelines on ethical issues, design standard formats for submission and approval of the proposals, format for taking informed consent, telephonic consent, diagnostic report reporting format, publication of data from retrospective studies as per ICMR/relevant guidelines.

12

Distinguished Visitors

- Dr. K Srinivas, Assistant Director General (A) (Intellectual Property & Technology Management), ICAR, New Delhi Visited on 7 May, 2022.
- Dr. VA Srinivasan, Former Director, Indian Immunologicals, Hyderabad Visited on 23-24 June, 2022.
- Dr. KC Veeranna, Vice Chancellor, KVAFSU, Bidar, Karnataka Visited on 23 June, 2022.
- Maj. Gen. (Dr) Shrikant Sharma, Former Vice Chancellor, LUVAS, Hisar Visited on 29 June, 2022.
- Dr. Lal Krishna, Former Assistant Director General (Animal Health), ICAR, New Delhi Visited on 23 June, 2022.
- Dr. Manjunath S Palegar, Director, Department of Animal Husbandry and Veterinary Services, Government of Karnataka Visited on 10 January, 2022.
- Dr. M Suresh, Associate Dean, University of Wisconsin-Madison, USA visited on 2 June, 2022.
- Dr. A Chakraborty, Former Director (Research), AAU, Khanapara, Assam visited on 23-24 June, 2022.
- Dr. Chaitra Rao, Associate Project Director, NISAR, URSC, ISRO, Bengaluru visited on 8 March, 2022.
- Dr. JR Rao, Former Head, Division of Parasitology, ICAR-IVRI, Izatnagar visited on 23-24 June, 2022.
- Dr. T Thippeswamy, Additional Director (Livestock Health), Department of Animal Husbandry and Veterinary Services, Government of Karnataka visited on 3 January, 2022.
- Dr. MK Sudarshan, Chairman, Technical Advisory Committee (TAC), Karnataka visited on 23 March, 2022.
- Dr. D Swarup, Former Head, Division of Veterinary Medicine and Center for Wildlife, ICAR-IVRI, Izatnagar visited on 21 March, 2022.
- Dr. Janaki, HP, Former Deputy Director, Department of Animal Husbandry and Veterinary Services, Government of Karnataka visited on 8 March, 2022.
- Sis. Brahma Kumari Kala, Brahma Kumari Centre, Yelahanka, Bengaluru visited on 8 March, 2022.
- Shri GP Sharma, Joint Secretary (Finance), ICAR, New Delhi visited on 3 September, 2022.
- Dr. BB Mallick, Former Vice-Chancellor, WBVFSU, Kolkata visited on 5-6 September, 2022.

- Dr. Ashok Kumar, Assistant Director General (Animal Health), ICAR, Krishi Bhavan, New Delhi visited on 14 September, 2022.
- Dr. SC Dubey, Former Joint Director, HSADL, Bhopal visited on 14 September, 2022.
- Dr. R Singh, Former Head, Division of Pathology, IVRI, Izatnagar visited on 14 September, 2022.
- Dr. C Madan Mohan, Principal Scientist, Division of Veterinary Biotechnology, IVRI, Izatnagar visited on 14 September, 2022.
- Dr. Vivek Kapur, Penn State University, USA visited on 19 December, 2022.
- Dr. M Rajasekhar, Former Director, PDADMAS, Bengaluru visited on 19 December, 2022.
- Dr. Pallab Chaudhuri, Joint Director, ICAR-IVRI, Bengaluru visited on 19 December, 2022.
- Dr. Vijay Makhija, president of Indian Federation of Animal Health Companies visited ICAR-NIVEDI on 12 August, 2022 and interacted with scientists.

Dr. K. Srinivas, ADG (IP&TM), ICAR, New Delhi visited ICAR-NIVEDI on 7 May 2022 and held a meeting on sensitizing the ICAR-NIVEDI scientists on different aspects of IP and technologies for commercialization

Major General Dr. Srikanth Sharma, Former Vice Chancellor, Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Haryana and Former President of National Academy of Veterinary Sciences (NAVS) visited ICAR-NIVEDI on 29 June, 2022.

ICAR-NIVEDI in News...

ಲಸಿಕೆ ಹಾಕಿಸಿ, ನೈರ್ಮಲ್ಯ ಕಾಪಾಡಿಕೊಂಡು ಲಂಪಿಸ್ಕಿನ್ ರೋಗದಿಂದ ...ಬಿ. ಚವ್ಹಾಣ

ಚರ್ಮಗಂಟು ರೋಗಕ್ಕೆ ಮುಂಜಾಗ್ರತೆಯೇ ಮದ್ದು

ವಿಕ ಫೋನ್‌ಇನ್

ಇಲಾಖೆ ಕಾಳಜಿ

ರೈತರು ಪಾಲಿಸಬೇಕಾದ ಮುನ್ನೆಚ್ಚರಿಕೆಗಳು

ಸರಕಾರ ಕೈಗೊಂಡಿರುವ ಕ್ರಮ

ಲಕ್ಷಣಗಳು ಏನು?

ಸಹಾಯವಾಣಿ 8277 100 200

ಆಂಬ್ಯುಲೆನ್ಸ್ ಕಾಲ್ ಸೆಂಟರ್ 1962

3,591

38,726

22,684

1,723

0.1%

ಮುನ್ನೆಚ್ಚರಿಗೆ ಬರುವುದಿಲ್ಲ

ಮನೆ ಮದ್ದು

ಒಂದನೇ ಸೂತ್ರದ ತಯಾರಿಕೆ

ಸಣ್ಣ ಪ್ರಮಾಣದಲ್ಲಿ ತಿನ್ನಿಸಿರಿ

ಎರಡನೇ ಸೂತ್ರದ ತಯಾರಿಕೆ

ಔಷಧ ತಯಾರಿಸುವ ವಿಧಾನ

ಯಾವ ಜಿಲ್ಲೆಯಲ್ಲಿ ಹೆಚ್ಚು

ರೋಗ ಬಂದ ನಂತರ ಲಸಿಕೆ ಹಾಕುವುದಿಲ್ಲ

ಒಂದು ಸಾವಿರ ವೈದ್ಯರ ಕೊರತೆ

ಚೇತರಿಕೆಗೆ 3 ವಾರ

ಹಾಲಿನ ಇಳುವರಿ ಇಳಿಕೆ

ಕಾಲು ಬಾಯಿ ಜ್ವರಕ್ಕೆ ಲಸಿಕೆ

'ಪಿಲ್ಲಿಗೊಂಡು ಗೋಶಾಲೆ'ಗೆ ಜಾಗ ಹುಡುಕಿ

ಫೋನ್ ಇನ್ ಕಾರ್ಯಕ್ರಮದಲ್ಲಿ ಭಾಗವಹಿಸಿದ್ದವರು

'అనంత'లో నీలి నాలుకపై అధ్యయనం

చిలమత్తూరు: అనంతపురం జిల్లా చిలమత్తూరు మండలంలోని పలు గ్రామాల్లో బ్లూటంగ్ (నీలి నాలుక) వ్యాధి సోకి గొర్రెలు, మేకలు అక్టోబర్, నవంబర్, డిసెంబర్‌ల్లో 4,000కు పైగా జీవాలు మృత్యువాత పడ్డాయి. ఈ నేపథ్యంలో బ్లూటంగ్‌పై అధ్యయనానికి బెంగళూరులోని నేషనల్ ఇన్‌స్టిట్యూట్ ఆఫ్ వెటర్నరీ ఎపిడమాలజీ అండ్ డిసీజ్ ఇన్ఫర్మేటిక్స్ (నివేది) సంస్థ ప్రిన్సిపల్ సైంటిస్ట్ డాక్టర్ దివాకర్ ఆధ్వర్యంలో శాస్త్రవేత్తల బృందం బుధవారం మండలంలో పర్యటించింది. చేనేపల్లి, నల్లబొమ్మనపల్లి గ్రామాల్లో గొర్రెల నుంచి రక్త నమూనాలు సేకరించింది. వ్యాధి లక్షణాలు, నివారణ వంటి వాటిపై గొర్రెల కాపరులకు సూచనలు చేసింది. వ్యాధి తీవ్రత పెరిగిన దృష్ట్యా మండలంలో 15 వేల వరకూ గొర్రెలకు వ్యాక్సిన్ వేసినట్లు నివేది బృందానికి పశు వైద్యాధికారి చైతన్య చెప్పారు.

నల్లబొమ్మనపల్లిలో గొర్రెల మందను పరిశీలిస్తున్న నివేది బృందం సభ్యులు

సాక్షి Thu, 30 December 2021
https://epaper.sakshi.com/c/65268108

ముద్దచర్మ వ్యాధి నుంచి రక్షణ ఇలా..

లక్షణాలు...

పెట్టుబడి తక్కువ.. ఆదాయం ఎక్కువ

రైతేరాజు

రైతుల సందేహాలు శాస్త్రవేత్త సలహాలు

ಚಿತ್ರಾವಳಿ

ರಾಣೆಬೆನ್ನೂರು ತಾಲ್ಲೂಕಿನ ಹೀಲದಹಳ್ಳಿ, ಬೇಲೂರು, ಸೋಮಲಾಪುರ ಗ್ರಾಮದಲ್ಲಿ ಜಾನುವಾರುಗಳಿಗೆ ಹರಡುತ್ತಿರುವ ಚರ್ಮಗಂಟು ರೋಗವನ್ನು ಬೆಂಗಳೂರಿನ ಐಸಿಆರ್‌ಎಆರ್ ನಿವೇದಿ ತಂಡದ ವಿಜ್ಞಾನಿ ಡಾ.ಯೋಗೇಶ ಆರಾಧ್ಯ, ಡಾ.ಸಂಜಯಕುಮಾರ ಲಾಲಸಂಗಿ, ಡಾ.ವಿವೇಕಪ್ರಭು, ಡಾ.ಕುಮಾರ ಎಸ್‌ಸಿ, ಡಾ.ಚಿರಂಜೀವಿ ಆರ್‌ ಅವರು ಬುಧವಾರ ತಪಾಸಣೆ ನಡೆಸಿ ಚಿಕಿತ್ಸೆ ನೀಡಿದರು. ಶಾಸಕ ಅರುಣಕುಮಾರ ಎಂ. ಗುತ್ತೂರ, ಎಪಿಎಂಸಿ ಮಾಜಿ ಸದಸ್ಯ ಬಸವರಾಜ ಹುಲ್ಲತ್ತಿ, ಸಹಾಯಕ ನಿರ್ದೇಶಕ ಡಾ.ಪರಮೇಶ ಹುಬ್ಬಳ್ಳಿ ಇದ್ದರು

ಕುರಿಗಳ ನೀಲಿ ನಾಲಿಗೆ ಪರೀಕ್ಷಿಸಿದ ವೈದ್ಯರು

ಬಾದಾಮಿ: ಕೇಂದ್ರ ಸರ್ಕಾರದ ಕೃಷಿ ಮಂತ್ರಾಲಯ (ಐಸಿಎಆರ್ ನಿವೇದಿ ಸಂಸ್ಥೆ) ಯ ಬೆಂಗಳೂರು ವಿಜ್ಞಾನಿಗಳ ತಂಡ ತಾಲೂಕಿನ ಯರಗೊಪ್ಪ ಎಸ್.ಬಿ. ಮತ್ತು ಕಬ್ಬಲಗೇರಿ ಗ್ರಾಮದ ಕುರಿ ದೊಡ್ಡಿಗೆ ಭೇಟಿ ನೀಡಿ ಕುರಿಗಳಿಗೆ ಬರುವ ನೀಲಿ ನಾಲಿಗೆ ರೋಗದ ಹಾನಿ ಪರಿಶೀಲಿಸಿದರು. ಈ ಬಗ್ಗೆ ಸರ್ವೆ ಮಾಡಿ, ರಕ್ತದ ಮಾದರಿ ಸಂಗ್ರಹಿಸಿ ಕುರಿಗಾರರಿಗೆ ಮಾಹಿತಿ ನೀಡಿದರು. ಪಶು ಸಂಗೋಪನಾ ಇಲಾಖೆಯ ಸಹಾಯಕ ನಿರ್ದೇಶಕ ಎಸ್.ಎಚ್. ಕರಡಿಗುಡ್ಡ, ಮುಖಂಡರಾದ ಹನುಮಂತ ಅಪ್ಪನ್ನವರ, ಬೀರಪ್ಪ ಹನುಮಸಾಗರ, ಹನುಮಂತ ಪೂಜಾರ, ಚಿದಾನಂದ ಕಂತಿ ಇತರರಿದ್ದರು.

ಬಾದಾಮಿ ತಾಲೂಕಿನ ಯರಗೊಪ್ಪ ಎಸ್.ಬಿ. ಗ್ರಾಮದ ಕುರಿ ದೊಡ್ಡಿ ಸ್ಥಳಕ್ಕೆ ಅಧಿಕಾರಿಗಳು ಭೇಟಿ ನೀಡಿದರು. ಎಸ್.ಎಚ್. ಕರಡಿಗುಡ್ಡ, ಹನುಮಂತ ಅಪ್ಪನ್ನವರ, ಬೀರಪ್ಪ ಹನುಮಸಾಗರ, ಹನುಮಂತ ಪೂಜಾರ, ಚಿದಾನಂದ ಕಂತಿ ಇತರರಿದ್ದರು.

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