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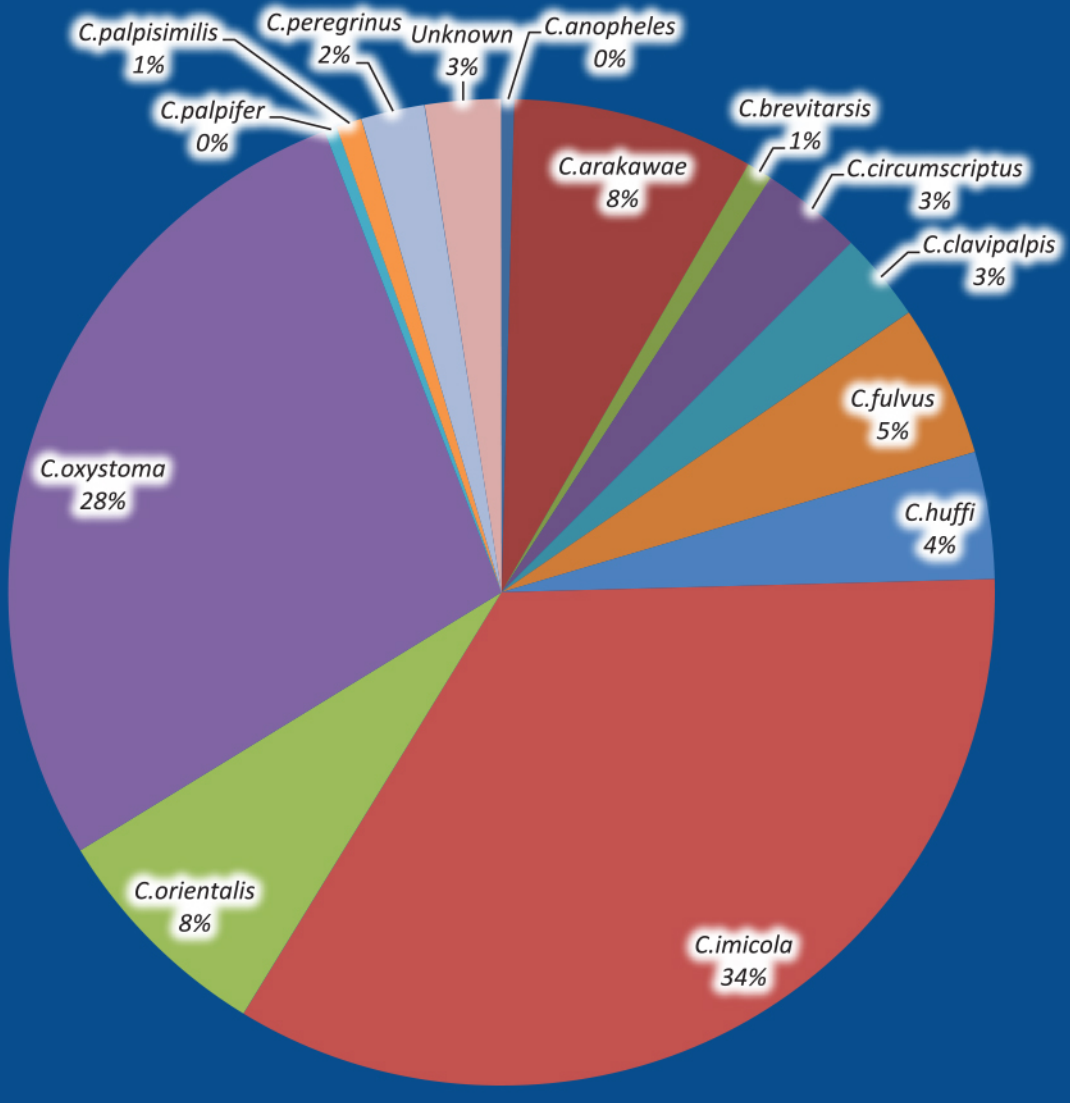
ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), Bengaluru



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Director

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Annual Report
2016-17

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Cover Front Page: Glimpses of activities and achievements in 2016-17
Cover Back Page: Pie Diagram showing distribution of *Culicoides* flies in Bannergatta National Park, Bengaluru, Karnataka

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'Jai Kisan Jai Vigyan'

Jai Hind!

(Parimal Roy)
Director

EXECUTIVE SUMMARY

During the year 2016-17, three new external projects have been initiated. This year, as per the NADRES report, Foot rot, Hemorrhagic Septicemia (HS), Black Quarter (BQ), Enterotoxaemia (ET), Glanders and Anthrax were recorded as the predominant bacterial diseases whereas Peste des Petits Ruminants (PPR), Capripox, Bluetongue (BT), Rabies and Classical Swine Fever (CSF) were reported as major viral diseases, and Fasciolosis, Amphistomosis, Anaplasmosis, Babesiosis, Coccidiosis and Trypanosomosis were found most frequently reported parasitic diseases. The monthly forewarning information were sent to DADF and other state animal husbandry departments two months in advance to take up suitable preventive measures.

During this period, 32 blood samples, 16 nasal swabs and 30 tissue samples from heart, liver, spleen, bone marrow from large and small ruminants belonging to Odisha, Madhya Pradesh and Karnataka were collected during outbreak investigation and further screened for presence of *Pasteurella multocida* by conventional methods like post mortem lesion and polymerase chain reaction (PCR) assay. A total of 8 samples were found positive by PCR. N-terminal gene of *P. multocida* encoding for NanB-Nt protein (~94 kDa) was expressed and characterized by SDS-PAGE and further it will be evaluated for its diagnostic potential. Two whole genome sequence, of *P. multocida* strain and *M. haemolytica* isolated from Yak were done and reported first time from India. A total of 157 Yak nasal samples were analysed and *M. haemolytica* (17.9%), *P. multocida* (3.9%) and *H Somnil* (2.5%) were detected. A multiplex PCR was optimized for detection of *Mannheimia haemolytica* and *P. multocida* in bovine clinical samples. Study on epidemiology of HS in livestock vis-à-vis Foot and Mouth Disease (FMD) in India revealed the high cumulative outbreaks of HS than FMD in Gujarat and FMD than HS in West Bengal. In both the states a decreasing pattern was noticed for both the diseases. In Gujarat, HS showed high case fatality rate (CFR) than FMD. In FMD vaccine effectiveness study, it was found that age & breed significantly affect the vaccine effectiveness of FMD vaccine in Karnataka.

A total 113 clinical environmental samples were collected from Odisha for screening of *Bacillus antharacis* 14 samples from cattle, elephant and pigs showed positive by standard laboratory technique. Further, risk factor analysis showed Kolar, Tumkur, Hassan, Mysuru, Chamarajanagara, Raichur, Belagavi, Gadag, Koppal and parts of Mandya were at high risk for anthrax.

A multi-epitope recombinant protein antigen of *Brucella abortus* was designed, synthesized cloned in the vector and expressed in addition to expression of individual immuno dominant proteins BP26, BLS, SodC, VirB12 etc. Further these recombinant proteins are to be evaluated in single or cocktail as diagnostic antigen in ELISA for bovine brucellosis. During this period, 4767 random serum samples received from 18 AICRP centers were screened for brucellosis. Among livestock species screened, high prevalence was observed in pig (40.19%) followed by sheep (20.82%), cattle (2.73%) goat (2.18%) and buffalo (1.11%). An overall prevalence of 7.69% was observed among all species. During milk surveillance for brucellosiss, 1986 milk samples from Kolar and Chickballapur were screened by Milk Ring Test (MRT) which showed 5.06% and 6.36% prevalence respectively. In house developed Protein G ELISA kit was validated against commercial Priocheck BrucellaAb 2.0 iELISA kit and it showed 95 % agreement which clearly indicated high sensitivity and specificity of in house developed kit. Fluorescent Polarization Assay (FPA) for sero-monitoring of brucellosis in livestock was developed and validated and was transferred to ADMaC core Lab-I to generate the geo-epidemiological data on brucelloisis in North Eastern States.

The extended spectrum beta lactamase producing multi drug resistant *Escherichia coli* isolated from subclinical mastitis milk was identified and characterized. The multidrug resistant *Proteus mirabilis* carrying multiple efflux pumps detected in apparently healthy pig fecal sample. *Escherichia coli* strain SCM-21 and *Proteus mirabilis* strain NIVEDI3-PG74 whole genome shotgun sequencing was done. The study concludes that the environmental variables are very crucial to study the epidemiology of pathogen and disease prediction to implement timely control measures to the present scenario of global climate change. Out of 96 human clinical isolates four were found positive for *E.coli*.

On virulence gene analysis, 50 *E. coli* isolates showed positive traT and six for cnf1 gene.

Out of 119 human samples of PUO cases 41.17% shown sero positivity for leptospirosis representatively of major of *Leptospira* serovars like Hurstbridge, Tarassovi, Javanica, Bataviae Pyrogenes, Shermani, Icterohaemorrhagiae, Kaup, Hardjo, etc., Out of a total of 1116 cattle samples, 617 showed seropositivity in MAT at 1:100 titre with 18 reference leptospira serovars. Out of 43 rat samples from Nagpur, 79.06% showed positive by MAT with serovars like Grippotyphosa, Hurstbridge, Australis, Tarassovi, Shermani, Bataviae, Bankinang, Canicola, Djasiman. Out of 297 human serum samples from Kerala, Karnataka and Dadra and Nagar Haveli, 55 samples were positive for IgG antibody in of *Toxoplasma gondi*.

The outbreak data of Avian Influenza (AI) from 2006 to 2015 were collected and analyzed with related risk factors namely Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Normalized Difference Moisture Index (NDMI) and Land Surface Temperature (LST), rainfall and other Anthropometric variable like distance from highways and rivers water-bodies and Poultry population density was found Nadia, Malda, Dakshin Dinajpur, and Purulia in WB and Nandurbar in Maharashtra. Spatial heat map of AI outbreaks in eastern and north eastern states from 2008-10 plotted. Economic impact of AI outbreaks to hatcheries, commercial poultry farms/duck farms, traditional duck farmers, tourist boat industry in Kerala during 2014 was carried out.

The economic loss due to pox in sheep and goat was estimated based on the data derived from secondary sources, and certain assumptions. It revealed that, the total loss estimated due to sheep and goat pox was INR 480.72 crore, 961.34 crore and INR 1442.05 crore at assumed 1%, 2% and 3% annual incidence levels, respectively. The PPR clinical score card was used for assessing the severity of disease pattern in sheep and goats like very mild, mild, moderate, severe, and very severe. Further, it was revealed that the outbreaks of the diseases remains in mild to severe form and mild to moderate form in the places nearby regularly vaccinated whereas the severe form of the disease occurred in the places where the vaccination was not conducted. In another survey in Karnataka it was observed that incidence was 8.31%. The estimated mortality loss, cost of treatment, distress sale and opportunity cost of labor among the infected flock was INR 3231, INR 108.2, INR 3040, and INR 15.7 per animal, respectively. A questionnaire has been developed to assess the risk factors for occurrence of Porcine Reproductive and Respiratory Syndrome (PRRS) using different variables. A total of 62 sero-prevalence samples were screened for PRRSV by RT-PCR, out of which 22 samples were found positive. Clinical samples received from different regions of India were screened by PCR and out of the total of 61 clinical samples, 3/20 from Sikkim, 1/2 from Kerala, 1/2 from Telangana, 3/10 from Karnataka, 2/27 from Madhya Pradesh were found positive for Torque Teno Virus (TTSuV) infection.

Out of 2008 serum samples from NER states screened for the prevalence of CSFV antibodies and showed 20.54% prevalence in Assam, 37.13% in Mizoram, 21.3% in Meghalaya, 44.07% in Manipur, 36.11% in Sikkim and 10.57% in Tripura. Meta analysis of ten CSFV study data from seven states of NER with sample of 1323, the seoprevalance of CSFV was estimated as 31% and same for BT was estimated as 35% when Meta analysis study was done with samples size of 460.

Three multiplex PCR were developed for detection of BTV serotypes 5 & 9, 3, 13 & 16 and 10 & 24 were developed, optimized and specificity was confirmed by nucleotide sequencing. Blood samples from different parts of states were collected and isolation of virus was done. The predominant isolates were belonged to BTV 1, 2, 3, 4, 5, 9, 16, 23, and 24. A total of 411 serum samples from small ruminants were received from the NE states like Assam, Mizoram, Manipur, Meghalaya, Nagaland and Sikkim. On screening for the presence of BT antibody, 88 samples found positive by C-ELISA kit. Highest prevalence found in Manipur where as the lowest was found in Assam. In another study 8000 *Culicoides* specimens from 31 sites near to wildlife sanctuaries were entrapped using CDC light traps with UV light for a period of eight months. Among them 13 major *Culicoides* species were found. The selected *Culicoides* species were DNA bar coded and BTV was detected in *C.oxystoma* and *C.imicola* samples. Results of study indicate that there is a circulation of *Culicoides* species in forest habitats and presence of BTV in some *Culicoides* species.

During this period, 9923 bovine sera samples from different states of India screened for the IBR antibodies using Avidin-Biotin ELISA and Chattisgarh showed highest prevalence rate with 50.54% whereas Nagaland showed least with 6.80%. A total of 16 isolates Bovine

Herpes Virus (BoHV) were received from Karnataka, Orissa, West Bengal and UP and maintained in virus repository of NIVEDI. In another study 2418 bovine serum samples NE states were screened for the presence of IBR antibodies by avidin biotin ELISA and an overall 33.79% positive was found. 59 bovine blood samples were screened by PCR for presence of BOHV-1 and 10 samples were found positive.

A total of 2077 *Lymnaea* spp. snails were collected from 25 water bodies covering 11 districts of Karnataka and screened for infection of *F. gigantica* by PCR targeting ITS 2 region. It was found that 5.1% of snails were found to be positive for *F. gigantica*. Deccan plateau of Karnataka showed highest prevalence with 5.79% followed by 5.22% in Western Ghats and 3.95% in Coastal region. Districts wise, Ramanagara showed highest infection rate with7.8% and Dakshina Kannada least infection (3.09%). Seasonal prevalence of infection was found to be more in winter (6.22%) followed by the rainy (4.61%) and summer (4.35%) seasons respectively. In another study, 968 bovine samples from Tamil Nadu, Madhya Pradesh, Karnataka, Bihar and Andaman & Nicobar isoland, Himachal Pradesh, Uttar Pradesh, Sikkim, Odisha, Assam, Mizoram and Puducherry were screened for the prevalence of *Trypanosoma evansi* antibodies using recombinant VSG based indirect ELISA and 732 (75.62%) animals showed positive. Puducherry showed highest (94.5%), whereas Odisha showed lowest (25.58%), prevalence.

During 2016-17 a total of 16824 serum samples were received from different states, were catalogued and aliquoted. The sera samples were screened for brucellosis, IBR, CSF, BT and trypanosomosis.

Three MoU has been made between ICAR-NIVEDI and Other institutes (Department of Biosciences and Bioengineering, IIT, Guwahati, College of Veterinary Sciences & Animal Husbandry, Bhubaneswar, Odisha, OUAT and SKUAST-Kashmir FVSc & AH) for carrying out collaborative research.

ABOUT ICAR-NIVEDI

ICAR-NIVEDI had its humble beginning as AICRP on ADMAS in 1987, upgraded to PD-ADMAS in 2000 and finally in the year 2013 the institute was rechristened as ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI). The coordinating units of AICRP-ADMAS continued to grow in number from 4 co-ordinating units during 1987 to 32 at present. ICAR-NIVEDI is a pioneering institute working with the mandate of R&D in the field of veterinary epidemiology and disease informatics. Its role is significant in developing disease models, risk analysis, animal disease forecasting & forewarning, need based diagnostics and analysis of disease economic impact. The institute has developed various technologies and patented few products which are being utilized by different stakeholders of the country. The role of this institute in the eradication of Rinderpest from India and development of National Animal Disease Referral Expert System (NADRES), interactive software for animal disease forecasting are noteworthy. The institute has been conducting plethora of training programmes related to epidemiology, economic impact, research methodologies, sampling frame and disease diagnosis for various stakeholders associated with animal health as part of capacity building in the area. The efforts of ICAR-NIVEDI have been appreciated and recognized by various organizations by conferring international and national awards and fellowships.

ICAR-NIVEDI plays a significant role by delivering many innovative solutions and services in the form of improved diagnostic techniques, animal disease forecasting and forewarning models, animal disease economic impact analysis and capacity building in animal disease epidemiology in the country. The institute is working on the following vision, mission, focus and mandates :

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 zoonoses and animal healthcare intelligence.

Focus

- Improving disease monitoring and surveillance through development of pen side diagnostics
- Risk assessment for 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 modelling/ forecasting
- Understanding economic impacts of animal diseases and the management strategies
- Promoting innovations and improving human resource capacity

Mandate of ICAR-NIVEDI

- Epidemiology, informatics and economics of animal disease including zoonoses
- Surveillance, forecasting and forewarning for management of animal diseases including zoonoses
- Repository and capacity development

Mandate of AICRP on ADMAS

- Strengthening of National Livestock Serum Repository
- Effective updating of NADRES with active disease data climatic and non-climatic risk factors
- Surveillance of diseases/pathogens of companion, lab and wild animals
- Analysis on economic losses due to animal diseases and the control measures adopted for their management
- Sero-monitoring of animal diseases based on sample frame
- Investigation of endemic, emerging and reemerging animal disease outbreaks using innovative technologies

INSTITUTE RESEARCH PROJECTS

Development of Geographic Information System (GIS) enabled Early Warning System for Avian Influenza (AI) infection using Remote Sensing (RS)

K P Suresh, M M Chanda, R Sridevi (NIVEDI) and S Nagarajan (NISHAD)

The aim was to study the spatial epidemiology of a disease remote sensing data and mapping. The disease outbreak data for AI was collected for the time period of 2006 to 2015. The variables of AI considered for the study are remote sensing variables. Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), Normalized Difference Moisture Index (NDMI) and Land Surface Temperature (LST), Meteorological variables, Anthropometric environmental variables and Management risk variables. Risk variables such as NDVI, LST, rainfall, Air temperature and other anthropogenic variables like distance from major cities, railways and highways, distance from nearest water-bodies like lakes and rivers, etc, Poultry density and Population density were generated using remote sensing. The Poisson Regression model was used in ArcMap for risk map generation. It was observed that environmental variables and their interactions were significantly associated with incidence of AI.

The high risk of disease occurrence is predicted in Jalgaon, Murshidabad and Birbhum regions and was represented in Red colour and followed by Nadia, Maldah, Dakshin Dinajpur, Nandurbar and Purulia represented in Rose colour (Fig. 1). Movement of AI outbreaks based on the year of occurrence is shown in the Fig. 2

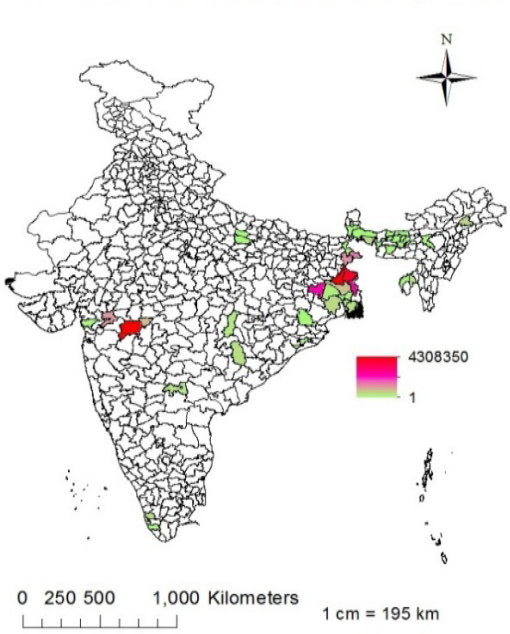


Fig. 1. Risk map for Avian influenza in India

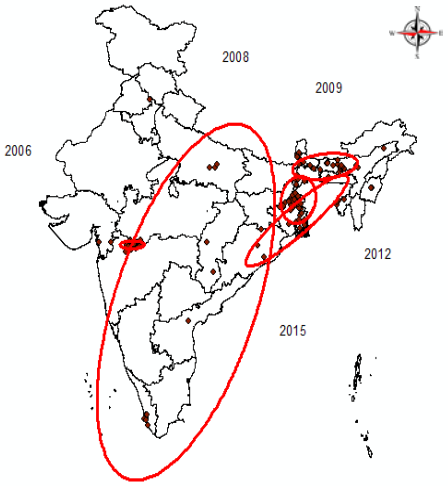


Fig. 2. Movement of AI outbreaks based on the year of occurrence in India

IPC: ANSCNIVEDISIL201500600069 Project ID: IXXI12456

Identification of ecological risk factors for occurrence of Anthrax in India

M M Chanda, D Hemadri, P P Sengupta, K P Suresh, R Sridevi and S B Shivachandra

Analysis of Anthrax outbreak data was conducted to develop risk map for Karnataka using remotely sensed variables (Fig. 3). The analysis revealed importance of elevation, day time land surface temperature and night time land surface temperature. The analysis identified the Kolar, Tumkur, Hassan, parts of Mandya, Mysore, Chamarajanagara, Raichur, Belgaum, Gadag and Koppal Districts as high risk areas. The risk map was validated using different accuracy and validation statistics (Kappa: 0.8233 ± 0.066, Sensitivity: 0.9908 ± 0.0105, Specificity: 0.9931 ± 0.0095). The risk areas identified will be useful for planning vaccination in high risk areas. The district level predictive model was also developed which can be used to predict outbreaks in different districts.

Suspected anthrax outbreaks that occurred in Karnataka was investigated. The clinical materials were collected from dead/live animals as well as from environment for diagnosis of anthrax. A total of 14 samples were collected from different outbreaks in Karnataka and two isolates of *Bacillus anthracis* were obtained. All the clinical specimens were processed as per standard conventional and molecular methods. The bacterial isolates of *Bacillus anthracis* were confirmed by growth characteristics, staining, Phage lysis and specific PCR assays.

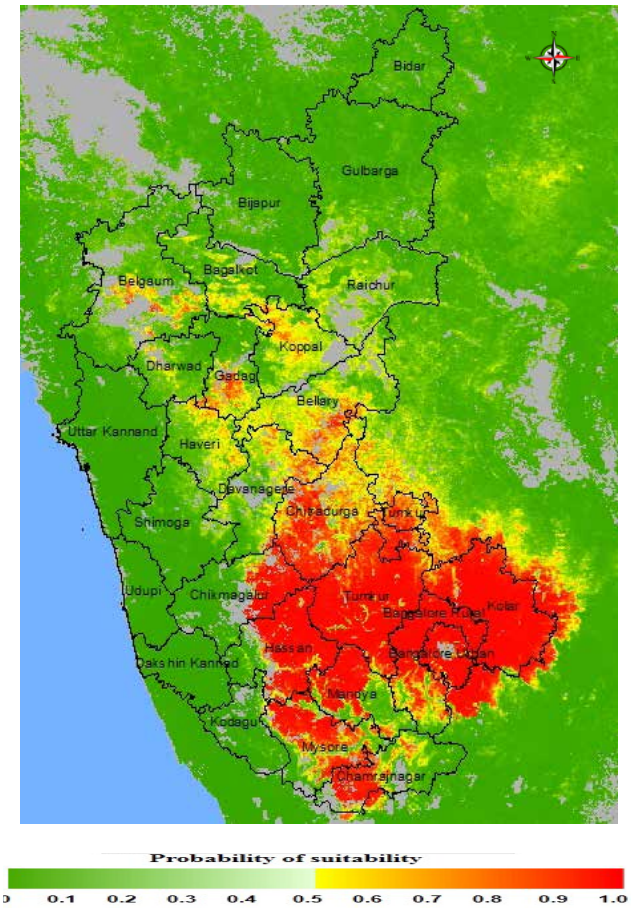


Fig. 3. Risk map for Anthrax in Karnataka showing high risk and low risk areas

IPC: ANSCNIVEDISIL201100200021 Project ID: IXX08329

Molecular epidemiology of MRSA, MR-CoNS and ESBL producing Gram-negative bacteria in animals including their environment

B R Shome and R Shome

Screening of MRSA/MRCoNS in livestock and handlers: Out of a total of cattle milk samples (n=123), nasal (n=50), extramammary site (n=46), wound (n=7), animal handlers (n=17) and environment (n=16) collected from various cattle farms of Karnataka, duplex PCR identified *Staphylococci spp.* in various sources as milk (n=201), nasal (n=62), extramammary site (n=56), wound (n=8), animal handler (n=23) and environment (n=20). *MecA* gene was detected in cattle milk (n=22), nasal (n=1), extramammary site (n=3), wound (n=2), animal handlers (n=7) and environment (n=0). A total of 32 sheep nasal swabs collected from Kolar, duplex PCR identified 35 Staphylococcus spp but none of the isolates were positive for *mecA* gene. Multiplex PCR for

species level identification identified majority of *mecA* positive isolates as *S.epidermidis* (n=12), followed by *S.aureus* (n=10), *S.haemolyticus* (n=7), *S.chromogenes* (n=1) and *S.scuiri* (n=1). SCC mec typing showed *S. aureus*, *S. epidermidis*, *S.heamolyticus*, *S.chromogenes*, as Type V among cattle and type V *S.epidermidis* (2) in cattle handlers.

Screening of ESBL/MBL/AmpC in livestock and handlers: Out of a total fecal samples (n=35), milk (n=34), extramammary site (n=15), wound (n=3), animal handlers hand swabs (n=6), cattle environment (n=6) (Karnataka), 74 Gram negative isolates were obtained viz., milk (n=16), fecal (n=33), extramammary site (n=15), animal handlers (n=4) and environment (n=6). Antimicrobial resistance genes were detected in 19 isolates by PCR viz., 13 from fecal (n=3 shv, n=1 ampC, n=5 mbl, n=2 shv +mbl n=2 ctxm1), 3 from milk (n=2 shv, n=1 shv+ampC), 2 from animal handlers (n=2 ctxm1) and environment (n=1 mbl).In goat fecal swabs (n=4) and sheep fecal (n=36) from Kolar, mPCR for *E.coli* identified in sheep (n=36 *E.coli*) in goat (n=5 *E.coli)*. Antibiotic resistance genes showed for tem (n=2), ctxm1+ampC(n=1), ampC(n=1), mbl(n=1) and tem+ampC(n=1). Where as in goat three *E.coli* isolates were positive for tem genes by PCR.

Antimicrobial resistance in human clinical samples (Hospital set up): Among human clinical isolates (n=96, 70 *E.coli* and 26 non *E.coli*) obtained from KIMS hospital, Bengaluru, plasmid replicon typing (n=63 *E.coli*) was done to investigate the presence of 18 replicons using three multiplex PCR assays, showing positive for four different genes in four isolates. PCR-based replicon typing approach, a novel method was carried out to describe the dissemination and evolution of resistance plasmids. Virulence gene analyses (n=63), showed 50 *E.coli* isolates positive for *traT* and 6 positive for *cnf1*genes respectively. MLST of *E.coli* isolates (n=9) showed ST 1079 to be predominant. Among human clinical isolates (n=100) obtained from Ramaiah hospital, Bengaluru 45 isolates showed combination of various antibiotic resistance genes while 33 isolates showed positive for genes viz., tem (n=1), ctxm1 (n=20), ctxm IV (n=3), ampC (n=6), mbl (n=3).

IPC: ANSCNIVEDISIL201201000034 Project ID: IXX09422

Epidemiology of Haemorrahgic Septicemia in livestock vis-à-vis Foot and Mouth Disease in India

P Krishnamoorthy, B R Shome and G Govindaraj

Village level time series data on HS and FMD outbreaks occurred in Gujarat (2006-17) and West Bengal (2009-16), were collected. The geo coordinates were also collected for outbreak villages and mapped using QGIS software version 2.10, and cluster analysis was carried using EpiInfo software version 7 (CDC, Atlanta, USA). The results revealed high cumulative outbreaks of HS (129) than FMD (70) in Gujarat and FMD (511) than HS (123) in West Bengal whereas trend analysis showed decreasing pattern for both diseases in these states. In Gujarat HS occurrence was high in monsoon season whereas FMD during winter season, but in West Bengal, both disease outbreaks were high in south west monsoon. Agroclimatic zone wise analysis revealed more number of HS in North Gujarat zone (36) and undulating red and laterite zone (81), FMD in North Saurastra zone (16) and gangetic alluvial zone (226) in Gujarat and West Bengal, respectively indicating variation in HS and FMD outbreaks occurring zones. District wise analysis revealed HS and FMD outbreaks reported were high in Rajkot (12) and Jamnagar (7) in Gujarat; Bankura (41) and Hooghly (69) in West Bengal, respectively. The prevalence and mortality rate per 10^3 population and case fatality rate (CFR) are presented in Table 1. The prevalence rate was high for FMD and mortality rate, CFR was high for HS in both the states indicating the importance of HS in death cases and FMD in diagnosed cases. The HS and FMD outbreaks were mapped for Gujarat (Fig.4a) and West Bengal (Fig. 4b). Cluster analysis showed important clusters for HS in Rajkot and FMD in Ahmedabad districts in Gujarat; HS in Purulia and FMD in North 24 Paraganas, Hooghly districts in West Bengal. Further, cluster analysis of HS and FMD outbreaks showed occurrence of no overlapping clusters in Gujarat and West Bengal (Fig. 4c&d), indicating no co-occurrence of HS and FMD in these states. Thus, the spatial and temporal variation in HS and FMD occurrence in these states indicated the need for vaccination in the specified districts at appropriate time for effective control of HS and FMD in animals. No co-occurrence of the HS & FMD during screening data.

Table 1 : Prevalence, Mortality and Case fatality rate of HS and FMD in Gujarat and West Bengal states

State Name	Prevalence rate per 10^3 Population		Mortality rate per 10^3 Population		Case Fatality Rate (%)	
	HS	FMD	HS	FMD	HS	FMD
Gujarat	0.22	**0.37**	**0.075**	0.008	**34.48**	2.18
West Bengal	0.04	**0.83**	**0.02**	0.003	**42.48**	0.36

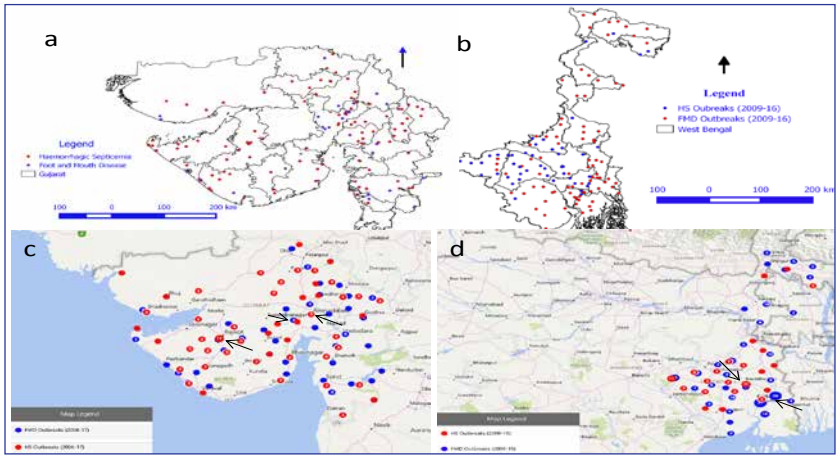


Fig. 4. Haemorrahgic septicemia and Foot and Mouth disease outbreaks mapped for Gujarat (a) and West Bengal (b) and depicting case cluster map of these diseases in Gujarat (c) and West Bengal (d) indicating the separate clusters.

IPC: ANSCNIVEDISIL201500300066 Project ID: IXX12176

Epidemiology of haemorrhagic septicaemia [HS] in India

S B Shivachandra, M M Chanda, J Hiremath, P Krishnamoorthy and R Yogishardhya

Haemorrhagic septicaemia outbreaks occurs regularly in different parts of the country. In Karnataka, the HS outbreaks are regularly reported since 1987 and from 2011 onwards there is slight reduction in the outbreaks. The analysis of HS outbreaks for Karnataka resulted in development of risk map and predictive model. In Andhra Pradesh and Telangana, the outbreaks were more severe (Fig 5) from the year 1992 until 2006. However, there was reduction in number of HS outbreaks from the year 2007 onwards and there were very few outbreaks in the year 2016. The reduction in number of outbreaks may be due to effective and planned vaccination in the Andhra Pradesh and Telangana.

During a reporting period, a total of 32 blood samples, 16 nasal swabs and more than 30 tissue samples (heart, liver, spleen, bone marrow) from sheep/goat/cattle/buffaloes belonging to Odisha, Madhya Pradesh and Karnataka were screened for presence of *P. multocida* by conventional methods as well as PM specific PCR assay. A total of 8 samples were found positive for *P. multocida* serogroup A in PM-PCR assay and serogroup A specific PCR assay with amplification of ~460 bp and ~564 bp products respectively. Rest all the samples were found negative for *P. multocida*. A cloned N-terminal gene (~2061 bp) encoding for NanB-Nt protein (~94 kDa) of *P. multocida* was over-expressed and purified from recombinant *E. coli* BL21-CodonPlus(DE3)-RIPL cells by affinity chromatography using Ni-NTA superflow cartridges. Further, a purified rNanB-Nt protein along with native antigens would be evaluated for its diagnostic efficacy using indirect-ELISA.

Estimating HS vaccine effectiveness (VE) and identifying the factors that influence HS VE is important for HS control in endemic areas. To achieve this, a questionnaire was prepared and field testing is in progress. A separate questionnaire was also prepared to estimate the field level VE of HS vaccine as perceived by the veterinarians.

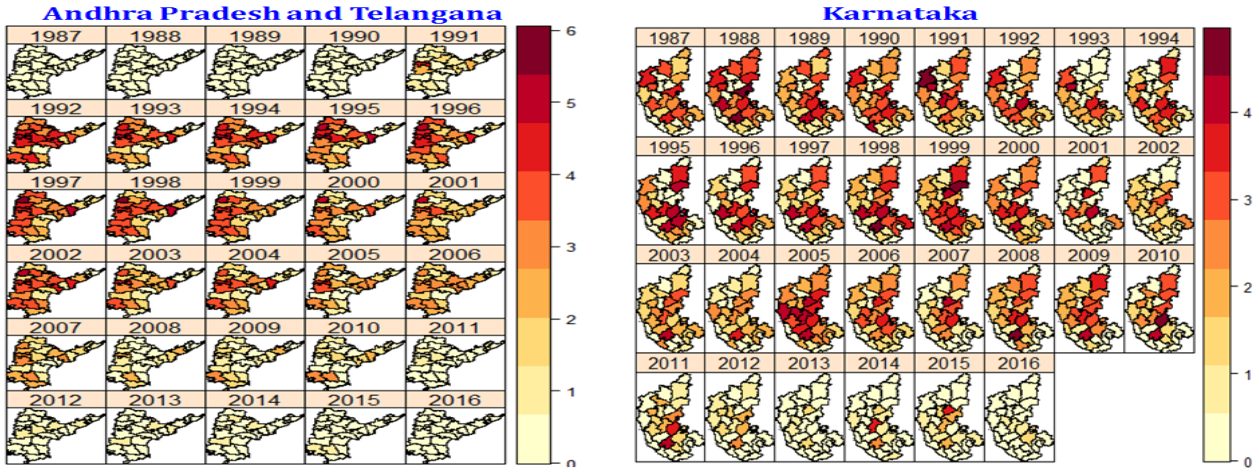


Fig. 5. Map showing Haemorrhagic septicaemia outbreaks (1987 - 2016) in Andhra Pradesh, Telangana and Karnataka.

IPC: ANSCNIVEDISIL201201800042 Project ID: IXX09665

Epidemiology and impact analysis of sheep and goat pox

G B Manjunathareddy, V Balamurugan, D Hemadri and G Govindaraj

The secondary data analysis for last 10 years, the highest number of outbreaks were reported during the year 2006 followed by 2000 and 2005. Among the different states, south India states reported more number of outbreaks. The number of outbreaks, attacks and mortality followed similar trends over a period of time. The sheep and goat pox disease outbreaks were more recorded during December to May followed by decline in the number of outbreaks. The spatial distribution showed more number of outbreaks in southern India than rest of India.

During active surveillance, the disease outbreaks were recorded in unvaccinated flocks. The clinical signs, postmortem and microscopic lesions observed were characteristic of sheep and goat pox. The capripox viruses were isolated from the clinical samples and confirmed by P32 gene based PCR and sequencing of partial and full length P32 gene. The phylogenetic analysis revealed 94.6% to 100 % homology with all the other Indian capripox virus isolates at nucleotide as well as amino acid levels (Fig 6).

The economic loss due to pox in sheep and goat was estimated based on the data derived from secondary sources, expert opinion, field investigation results and past reviews. The results revealed that, the total loss estimated due to sheep and goat pox was INR 480.72 crore, 961.34 crore and INR 1442.05 crore at the assumed 1% , 2% and 3% annual incidence levels, respectively.

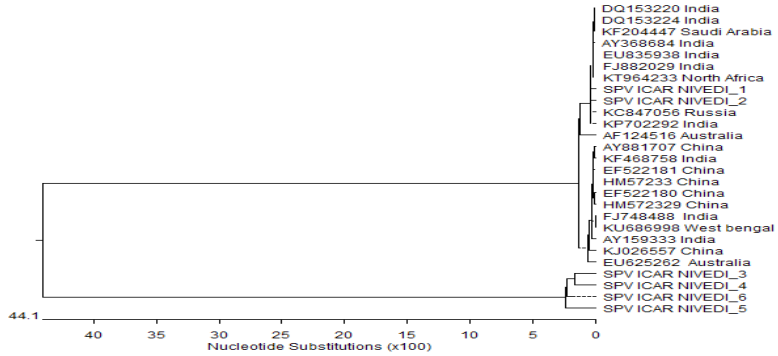


Fig. 6. Phylogenetic analysis of capripox virus isolates from outbreak based on the complete nucleotide sequence of P32 gene. The phylogenetic tree was constructed by the neighbour joining algorithm using Lasergene 5.0 software. The percentages of bootstrap scores (500 replicates) are indicated on the branches. The scale bar represents genetic distance.

IPC: ANSCNIVEDISIL201500200065 Project ID: IXX09659

Disease severity pattern and risk factors identification for PPR in sheep and goats in India

V Balamurugan, G Govindaraj, G B Manjunathareddy and R Yogisharadhya

A declining trend was observed in PPR outbreaks during the past five years due to implementation of strategic mass vaccination of sheep and goats in states like Karnataka, Andhra Pradesh and Chhattisgarh. The disease occurrence and severity of the clinical disease have progressively and substantially declined in areas under regular vaccination mostly under PPR_CP and partly under ASCAD programme. Further, changing pattern of the disease in term of severity levels was also observed. In India, decreased number of outbreaks in the recent part might be due to the effectiveness of vaccination programme. Hence, in the present scenario, the studies need to be undertaken with the objective to know the effect of vaccination on the occurrence of PPR in sheep and goats and also to analysis the severity of the disease pattern in different geographical locations under both vaccination and non-vaccinated area in different states. Further, there is a need for identification of associated risk factors associate with the incidence of PPR in sheep and goats. The PPR clinical score card was used for assessing the severity of the disease pattern during PPR outbreaks in sheep and goats in the pattern of very mild, mild, moderate, severe, and very severe.

By using score card, the severity of the disease pattern during PPR outbreaks in sheep and goats in the selected states of India (vaccinated and unvaccinated area) was carried out which revealed the outbreaks were mild to severe form of the disease. Generally, mild or moderate form of the disease was observed in the places or nearby regularly vaccinated place of the villages, whereas the severe form of the disease occurred in the places where the vaccination was not taken place. Further, schedules were also developed to identify risk factors as well disease severity in the field level.

IPC: ANSCNIVEDISIL201500400067 Project ID: IXX12421

Epidemiology of Porcine Reproductive and Respiratory Syndrome in India

J Hiremath, D Hemadri, K P Suresh, S S Patil, G Govindaraj and M M Chanda

The pig population in India is 10.3 million and pork constitutes 7% of the country's animal protein sources. The major share of pork meat consumption is with north eastern (NE) India and pig is a important livestock that plays major role in livelihood of the farmers. There are number of infectious diseases that threaten pig industry in NE India, of all, Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) is highly infectious, economically important and emerging viral disease which has been reported first time in India in 2013 and later resurfaced in 2015. The economic loss due to PRRSV in US is reported to be $664 million in 2011 and loss in India needs to be estimated. For effective control and prevention of PRRSV in NE India, it is critical to understand the epidemiological factors that lead to PRRSV outbreak in this part of the country.

Currently the disease is officially reported from north east India but status of the disease in rest of India is not well studied. The pilot tested questionnaire for identification of risk factors is used and data collection is in progress. To assess the risk of getting PRRS from northeastern India to rest of India, we have developed a questionnaire by literature review, interaction with

pig farmers, Pig traders, Pig transporters and state/ central departments involved in animal trade. The questionnaire was developed using selected variables for risk estimation (Table 2). Using the developed questionnaire, the target sample population will be contacted to collect the data. For estimation of sero-prevalence of the PRRSV in south India we have developed sampling frame and started collecting samples as per the sampling frame.

Table 2 : List of variables used to develop questionnaire for risk estimation of introduction PRRS from northeastern India to rest of India

Variables
The pig population in North East India
Prevalence of PRRSV in North East India
No. of undetected PRRSV-infected pig herds in North East India
No. of live pigs transported annually to rest of India
Quantity of pork transported annually to rest of India
Quantity of semen transported annually to rest of India
No. of days PRRSV remains undetected in North East India
Prevalence of PRRSV in rest of India

IPC: ANSCNIVEDISIL201100500024 Project ID: IXX07976

Epidemiological study of surra and fascioliosis in animals

P P Sengupta, V Balamurugan, P Krishnamoorthy and S S Jacob

Trypanosoma evansi, a haemo flagellated protozoan parasite, is responsible for causing devastating disease called surra in a wide range of domestic and wild animals. Sera collected from 968 animals (cattle and buffalo) from 12 states/union territories (Tamil Nadu-80, Madhya Pradesh-44, Karnataka-72, Bihar-27, Andaman-195, Himachal Pradesh-108, Uttar Pradesh-23, Sikkim-80, Odisha-43, Assam-35, Mizoram-78 and Puducherry-183) were screened for surra by recombinant VSG indirect ELISA and 732 (75.62%) animals were found positive for antibodies against *Trypanosoma evansi.* Highest seroprevalence was found in Puducherry (94.5%) followed by A&N islands (93.84%), Sikkim (88.75%), Assam (88. 57%), Tamil Nadu (87.5%), Madhya Pradesh (86.36%), Mizoram (76.92%), Bihar (51.85%), Himachal Pradesh (46.29%), Karnataka (34.72%), Uttar Pradesh (26.08%) and Odisha (25.58%).

Fasciolosis caused by *Fasciola gigantica* is one of the major constraints to the livestock industry and aquatic snails belonging to the genus *Lymnaea* acts as intermediate host for this parasite. A total of 2077 *Lymnaea* spp. snails were collected from 25 water bodies covering 11 districts of Karnataka and screened for *F. gigantica* larval stages and 5.1% of snails were found to be positive. Region wise prevalence of fasciolosis in Karnataka was found to be 5.79% in Deccan plateau, 5.22% in Western ghat and 3.95% in Coastal region. Among the eleven districts screened for fasciolosis (Fig.7), Ramanagara district had highest infection rate (7.8%) and Dakshina Kannada showed the least infection (3.09%). Seasonal prevalence of infection was found to be more in winter season (6.22%) followed by the rainy (4.61%) and summer (4.35%) seasons respectively.

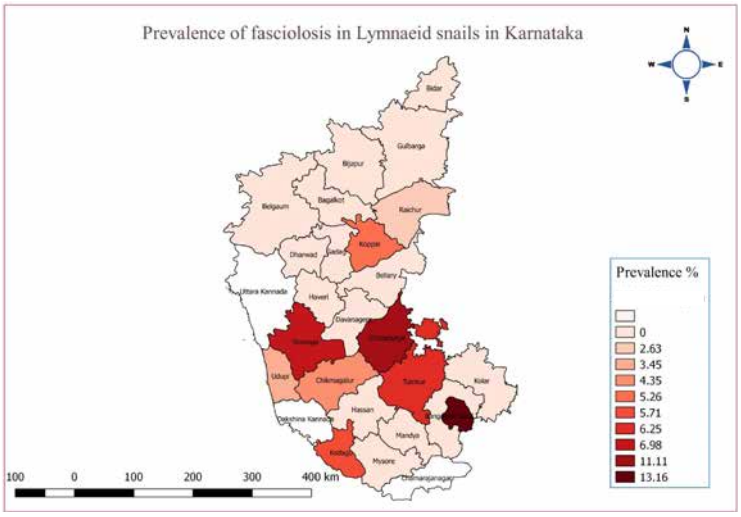


Fig.7. Prevalence of fasciolosis in Lymnaeid snails in Karnataka

IPC: ANSCNIVEDISIL201300300046 Project ID: IXX10616

Retrospective Epidemiological studies on HPAI with reference to spatio-temporal pattern and the probable associated risk factors identification

R Sridevi, G Govindaraj, P Krishnamoorthy, K P Suresh and A A Raut

Brief Summary: Data on various factors like poultry population density, human population density, wetlands, waterbodies, ramsar convention sites, collected and analysed.Spatial heat map of AI outbreaks in eastern and north eastern states from 2008-2010 plotted (Fig. 8). Economic impact analysis of avian influenza outbreaks occurred in Kerala on various sectors hatcheries, commercial poultry farms/ducks farms, traditional duck farmers, tourist boat industry, human health in 2014 was done. Pre-tested questionnaires were employed to collect the primary data from farmers, hatcherres, boat owners, retail sale markets of meat shop owners,etc. Probable factors for avian influenza outbreaks at Kerala–Kuttanad region identified were high duck population density, vast backwater, presence of branches of 4 major rivers, presence of vast paddy fields, close contact between the host (ducks) and the wetland environment, and lack of biosecurity measures.

Illustration:

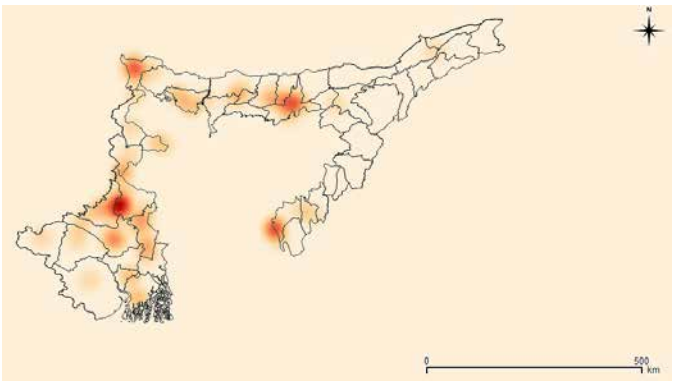


Fig. 8. Heat map of Avian influenza outbreaks from 2008-2010 in Assam, West Bengal and Tripura

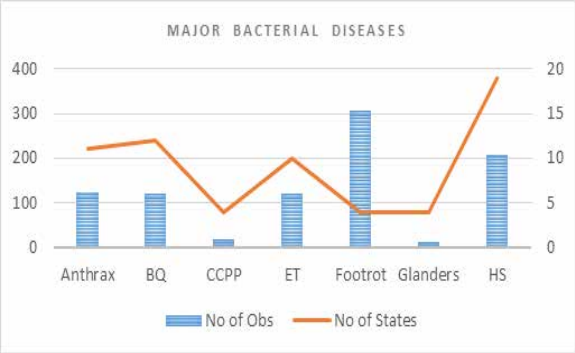
INSTITUTE SERVICE PROJECTS

National Animal Disease Referral Expert System (NADRES)

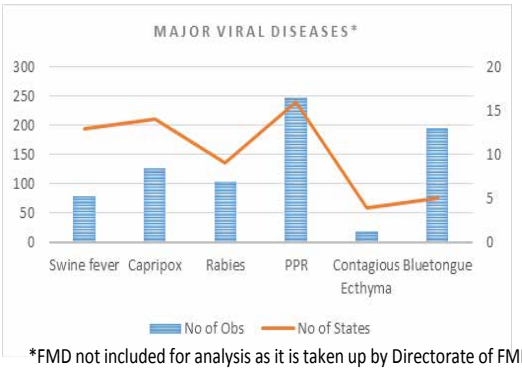
D Hemadri, K P Suresh, S S Patil and J Hiremath

The NADRES database contains information on major livestock diseases of the country along with their associated risk factors. During the period under report, about 82440 entries related livestock diseases in the country were made. Details of the most reported bacterial, viral and parasitic diseases during the calendar year 2016 shown in Fig. 9. The red line indicates number of states reporting the said diseases. Thus from the figure it can be inferred that though largely reported some diseases are restricted to smaller geographic regions. Among the bacterial diseases, foot rot, HS, BQ, ET, Glanders and anthrax were the most reported in that order. Similarly, PPR, Capripox, BT, Rabies and swine fever were the most reported viral diseases. In addition, fasciolasis, amphistomiasis, anaplasmosis, babesiosis, coccidiosis and trypanosomiasis were most reported parasitic diseases.

a)



b)



*FMD not included for analysis as it is taken up by Directorate of FMD

c)

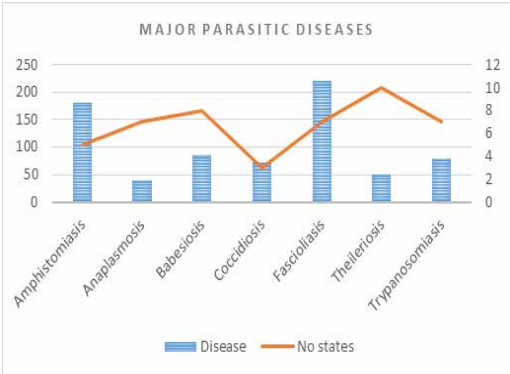


Fig. 9. Major Bacterial (a), Viral (b) and Parasitic disease (c) in India during 2016

The NADRES database contains information on major livestock diseases of the country along with their associated risk factors. Using these databases, (which are updated regularly) the probability of occurrence of disease outbreaks at the district level was forecasted 2 months in advance. The results are available to any user on interactive basis at the website (www.nadres.res.in). The forewarning information were also sent as monthly bulletin to DADF and other directors of animal husbandry departments for taking up suitable preventive measures. During the period, forewarning for 13 of the livestock diseases widely reported in 29 states and 7 union-territories of the country were prepared and circulated. (Table 3) Time series analysis of major livestock diseases also carried out to the disease trend in India (Fig. 10 & Fig. 11)

Table 3: The total number of predicted district- diseases for the period between April 2016 and March 2017.

Sl.No	Diseases	Month-wise OB No. of districts predicted (April 2016-March 2017)											
		April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March
1	Anthrax	68	57	64	58	60	58	66	62	62	63	41	48
2	Babesiosis	43	42	50	42	46	38	37	37	38	38	58	54
3	Black Quarter	187	152	183	154	143	108	84	108	108	109	152	183
4	Bluetongue	3	9	14	23	25	24	20	22	22	22	3	0
5	Entertoxemia	42	41	33	29	33	36	41	37	41	42	37	36
6	Fascioliasis	68	60	64	72	51	54	36	59	55	55	37	47
7	FMD	148	161	152	166	227	263	250	242	265	266	181	138
8	HS	172	192	213	213	176	138	124	156	136	137	142	166
9	PPR	53	48	48	48	51	59	60	62	63	63	69	64
10	S&G Pox	51	50	50	49	49	54	57	54	53	57	63	52
11	Swine Fever	19	23	33	29	28	24	27	25	24	24	32	34
12	Theileriosis	35	37	35	32	49	40	34	40	38	39	34	65
13	Trypanosomiasis	44	36	45	63	64	41	26	104	41	42	64	63
	GRAND TOTAL	933	908	984	978	1002	937	862	1008	946	957	913	950

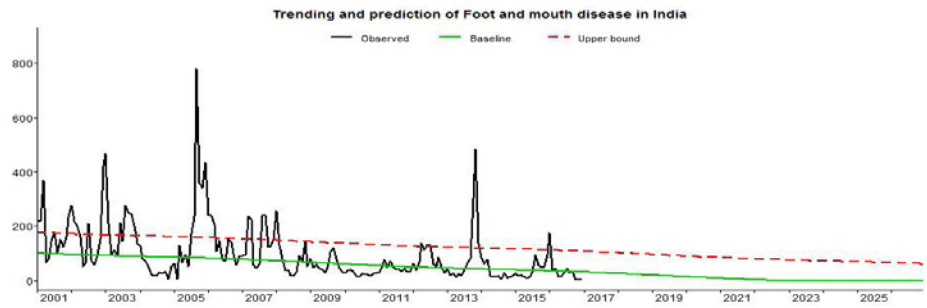


Fig. 10. Graphs showing the time series analysis of FMD in India

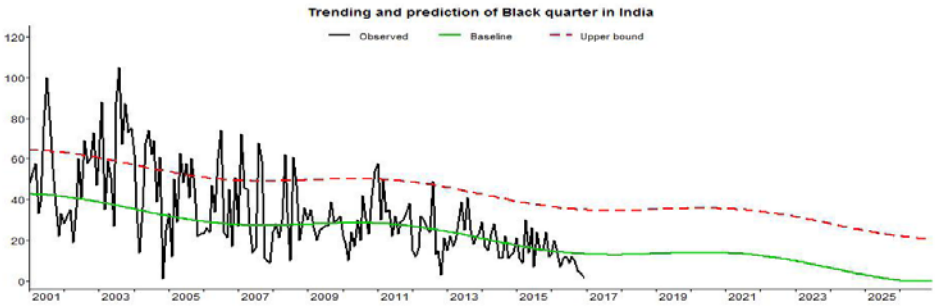


Fig. 11. Graph showing the time series analysis of Black quarter in India

IPC: ANSCNIVEDISIL201100300022 Project ID: IXX08279

Maintenance and updating of livestock serum repository

D Hemadri, K P Suresh and S S Patil

As part of the annual survey conducted by the AICRP on ADMAS, central unit at NIVEDI designs and sends sampling plan every year to each of the centers of AICRP on ADMAS. The serum samples so collected, as per the plan, are sent to NIVEDI for screening against various livestock diseases mainly, Brucellosis (Bovine, Caprine, Swine), Infectious Bovine Rhinotracheitis (IBR), Classical Swine Fever, Bluetongue, Leptospirosis

etc. The serum bank at ICAR-NIVEDI, arranges for screening (aliquoting, labeling, distributing) against the said diseases and catalogues the serum along with the results. The serum bank also sends the results to sender. During the period under report a total of 16824 serum samples were received. From different states (Fig.12). Depending on suitability, all the samples were aliquoted and distributed for screening against Brucella, IBR, Classical swine fever, Bluetongue and trypanosomiasis. The screening against bluetongue for the year 2016-17 could not be done due to non-availability of kits, however, screening of 943 samples of 2015-16 showed that 134 of these were positive.

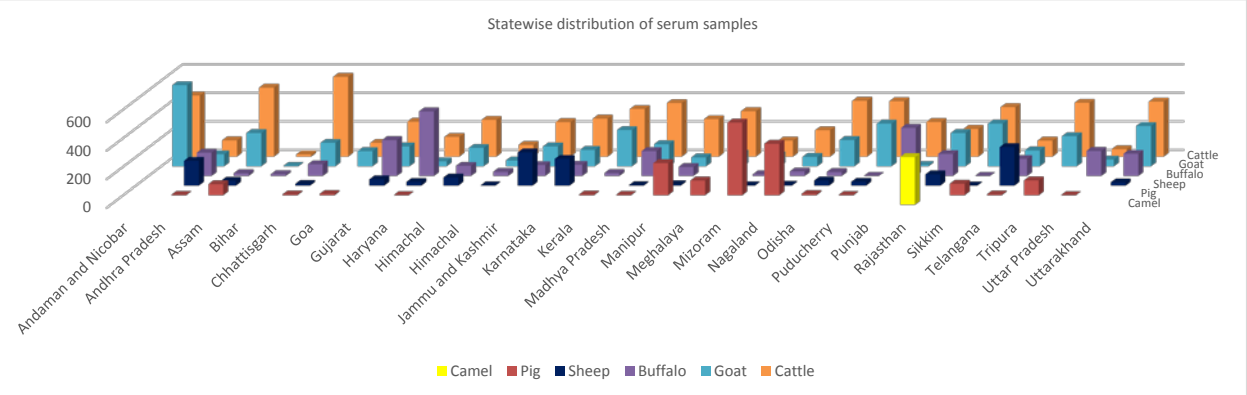


Fig. 12. State wise distribution of serum samples collected from different states of India during 2016-17.

Species-wise distribution of samples

Species-wise distribution of samples shows that large quantity of serum received belong to cattle and buffaloes as these are two predominant species of livestock in the country (Fig. 13).

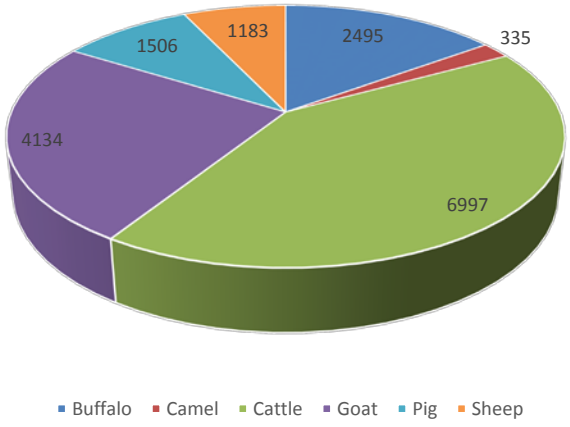


Fig. 13. Species wise distribution of samples collected from different states of India during 2016-17

Bovine Brucellosis

A total of 9500 serum samples from cattle/buffalo samples were received as part of the annual survey conducted by the AICRP on ADMAS. Of which 1401 samples were screened only 9 were positive for bovine brucellosis.

Ovine Brucellosis

A total of 1224 serum samples from sheep samples were received as part of the annual survey conducted by the AICRP on ADMAS. Of which results of 41 samples were received at NLSR, which showed only 2 samples positive for ovine brucellosis.

Caprine Brucellosis

A total of 4134 serum samples from goat samples were received as part of the annual survey conducted by the AICRP on ADMAS. Of which results 339 samples were received at NLSR which showed 6 samples as positive for caprine brucellosis.

Swine Brucellosis

A total 1506 pig serum samples were received as part of the annual survey conducted by the AICRP on ADMAS. Of which, results of 288 samples were received at NLSR which showed all the samples as negative for caprine brucellosis.

Infectious Bovine Rhinotracheitis

A total of 9500 serum samples from cattle/buffalo samples were received as part of the annual survey conducted by the AICRP on ADMAS. Of which results 4565 samples were received at NLSR which showed 1408 samples as positive for anti BoHV-1 antibodies.

Annual survey on classical swine fever

A total 1506 pig serum samples were received as part of the annual survey conducted by the AICRP on ADMAS, of which large number (n=1461) of serum samples belonged to seven states of the north east India. Considering the insignificant number of serum samples received from rest of India and the availability of the testing kits, it was decided to screen the samples from the north eastern states. In addition it is also to be noted that north eastern states harbor nearly half of the total pig population in India.

CSF in the North Eastern States

A total of 1140 out of 1461 pig serum samples from seven states of north east were screened for the presence of anti-CSFV antibodies using a commercially available kit. These serum samples collected as part of the AICRP annual survey. CSF prevalence of more than 40% was found in Manipur, Mizoram, Nagaland and Sikkim. The significance of the values found in Sikkim needs further investigation as the state ranks low on livestock population.

IPC: ANSCNIVEDISIL201300200045 Project ID: IXX10708

Sero-epidemiology of brucellosis

R Shome, B R Shome and M Nagalingam

During the period, a total of 4767 random serum samples {cattle (2200), buffalo (539), sheep (317), goat (1191) and swine (520)} received from 18 AICRP centers were screened for brucellosis by using Protein-G iELISA kit for bovine brucellosis, Sheep & Goat iELISA kit for sheep and goat and laboratory standardized swine protocol for swine brucellosis (Table 4). Highest seroprevalence was recorded in Nagaland 45.6% (249/546); followed by Maharashtra12.7% (46/362) and Karnataka10.54% (45/427). States like Mizoram, Punjab, West Bengal and Manipur have shown < 1% and A&N, island Bihar, Tamil Nadu, Uttarakhand and Uttar Pradesh have shown no seroprevalence for brucellosis.

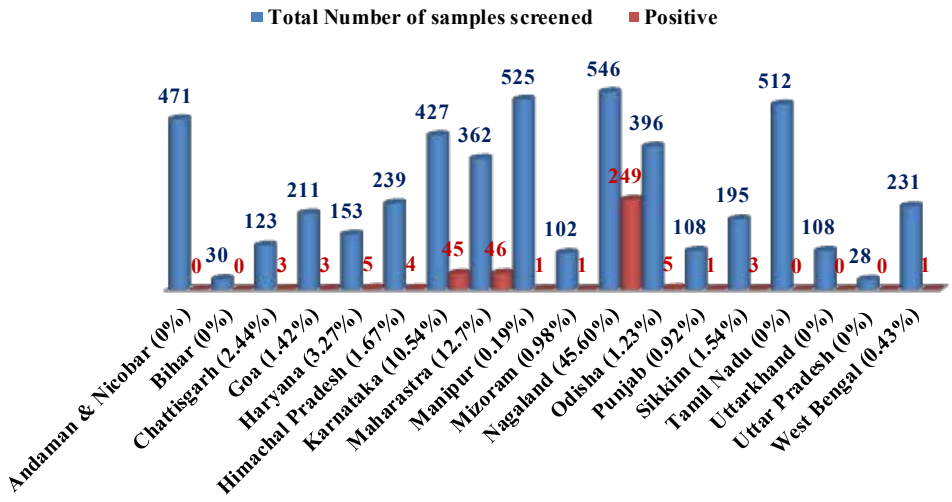


Fig. 14. Graph representing the total number of samples screened in the year 2016-17

Among livestock species screened, highest seroprevalence was recorded in pig 209/520 (40.19%) followed by sheep 66/317 (20.82%), cattle 60/2200 (2.73%) goat 26/1191(2.18%) and lowest prevalence in buffalo samples 6/539 (1.11%). An overall prevalence of (7.69%) 367/4767 was observed. The state and species wise sample tested results are presented in Table 4 & Fig 14.

Table 4: Sero- prevalence of brucellosis in livestock species state wise during 2016-2017.

State	*Cattle	*Buffalo	**Sheep	**Goat	***Pig	Total	Percent Positivity
Andaman & Nicobar	309(0)	0	0	143(0)	19(0)	471(0)	0%
Bihar	15(0)	12(0)	0	3(0)	0	30(0)	0%
Chhattisgarh	78(1)	10	0	34(2)	1(0)	123(3)	2.44%
Goa	96(0)	0	0	106 (3)	9 (0)	211 (3)	1.42%
Haryana	40(1)	99 (2)	8(2)	6(0)	0	153(5)	3.27%
Himachal Pradesh	130(4)	52(0)	4(0)	53(0)	0	239(4)	1.67%
Karnataka	110(1)	58	172(33)	81(8)	6(3)	427(45)	10.54%
Maharastra	134 (5)	80(2)	70(31)	78(8)	0	362 (46)	12.7%
Manipur	236(0)	67(0)	6(0)	42(0)	174(1)	525(1)	0.19%
Mizoram	47(1)	6(0)	0	49(0)	0	102(1)	0.98%
Nagaland	162(43)	15(1)	3(0)	75(0)	291 (205)	546(249)	45.60%
Odisha	247(2)	24(0)	24(0)	97(3)	4(0)	396(5)	1.23%
Punjab	30(1)	70(0)	0	8(0)	0	108(1)	0.92%
Sikkim	106(1)	0	0	80(2)	9(0)	195(3)	1.54%
Tamil Nadu	279(0)	0	5(0)	228(0)	0	512(0)	0%
Uttarkhand	57(0)	15(0)	1(0)	35(0)	0	108 (0)	0%
Uttar Pradesh	4(0)	19(0)	0	5(0)	0	28(0)	0%
West Bengal	120(0)	12(1)	24(0)	68(0)	7(0)	231(1)	0.43%
Total	2200(60)	539(6)	317(66)	1191(26)	520(209)	4767(367)	
	2.73%	1.11%	20.82%	2.18%	40.19%	7.69%	

*Protein-G ELISA kit; **Sheep & Goat iELISA kit, *** Laboratory standardized swine ELISA samples sequenced by protocol.

Seroepidemiology of Infectious Bovine Rhinotracheitis in India

S S Patil and D Hemadri

Infectious Bovine Rhinotracheitis (IBR) is a highly contagious, infectious respiratory disease that is caused by Bovine Herpesvirus-1 (BoHV-1). Disease outbreaks can result in severe production losses, abortion and delayed inter calving periods.

A total of 9923 sera samples from different states of India were tested (Table 5), out of which 2702 samples were found to be positive for the presence of IBR antibodies using Avidin-Biotin ELISA. The highest prevalence rate of 50.54 was observed in Chattisgarh and the lowest prevalence was found to be 6.80 in Nagaland.

Bovine Herpesvirus 1(BoHV-1) Repository: A total of 16 isolates of BoHV-1 were revived and maintained in the laboratory and they are-IBRV-1, ADMAS-1, BoHV-1:258/08, BoHV-1:685/10, BoHV-1:688/10, BoHV-1:707/10, BoHV-1:723/10, BoHV-1:741/10, BoHV-1:743/10, BoHV-1:744/10, BoHV-1:745/10, BoHV-1:746/10, BoHV-1:774/11, BoHV-1:775/11, BoHV-1:776/11, BoHV-1:777/11 from Karnataka, Orissa, West Bengal and UP.

PCR analysis of Bovine clinical samples: A total of 69 samples (nasal swabs, vaginal swabs, blood in EDTA) received from Tripura (20 Blood in EDTA, 5 vaginal swabs, 4 nasal swabs), Kerala (one tissue samples from Elephant calf), Mizoram (39 blood in EDTA) were subjected for DNA extraction and tested by PCR using primers specific for gB region of BoHV-1. Ten samples were found to be positive for gB293 (IBR) amplicon. A total of 11 bovine samples (one each tissue from Amreli-Gujarat_buffaloes and Vizag-AP-Bison, 9 blood samples from Amreli-Gujarat-Buffaloes) were screened for MCF (OvHV-2) sequences using tegument and gB specific primers of OvHV-2. All were found positive (except one blood samples from Gujarat) for tegument and gB sequences. A total of 12 IBR Avidin Biotin-ELISA kits were supplied to different Disease Diagnostic Laboratories across the country (A & N island, Andhra Pradesh, Haryana, Kerala, Maharshtra, Punjab, UP).

Table 5: Sero-prevalence of IBR in different states of India during 2016-17

STATE	Total no sample	IBR positive	Percent Positive
Andaman & Nicobar	600	278	46.33
Assam	856	157	18.34
Bihar	27	6	22.22
Chattisgarh	632	93	14.72
Goa	96	19	19.79
Gujarat	320	91	28.44
Haryana	135	65	48.15
Himachal Pradesh	774	140	18.09
Jammu and Kashmir	222	25	11.26
Karnataka	883	339	38.39
Kerala	630	144	22.86
Kolkata	132	73	55.30
Maharashtra	215	68	31.63
Manipur	752	218	28.99
Meghalaya	109	16	14.68
Mizoram	80	37	46.25
Nagaland	324	111	34.26
Orissa	415	134	32.29
Punjab	405	127	31.36
Rajasthan	275	30	10.91
Sikkim	582	227	39.00
Tamil Nadu	668	120	17.96
Telangana	332	122	36.75
Uttar Pradesh	151	11	7.28
Uttarakhand	308	51	16.56
Total	**9923**	**2702**	**27.23**

EXTERNALLY FUNDED PROJECTS

Outreach Programme on Zoonotic Diseases

V Balamurugan, P P Sengupta, S B Shivchandra, R Sridevi and M M Chanda

For surveillance of leptospirosis in livestock and human from different areas, samples from Karnataka (Bidar and Doddabalapur), Andhra Pradesh (Tirupati), Tamil Nadu (Chennai, Kanchipuram), Uttarakhand (Kashipur), Punjab, Gujarat, Kerala and Sikkim were tested in MAT and ELISA. A total of 1149 livestock (Cattle-1116, Bear -23 and Goat-10), and 562 human serum samples were tested along with 43 rat samples from Nagpur in the MAT at 1:100 titre with 18 reference leptospira serovars in MAT of which 640 livestock (Cattle-617, Bear-13 and Goat-10), 207 human and 34 rat samples were showed positive reactivity for leptospira serovars group specific antibodies.

The seropositivity of 41.17 % (49/119) leptospirosis was observed when testing the human samples collected from pyrexia of unknown origin (PUO) cases with sero prevalence of major of *Leptospira* serovars representing serogroups specific antibodies against serovars Hurstbridge, Tarassovi, Javanica, Bataviae/ Pyrogenes, Shermani, Icterohaemorrhagiae, Kaup, Hardjo, etc., whereas the seropositivity of 65 % (13/20) was observed in the case of human with neurological disorders with serogroups specific antibodies against serovars Hardjo/Pyrogenes, Shermani/ Kaup /Djasiman Hebdomadis/ Tarassovi / Hurstbridge /Bataviae, Australis/Bankinang/Canicola/ Djasiman.

Samples received from human with history suspected for leptospirosis with case definition, showed the seropositivity of 78.9 % (101/128) with seroprevalence of major *Leptospira* serovars representing serogroups specific antibodies against serovars Pyrogenes / Tarassovi / Hebdomadis, Hurstbridge, Kaup, Shermani/ Hebdomadis, Australis/ Bankinang/ Pomona. In the risk groups of veterinarians, the seropositivity of 14.97% (44/295) leptospirosis was observed with seroprevalence of major *Leptospira* serovars representing serogroups specific antibodies against serovars Pyrogenes, Javanica, Tarassovi, Icterohaemorrhagiae, Hebdomadis, Canicola, Hardjo, Australis/ Bankinang. However high sero positivity of 64.75% (191/295) was observed when sample tested with in panbio human IgM ELISA kit.

Samples from the reservoir host (rat) from Nagpur showing seropositity of 79.06% with prevalence of serovars against Grippotyphosa /Hurstbridge, Australis, Tarassovi/ Shermani/ Bataviae, Bankinang/Canicola/ Djasiman. Further, on testing of 323 random purposive livestock (Cattle, Buffaloes, sheep and goats) serum samples from Surat district in Gujarat, 179 samples were showed positive reactivity in MAT representing high seropositivity (55.41%) with serogroups specific antibodies against serovars, Panama, Hebdomadis/ Bataviae, Pyrogenes, Pomona/ Hurstbridge/ Tarassovi, Grippotyphosa/ Icterohaemorrhagiae/ Canicola, Hardjo/ Shermani /Kaup.

On testing 373 bovine serum samples with history of abortion and reproductive disorders, 263 samples showed positive reactivity in MAT, indicating the 70.51 % seropositivity against serovars Hardjo, Canicola, Hebdomadis, Icterohaemorrhagiae, Pyrogenes, Hurstbridge, Javanica, Panama, Copenhageni, etc., in cattle associated with abortion and reproductive disorders. Moreover, seropositivity of 29.22 % only was observed when subject the samples in *Leptospira Bovine Hardjo* ELISA kit. This study supports that cattle have a role as reservoir in maintaining Hebdomadis, Icterohaemorrhagiae, Hurstbridge, Shermani, Pomona, etc., in addition to *Leptospira* Hardjo serovar in cattle dairy farms of India and warrants need of an intensive surveillance programme, prevention and control strategies including implementation of vaccination and mitigating measures to reduce the incidence of leptospirosis in cattle farms.

Toxoplasmosis is a well-known zoonotic disease in human and it mainly causes abortion and reproductive disorders in human, sheep and other animals. As a

preliminary study, to generate the data, during the period 2016-17, a total of 297 human serum samples (Kerala n=184 and Karnataka n=66; Dadra and Nagar Haveli n=47) were screened for toxoplasmosis by using commercial diagnostic kit (Toxoplasma IgG & IgM, DIESSE Diagnostica Senese, Italy Enzywell) as per manufacture's protocols. Out of 297 human serum samples, 55 samples (Kerala n=19, Karnataka-n=25 and Dadra and Nagar Haveli n=11) were showed positive by *toxoplasma* IgG, further 10 samples (male-3 and female-7) out of 19 from Kerala also showed positive reaction by IgM ELISA with overall seropositivity of 18.51% with 16.88 % (26/154) and 20.28 % (29/143) in male and female, respectively. The seropositivity of 31.85 % was observed with history of PUO cases (28/93=30.10%) and neurological disorders (8/20=40%) whereas in the risk groups veterinarians seropositivity of 10.32 % (19/184) was observed with respect to toxoplasmosis specific antibodies.

Anthrax: A total number of (113) clinical/ environmental sample from Odisha state were screened for presence of *Bacillus anthracis* of which 14 samples (Cattle-7 ; Elephant 2 and Soil-5) showed positive when applied standard bacterial techniques along with Grams Staining and confirmatory test by using Protective antigen (PA) and capsular specific PCR confirming anthrax infection. The details of samples and its test results are given in Table 6

Table 6: Details of samples received from Odisha and its test results for Bacillus anthracis

Host	Sample Type	Total No. of Samples tested	No. of samples Positive
Cattle	Spleen, liver, lung, kidney, heart	05	-
	Heart Blood	01	-
Cattle	Blood	37	04
	Soil	06	-
	Bone	04	01
	Dried Meat/beef	07	01
	Soil + Bone	05	01
Elephant	Blood	10	02
	Soil	06	01
	Tissue	01	-
	Muscle	01	-
	Bone	02	
Sheep	Blood	07	-
Goat	Blood	01	-
	Soil	05	01
	Blood	01	01
	Nasal swab with Blood	01	-
Zebra	Lung	01	-
	Spleen	01	-
	Blood	01	-
	Environmental sample -Soil	10	02
	Total	113	14

IPC: ANSCNIVEDISOP201200600030 Project ID: OXX01504

All India Network Programme on Bluetongue

D Hemadri, M M Chanda and K P Suresh

Compared to the previous year, there were relatively fewer number of bluetongue outbreaks reported from the states of Karnataka and Andhra Pradesh. During the period 2016-17 (Fig.15), eighty five outbreaks were reported from all over India, of which, large number of these were reported from Telangana. Noteworthy information about the disease is the first time reporting of bluetongue outbreaks from the state of Odisha. Initial serotyping results indicated the involvement of serotypes 24 along with serotype 1.

With the availability of different serotypes, the work on development of multiplex PCR was continued during the period. Multiplex PCR for the detection of serotypes 5 & 9, 3, 13 & 16 and 10 & 24 were optimized and specificity of the so obtained PCR was confirmed by nucleotide sequencing. Partial nucleotide sequencing indicated higher levels of genetic homogeneity with in the each serotypes (BTV1, 2, 24, 16, 4) tested.

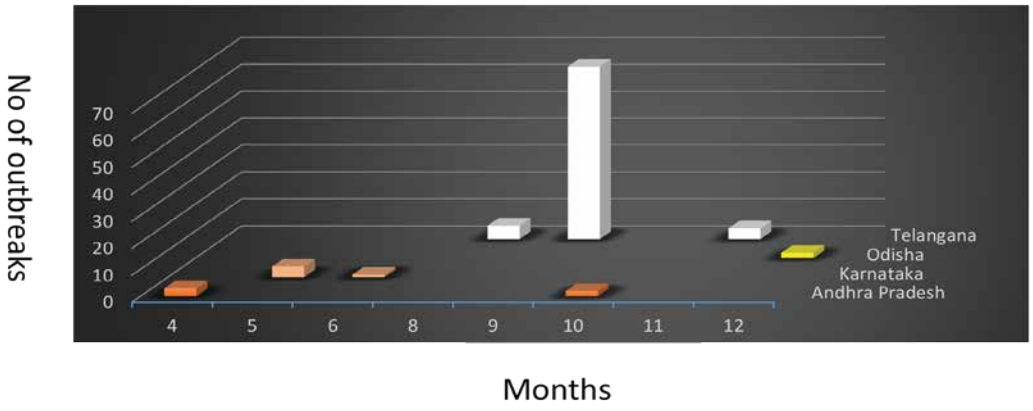


Fig.15. Bluetongue outbreaks during April 2016-December 2016

IPC: ANSCNIVEDICOP201500100064 Project ID: OXX02963

National Innovations on Climate Resilient Agriculture - Livestock disease surveillance in relation to weather data and emergence of new pathogens

B R Shome, K P Suresh, P Krishnamoorthy, G B Manjunath Reddy, S S Patil, G Govindaraj, R Yogisharadhya and A Prajapati

During period (2016-17), disease incidence data reported in West Bengal, Kerala & Rajasthan were linked to the remote sensing and meteorological parameters subjecting it to Poisson regression model to establish the climate-disease relationship model. Risk Maps were developed for West Bengal, Kerala & Rajsthan states, which are useful for resource allocation like manpower, material, money and effective vaccination program. In West Bengal, the high risk of parasitic disease occurrence was predicted (Fig. 16) in Malda and Diamond Harbour regions in red. and mode safe risk was predicated in Krishnanagar in pink and The high risk of bacterial disease occurrence was predicted in Purulia, Bankura and Murshidabad whereas for viral diseases, the high risk of occurrence was predicted in Kandi, Raiganj, Jangipur and Alipurduar region of West Bengal.

In Kerala, the high risk of disease occurrence for parasitic diseases was found in Ernakulum and Malappuram followed by Thirssur, (Fig. 17). In Rajasthan, the high risk of disease occurrence for parasitic diseases was found in Udaipur and Sikar district.

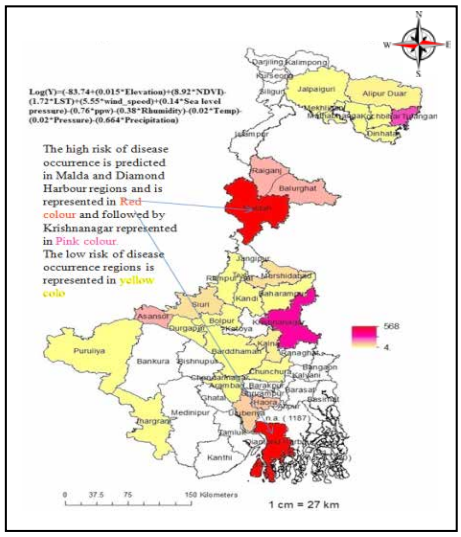


Fig. 16. Risk Map for parasitic diseases in West Bengal

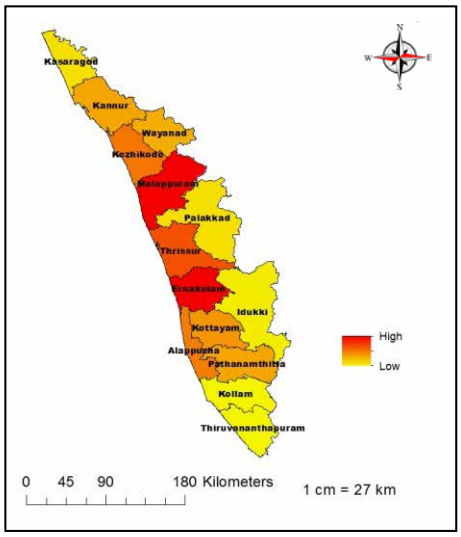


Fig. 17. Risk Map for parasitic diseases in Kerala

Emergence of new pathogens: The extended spectrum beta lactamase producing multi drug resistant *Escherichia coli* isolated from subclinical mastitis milk was identified and characterized. The multidrug resistant *Proteus mirabilis* carrying multiple efflux pumps detected in apparently healthy pig fecal sample. *Escherichia coli* strain SCM-21 and *Proteus mirabilis* strain NIVEDI3-PG74 whole genome shotgun sequencing was done.

The study concludes that the environmental variables are very crucial to study the epidemiology of pathogen and disease prediction to implement timely control measures to the present screening of global climate change.

IPC: ANSCNIVEDICOP201600800077 Project Code: OXX03488

All India network project on GIP

P P Sengupta, K P Suresh and Siju Susan Jacob

Haemonchosis caused by *Haemonchus contortus* is a predominant, highly pathogenic and economically important disease of sheep and goats. These parasites are common blood feeders that cause anaemia and reduced productivity and can lead to death in heavily infected animals. In order to assess the risk areas for haemonchosis in Rajasthan, disease data on haemonchosis (EPG) was received from CSWRI, Avikanagar unit. The data related to four districts viz., Tonk, Pali, Sikar and Bhilwara including 6 talukas and 11 villages. Some other parameters like LST (land surface temperature), NDVI (normalized difference vegetation index), distance from river/highways etc. were incorporated in the data. The disease prediction models were developed using logistic regression analysis considering few influencing parameters viz., LST, LST (1 month lag), rainfall and flock size (Fig. 18). The overall accuracy of the model found to be 67.5% which is quite satisfactory. Further accuracy can be achieved by increasing randomness, representativeness and independence by proper sampling. Risk maps were prepared using Poisson regression model employing ArcGIS software. The parameters showed highly significant with a low profile of standard error.

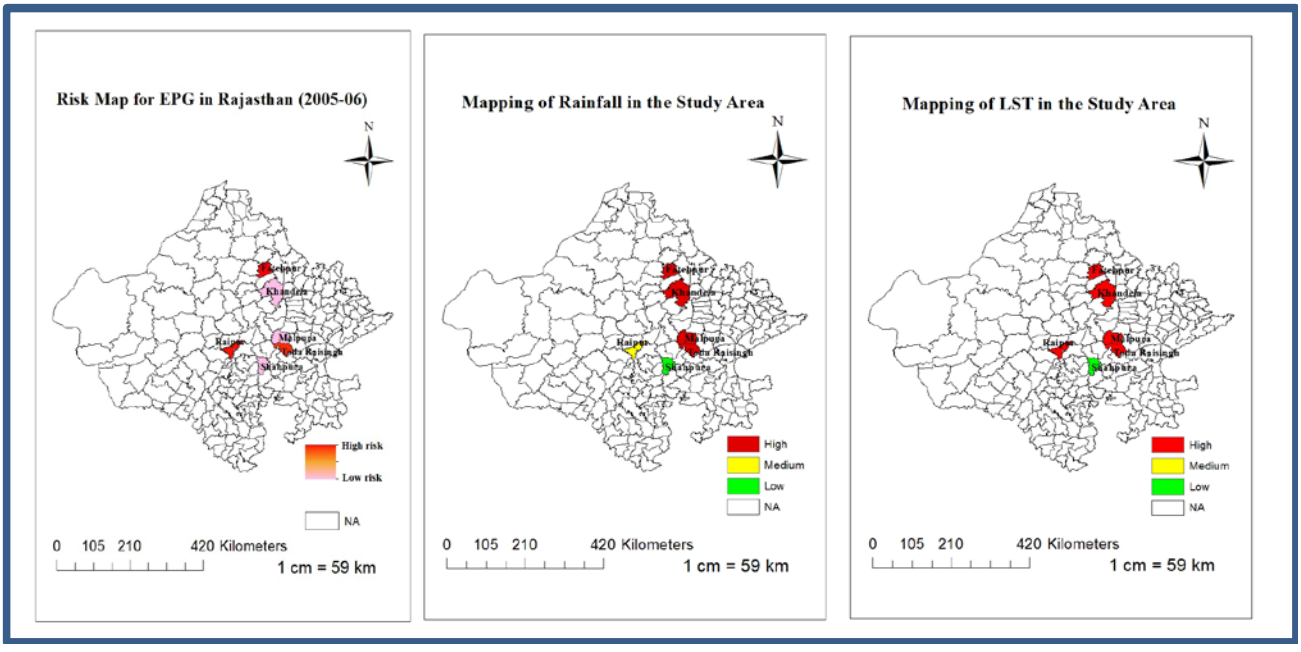


Fig. 18. Risk map for EPG in Rajasthan in correlation with rainfall and LST

IPC: ANSCNIVEDISOL201600200071 Project Code: OXX03660

Evaluation of vaccine effectiveness and identification of the factor that affect field level vaccine efficacy of the vaccine against diseases under control program

J Hiremath, R Shome, D Hemadri, K P Suresh, V Balamurugan, S S Patil,
M M Chanda and GB Manjunathareddy

The objective of the project was to evaluate vaccine effectiveness and to identify the factors that affect the effectiveness of vaccines against FMD. A questionnaire was used to collect the survey data on vaccine and vaccination. In addition, pre and post-vaccination serum samples were also collected from selected districts of Karnataka to measure the antibody titre values using LPB ELISA kit (Life Technologies [India] Pvt. Ltd). The pre and post-vaccination serum samples were collected from the identified cattle from selected districts (Hassan, Chikkaballapur, Mandya and Udupi) of Karnataka which were subjected to estimation of Liquid Phase Blocking (LPB) ELISA antibody titre for FMD serotype O.

The comparison was done between pre and post-vaccination serum LPB ELISA titer (>1.8 is protective titre as per the LPB FMD ELISA Kit from Life Technologies) in population of cattle irrespective of age and breed. A 67% (89/132) of the cattle showed the titre of more than 1.8 before vaccination and number has increased to 82% (108/132) after 45 to 60 days of post vaccination. Whereas 33% (43/132) of the cattle showed the titre of less than 1.8 before vaccination and number has decreased to 18% (24/132) after 45 to 60 days post vaccination. Further, 45% (23/51) of the cattle < 3 years old showed the titre of >1.8 before vaccination and number has increased to 59% (30/51) after 45 to 60 days of post vaccination (Fig.19A). Whereas the 81% (66/81) of the cattle (>3years) were having titre of >1.8 before vaccination and number has increased to 93% (75/81) after 45 to 60days post vaccination (Fig. 19B). The data analysis for other districts is in progress.

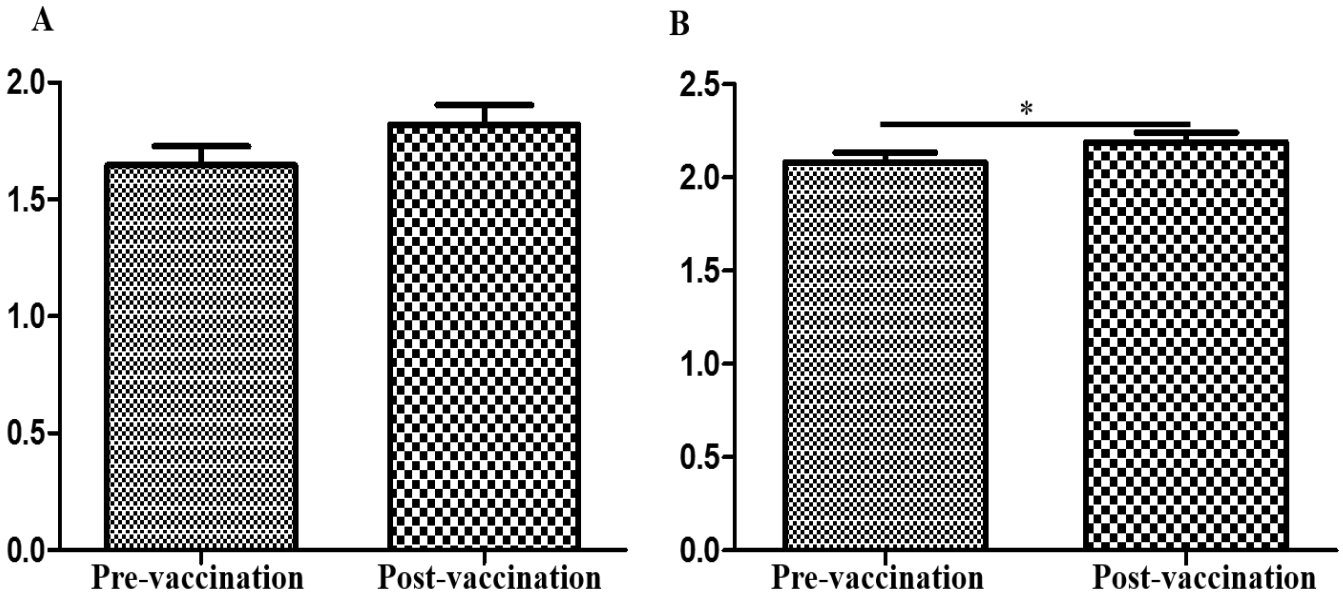


*Fig. 19. Pre and Post vaccination serum LPB ELISA antibody titer in cattle. A <3years, B >3years (*p<0.05)*

Understanding the epidemiology of *Culicoides* borne diseases in wild and domestic ruminants

M M Chanda, D Hemadri, P P Sengupta, J Hiremath and S B Shivachandra

Culicoides species are responsible for transmitting many viral diseases (e.g. Bluetongue) in domestic and wild ruminants. There is a risk of spill over of the pathogens transmitted by *Culicoides* from wild to domestic and *vice-versa*. Control strategies require research on different aspects of vector, virus and host involved in complex epidemiology of *Culicoides* borne diseases. In the present study, different wild life sanctuaries and national parks of Karnataka were selected for collection of the *Culicoides* using light traps. The sites near to wild life sanctuaries with domestic livestock population were also selected to compare the *Culicoides* species composition and possible spill over from wild to domestic and *vice-versa*. We also selected three sites from Tamil Nadu in the study. Monthly collections were made by using CDC light traps with UV light for a period of eight months. The traps were placed overnight in thirty one sites during which more than 8000 *Culicoides* were collected. The major species found in these sites were: *C. imicola, C. oxystoma, C. fulvus, C. brevitarsis, C. huffi, C. arakawae, C. peregrinus, C. palpifer, C. anophelis, C. palpisimilis, C. inoxius* and *C. actoni* (Fig. 20) The selected *culicoides* species were DNA bar coded and voucher specimens prepared. The work on host preference was carried out to identify the host bitten by the *Culicoides* species which is important in transmission of diseases. Bluetongue virus (BTV) was detected in *C.oxystoma* and *C.imicola* samples. Results of present study indicate that there is a circulation of *Culicoides* species in forest habitats and presence of BTV in some *Culicoides* species. thus, more studies are required to get deeper insights into the epidemiology of *Culicoides* borne diseases in forest habitat, so that control strategies can be planned to prevent spill over of the disease.

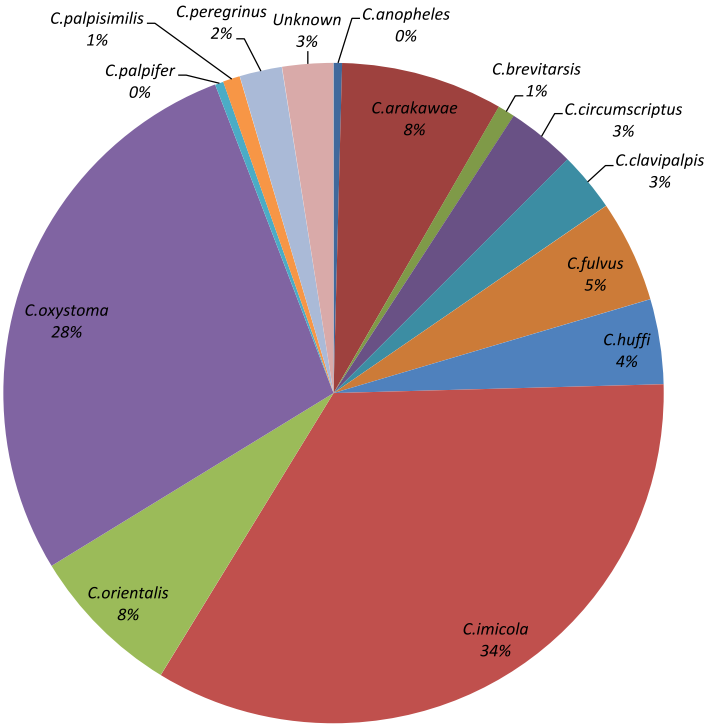


Fig. 20. Culicoides species distribution in Bannerghatta biological park

IPC: ANSCNIVEDISOL201600400073 Project ID: OXX03634

Impact assessment of PPR vaccine technology in India

G Govindaraj, V Balamurugan, GB Manjunathareddy and R Yogisharadhaya

Peste des petits ruminants (PPR) is one of the highly contagious and economically important viral diseases of small ruminants, especially in sheep and goats. The mortality and morbidity rates are as high as 90% and 100%. The annual loss due to PPR in the small ruminants in India was estimated at 1611 crores at 10% annual incidence level. Considering the devastating nature of the disease and threat to the smallholders livelihood, an effective live attenuated vaccine was developed in India. The developed vaccine has been widely used in National Control Programme on PPR (PPR-CP) since 2010-11. A multi-stage random sampling procedure was followed for undertaking primary survey to assess the field level disease lossess. During the period under report, the survey was completed in Karnataka state and hence the results are presented for Karnataka. The total number of farms surveyed were 350 and the samples were distributed among the identified districts in proportion to the number of households rearing sheep and goat (Fig. 21). The pooled results revealed that among the surveyed villages PPR incidence level was 8.31% in sheep and goats. The estimated per animal mortality loss, cost of treatment, distress sale and opportunity cost of labour among the infected flocks was INR 3231, INR 108.2, INR 3040, and INR 15.7 respectively.

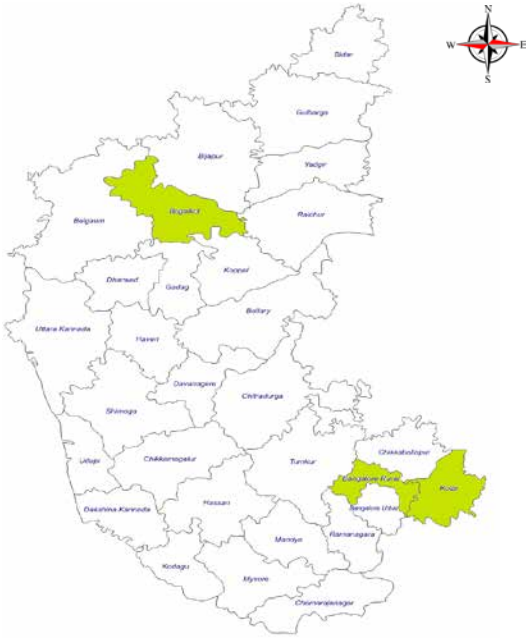


Fig.21: Represents the districts surveyed in Karnataka during 2016-17

IPC: ANSCNIVEDISOP201201600039 IPC code: OXX02733

DBT - Network Project on Brucellosis : Project Monitoring Unit (PMU)

H Rahman and G B Manjunatha Reddy

Brucellosis is an economically important bacterial disease affecting both animals and human. The DBT-Network Project on Brucellosis is a multi-intuitional project sponsored by Department of Biotechnology, Ministry of Science and Technology, GoI. The project has different subunits on brucellosis epidemiology (6), Brucellosis diagnostics (2), Brucellosis vaccine (2), Brucellosis repository (1) and Brucellosis bioinformatics (1), with overall monitoring of project entrusted to Project Monitoring Unit (PMU) at ICAR-NIVEDI, Bengaluru. PMU is involved in co-ordinating different activities of all the subunits under DBT Network Project on Brucellosis. Monitoring the research activities of different centres by means of monthly and quarterly reports, also submitting the compiled reports on monthly, quarterly and annual basis to DBT. PMU coordinated the midterm review meet on 25th and 26th July, 2016 at MKU, Madurai and Tamil Nadu. The regular updating and maintenance of DBT-Brucellosis website in collaboration with MKU. PMU actively coordinated and participated for successful completion of international brucellosis conference organized at NAAS complex, New Delhi from 17th to 19th December, 2016. PMU co-ordinated in sending the serum samples, bacterial cultures, Brucella antigens procurement, DNA between the different subunits. PMU also coordinated the validation of different Brucella diagnostic kits developed under the

project. The 4th annual review meeting was organised in collaboration with DBT at DBT headquarters on 6th February, 2017 to review the research progress of different units.

IPC: ANSCNIVEDISOP201201600040 Project ID: OXX02578

Brucellosis Epidemiology (BE-1)

R Shome, BR Shome and Nagalingam M

A total of 3610 cattle (3221) and buffaloes (389) sera were tested, positivity was recorded with apparent and true prevalence overall, 6.31% (228/3610) were 6.1% and 1.2% for cattle and 8.2 % and 6.9% for buffaloes, respectively. Among 24 farms prevalence screened seropositivity in the farms varied from 0 to >12% in which 3 farms had seropositivity of greater than 12% and lowest seroprevalence rate of 0-3% in majority (13) of the farms. Multivariate logistic regression model identified overall seven risk factors such as sex, absence of separate sheds, nonvaccination against brucellosis, disposing manure in the pits, cleaning the shed without disinfectants, cleaning the animal shed twice in a week and obtaining monthly veterinary services in the farms have been significantly correlated to brucellosis (Fig. 22).

The results of 1084 serum samples, (719 from seven sheep flocks and 365 from five goat flocks) tested showed seropositivity in 26 out of 365 (7.12%) in goats and 58 out of 719 (8.06%) in sheep. Multivariate logistic regression model in caprines indicated that female sex and procurement of animals from livestock fairs were considered risk factor for brucellosis. Similarly, in ovines female sex, orchitis, extensive rearing, disposal of aborted foetus in water bodies and access to stray animals in the farm were considered.

Milk surveillance for brucellosis was carried out in 2 districts of Karnataka (Kolar and Chikkaballapur) through Kolar Milk Union Limited (KOMUL), Kolar by Milk Ring Test (MRT). A total of 960 milk samples from Kolar [Bulk Milk Cooler Centre (BMC=79); Dairy Co-operative Societies (DCS=766) and Sub Centres (SC=115)] and 1026 milk samples from Chikkaballapur [(BMC=78; DCS = 849 and SC= 99) were screened by MRT at Kolar and Chinthamani milk union laboratories, respectively. Of these, 5.06% and 2.08% milk samples from Kolar BMC and DCS were positive for anti *Brucella* antibodies. Similarly 5.12%, 6.36% and 5.05% from Chikkaballapur BMC, DCS and SC, respectively were recorded positive by MRT. Very high prevalence of brucellosis was recorded in Chikkaballapur district where 63 villages were identified positive for brucellosis out of 1521 villages. Whereas, only 20 villages were identified positive for brucellosis out of 1809 villages of Kolar district. The annual disease mapping of brucellosis through milk co operative societies as per OIE 2016 facilitate vaccination in risk areas.

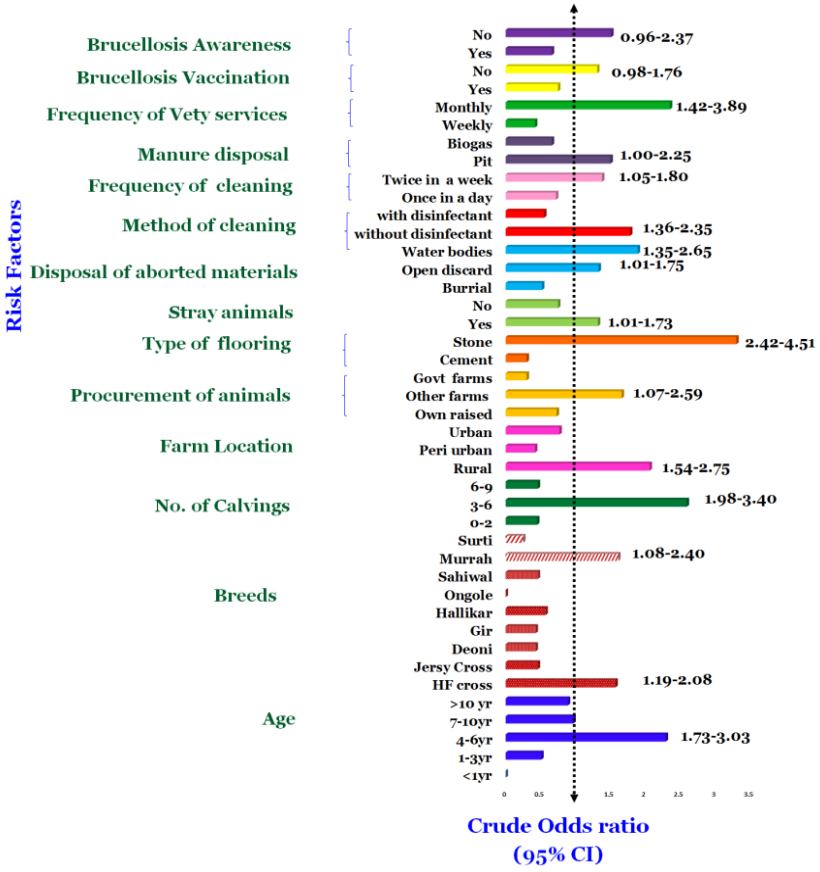


Fig. 22. Univariate analysis of 15 potential risk factors in dairy farms

IPC: ANSCNIVEDISOP201201700041 Project ID: OXX02384

Brucellosis Diagnostics (BD-2)

M Nagalingam, V Balamurugan, R Shome and GB Manjunathareddy

The project was initiated in an attempt to develop serological test for diagnosing bovine brucellosis using recombinant proteins in order to avoid use of lipopolysaccharide (LPS) of *Brucella* species which causes cross reactivity with organism like *Yersinia enterocolitica* : O9 that share common features of the LPS thereby reducing the specificity of the test. In 2016-17, a multi-epitope recombinant protein antigen was designed by identifying nine immuno dominant proteins which have no cross reactivity with antibodies of *Yersinia enterocolitica* : O9. Then identification of 16mer immuno dominant epitopes from each protein using online bioinformatics tools such as ABCpred and Bepipred 1.0b was carried out, cross reactivity checked and all identified epitopes were linked by rigid linkers (in collaboration with *Brucella* Bioinformatics DBT Unit, Madurai Kamaraj University, Madurai), reverse translated, codon optimized and multi epitope gene was synthesized, cloned in the vector and expressed. In addition, individual immuno dominant proteins BP26, BLS, SodC, Twin arginine, Thiamine transporter, VirB12, Invasion B, Ab2-0647, Bacterioferritin, Aldehyde dehydrogenase were selected, designed primers, amplified the genes, cloned in the vector and recombinant proteins were expressed. The expressed proteins were characterized by SDS-PAGE (Fig. 23). Further characterization by Western Blot and evaluation of suitability of expressed recombinant proteins in single or cocktail as diagnostic antigen in ELISA for bovine brucellosis, is in progress.

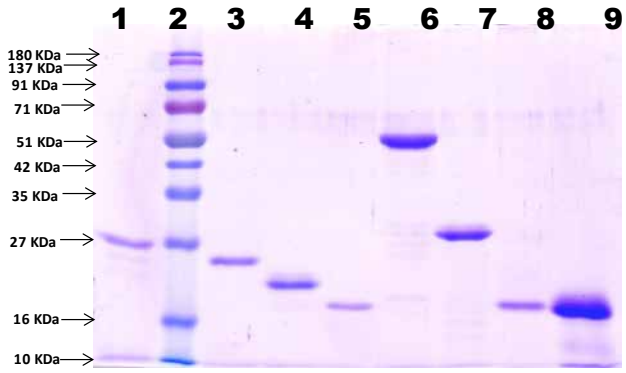


Fig. 23. SDS-PAGE showing expressed recombinant proteins

Lane 1: Purified multi epitope antigen, Lane 2: Protein marker, Lane 3: Purified Twin arginine recombinant protein, Lane 4: Purified Inv B recombinant protein, Lane 5: Purified Bacterioferritin recombinant protein, Lane 6: Purified Aldehyde dehydrogenase recombinant protein, Lane 7: Purified Bp26 recombinant protein, Lane 8: Purified BLS recombinant protein, Lane 9: Purified Sod C recombinant protein

IPC ANSCNIVEDICOL201600100070 Project Code: OXX03486

DBT-TRPVB _External validation of the diagnostic assays for detection of anti-brucella antibodies developed under the DBT-Network project on brucellosis

R Shome and M Nagalingam

A total of 1212 bovine and 530 small ruminants sera collected from 10 organized farms in Karnataka were screened for brucellosis by laboratory standardized Protein G iELISA kit and Rose Bengal Plate Agglutination Test (RBPT). Both test positive and negative sera samples were sorted out and good quality one ml quantity sera [bovine seropositive (n=154) and sero negative (n=410) and small ruminant seropositive (n=8) and seronegative (n=20) sera] were sent to TRPVB, Chennai for third party validation of the diagnostic assays as per the approved DBT-TRPVB project proposal. Similarly, DNA was extracted from 50 each of sero positive and negative sera (n=100) and Brucella genus PCR positive (n=16) and negative (n=25) cattle sera were sent to TRPVB for validation of brucellosis diagnostic tests. Validation and quality

check of the laboratory standardized Protein G iELISA kit was also performed during this period using 200 sera received from AH & VS, Buffalo breeding station, Dharwad using Protein G-iELISA, RBPT and PriocheckBrucellaAb 2.0 iELISA kit.There was 99.5% agreement between protein G ELISA kit of ICAR-NIVEDI with that of kit which clearly indicated the quality, sensitivity and specificity of protein G ELISA kit.

DBT-NER Centre for Advanced Animal Diagnosis and Management Consortium (ADMaC)

IPC: ANSCNIVEDISOL201400100054 Project ID: OXX01506

Sub Project 1: Surveillance and Molecular analysis of MRSA, MR-CoNS, VRE; ESBL and Carbapenemase producing Gram-negative bacteria in farm animals and the animal handlers and livestock products in NE India

B R Shome and K P Suresh

A total of 218 (126 fecal +92 nasal) samples were collected from different livestock viz., Pig (45), Goat (6), Cattle (7) and Chicken (68) from various regions of Mizoram. Species specific PCR for *E.coli* n=126 isolates identified 10 isolates as *E. coli*. Out of 126 isolates 53 isolates (10 *E. coli* + 43 non-*E. coli*) were subjected to a combination of 2 multiplex and 6 uniplex PCR assays for screening 17 ARGs covering ESBL (genes *viz.,tem, shv* and *ctxmI, II, III and IV*), MβL (*imp, vim, sim, gim, spm*) and *Amp*C (*fox, mox, acc, ebc, cmy, dha*). The results showed PCR (n=16) as ESBL producer, n=8 as MBL producers and n=29 as *Amp*C producers. (Table 7 and Table 8).

Plasmid replicon typing (PCR-based replicon typing approach) was carried out (n=53) to investigate the presence of 18 replicons using three multiplex PCR assays and it showed 7 *E.coli* isolates and 4 non *E.coli* isolates positive for 6 different genes. Integrons A multiplex PCR assay targeting Class 1, 2 & 3 integrons was performed to investigate the occurrence of integrons in the resistant isolates (n=53) and found 5 non *E.coli* isolates to be positive.

Out of 92 nasal samples collected, duplex PCR identified 61 staphylococcas isolates and 1 *mecA* positive (pig origin). The *mec A* positive isolate was identified as *S.scuiri* by mPCR. The RAPD-PCR for drug resistant *E. coli* isolates from North East India (n=32) grouped *E. coli* isolates into three major clusters (I–III). The *E. coli* isolates from cattle host showed maximum similarity falling majorly under one cluster. Notably, the Shiga toxin producing *E. coli* isolates were grouped into same cluster.

Table 7: Distribution details of antimicrobial resistance determinants of selected farms in Mizoram.

Farm location	Total Gram negative bacteria	Distribution	Total resistance by PCR	Pig	Poultry	Cattle	Goat
Serchhip	29	15(Pig)+14(Poultry)	4	1	3		
Saitual	46	28(poultry)+ 6 (goat)+ 7(cattle) + 5(pig)	24	2: 1(farm 1)+ 1 (farm 2)	11: 3 (farm 1)+ 8(farm 2)	7: 3=(farm1) +4(farm 2)	4:3(farm 1)+1(farm 2)
Samtlang	14	pig	4	4			
Selesih	10	poultry	6		6		
Kolasib	26	10(pig)+15(poultry)	15	8	7		

Table 8: Distribution details of antimicrobial resistance genes, integron & plasmid replicon types in Gram negative bacteria isolated from livestock & poultry of selected farms in Mizoram.

Farm	*E.coli*	*tem*	*ctxm1*	*ctxm4*	*mbl*	*AmpC*	*Integron* *Intl 2 intl 3*	*Plasmid replicon typing* *mpcr1 mpcr2 mpcr3*
Serchhip	2	2	2	1	-	*1=Fox/dha*	*1*	*1*
Saitual	2	-	1	5	2:(1=sim, 1=spm/vim	18(1=dha, 17=ebc)	2	2 2 2
Samtlang					1=sim	3=ebc		1
Selesih	1	-	-	-	2=imp	6=ebc	2	
Kolasib	5	8			3(2=spm,1=sim	9=(1=ebc, 2=mox,6=cmy		2 4 3

IPC: ANSCNIVEDISOL201400200055 Project ID: IXX03176

Sub Project 2: Sero-epidemiological study of brucellosis in livestock in North East Region of India using ELISA and Fluorescent Polarization Assay

R Shome

Fluorescence polarization Assay (FPA) developed earlier has been evaluated for investigation of brucellosis outbreak serum samples (n- 203) from an organized pig farm in comparison with cELISA, iELISA and RBPT. The results revealed the seroprevalence of 59.8% (122/203), 54.4% (111/203), 48% (98/203) and 36% (75/203) respectively by cELISA, iELISA, FPA and RBPT respectively. The diagnostic sensitivity of FPA 90.4%, 81.1% and 70.6% in comparison with iELISA, RBPT and cELISA and Specificity 91.5%, 91.4% and 84.8% respectively, in comparison with iELISA, RBPT and cELISA was recorded. This field evaluation indicated more than 90% of diagnostic specificity compared to sensitivity which needs to be enhanced beyond 90%. A total of 1281 serum samples (Bovine=589, Small ruminants=247, Pig=338 and Yak=107) from five NE states (Assam=145, Arunachal Pradesh=107, Meghalaya=350, Nagaland=546 and Sikkim=133) were screened for anti-*Brucella* antibodies by FPA and indirect ELISA. Highest brucellosis seroprevalence of 56.36% and 26.54% was recorded in Nagaland in pig and cattle sera samples, whereas, other four states were found negative for anti-*Brucella* antibodies. Such a high seroprevalence in swine and cattle herds warrants great public health threat to humans and other livestock in the region. There is a need to survey large number of farm animals and animal handlers for brucellosis and its zoonotic threat in Nagaland. The district-wise prevalence of brucellosis provided in the Fig 24.

The FPA was validated in Core lab-I with known status of 75 serum samples consisting of 35 positive and 40 negative by RBPT and diagnostic sensitivity and specificity of 88.57% and 100% respectively with Positive Predictive Value of 100% and Negative Predictive Value of 90% was recorded . After successful evaluation and validation of FPA with ICAR-NIVEDI panel samples (n=400), pig outbreak samples (n=205), field random samples (n=1281) and post vaccinated field samples (n=1581), the FPA technology consisting of FPA reagents, Ellie Sentry 200 equipment along with the standard operating protocol (SOP) and transferred to North East core lab-I (AAU, Khanapara, Assam). This assay will be used to generate the geo-epidemiological data on brucellosis in North East States of India.

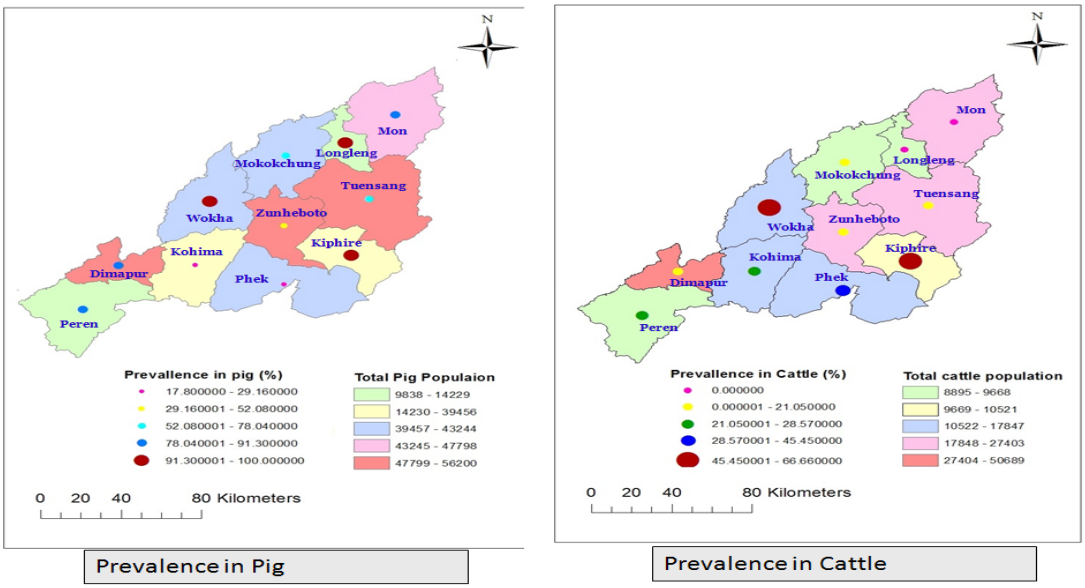


Fig. 24. District-wise prevalence of brucellosis in Nagaland

IPC:ANSCNIVEDISOL201400300056 Project ID:OXX03175

Sub Project 3: Epidemiological study of Classical Swine Fever (CSF), Porcine Reproductive and Respiratory Syndrome (PRRS) and Porcine Torqueteno (TTV) in pigs in North East (NE) region of India

D Hemadri and S S Patil

During the period 2016-2017, a total of 2008 serum samples were received from seven states of North East India. These serum samples were tested for anti-CSFV antibodies using commercial enzyme-linked immunosorbent assay (ELISA) kit. State-wise percent positivity for CSFV is as follows; Assam 20.54% (15/73), Mizoram 37.13% (189/509), Meghalaya 21.38% (65/304), Manipur 44.07% (119/270) Sikkim 36.11% (26 /72), Tripura 10.57% (11/104). The high percent positivity of 78.2% (510/652) found in Nagaland needs further investigation. This baseline data shows the probable high prevalence of CSFV in the north east region.

During the period 23 isolates could be recovered in PK-15 cell lines from 96 clinical specimens received from the states of Mizoram (n=9), Goa (n=4), Karnataka (n=5), Telangana (n=1), Assam (n=2), Kerala (n=1) and Madhya Pradesh (n=1). Nucleotide sequencing of the said isolates in the NS5B and E2 indicated continued circulation of genetic groups, 1.1 and 2.2 in the country.

Torque teno sus virus (TTSuV) is a small non-enveloped virus, containing a single-stranded, negative sense circular DNA genome, which is more often found associated with Porcine Circo Virus (PCV's) and Porcine Respiratory Disease Complex (PRDC). Clinical samples received from different regions of India were screened by PCR targeting non-coding regions as established by earlier report. Out of the total of 61 clinical samples, 3/20 from Sikkim, 1/2 from Kerala, 1/2 from Telangana, 3/10 from Karnataka, 2/27 from Madhya Pradesh were found positive for TTSuV infection. However, samples screened from Goa (n=6), Odisha (n=7), Andhra Pradesh (n=6), Punjab (n=13), Maharashtra (n=4) were found negative.

During this period a total of 62 suspected samples were screened for PRRSV by RT-PCR, out of which 22 samples were found positive.

Sub Project 4: Development of Infectious Disease Information System (IDIS) and Risk assessment models for Transboundary animal diseases (TAD) & other emerging livestock diseases in NE region of India

K P Suresh and S S Patil

Top five livestock diseases of the different zones of Assam were assessed and pattern of disease distribution were presented defined agro-climatic zones in Assam.

It was observed that Hemorrhagic Septicemia was the most occurring disease in Barak Valley zone. FMD was more frequent in Central Brahmaputra Zone & Lower Brahmaputra Valley Zone of Assam (Fig. 25). Classical Swine fever was seen mostly in Hills Temperature Zone and North Bank Plain Zone of Assam.

The risk map prediction for CSF in North Eastern regions was attempted using the Remote sensing applications and GIS. For this purpose, data viz. Land Surface Temperature (LST), and Normalized Difference Vegetation Index (NDVI), Distance from major cities (km), Distance from Highways (km), Distance from Roads (km), Distance from Railways (km), Distance from Water bodies (km), Rainfall were measured using earth observatory satellite images or maps. Using ArcGIS tool the raster layers are generated for each risk factor mentioned above. The Logistic regression model was employed for the risk map generation.

The high risk of disease occurrence is predicted in Kamrup, Marigon, Sonitpur and Cachar regions and is represented in Red colour and followed by Kamrup metropolitan, Dhubri, Goalpara and Karimganj represented in Orange colour. The low risk of disease occurrence regions is represented in green colour.

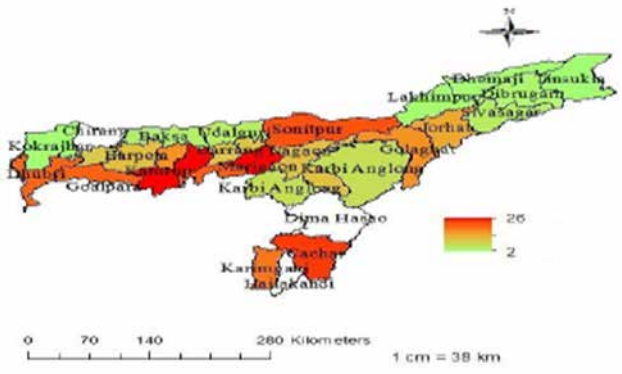


Fig. 25. Risk map for FMD outbreaks in Assam

Quantitative Risk Assessment

Quantitative assessment of the likelihood of introduction of Classical Swine Fever Virus (CSFV) into Arunachal Pradesh via importation of pigs from neighboring countries was performed.

Binomial probability model was employed for quantifying the volume of trade and scale of movement in Arunachal Pradesh sharing international borders with Bhutan in the west, Burma in the east and China in the north. The null hypothesis tested is that there is a threat involved for the risk of CSFV introduction into Arunachal Pradesh via import of pigs (live animals) from the neighboring countries of Bhutan, China & Myanmar.

As the null hypothesis was rejected, it was evaluated that, the expected number of years in which at least one CSFV incursion might occur from pig imports from Bhutan were found to be 1022.23 year for groups with herd sizes depending upon the population of pigs present in the country. Whereas, the predicted risks from pig imports from China were found to be 3373.014, 842.82, 421.124 years for groups of 1000, 4000 and 8000 herds respectively. For Myanmar it was calculated to be 117132.6934, 58565.8363 and 29282.41 years for the different selection of herds accordingly.

A web application was also developed to quantify risk of introduction of CSFV into Arunachal Pradesh by importation of pigs from neighboring countries.(http://www.nivedi.res.in/adsmc/quantitative.php).

Estimation of disease prevalence in NER using Meta-analysis.

Bluetongue- Various epidemiological studies on Bluetongue seroprevalence published by different studies in different parts of India and also from disease reports submitted by respective states were collected. Studies reporting seroprevalence of BT for sheep, goats, cattle and buffalo were selected.

The estimated seroprevalence in sheep population were obtained from 3 studies with a sample size of 460 and a moderately high I^2 value of 92.5% showing heterogeneity. The prevalence was 35% (95% C.I: 17%- 59%.

The estimated seroprevalence in goat population were obtained from 3 studies with a sample size of 398 and a high I^2 value of 94.9 % showing heterogeneity. The prevalence was 30% (95% C.I: 11%- 61%).

Classical Swine Fever- A total of 10 studies with data from all the seven states in NER India with a sample size of 1323 were used for the quantitative analysis. The sero-prevalence of CSFV was estimated to be 31% (95% CI= 0.18,0.47).

IPC: ANSCNIVEDICOP201300500048 Project ID: OXX02582

Sero-serveillance, molecular characterization and epidemiology of pox viral infections in animals from north eastern region of India

G B Manjunathareddy and V Balamurugan

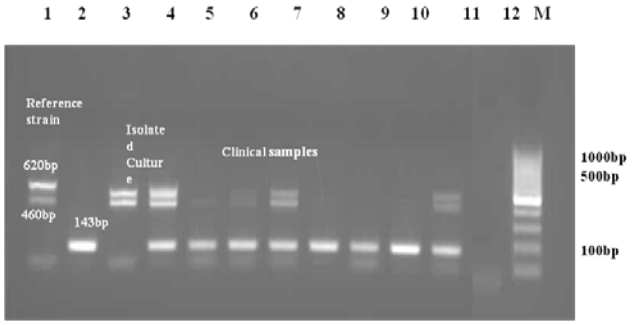
The 19th livestock census data on total livestock population data covering different species of animals for North-Eastern states was compiled and spatial distribution maps for different animal species were prepared with the help of geo-coordinates for cattle, buffaloes, sheep and goats of NER states. The sheep and goat pox disease outbreaks data was collected for NER states from animal husbandry departments and also from OIE animal health information portal and is under mapping for knowing the temporal and spatial distribution pattern at district level resolution. The climate variables (temperature, relative humididty and rain fall) data were collected and complied. The preparation of bioclimatographs is underway. Procured and maintaining the standard vaccine strain of sheep pox virus from ICAR-IVRI. The PCR for P32 gene was developed and standardized for detection of field capripox virus infection. The VNT was standardized for detection of anti-capripox virus antibodies and 150 serum samples were tested.

IPC: ANSCNIVEDICOP201300700050 Project ID: OXX02584

Aetio-Pathology and molecular epidemiology of bacterial and viral diseases associated with the respiratory problems of yak in the North Eastern Regions of India

R Shome, S S Patil and G B Manjunathareddy

The study aimed to rule out the prevalence of the various bacterial and viral pathogens in bovine respiratory disease (BRD). Overall 157 nasal swabs and 182 sera samples from collected of ICAR-NRC on Yak, Arunachal Pradesh were received in ICAR-NIVEDI. The samples were processed for isolation and identification of *M. haemolytica*, *P.multocida* and *H.somni* earmarked for ICAR-NIVEDI centre as per the standard bacteriological protocols. Similarly, all the samples were processed for DNA extraction and attempted for direct detection of *M. haemolytica*, *P.multocida* and *H.somni* pathogens by molecular assays one isolate each of *M.haemolytica,Staphhaemolytica*and *Klebsiella pneumonia,* two isolates of *H. somni* and seven isolates of *Staph sciuri*. Were isolate from a total of 157 yak nasal samples processed for direct DNA detection in 18 hours brain heart infusion broth enriched clinical samples for *M.haemolytica*, *P.multocida* and *H. somni*, 28(17.9%), 6 (3.8%) & 4 (2.5%) samples were positive for the *M.haemolytica*, *H. somni* & *P.multocida,* respectively by multiplex PCR (Fig.26).



Lane1: reference strains; Lane 1-4: DNA extracted from clinical isolates; Lane 5-11: DNA extracted from 18h enriched clinical samples; Lane 12: no template control; Lane M: 100bp molecular marker.

Fig. 26. Evaluation of standardized mPCR for detection of P. multocida type 'A' & 'B' and M. haemolytica using isolated cultures & 18h enriched clinical samples.

Two whole genome sequences,one *P. multocida* (Accession No. MEDF01000000) and *M. haemolytica* (MEHR01000000) are available for the first time from India. Apart from 11 partial 16sRNA sequences. Overall 65 bacterial isolations recovered out of which, 11 isolates have been submitted to National Culture Repositories (ICAR- VTCC and CSIR-MTCC). A total of 182 sera samples were screened for IBR, PPR and brucellosis antibody, 37% (67/182) of the samples showed IBR antibody indicating importance of IBR in yak and all the samples were negative for PPR and brucellosis.

IPC: ANSCNIVEDICOP201300900051 Project ID: OXX02585

Serosurveillance and Molecular Epidemiology of Bovine Herpesvirus -1 (BoHV-1) infection in bovines of North Eastern states of Mizoram, Meghalaya and Tripura

S S Patil, D Hemadri and H Rahman

Under the project, surveillance study of serum samples and viral isolates for BoHV-1 in three states of North Eastern region along with other North Eastern States was undertaken. a total of 2418 bovine sera samples were tested for the presence of IBR antibodies using Avidin-Biotin ELISA and prevalence was found to be 33.79% (Table 9). The prevalence was found to be higher in Nagaland (55.93%) and Sikkim (53.75%) and less prevalence was found in Assam (22.77%) and Tripura (24.10). The reason for higher prevalence of IBR in Nagaland and Sikkim may be attributed to that they share a porous international border. A total of 59 bovine blood samples (39 from Mizoram and 20 from Tripura) were subjected for DNA extraction and tested by PCR. Ten samples (6 from Mizoram and 4 from Tripura) were found to be positive by gb293 primers for IBR testing and are under analysis.

Table 9: Sero-Prevalence of IBR in North Eastern States of India during 2016-17

Sl No	States	Total	Positive	Positive percentage
1	Assam	404	92	22.77
2	Manipur	715	219	30.63
3	Meghalaya	513	160	31.19
4	Mizoram	81	37	45.68
5	Nagaland	177	99	55.93
6	Sikkim	279	150	53.76
7	Tripura	249	60	24.10
	Total	**2418**	**817**	**33.79**

Serosurveillance, isolation and molecular characterization of bluetongue virus in sheep and goats of Tripura and Assam states

D Hemadri and V Balamurugan

A total number of 411 serum samples belonging to small ruminants (mostly belonging to goats) from north east states, namely, Assam, Mizoram, Manipur, Meghalaya, Nagaland and Sikkim was received at the serum repository of ICAR-NIVEDI during the year 2016. Out of which, 88 samples were found to be positive for Bluetongue antibodies, when screened using commercially available cELISA kit (VMRD Inc, USA) (Fig. 27).

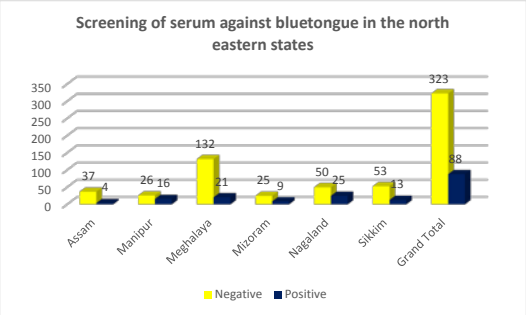


Fig. 27. Screening of serum samples against bluetongue in the north eastern states of India.

From the figure it can be seen that highest percent positivity was found in Manipur (38%), followed by Nagaland (33.33%). Lowest percent positivity was found in Assam (9.76%), followed by Meghalaya (13.73%).

Antibodies to bluetongue virus have been shown to be present in small ruminant population of the north eastern states, however, till date there is no report of clinical disease from this region. It is worth to note that bluetongue viruses have been recovered from ruminants with mild/inapparent clinical infections or apparently healthy animals. In order to recover BTV strains circulating if any in the ruminant population of this region, a total of 242 blood samples collected from apparently healthy goats, originating from Gomati, Khanapara, Khowai, Sipahijala, South Tripura, West Tripura, North Tripura, Unakoti and Dhalai regions, received from Tripura state were subjected to cell culture passaging. Lysed RBCs from the said samples were inoculated on to KC cells. After two blind passaging in these cells, a further three passaging were done in BHK-21 cells, unfortunately no virus could be recovered from the samples. Further, real time PCR using BTV specific primers also could not detect virus genome in pooled blood samples from Tripura state.

Goat Serum samples collected from Tripura state were screened & analyzed. Of the 481 serum samples collected from goats 227 were positive. IDW interpolated surface map was drawn to know the extent of prevalence of anti-bluetongue antibodies in Goats in Tripura state (Fig. 28). The results indicate higher prevalence southern part of the state.

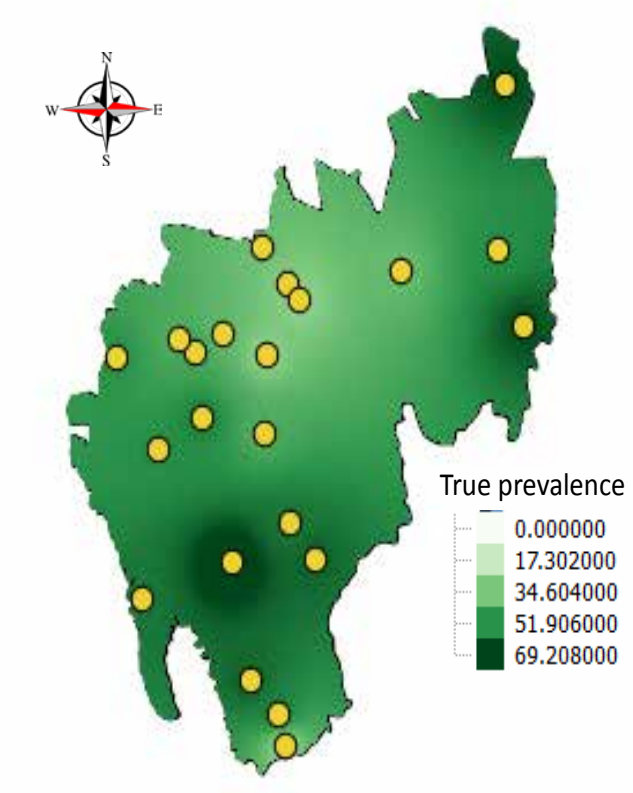


Fig. 28. *IDW interpolated surface map depicting extent of prevalence of anti-bluetongue antibodies in Goats. Yellow color dots indicate sampling locations.*

IPC: ANSCNIVEDICOP201300900052 Project ID: OXX02581

National Surveillance Programme for Aquatic Animal Diseases (NSPAAD)

K P Suresh and G B Manjunathareddy

National level database on aquatic animal disease is developed. Application is dynamic, user friendly and flexible. Presently the application is in use with URL: http://49.50.73.242/nspaad_live/. Introduction of data capturing for Leading center. addition of farm code functionality, creation of data entry reports. Improvements also made in functionality in Web applications for baseline form, biological samples and outbreak investigations. In addition, query reports can also be generated. Manual for operation application is developed.

Technical Progress such as creation of NSPAAD user manual was uploaded on NSPAAD website. Collection of Master data for states, districts, blocks and villages. Modifications in the data format. Login User ID & PDF formats for data collection facilities are provided. In the results section, fish species, tissues collected fields were included in biological and disease outbreaks forms. Around 5528 baseline and 437 biological data information flowed in to application since last year. Regular maintenance of the database and reports for all the centres and weekly report of data entries for all the farms of NSPAAD. Verification of the data entry reports of all the farms were done on weekly basis.

IPC: ANSCNIVEDISOL201200300027 Project ID: OXX02580

Brucellosis - Control Program

Parimal Roy, B R Shome, R Shome and M Nagalingam

A total of 1313 brucellosis post vaccinated sera received from different states were screened for *B.abortus* S19 vaccinial antibodies by RBPT, iELISA and Fluorescence polarization Assay (FPA) tests. Highest vaccination coverage percentage was observed in Himachal Pradesh (80.66%) followed by Tamil Nadu (55.72%) and Gujarat (52.94%) and Rajasthan & Chhattisgarh states showed less than 50% , vaccination coverage (Table 10 & Fig. 29).

Table 10: Sero monitoring of brucellosis post vaccination sera from various states

State	21-45 days	46-60 days	61-120 days	121-180 days	181-240 days	PVD NA*	>240 days	Total
HP	140/147 (95.23%)	13/13 (100%)	36/45 (80%)	0/12 (0%)	2/16 (12.5%)	26/35 (74.28%)	0/1 (0%)	217/269 (80.66%)
Tamil Nadu	63/80 (78.75%)	9/25 (36%)	-	-	-	1/26 (3.84%)	-	73/131 (55.72%)
Gujarat	95/110 (86.36%)	44/67 (65.67%)	1/18 (5.5%)	4/25 (16%)	1/49 (2.04%)	-	8/20 (40%)	153/289 (52.94%)
Rajasthan	26/58 (44.82%)	-	-	-	-	40/72 (55.55%)	8/57 (14%)	74/187 (39.57%)
Chhattisgarh (post vacc)	-	-	-	-	-	159/340 (46.76%) (PV)	-	161/437 (36.84%)
Chhattisgarh (Pre vacc)	-	-	-	-	-	2/97 (2.06%)	-	-
Total	324/395 (82.02%)	66/105 (62.85%)	37/63 (58.73%)	4/37 (10.81%)	3/65 (4.61%)	228/570 (40%)	16/78 (20.51%)	678/1313 (51.63%)

PVD NA(post vaccination days not mentioned); PV: post vaccination;*
Prevacc: pre vaccinated sera samples samples; post vacc: Post vaccination sera samples.

KAP studies on perceptions and preparedness of veterinarians to combat brucellosis was collected during one day brucellosis sensitization trainings conducted in various states. Under B-CP. Overall, there were 453 participants from ten states and one UT. Out of 268 veterinarians who were handling abortion/ infertility/ROP cases in cattle, 134 veterinarians (50%) were handling the brucellosis suspected cases. Similarly, in case of buffalo, sheep and goats, 64 out of 136 (47%) veterinarians; 23 out of 41 (56%) veterinarians and 42 out of 128 (33%) veterinarians, respectively, were handling brucellosis suspected cases. Majority of veterinarian from Punjab (76%) obtain the lab confirmation compared to other state. But only 12 per cent of them recommend for the vaccination. Least number of veterinarians from Uttar Pradesh (5%) goes for the laboratory confirmation. Though, many veterinarians from Madhya Pradesh (50%) recommend for the vaccination only 18 per cent of veterinarian obtain laboratory confirmation for the brucellosis. and least contribution on vaccination recommendation was from Tripura. From the overall participants training, only 17 per cent were obtaining the laboratory confirmation from the brucellosis suspected cases and only 20 per cent of participants recommend the vaccination for brucellosis to the bovine. One day brucellosis sensitization trainings were conducted in Puducherry, Kerala and Bihar states under the B-CP and total of 241 veterinary officers were sensitized on diagnosis and vaccination against brucellosis.

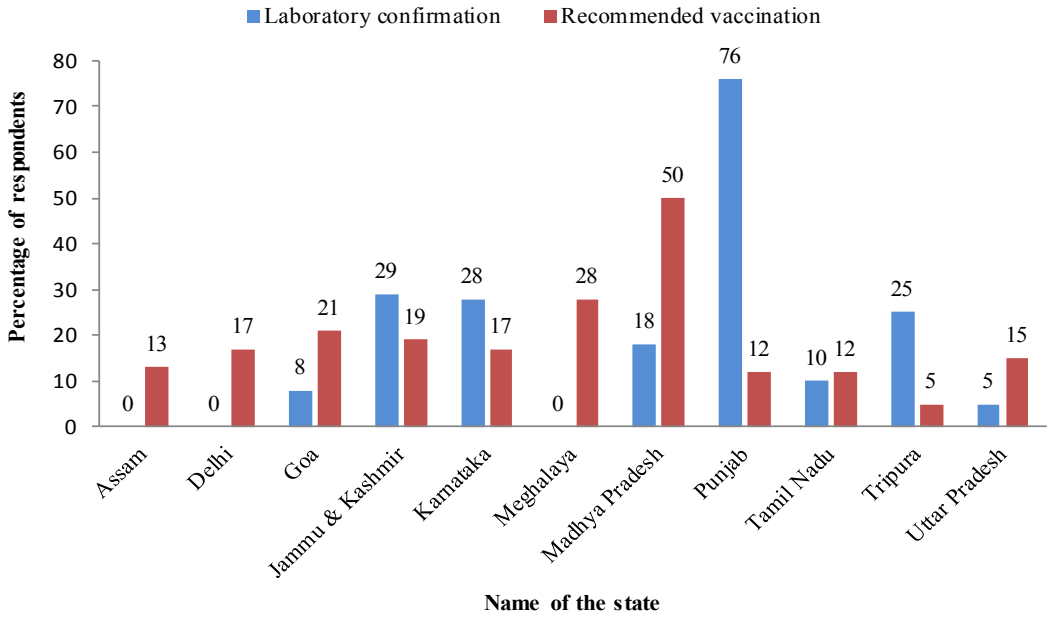


Fig. 29. Percentage of respondents obtained laboratory confirmation and recommended vaccination against brucellosis

IPC: ANSCNIVEDICOP201400900062 Project ID: OXX03174

Development of Diagnostic Systems, Reference Collection and Molecular Epidemiology Studies for Important Arboviral Pathogens of Livestock in India

D Hemadri

Only few outbreaks of bluetongue reported during 2016-17 and also due to the fact that BTV have been isolated from apparently healthy animals an attempt was made to recover BTV from such animals. To this end, a total of 15 blood samples in EDTA were received from ADMAS Bhopal unit from Mandsur and

Shivapuri districts of Madhya Pradesh. RBCs from these samples collected from apparently healthy sheep were washed and infected into cell lines (2 passages in KC- and 3 passages in BHK-21). With all the efforts no virus could be recovered from these samples. In addition to samples from Madhya Pradesh a total of 99 blood samples were collected from Chikkaballapur and Haveri districts of Karnataka, from apparently healthy flocks. One Bluetongue virus isolate was recovered from Varlakonda village, of Gudibande taluk of Chikkaballapur district. Fourteen blood samples were sent from Sindhanur taluk where suspected Bluetongue occurred during September, 2016. The samples were processed and 4 BTV isolates could be recovered. Initial sero typing results indicated these belong to serotypes 4 and 24. Similarly, a total 62 blood samples received from ADRI Cuttak (Table 11) were processed for BTV isolation using cell cultures (KC and BHK-21 cell lines). Seven samples showed cytopathic effect after 2 passages in KC cell line and 3 passages in BHK-21 cell lines.

Table 11: Details of blood samples received from Odisha

Sl No.	State	District	Taluk	Village	
1	Odisha	Ganjam	Digapahandi	Gokarnapur	9
2	Odisha	Ganjam	Digapahandi	Basudevpur	9
3	Odisha	Ganjam	Chatrapur	Chikalakhandi	9
4	Odisha	Ganjam	Purusuttompur	Sasanpalli	22
5	Odisha	Ganjam	Purusuttompur	Jaganathapalli	13

As the bluetongue virus outbreaks may involve different serotypes, the virus isolates of 2014, 2015 and 2016 outbreaks were screened for different serotypes using VP2 based serotype specific primers (Table 12).

Table 12: Details of sero typing done using serotype specific primers

Sl. No	BTV serotype	No. of samples positive
1	BTV-1	92
2	BTV-2	24
3	BTV-3	1
4	BTV-4	7
5	BTV-5	3
6	BTV-9	1
7	BTV-16	19
8	BTV-23	3
9	BTV-24	23

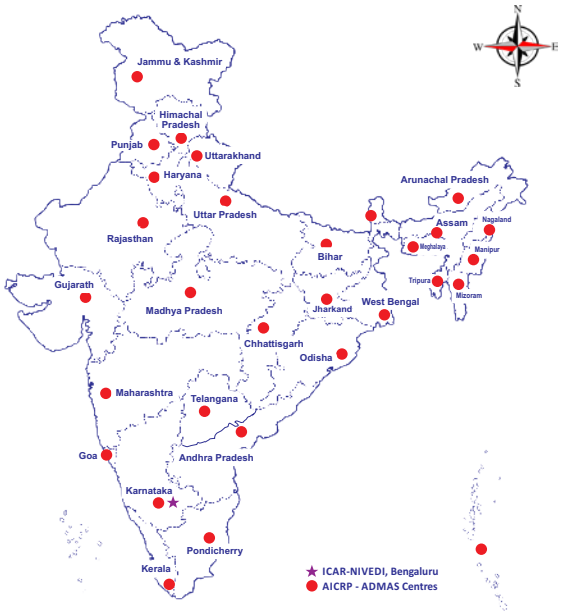
AICRP on ADMAS

Parimal Roy, B R Shome, D. Hemadri, S S Patil and A Prajapathi

To achieve the mandate of monitoring and surveillance of livestock disease in the country an All India Coordinated Research Project on Animal Disease Monitoring and Surveillance (AICRP on ADMAS) is functioning at the institute with 31 center spread across the country. Occurrence of animal disease data namely (Hemorrhagic Septicemia, Anthrax, Black Quarter, Enterotoxaemia, Brucellosis, Sheep and Goat Pox, Contagious Caprine Pleuro Pneumonia, Bluetongue, Foot and mouth disease, Peste des petits ruminants, Rabies, Classical Swine Fever, Babesiosis, Theileriosis, Trypanosomasis, Fasciolosis etc.,) were received from all the centers. The 24thAnnual Review Meet of AICRP on Animal Disease Monitoring and Surveillance of ICAR-NIVEDI was organized at Gandhinagar on 23 & 24th September 2016 under the chairmanship of Dr H Rahman, Deputy Director General (Animal Sciences), ICAR, New Delhi. All the PI of 31 AICRP centers were participated in meeting and the technical sessions included presentations by thread bare discussions on the progress made and activities to be undertaken in the upcoming year.

The 24thAnnual Review Meet of AICRP on Animal Disease Monitoring and Surveillance of ICAR-NIVEDI was organized at Gandhinagar on 23rd- 24th September 2016.

XXIV Annual Review meeting of AICRP on ADMAS under ICAR-NIVEDI held at Ahmedabad, Gujarat 23-24th September 2016.



Tribal Sub Plan (TSP)

G Govindaraj, P Krishnamoorthy, R Sridevi, R Yogisharadhya and A Prajapati

During the period under report, TSP programme was implemented in Assam, Chhattisgarh and Karnataka states. In Assam, 50 piglets were distributed to 10 women self-help groups and 50 goats to the identified ST farmers. In Chhattisgarh, 120 chick rearing units were established and provided feed and training to the beneficiaries. In Karnataka, 60 sheep were distributed to 20 tribal farmers in two villages viz,Gowdarahatti and Kaluvehalli in Chitradurga district,Karnataka. Further, Animal Health Camps were conducted in the Gonwar and Irranna camp villages in the Raichur district ,Karnataka and mineral mixtures were distributed to the tribal farmers for better health management of sheep.

Distribution of sheep to Tribal farmers in Challekera,Chitradurga,Karnataka

Scientist from NIVEDI and PI, AICRP on ADMAS, Tamil Nadu centre collecting village details and selecting tribal beneficiaries at Gurumalai Village, Vellore district, Tamil Nadu for implementation of Tribal Sub Plan Programme on 27th February, 2017.

NIVEDI Scientists monitored the Tribal Sub Plan (TSP) programme activities at Gonwar and Iranna camp villages, Raichur district and conducted the Animal Health camp and distributed mineral mixtures to the tribal farmers on 21st October, 2016.

Mera Gaon Mere Gaurav (MGMG)

MGMG programme was implemented at ICAR-NIVEDI during the year 2016-17. Five scientific teams constituted under MGMG proggramme visited the identified villages in the Bangalore (rural) district and established linkages with Village Panchayat, Anganvadi, Veterinary Doctor, Milk producers Union, Agricultural Department, village leaders and farmers. The details of the activities and number of farmers benefited is presented below.

Table : Activities organised and farmers benefited under MGMG

Sl. No.	Name of activity	No. of activities conducted	No. of farmers participated & benefitted
1	Interface meeting/ *Goshthies*	03	114
2	Training organized	00	00
3	Demonstrations conducted	01	12
4	Mobile based advisories (No.)	05	163
5	Literature support provided	08	213
6	Awareness created	08	167
7	Input support provided (q)	01	32
8	Total number of activities performed and farmers benefited	26	701

NIVEDI Scientists actively participating in MGMG

Swachh Bharath Abhiyan

Swachh bharat abhiyaan related activities are carried out on regular basis in ICAR-NIVEDI campus as per the Swachhta action plan and guidelines issues by the instructions from the Ministry of urban development, Government of India, regarding guidelines and SOP (Standard Operating Procedures) for "Swachh office". Other activities are performed as per the instructions from council. During the year 2016-17, two Swachhta Pakhwara were observed (16th- 31st May 2016 and 16th- 31st October 2016). Swachhta pledge was given to all the staff of ICAR-NIVEDI before start of the two Swachhta Pakhwara in the campus. Various activities were carried out in the Swachhta Pakhwara (16th- 31st May 2016) like cleaning of the campus by all the staff, beautification of the campus by placing pots, levelling of the ground, making compost pits etc. Various competitions like Swachh lab, Swachh office and Swachh office was conducted at the institute. Quiz competion regarding Swachh Bharat Abhiyan was organised at the institute. All the staff of NIVEDI also visited neighbouring village to create awareness regarding Swachh Bharat Abhiyan and cleanliness drive was organized. Villagers were given Swachhta pledge in local language. School children of the village were motivated to keep their premises clean and charts were distributed to them regarding good habits.

NIVEDI Staff involved in Swachh Bharath Abhiyan

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Book/Book chapter/Manuals

1. Apsana R, Manjunathareddy GB and Rahman H. 2016. Anthrax. In: Neglected Zoonosis: Concern for One Health. 1st Edt. Published by Biotech Books, New Delhi-110002. pp.43-59.

2. Balamurugan V. 2016. Peste des petitis Ruminants. In: Emerging –and remerging infectious diseases of livestock - ISBN 978-3-319-47424-3. Edited by Dr. Jagadeesh Bayry. Springer International Publishing AG 2017. pp 55-98.

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4. Manjunathareddy GB, Sumana K, Suresh KP and Rahman H. 2016. Rabies. In: Neglected Zoonosis: Concern for One Health. 1st Edt. Published by Biotech Books, New Delhi-110002. pp 73-87.

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6. Prajapati A, Sengupta PP and Rahman H. 2016. Echinococcosis or Hydatidosis. In: Neglected Zoonoses: Concern for one health, ed. H.Rahman. Biotech Books, New Delhi. pp. 113-130.

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8. Sampath K T, G. Ravikiran, K.P.Suresh, and N.K.S Gowda. Challenges and strategies for meeting the requirement of livestock production by 2050- Indian context. Food Expectations of people in the new millennium : Basics of Human Civilization : Food, Agriculture and Humanity. International edition . Vol. 5 Edited by Nath Prem & P B Gaddagimath eds published by Bio-Green Books New Delhi - 02 pp. 203-218.

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11. Suresh KP, Barman NN, Hemadri D and Patil SS. 2017. Training manual on sampling techniques and data analysis using GIS, pp 1-60.

12. Yogisharadhaya R, Sengupta PP and Rahman H. 2016. Cystocercosis. In: Neglected Zoonoses: Concern for one health, ed. H.Rahman. Biotech Books, New Delhi. pp. 97-111.

Technical Bulletins / Booklets

1. Shivachandra SB, Chanda MM, Reddy GBM and Hemadri D. (2016). Anthrax- at a Glance. NIVEDI/ Tech. Bull./38/2016.

2. Shome R, Triveni K, Patil S, Shome BR, Barman NN and Rahman H. (2016). Swine Brucellosis. ICAR-NIVEDI/Folder/22/2016.

3. Sengupta PP, Alamuri A and Balamurugan V. 2016. Toxoplasmosis and Zoonoses

4. Balamurugan V, Yogiharadhya R and Prajapati A, Hiremath J and Govindaraj G. (2016). Glimpse of ICAR-NIVEDI. NIVEDI/Tech. Bull. /2016.

5. Krishnamoorthy P, Govindaraj G, Chanda MM, Hiremath J, Balamurugan V, Suresh KP and Hemadri D. (2016). Technical Bulletin on "Glossary in Epidemiology" Revison I. NIVEDI/Tech.Bull. 39/2016.

6. Jacob SS, Sengupta PP and Roy P. (2016). Paramphistomosis in ruminants. ICAR-NIVEDI/ Folder./22/2016.

Popular Articles

1. Prajapati A, Yogisharadhya R, Manjunatha Reddy G B, and Verma R. (2017). Poultry Hatchary Hygiene Evaluation. Poultry World. January-2017:18-20.

2. Prajapati A, Manjunatha Reddy G B and Yogisharadhya R. (2016). मुर्गियों में गाउट का प्रबंधन. Poultry World. November-2016:12-14.

3. Prajapati A, Yogisharadhya R, Manjunatha Reddy G B, and Verma R.(2016) . Poultry acidifier and its role in poultry health and production poultry world journal. November-2016:16-18.

Capacity Building / Human Resource Developement

Programmes Organized:

Training/ Refresher Course/Summer/Winter School/ Seminars/ Conferences/ Symposia/ Workshops

SN.	Name of Seminar /Workshop /Training	Venue	Duration (Days)	Date
1	One day brucellosis sensitization training	Department of Animal Husbandry, Puducherry	1 day	27.04.2016
2	Sensitization training program on control of brucellosis under BCP	Puducherry	1 day	28.04.2016
3	International training cum workshop on to improve diagnostic capacity and foster regional co-operation for anthrax control and prevention	ICAR-NIVEDI, Bengaluru	3 days	14.06.2016-16.06.2016
4	Training on Standardization of duplex PCR for simultaneous detection of genus *Staphylococcus* and methicillin resistance in the isolates to M.V.Sc student, Tirupati Veterinary College	ICAR- NIVEDI	6 days	25.07.2016-30.07. 2016
5	Training programme on epidemiology and statistics to asst professors from veterinary colleges of Hassan and Shivamogga	ICAR-NIVEDI	5 days	26.07.2016 - 30.07. 2016
6	Training Program on Research Methodology , Data Management , and Bio - Statistics	Chanre, Bengaluru	2 days	20.08.2016 - 21.08. 2016
7	Short course training on Advances in livestock disease surveillance: integration of molecular biology and statistical methods in veterinary epidemiology	ICAR-NIVEDI	10 days	01.09.2016-10.09.2016
8	Training on disease diagnosis, interpolation, management and surveillance" to MFSc students, CIFE, Mumbai	ICAR-NIVEDI	30 days	01.09.2016-30.09. 2016
9	Training Program on Research Methodology	TDU, Bengaluru	2 days	05.10.2016-06.10.2016
10	Sensitization training program on control of brucellosis under BCP	Thiruvananthapur-am, Kerala	1 day	04.11.2016

SN.	Name of Seminar /Workshop /Training	Venue	Duration (Days)	Date
11	2nd Annual Review Meet of ADMaC Project	ICAR-NIVEDI, Bengaluru	1 day	25.11.2016
12	NSPAAD Project Review Meeting	ICAR-NIVEDI, Bengaluru	1 day	26.11.2016
13	VIROCON, 2016	ICAR-IIHR	4 days	07.12.2016-10.12.2016
15	Sensitization training program on control of brucellosis under BCP	Patna, Bihar	1 day	11.01.2017
16	Training delivered on sampling techniques and data analysis using GIS	AAU, Guwahati, Assam	3 days	02.03.2017-04.03.2017
17	ICAR-OPZD workshop on basic veterinary epidemiology and economics of animal diseases	ICAR-NIVEDI	5 days	31.01.2017-04.02.2017

Programmes participated :

Training/ Refresher Course/ Summer/Winter School/ Seminars/ Conferences/ Symposia/ Workshops

Sl. No.	Name of Seminar /Workshop / Training	Venue	Date	Attended by
1	Meeting to address external validation of diagnostic assays for detection of anti-*Brucella antibodies* developed at M/s Genomix, Hyderabad	M/s Genomix, Hyderabad	21.04.2016	Dr. R. Shome
2	Workshop on role of NIVEDI in one health framework	ICAR-NIVEDI, Bengaluru	30.04.2016	Dr. M. Nagalingam
3	Payroll and Human resource module	ICAR-IASRI, New Delhi	02.05.2016-03.05.2016	Dr Yogisharadhya R
4	FAO consultation on Antimicrobial resistance and emerging infectious diseases in collaboration with Govt. of India	Kolkata	22.05.2016	Dr. B. R. Shome
5	Impact assessment of agricultural extension	NAARM, Hyderabad	06.06.2016-10.06.2016	Dr.G. Govindaraj

Sl. No.	Name of Seminar /Workshop / Training	Venue	Date	Attended by
6	Molecular diagnostics of anthrax	MCVR, Manipal	17.06.2016 19.06.2016	Dr. G. B. M.Reddy Dr. S. B. Shivachandra Dr. M.M. Chanda
7	Annual review meeting for the year 2015-2016 of ICAR- network project on OPZD	Veterinary College, Bengaluru	18.06.2016-19.06.2016	Dr. P. P. Sengupta Dr. V. Balamurugan
8	Review meeting on Achievements of ICAR institute based in Karnataka	College of Agriculture, (UAS, Dharwad), Vijayapura	22.06.2016	Dr M R Gajendragad Dr G Govindaraj Dr Manjunatha Reddy G B Dr Yogisharadhya R Dr Awadesh Prajapati
9	Annual review meeting of the BBSRC DBT FADH project Understanding of the immune mechanism for host disease resistance and development of Marker vaccines and DIVA tests for PPR	The Pirbright Institute, Pirbright, London, UK	24.06.2016-27.06.2016	Dr. V. Balamurugan
10	Annual review meeting ICAR-AINWP on GIP	Madras Veterinary College , Chennai	26.06.2016-28.06.2016	Dr. K. P. Suresh
11	18th National Conference of Association for Prevention and Control of Rabies in India, APCRICON-2016	NIMHANS, Bengaluru	09.07.2016-09.07.2016	Dr. G. B. M. Reddy
12	ICAR-ILRI joint project proposal presentation meeting	Krishi Bhavan, New Delhi	21.07. 2016.	Dr. R. Shome Dr. B.R. Shome
13	4th Mid term review meeting of DBT-brucellosis network project	Madurai Kamaraj University, Madurai	25.07.2016-26.07.2016	Dr. R. Shome
14	Agrometeorological Data Collection, Analysis and Management	ICAR-CRIDA, Hyderabad	25.07.2016-06.08.2016	Dr Yogisharadhya R
15	Participated in GRAM-Global Rajastahan Agritech meet	Bengaluru	08.08.2016	Dr. V. Balamurugan Dr. G. Govindraj Dr. Manjunath Reddy Dr. A. Prajapati
16	Basic Epidemiology for Veterinarians	NIE, Chennai	22.08.2016-26.08.2016	Dr. G.B. M. Reddy Dr. M. Nagalingam Dr. Yogisharadhya R Dr. Siju Susan Jacob Dr. D. Hemadri

Sl. No.	Name of Seminar /Workshop / Training	Venue	Date	Attended by
17	All India Network Programme on Bluetongue	NASC complex, New Delhi	31.08.2016	Dr. D. Hemadri
18	Advances in livestock disease surveillance: Integration of molecular biology and statistical methods in veterinary epidemiology	ICAR- NIVEDI, Bangalore	01.09.2016-10.09.2016	Dr. S. J. Siju Dr. A.Prajapati
19	Workshop on Agriculture in Media	UAS, GKVK, Bengaluru	02.09.2016	Dr Sathish B Shivachandra Dr Yogisharadhya R
20	NICRA, Financial review meeting	ICAR- CRIDA, Hyderabad	15.09.2016-17.09.2016	Dr. K. P. Suresh
21	RTI training workshop	ISTM, New Delhi	19.09.2016-20.09.2016	Dr. R. Shome
22	Annual scientist meet of AICRP on animal disease monitoring and surveillance	Gandhinagar, Gujarat	23.09.2016-24.09.2016	Dr. D. Hemadri
23	Meeting of District Nodal officers (epidemiology), Karnataka	JD (Epidemiology) office, Hebbal, Bengaluru	24.09.2016	Dr R Shome, Dr Sathish B Shivachandra Dr M M Chanda Dr Yogisharadhya R
24	Meeting on merging NADRS and NADRES	AHC, New Delhi	07.10.2016	Dr. K. P. Suresh
25	Workshop on sexual harassment at work place	ISTM, New Delhi	13.10.2016-14.10.2016	Dr. R. Shome
26	National training on Good Laboratory Practices	SRS, ICAR-NDRI, Bengaluru.	17.10.2016-22.10.2016	Dr Yogisharadhya R
27	Ist International agrobiodiversity congress	NASC, complex, New Delhi	06.11.2016-09.11.2016	Dr. M. M. Chanda
28	Workshop on surveillance and outbreak investigations for veterinarians	Nagpur Veterinary College	07.11.2016-11.11.2016	Dr. D. Hemadri, Dr K P Suresh, Dr M M Chanda Dr. M. Nagalingam Dr. S. J. Siju, Dr. Yogisharadhya R

Sl. No.	Name of Seminar /Workshop / Training	Venue	Date	Attended by
29	National symposium on innovative approaches for diagnosis and control of emerging and re-emerging diseases of livestock, poultry and fish	College of Veterinary Science & Animal Husbandry, Chhattisgarh	09.11.2016-11.11.2016	Dr. P. Krishnamoorthy Dr. G. B. M. Reddy
30	User awareness workshop on J-GATE@CeRA for the staff members provided by Mr. B.S. Ravishankar trainer from informatics India limited, Bengaluru	ICAR-NIVEDI	15.11.2016	All Scientists and STO
31	Workshop on metabolomics for plant, human and animal health	The Energy and Resources Institute (TERI), New Delhi	17.11.2016-18.11.2016	Dr. S.B. Shivachandra Dr. M. M. Chanda
32	International brucellosis conference	NASC complex, New Delhi	17.11.2016-19.11.2016	Dr. R. Shome Dr. V. Balamurugan Dr. P. Krishnamoorthy Dr. A. Prajapati Dr. J. Hiremath
33	XIV IAVPH Conference	RAJUVAS, Udaipur, Rajasthan	21.11.2016-22.11.2016	Dr. R. Shome
34	ILRI-ICAR brucellosis project launch meet	AAU, Ghuwahati	27.11.2016	Dr. R. Shome, Dr. B. R. Shome
35	Venus international foundation organized annual research meet (ARM) 2016	Chennai	03.12.2016	Dr. V. Balamurugan
36	Meeting on national action plan on antimicrobial resistance	New Delhi	05.12.2016	Dr. B. R. Shome
37	National workshop on development of national action plan on antimicrobial resistance	New Delhi	08.12.2016-09.12.2016	Dr. B. R. Shome
38	25^{th0} National and International Conference of Indian Virological Society (IVS), *VIROCON-2016* on Global Prospectives in Virus Disease Management	IIHR, Bengaluru	08.12.2016-10.12.2016	Dr. D. Hemadri Dr. S.B. Shivachandra, Dr. S. S. Patil, Dr. V. Balamurugan Dr. Yogisharadhya R
39	Indo-Norway workshop on antimicrobial resistance-Understanding challenges and identifying potential solutions	New Delhi	10.12.2016-11.12.2016	Dr. B. R. Shome

Sl. No.	Name of Seminar /Workshop / Training	Venue	Date	Attended by
40	National capacity building on Recent diagnostic tools for hydatidosis, cysticercosis and trichinellosis	Veterinary College, Mumbai	05.01.2017 - 07.01.2017	Dr P P Sengupta
41	Regional Horticulture Fair	ICAR-IIHR, Bengaluru	15.01.2017-19.01.2017	Dr V. Balamurugan Dr G Govindaraj Dr P Krishnamoorthy Dr Jagadish Hiremath Dr R Sridevi Dr Manjunatha Reddy Dr Yogisharadhya R Dr Awadesh Prajapati
42	Epi-Info training	Pune	16.01.2017-19.01.2017	Dr. M. M. Chanda Dr P Krishnamoorthy
43	FAO-ICAR-NIVEDI on laboratory based surveillance of AMR in human health and veterinary sectors	Bengaluru	18.01.2017-16.01.2017	Dr B R Shome Dr R Shome Dr. S.B. Shivachandra Dr R Sridevi Dr. M Nagalingam
44	DBT_BIRAC project technical expert meeting	BIRAC Office , Lodhi Road, New Delhi	24.01.2017	Dr. R. Shome
45	GHSA scientific writing workshop	Manipal University, Manipal	30.01.2017-02.02. 2017	Dr. J. Hiremath
46	Capacity building workshop on basic veterinary epidemiology and economic of animal diseases	ICAR-NIVEDI	31.01.2017-04.02.2017	Dr. R. Sridevi
47	4th Annual meeting of DBT network project on brucellosis	DBT Office, New Delhi	06.02.2017	Dr. R. Shome
48	National Symposium on Challenges in Animal health for higher productivity and income to farmers and XXX Annual convention of Indian Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases	Veterinary College, Nagpur, Maharashtra.	10.02.2017-12.02.2017	Dr G Govindaraj Dr Yogisharadhya R
49	Meeting and short training of the partners of the Indo-UK/DBT-BBSRC project on development of diagnostic systems, reference collections and molecular epidemiology studies of important arboviral pathogens of livestock in India	Pirbright and Glasgow, UK	13.02.2017-18.02.2017	Dr. D. Hemadri

Sl. No.	Name of Seminar /Workshop / Training	Venue	Date	Attended by
50	International symposium on current concepts in diagnosis and control of parasitic diseases to combat climate change	Veterinary College, Shimoga, Karnataka	15.02.2017-17.02.2017	Dr. P. Krishnamoorthy Dr. M. M.Chanda
51	Competence enhancement programme for effective implementation of Training functions by HRD Nodal Officers of ICAR	ICAR-NAARM, Hyderabad	16.02.2017-18.02.2017	Dr Yogisharadhya R
52	XIII Agricultural Science Congress 2017 and exhibition	GKVK, UAS Bengaluru	21.02.2017-24.02.2017	Dr M R Gajendragad Dr. S. S. Patil Dr. S. B. Shivachandra, Dr G Govindaraj Dr P Krishnamoorthy Dr Jagadish Hiremath Dr R Sridevi Dr Manjunatha Reddy Dr Yogisharadhya R Dr Awadesh Prajapati
53	FAO-ICAR meeting on establishment of national network of veterinary lab for AMR	Kolkata	07.03.2017-08.03.2017	Dr. B. R. Shome
54	NCDC-IVRI joint workshop on zoonotic diseases of public health importance	ICAR - IVRI, Bengaluru campus	07.03.2017-10.03.2017	Dr. R. Sridevi Dr. S. J. Siju
55	Krishi Unnati Mela 2017	ICAR-IARI, New Delhi	15.03.2017-17.03.2017	Dr G Govindaraj Dr P Krishnamoorthy Dr Yogisharadhya R
56	CDC-ICAR interactive meeting	Krishi Bhawan, ICAR New Delhi	16.03.2017	Dr. S.B. Shivachandra
57	Meeting to discuss ICAR-ICMR joint proposals	Krishi Bhavan, ICAR ,New Delhi	21.03. 2017	Dr. R. Shome, Dr. B. R. Shome
58	Bioinformatics for transcriptome sequencing	ICAR-IISR, Kozhikode	22.03.2017 25.03.2017	Dr. G. B. M. Reddy
59	FAO- ICAR meeting to identify research priorities in veterinary sector for Antimicrobial Resistance	ICAR-CFTRI, Kochi	27.03.2017-28.03.2017	Dr. B. R. Shome

AWARD/FELLOWSHIP/RECOGNITION

1. Biotech product and process development and commercialization award-2016, Dr. Rajeswari Shome, Dr. B. R. Shome, Ms.Triveni K and Dr. H. Rahman. In recognition of their work on "Indigenously developed affordable diagnostics for serosurveillance of brucellosis for livestock in India from Department of Biotechnology, Ministry of Science and Technology, Government of India on Technology day ceremony. 11.05.2016 Vigyan Bhavan, New Delhi.
2. Dr. Parimal Roy received M.R. Dhanda oration award from the Association of Public Health Veterinarians conferred on 3rd December, 2016 during 12th National conference held at Durg, M.P.
3. Dr. Parimal Roy received Recognition award (2015-2016) for significant contribution in Animal Sciences form the National Academy of Agricultural Sciences, New Delhi.
4. Certificate of appreciation by Indian association of women veterinarians, Dr. Rajeswari Shome. on World Veterinary Day, Veterinary College, KVAFSU, Bangalore, 7th May 2016.
5. Best poster awards, Shome R, Suresh KP, Krithiga N, Padmashree BS, Reshma K, Aradhya Y, Kumar C, Ranjitha S, Shome BR and Rahman H. 2016. Human brucellosis: A study on eroprevalence and potential risk factors among the occupational high risk groups. In: Brucellosis 2016 International Research Conference, National Agricultural Science Complex in New Delhi, 17th-19th, November, 2016.
6. Best poster awards, Shome R, Suresh KP, Krithiga N, Mangadevi N, Padmashree BS, Reshma K, Nagalingam M, Shome BR and Rahman H. 2016. Identification of potential risk factors for bovine brucellosis in organized farms of Karnataka, India. In: Brucellosis 2016 International Research Conference, National Agricultural Science Complex in New Delhi, India, 17th- 19th November.
7. First Prize in 'Chess (Men), Dr. Sathish B. Shivachandra, 'ICAR-Inter-Institutional Sports Meet (South Zone)' at ICAR-NAARM, Hyderabad, Telangana.
8. Best Poster Award, Phani K, Hiremath J, Patil SS, Suresh KP, Chanda M, Rahman H and Hemadri D. 2016. Baseline survey of PRRSV in India. In: XXV National Conference of the Indian Virologoical Society (IVS)-VIROCON 2016 and International Conference on 'Global Perspectives in Virus Disease Management' ICAR-IIHR, Bengaluru, 8th-10th December, 2016.
9. Fellow of National Academy of Agricultural Science (NAAS), Dr. V. Balamurugan, Senior Scientist, w.e.f. 1.1.2017.
10. International foundation outstanding scientist of the research awards - 2016, Dr. V. Balamurugan, Annual Research Meet (ARM) 2016, Chennai. 3rd December, 2016.
11. Pearl foundation Outstanding Research Award in Agricultural Research (Veterinary Science)- 2016, Dr. V.Balamurugan, SMART Summit 2016, Madurai, Tamil Nadu.
12. Best research oral presentation award, R.Sharada, S. Isloor, BH Veeresh, V.Balamurugan, VVS Suryanarayana, D. Rathnamma, R.Manisha and M.L Satyanarayana 2016. Development of recombinant rabies virus glycoprotein based ELISA for sero-monitoring of vaccinal antibodies in dogs. In: 18th National Conference of Association for Prevention and Control of Rabies in India. NIMHANS, Bengaluru, 9th -10th July, 2016, pp 9.
13. Best poster award Santosh AK, Deepak KS, Isloor R, Nandhini R, Sharada, Balamurugan V, Rathnamma D, Yathiraj S, Satyanarayana ML and Nagendra RH.2016. Cloning of rabies virus glycoprotein in baculovirus expression system. In: 18th National Conference of Association for Prevention and Control of Rabies in India. NIMHANS, Bengaluru, 9th -10th July 2016,pp 33.
14. Best poster presentation, award M. Nagalingam, V.Balamurugan, JB Thaslim, N Vijayagowri, R. Shome, GB Manunathareddy, BR Shome and H. Rahman. 2016. Cloning and expression of immunogeneic protein (s) of *Brucella abortus* in prokaryotic xpression system and assessing their suitability for sero-diagnosis of bovine brucellosis. In: International Research conference brucellosis-2016 held at NASC complex, New Delhi, Bengaluru,17t^{h}- 19th November 2016,pp 194.

15. Best Paper (Oral) award (First Prize), Krishnamoorthy P. 2016. Boron supplementation improves performance in lambs with abiotic stress induced by feeding calcium deficient diets. In: National conference on "Newer perspectives in animal nutrition research for augmenting animal productivity" 9th-11th November, 2016, Sri Venkateswara Veterinary University, Tirupati.

16. Best poster award, Krishnamoorthy P. 2016. Effect of feeding graded doses nano zinc oxide (nZnO) on rat immunity and intestinal architecture. In: National conference on Newer perspectives in animal nutrition research for augmenting animal productivity, 9th-11th November, 2016, Sri Venkateswara Veterinary University, Tirupati.

17. Best poster-papers, Suma AP, Suresh KP, Sandip Santra, Gajendragad MR. 2017. A climate-anthrax relationship model: a case study in Karnataka. In: Poster was adjudged as one of the six at the XIII Agricultural Science Congress 2017, UAS, Bengaluru, February 2017.

18. Best poster presentation, Shome R, Suresh KP, Krithiga N, Mangadevi N, Reshma K, Nagalingam M, Shome BR and Rahman H. (2016). Identification of potential risk factors for bovine Brucellosis in organized farms of Karnataka. In: 68th Annual International Brucellosis Conference. New Delhi, November, 2016.

Dr. Rajeswari Shome, Team leader receiving the prestigious "Biotech Product and Process Development and Commercialization Award-2016" from The Hon'ble President of India Shri Pranab Mukherjee. Dr. Harsh Vardhan, Minister of Science and Technology and Earth Sciences, Govt. of India, Dr.Vijay Raghavan, Secretary, DBT and Prof. Ashutosh Sharma, Secretary, DST and other dignitaries were present during the occasion.

Dr. Parimal Roy, Director, ICAR- NIVEDI received NAAS Recognition Award in the field of Animal Sciences during Agricultural Science Congress held at UAS, Bengaluru from 18-22nd February, 2017, from Sri. V.R.Vala, Hon'ble Governer, Karnataka. Dr. H. Shivanna, Vice Chancellor, UAS, Bangalore, Sri K.B. Gowda, Hon'ble Minister of Agriculture, Karnataka and Dr. T. Mohapatra, DG, ICAR, New Delhi (L to R) were present on this occasion.

Dr. S. B. Shivachandra, Senior Scientist won First prize in Chess (Men) event during 22-26th August 2016 south zone held at Hyderabad

MISCELLANEOUS

Quinquennial Review Team (QRT)

Name	Designation	
Dr. S. K. Garg	Former Vice-Chancellor Vet. University, Mathura, Director, College of Applied Education and health Sciences, Meerat (U.P.)	Chairman
Dr. M. S. Oberoi	Former Sub Regional Manager, Food & Agriculture Organization of the United Nations	Member
Dr. M. Rajasekhar	Former Project Director, PD_ADMAS, Bengaluru	Member
Dr. Lal Krishna	Former ADG (AH), ICAR, New Delhi	Member
Dr. Mruthyunjaya	Former National Director, NAIP, ICAR, New Delhi Former Director, ICAR-NCAP, New Delhi	Member
Dr. Kumanan K	Dean, Faculty of Basic Sciences, TANUVAS, Madras Veterinary College, Chennai	Member
Dr. V. Balamurugan	Senior Scientist, ICAR-NIVEDI, Bengaluru	Member Secretary

First review meeting of 4th Quinquennial review team held on 11th - 13th August 2016

Third review meeting of 4th Quinquennial review team held on 5th November 2016

Research Advisory Committee (RAC)

Name	Designation	
Dr. K.M. Bujarbaruah	Vice Chancellor, Assam Agricultural University, Jorhat	Chairman
Dr. Minakshi Prasad	Professor & Head Department of Animal Biotechnology LUVAS, Hisar, Haryana	Member
Dr. Suresh Pal	Principal Scientist & Head Agriculture Economics Division IARI, New Delhi	Member
Dr. Devendra Swarup	Former Director, CIRG, Makhadoom	Member
Dr. J.R. Rao	Former JD (Res) IVRI, Izatnagar	Member
Dr. Parimal Roy	Director, ICAR-NIVEDI, Bengaluru	Member
Dr. Ashok Kumar	ADG (AH), ICAR, New Delhi	Member
Dr. D. Hemadri	Principal Scientist, ICAR-NIVEDI, Bengaluru.	Member Secretary

Institute Research Committee (IRC)

Name	Designation	
Dr. Parimal Roy	Director, ICAR-NIVEDI, Bengaluru	Chairman
Dr. R. Raghavan	Professor & Head (Retd.), Dept. of Veterinary Microbiology, Veterinary College, Bengaluru	Expert
Dr. Yathiraj	OSD to Veterinary College, Gadag. KVA&FSU, Bengaluru	Expert
Dr. G. R. Reddy	Principal Scientist ICAR-IVRI, Bengaluru	Expert
Dr. Lalith Achoth	Prof & Head, Dairy Economics and Business Management, Diary Science College, Bengaluru	Expert
All Scientist of the Institute		Members
Dr. P. P. Sengupta	Principal Scientist. ICAR-NIVEDI, Bengaluru	Member Secretary

The RAC meeting of the Institute was conducted on 26th November 2016

The IRC meeting of the Institute was conducted on 12th January 2017

Institutional Animal Ethics Committee (IAEC)

Name	Designation	
Dr. Parimal Roy	Director, ICAR-NIVEDI, Bengaluru	Chairman
Dr. S.P. Muthukumar	CPCSEA Nominee	Member
Dr. B R Shome	Principal Scientist, ICAR-NIVEDI, Bengaluru.	Member
Dr. Rajeswari Shome	Principal Scientist, ICAR-NIVEDI, Bengaluru.	Member
Dr. Divakar Hemadri	Principal Scientist, ICAR-NIVEDI, Bengaluru.	Member
Dr. P.P. Sengupta	Principal Scientist, ICAR-NIVEDI, Bengaluru.	Member
Dr. P. Krishnamoorthy	Scientist, ICAR-NIVEDI, Bengaluru.	Member Secretary

Institute Management Committee (IMC)

Name	Designation	
Dr. Parimal Roy	Director, NIVEDI, Bengaluru	Chairman
ADG (AH)	ICAR, New Delhi	ICAR Representative
Dr. R. Bhatta	Director, NIANP, Bengaluru	Member
Dr. K.P. Ramesha	Principal Scientist, Southern Region Station, NDRI, Bengaluru	Member
Dr. B. R. Shome	Principal Scientist, NIVEDI, Bengaluru	Member
Dr. A. N. Shylesha	Principal Scientist, NBAIR, Bengaluru	Member
Mr. Rajeevlochana	AAO, ICAR-NIVEDI, Bengaluru	Member Secretary

ICAR-NIVEDI conducted 9th Institutional Animal Ethics Committee (IAEC) meeting on 30th December, 2016 under the Chairmanship of Dr. Parimal Roy, Director.

IMC Meeting held on 8th December 2016

DISTINGUISHED VISITORS

1. Dr. Trilochan Mohapatra, Secretary DARE & DG, ICAR
2. Dr. H. Rahman, DDG (AS), ICAR, New Delhi.
3. Dr .R.K. Singh, Director, ICAR-IVRI, Izatnagar
4. Dr. A. K. Srivatsava, Director, ICAR-NDRI, Karnal
5. Dr. K.M. Bujarbaruah, Vice-Chancellor, AAU, Guwahati
6. Dr. Madhan Mohan, Advisor, DBT, New Delhi
7. Dr. S. K. Garg, Director, CAEHS, Meerut.
8. Dr. M.S. Oberoi, Former Sub Regional Manager, FAO, United Nations
9. Dr. R.N. S. Gowda, Former Vice Chancellor, KVAFSU, Bidar
10. Dr. M. Rajasekhar, Former Project Director, PD_ADMAS, Bengaluru
11. Ashok Kumar, ADG (AH), ICAR, New Delhi
12. Dr. J R Rao, Former Professor & Head IVRI, Izatnagar
13. Dr. Minakshi Prasad, Professor, & Head, LUVAS, Hisar
14. Dr. Johanna, CDC, USA
15. Dr. Kayla Laserson, Country Director, CDC, India
16. Dr. Apoorva Chakraborthy, Director of Research, AAU, Guwahati
17. Dr. Lalkrishna, Sr. Consultant, (NER-BPMC), DBT, New Delhi
18. Prof. Alan Jenkins, Deputy Director, Water & Pollution Science Director, Centre for Ecology & Hydrology, UK
19. Prof. Mark Bailey, Director, Centre for Ecology & Hydrology, UK
20. Dr. S. Yathiraj, Dean Veterinary College, Bengaluru.
21. Dr. Raghavendra Bhatta, Director, ICAR-NIANP, Bengaluru.
22. Dr. Kumanan. K, Dean Faculty of Basic Sciences, TANUVAS, Chennai
23. Dr. B. N. Tripati, Director, ICAR-NRC on Equines, Hisar
24. Dr. Mruthyunjaya, Former National Director, NAIP
25. Dr. R. Raghavan, Retd. Professor, Dept. of Veterinary Microbiology, Veterinary College, Bengaluru
26. Dr. K. P. Ramesha, Station In-charge, ICAR-NDRI (SRS), Bengaluru
27. Dr. Lalith Achoth, Professor & Head, Dairy Science College, Bengaluru
28. Dr. G.R. Reddy, Principal Scientist, ICAR-IVRI, Bengaluru

STAFF POSITION DURING 2016-17

Sl. No.	NAME OF THE STAFF	Designation
1	Dr. Parimal Roy	Director (RMP)
SCIENTIFIC STAFF		
2	Dr. B.R. Shome	Principal Scientist
3	Dr. (Mrs) R. Shome	Principal Scientist
4	Dr. D. Hemadri	Principal Scientist
5	Dr. P.P. Sengupta	Principal Scientist
6	Dr. K.P. Suresh	Principal Scientist
7	Dr. V. Balamurugan	Senior Scientist
8	Dr. S.S. Patil	Senior Scientist
9	Dr. Sathish B Shivachandra	Senior Scientist
10	Dr. G. Govindaraj	Senior Scientist
11	Dr. P. Krishnamoorthy	Scientist
12	Dr. Md. Muddassar Chanda	Scientist
13	Dr. Jagadish Hiremath	Scientist
14	Dr. M. Nagalingam	Scientist
15	Dr. (Mrs.). R. Sridevi	Scientist
16	Dr. G. B. Manjunatha Reddy	Scientist
17	Dr. (Mrs.). Siju Susan Jacob	Scientist
TECHNICAL STAFF		
18	Dr. R. Yogisharadhya	Senior Technical Officer
19	Dr. Awadesh Prajapati	Senior Technical Officer
ADMINISTRATIVE STAFF		
20	Sh. Rajeevalochana	Assistant Administrative Officer
21	Sh. Babu R. K	Assistant Finance &Accounts Officer
22	Smt. Divya C. N	Assistant
23	Sh. N. Narayanaswamy	Assistant
24	Smt. A. Saranya	Stenographer Grade-III
25	Mr. K. Vijayraj	Stenographer Grade-III
26	Smt. G. C. Sridevi	Lower Division Clerk
27	Sh. Gangadhareshwara	Lower Division Clerk
SKILLED SUPPORT STAFF		
28	Sh. M. K Ramu	Skilled Support Staff
29	Sh. Hanumanthuraju	Skilled Support Staff
30	Mr. H. S. Umesh	Skilled Support Staff

Joining:

Dr. Parimal Roy joined this Institute as Director ICAR - NIVEDI on 30-9-2016

Promotion:

1) Dr. Mohd. Mudassar Chanda, Scientist placed in Rs.7000/- RGP w.e.f.10-2-2014
2) Dr. R. Sridevi, Scientist placed in Rs.7000/- RGP w.e.f. 10-2-2013
3) Dr.M.Nagalingam, Scientist placed in Rs.7000/- RGP w.e.f.21-4-2014
4) Dr. Jagadish Hiremath, Scientist placed in Rs.7000/- RGP w.e.f. 1-3-2012

Probation clearance :

1) Dr. R. Yogisharadhya , STO w.e.f. 16-12-2015
2) Dr. Awadhesh Prajapathi, STO w.e.f. 1-1-2016

Demise:

Dr. Gururao Shrinivas Desai
(9^{th} July, 1970 - 20^{th} June 2016)

NIVEDI family is saddened to inform that our beloved colleague Dr. Gururao S. Desai, Principal Scientist has left for heavenly abode on 20th June 2016 following a brief illness. He joined at ICAR-NIVEDI, Bengaluru on 2nd May 2014 from ICAR-IVRI on transfer. Dr. Desai joined ARS in the discipline of Veterinary Microbiology at ICAR-NIHSAD (former HSADL), Bhopal on 25th November, 1999. He obtained his Ph.D., in Veterinary Virology from ICAR-IVRI, Izatnagar/Mukteswar as in-service candidate in 2007.

He served as the Biosafety Officer for the newly established state of art BSL2++ facility at ICAR- NIVEDI. His contributions in the field of conventional virology and molecular epidemiology of Classical Swine Fever, Bluetongue, PPR, Influenza, Ganjam disease and research contribution in NAIP and NICRA projects are highly recognized.

The NIVEDI family prays almighty for departed soul for eternal peace and gives enough strength to the bereaved family to bear his loss.

BUDGET

Revised Estimate and Expenditure under Plan & Non Plan for 2016-17

(In lakh rupees)

Major Heads	PLAN		NON PLAN	
	Revised Estimate	Expenditure	Revised Estimate	Expenditure
Grants for Creation of Capital Assets (Capital)				
Works	376.15	376.15		
Equipments	43.63	43.62	3.00	2.97
Information Technology	1.19	1.17		
Library Books & Journals	1.00	1.01		
Furniture & Fixtures	2.54	2.54	1.00	1.00
Grants in Aid - Salaries (Revenue)				
Establishment Expenses (Salaries)			405.00	405.00
Grants in Aid - General (Revenue)				
Pension & Other Retirement Benefits				
Travelling Allowances	10.00	10.00	2.00	2.00
Research & Operational Expenses	101.00	101.00	62.00	62.00
Administrative Expenses	25.50	25.49	161.50	161.49
Miscellaneous Expenses	3.00	2.98	1.50	1.51
AICRP on ADMAS	173.99	173.98		
NEH	60.00	60.00		
TSP	15.00	15.00		
Grant Total	813.00	812.94	636.00	635.97

Revenue Receipts during 2016-17

Description	Amount (Rs.)
License Fee	29760
Interest earned on loans & advances	209481
Application Fee from Candidates	1630
Interest earned on short term deposits	3024417
Receipt from Schemes	309391
Income generated on sale of kits	930366
Miscellaneous receipts	13352909
Total	**17857954**

NIVEDI ACTIVITIES

Dr. D. Hemadri, Pr. Scientist along with DBT-BBSRC FADH Project partners at University of Glasgow.

Dr. V. Balamurugan, Senior Scientist, participated in the DBT-BBSRC FADH PPR Annual Review Meeting held at The Pirbright Institute, London, United Kingdom during 24-27th June, 2016.

Organization of International training cum workshop on to 'Improve Diagnostic Capacity and Foster Regional Co-operation for Anthrax Control and Prevention' from 14-16th June, 2016, at ICAR-NIVEDI. Delegates from Bangladesh, AICRP-ADMAS centers and Manipal University, participated in the programme.

Scientists of NIVEDI investigating Anthrax outbreak in Doddaballapura Taluk, Karnataka

NIVEDI Scientists providing demonstration and interaction with participants from Bangladesh about Biosafety (BSL-2+) laboratory procedures in handling and processing of clinical material as part of training cum workshop on Anthrax on 15th June, 2016, at ICAR-NIVEDI.

The staffs from ICAR-NIVEDI participated in the Krishi Unnati Mela 2017 organized at Indian Agricultural Research Institute, New Delhi during 15-17th February, 2017.

ICAR Sponsored Short Course on "Advances livestock disease surveillance: Integration of molecular biology and statistical veterinary epidemiology" from 1st -10th September, 2016, ICAR-NIVEDI, Bengaluru.

Sixth Institute joint staff council of ICAR-NIVEDI meeting held on 20th January 2017 under chairmanship of Dr. Parimal Roy.

Inaugural session of "Sampling techniques and data analysis using GIS" training programme organized by ICAR-NIVEDI in collaboration with ADMaC, Core Laboratory-I, AAU, College of Veterinary Science, Guwahati from 2nd to 4th March, 2017.

Inaugural session of NSPAAD website at the Annual Review Meeting from 27th to 29th May, 2016.

NIVEDI staffs participating in the essay writing competition held during Hindi Week from 14 to 20th Sept 2016.

Quarterly meeting of Institute Hindi Implementation Committee under the chairmanship of Director NIVEDI.

International Women's Day celebration-2017 at ICAR-NIVEDI, Bangalore.

Brucellosis 2016 International Research Conference New Delhi, India November 17-19, 2016.

Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR laid the Foundation stone for the Training cum Farmers Hostel of ICAR-NIVEDI, Bengaluru on 19th May, 2016. Dr. H. Rahman, DDG (AS), Dr. A.K. Srivatsava, Director, ICAR-NDRI, Dr.Raghavendra Bhatta, Director, ICAR-NIANP and Dr. A. Sanyal, Joint Director, ICAR-IVRI, Bengaluru Campus were present.

Sensitization training program to Veterinarians of Animal Husbandry Department, Puducherry under Brucellosis Control Program on 27.04.2016 by ICAR-NIVEDI Scientists.

NIVEDI Scientist visited selected village in Shimoga district of Karnataka to collect data and samples to evaluate the Vaccine Effectivenss of vaccine against FMD on 11th September 2016.

Training of BVSC internship students from KVAFSU, Bengaluru

World Veterinary Day was celebrated with Guest lecture delivered by Dr. N. Balakrishnan, Joint Director, National Centre for Disease Control, Bengaluru on 30th April, 2016.

Dr. Parimal Roy, Director and Scientists interacted with officers of M/s. Merck India Pvt Ltd, Mumbai on development of seroepidemiological survey studies on IBR and Leptospirosis models under Public Private Partnership Projects on 7th November, 2016.

Organized Diagnostic Health Camp in association with RV Metropolis Diagnostic and Health care, Bengaluru for all the staff of ICAR-NIVEDI on the eve of Institute Foundation day on 1st July, 2016.

70th Independence day was celebrated at NIVEDI on 15th August, 2016.

Vigilance awareness week was celebrated during 31st October - 5th November, 2016 at ICAR-NIVEDI and various competitions and activities were organized on this occasion.

Agricultural Education day was celebrated at ICAR-NIVEDI by organizing the competitions to Government School children from Ramagondanahalli on 2nd December, 2016.

Scientists of ICAR-NIVEDI visited Kodihalli village, Bengaluru rural district on 25th November, 2016 to investigate suspected cases of Anthrax outbreak and to create awareness on Anthrax disease.

Training on Research Approaches, Methods and Communication was organized at ICAR-NIVEDI during 26-30th July, 2016 for Professors of Veterinary College, Shimoga and Hassan under Tribal Sub Plam/Schedule caste plans.

ICAR sponsored short course on Advances in Livestock Disease Surveillance: Integration of Molecular Biology and Statistical Methods in Veterinary Epidemiology was organized at ICAR-NIVEDI during 1-10th September, 2016.

NIVEDI Scientist visited Pork Market at Champhai, Mizoram for CSF data collection during March 2017

Kannada Rajyotsava was celebrated at ICAR-NIVEDI on 3rd November, 2016 and various activities were organized on this occasion.

Scientists conducted socio-economic survey at Bhopal, Madhya Pradesh on 22nd December, 2016.

ICAR-NIVEDI organized Sensitization training for the implementation of Brucellosis control programme for field veterinarians of Dept. of Animal Husbandry, Govt. of Kerala on 4th November, 2016.

ICAR-NIVEDI participated in the exhibition of XIII Agricultural Science Congress 2017 organized at GKVK, UAS Bengaluru from 21 - 24th February 2017

ICAR-NIVEDI participated in the exhibition of Regional Horticulture fair organized at ICAR-IIHR Bengaluru from 15 - 19th January 2017

Vigilance awareness week was celebrated during 31st October - 5th November, 2016 at ICAR-NIVEDI and various competitions and activities were organized on this occasion.

Brucellosis 2016- International Research Conference, 17th to 19th December, 2016 at NAAS Complex, New Delhi, India.

Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR and Dr. J. K. Jena, DDG (Fisheries) along with ICAR Animal Science Institute Directors and Scientists in interactive meeting held on 14th January 2017 at ICAR-NIANP, Bengaluru

2nd Annual Review meet of DBT-NER-Advanced Animal Disease Diagnosis and Management Consortium (ADMaC) held at ICAR-NIVEDI, Bengaluru on 25th November, 2016.

Infrastructure Development : Completed

Solar panel (50 kw) has been installed on the roof top of the Laboratory Building

Digital Franking Machine : Cashless transaction

Aadhaar based biometric attendance system

Swiping Machine (POS) : Cashless transaction

Infrastructure Development : Ongoing

Director's Residence Building

1st and 2nd Floor Utility Building

Farmers' Hostel

Collaborative Linkages with ICAR-NIVEDI

ICAR-NIVEDI has established Memorandum of Understanding (MoU) with Universities and IIT for collaborative research :

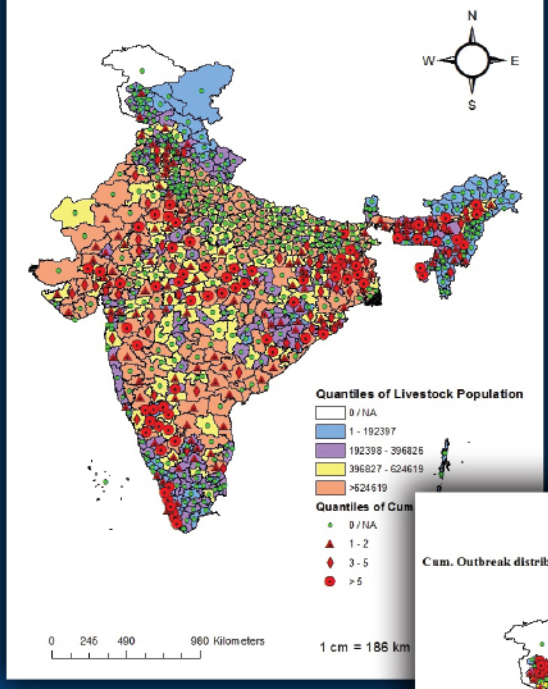
Department of Biosciences and Bioengineering, IIT, Guwahati (26.04.2016 to 25.03.2021)

College of Veterinary Sciences & Animal Husbandry, Bhubaneswar, Odisha, OUAT (28.06.2016 to 27.05.2021)

SKUAST-Kashmir FVSc & AH, Srinagar, Jammu and Kashmir (07.09.2016 to 06.08.2021)

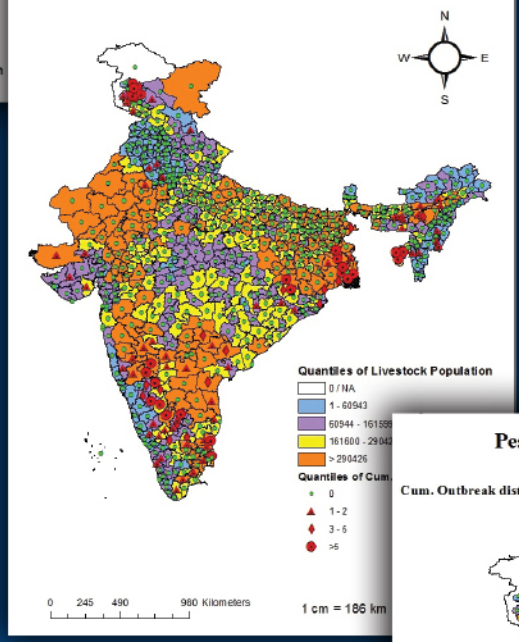
Haemorrhagic Septicaemia (HS)

Cum. Outbreak distribution (2011-16) Vis a Vis Cattle & Buffalo Livestock Population 2012



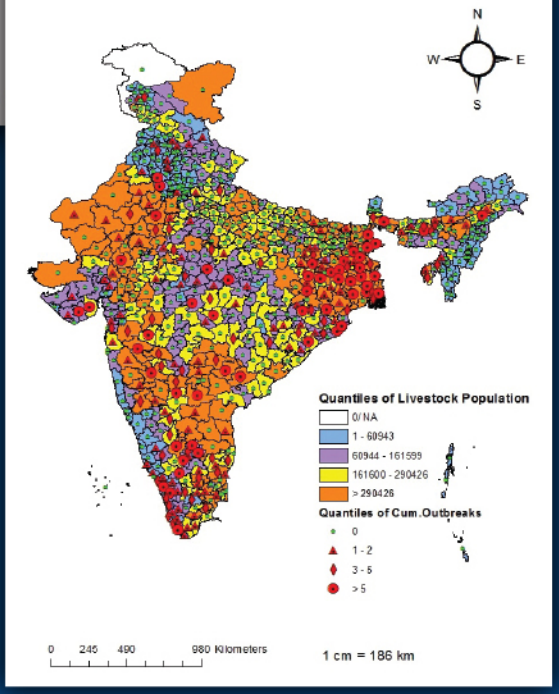
Sheep & Goat Pox

Cum. Outbreak distribution (2011-16) Vis a Vis Sheep & Goat Livestock Population 2012

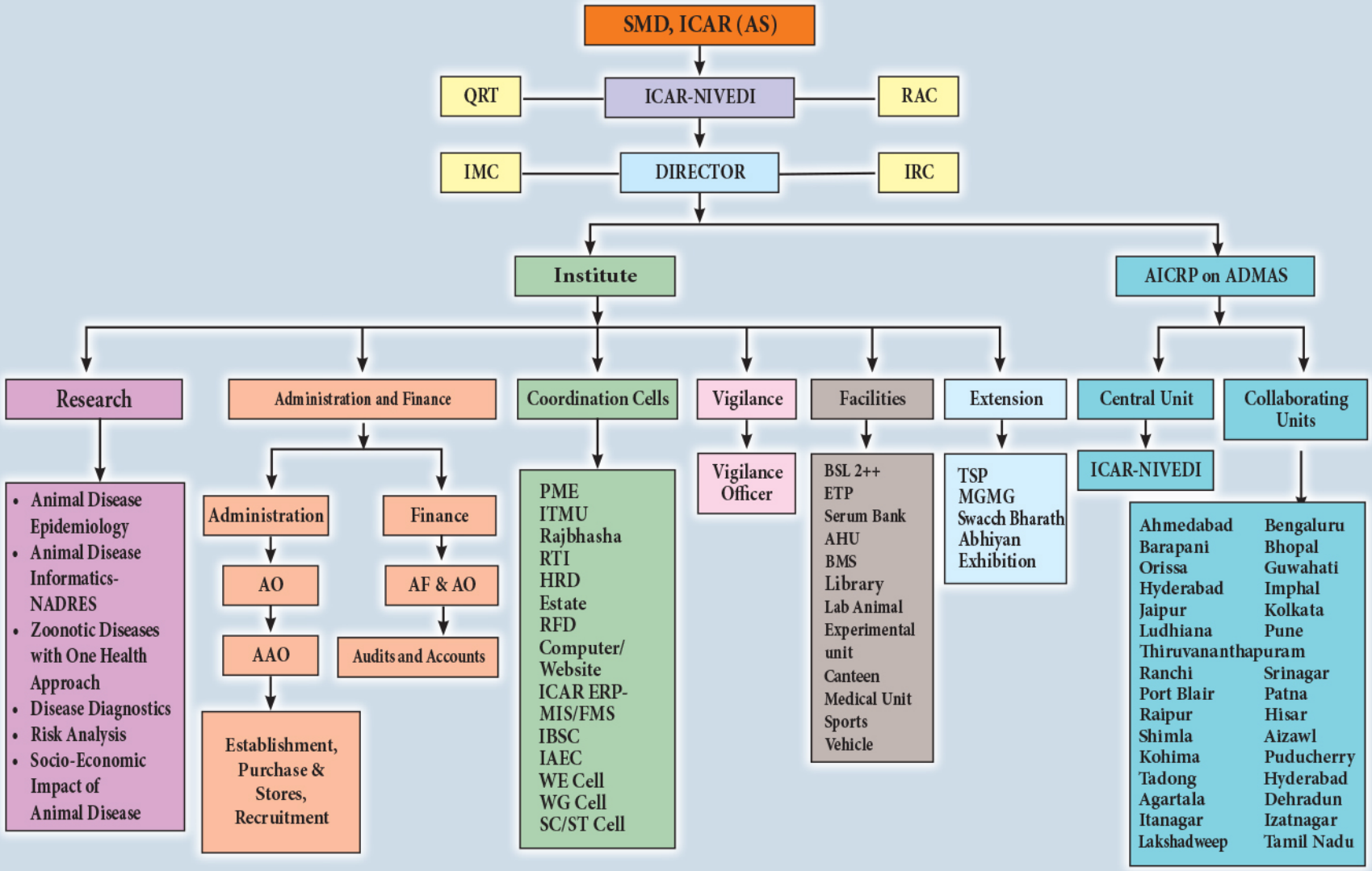


Peste des petits ruminants (PPR)

Cum. Outbreak distribution (2011-16) Vis a Vis Sheep & Goat Livestock Population 2012



ORGANOGRAM


SMD, ICAR (AS)
QRT
ICAR-NIVEDI
RAC
IMC
DIRECTOR
IRC
Institute
AICRP on ADMAS
Research
Administration and Finance
Coordination Cells
Vigilance
Facilities
Extension
Central Unit
Collaborating Units
• Animal Disease Epidemiology
• Animal Disease Informatics-NADRES
• Zoonotic Diseases with One Health Approach
• Disease Diagnostics
• Risk Analysis
• Socio-Economic Impact of Animal Disease
Administration
Finance
AO
AF & AO
AAO
Audits and Accounts
Establishment, Purchase & Stores, Recruitment
PME
ITMU
Rajbhasha
RTI
HRD
Estate
RFD
Computer/ Website
ICAR ERP-MIS/FMS
IBSC
IAEC
WE Cell
WG Cell
SC/ST Cell
Vigilance Officer
BSL 2++
ETP
Serum Bank
AHU
BMS
Library
Lab Animal Experimental unit
Canteen
Medical Unit
Sports Vehicle
TSP
MGMG
Swacch Bharath Abhiyan
Exhibition
ICAR-NIVEDI
Ahmedabad
Barapani
Orissa
Hyderabad
Jaipur
Ludhiana
Thiruvananthapuram
Ranchi
Port Blair
Raipur
Shimla
Kohima
Tadong
Agartala
Itanagar
Lakshadweep
Bengaluru
Bhopal
Guwahati
Imphal
Kolkata
Pune
Srinagar
Patna
Hisar
Aizawl
Puducherry
Hyderabad
Dehradun
Izatnagar
Tamil Nadu