KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Pookode, Wayanad, Kerala

REPORT ON
RESEARCH ACTIVITIES
2014-15

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Lakkidi (P.O), Pookode, Wayanad – 673576, Kerala State

Report on Research Activities 2014-15

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MESSAGE

Prof. (Dr.). M. R. Saseendranath
Vice-Chancellor

Greetings from Kerala Veterinary and Animal Sciences University!

I am gratified to know that Kerala Veterinary and Animal Sciences University is publishing the Annual Research Report for the year 2014-15. Kerala Veterinary and Animal Sciences University has been established with the objective of conducting need based research projects which will benefit the farming community and result in sustainable development needed for improving the economic prosperity of the country. The scientists of the university focus on various aspects of animal health like animal production, biotechnology, development of animal products, processing, extension and economics, climate adaptation studies, impact assessment of animal waste on environment etc. The proper documentation of research contributions will help to assess the impact of our achievements towards the socio-economic developments of our nation. Many of the research findings documented in this report are found accepted by the farmers and experts all over the world. I would like to congratulate the scientists and technical team of the university who supported the Director Academics and Research in implementing the projects with assistance from various Government agencies and other universities.

I wish all success to the entire team members.

Prof. (Dr.). M. R. Saseendranath
Vice-Chancellor

PREFACE

Dr. C. Latha
Director of Academics and Reseacrh

The Kerala Veterinary and Animal Sciences University came into existence on 14th June, 2010. The university has initiated pioneering efforts in the areas of academics, research, entrepreneurship and allied activities with significant commitment since its inception.

The university was established with the objectives of conducting need based research and making innovations in various sectors of animal husbandry activities. I am very happy to know that the whole team of the university has been taking part in the fulfilment of the objectives of the university. The findings of research activities undertaken by the university are to be disseminated to the veterinary professionals and farming community for making it fruitful.

I am happy to inform that the university is releasing the Annual Research Report for the year 2014-15. The report includes details of various research projects undertaken by different departments including externally aided projects, state plan projects, M.V.Sc. and Ph.D. research projects under the university. The details of financial assistance received by the university from the ICAR, NABARD/RIDF, State Plan, EFC special grant, RKVY and other funding agencies are also incorporated in this report. The growth of the university could be assured only through the sharing of various innovations and prototypes among different departments and other institutions of this sector. I would like to congratulate all the faculty members for the tremendous efforts undertaken for augmenting scientific research. I also express my hearty thanks to all the team members for active participation in preparing this report meticulously.

Dr. C. Latha
Director of Academics and Research

About the University

Kerala Veterinary and Animal Sciences University (KVASU) came into existence on 14th June, 2010 as per Ordinance No.44/2010 and later Act 3/2011 of the Government of Kerala. This institution presently undertakes academic, research, extension and entrepreneurship activities in animal production and dairy sector.

The University aims,

- to implement new courses and curricula based on the advances in the field of Veterinary and Animal Sciences
- to advance and disseminate learning and knowledge in Veterinary and Animal Sciences, Dairy Science and allied fields by fostering and promoting Veterinary and Animal Science research
- to undertake extension activities
- to collaborate and co-operate with regional, national and international research institutions and exchange any information that may be advantageous to livestock development in the State
- to act as the primary consulting and advisory body of the state government and various other agencies involved in policy making and implementation in the Veterinary and Dairy sectors

Kerala Veterinary and Animal Sciences University has three faculties, eight constituent colleges, 16 research stations and 12 schools/ centers.

Faculties under Kerala Veterinary and Animal Sciences University include:

1. Faculty of Veterinary and Animal Sciences
2. Faculty of Dairy Science
3. Faculty of Poultry Science

The eight constituent colleges of the University are:

1. College of Veterinary and Animal Sciences, Mannuthy, Thrissur
2. College of Veterinary and Animal Sciences, Pookode, Wayanad
3. College of Dairy Science and Technology, Mannuthy, Thrissur
4. College of Dairy Science and Technology, Pookode, Wayanad
5. College of Dairy Science and Technology, Chettachal, Thiruvananthapuram
6. College of Dairy Science and Technology, Kolahalamedu, Idukki
7. College of Food Technology, Thumburmuzhy, Chalakudy, Thrissur
8. College of Avian Sciences and Management, Thiruvazhamkunnu, Palakkad

The research stations of the University and the year of establishment are as follows:

1. University Veterinary Hospital, Kokkalai, Thrissur 1904
2. University Livestock Farm and Fodder Research and Development Scheme, Mannuthy, Thrissur -1917
3. Livestock Research Station, Thiruvazhamkunnu, Palakkad-1950

4. University Poultry and Duck Farm, Mannuthy, Thrissur – 1950
5. University Veterinary Hospital, Mannuthy, Thrissur- 1961
6. Centre for Pig Production and Research, Mannuthy, Thrissur-1965
7. University Goat and Sheep Farm, Mannuthy, Thrissur- 1965
8. Cattle Breeding Farm, Thumburmuzhy, Chalakkudy, Thrissur- 1973
9. All India Co-ordinated Research Project on Poultry for Eggs, Mannuthy, Thrissur- 1976
10. University Dairy Plant, Mannuthy, Thrissur- 1985
11. Centre for Advanced Studies in Poultry Science, Mannuthy, Thrissur- 1986
12. Centre for Advanced Studies in Animal Breeding and Genetics, Mannuthy, Thrissur- 1986
13. Meat Technology Unit, Mannuthy, Thrissur- 1992
14. Base Farm, Kolahalamedu, Idukki – 2000
15. Instructional Livestock Farm Complex, Pookode, Wayanad- 2004
16. Avian Research Station (ARS), Thiruvazhamkunnu -2015

Kerala Veterinary and Animal Sciences University has a well fabricated research network operated through the following schools and centres.

1. School of Applied Animal Production and Biotechnology
2. School of Animal Nutrition and Feed Technology
3. School of Zoonoses, Public Health and Pathobiology
4. School of Bioenergy and Farm Waste Management
5. School of New Media and Research
6. Centre for Advanced Studies in Poultry Science, Mannuthy, Thrissur
7. Centre for Advanced Studies in Animal Breeding and Genetics, Mannuthy, Thrissur
8. Centre for Animal Adaptation and Climate Change Studies, Mannuthy, Thrissur
9. Centre for Ethno Pharmacology, Pookode, Wayanad
10. Centre for Wildlife Studies, Pookode, Wayanad
11. Centre for One Health, Education, Advocacy, Research and Training, Pookode, Wayanad
12. Centre for Livestock Development and Policy Research, Thiruvananthapuram

Kerala Veterinary and Animal Sciences University has received 9 externally aided projects and 6 ICAR network projects. The faculty have published around 127 articles in peer reviewed journals during this period. The faculty members have also received 21 awards during 2014-15.

Research Policy

1.0 PURPOSE

This policy sets the framework to spearhead research at the Kerala Veterinary and Animal Sciences University (KVASU) consistent with its policy on research. The research policy shall help to –

a. Identify core areas of research.
b. Give direction to research activities carried out in different disciplines of basic science, veterinary science, animal science and dairy science.
c. Promote multi-disciplinary research.
d. Instil quality in research through competition among faculty members seeking research funds.
e. Act as the lead guide with a clear-cut policy on research and extension.

2.0 ORGANISATIONAL SCOPE

This is a university-wide policy and exceptions are to be accepted only with due approval by its Research Council.

3.0 VISION

The University aspires to be recognized nationally and internationally as the University of choice, in nurturing meritorious/ renowned Veterinarians, Dairy/ Livestock Products Technologists and professionals in related disciplines by entrenching a strong research culture. The research undertaken shall (a) promote sustainable and profitable animal production systems (b) provide quality care and veterinary services (c)assure food safety and quality and security of the State (d) disseminate modern scientific knowledge and skill (e) foster professionalism in animal welfare and ethics and (f) help the government to modify/ formulate policies based on scientific information and data.

4.0 MISSION

Sustainable animal production and development through –

a. Scientific breeding and production of superior quality stock and germplasm.
b. Model livestock and poultry enterprises and integrated farming systems.
c. Cost-effective interventions in feeds and feeding.
d. State-of-the-art hospitals, accredited laboratories, advanced diagnostics and superior vaccines for better diagnosis, treatment and control of animal diseases, food-borne diseases and management of infertility.

e. Production and evolution of value-added formularies. Internationally competent graduates/ professionals who can foster and promote veterinary, animal science and dairy research.
f. Control and prevention of zoonotic diseases.
g. Effective animal waste management.
h. Conservation and utilization of domestic and wild animal biodiversity.
i. Animal welfare measures in veterinary and animal science education and research.

5.0 CORE AREAS OF RESEARCH

5.1 Animal Production and Management

a. Continued improvement of stock through scientific intervention, and evaluation of various domestic and exotic animal genotypes. Breeding for disease resistance. Evolving new strains of animals and poultry adapted to local conditions.

b. Conservation, characterisation, evaluation and improvement of domestic animal and avian biodiversity.

c. Model livestock farms for optimum utilization of genetic potential of animals through micro-environmental interventions in different ecological zones; adoption of scientific management practices, user-friendly and less labour intensive technologies in routine farm operations; integration of bio-fuel technologies and value addition of farm wastes for higher net farm income.

d. Developing of feeds and fodders; cost-effective feeding schedules based on the availability of feed, fodder, other raw materials and unconventional feeds appropriate for small, medium and large livestock/poultry production units to make animal farming sustainable and economically viable.

e. Development of reproductive technologies for augmenting fertility and production in livestock.

f. Impact of climate change in animal production. Mitigation of greenhouse gas emissions and their link to climate change.

g. Application of biotechnological tools for improvement of animal and poultry production.

5.2 Animal Health

a. Development of vaccines, vaccination protocols and diagnostics for control, surveillance of diseases of farm and companion animals and disease forecasting.
b. Better strategies for treatment and control of disease of livestock and poultry, reproductive disorders and zoonotic and food-borne disease, to maintain a high standard of animal health and fertility.
c. Advanced molecular biological techniques for diagnosis of viral, bacterial, rickettsial, fungal, algal, protozoan and metazoan diseases and diseases due to infectious protein particles/ prions.
d. Investigations on disease of livestock and poultry due to deficiency or toxicity.

5.3 Improvement in Veterinary Care/Support Service

a. Research, development and refinement of medical/ surgical treatment and diagnostic strategies to sustain and improve health of farm and companion animals; development and use of biomaterials for veterinary use.
b. Research and development of newer drugs and drug molecules. Ethno veterinary medicine and health care of animals.

5.4 Biotechnology

a. Molecular characterization of domestic animal biodiversity, marker assisted selection
b. Bioinformatics
c. Development of diagnostic kits.
d. Gene expression studies- nutrigenomics
e. Embryo transfer technology, oestrous synchronization.
f. Manipulation of rumen ecosystem for improving productivity.

5.5 Livestock Products and Processing

a. Processing, packaging, preservation and storage, transport and marketing of meat, milk, egg and their products from the farm to the consumer, with quality management.
b. Traceability of food of animal origin and development of healthy low fat functional foods.
c. Value addition of livestock and poultry products
d. Development of production process through modern innovative technologies for traditional, fermented, functional and ethnic foods.

e. Energy conservation measures in dairy and food processing.
f. Low cost farm mechanisation for small scale milk and meat processing.
g. Physicochemical and microbiological characterisation of milk from different species and their value addition-Starter culture technology
h. Adulterants/contaminants in dairy and meat products

5.6 Extension and Economics

a. Technology validation through farmer participatory research/ on-farm research; development of client based knowledge sharing methods in the practice of Veterinary Science.
b. Documentation and evaluation of indigenous technical knowledge.
c. Economic feasibility of different systems of animal production and transfer of technology.
d. Evolving a mechanism to monitor the cost of production, market intelligence and suggesting periodic revision in the pricing of dairy, meat and egg products.
e. Utilisation of Information and Communication Technology (ICT) for linkages with other institutions for tele-imaging and diagnosis.

5.7 Other Core Areas

a. Need-based/ Problem-oriented research and adaptive research.
b. Animal welfare
c. Animal wastes management
d. Rearing of pet animals, birds and fishes as a livelihood.
e. Organic farming systems, nutrient cycling, insect and disease control.
f. Laboratory animal breeding and development of animal models.
g. Wildlife conservation and welfare
h. Veterinary forensics

6.0 OUTCOME

1. Food security and food safety for the state
2. Growth and development of the State of Kerala based on animal production systems.
3. Self-sufficiency in animal germplasm, production inputs and animal products.
4. Healthy and immune animals.
5. Better employment opportunities to economically weaker sections of people.
6. Equitable development and poverty alleviation through animal farming.

7.0 SUMMARY

The Kerala Veterinary and Animal Sciences University research policy is framed with an emphasis on research leading to sustainable development in animal production, thereby assuring food safety and security. It focuses on animal welfare and health, the effects of animal production on the environment, and application of new technologies to increase animal production.

Research Projects

1. Externally Aided Projects

Sl. No	Name of the Project	Funding Agency	Principal Investigator	Department	Total outlay (Lakhs)
1	Potential utilization of oil palm empty fruit bunch (OPEFB) for production of bioethanol and waste as cattle feed	Board of Research Nuclear Sciences (BRNS), Department of Atomic Energy (DAE), Mumbai	Dr. Senthil Murugan	Animal Nutrition, Pookode	30
2	Clinical applications of porcine derived collagen graft in veterinary practice	KSCSTE	Dr. S. Anoop	Department of Veterinary Surgery and Radiology, Mannuthy	15.08
3	Fermented milk products for cardiovascular benefits	KSCSTE	Dr. A. K. Beena	Dairy Microbiology	13.6
4	Laboratory and field trials on oil adjuvant inactivated vaccine for the control of New duck disease in Kerala	AHD, Kerala	Dr. Priya P.M.	Veterinary Microbiology	12.82
5	Development of a Multiplex PCR method for the simultaneous detection of four common food pathogens in meat and meat products	KSCSTE	Dr. C. Latha	Veterinary Public Health	12.5
6	Studies on the anomalies of embryos causing low hatchability in Chicken	KSCSTE	Dr. S. Maya	Veterinary Anatomy	2.67

7	Rapid screening of Intra ocular pressure in dogs	AHD	Dr. Syam K. Venugopal	Department of Veterinary Surgery and Radiology, Mannuthy	2.47
8	Morpho-histological differentiation of the skin and hair in wild and domestic small ruminants	AHD	Dr. S. Maya	Veterinary Anatomy	1.22
9	Development of a recombinant protein based lateral flow assay for the serodiagnosis of acute canine leptospirosis	KSCSTE	Dr. Ambily R.	Veterinary Microbiology	1

Potential Utilization of Oil Palm Empty Fruit Bunch (OPEFB) biomass for biofuel production and waste as cattle feed

The Oil Palm Empty Fruit Bunches (OPEFB) where the palm fruits are stripped out from fresh fruit bunches by using fruit stripper applying superheated steam at 90°C for 1 hour were collected from M/s. Oil Palm India (A Government of Kerala Undertaking). The steamed OPEFB was further hydrolysed by sulphuric acid at 1 per cent concentration for 1 hour, gamma irradiated at 100 kGy and 200 kGy as pre-treatment protocol to maximized hydrolysis. The samples were fermented by the simultaneous saccharification and continuous fermentation (SSCF) procedure in a 250 ml flask using commercial yeast strains of *Saccharomyces cerevisae* –NCIM 3090 (ATCC No: 9763); NCIM-3186 (Mandya distillery strain); NCIM-3523 (Ethanol tolerant yeast) and *Pichia stiptis*- NCIM- 3497(ATCC 58376); NCIM -3498 (ATCC 58785); NCIM-3507(ATCC-58784) from National Collection of Industrial Microorganisms (NCIM), CSIR, Pune. The yeast strain of *Pichia stiptis* has the ability of D-xylose degradation and is used for xylose fermentation. The in-vitro digestibility studies were done by using Rumen Simulation Technique equipment (RUSI E TEK) to ascertain the quality of the fermented product for ruminant feeding.

The results of lignocellulosic composition of OPEFB before fermentation revealed that the cellulose and NDF may be effectively used for bio conversion to produce bio ethanol. The maximum yield of 421. 46 g/100 g bioethanol obtained where OPEFB (gamma irradiated at 200 kGy) fermented by *Pitchia stiptis* strain 3498 (ATCC 58785) was comparable to glucose standard fermented by *S . cerevisae* NCIM-3523 (Ethanol tolerant yeast) (543.53 g/100 g bioethanol). The OPEFB lignocellulosic biomass could be effectively used for ethanol bio conversion. The *in-vitro* organic matter degradability and dry matter studies revealed that at 200 kGy, gamma irradiation increased the IVOMD degradability and also increased the dry matter degradability in acid treated samples. The increased NDF, ADF and ADL degradability was evidenced in 200 kGy gamma irradiated material at 48 hours. It is concluded that, OPEFB could be used as lignocellulosic biomass for bioethanol production and gamma irradiation at 200 kGy provides scope for in depth studies. The fermented samples also have increased nutrient degradability, hence these could be considered as raw material for ruminant feeding.

Lab Scale Fermentor

In-vitro Digestibility Studies (RUSI- E -TEK)

Clinical applications of porcine derived collagen graft in veterinary practice

Objective of the project was to develop low cost surgical treatment procedures for curing common diseases like corneal damage and cutaneous wounds of pet and farm animal and to develop at least two patentable clinical formulations of xenogeneic grafts for veterinary use. Major findings are:

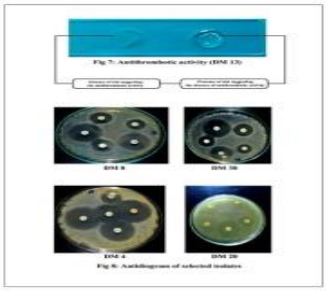
1. Porcine cholecyst derived collagen scaffold was found to be very effective in the management of corneal defects in dogs.
2. Porcine small intestinal submucosa (SIS) derived collagen sheet could be used successfully in the treatment of pigmentary keratitis after superficial keratectomy.
3. The project is being undertaken in the Teaching Veterinary Clinical Complex and Department of Veterinary Surgery and Radiology attached to College of Veterinary and Animal Sciences, Mannuthy. The grafting techniques have been very widely used for the treatment of corneal ulcers in dogs and collagen sheet of porcine cholecyst origin has found to be very effective in augmenting healing process. Work has been started to use this materials in the treatment of extensive skin wounds also.

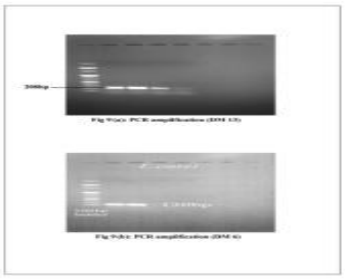
Patent application filed

Title. A method for fabricating corneal grafts using mammalian cholecyst derived extracellular matrix. Indian Patent Office filed through Sree Chithira Thirunal Institute of Medical Science and Technology. Ref. No. 5649/CHE/3013 of 7-12-2013

Fermented milk products for cardiovascular benefits

A total of sixty *Lactobacillus* isolates from various indigenous sources were biochemically characterized and systematically catalogued. An isolate from carrot (DM 18) exhibited highest angiotensin converting enzyme (ACE) inhibitory effect of 81per cent. Three of the isolates (DM 24, DM6 and DM 13) were found to release antithrombotic peptides. DM 13 was identified at molecular level as *Lactobacillus fermentum*, DM6 as *Lactobacillus casei* and DM53 as *Lactobacillus acidophilus.* Developed many probiotic products using promising isolates: Mango lassi using *L. fermentum*, ready to reconstitute drink using *L. casei* and concentrated yoghurt using *L. acidophilus.*





Laboratory and field trials on oil adjuvant inactivated vaccine for the control of new duck disease in Kerala

In Kerala, new duck disease caused by the Gram- negative bacteria, *Reimerella anatipestifer* has been reported from different parts of the state resulting in huge economic loss from 2008 onwards. So far, 21 serotypes of the organism have been reported with no cross protection. Inactivated vaccine incorporating local serotypes is an effective method to control. The different isolates obtained from the state were characterized based on biochemical, serological and molecular tests. Laboratory and field trials on the development of oil adjuvant vaccine using the local serotype has been completed successfully under an AHD funded project. Two different antigenic mass with homologous and heterologous challenge study was conducted to identify the optimum antigen dose and the antibody titre was estimated using indirect ELISA. The technology will be transferred soon to the state government.

Development of a multiplex PCR method for the simultaneous detection of four common food pathogens in meat and meat products

Multiplex PCR was standardized for the detection of *L. monocytogenes*, *Y. enterocolitica*, *S. aureus* and *S. enterica* Typhimurium. Sensitivity and specificity of standardized multiplex PCR was analyzed and found that developed multiplex PCR could detect upto 1cfu/g of organisms. Using standardized multiplex PCR protocol, detection of *L. monocytogenes*, *Y. enterocolitica*, *S. aureus* and *S. enterica* Typhimurium from meat and meat products were carried out. Out of the 349 beef samples, 325 chicken, 310 pork samples, 50 chevon and 100 meat products examined, two beef and two pork samples were found positive for *Y.enterocolitica and one beef sample for L. monocytogenes.* Out of 1134 samples, 43.91 percent showed presence of *Staph. aureus*. None of the samples showed presence of Salmonella and vibrio organisms.

Studies on the anomalies of embryos causing low hatchability in chicken

Studies were conducted on 2972 failed to hatch chicken eggs with embryonic deaths to detect the various abnormalities occurring during their development. The different hatcheries of the University farm showed good hatchability percentage due to the well maintained conditions except for the experimental groups which exhibited a lower hatchability percentage. A significant positive correlation existed between weight, length and width of eggs and also between weights of body, head and heart. Since some of the parents contributed to the anomalies to a greater extent, selective breeding by avoiding such parents may be recommended for improving the hatchability percent of the flock. Anomalies encountered in the present study were categorized as developmental failure, developmental arrest, and developmental excess including twinning and atypical differentiation with skeletal abnormalities. Histological investigations did not deviate from the normal structural plan in any of the grossly normal specimens and organs studied. All the structural components including the connective tissue components were apparently normal in tissues including the brain in grossly normal specimens. But, histochemical studies using FITC-conjugated lectin from *Ulex europaeus* revealed a general disturbance of epidermal maturation indicated by its binding to all layers of epidermis. Proventriculus exhibited decreased binding by UEA. An increased response to UEA by crypts of Leiberkuhn and goblet cells of duodenum might have been due to the changes in maturation as a result of degenerative changes induced. Even though there was a strong positive reaction in the islets, the reaction was weak in the exocrine part of pancreas. A moderate activity in the liver also indicated the relative physiological or

degenerative changes that set in after death. A strong positive reaction to Concanavalin A by the epithelium of nasal cavity and epithelium and cartilages of larynx indicated the slow setting in of degenerative changes in the upper respiratory tract due to lesser activity of enzymes in the area. The neurons and glia of brain did not show any positive reaction to either to UEA or Concanavalin A. Immunohistochemical detection of Anti-insulin antibody exhibited immunoreactive pancreatic beta cells of unhatched chick by 21-days of incubation, revealed only scattered solitary positive reaction in very few sites of islets due to the reduced activity of endocrine pancreas in unhatched stage. A positive alkaline phosphatase activity was seen in the liver indicating the active differentiation taking place in the organ even at hatch. But in contrast, the acid phosphatase activity, indicative of the lysosomal activity in the tissues, was reduced in the present study except for the lining epithelium of glandular stomach and intestine. Even though tissues exhibited normal reaction for carbohydrates, lipid activity was reduced. Ultrastructure revealed mild degenerative changes in the cellular architecture in all tissues studied. In the brain, higher degree of degenerative changes were appreciated since the tissue is very much susceptible to noxious effects. Protein estimation revealed that the protein content was more in mid gestation probably due to the decreased usage by the non-developing embryo. Genomic DNA analysis showed mismatching between nucleotides at various locations in the 693-bp fragment containing parts of sequences similar to chicken ovomucoid exons 7 and 8 and the full sequence of intron G between the two exons. Even though the TAT deletion between nt 575 and nt 579 (g.576_578del) as noted in the ovomucoid gene in ducks of low-hatchability group was not detected in the present study.

Morpho-histological differentiation of the skin and hair in wild and domestic small ruminants

A comparison of the anatomy of the skin of wild and domestic small ruminants is of great importance in forensic research. Several cutaneous glands that play an important role in scent communication characterize the skin of deer. Besides being the largest organ, the skin is important clinically as the mirror of health as it reflects various external and internal disease processes like ectoparasitism, autoimmune diseases, endoparasitism, endocrine disorders and nutritional problems. Hence, structural changes in skin will give an indication of the diseases prevailing in an area, variations in the healing pattern and also will reflect the climatic adaptations if any, for a particular region. Information gathered from this study will help to form a basis for identification of the skin samples of domestic and wild ruminants and also for the selection of the best quality skin samples for trade purposes and development of better

laboratory and surgical accessories. Moreover, it will form a basis for study of diseases affecting the skin, like epithelial and melanocyte tumors. This study will help to standardise the methods for identification of the skin samples of domestic and wild ruminants especially for forensic research and also for the selection of the best quality skin samples for trade purposes and development of better laboratory and surgical accessories. This standardisation of the skin of ruminants can be extrapolated in other species also. Moreover, it will form a basis for study of diseases affecting the skin, like epithelial and melanocyte tumors and can also be useful in the evaluation and interpretation of skin diseases of ruminants prevalent in a particular area and healing pattern.

Development of a recombinant protein based lateral flow assay for the serodiagnosis of acute canine leptospirosis

The present study was undertaken with the aim of developing a lateral flow assay for the detection of *Leptospira* specific IgM antibodies in canine sera. The assay used recombinant outer membrane protein LipL32 as antigen and a colloidal gold-labeled anti-canine IgM antibody as the detection reagent for the rapid field level serodiagnosis of acute canine leptospirosis. Other rapid diagnostic tests like dot ELISA and Latex Aggluttination Test (LAT) were also evaluated using this recombinant protein. Serum samples were collected from 100 dogs suspected for leptospirosis from District Veterinary Centre, Thrissur and from Veterinary Hospitals attached to Kerala Veterinary and Animal Sciences University. The serovars of *Leptospira*, *viz.*, *Leptospira interrogans* serovars Australis, Autumnalis, Canicola, Pomona, Bataviae, Hebdomadis, Icterohaemorrhagiae, Pyrogenes and Grippotyphosaprocured from the National *Leptospira* Reference Centre, Regional Medical Research Centre, Port Blair, Andaman and Nicobar Islands and maintained in the Department of Veterinary Microbiology, College of Veterinary and Animal Sciences, Mannuthy, were used in the study for conducting microscopic agglutination test (MAT). Out of the 105 samples tested, 56 were found to be positive by MAT**.** Latex Aggluttination Test (LAT) revealed the presence of leptospirosis in 58 samples using recombinant LipL32 as antigen. Out of the 105 samples tested, 55 were found to be positive using recombinant LipL32 as antigen**.** *Leptospira* lateral flow kits were prepared using Easymembrane kit (MDI) and out of the 105 samples tested, 35 were found to be positive using recombinant LipL32 as antigen

2. ICAR network projects

Sl. No	Name of the Project	Funding Agency	Principal Investigator	Total outlay (Lakhs)
1	AICRP on pigs	ICAR	Dr. A. P. Usha	55.30
2	Field progeny testing programme	ICAR	Dr Anil Kumar K.	41.27
3	Network Project on Buffalo Improvement	ICAR	Dr. Marykutty Thomas	41.00
4	AICRP on poultry for eggs (75 per cent of total outlay)	ICAR	Dr. Beena C. Joseph	36.94
5	AICRP on Goat Improvement	ICAR	Dr. Thirupathy Venkatachalapathy	24.90
6	Outreach programme on zoonotic diseases	ICAR	Dr. B. Sunil	20.60
7	All India Network Programme on Haemorrhagic Septicaemia	ICAR	Dr. Siju Joseph	15.33
8	Mega seed project on Pigs	ICAR	Dr. A. P. Usha	11.10
9	Outreach programme on Ethno Veterinary Medicine	ICAR	Dr. Usha Narayana Pillai	8.50

Field progeny testing programme

The increased first lactation yield of daughters born to the test bulls of the scheme is directly beneficial to the farmers to the tune of around 500 liters per lactation fetching them more than 16000 rupees per year per cow. The contribution of the project to the farmers of the state through more than 10000 female progenies produced is very substantial. Continued evaluation of milk constituents of the progenies and comparison those values with the contemporaries is done. Analysis of socio economic status of the farmers of the project gives an idea about the status of the farmers of the state involved in dairying. During the year 2014 -2015(report period) the project could produce 382 female progeny calves and their details are maintained in this unit. Socio economic statuses of 369 dairy farmers in Thrissur district have been collected and analysed. During the outbreak of foot and mouth disease, the field workers of the project were actively involved in vaccination, control and treatment of the diseased animals.

AICRP on poultry for eggs

Mannuthy centre of AICRP (Poultry) has been involved in selective breeding of IWN and IWP strains of White Leghorn for egg production through intra-population selection since 1977. During the year 2014-15**,** 1736 female birds of IWN strain and 1776 female birds of IWP strain in S28 generation have completed testing up to 40 weeks of age. Egg no 40 (EN40) on hen-housed basis was 264.81 in IWN and 255.09 in IWP strain. The values of EN40 in terms of hen-day and survivor egg production were 270.82 and 272.04 respectively in IWN and 262.21 and 262.43 respectively in IWP strain. The egg weight at 28^{th} week and 40^{th} week were 48.98 and 51.91g respectively in IWN strain. The corresponding values were 49.74 and 52.09 g respectively in IWP strain. The body weight at 16 weeks of age was 1118.23 g and 1132.82 g respectively for IWN and IWP strains. The body weight (g) at 40 weeks of age was 1446.03g in IWN and 1485.06g in IWP strains. The age of sexual maturity was 139.01 and 139.13 days in IWN and IWP respectively.

Heritability values for body weight at 16 and 40 weeks and egg weight at 28 and 40 weeks were high in both strains. The heritability estimate for age at sexual maturity showed a high degree of heritability. The heritability estimates for egg number at 40 weeks and 64 weeks were moderate in IWP strain. The heritability estimates, especially for egg number and egg weight, reveal immense scope for further improvement by selection. The sign and direction of genetic correlations among different traits follows the general rule and are consistent. A total of 8,42,056 table eggs, 12,294 day-old commercial chicks,1150 day-old parent stock chicks,

7883 birds for breeding and 4320 birds for meat purpose were supplied from this centre, generating total revenue of 33.79 lakhs rupees during the period under report.

Heritability estimates (S28 generation)

Strain	Traits	Sire	Dam	Sire + Dam
IWN	Average age at first egg	0.192±0.064	0.250±0.075	0.221±0.042
	16 Week Body Weight	0.402±0.101	0.600±0.091	0.501±0.059
	40 Week Body Weight	0.433±0.106	0.468±0.087	0.450±0.057
	64 Week Body Weight	0.315±0.087	0.452±0.088	0.384±0.054
	Egg weight at 28 Weeks	0.315±0.086	0.332±0.080	0.324±0.050
	Egg Weight at 40 Weeks	0.371±0.096	0.595±0.092	0.483±0.059
	Egg Weight at 64 Weeks	0.379±0.099	0.523±0.092	0.451±0.058
	Egg Number at 40 Weeks	0.034±0.033	0.049±0.064	0.042±0.027
	Egg Number at 64 Weeks	0.031±0.035	0.273±0.082	0.152±0.039
IWP	Average age at first egg	0.310±0.089	0.340±0.087	0.325±0.052
	16 Week Body Weight	0.450±0.112	0.622±0.098	0.536±0.063
	40 Week Body Weight	0.275±0.082	0.528±0.095	0.401±0.056
	64 Week Body Weight	0.234±0.075	0.452±0.092	0.343±0.053
	Egg weight at 28 weeks	0.286±0.084	0.646±0.099	0.466±0.060
	Egg Weight at 40 Weeks	0.454±0.113	0.689±0.100	0.572±0.064
	Egg Weight at 64 Weeks	0.278±0.083	0.580±0.097	0.429±0.058
	Egg Number at 40 Weeks	0.089±0.047	0.354±0.088	0.221±0.045
	Egg Number at 64 Weeks	0.069±0.039	0.180±0.071	0.125±0.034

Outreach programme on zoonotic diseases

A higher prevalence rate of *Listeria* spp. was observed in goat meat (68per cent) followed by soil (34.89per cent), and beef (27.35per cent). In fish catchment areas, prevalence rate of *Listeria* spp. was observed in crustaceans (23.5per cent) followed by fresh fish (19.5per cent) and hand wash of the workers (13per cent). Prevalence rates of *Listeria monocytogenes* in mussel (2per cent), hand wash of workers at fish catchment areas (1per cent), prawn (1per cent), dry fish (1per cent), fresh fish (0.25per cent), beef (0.85per cent) and leafy vegetable-amaranthus (0.54per cent) were obtained. A higher prevalence rate of *Listeria* spp. (21.39per cent) was observed from the district of Kollam. Presence of *Listeria* spp. in vegetables is of potential public health concern as the leafy vegetables especially coriander leaves and celery are used in the raw form for garnishing and for preparations like burgers. In fish catchment areas prevalence in critical points of *Listeria* spp were found to be 6 per cent in sea water, 2 per cent in soil, 4 per cent in ice, 8 per cent on fish contact surfaces, 4 per cent on boat decks and 13 per cent in hand wash samples. Higher prevalence rates were reported from Kozhikode and Kollam districts (12per cent) followed by Thiruvanathapuram district (8per cent) of Kerala.

The *Listeria* isolates obtained from different sources were 100 per cent sensitive to amoxicillin, chloramphenicol, doxycycline, erythromycin, oxytetracycline and streptomycin. Resistance was shown towards cefixime. *Listeria* isolates obtained from seafoods and fish catchment areas were intermediary sensitive to nitrofurazone and a few isolates from fish catchment areas were to furazolidone, nitrofurazone and streptomycin. In case of Listeria isolates from vegetables and human stool samples, 4.87 per cent were sensitive to cloxacillin, 31.70 per cent sensitive to rifampicin and 58.53 per cent sensitive to entrofloxacin.

Scanning Electron Microscopy of *Listeria monocytogenes* biofilm on food contact surfaces like stainless steel, aluminium, Fibre and rubber was done · Minimum inhibitory concentration of methanolic extract of *Coroupita guanensis* (Cannon ball tree) flower and leaf on *Listeria* biofilm was found to be 12.5mg/ml. The methanolic and aqueous extracts of the flower and leaf exhibited antibiofilm properties. The aqueous extract of the leaf and methanolic extract of the flower showed antibiofilm properties on test surface and was more effective on metallic surfaces (stainless steel and aluminum) when compared to fiber and rubber. The recovery of Listeriophage from sewage samples was found to be 16.36 per cent. The double agar method of isolation of Listeriophage from the sewage water, specific for *Listeria monocytogenes* were found to be positive for phages as they showed clean circular zones (complete inhibition) of the bacterial growth for 18 samples. Zones of 2 mm diameter were

taken as positive samples. Listeriophage was found to be effective at a volume of 30µl in chicken (sliced piece of 2cm x 2cm) and 20µl in fish. The average bacterial growth reduction was of 2.65±0.35 $\log_{10}$ cfu/g in chicken and with an average reduction of count by 1.65±0.59 $\log_{10}$cfu/g in fish. Nisin was found to be effective at a volume of 30µl in both chicken and fish. The mean bacterial count reduction of 30µl of nisin in chicken and fish were 2.12±0.37 $\log_{10}$cfu/g and 1.38±0.38$\log_{10}$ cfu respectively.

All India network programme on haemorrhagic septicaemia

A total number of 155 clinical samples were collected from different animals and birds for isolation of *P.multocida*. Four isolates were obtained from duck (DP, 53,54,55 and 56), and one from cat (CP1). All these isolates were biotyped as *P. multocida* subsp. *multocida.* All the four isolates were subjected PM PCR and agarose gel electrophoresis of the amplified products revealed an amplicon size of 460bp which was specific for *P. multocida.* All the isolates were sensitive to enrofloxacin, tetracycline and chloramphenicol, and all were resistant to amoxicillin, sulphadiazine and metronidazole. Except DP56, all were sensitive to ceftrixone. DP54 and DP55 were found to be resistant to gentamicin. All the isolates were sent to IVRI, Izatnagar for capsular serotyping and except for CP1, all were serotyped as *P. multocida* serotype A. The isolate CP1 was reported as untypable.

Oil adjuvant vaccine with an antigenic concentration of 3.9 $\times 10^9$ cells/ml was prepared. Five hundred ducklings from the field and 250 ducklings from the University Poultry and Duck Farm, Mannuthy of six week age were selected. They were vaccinated with oil adjuvant inactivated vaccine @ 0.5 ml vaccine intra muscularly in the thigh region. First booster dose was given on day 30 and the second dose on day 120 post primary vaccination. Blood was collected at the 1st and 3rd months and the antibody titre was monitored by PHA. The mean PHA titre for 1st and 3rd months were 139 ± 25.6 & 1120.68 ± 434.76, respectively

Outreach programme on ethno veterinary medicine

Antifungal effects of selected plants

The project envisages the development of safe and eco-friendly herbal medicines against skin diseases especially fungal skin diseases, otitis externa and rumen flukes. Various medicinal plants were tested for their efficacy against these disease conditions/parasites/microorganisms. Antifungal effect of acetonic, chloroform and ethyl acetate extracts of *Cyclea peltata* and *Artemisia japonica* were tested and *Artemisia japonica* was found to be more effective against fungal skin diseases. Antibacterial/antifungal activities of the aqueous extract of *Annona squamosa* leaves against skin diseases was also studied and found to be effective. *Cassia alata*

was found to very effective against otitis externa caused by yeast. Effect of the aqueous extract of *Butea monosperma* against rumen flukes was also tested.

Based on clinical trials, *Artemisia japonica* was found to be effective against fungal infections in animals. Essential oil of *Artemisia japonica* was found to be effective for *Trichophyton mentagrophytes*, *Trichophyton rubrum*, *Microsporum canis* and *Microsprum gypseum*. Essential oil of *Artemisia japonica* was found to be effective against *Staphylococcus aureus* (*in vitro*). Aqueous extract and protein extracted from seed of *Centrosema molle* was found to be effective against *Trichophyton mentagrophytes*, *Trichophyton rubrum*, *Microsporum canis* and *Microsprum gypseum.*

Artemisia japonica

3. State plan projects

Sl.No	Name of the Project	Department	Total outlay (Lakhs)
1	Athulya pullet production and feed production unit for Aiswarya project	AICRP	70.00
2	Establishment of Animal Biotechnology Laboratory	CASAGB	40.00
3	Strengthening of Cattle Breeding Farm, Thumburmuzhy	Cattle Breeding Farm, Thumburmuzhy	35.00
4	Multiplication of seedling-Establishment of Fodder Bank at University Livestock Farm, Mannuthy	Department of Livestock Production management	35.00
5	Enhancing the productivity of crossbred cattle at LRS, Thiruvazhamkunnu	Livestock Research Station, Thiruvazhamkunnu	33.50
6	Infrastructure facilities for buffalo improvement at Cattle Breeding Farm, Thumburmuzhy	Cattle Breeding Farm, Thumburmuzhy	30.00
7	Identification of suitable fodder varieties for sustainable milk production - Wayanad special package	Animal Nutrition, Pookode	24.99
8	Quality assurance of meat and meat products with special reference to foodborne pathogen of public health significance	Department of Veterinary Public Health	22.00
9	Strategies for improving fodder production and improvement of nutritional base	Cattle Breeding Farm, Thumburmuzhy	20.00
10	Increasing Productivity of crossbred Cattle of University Livestock Farm, Mannuthy	Department of Livestock Production Management	20.00
11	Strategies for improving fodder production of Kerala	Livestock Research Station, Thiruvazhamkunnu	20.00
12	Modernization of Vechur Cattle Conservation centre	CASAGB	20.00

13	Evaluation of the lactation performance and establishment of a system of milk recording in crossbred cows of Kerala for sire evaluation	CASAGB	20.00
14	Popularization of Malabari Goats in Wayanad District - Wayanad special package	Animal Nutrition, Pookode	19.99
15	Sustainable poultry production for self-help groups	Department of Poultry Science	19.75
16	AICRP on poultry for eggs (25 per cent of total outlay)	AICRP	16.67
17	Conservation of local cattle of Kerala	Cattle Breeding Farm, Thumburmuzhy	15.00
18	Intensive productivity augmentation measures in the establishment of Heritage Farm, Base Farm, Kolahalamedu	Base Farm, Kolahalamedu	15.00
19	Conservation and popularization of native chicken varieties in Kerala	Department of Poultry Science	15.00
20	Establishment of Germplasm Repository for domestic animal diversity of Kerala	Department of Animal Breeding and Genetics, Mannuthy	15.00
21	Post-mortem complex and forensic laboratory	Department Of Veterinary Pathology, Mannuthy	13.00
22	Setting up of a Centre for Milk Testing and quality awareness for stakeholders	Dairy Chemistry	12.00
23	Strategies for improving the fodder production of Kerala State	Department of Animal Nutrition	12.00
24	A study on prevalence and clinico pathological effects of common tick borne haemoparasitic pathogens observed in cattle population of Wayanad district	Department of Clinical Medicine, Ethics & Jurisprudence, Pookode	11.00
25	Development of starter culture centre	Department of Dairy Microbiology	10.00

26	Research on fermented and functional dairy foods-Multidisciplinary department project	Department of Dairy Technology	10.00
27	Screening and evaluation of medicinal plants for anticancer activity	Department of Veterinary Pharmacology and Toxicology, Mannuthy	10.00
28	Centre for rehabilitation of stray puppies under END programme	Department of Veterinary Surgery And Radiology, Mannuthy	10.00
29	Feeding strategies to manipulate rumen fermentation in crossbred cattle of Kerala"	Department of Animal Nutrition	10.00
30	Project on Buffalo improvement	Livestock Research Station, Thiruvazhamkunnu	10.00
31	Infrastructure development in Thiruvazhamkunnu Station	Livestock Research Station, Thiruvazhamkunnu	10.00
32	Strengthening of Rabbit Research Station, Mannuthy	CASAGB	10.00
33	Strengthening of CAADECCS	CAADECCS	10.00
34	Augmenting biotechnology and molecular biology research in KVASU, Mannuthy	CASAGB	9.50
35	Effect of LH, IGF-1 and EGF on in vitro granulosa cell expression and secretion of vascular endothelial growth factor in the ovarian follicle during estrous cycle of Malabari goats	Department of Veterinary Physiology, Pookode	8.75
36	Bovine theileriosis and its effect on milk quality in Wayanad District	Department of Clinical Medicine, Ethics & Jurisprudence, Pookode	8.00

37	Screening and evaluation of medicinal plants for anticancer activity	Department Of Clinical Medicine, Ethics and Jurisprudence, Mannuthy	7.00
38	Estimation of Antibiotic residues present in individual raw milk samples from Thrissur and Wayanad Districts	Dairy Chemistry	6.00
39	Developing balanced pet food for adult dogs	Department of Animal Nutrition	5.00
40	Augmentation of Biotechnology	Department of Veterinary Microbiology	5.00
41	Diagnosis and sero-surveillance of leptospirosis in animals and humans of Thrissur district	Department of Veterinary Microbiology	5.00
42	Biopreservation of Traditional dairy products using Lactic acid bacteria"	Department of Dairy science, Mannuthy	5.00
43	Assessment and improvement of quality of milk produced by selected dairy Co-operative societies in Thrissur District	Department of Dairy science, Mannuthy	5.00
44	Development of cloning and transgenic research facilities	CASAGB	5.00
45	DNA repository of crossbred animals	CASAGB	5.00
46	Establishment of Visual Simulator Lab and Educational Museum in Anatomy	Department of Veterinary Anatomy	4.00
47	Bovine Brucellosis in Northern Districts of Kerala – A surveillance based on Milk ELISA	Department of Veterinary Epidemiology and Preventive Medicine, Pookode	4.00
48	Scientific validation and evaluation of galactogogue herbal formulations used by local tribes as supplement to increase milk yield	Department of Veterinary Physiology, Pookode	3.70
49	Establishment of a molecular biology lab	Department of Veterinary Pharmacology and Toxicology, Mannuthy	3.00

50	Development of diagnostic protocol for rapid detection and screening of brucellosis in dogs	Department of Veterinary Microbiology	3.00
51	Development of lateral flow assay for the rapid detection of leptospirosis in animals	Department of Veterinary Microbiology	3.00
52	Surveillance and monitoring of zoonotic diseases with special reference to *Toxoplasma gondii* and enterohaemorrhagic *E. coli*	Department of Veterinary Public Health	3.00
53	Conservation and sustenance of indigenous goat production under the changing climatic scenario in Kerala	Livestock Research Station, Thiruvazhamkunnu	3.00
54	Proteome analysis of goat ovarian follicles during different developmental stages.	Department of Veterinary Physiology, Mannuthy	3.00
55	Augmenting biotechnology and molecular biology research in KVASU	Department Of Clinical Medicine, Ethics and Jurisprudence, Mannuthy	2.00
56	Augmentation of biotechnology-collaborating centre	Department of Veterinary Parasitology	2.00
57	Diagnosis and serosurveillance of Leptospirosis in animals and humans of Thrissur district	Department of Veterinary Public Health	2.00
58	Augmenting biotechnology molecular biology research in KVASU	Department of Veterinary Public Health	2.00
59	Assessment of fertility in bulls by in vitro techniques	Department of Veterinary Physiology, Mannuthy	2.00
60	Strengthening of Department	Department of Veterinary Public Health	1.00
61	Morbidity and mortality of livestock in Kerala in relation to climate change	Department of statistics	1.00

Quality assurance of meat and meat products with special reference to foodborne pathogen of public health significance

Multiplex PCR was standardized for the simultaneous detection of *L. monocytogenes*, *Y. enterocolitica*, *S. aureus* and *S. enteric Typhimurium.* The standardized m PCR was assessed for sensitivity by artificially inoculating meat with different concentrations of each reference organisms and it was possible to detect these at the level of 1cfu/g of the organism. Occurrence of food borne pathogens in beef:- Seven samples of beef, were positive for *Listeria* spp. *L. monocytogenes* was identified in two beef samples. *Staphylococcus aureus* was isolated from 58 beef samples. Six out of 80 beef samples were positive for *Salmonella* spp. By using multiplex PCR on eighty beef samples, *L. monocytogenes* was detected in two samples and *S. aureus* from 119 samples. Eight samples of beef yielded *L. innocu* and six beef samples had *S. enteritidis.*

Occurrence of food borne pathogens in pork.:- Two samples of pork were positive for *Listeria* spp. Twenty four samples of pork had *S. aureus.* Three out of fifty samples of pork were positive for *Yersenia* spp. and one was confirmed as *Y. enterocolitica.* Two pork samples were positive for *Y. intermedia.* Fifty samples of pork were subjected to multiplex PCR and one sample showed the presence of virulence gene,*ail* of *Y. enterocolitica. Nuc* gene of *S. aureus* was present in 8.5 per cent of the samples. Two pork samples gave positive result for *L. innocua.* Two samples were positive for *S. enteritidis.*

Occurrence of food borne pathogens in chevon:- One sample was positive for *Listeria* spp, 17 were positive for *S. aureus* and one for *Salmonella* Spp. *Nuc* gene of *S. aureus* was also positive present in 60.7 per cent samples of chevon. One chevon sample was positive by individual PCR for *L. innocua*. Four samples were positive for MRSA by targeting *mec* A gene. One chevon sample was positive for *S. enteritidis*

Occurrence of food borne pathogens in meat products:- None of the samples were positive for L. *monocytogenes.* However one sample yielded *L. innocua.* Twenty meat products showed the presence of *S. aureus.* Only two samples were positive for MRSA by targeting *mec* A gene. Eight samples were positive for *S. enteritidis.* The overall prevalence of *L. monocytogenes* by both conventional and multiplex PCR was found to be 0.71 per cent. The values for *Yersenia* spp. by conventional culture method was 1.07 per cent. The overall prevalence by conventional and multiplex PCR for *Y. enterocolitica* was 0.35 per cent. The overall prevalence of *S. aureus* by cultural and multiplex PCR was 38.21 and 42.5 per cent respectively. None of the cloacal swab samples were positive for *Campylobacter* spp. Of the twenty caecal swab, six samples were positive for *C. coli* and two samples yielded *C. jejuni* and of the fifteen jejunal swab

samples collected, five samples were for *C. coli* and two samples were positive for *C. jejuni by* both cultural and multiplex PCR. Both *C. jejuni* and *C. coli* was detected in two samples each of caecal and jejunal swabs samples by multiplex PCR.

Research on fermented and functional dairy foods-multidisciplinary department project

Assessed the microbiological quality of thirty samples each of crossbred and Vechur cows and Goat raw milk in terms of Total viable, Lactic Acid Bacteria, proteolytic bacteria, *S. aureus* and coliform counts and met Methylene Blue Reduction test Time (MBRT) time. Microbiological quality of goat milk was found to be better than the other two. The highest MBRT time was exhibited by goat milk followed by Vechur cow milk and cross bred cow milk.

Estimation of antibiotic residues present in individual raw milk samples from Thrissur and Wayanad Districts

Purchase of the antibiotic residue detection kit which comprised of Trisensor, Heat sensor and Read sensor helps in the rapid detection of the antibiotic residues in the test sample. A total of 89 individual milk samples were collected from Thrissur and Wayanad districts and were further analysed for the presence of antibiotic residues mainly belonging to the class sulphonamides, tetracyclines and β-lactams. Out of 54 samples collected from different parts of Thrissur, nine samples tested positive for β-lactams. Out of 35 samples collected from different parts of Wayanad, eight samples tested positive for β-lactams. A one day Quality Awareness programme was conducted at Thumburmuzhi for the farmers, processors and consumers in the Dairy Industry.

Post-mortem complex and forensic laboratory

Strengthened the existing labs, Post-mortem Room and cold storage room and purchased equipment like high definition dome camera and accessories for recording, demonstration and display facilities, rechargeable binocular microscopes, monocular microscopes, essential chemicals, rapid diagnostic kits, computer for data storage for conduct of research and documentation of the research findings. Modification of the museum display was also done for research and educational purpose.

Establishment of visual simulator lab and educational museum in anatomy

Animal models suitable for the veterinary curriculum were purchased in this project which would be very useful for demonstrating anatomical features of animals to students of the Bachelor of Veterinary Science programme.

Animal models

Feeding strategies to manipulate rumen fermentation in crossbreed cattle of Kerala (*in vitro*)

The basic work with various feed ingredients and combinations on the rumen functioning will provide a data base for arriving at a suitable combination for maximising the efficiency. Under this project ten unconventional feeds and three different combinations were analysed. This work is a beginning for further research in rumen fermentation studies

Development of diagnostic protocol for rapid detection and screening of brucellosis in dogs

A total of 200 canine sera samples of bitches suffering from infertility / abortion were screened for brucellosis by an antibody detection using rapid detection kit (Lateral flow technique) and 32 were found positive. A PCR was standardized for the detection of brucellosis using genus specific primers of gene IS711 which gave a 498 bp amplicon. Out of 50 uterine discharge / abortions screened using PCR, eight were found to be positive.

Development of lateral flow assay for the rapid detection of leptospirosis in animals

Recombinant LipL32 (rLipL32) protein of *Leptospira interrogans* was purified. This protein was utilised as antigen and a lateral flow was standardized for the serodiagnosis of leptospirosis in dogs.

Diagnosis and sero surveillance of leptospirosis in animals and humans of Thrissur district

Recombinant LipL32 protein was expressed, purified and incorporated in an ELISA and Dot-ELISA for the carrying out the serosurveillance of leptospirosis in humans and animals of Thrissur district. A total of 267 samples were collected during the period of the study, 61 were found positive with Dark field microscopy and 37 samples were positive in PCR. 58 samples showed agglutination in MAT (1:200). Fifty samples were inoculated to EMJH medium and six isolates were obtained. The MAT result with available sera could reveal that four of the isolates were *Leptospira interrogans* serovar Australis and one each of serovar Canicola and Pomona.

Augmentation of biotechnology-collaborating centre

Procurement of equipments like power pack and consumables for up gradation of existing facilities in molecular diagnostic lab in the Department of Parasitology was conducted. Diagnostic PCR was standardised for animal and human isolates of filarid nematode using mitochondrial and genomic primers. The species of filarid nematode isolated from human beings was identified for the first time in Kerala using PCR. The sequencing and phylogenetic analysis of cytochrome oxidase subunit 1 gene of zoonotic *D. repens* was done.

Diagnosis and serosurveillance of leptospirosis in animals and humans of Thrissur district

The occurrence of leptospirosis in dog owners by dark field microscopy was found to be 1.67 per cent. Microscopic agglutination test (MAT) of these samples showed a seropositivity of 13 per cent at titres above 1:400 which revealed the presence of the disease. However 20 per cent of serum samples revealed a titre between 1:50 to 1:200 which revealed past infection or exposure to the antigen. The analysis of blood samples of cattle and goat farm workers revealed that all samples were negative when observed under Dark field microscope. The analysis of the serum samples of these workers by ELISA revealed a seropositivity of 7.69 per cent at 1:50 dilution. Similar seropositivity (7.69per cent) at 1: 50 dilution was observed by MAT which revealed exposure to infection. None of the samples were positive at 1:400 dilution which revealed the absence of infection in farm workers.

The blood samples of veterinarians and para veterinarians were negative by Dark Field Microscopy (DFM). However a seropositivity of 2.85 percent was observed at 1:50 dilution by ELISA and MAT. The serum samples were found to be negative at 1:400 dilution by MAT, which reveals the absence of active infection in human patients suspected with leptospirosis,

the occurrence was found to be 2.50 per cent by DFM. Microscopic agglutination test (MAT) of these samples showed a seropositivity of 25.71 per cent at titres above 1:400 which revealed the presence of the disease. The most dominant serovars detected in humans was Autumnilis (26.32 per cent) followed by Pyrogenes (17.18 per cent), Canicola (9.37 per cent). The overall seroprevalance of 8.66 per cent was observed among risk groups. The protocol for isolation of the organism was standardised. The PCR targeting *16s r RNA* and *lipl32* gene was standardised for the organism. Awareness programmes on Leptospirosis were conducted for high school students in different school and farmers in association with Animal Husbandry Department and Health Department in Thrissur district**.**

Study on prevalence of zoonoses with special reference to *Toxoplasma gondii* and Enterohaemorrhagic *E. coli*

A total of 248 meat samples consisting of 112 beef, 104 goat meat and 32 buffalo meat samples were collected from various retail shops from Kozhikode, Thrissur and Alappuzha. Out of 51, 34 and 27 beef samples collected from Kozhikode, Thrissur and Alappuzha, eight samples from Kozhikode and three samples each from Thrissur and Alappuzha respectively showed the presence of EHEC. *Stx*1and *stx*2 genes were identified in eight EHEC isolates. Three of the isolates carried *hly* A gene. Out of 47 and 29 goat meat samples collected from Thrissur and Alappuzha respectively, three samples each showed the presence of EHEC. *Stx*1 and *stx*2 gene was identified in all the EHEC positive isolates. 12.5 per cent of buffalo meat samples collected from Kozhikode district was found to be positive for EHEC. All the EHEC isolates carried *stx* 1 and *stx2* genes, respectively. The overall occurrence of EHEC were 14 out of 112 beef samples, 6 out of 104 goat samples and 4 out of 32 buffalo meat samples. EHEC could not be detected in any of the human stool samples examined. Out of 15 feline faecal samples, two samples were detected positive for Toxoplasma oocyst.

Conservation and sustenance of indigenous goat production under the changing climatic scenario in Kerala

Conservation and improvement of Attappady Black goats was carried out at LRS, Thiruvazhamkunnu. The adaptability of Attappady Black goats to heat stress was studied in detail. Studies for breeding for parasitic resistance in goats were undertaken

Morbidity and mortality of livestock in Kerala in relation to climate change

The study focused on morbidity and mortality patterns of livestock disease in Kerala during the period 1982-2011. FMD, H.S., B.Q. and anthrax were the mostly reported diseases. Alappuzha District was entirely different from other Districts, with highest morbidity and

mortality rate due to livestock diseases. Year 2002 is different from all other years in terms of morbidity and mortality rate. For the morbidity rate, clustering of Districts for FMD and that of livestock disease resulted in five clusters. Alappuzha being the cluster with highest morbidity rate followed by Kottayam formed one cluster, Palakkad as another cluster, Pathanamthitta and Kannur together as the next cluster and all other Districts in to a single cluster.

Biopreservation of traditional dairy products using lactic acid bacteria

The crude culture extract from *Lactobacillus acidophilus* isolates showed a positive zone of inhibition against Bacillus species. When the microbiological quality parameter of the *L. acidophilus* fermentate was assessed on selected traditional dairy products such as paneer, khoa and Sandesh, a significant reduction in total viable number of organisms (TVC), Coliform count and Yeast and mould count were observed in all the three selected dairy products. When the microbiological quality parameters of the products treated with the bacterial fermentate were compared with those of the untreated products, the quality of treated products were found to be superior. The microbiological quality was also found to be within the prescribed limit of by Food Safety and Standards Authority of India (FSSAI). From the observed results, it could be concluded that crude culture extract from *Lactobacillus acidophilus* was an effective biopreservative. The preparation can be used in dairy plants or food processing plants for increasing the shelf life of indigenous products.

Assessment and improvement of quality of milk produced by selected dairy co-operative societies in Thrissur District

A survey was conducted among dairy farmers and three milk cooperatives namely Akkarappuram, Vellanikkara and Cherumkuzhy were selected for the study. Morning milk samples were collected with help of student volunteers from 114 farmer households both for chemical and bacteriological analysis. Samples were analysed for Total solids (percent), fat (percent), Solids Not Fat (SNF) (percent), Protein (percent), Acidity (percent), Methylene Blue Reduction Test (MBRT), Standard Plate Count (SPC), California Mastitis (CMT) and Somatic cell count by different techniques. It was found that out of 114 samples 34 samples were did not meet minimum fat percentage and 55 samples were did not meet minimum SNF percentage prescribed by Food Safety and Standards Authority of India (FSSAI). Microbiological qualities of 24 samples were poor. Eleven samples showed higher somatic cell count and were CMT positive. Reasons for lower quality were looked into. There were five milk samples showing exceptionally high chemical and microbiological quality. Meetings of farmers were held in

each location and they were appraised of the findings of the tests. Discussions were held about reasons for low milk quality. Officials from KCMMF also took part in the discussion. Inputs for improving udder health and milking hygiene were distributed among farmers.

Screening and evaluation of medicinal plants for anticancer activity

Literature documentation of some medicinal plants on Northern zone of Kerala was done. In vitro screening of *Thespesia populnea* and *Simarouba glauca* done in MCF7 cell lines. Bioguided fractionation of *Annona muricata*, *Thespesia populnea*, *Simarouba glauca* was done

Proteome analysis of goat ovarian follicles during different developmental stages

Gained basic data on follicle development of Malabari breeds of goats. The work could gather data on biochemical and steroid profile of different classes of developing follicles. As the dynamic constituents of follicular fluid reflect both biochemical and endocrinological activity of the follicle, biochemical profiling of follicular fluid from different stages of follicles can contribute to the understanding of follicular development which imparts competence to oocytes for fertilization and further development. TGF beta growth factor expression studies at mRNA level and protein level along with the biochemical parameters of developing follicles would contribute to analyzing the physiological process of follicle development

Assessment of fertility in bulls by in vitro techniques

Cumulus expansion and first polar body extrusion were demonstrated in successfully matured oocytes. Further, *in vitro* fertilization protocol for cattle oocytes using chilled semen is being standardized in the lab to get maximum fertilization efficiency.

Identification of suitable fodder varieties for sustainable milk production

Established 30 field fodder units comprising of different fodder varieties in entire Wayanad district. Model fodder plot established in CVAS, Pookode with fencing and open irrigation facility. Ensured a source for the supply of the fodder and also fodder slips to the farmers of the locality. Developed fodder production as an entrepreneurial venture. Addressed the fodder scarcity issue of Instructional Livestock Farm Complex, Pookode

4. PhD and PG Projects

Sl. No.	Title of the Thesis/Dissertation	Degree conferred	Department
1	Diversity analysis among goat genetic groups of Kerala	Ph.D	Department of Animal Breeding, Genetics & Biostatistics, CVAS, Mannuthy
2	Single nucleotide polymorphism of production associated loci in crossbred cattle of Kerala	Ph.D	Department of Animal Breeding, Genetics & Biostatistics, CVAS, Mannuthy
3	Thermotolerance and gene expression in Vechur, Kasargode and crossbred cattle of Kerala	Ph.D	Department of Animal Breeding, Genetics & Biostatistics, CVAS, Mannuthy
4	Management of anoestrum in crossbred heifers and cows by hormonal induction of oestrus	Ph.D	Department of Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy
5	Climatic adaptation and stress evaluation of crossbred cattle of Kerala	Ph.D	Department of Veterinary Microbiology, CVAS, Mannuthy
6	Diagnosis and management of mitral valve insufficiency in dogs	Ph.D	Department of Clinical Medicine, Ethics and Jurisprudence, CVAS, Mannuthy
7	Efficacy of antimicrobial peptides from lactic acid bacteria against selected mastitic bacterial pathogens	Ph.D	Department of Dairy science, CVAS, Mannuthy
8	Effect of multi species probiotic combination on *Helicobacter pylori* infection *in vitro* and in murine model	Ph.D	Department of Dairy science, CVAS, Mannuthy
9	Isolation and molecular characterisation of *Listeria monocytogenes* from different sources	Ph.D	Department of Department of Veterinary Public Health, CVAS, Mannuthy

10	Diagnosis of porcine cysticercosis and its public health significance	Ph.D	Department of Department of Veterinary Public Health, CVAS, Mannuthy
11	Development of an information technology based advisory system on scientific management of pet dogs	Ph.D	Department of Extension, CVAS, Mannuthy
12	Development and evaluation of functional chicken nuggets	Ph.D	Department of Livestock Products Technology, CVAS, Pookode
13	Development of improved diagnostic for detection of bovine intestinal schistosomosis	Ph.D	Department of Parasitology, CVAS, Mannuthy
14	Detection and molecular identification of cryptosporidium species in cattle,buffalo and goats	Ph.D	Department of Parasitology, CVAS, Mannuthy
15	Cellular and molecular response to bioscaffold grafts in a rat abdominal regeneration model	Ph.D	Department of Veterinary Pathology, CVAS, Mannuthy
16	Anti-cancer and nematocidal properties of crystal proteins of *Bacillus thuringiensis*	Ph.D	Department of Physiology, CVAS, Mannuthy
17	Clinico-therapeutic studies and experimental evaluation of a bacterin against common bacterial isolate of bovine mastitis	Ph.D	Department of Preventive Medicine, CVAS, Mannuthy
18	Development of muscosa-associated lymphoid tissue of digestive tract in goats	Ph.D	Department of Veterinary Anatomy, CVAS, Mannuthy
19	Developmental studies on pancreas in goats	Ph.D	Department of Veterinary Anatomy, CVAS, Mannuthy
20	Developmental pattern of the respiratory system in Kuttanad ducks. (*Anas platyhynchos domesticus*)	Ph.D	Department of Veterinary Anatomy, CVAS, Mannuthy
21	Developmental pattern of the pancreas in Kuttanad ducks. (*Anas playtyrhynchos domesticus*)	Ph.D	Department of Veterinary Anatomy, CVAS, Mannuthy

22	Development of mucosa-associated lymphoid tissue of digestive tract in goats	Ph.D	Veterinary Anatomy
23	Molecular studies on myeloid anti-microbial peptides in buffalo (*Bubalus bubalis*)	Ph.D	Department of Veterinary Biochemistry, CVAS, Mannuthy
24	Seroprevalence and molecular characterization of avian oncogenic viruses with special reference to Marek's disease virus	Ph.D	Department of Veterinary Microbiology, CVAS, Mannuthy
25	Standardization of multiplexing PCR and ELISA as a diagnostic protocol for the bacterial abortions in ruminants	Ph.D	Department of Veterinary Microbiology, CVAS, Mannuthy
26	Prevalence of gastrointestinal strongylosis in cattle and identification of immunogenic proteins	Ph.D	Department of Veterinary Parasitology, CVAS, Mannuthy
27	Effect of dietary supplementation of betaine hydrochloride on growth and nutrient utilization in broiler chicken	MVSc	Department of Animal Nutrition, CVAS, Mannuthy
28	Effect of dietary incorporation of 'Ksheerabala' residue on growth performance in Malabari kids	MVSc	Department of Animal Nutrition, CVAS, Mannuthy
29	Effect of phase feeding on growth in pre-ruminant crossbred calves	MVSc	Department of Animal Nutrition, CVAS, Mannuthy
30	Dietary supplementation of probiotic, prebiotic and synbiotic on growth performance and carcass characteristics in crossbred pigs	MVSc	Department of Animal Nutrition, CVAS, Mannuthy
31	Effect of varying levels of dietary energy and protein on growth performance of broiler chicken	MVSc	Department of Animal Nutrition, CVAS, Mannuthy
32	Comparative study on ameliorative effects of dietary Vitamin C and DL- Methionine against lead toxicity in guinea pigs	MVSc	Department of Animal Nutrition, CVAS, Pookode

33	Efficacy of whelping induction protocols as an alternative to elective caesarean section in dogs	MVSc	Department of Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy
34	Clinico-therapeutic studies on *Babesia gibsoni* infection in dogs	MVSc	Department of Clinical Medicine, Ethics and Jurisprudence, CVAS, Mannuthy
35	Clinico-biochemical and electrocardiographic evaluation of uremia in dogs	MVSc	Department of Clinical Medicine, Ethics and Jurisprudence, CVAS, Mannuthy
36	Clinical investigation of immune mediated haemolytic anaemia in dogs	MVSc	Department of Clinical Medicine, Ethics and Jurisprudence, CVAS, Mannuthy
37	Clinico-pathological studies on splenomegaly in dogs	MVSc	Department of Clinical Medicine, Ethics and Jurisprudence, CVAS, Mannuthy
38	Development of uniform enrichment protocol and standardisation of multiplex PCR for the detection of yersinia and salmonella species from chicken and pork	MVSc	Department of Department of Veterinary Public Health, CVAS, Mannuthy
39	Control of listeria biofilm formation in food processing environment	MVSc	Department of Department of Veterinary Public Health, CVAS, Mannuthy
40	Comparative effect of bacteriophage and Nisin on *Listeria mono-cytogenenes* in chicken and fish	MVSc	Department of Department of Veterinary Public Health, CVAS, Mannuthy
41	Assessment of biogas production potential of ruminant farm animal waste	MVSc	Department of Livestock Products Management, CVAS, Mannuthy
42	Assessment of biogas production potential of monogastric farm animal waste	MVSc	Department of Livestock Products Management, CVAS, Mannuthy

43	Quality of novel chicken sausage incorporated with paneer and oats	MVSc	Department of Livestock Products Technology, CVAS, Pookode
44	Pathology of endocrine glands of layer chicken in experimental aflatoxicosis	MVSc	Department of Veterinary Pathology, CVAS, Mannuthy
45	Effects of untreated and detoxified jatropha deoiled seed cake in broiler chicken and their amelioration with triphala	MVSc	Department of Veterinary Pathology, CVAS, Mannuthy
46	Pathology of experimental coccidiosis and evaluation of curative effects of *Holarrhena antidysenterica* in broiler chicken	MVSc	Department of Veterinary Pathology, CVAS, Mannuthy
47	Evaluation of Immunomodulatory and Antibacterial effects of urine of Vechur and crossbred cows	MVSc	Department of Pharmacology & Toxicology, CVAS, Mannuthy
48	Hypolipidemic and antioxid effects of *Calocybe indica* (Milk Mushroom) in hypercholesterolemic rats	MVSc	Department of Pharmacology, CVAS, Mannuthy
49	Assessment and alleviation of transportation stress in broiler chicken	MVSc	Department of Physiology, CVAS, Mannuthy
50	Assessment of growth and thyroid function in response to dietary supplementation of selenium and iodine in crossbred calves	MVSc	Department of Physiology, CVAS, Mannuthy
51	Utility of decorticated cotton seed, meal as an alternative to soyabean meal in broiler diets.	MVSc	Department of Poultry Science, CVAS, Mannuthy
52	Standardization of ration for Gramasree cockerel for meat purpose	MVSc	Department of Poultry Science, CVAS, Mannuthy
53	Bovine collagen-alginate sheet for cutaneous wound healing in dogs	MVSc	Department of Surgery and Radiology, CVAS, Mannuthy
54	Common ophthalmic disorders in dogs and their management	MVSc	Department of Surgery and Radiology, CVAS, Mannuthy

55	Clinical evaluation and surgical management of Pigmentary keratitis in dogs	MVSc	Department of Surgery and Radiology, CVAS, Mannuthy
56	Augmentation of fracture healing by bioglass ceramic implantation in dogs	MVSc	Department of Surgery and Radiology, Mannuthy
57	Decellularised bovine pericardium for hernioplasty in dogs	MVSc	Department of Surgery and Radiology, Mannuthy
58	Evaluation and management of long bone fractures in birds.	MVSc	Department of Surgery and Radiology, Mannuthy
59	Evaluation of porcine chloecyst derived collagen scaffold for the treatment of corneal injuries in dogs	MVSc	Department of Surgery and Radiology, Mannuthy
60	Histomorphological comparison of the lymphoid tissue of Waldeyer's ring in large white yorkshire and indigenous pigs of Kerala	MVSc	Department of Veterinary Anatomy, CVAS, Mannuthy
61	Impact assessment of the livestock development for livelihood support programme in Wayanad district	MVSc	Department of Veterinary and Animal Husbandry Extension, CVAS, Pookode
62	Molecular characterisation of OMPA gene of *Riemerella anatipestifier* isolates from ducks of Kerala	MVSc	Department of Veterinary Biochemistry, CVAS, Mannuthy
63	Molecular sexing of green-cheeked conure (*Pyrrhura molinae*) using CHDI and NIPBL genes	MVSc	Department of Veterinary Biochemistry, CVAS, Pookode
64	Serological and Molecular diagnosis of Bovine Neosporosis	MVSc	Department of Veterinary Parasitology, CVAS, Mannuthy
65	Detection and characterization of pyrethroid resistance in bovine Ixodid ticks from south India	MVSc	Department of Veterinary Parasitology, CVAS, Pookode
66	Acaricidal activity of extracts and the fractions of *Artemisia nilagirica* (clarke) pamp. and *Clerodendrum philippinum schauer*. against *Rhipicephalus* (boophilus) *annulatus*	MVSc	Department of Veterinary Pharmacology and Toxicology, CVAS, Pookode

67	Toxicokinetics of amitraz following single dermal application in goats	MVSc	Department of Veterinary Pharmacology and Toxicology, CVAS, Pookode
68	Prevalence and survivability of *Listeria* SPP.in soil	MVSc	Department of Veterinary Public health, CVAS, Mannuthy
69	Molecular detection of *Salmonella* spp. and S*taphylococcus aureus* from foods of bovine origin	MVSc	Department of Veterinary Public Health, CVAS, Pookode
70	Occurrence of zoonotic diseases in cattle with special reference to *Brucella abortus*, *Escherichia coli* O157:H7 and S*almonella* species	MVSc	Department of Veterinary Public Health, CVAS, Pookode
71	Comparative evaluation of Xylazine-Ketamine anaesthesia with and without oral Haloperidol premedication for vasectomy in spotted deer (*Axis axis)*	MVSc	Department of Veterinary Surgery and Radiology, CVAS, Pookode
72	Comparative evaluation of laparoscopic tubectomy by endoclip application versus electrocautery in Bonnet macaques (*Macaca radiata)*	MVSc	Department of Veterinary Surgery and Radiology, CVAS, Pookode
73	The leverage of riparian vegetation and physical habitats of fish assemblage structure	MSc.	Centre for Wildlife Studies, CVAS, Pookode
74	A Comparative study of mixed-species bird flocks in a forest and coffee habitat in Wayanad, Kerala	MSc.	Centre for Wildlife Studies, CVAS, Pookode
75	Diversity, habitat preference and feeding habits of chiropterans in Wayanad wildlife sanctuary	MSc.	Centre for Wildlife Studies, CVAS, Pookode
76	Comparison of community structure of reptiles between a forest fragment and an intact	MSc.	Centre for Wildlife Studies, CVAS, Pookode
77	Epidemiological study on Kyasanur Forest Disease (KFD) in the monkey population of Wayanad district, Kerala	MSc.	Centre for Wildlife Studies, CVAS, Pookode

78	Assessing genetic diversity of tiger (*Panthera tigiris tigiris*) in Wayanad wildlife sanctuary using non-invasive technologies	MSc.	Centre for Wildlife Studies, CVAS, Pookode
79	Detection of rickettsial pathogens of ticks of wild mammals and reptiles	MSc.	Centre for Wildlife Studies, CVAS, Pookode
80	Influence of different habitats on occurrence of asian small-clawed otter (*Aonyx cinerea* Illeger, 1815) in Wayanad, Kerala, India	MSc.	Centre for Wildlife Studies, CVAS, Pookode
81	Assessing the genetic variability in the free ranging asian elephant (*Elephas maximus*) population of Wayanad wildlife sanctuary	MSc.	Centre for Wildlife Studies, CVAS, Pookode
82	Preference of Tiger (*Panthera tigris tigris*) in Wayanad Wildlife Sanctuary	MSc.	Centre for Wildlife Studies, CVAS, Pookode
83	Antibiogram and plasmid pattern analysis of *Staphylococcus aureus* from subclinical bovine mastitis	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
84	Isolation, identification and antibiogram of bacterial organisms associated with corneal diseases in dogs	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
85	Diagnosis of canine parvovirus infection using immunochromatographic strip test and polymerase chain reaction	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
86	Standardisation of recombinant LIPL32 protein based Dot-ELISA for the diagnosis of acute canine leptospirosis	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
87	Isolation and confirmation of *Pasteurella multocida* from birds by polymerase chain reaction	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
88	Analysis of the neurodevelopment status of very low birth weight babies and the risk factors associated with development delay	MSc.	Department of Biostatistics, CVAS, Mannuthy
89	Estimation of influence of temperature and humidity on milk yield of dairy cattle and its quality parameters	MSc.	Department of Biostatistics, CVAS, Mannuthy
90	Utilisation of non-edible fat from diary effluent in the preparation of soap.	MSc.	Department of Dairy Science, CVAS, Mannuthy

91	Development of chakka based diary spread and its quality evaluation	MSc.	Department of Dairy Science, CVAS, Mannuthy
92	Development and standardisation of pachedi by replacing coconut paste with cow milk	MSc.	Department of Dairy Science, CVAS, Mannuthy
93	Study on impact of certain milk sample preservatives on milk composition analysis.	MSc.	Department of Dairy Science, CVAS, Mannuthy
94	Study on antimicrobial potential of lactic acid bacteria against Bacillus species	MSc.	Department of Dairy Science, CVAS, Mannuthy
95	Formulation and quality evaluation of non fat functional yoghurt fortified with fruit pulp	MSc.	Department of Dairy Science, CVAS, Mannuthy
96	A study on accuracy of zeal lactometer available in the market and their efficiency for detecting adulteration of milk	MSc.	Department of Dairy Science, CVAS, Mannuthy
97	Utilization of paneer whey for Biogas production in combination with farm manure	MSc.	Department of Dairy Science, CVAS, Mannuthy
98	Evaluation of quality of starter cultures isolated from home-made dahi	MSc.	Department of Dairy Science, CVAS, Mannuthy
99	Study on biodiversity of lactic acid bacteria from conventional curd (Dahi)	MSc.	Department of Dairy Science, CVAS, Mannuthy
100	Assessment of microbiological quality of KOHA based sweets marketed in Thrissur City	MSc.	Department of Dairy Science, CVAS, Mannuthy
101	Development and quality evaluation of functional yoghurt from goat milk	MSc.	Department of Dairy Science, CVAS, Mannuthy
102	Utilization of goat milk for the preparation of paneer	MSc.	Department of Dairy Science, CVAS, Mannuthy

103	Study of functional properties of casein and caseinate derived from cow and buffalo milk	MSc.	Department of Diary Science, CVAS, Mannuthy
104	Analysis of repeated measures data from animal experiments.	MSc.	Department of Statistics, CVAS, Mannuthy
105	Morbidity and mortality of livestock in Kerala	MSc.	Department of Statistics, CVAS, Mannuthy
106	Molecular characterization of canine major histocompatibility complex DLA-DQA1 gene in dogs.	MSc.	Department of Veterinary Biochemistry, CVAS, Mannuthy
107	Metabolic profiling of Malabari does with subclinical pregnancy toxaemia.	MSc.	Department of Veterinary Biochemistry, CVAS, Mannuthy
108	Assessment of the mineral status in gastrointestinal parasitic infested Malabari kids.	MSc.	Department of Veterinary Biochemistry, CVAS, Mannuthy
109	Loop Mediated Isothermal Amplification (LAMP) assay based diagnosis of New Duck disease in ducks of Kerala.	MSc.	Department of Veterinary Biochemistry, CVAS, Mannuthy
110	Antibacterial and antifugal activity of aloe vera extracts	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
111	Development of a rapid quantitative latex assay to detect new castle disease virus in birds	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
112	Comparison of different serological test to detect Newcastle disease viral antibodies in chicken	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
113	Rapid serological tests to diagnose brucellosis in bovines	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy
114	Isolation and plasmid profiling of *Escherichia coli* of avian origin	MSc.	Department of Veterinary Microbiology, CVAS, Mannuthy

Seroprevalence and molecular characterization of avian oncogenic viruses with special reference to Marek's disease virus

A detailed study was undertaken to assess the prevalence of avian oncogenic virusesin Kerala by serological tests and molecular characterization. Serum samples (1030) and biomaterials (280) were collected from nine organized poultry farms. Among the three serological tests employed, ELISA had highest sensitivity and specificity compared to agar gel immunodiffusion and indirect fluorescent antibody assays. The overall per cent positivity estimated by ELISA was 15.2 (157/1030), 48 (494/ 1030) and 14(144 /1030) respectively, for Marek's disease (MD), avian leukosis (AL) and reticuloendotheliosis (REV) viral antibodies. The highest per cent of positive sample was obtained from University Poultry and Duck Farm (UPDF), Mannuthy for the three diseases studied. Marek's disease virus was isolated from clinical samples using embryonated chicken eggs and identified as virulent strain. Avian leukosis and reticuloendotheliosis viruses did not show any post inoculation changes in embryos. Hence, their presence was confirmed by PCR. The DNA extracted from biomaterials were assayed by virus specific PCR and amplicons obtained were sequenced and phylogenetic tree was constructed using reference strains. Out of 280 samples screened, 31, 166 and 5 samples were detected as positive by PCR for MD, AL and REV, respectively. Out of nine, three farm viz., UPDF, Mannuthy, Regional Poultry Farm (RPF), Mundayad and Kodappanakunnu showed positive for all three viruses by PCR.

Serological and molecular diagnosis of bovine neosporosis

A total of 50 blood samples were collected from cattle with the history of abortion, from organised/unorganised farms and households from 16 different areas of three districts in Kerala *viz*., Thrissur, Palakkad and Ernakulam. The blood samples obtained from cattle belonging to small holder farmers were collected within 15 days after abortion. The overall prevalence of *N. caninum* was determined to be 18.0 percent. The antibodies were detected in higher no. of animals that aborted in the second stage of pregnancy when compared with the 1 and 3 stages. A total of 52 dog faecal samples were collected from the vicinity of animals that had aborted and examined for *N. caninum* like oocysts microscopically by floatation technique. *Neospora caninum* oocysts could not be recovered from any of these samples by floatation technique. Use of nested PCR for diagnosis of infection in eight dog faecal samples revealed presence of infection in two dogs, thereby confirming the presence of infection in both dogs and cattle in Cheruthuruthy area of Thrissur district.

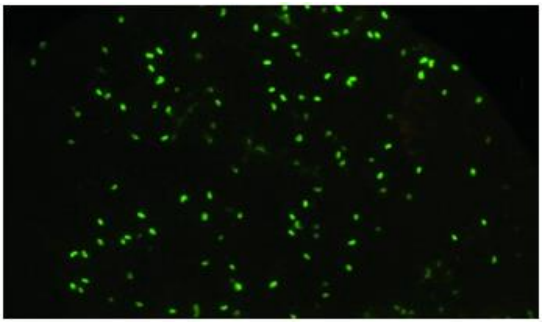


Fig: IFAT- *Neospora caninum* positive sample

Prevalence of gastrointestinal strongylosis in cattle and identification of immunogenic proteins

A total of 883 faecal samples from cattle in six agro-ecological zones *viz*. Central midland, Coastal sandy, Chittoor black soil, Palakkad plains, Malappuram type and Malayoram were screened for studying the prevalence of strongylosis in cattle during pre-monsoon, monsoon, post-monsoon season. The study area encompassed the four central districts of Kerala, *viz*., Ernakulam, Thrissur, Palakkad and Malappuram. An overall prevalence of 39.64 per cent was obtained for strongyle infections. *Haemonchus* sp. was found to be the most predominant strongyle (16.19per cent). This was conclusively derived in the zone-wise, season-wise analysis studies and also on the analysis of the interactive effects of various seasons in different zones. A prevalence of 7.7 per cent was obtained for *Trichostrongylus* sp. and 6.68 per cent each for *Mecistocirrus* sp. and *Bunostomum* sp. A prevalence of 3.96 and 2.38 per cent was obtained for *Cooperia* sp. *and Oesophagostomum* sp. respectively. The coastal sandy zone was most congenial for strongyles with a prevalence of 52.1 per cent followed by a statistically similar prevalence of 47.9 and 43.4 per cent in Malappuram type and Chittoor black soil respectively. Maximum prevalence of *Bunostomum* sp. (15.7per cent) and *Oesophagostomum* sp. (8.3per cent) was noticed in the Coastal sandy zone. Monsoon was found to be the most favourable season for the development of strongyles (45.4per cent). *H. placei* (20.3per cent) and *Cooperia* species (6.6per cent) of strongyles were found to be significantly high during monsoon. The season-wise interactive prevalence in different zones of strongyles revealed a high prevalence in monsoon of Coastal sandy zone of 78.1 per cent. The monsoon of Chittoor black soil (37.8per cent) was most congenial for *Haemonchus* sp., followed by monsoon of Coastal sandy (34.4per cent) and post-monsoon of Chittoor black soil (27.3per cent). *Trichostrongylus* sp. recorded highest prevalence rate of 31.3 per cent in monsoon of Coastal sandy whereas that of *Bunostomum* sp. was 32.5 per cent in the post-monsoon of Coastal sandy zone. The monsoon of Malayoram and Chittoor black soil, Malappuram type, Palakkad plains

and Central midlands were congenial for *Cooperia* sp. with a prevalence of 18, 13.5, 5.6, 3.8 and 1.8 per cent respectively. Age-wise prevalence of strongyles revealed higher prevalence rate of *Haemonchus* sp., *Mecistocirrus* sp. and *Trichostrongylus* sp. *Bunostomum* sp. in cattle of three to seven year age followed by the calf hood stage. *Oesophagostomum radiatum* was most prevalent in cattle of three to seven years. Parity-wise prevalence of strongyles showed that cows at first parity had maximum infection with strongyles, followed by C_2, C_3, C_4, C_6 and above and C_5 parid animals. Cows at first parity harboured species like *Haemonchus* sp., *Trichostrongylus* sp. and *Cooperia* sp. in large numbers.

Concurrent gastrointestinal parasitic infection was also recorded which included *Strongyloides* sp., *Trichuris* sp., Amphistomes, *Schistosome* sp., *Moniezia* sp., *Buxtonella* sp. and coccidia. Amphistomes had on overall prevalence rate of 19.7 per cent while *Moniezia* sp. had 1.59 per cent only. Amphistomes and coccidia were significantly high in all zones and the highest prevalence was noted in Palakkad plains with 23.9 per cent and 35.9 per cent prevalence respectively. Monsoon season favoured the prevalence of amphistomes (28per cent) significantly. The season-wise interactive prevalence in different zones revealed a high prevalence of amphistomes (41.9per cent) in pre-monsoon in Malayoram region and monsoon in Palakkad plains (41.5per cent). The monsoon of Palakkad plains (50.9per cent) was congenial to the development of coccidia. Pre-monsoon of Malayoram (30.8per cent) was congenial for *Buxtonella* sp. The species *H. placei* was established from the measurements of the male spicule and synlophe of the adult worms. The knobbed type of vulval morphology was found to be predominant in the study. Morphometry of the infective larvae also revealed the species to be *H. placei*. Analysis of protein of *H. placei* CSA using SDS-PAGE gave several bands of varying intensities with molecular weights approximately between 96 to 17 kDa. The most immunodominant band was found to be at approximately 17 kDa molecular weight, when blotted against hyperimmune serum raised in rabbits against CSA of *H. placei.* Identification of the immunodominant protein fraction of *H. placei* is a preliminary study in the development of vaccine for controlling haemonchosis in the state.

Molecular studies on myeloid anti-microbial peptides in buffalo (*Bubalus bubalis*)

Identified three novel myeloid cathelicidin antimicrobial peptide genes from buffalo bone marrow. Putative antimicrobial domains were identified and custom synthesized these peptides and its three analogues. Structural and functional studies of all the peptides were carried out to develop these peptides as promising drug molecules. *In vitro* antibacterial, antifungal, anti-viral and anti-cancerous studies revealed its broad spectrum antimicrobial activity. *In vitro*

antibacterial studies showed that these molecules are potent against even MDR bacteria which were later confirmed by *in vivo* experiments.

Development of mucosa-associated lymphoid tissue of digestive tract in goats

Development of mucosa-associated lymphoid tissue (MALT) of digestive tract was studied in goats of various age groups. Prenatal studies were conducted using 30 goat foetuses ranging from 1.4cm Crown Rump Length (CRL) (24 days of gestation) to 38.0cm CRL (full term). For postnatal studies, 36 apparently healthy male goats from one to six months of age were used. In the prenatal period only three tonsils were recognizable, viz. palatine, pharyngeal and lingual. The lymphoid cells first appeared in lingual tonsil by 60 days and in pharyngeal and palatine tonsils by 71 days. In tonsil of soft palate, tubal and paraepiglottic tonsils though lymphocytes were seen by 122 days, their development was completed only after birth. In gut-associated lymphoid tissue (GALT), lymphocyte aggregations were noticed in jejunum, proximal colon and rectum by 60 days and in ileum by 91 days of gestation. GALT was composed of jejunal Peyer's patches (JPP) and ileal Peyer's patch (IPP) in small intestine and patches in large intestine at ileocecal entrance (IC patch), in proximal colon (PC patch) and in rectum (RC patch) at birth. When compared to tonsils in which only primary nodules were identified at birth, the degree of development was more in GALT with both primary and secondary nodules, suggesting the presence of intrinsic factors that might have stimulated the development in it. In the postnatal period, except the tonsil of soft palate, all other tonsils presented crypts. Morphometry and micrometry of tonsils and GALT increased as age advanced and showed highly significant correlation with body weight and age. However, IPP in small intestine and IC patch in large intestine started regressing by the fourth month of postnatal life. The ability of IPP and IC patch nodules to produce lymphocytes without antigenic stimulation during prenatal period and their early regression implied that they belonged to the group of primary lymphoid organs. The maximum development of lymphoid tissue was noticed in the pharyngeal tonsils and rectal patches, respectively suggesting that they could be exploited as targets for nasal and rectal vaccines for the induction of mucosal immune response in this species.

1. Surface epithelium
2. Duct
3. Glands

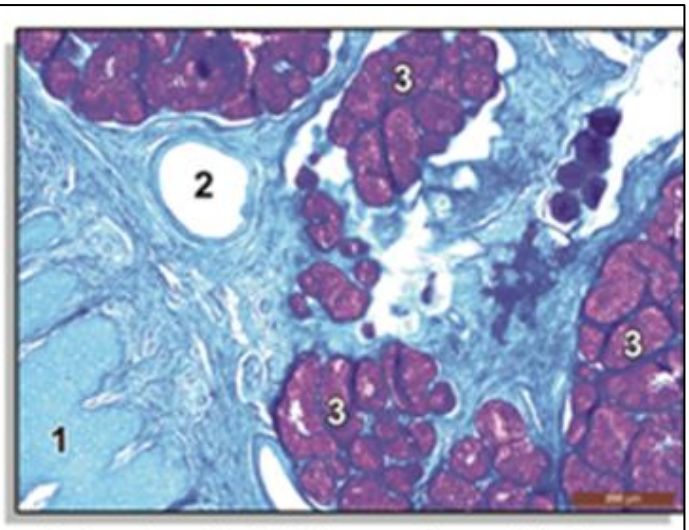


Fig. . C.S. of palatine tonsil showing glands below surface epithelium (6 month). PAS method x 100

1. Mucosa
2. Lymphoid nodules
3. Blood vessels
4. T. muscularis

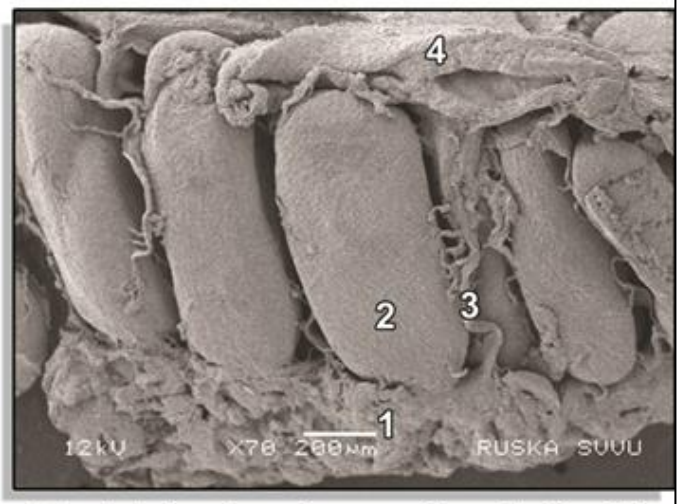


Fig. Ultramicroscopy of rectal patch showing submucosal lymphoid nodules (6 month). SEM x 70

1. Goblet cell
2. M cell
3. Reticular epithelium
4. Surface epithelium

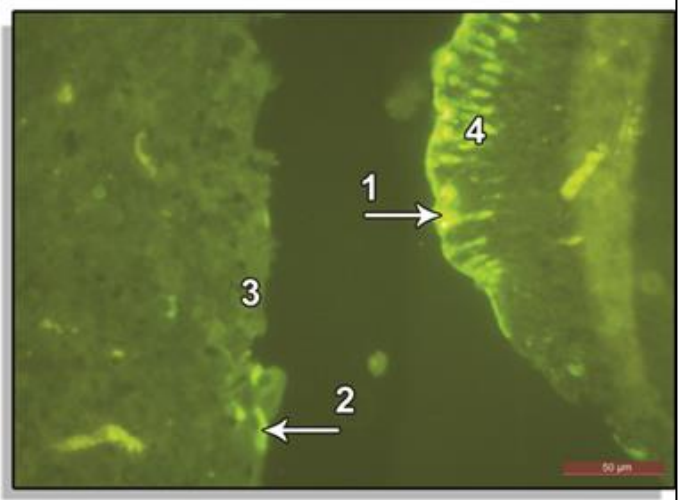
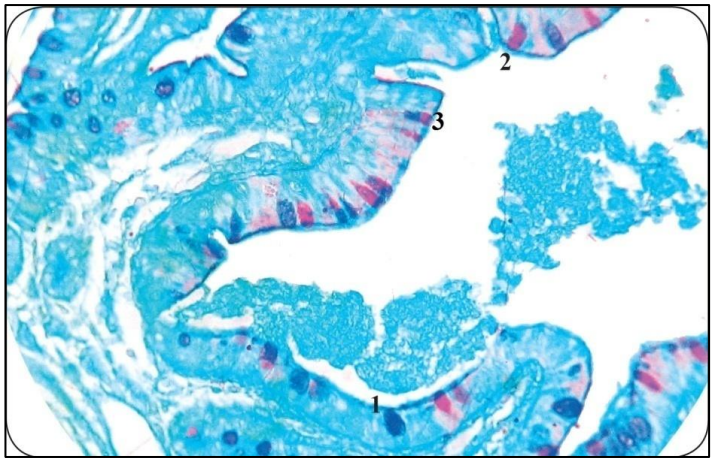


Fig. C.S. of pharyngeal tonsil showing fluorescence of FITC-conjugated lectin from Ulex europaeus (UEA-I) (6 month). FITC-UEA-I x 400

Developmental studies on pancreas in goats

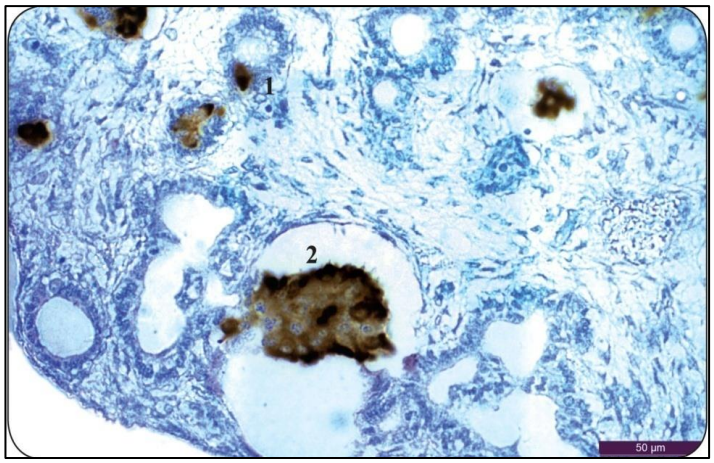
The prenatal and postnatal development of pancreas was studied in goats from the time of appearance of primordia upto six months post partum. The study was conducted using 30 embryos and 36 male kids. Gross anatomical, contrast radiographic, light microscopic, ultrastructural and immunohistochemical methods were employed. Statistical analysis of the data was done. The dorsal pancreatic primordium was identified in 40 days-old embryos in the dorsal mesogastrium and the ventral one near the hepatic diverticulum. The two primordia fused to form a single mass by 61 days. By 91 days, it assumed a butterfly shape with right and left lobes connected by a narrow body. The large accessory pancreatic duct and the pancreatic duct united to form the major pancreatic duct that opened into the common bile duct to form the hepato-pancreatic duct. This duct opened into the duodenum. The exocrine pancreas appeared in the mesenchyme of the dorsal pancreatic primordium by 52 days and angiogenesis was started from 58 days. Acini started developing from 70 days of foetal life. From 71 days onwards, the lobulation and innervation became evident and by 91 days peri-vascular plexuses was noticed. In 98 days-old embryos, larger ducts showed the presence of secretory material. During the last month of gestation, most of the lobules contained a well developed duct system and numerous acini. Development of the endocrine part started from 52 days onwards as buds from the walls of ductules. By 69 days, islets of Langerhans containing A-cells and B-cells appeared and their number increased as age advanced. From 71 days onwards, islets were arranged within the lobules and some of the larger islets showed invasion of blood at the central part. From 140 days onwards, some of the large islets showed a central sinus. In postnatal animals, the lobules contained a several secretory acini, ducts, islets of Langerhans, blood vessels, nerve bundles and ganglia. Islets showed the presence of A-, B- and D-cells. The ultrastructure of pancreatic acini, ducts and endocrine cells was studied by electron microscopy. Histochemistry revealed the presence of glycogen, mucoploysaccharides, lipids and enzymes in different parts of pancreas. Immunohistochemistry with anti-insulin antibody revealed the presence of insulin immuno-reactive cells from 58 days of development and their number increased till the end of study period. It was concluded that the exocrine and endocrine parts of pancreas developed structural maturity in the prenatal life itself. During prenatal and postnatal periods there was an absolute increase in the endocrine and exocrine components of pancreas even though the relative increase was more with exocrine pancreas.

C. S. of hepato pancreatic duct showing positive reaction for mucoploysaccharides (six months - postnatal). PAS- Alcian blue method x 400



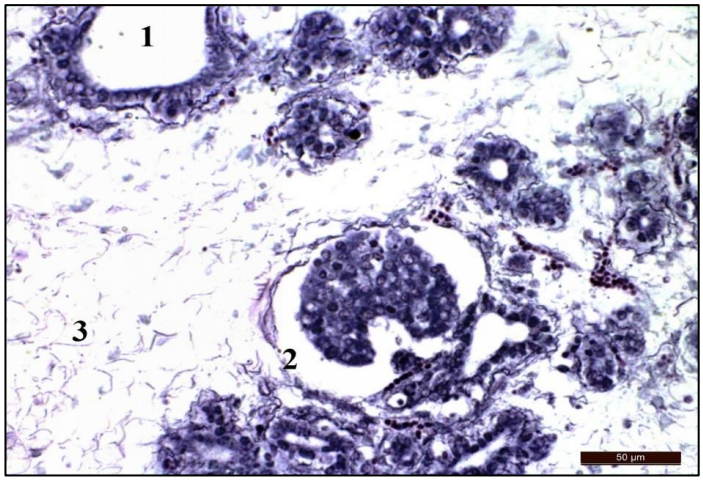
1. Goblet cell with acid mucopolysaccharides
2. Goblet cell with neutral mucopolysaccharides
3. Goblet cell with acid and neutral mucopolysaccharides

Dorsal pancreatic primordium showing distribution of insulin immunoreactive cells within a large, developing islet of Langerhans (58 days of gestation). Immunohistochemistry x400.



1. Insulin immunoreactive cells,
2. Developing islet of Langerhans

Pancreas of 69 days-old embryo showing a well developed islet of Langerhans. Gridley's method. x 400



1. Ductule
2. Islet of Langerhans
3. Mesenchyme

Comparative study on ameliorative effects of dietary vitamin C and DL- methionine against lead toxicity in guinea pigs

The ameliorative effects of DL- methionine and vitamin C against chronic lead toxicity in guinea pigs were studied and a comparison was done between the two ameliorating agents against adverse effects of 20 ppm lead. 32 weaned guinea pigs were divided into four groups of 8 animals under RBD and group G1 was fed on basal diet, G2 basal diet plus 20ppm lead, G3 basal diet plus 20 ppm lead plus 20 ppm DL-methionine and the G4 basal diet plus 20 ppm lead plus 500 ppm vitamin C for 90 days. Lead was given as aqueous solution of lead acetate; DL-methionine as aqueous solution of DL-methionine; and vitamin C as aqueous solution of L-ascorbic acid. A metabolism trial of four days duration was carried out after 45 days of experimental feeding selecting four animals from each group. Supplementation of 20 ppm lead (Pb) in the diet of guinea pigs had no significant effect on the dry matter intake, body weight gain and nutrient digestibility of guinea pigs. The intake and balance of calcium and lead were significantly different in all lead treated group as compared to control group. No significant difference effect on growth and metabolism were obtained in DL methionine supplemented group with Vitamin C supplemented group.

Quality of novel chicken sausage incorporated with paneer and oats

Novel chicken sausage with incorporation of paneer and oats which increased the sensory appeal and dietary fibre level was developed. Chitosan addition (1.5per cent level) and vacuum packaging were employed to increase the shelf life of the developed sausage under chiller shelf life. It was observed that chitosan and vacuum packaging could enhance the shelf life of the sausages by 5 days.

Comparative evaluation of Xylazine-Ketamine anaesthesia with and without oral haloperidol premedication for vasectomy in spotted deer (*Axis axis)*

A prospective clinical trial was performed to evaluate the efficacy of haloperidol premedication prior to xylazine-ketamine anesthesia with a goal of reducing capture stress in adult male captive spotted deer (Axis axis). On the morning of the study, deer were fed a banana either containing haloperidol tablets (1 mg/kg) (haloperidol group, n = 10) or without haloperidol (placebo group, n = 10). Six hours post administration, xylazine (3 mg/kg) and ketamine (2 mg/kg) was administered intramuscularly via a dart. Rectal temperature, heart rate, respiratory rate, and SpO2 (percent hemoglobin saturation) were recorded at 5-min intervals. Blood gas analysis was performed at time 0 (venous blood) and 10 and 20 min (arterial blood) postinduction. Serum cortisol was determined from venous blood (35 min postinduction),

following which yohimbine was administered at a dose of 0.15 mg/kg intramuscular and 0.15 mg/kg intravenous. Statistical analysis of repeated measures data was performed with a two-way analysis of variance. Paired data were analyzed with a Wilcoxon rank-sum test (categorical data) or a paired t-test (continuous data). Significance was set at $P \leq 0.05$, and results were expressed as mean ± SEM. There was no significant difference in induction time or recovery time between treatment groups. Rectal temperature and heart rate were significantly lower in the haloperidol group. Both groups demonstrated acidosis with venous pH being significantly lower in the placebo group when compared to the haloperidol group. Serum cortisol and arterial plasma lactate were lower in the haloperidol group indicative of reduced stress and physical exertion. Haloperidol premedication proved to be beneficial in reducing capture stress, when administered prior to xylazine-ketamine anesthesia, in spotted deer.

Occurrence of zoonotic diseases in cattle with special reference to *Brucella abortus*, *Escherichia coli* O157:H7 and *Salmonella* species

The study was conducted from June to March 2013/ 2014 in different slaughterhouses of Kerala. The aim of this study was to identify major zoonotic diseases, determine carcass condemnation, detect important food borne pathogens and to estimate the magnitude of the direct losses attributed to the condemned organs and carcasses. Standard antemortem and postmortem inspection procedures were followed throughout the study. Antemortem inspection was carried out prior to slaughter and abnormalities encountered were recorded, followed by postmortem examination through their identification number to detect gross abnormalities and aesthetic reasons that rendered each organ to be rejected from market. During the study a total of 1857 cattle and same number of organs and carcasses were examined, out of which 16.85 per cent showed abnormal respiratory sounds, 3.88 per cent detected mastitis, 9.74 per cent recorded abnormal temperature, 5.86 per cent revealed enteric infections, 4.90 per cent showed lymph node abnormalities, 3.66 per cent tuberculosis-like condition and 3.39 per cent confirmed hydatidosis have been documented. The study further revealed that 3.17 per cent liver, 3.39 per cent lungs and 4.68 per cent carcass were rejected due to various causes. Bruise (21.43 per cent), Biliary amphistomiasis (2.04 per cent), Hepatomegaly (0.43 per cent), Liver abscess (0.10 per cent), Spleenomegaly (1.18 per cent), Gravid uterus (4.78 per cent) and Cystic ovary (0.91 per cent) were the major causes responsible for rejection of respective organs and carcasses. The annual loss due to the rejection of organs and carcasses from the cattle slaughtered in the abattoirs was estimated at approximately 5,49, 544 Rupees or 9360 USD. Out of 1020 serum samples collected during

inspection, 6.17 per cent and 11.37 per cent showed positivity for brucellosis and bovine viral diarrhoea respectively. Laboratory findings revealed that out of 300 beef samples tested (150 each from slaughter house and retail market) the major pathogens which were isolated were *E. coli* (34.67 per cent), *Salmonella spp* (10 per cent), *S. aureus* (43.67 per cent), *L. monocytogenes* (nine per cent) and *V. cholera* (12 per cent).

Acaricidal activity of extracts and the fractions of *Artemisia nilagirica* (clarke) pamp. and *Clerodendrum philippinum schauer*. against *Rhipicephalus* (boophilus) *annulatus*

The present study is envisaged to find out the acaricidal potential of the extract / fractions / subfractions of the plants *Artemisia nilagirica* (Clarke) Pamp and *C. philippinum* Schauer. Safety of the extract were assessed by oral (rats) and dermal (rabbits) toxicity studies using relevant OECD guidelines. The efficacy of crude ethanolic extract of *A. nilagirica* and *C. philippinum* against *R. (B.) annulatus* females were assessed by estimating the per cent larval mortality by larval packet test and per cent adult mortality, inhibition of fecundity and larval hatching rate by adult immersion test. The ethanolic extract of A. nilagirica was positive for flavonoids, terpenoids, steroids, glycosides, phenolic compounds, tannins, saponins, fixed oils and fats. The ethanolic extracts of *A. nilagirica* produced concentration dependent larvicidal activity, adult tick mortality, inhibition of fecundity and highly significant inhibition of hatching. The hexane fraction of this extract retained the acaricidal properties of the extract. The subfraction FA_{1c} was acaricidal among the eight subfractions separated from hexane fraction. Crude extract of *C. philippinum* demonstrated concentration dependent adult tick mortality and also a significant inhibition of hatching of eggs. The n-butanol fraction of this extract retained the eclosion blocking properties. Qualitative phytochemical analysis of the ethanolic extract of C. philippinum revealed the presence of flavonoids, steroids, glycosides, phenolic compound, tannins, alkaloids, saponins, fixed oils and fats. The subfraction FC_{3a} obtained from the n-butanol fraction of C. philippinum showed significant acaricidal activity. Acute oral, acute and sub-acute dermal toxicity studies did not reveal any toxicity of these two plants. The present work imply that FA_{1c} of hexane fraction of A. nilagirica and FC_{3a} of n-butanol fraction of C. philippinum possessed significant acaricidal activity. The subfraction could be new drug leads for development of promising acaricides.

Impact assessment of the livestock development for livelihood support (LDLS) programme in Wayanad district

The impact of LDLS programme was assessed among the beneficiaries of Wayanad district. The strengths, weaknesses, opportunities and threats of the programme as well as, the

constraints perceived by the beneficiaries and the implementing officers respectively were also studied. The study revealed that most of the beneficiaries were middle aged with only either primary or secondary education. The communication behaviour in terms of personal cosmopolite source contact and mass media utilization was of medium level. Further, majority of the beneficiaries' attitude towards dairying and goat farming was moderately favourable, whereas beneficiaries were highly favourable towards poultry farming. Regarding knowledge majority had moderate level of knowledge in dairying and goat farming, and less or moderate level of knowledge in poultry farming. The direction of income and employment generated in animal husbandry was one towards low to medium level and was the same with milk and egg productivity. The top ranked constraint perceived by the implementing officers was the inability of beneficiaries to avail loan in time due to a failure in winning the confidence of bank personnel. Permitting the willing beneficiaries to meet non-subsidy part of loan from own resources was the solution mentioned. The important strength of the scheme perceived by the beneficiaries was the experience and knowledge beneficiaries felt they had in this sector, whereas livestock obtained under the scheme acting as replacer stock was perceived as the most important weakness of programme. Potential scope for promotion of organic and integrated farming through implementation of the scheme was the most important opportunity, whereas massive death and predation of poultry distributed under the scheme was perceived to be a significant threat.

Detection and characterization of pyrethroid resistance in bovine Ixodid ticks from South India

The present study evaluated the pyrethroid resistance status of *Rhipicephalus (Boophilus) microplus* and *R. (B.) annulatus* tick populations collected from cattle farms of four states of South India (Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra). Two isolates of adult engorged female ticks were collected each from cattle farms of four South Indian states *viz.*, Andhra Pradesh (Kortula and Mehboob Nagar), Karnataka (Sakhleshpur and Buvenduvella), Tamil Nadu (Cuddalore and Madhavaram) and Maharashtra (Nagpur and Parbani). All the ticks collected were identified as *Rhipicephalus (Boophilus) microplus* except Cuddalore isolate which belonged to *R. (B.) annulatus*. The prevalence of ticks was more in summer season. Chemical acaricides, mainly synthetic pyrethroids, were the only methods used by the farmers to combat tick infestations in these farms. The resistance was characterized based on biological, biochemical and molecular tools. Larval packet test (LPT) was carried out to find out the LC_{50} values against these tick isolates. *Rhipicephalus (Boophilus) microplus* (Thiruvizhamkunnu

isolate) and *R. (B.) annulatus* (Pookode isolate) were used as reference susceptible isolates. The LC_{50} values of the reference isolates were 2.15 ppm and 2.11 ppm respectively. Larval packet test was also performed using the field isolates for determining LC_{50} values. The resistance factor (Quotient between LC_{50} of the field isolate and LC_{50} of the susceptible isolate) was calculated for each of the field tick isolates. Based on the resistance factor, the isolates were categorised under different resistance levels (I, II, III and IV). Out of eight isolates, two (Kortula, Andhra Pradesh and Parbani, Maharasthra) were susceptible. Nagpur (Maharashtra) isolate revealed level II resistance while the rest of the isolates developed level I resistance.

Biochemical assay using α and β napthyl acetate was performed to know the role of esterases in detoxification of the chemical compounds. Enzyme activity for both the substrates was higher in two isolates (Nagpur, Maharashtra and Sakhleshpur, Karnataka) which showed higher LC_{50} values for deltamethrin in LPT. This elevation might have resulted in the development of low level of resistance. The previously identified mutations causing synthetic pyrethroid resistance in tick populations were analysed by sequencing the mutation flanking regions of the carboxyl esterase (G1120A) and the sodium channel genes (T2134A in domain III S6 and C190A in domain II S4-5 linker region). However, these point mutations were not detected in any of the field isolates. The results of the present study revealed that low levels of synthetic pyrethroid resistance (level I to II) had already developed in field populations of ticks of southern India which can develop further into higher levels of resistance with the wide spread, indiscriminate and frequent use of the drugs. Hence, it is suggested that strategic and judicious use of acaricides along with other ecofriendly integrated pest management (IPM) protocols may be utilised to avoid the full blown acaricidal resistance that might develop in this part of the country in future.

Toxicokinetics of Amitraz following single dermal application in goats

Amitraz is a formamidine derivative widely used for the control of ticks and mange mites in animals. The work reported here describes the toxicokinetics of amitraz in Malabari goats after single dermal application at 0.25 per cent. Blood samples were collected at predetermined time intervals up to 168 h and milk samples were collected every morning and evening up to eight days post dermal application. Analysis of amitraz was done by High Performance Liquid Chromatography. Amitraz was detected in blood within 0.5 h attaining a peak concentration of 7.24 ± 0.79 at 6 hfollowed by a decline and persisted till 168 h. The various kinetic parameters were calculated using a two compartment open model. The absorption rate constant (K_a), apparent volume of distribution (V / F), elimination half-life ($t_{1/2}\beta$), ratio of k_{12} and K_{21}, tissue-

blood ratio and mean residence time (MRT) were 0.58 h^{-1}, 33.29 µl / mg, 172.59 h, 0.63, 0.71 and 240.10 h respectively. Amitraz was rapidly absorbed from the site of application, widely distributed and slowly eliminated from the body. The lower tissue-blood ratio suggested its minimum affinity for accumulation in thetissues. The concentration of amitraz detected in milk ranged from 0.37-0.44 mg / L until the duration of the study period. Absorption of the retained drug from the application site contributed to the persistent concentration detected in the blood and milk till 168 h.

Comparative evaluation of laparoscopic tubectomy by endoclip application versus electrocautery in Bonnet macaques (*Macaca radiata)*

The study was conducted on 12 adult apparently healthy non-pregnant adult captive-born female Bonnet Macaques of different age and body weight reared under uniform diet, environment and housing conditions at the State Museum and Zoo, Thrissur. They were randomly divided into two groups of six animals each - Group I (laparoscopic tubectomy by electrocautery) and Group II (laparoscopic tubectomy following endoclip application). The study was carried out to standardize laparoscopic tubectomy by endoclip application and to compare it with that by electrocautery, and also to assess the surgical stress involved in the techniques. All the animals were anaesthetized using a combination of xylazine- ketamine followed by butorphanol and midazolam. Laparoscopic tubectomy by electrocautery required two ports, with a carbon dioxide flow rate of 2L/minute. The procedure was easy and quick, and needed only one trained surgeon. Coagulation of considerable length of fallopian tube was noticed in all animals of group I. This technique required minimum instruments and a single surgeon, producing higher output, suggesting that this technique can be adopted for permanent sterilization of pest species. Laparoscopic tubectomy following endoclip application required an additional 11 mm port for the introduction of endoclip applicator. This technique required more skill and time, and also an additional trained person to handle the rigid telescope. A higher flow rate of 5.5 L/minute for CO_2 had to be employed to provide optimum optical space and insufflations. Endoclip application guaranteed good haemostasis for tubectomy, and inflicted minimum injury to the nearby tissue. Both techniques inflicted minimal pain and the post surgical tolerance was good and comparable between groups with no post operative complications. There was increase in serum cortisol levels, but was not significant. The return-to-group-time was 7 days following laparoscopic tubectomy by electrocautery, while it was 12 days after laparoscopic tubectomy following endoclip application.

Molecular sexing of green-cheeked conure (*Pyrrhura molinae*) using *CHDI* and *NIPBL* genes

Sexing in birds is important for scientific management, behavioral and ecological studies and also to improve breeding programme in captivity. Sexing by examining external morphology is difficult in more than 50per cent of the world's bird species. Since maintenance of ideal sex ratio is important for any successful breeding programme pet breeders encounter difficulties with breeding of monomorphic birds. In the present study, DNA was isolated from feathers and polymerase chain reaction was done using three different sets of primers to identify the sex of a popular pet bird, Pyrrhuramolinae (Green-cheeked conure), which is monomorphic in nature. The primer sets were designed to amplify intron 9 and16 of *CHDI* gene and intron 16 of *NIPBL* gene. Both CHD1 (encoding chromo helicase- DNA-binding protein 1) and *NIPBL* (Nipped B homolog) is located in both the sex chromosomes, Z and W of birds.Intron 9 of *CHDI* gene wasamplified by PCR technique in DNA isolated from the feather. As female birds are heterogametic (ZW) PCR amplificationgenerated fragments of two different sizes- 1100 bp and 600 bp, whereas in male birds (ZZ), only a single fragment of1100 bp was observed. Two different pattern generated on electrophoresis of amplicons, in male and female birds, helps toidentify the sex accurately. The other two primer sets did not consistently yield different patterns in all male and female birds raising doubts in their efficacy in being used for sex identification of conures.

The leverage of riparian vegetation and physical habitats of fish assemblage structure

The assemblage structure of fish species in two different regions of Vythiri River of Wayanad was studied from April to September, 2015. The study was aimed to explain the role of riparian vegetation and physical habitat in designing the assemblage structure of stream fishes. Altogether 32 species could be collected from both study sites, of which 20 were located only in Chekuthankundu region of the river. Analysis of the physical parameters suggested that canopy and water temperature had a negative correlation. The correlation between canopy, water temperature and substrate with fish species assemblages was studied. Most of the species were found to be influenced by all these variables, except for some which were assessed as habitat generalists. A total of 31 canopy species were identified from the Chekuthankundu region of the river. The highest number of species belonged to the Family Moraceae (16per cent). Removal of riparian vegetation, uncontrollable sand mining, agricultural runoff, destructive fishing practices like dynamiting and poisoning, damming, stream channel

widening, and introduction of exotics were assessed as the major disturbances to fish fauna in the river.

A comparative study of mixed-species bird flocks in a forest and coffee habitat in Wayanad, Kerala

Mixed-species flocks in two different habitats (a coffee plantation and a natural forest habitat) in Wayanad District were studied in order to compare the species composition and organization of flocks in both the habitats. Studying the association of Racket-tailed Drongos (RTD) with other species within flocks and checking if there was any influence of the associating species on the occurrence of RTDs in flocks was another objective of the study. Flocks were surveyed along three 500 m trails in both the study sites and the different species, number of species, number of individuals, foraging height and foraging substrate of species within the flocks were recorded. The findings of the study suggested that there were no significant differences in the abundance of mixed-species flocks, mean species richness, and mean number of individuals per flock. Though species composition of flocks in both habitats remained almost similar, the organization of species within flocks was different in both the habitats. Also, flocks which comprised of White-bellied Treepie, Dark-fronted Babbler, Indian Scimitar Babbler, Flame-throated Bulbul, White-bellied Blue Flycatcher, Puff-throated Babbler and Malabar Trogon were found only in the forest habitat. Canopy cover in the forest was higher than that in the coffee plantation and differences in the foraging height of flocking species in both habitats were also noted. RTDs were found interacting positively with barbets, minivets, woodpeckers, nuthatches and bulbuls. The preferred associates of RTD were mostly same in both habitats.

Diversity, habitat preference and feeding habits of chiropterans in Wayanad wildlife sanctuary

Species richness, abundance, roosting habitat and diet composition of bats in different forest types of Wayanad Wildlife Sanctuary (WWS) were studied from December, 2014, to September, 2015. Sampling methods included direct observations and mist-netting. A total of ten bat species were reported from six families and eight genera during the study period. *Pteropus giganteus* was the highest in abundance (538) followed by *Megaderma spasma* (70), *Rhinolophus rouxii* (24), *Cynopterus sphinx* (12) and *Kerivoula picta* (9). In Muthanga (dry deciduous forest), Cynopterus sphinx, Kerivoula picta, Megaderma spasma and Taphozous sp. were recorded. In Sulthan Bathery (dry deciduous forest), Pteropus giganteus and Megaderma spasma were found. In Kuruchiyad (semi-evergreen forest), only Megaderma spasma was found from just one roost. In Tholpetty (moist-deciduous forest), a total of seven roosts were

observed and the roosts were occupied by *Rhinolophus rouxii*, *Kerivoula picta*, *Pippistrellus* sp. and *Hipposideros speoris*. One road killed Myotis species specimen was also found from this area. Mixed species roosting and seasonal migration was also reported from Tholpetty. Bat species abundance was highest in moist-deciduous forest. Diet composition analysis revealed that guava was the most preferred fruit (37per cent) of Pteropus giganteus. The analyzed samples also indicated Rhinolophus rouxii to be a generalized insectivorous bat with Lepidoptera forming a major (32per cent) part of its diet. Diet analysis also revealed that Megaderma spasma fed upon seven insect orders with Coleoptera forming 33per cent of its prey. This study, although preliminary, provided baseline information of bats found in WWS.

Comparison of community structure of reptiles between a forest fragment and an intact forest

The study compared the community structure of reptiles in a forest fragment to that of a continuous forest. The study was carried out in the Vythiri section of South Wayanad Forest Division from June to September, 2015. Diurnal quadrats, transects and time constrained searches were carried out to describe the species assemblage. In total, 80 person hours were spend in the continuous forest and 70 person hours were spend in the forest fragment for sampling. Species accumulation curves were plotted and diversity indices were evaluated for both sites. Eight species and forty nine individuals were sampled from the continuous forest, while from the fragment merely three individuals belonging to two species were found. *Eutropis macularia* (n = 18) was the most abundant species in the forest followed by *Calotes ellioti* (n = 9). *Cnemaspis monticola* was the only shared species in the forest and forest fragment from quadrats and transects. Twelve different habitat variables were measured from the sampling sites and five of the variables differed significantly with respect to the study sites. Correlation analysis revealed that canopy cover (-0.44) had a negative correlation and leaf litter depth (0.41) had a positive correlation with abundance of reptiles in the forest. None of the habitat variables correlated with abundance in the fragment. The long isolation, small area and edge effects might have resulted in the local extinction of many of the herpetofauna in the fragment.

Epidemiological study on Kyasanur Forest Disease (KFD) in the monkey population of Wayanad district, Kerala

Mass mortality in the non-human primates, Bonnet Macaques (*Macaca radiata)* and Southwestern Langurs (*Semnopithecus hypoleucos*), of Wayanad District of Kerala was being reported since December, 2014, which also coincided with incidence of a febrile illness among

the people living in the vicinity of the monkey deaths. Eleven human deaths were also reported during this period. Epidemiological study from December, 2014, to June, 2015, revealed that 262 non-human primate deaths were reported from different parts of Wayanad and high mortality was observed between March and May, the highest being in May. Fifteen Macaca radiata carcasses, suspected to be infected with KFD virus were necropsied, out of which twelve cases showed characteristic lesions of KFD, like multi-organ haemorrhages and encephalitis. Five cases were positive for KFD on molecular diagnosis. Amplification and sequencing of the 5' UTR and NS5 region of the viral genome indicated considerable differences from the genome of the 1957 isolate deposited in GenBank. KFD was thus confirmed in Wayanad District of Kerala to be causing high mortality of non-human primates during a short period of time, suggesting the emergence of the virus in Kerala and rapid spread of the infection.

Assessing genetic diversity of tiger (*Panthera tigiris tigiris*) in Wayanad wildlife sanctuary using non-invasive technologies

The study looked into the genetic diversity of tigers in Wayanad Wildlife Sanctuary, which is an integral part of the largest tiger population in the world, by analyzing allelic diversity in six microsatellite loci by extracting DNA from scat samples. In total, sixty scat samples were collected from eighteen sampling blocks of four ranges from Wayanad Wildlife Sanctuary and DNA was extracted. All the samples were screened with the tiger specific cytochrome b primer set (TIF/TIR) for separating tiger scat from its sympatric carnivores. 40 per cent of the DNA isolated from the scat was identified as of tiger origin. The samples positive for tiger DNA were amplified for six microsatellite loci i.e. D10, E7, C34, E21, 3E6 and D15. The mean amplification rate and allelic dropout were observed to be 91 per cent and 9 per cent respectively. The observed heterozygosity and expected heterozygosity were 0.48 and 0.72, respectively. The samples/loci analysed in the present study were deviated from Hardy Weinberg Equilibrium.

Detection of rickettsial pathogens of ticks of wild mammals and reptiles

The study detected the rickettsial pathogens of ticks of wild mammals and reptiles from five different regions of Wayanad district, Kerala (Vaduvanchal, Vythiri, Noolpuzha, Muthanga and Meppadi). A total of 62 ticks were collected from four different wild mammals and one reptile species. The collected species included Amblyomma integrum from Wild Boar, elephant calf and Barking Deer; *Haemaphysalis bispinosa, Rhipicephalus haemaphysaloides, Haemaphysalis spinigera* and *Amblyomma integrum* from Sambar Deer; and *Aponoma gerviasi*

from python. RNA was isolated from individual adult engorged female ticks, using RNAeasy minikit (Quiagen, Germany). cDNA was synthesized from the isolated RNA samples by using Revertaid H Minus cDNA synthesis kit (Fermentas, USA) based on manufacturer`s protocol. cDNA was synthesized and subjected to PCR amplification using specific primers. The primers used for the PCR amplification included Mitochondrial 16S rDNA gene of tick species which amplified a 450 bp product, a pair of oligonucleotide primer sequence which were localized within the coding V4 region in a 18S gene. Rickettsia specific citrate synthase gene (gltA) using CS2d and CSEndr primers which amplified a product of 1234 bp and Rickettsia specific outer membrane protein A by using ompA F and R primers which amplified a product of 632 bp. Agarose gel electrophoresis was performed on 2.0 per cent Agarose (Biogene, USA) gel prepared in 0.5X Tris Borate EDTA buffer (Tris 2.7g, Boric Acid 1.37g, EDTA-0.5M 1ml, Aqua dist. Ad 500ml) using 80V power supply for 90 minutes. The samples were sent for sequence analysis and results obtained were first BLAST analyzed (www.ncbi.nlm.nih.gov/ BLAST) to confirm their identity.

Influence of different habitats on occurrence of Asian small-clawed otter (*Aonyx cinerea Illeger*) in Wayanad, Kerala, India

The study mainly focused on assessing the occurrence of *Aonyx cinerea* in different habitats adjacent to forest areas. Field sampling was carried out from January to May, 2015, which was the driest period of the year and considered an ideal time for sampling otters. The South Wayanad Forest Division was divided into four sectors based on location and habitat types namely forests, coffee plantations, tea plantations and paddy fields. Equal number of transects were allotted to each vegetation (ten transects in each vegetation). In each habitat type, samplings for indirect and direct evidence of otter occupancy was carried out along a 500 m transect which was further divided into twenty 25 meter sub-sections. For each 25 meter subsection, habitat variables were recorded. 140 signs including direct and indirect signs were recorded from 40 segments that were surveyed. Otter spraint abundance were identified from 34 segments (85 per cent occurrence) while the rest of the segments were considered as non-otter sites. One way ANOVA between encounter rates in different habitats showed that there was significant difference in encounter rates between the different habitats (p value 0.0004583; F= 7.6099). Correlation between encountered rates of spraints in tea plantation showed that there was significant difference between shoreline vegetation width and species occurrence.

Assessing the genetic variability in the free ranging Asian elephant (*Elephas maximus)* population of Wayanad wildlife sanctuary

Genetic variability of Asian Elephant (*Elephas maximus*) population of Wayanad Wildlife Sanctuary was assessed using microsatellites markers. The observed polymorphism was low at the tri and tetra nucleotide loci in the samples analysed (n=28). The observed heterozygosity (0.029) was lower than the expected heterozygosity (0.915) and the mean observed heterozygosity was almost half of the expected heterozygosity indicating very high occurrence of inbreeding.

Preference of tiger (*Panthera tigris tigris*) in Wayanad wildlife sanctuary

Coprological analysis of scat samples was carried out to evaluate gastro-intestinal parasitic diversity and diet composition in the tiger (*Panthera tigris tigris*) population of Wayanad Wildlife Sanctuary (WWS), Kerala, from April to September, 2015. A total of 46 scat samples (76.6per cent) analyzed were found to be positive for endoparasites. Scat analysis for parasitic diversity was carried out by sedimentation method. Gastro-intestinal parasitic analysis revealed the presence of parasites belonging to seven different genera. *Diphyllobothrium latum* (33 nos.) was the most commonly recorded parasite followed by *Paragonimus westermani* (25), Taenia sp. (6) Strongyle sp. (4), Trichuris sp. (2), Toxocara sp. (2) and Nematode larvae (2). Although gastro-intestinal parasitic diversity was less compared to similar studies from other tiger habitats, the number of individuals infested was considerably high. Hair samples of known animals were collected and studied for cuticular and medullary structures. This was used as reference while analyzing the hair from scat samples. A total of 60 scats were analyzed. The tigers of WWS were found to be feeding on five prey species. Sambar was the most predominant prey, featuring in 29 of the 60 scat samples (48.33per cent) followed by Gaur (21.66per cent), Chital (20per cent) and Wild Boar (5per cent). The data revealed that tigers of WWS preferred larger ungulates (i.e. Gaur and Sambar) to smaller prey species such as Wild Boar, Chital and Barking Deer.

Anti-cancer and nematocidal properties of crystal proteins of *Bacillus thuringiensis*

The native *Bacillus thuringiensis* (Bt) strains isolated from Western Ghats, a biodiversity hot spot in terms of natural flora and fauna, were used for this study. A total of 10 Bt strains from the repository of 507 strains collected from Western Ghats, were selected with the objectives of isolation of inclusion proteins, their characterisation, evaluation of anti-cancer and nematocidal properties and elucidation of possible mechanisms of toxicity. After quantifying the proteins haemolysis assay the strains KAU 34, 59, 353 and 375 were selected as non-

haemolytic strains, whereas strains KAU 49, 50, 52, 61, 99 and 424 were grouped under haemolytic strains. Non- haemolytic strains were screened for anti- cancer properties and haemolytic strains strains were screened for nematocidal properties. Bt strains KAU 34, 59 and 375 were found to possess novel proteins (parasporins) which are cytotoxic to Jurkat (human T lymphocytic leukemic) cell line and at the same time non-toxic to normal lymphocytes. The mode of cytotoxicity for KAU 34 and 59 was by the induction of apoptosis and for KAU 375 by necrosis. Out of the six haemolytic strains screened for nematocidal properties against Haemonchus contortus larvae of goats the strains KAU 50 and 424 were found to be positive.

Assessment and alleviation of transportation stress in broiler chicken

An experiment was conducted in the Vencobb strain of broiler chicken to study the physio-biochemical changes and oxidative damages associated with transportation stress. The study also envisaged evaluation and comparison of efficacy of vitamin C and fruit juice of acerola berry (*Malphigia glabra*) in alleviating the transportation stress. In the study, sixty chicks of five weeks of age were randomly selected from a flock of 1000 birds maintained in a private farm at Palani, 180 kms away from College of Veterinary and Animal Sciences (CVAS), Mannuthy. The birds were equally divided into four groups (G I, G II, G III and G IV) and reared separately in the farm.Birds of G-I group included those reared on standard finisher ration (BIS, 1992) and not subjected to transportation. Birds of G-II group were reared on standard finisher ration without any supplementation and were transported. The birds of G-III group were supplemented with vitamin C @ 60 mg/kg body weight and that of G-IV group were supplemented with 25 ml of aqueous extract of acerola berry fruit in drinking water for one week before transportation.At sixth week of age, the birds were transported from the farm to CVAS, Mannuthy (180 km) for duration of six hours. The birds of G-I group were sacrificed at the farm and the birds of the other groups (G-II, G-III and G-IV) were sacrificed immediately after reaching CVAS, Mannuthy.The results of the study showed that there was no significant difference in body weight of individual birds compared before and after transportation. The Haemoglobin (Hb) concentration, total eosinophil count, total leukocyte count, monocyte count, serum total protein and creatine phosphokinase concentrations, total antioxidant status and reduced glutathione levels of birds were also similar before and after transportation. Supplementation of vitamin C and aqueous extract of acerola berry had no effect on Hb concentration, total eosinophil count, total leukocyte count, monocyte count, serum total protein and creatine phosphokinase concentrations, total antioxidant status and reduced glutathione levels of birds. But the stress of transportation increased the heterophil count,

Heterophil: Lymphocyte (H/L) ratio, blood glucose level, total cholesterol concentration, uric acid concentration, lipid peroxide and superoxide dismutase levels and decreased the lymphocyte count of birds. Both the antistress agents used were found effective in reducing the stress of transportation indicated by lowered heterophil count, increased lymphocyte count, reduced Heterophil:Lymphocyte (H/L) ratio, normal blood glucose and cholesterol concentrations as well as low levels of oxidative damages in supplemented group of birds.

Experimental group of birds in the farm at Palani

Mature ripened and unripened fruits of *Malphigia glabra*

Assessment of growth and thyroid function in response to dietary supplementation of selenium and iodine in crossbred calves

The study was conducted in crossbred female calves of three to four months of age for assessing the growth and thyroid function in response to dietary supplementation of Selenium (Se) and Iodine(I). Selenium supplemented calves showed better anti-oxidant status and thyroid function. Combined supplementation of Se and I did not alter the T_3 and T_4 concentrations significantly during the study period.

Diversity analysis among goat genetic groups of Kerala

Goat populations of Kerala, viz., Attappady Black (AB), Malabari populations of Kannur, Calicut, Thrissur and Malappuram districts (MK, MC, MT and MM respectively) and Malabari crossbreds (CB) were analysed for phenotypic diversity using morphobiometric markers and genetic diversity using microsatellite markers. Dendrogram drawn for biometric traits using PROC CLUSTER from SAS V.9.2, confirmed the existence of different groups, CB goats evolving as a different cluster. Ten microsatellite markers were chosen from FAO-ISAG panel and grouped into three, each group amplified from genomic DNA by multiplex PCR using fluorescent labeled primers. Overall mean value for expected heterozygosity was 0.78 ± 0.02 revealing high genetic diversity in the population, but with slight heterozygote deficit as

evidenced by lower observed heterozygosity values (0.73 ± 0.03). Positive FST value, indicating genetic difference between populations, was low (0.02 ± 0.004), but statistically significant differences existed between studied populations, except MC, which was not significantly different from MK, MT and MM. Structure analysis (STRUCTURE 2.3.4) revealed the presence of three underlying clusters, of which AB and CB belonged to a single major cluster, whereas Malabari populations showed great admixture. PCR-RFLP was conducted for six loci namely Growth hormone (GH), Bone Morphogenetic Protein Receptor 1B (BMPR1B), G Protein Coupled Receptor 54 (GPR54), Beta Lactoglobulin (βLG), Stearoyl Coenzyme A Desaturase (SCD) and Leptin genes. Sequencing of GH gene revealed a mismatch G55A at 90th position of exon 2 which resulted in three genotypes AA, AB and BB on digestion with HaeIII enzyme. The BB sequence was rare with a genotype frequency of 0.02 and was not reported in other goat breeds. Forced RFLP was conducted with AvaII enzyme on BMPR1B gene fragment revealing monomorphic banding pattern. A novel PCR-RFLP was established using BceA1 enzyme, confirming the existence of C96T mutation in exon 1 of GPR54 gene in goats. Phenotypic and genetic diversity was established between goat populations of Kerala, where AB and CB formed distinct groups with less admixture. Among Malabari populations, MM remained different from MK, MC and MT, both phenotypically and genetically.

Single nucleotide polymorphism of production associated loci in crossbred cattle of Kerala

The effect of fifteen single nucleotide polymorphisms (SNPs) on dairy traits and the accuracy of breeding values estimated using the average effects of alleles were investigated in crossbred cattle of Kerala. A total of 144 crossbred cattle comprising two herds of 104 and 40 animals were genotyped for the polymorphic sites by restriction fragment length polymorphism (RFLP). The polymorphism, MAF1/A628G was investigated for the first time using Apa1. The distribution of genetic variants of all the SNPs was according to Hardy-Weinberg equilibrium except three. Sequence analysis revealed a novel SNP (G4104A) at 4104th position and an addition of eleven base pairs in the 13th intron of ABCG2 gene of Vechur cattle. Association of SNPs with dairy traits was analysed by general linear model univariate considering marker, season of calving and parity as fixed effects and dairy trait as dependent variable. Allele substitution effects and breeding values for respective genetic variants were estimated. The phenotypic values for dairy traits were predicted in a separate herd of 40 animals using the breeding values derived from the first herd. The predicted and observed values for dairy traits

were not different ($p>0.05$) according to paired t-test. The results confirmed the influence of SNPs on milk yield 305 day (GH/C1547T), daily milk yield (GH/C1547T), fat yield (GH/C1547T) and fat (DGAT1/K232A, PPARGC1A/A3359C, OPN/C8514T and IGF1/C512T), protein (DGAT1/K232A), SNF (DGAT1/K232A and OPN/C8514T) and lactose content (OPN/C8514T). These markers can be suggested for marker assisted selection (MAS) for future breeding programmes.

Management of anoestrum in crossbred heifers and cows by hormonal induction of oestrus

The objective of the present study was to assess the incidence, nature and magnitude of anoestrus among crossbred heifers and cows under field conditions, to evaluate haemato-biochemical and progesterone profiles in anoestrus cattle, to study the fertility rate in induced oestrus under different hormone treatment protocols and to identify most suitable treatment regimen. Trials were conducted in 40 crossbred anoestrus heifers (Trial I) which failed to exhibit oestrus even after 18 months of age and 40 anoestrus cows (Trial II) which failed to exhibit oestrus even after 90 days postpartum having a body condition score of 2.5 to 3.5. In both Trials eight animals were randomly allotted to four treatment and one control group. Oestrus induction protocols for Trial I (heifers) and II (cows) were the same for treatment groups I to IV. For group I, oestrus induction was conducted by administration GnRH analogue (busereline) 20µg on day 0 and the animals were observed for 10 days. AI was done on detection of oestrus. In group II, GnRH on day 0, plus CIDR intravaginal P4 insert, on day seven insert was removed and a dose of PGF2α analogue (cloprostenol) 500 µg was administered. AI was done 56 h after the removal of CIDR. For group III, GnRH administered on day 0, followed by PGF2α on day seven. A second dose of GnRH (10µg) was administered on day nine followed by AI at 18 h after second dose of GnRH. In group IV, oestrus induction protocol was same as group II except that a second dose of GnRH (10 µg) was administered on day nine followed by AI 18 h later. Gynaecological examination of animals presented in the infertility camps revealed that out of 516 animals examined through 44 infertility camps a total of 371(72per cent) infertility cases were diagnosed of which 75 per cent were true anoestrum forming 46 per cent of total infertility problems. Under true anoestrum, the incidence of cases of pre service, post service and genital tract infection cases were 58, 9 and 8 per cent, respectively.

Efficacy of whelping induction protocols as an alternative to elective caesarean section in dogs

With the objective of studying the efficacy of whelping induction protocols as an alternative to elective caesarean section (C-section) in dogs, 18 apparently healthy bitches in advanced gestation, between one and half to four and a half years of age, with a history and clinico-gynaecological examination results suggestive of an elective C-section, were selected for the study. The study was conducted at University Veterinary Hospital, Kokkalai and Mannuthy. These animals were assigned to three groups of six animals each. Animals in Group I were treated with mifepristone at the rate of 2.5mg/kg BID orally, while those in Group II were treated with mifepristone at the rate of 2.5mg/kg BID orally and oxytocin at the rate of 0.15 IU/kg subcutaneously 24 h after the first dose of mifepristone. In Group III elective C-section was performed. These animals were subjected to general anaesthesia using propofol at the rate of 6mg/kg intravenously for induction and maintained with 2-3 per cent isoflurane gaseous anaesthesia. The time taken for induction of whelping in Group I was less when compared to Group II and clinical interventions were required for Group II during whelping. Even though the percentage of stillbirths were slightly more in whelping induction protocols and post whelping/caesarean neonatal mortality was noticed only in case of elective C-section group, the total perinatal puppy survival rates were well within the accepted range in all the three groups. There were no post-caesarean or induction complications during the course of the study. Statistical analysis revealed that treatment costs for Group III were significantly higher (p<0.01) when compared to Groups I and II. The animals in Groups I, II and III showed decrease in P 4 levels with means of 1.206 ng/ml, 2.43 ng/ml and 1.33 ng/ml, respectively and a decrease in body temperature with means of 1.1 ± 0.18 ºC, 1.06 ± 0.01 ºC and 0.36 ± 0.21 ºC, respectively, 24 h after treatment. From the results of the study, it could be inferred that mifepristone can be considered for induction of whelping as a non-invasive alternative to elective C-section as per the discretion of the clinician and merit of the case.

Clinico-pathological studies on splenomegaly in dogs

Splenomegaly was the major clinical sign to recognize splenic disease. Ultrasonography aid to differentiate diffuse, focal and multifocal masses in spleen. Ultrasound guided FNAB was helpful in the specific diagnosis of lymphoma and splenitis.

Diagnosis and management of mitral valve insufficiency in dogs

Early diagnosis of mitral valve insufficiency is important. Echocardiography will aid in the diagnosis.

Clinico-therapeutic studies on *Babesia gibsoni* infection in dogs

Babesiosis caused by *B.gibsoni* was more common compared to *B. canis*. Normocytic normochromic or macrocytic anaemia with mild *Lymphocytosis, Thrombocytopenia* and *Hypoproteinemia* were the prominent findings of canine babesiosis.

Clinico-biochemical and electrocardiographic evaluation of uremia in dogs

Metabolic acidosis and hyperkalemia were common in uremic dogs. Sinus arrest, ventricular premature complexes and peaked T waves were the common ECG changes.

Assessment of biogas production potential of ruminant farm animal waste

The research work was conducted at University Livestock Farm and Fodder Research and Development Scheme, Mannuthy using portable floating drum biogas plants of 0.5 m^3 capacity, to study the biogas production potential of the excreta of cattle, buffalo and goat with a retention period of 25–30 days in the mesophilic temperature range. The study was conducted in monsoon and summer season, and at two different loading rates of two kilogram one time loading and one kilogram two time loading, with substrate diluted to 10per cent dry matter level. The gas volumes were taken throughout the entire observation period in both seasons at constant pressure. The methane and carbon dioxide concentrations of biogas were analyzed using Gas Chromatography. The fertilizer value [Nitrogen (N), Phosphorus (P) and Potassium (K) content] of sludge were analysed fortnightly.

Comparison of biogas production using different substrates showed that there existed significant difference ($P<0.01$) between the three different substrates, two different loading rates and between the two seasons, in case of biogas volume and concentration of methane and carbon-dioxide. The mean value of biogas volume in m^3 were in the order of goat excreta at the highest (0.0778 ± 0.0007) followed by cattle excreta (0.0739 ± 0.0004) and buffalo excreta (0.0706 ± 0.0006). The mean value of methane concentration was in the order of goat excreta at the highest (67.08 ± 0.12) followed by buffalo excreta (63.58 ± 0.12) and cattle excreta (61.12 ± 0.14). The mean value of carbon dioxide concentration was highest in goat excreta (26.62 ± 0.32) followed by cattle excreta (26.42 ± 0.15) and buffalo excreta (24.80 ± 0.18). The biogas production was significantly ($P<0.01$) higher in summer and in the treatment of one kilogram two time loading than in monsoon and the treatment two kilogram one time loading. The sludge was observed to have good fertilizer value (N and P content) than the substrate. The parasitic load (Eggs per gram) of the sludge was significantly lower ($P<0.01$) than that of the substrate, in the case of goat excreta.

Assessment of biogas production potential of monogastric farm animal waste

The research work was conducted at University Livestock Farm and Fodder Research and Development Station, Mannuthy using portable floating drum biogas plants of 0.5 m^3 capacity, to study the biogas production potential of the excreta of swine, rabbit and poultry using retention periods of 25 – 30 days and within the mesophilic temperature range. The study was conducted in two seasons (monsoon – S1 and summer – S2), with two different loading rates – two kilo gram, one time loading (T1) and one kilo gram, two time loading (T2), both diluted to 10per cent dry matter level. The gas volumes were taken throughout the entire observation period in both seasons at constant pressure. The methane and carbon dioxide concentrations of biogas were analyzed using Gas Chromatography. The fertilizer value [Nitrogen (N), Phosphorus (P) and Potassium (K) contents] of biogas slurry was determined fortnightly.

Comparison of biogas production from different substrate using one way ANOVA showed that there existed significant difference ($p < 0.01$) between the three different substrates, two different loading rates and also between the two seasons in case of biogas volumes, and concentrations of methane and carbon dioxide. The mean values of biogas volumes were in the order rabbit excreta ($0.0813 \pm 0.0007 m^3$) followed by poultry excreta (0.0778 ± 0.0005 m^3) and swine excreta (0.0738 ± 0.0004 m^3). The mean value of methane concentration was in the order rabbit excreta (70.96 ± 0.19) followed by poultry excreta (66.87 ± 0.21) and swine excreta (62.41 ± 0.20). The mean value of carbon dioxide concentration was highest in swine excreta (28.07 ± 0.32) followed by rabbit excreta (24.54 ± 0.15) and poultry excreta (22.14 ± 0.14). The biogas production was significantly ($p < 0.01$) higher in S2 andT2 than S1 and T1, in all the three substrates. The biogas slurries were observed to have good fertilizer value. The egg per gram of the slurry was significantly lower ($p < 0.01$) than that of the substrate in the case of rabbit excreta.

Developmental pattern of the respiratory system in Kuttanad ducks (*Anas platyhynchos domesticus*)

Development pattern of respiratory system in Kuttanad ducks was studied in detail by investigation of topography, morphogenesis and histogenesis of this system during prehatch and post hatch periods and to derive the relationship with age and body weight. Material for the study was formed by 18 fertile eggs with viable embryos collected on 7th, 14th and 21st days of incubation and 78 female Kuttanad ducklings divided into thirteen groups with six birds in each age group collected at fortnightly intervals. Observations on morphology, histology,

histochemistry, electron microscopy, morphometry and micrometry were carried out and data were analysed statistically to find out the relationship.

Evaginated postbranchial region of the pharynx presented a midventral laryngo-tracheal groove as a primordium of the respiratory tract, by third day of incubation. By seventh day nasal cavity was formed, pharyngeal arches gave out the primordia for laryngeal cartilages. Lungs attained a dorsal position and exhibited initiation of vascularization. Near the base of lungs lay the primordium of extrapulmonary bronchi. Individual parts of respiratory system became grossly visible by 14th embryonic day. Nostrils were covered by undifferentiated layer of cuboidal cells. Syrinx was a slightly dilated organ at the base of heart. Lungs were greyish-white, with most of parabronchi canalized. By 21st day of incubation, nostrils presented four layers of stratified squamous epithelium histologically. All three conchae became visible and nasal cavity was lined by three types of epithelia. Lungs were firm, wedge-shaped with little mesenchymal tissue. Parabronchi, atria and infundibulae were also developed. Nostrils were plugged upto the day of hatch, became open as nares perviae after this stage. Free respiratory macrophages were highest in 24weeks-old ducks. Cross sectional anatomy and methylene blue staining revealed three conchae in nasal cavity. On staining with alizarin red, varying degrees of ossification were seen throughout study period. Visualization of gross internal structure of lungs and bronchi, dimensions and volume of air sacs and estimation of their number were carried out by radiography, contrast radiography and latex casting. Air sacs were nine in number. Laterodorsal secondary bronchi were most numerous in lungs.

Histological structure similar to that of adult was attained by fourth week. Scanning electron microcopy revealed tall columnar cells in nasal cavity. Size of cilia increased as age advanced. Olfactory or sensory cells presented brush like appearance with bipolar neurons. Trachea was a hyaline cartilaginous tube upto 8th weeks and showed signs of differentiation hereafter. Transmission electron microscopy revealed fat and glycogen granules in chondrocytes at later stages indicating regression. Supporting framework and membranes of syrinx developed by 21st day of incubation. Hexagonal shape was attained by parabronchi from day-old stage. Mucous cells and cartilage along respiratory tract were positive for PAS. Percentage contribution of respiratory tract to body weight showed a significant positive correlation with age and body weight in both prenatal and postnatal periods. Parts of respiratory system were highly correlated with body weight than on age. Maximum contribution of respiratory tract was by 21st day in prehatch and four weeks in post hatch periods confirming the system as an early maturing one.

Developmental pattern of the pancreas in Kuttanad ducks (*Anas playtyrhynchos domesticus*)

Prehatch and posthatch development of the pancreas was studied in Kuttanad ducks using 18 fertile eggs with viable embryos and 78 apparently healthy female ducklings from the day of hatch to 24 th week of age. Histologically the primordia appeared on the third day of incubation. However, it could be detected by stereozoom microscope only on eighth day and with unaided eyes on tenth day of embryonic life. On 14th day, the organ was positioned in the duodenal loop in close topographic relation with the liver and by 21st day the three distinct lobes attained their final topographic position in between the limbs of duodenum. On the day of hatch, pancreas was divisible into three morphologically distinct lobes, viz., dorsal, ventral and splenic lobes. This lobar arrangement was maintained throughout the developmental period. The dorsal lobe was the largest, longest and heaviest lobe while, the splenic lobe was the smallest. The splenic lobe was found to be attached to dorsal lobe throughout the posthatch period. The pancreas of Kuttanad ducks possessed three morphologically distinct extrapancreatic ducts throughout the posthatch period. The ventral lobe was drained by a single ventral extrapancreatic duct and was the largest among all the three. The secretion from the dorsal lobe was carried to duodenum by two distinct ducts, i.e., chief dorsal extrapancreatic duct that and an accessory dorsal pancreatic duct. The accessory dorsal extrapancreatic duct was the first to open into the ascending limb of duodenum followed by the chief dorsal and ventral extrapancreatic ducts. The splenic lobe never had any independent duct of its own and hence was drained by one of the tributaries of chief dorsal pancreatic duct. Histologically each lobe presented both exocrine acini and endocrine Islets of Langerhans. The exocrine part of the pancreas of Kuttanad ducks was composed of compound tubuloacinar glands in all the age groups. The endocrine part was composed of alpha, beta and delta cells, of which alpha and beta cells formed histomorphologically distinct islets. Three types of islets such as dark, light and mixed islets were observed throughout the posthatch period. The alpha islets were variable in size and distributed throughout the pancreas and were largest and more frequent in the splenic lobe. Beta islets were distributed at random in all the lobes of pancreas and appeared lighter. Ultrastructurally exocrine acinar cells showed characteristic features of a secretory cell like well developed rough endoplasmic reticulum, large number of mitochondria and secretory zymogen granules. TEM revealed principal cells and globose cells lining the pancreatic ducts. It is concluded that the pancreas in Kuttanad duck is precocial in development with the attainment of final morphological and histological architecture on the day of hatch.

Histomorphological comparison of the lymphoid tissue of Waldeyer's ring in large white yorkshire and indigenous pigs of Kerala

The present study was undertaken to compare the distribution, histomorphology and histochemistry of the lymphoid tissue of Waldeyer's ring in Large White Yorkshire and indigenous pigs of Kerala. Tissue samples were collected from 12 apparently healthy adult male animals (six from each group) sold for slaughter from Centre for Pig Production and Research, Mannuthy. In both the groups the lymphoid tissue of Waldeyer's ring were composed of five tonsils namely, lingual tonsil and tonsil of soft palate located in the oropharynx, pharyngeal and tubal tonsils in the nasopharynx and paraepiglottic tonsil present in the laryngopharynx. The palatine tonsil seen in other domestic animals was absent. Histological structure of the tonsils of oropharynx and laryngopharynx were similar but differed from that of the nasopharynx. Among all the tonsils present, tonsil of soft palate was the largest and the average number of lymphatic nodules per microscopic field and lymphocyte count per nodule was maximum in it. Histochemistry of the lymphoid tissues of Waldeyer's ring showed similar results in both the groups studied. Statistically significant differences were recorded in the average size of tonsils, crypt depth, number and size of lymphatic nodules and lymphocyte count per nodule in Large White Yorkshire and indigenous pigs. Though the average size of tonsils of soft palate and nasopharynx were larger in Large White Yorkshire, the average crypt depths were more in these tonsils in the indigenous pigs that provided a larger surface area and intimate contact between the lymphocytes of the parenchyma and the surface epithelium. The average size of lymphatic nodules and number of lymphocytes per nodule in all the tonsils were more in indigenous pigs when compared to Large White Yorkshire. Since the lymphocytes carry out the activities of immune system, it may be interpreted that in the indigenous pigs the tonsils offer better immunological protection against antigen that enter the body by oral or nasal routes and hence they are resistant to many of the respiratory and digestive disorders when compared to Large White Yorkshire pigs.

Development of an information technology based advisory system on scientific management of pet dogs

In this era of information society, Information Technology (IT) has the power to cut across social and geographical distance and help people by finding new ways of facilitating the flow of information and knowledge. Keeping this in view, an effort was made to develop an IT based advisory system on scientific management of pet dogs and to assess the applicability of the system as an adult education tool from the perspective of stakeholder perception.

As the first step, the information needs of the pet dog owners on scientific pet dog management were identified. Based on the needs identified, appropriate contents for the advisory system were prepared in electronic format. The advisory system was developed employing Visual Basics 06 and Microsoft Access 2007 with the assistance of a programmer. Visual basic tool was selected to develop a simple, attractive graphic design and user interface where as Microsoft access tool was used to create the database. Finally, the system was tested among the pet dog owners and pet dog practitioners to assess their perception of its applicability as a technology transfer tool. All the respondents perceived it as highly applicable in disseminating the information regarding scientific management of pet dogs.

The results of the study revealed the computer usage pattern of the pet dog owners. Even though more than half of the respondents had access to computer, about a half of the pet dog owners were not doing any tasks using computer. Majority of the pet dog owners were using computer only once or twice in a month. The data indicated that most of the pet dog owners had not attended any training regarding computer application. Regarding knowledge and skill of the pet dog owners in computer application, most of them had only low levels of knowledge and skill. Further, majority of the pet dog owners had an ambivalent or neutral attitude towards computer usage.

Nearly all of the veterinarians had access to computer either at home or office. One-half were doing more than two tasks using computer. A majority of the veterinary surgeons were using the system every day and also had training regarding computer application. Knowledge and skill in computer application was also high to a large majority. On inspection of data pertaining to attitude towards computer usage, it was found that most of the veterinarians had an ambivalent or neutral attitude towards computer usage.

While pet dog owners' information seeking and storing behaviour was low, it was found to be high for most of veterinary surgeons. When information storing and processing behaviour of majority of the veterinarians was medium, it was low in the case of information dissemination behaviour.

The result of the Spearman correlation study indicated that the variables such as number of dogs reared, experience in rearing dogs and attitude towards computer usage were having significant positive association whereas the variables educational qualification, frequency of computer usage, training in computer application, tasks performed using computer, knowledge and skill in computer application were having significant negative association with the pet dog owners' perception of applicability of the advisory system. Also, the variables such as training

in computer application and tasks performed using computer were significantly and negatively associated with the veterinarians' perception of applicability of the advisory system.

Molecular characterisation of OMPA gene of *Riemerella anatipestifier* isolates from ducks of Kerala

The work aimed at characterizing ompA gene of *Riemerella anatipestifer* isolates from ducks of Kerala by molecular methods and elucidating the immunogenic properties of membrane proteins of the organism. Freeze dried bacterial isolates viz KML-1,KML-2 and KML-3 maintained in the Dept. of Vety. Biochemistry were used for this study. The revived isolates were confirmed as *R. anatipestifer* by biochemical tests and by 16S rRNA based PCR using specific primers. All the isolates on amplification by ompA based PCR using specific primer pairs showed amplicons of 1119 bp size. The gel purified PCR products were cloned and sequenced. All the isolates showed 95- 98per cent identity of their nucleotide sequences with the GenBank sequence (AY606208). The aminoacid sequences derived from the nucleotide sequences were blasted using NCBI BLAST tool which showed 91-97per cent similarity to ompA protein of *R. anatipestifer*. Majority of variations were found to be between 16-50 aminoacid residues which contribute to the formation of the outer membrane protein β barrel domain. KML-3 was the most variant among the isolates.

The protein profile of OMP enriched portion (sarkosyl insoluble) revealed several bands of approximate molecular masses of 40, 41, 42, 60,62,68,70,190 and 205 kDa on SDS-PAGE; of which 42,60 and 62 were the major bands. Upon immunoblotting analysis, the IgG antibody response was observed against membrane protein components 30, 35, 42 and 66 kDa as the major immune reactors, of which 42 kDa reactor was suggestive of ompA. In addition, a protein of high molecular weight i.e., 66kDa and other low molecular weight proteins of 30 and 35kDa could also be found as major immunodominant proteins. The results suggest that these immunogenic components could be significant in the virulence of the organism and that these membrane proteins could be utilized in developing control and therapeutic strategies against the emerging New Duck disease in Kerala.

Clinico-therapeutic studies and experimental evaluation of a bacterin against common bacterial isolate of bovine mastitis

The present study was conducted to understand the epidemiology of clinical bovine Mastitis, etiological agents involved, their antibiotic sensitivity pattern and to assess the efficacy of a bacterin prepared from the commonest bacterial etiology involved based on the presence of

certain selected virulence factors. The efficacy of bacterin was evaluated in a rabbit mastitis model.

Epidemiological investigations revealed that bovine are getting infected with contagious Mastitis at an earlier age and earlier stages of lactation. Most of the animals were having unfavorable udder and teat characteristics. Practice of hygienic milking and importance of dry-Cow therapy were not perceived by the farmer. Milk from affected animals were mostly creamy milk and that three fourth of the population had udder fibrosis.

Milk samples of 289 cases were subjected for culture examination and antibiogram studies. *Staphylococcus aureus* was identified as the commonest. Organism followed by *E. coli*, Klebsiella spp. and streptococcus spp. Other organisms isolated were *Staphylococcus xylosus, S. hominis,* Enterobacter spp., Pseudomonas spp., *S. auricularis*, Citrobacter spp., *S. chromogens*, Micrococcus spp., Proteus spp., Bacillus spp and *S. lugdunensis*. Most of the isolates were sensitive to Gentamicin, followed by, Ciprofloxacin and Chloramphenicol. Ampicillin and penicillin were found to be least sensitive.

PCR based detection of staphylococcal virulence Factor coa , clfA ,spA, icaA ,agrII operon, icaA, fnbpA and tst resulted in detection of all virulence factors except tst . One isolate, containing six out of seven factors were selected was Preparation and evaluation of a formalin treated bacterin in a rabbit mastitis model. It was observed that there was a significant reduction in somatic cell count of vaccinated rabbits following challenge and reduction was more appreciable as the challenge dose increased. An indirect ELISA, was developed for assessing the immune response to vaccination. It was observed that the vaccine could significantly increase the antibody titre by fifteenth day of vaccination and vaccinated group had increased antibody response than unvaccinated following a challenge. By the end of study, the antibody titre of vaccinated group was almost double than that of unvaccinated group.

Hypolipidemic and antioxid effects of *Calocybe indica* (Milk Mushroom) in hypercholesterolemic rats

The aim of the present study was to investigate the hypolipidemic and antioxidant effects of ethanolic extract of fruiting bodies of *Calocybe indica* (milky mushroom) in hypercholesterolemic rats by estimating serum lipid profile and tissue antioxidant status. Experimental animals (Wistar rats) were randomly divided into six groups (n=8). Hyperlipidemia was induced by feeding high fat diet (20per cent coconut oil, 2per cent cholesterol, 1per cent cholic acid and 1 mL coconut oil supplemented with egg) for 45 days to all groups except normal control which were fed with standard diet. Then ethanolic extract of

C. indica (250, 500 and 750 mg/kg, p.o) and reference drug, rosuvastatin (10 mg/kg, p.o) were administered along with hyperlipidemic diet for the latter 30 days. The hypolipidemic activity of fruiting bodies *of C. indica* extract was found to be slightly less efficacious than that of the reference drug but it has pronounced antioxidant activity and also reversed the hyperlipidemia induced histopathological alterations in liver and kidneys as similar as the reference drug. The protective effect of *C. indica* may be attributed to the combined effect of many factors like the presence of mushroom's secondary metabolites (saponins, glycosides, diterpenes and flavonoids) and also suppression of endogeneous cholesterol absorption.

Evaluation of immunomodulatory and antibacterial effects of urine of Vechur and crossbred cows

The immunomodulatory and antibacterial activity of Vechur and crossbred cow urine distillate was investigated in the present study using cyclophosphamide induced immunosuppressed mouse model. Urine distillate was prepared by distilling cow urine at 100^0 C in a temperature controlled distillation apparatus. The routine evaluation of urine distillates revealed the presence of urea, uric acid and creatinine, with higher levels in Vechur urine distillate. They were also tested for the presence of various constituents. One hundred and forty four male Swiss albino mice were used to assess the humoral and cellular immunity by administering the urine distillate at the dose level of 10.8 ml/kg body weight for 19 days. In order to study the effect of urine distillate in immunosuppressed animals, cyclophosphamide at the dose rate of 30 mg/kg body weight was used. Various physiological, haematological, biochemical and immunological parameters were performed. The immunosuppression in cyclophosphamide control animals was confirmed from significantly decreased spleen weight, total leukocyte count, lymphocyte count, total protein and globulin concentration, HA titre, splenic plaque forming cells and bone marrow cellularity compared to normal control. Both the urine distillates significantly increased the spleen weight and liver weight in normal as well as immunosuppressed animals. In both normal and immunosuppressed mice, both urine distillates dramatically raised spleen and liver weight and there was a considerable rise in total leukocyte count, lymphocyte count, and decreased neutrophil count. A significant stimulation of humoral immune response as indicated by an increase in antibody titre and number of antibody producing cells in immunocompetent and immunosuppressed animals was noticed. The bone marrow cellularity and DTH reaction showed a significant stimulation in immunocompetent as well as immunosuppressed animals throughout the experiment. Antibacterial activity could not be detected for Vechur and crossbred urine distillate against the microorganisms tested. The

present study shows that Vechur urine distillate exhibited better immunomodulatory effect compared to crossbred urine distillate in normal as well immunosuppressed animals.

Antioxidant and hepatoprotective effect of Malabar tamarind *(Garcinia gummi-gutta*) fruit rind extract in paracetamol induced toxicity in rats

The study was aimed to evaluate the antioxidant and hepatoprotective effect of ethanolic extract of Malabar tamarind (*Garcinia gummi-gutta)* fruit rind on paracetamol induced toxicity in rats and to compare the level of expression of *CYP2E1* gene in liver. Administration of extract revealed hepatoprotection by significant reduction in serum levels of liver marker enzymes like AST, ALT an ALP and lipd peroxidation with a significant increase in the antioxidant level SOD and GSH in liver and kidney. Histopathological studies revealed the presence of regenerating binucleated hepatocytes. The expression level of Cytochrome P450 2E1 (CYP2E1) as measured by RT- qPCR was found to be significantly down regulated in the liver of extract -treated group in a dose dependent manner when compared with that of control group. Thus it could be concluded that the ethanolic extract of dried fruit rind of *G. gummi – gutta* has marked antioxidant and hepatoprotective effect in paracetamol induced toxicity in rats.

Screening and evaluation of selected herbal extract for management of obesity and associated metabolic disorders

Dyslipidemic potentials along with targeting the underlying oxidative stress. The plants were shortlisted based on history of food use, usage in daily life, mentioned in texts of ayurveda for medicinal use, not classified as endangered species and present in normally traded as commodities list. Six plant extracts were screened for acute oral toxicity & hypotriglyceridemic effect in oral lipid load test. After the screening test for safety, potency & solubility, water soluble fraction of *Zingiber officinale* extract (WFZE) was evaluated for anti-obese & anti-dyslipidemic potentials. The anti-obesity effect of WFZE was established in high fat diet induced obese male rats by significant reduction in body weight gain, adiposity & triglyceride levels. WFZE treatment significantly reduced the oxidative stress induced by high fat feeding, indicating its anti-oxidant potential. A significant reduction in serum triglycerides & cholesterol levels following the administration of Trion WR-1339 & chronic feeding of cholesterol & cholic acid in rats established the anti-dyslipidemic activity of WFZE. WFZE also indicated invitro pancreatic lipase inhibitory activity. The findings of the present study suggest that WFZE is safe effective therapeutic agent for the management of obesity and dyslipidemia via the inhibition of pancreatic lipase and anti-oxidant mechanism.

Standardization of multiplex PCR and ELISA as a diagnostic protocol for the bacterial abortions in ruminants

A study was carried out to determine the bacterial agents commonly associated with abortions in cattle and goats in Palakkad district for a period of one year. Fifty abortions each, in both species occurred during the period, were classified as early and late based on the stage of pregnancy and also the occurrence in monsoon and non-monsoon based on the season as well. The samples collected were the stomach contents of the aborted fetus. The samples were subjected to DNA extraction by both conventional Phenol chloroform method and by employing standard DNA extraction kit. Polymerase chain reaction, for commonly occurring seven bacterial organisms viz., Brucella, Salmonella, Listeria, Leptospira, Campylobacter, Chlamydophyla and E. coli, were standardized. The extracted DNA from the samples were subjected to PCR for these bacterial agents revealed that Brucella, Leptospira, Salmonella and Listeria were the common agents responsible for abortions in cattle while the latter two were responsible for the same in goats. The results, when compared with that of the direct culturing from the sample, were found satisfactory. Stage of pregnancy and season wise classification of the etiological agents were also done. Based on these results a multiplex PCR involving these four organisms was standardized. The Brucella, Salmonella, Listeria and E coli clones having lipl32 gene were cultured to prepare the antigen for standardizing ELISA. The OMPs of Brucella, Salmonella and Listeria were extracted by sarcosyl method. The Sarcosyl insoluble fraction of these OMPs and the purified LipL32 protein expressed by IPTG induced E coli clones were used as antigens. These antigens were confirmed by ruling out the cross reaction between them and with other related organisms by immune-blotting. The concentration of antigens and serum were standardized using checker board analysis. Two hundred and fifty nano grams of OMPs and 100ng of LipL32 proteins were used for coating the wells of the ELISA plate. The serum dilution was found optimum at 1:100 dilutions for all the four agents. The cut off OD values were determined as 0.361, 0.3532. 0.4235 and 0.3291 respectively, for Brucella, Salmonella, Listeria and Leptospira in cattle and 0.1497 and 0.1389 for Salmonella and Listeria respectively, in goats. The antibody detection ELISA for the bacterial agents in both bovines and caprines standardized in this study was found satisfactorily sensitive and specific, when compared with respective standard antibody detection tests for a sera sample size of 200 including that of aborted and healthy animals.

Isolation and molecular characterisation of *Listeria monocytogenes* from different sources

A study was carried out on the isolation and molecular characterization of *Listeria monocytogenes* among different species of animal and human being. The presence of *L. monocytogenes* in the environment was also assessed by screening soil, water and vegetable samples. A total of 2193 sample comprising of 580 samples from cattle, 70 samples from buffalo, 490 samples from goat, 345 samples from human being and 708 environmental samples (consisting of 270 soil, 328 water and 110 vegetables) were collected from different districts of Kerala for analysis. The samples were screened by two different cultural techniques for presence of Listeria. First method comprised of single step selective enrichment using Buffered Listerial Enrichment Broth (BLEB) and plating onto Polymixine, Acriflavin, Lithium Chloride, Ceftazidime and Mannitol agar (PALCAM) and Oxford agars. The method was the combination of using University of Vermount (UVM) broth for two step selective enrichment and plating onto PALCAM and Oxford agar. The isolates obtained were subjected to an immunological technique, SinglepathL'mono (Merck), for conformation as *L. monocytogenes*. The Listeria isolates obtained were screened by polymerase chain reaction for the presence of six virulence genes viz., *iap, hlyA, actA, prfA, plcA* and *inlA*. The 456 bp amplicon (*hlyA*) obtained through PCR was sequenced and analysed. The *L. monocytogenes* isolate obtained during the study were subjected to serotyping using four steps of primers viz. D_1, D_2, GLT and fla A. after screening for the presenceof the Listeria, the soil and water samples were subjected to further chemical analysis. The pH, total soluble salts (TSS), organic carbon, phosphorus and potassium of soil samples and pH Chemical Oxygen Demand (COD) of water samples were analysed. The antibiotic resistance profiles of the isolates were assessed. In the study, a total of 76 Listeria isolates were obtained and out of these, four were L. monocytogenes, obtained one each from cattle, goat, soil, and cabbage. The prevalence of listeria spp. among cattle, goat and humans were, 2.76 per cent, 4.08 per cent and 1.45 per cent, respectively. Maximum numbers of isolates were obtained by two step enrichment in UVM broth which yielded isolates from 4.04 and 3.35 per cent of the samples compared after plating on the PALCAM and Oxford agars, respectively. The immunological techniques revealed cent per cent specificity and sensitivity for the detection of *L. monocytogenes* . All the isolates of *L. monocytogenes* showed the presence of six virulence genes and also four *L. innocua* isolates were positive for *hlyA* genes. The results of sequencing revealed two different groups, which were confirmed in serotyping as it showed presence of 1/2c and 4b serotypes. The antibiotics resistance profiling showed that Listeria isolates were resistance to Ampicillin and Azhithromycin and they were

sensitive to Cefonicide, Ceftazide, Chloramphenicol, Clindamycin, C-trimoxazole, Doxycycline, Gentamicin, and Tetracycline.

Development of uniform enrichment protocol and standardisation of multiplex PCR for the detection of Yersinia and Salmonella species from chicken and pork

An investigation was carried out for the standardisation of a multiplex PCR assay for the simultaneous detection of *Y. Enterocolitica*, *S. Typhimurium* and *S. Enteritidis*. For that, a common enrichment protocol was developed for the simultaneous recovery of all organisms under study. Different enrichment broths i.e., Peptone water, Nutrient broth, Luria broth, Selinite Cystine broth, Brain Heart Infusion broth and Tryptone Soy Yeast Extract Broth were inoculated with standard culture of pathogens under study separately and as mixed culture and incubated at six different incubation conditions i.e., 37^0 C for 12 h., 16 h., 18 h. and 32^0 C for 12 h., 16 h. and 18 h. After comparing the growth of the organisms by measuring optical density and by enumeration of the pathogens, TSBYE at 37^0 C for 16 h. was found to be giving optimum growth of pathogens under study after statistical analysis. Composition of TSBYE was further modified in such a way that it promotes the optimum growth of all the organisms together especially Y. enterocolitica which showed comparatively less growth in the mixed cultures. The PCR protocol was standardised for all the pathogens under study individually and as multiplex using primers targeting ail, senandstm genes for Y. enterocolitica, S. Enteritidis and S. Typhimurium respectively. A total of 435 samples including 225 samples of chicken and 210 samples of pork, collected from different retail outlets in Thrissur and Ernakulam and slaughter house at Ernakulum, were screened by conventional culture technique and by standardised multiplex PCR technique. One isolate each of *Y. enterocolitica* and *Y. intermedia* could be isolated from pork. *Salmonella enteritidis* could be isolated from nine samples of chicken and five sample of pork by conventional method. The overall prevalence of Y. enterocolitica and S. *enteritidis* in the present study was 0.23 per cent and 3.91 per cent by multiplex PCR. Antibiotic sensitivity pattern of two isolates of Yersinia and 14 isolates of *S. enteritidis* was carried out using 13 commonly available antibiotics. Sensitivity to Gentamicin was shown by 80 per cent of the S. Enteritidis isolates from chicken and 100 per cent isolates from pork.

Control of Listeria biofilm formation in food processing environment

In the present study, isolation of Listeria spp. from vegetables, fishes and prawns, ready to eat meat products and meat processing environments were carried out to determine the prevalence of Listeria organisms. A total of 450 samples were collected and percentage occurrence of

Listeria spp. in vegetables, seafoods and meat processing environments were 2.00, 6.20 and 5.80 respectively. None of the ready to eat meat products were positive for Listeria spp. Of the 17 isolates obtained, 15 were L. innocua and two were L. ivanovii. Antibiotic sensitivity test showed that all Listeria isolates were 100 per cent sensitive to cefotaxime, chloramphenicol, cotrimoxazole, doxycycline, erythromycin, gentamicin, streptomycin and vancomycin. Resistance was shown towards cloxacillin and ampicillin. To assess the effect of different sanitizers in controlling biofilm formation, Listeria biofilms were artificially created on stainless steel, plastic and fibre cutting board surfaces. Stainless steel was found to be the least adherent of the materials tested and remained the best material for food contact surfaces in terms of resistance offered to cell attachment. The comparative effects of sodium hypochlorite, chitosan, hot water and tap water (as a control) on biofilm were assessed. All the sanitizers were significantly different from the control in reducing the biofilm cells attached to different surfaces. Biofilm on stainless steel, polypropylene and fibre surfaces were completely removed by hot water sanitation whereas sodium hypochlorite removed the biofilm cells on polypropylene only. Biofilm formation was totally inhibited by chitosan coating on stainless steel and polypropylene surfaces. These results implied that the resistance of biofilm cells to sanitation depends on the type of surface to which they adhere. With increasing the age of biofilm, more resistance was offered to sanitizer treatments and this emphasizes the need of practicing cleaning and sanitation protocol in food industry immediately after daily operations.

Comparative effect of bacteriophage and Nisin on *Listeria monocytogenenes* in chicken and fish

In the present study, isolation of *Listeria monocytogenes* from chicken, fish and sewage was undertaken to understand its prevalence using standard culture method and confirmation by polymerase chain reaction (PCR). About 60 samples of chicken were collected and screened for the evaluation of the *L. monocytogenes* and none of the samples were found positive. Out of the 60 samples of fish collected from retail outlets from markets of Thrissur, Kozhikode and Palakkad, 5 samples were found positive for Listeria spp and out of which one isolate was confirmed as *L. monocytogenes*. The other four samples were confirmed as *L. innocua*. All positive samples were obtained from the municipal markets of Kozhikode. A total of 80 samples of sewage were screened for the presence of *L. monocytogenes* and three positive samples were obtained and the isolates were confirmed as *L. innocua* using PCR. The prevalence rate of Listeria in sewage was found to be 8.33 per cent. Sewage samples (110) were screened for the presence of Listeria specific bacteriophages and plaques could be isolated

from 18 samples. Comparative effect of bacteriophage and nisin on *L. monocytogenes* in chicken and fish were assessed. Bacteriophage (10^3pfu/ml) and nisin (1 per cent) was added on the substrates at 10µl, 20µl and 30µl levels. Bacteriophage at 20µl level could completely inhibit the growth of *L. monocytogenes* on day 14 and day 7 of storage in chicken and fish respectively. But on addition of 30µl of nisin complete inhibition of bacteria was observed on 14^{th} and 3^{rd} day of storage in chicken and fish.

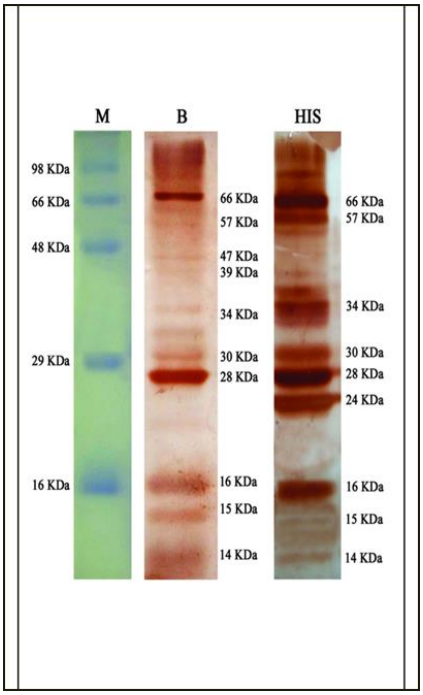
Prevalence and survivability of Listeria spp. in soil

Listeria monocytogenes is a ubiquitous Gram-positive bacterium associated with potentially serious invasive diseases in humans and in a variety of animal species. The study was conducted to examine the prevalence of Listeria spp. in soil, antibiotic sensitivity of the isolates and the survivability of *L. monocytogenes* in three different viz., *laterite, saline and loam, soils* of Kerala. Soil samples were collected from different districts of Kerala to study the occurrence of Listeria spp. All the samples were subjected to isolation and identification by USDA method with necessary modification. The species level identification was carried out by carbohydrate utilization test and pathogenicity assay and confirmation by polymerase chain reaction. For Survivability study nine conditions of each type of soil were prepared and they were sterile soil with and without moisture at 25°C, sterile soil with and without moisture at 37°C, nonsterilised soil with and without moisture at 25°C, nonsterilised soil with and without moisture at 37°C, nonsterilised soil with manure i.e., cowdung added soil at 25°C. Soil Samples were inoculated with L. monocytogenes culture (Microbial Type Culture Collection Strain No. 1143) and incubated at 25°C and 37°C respectively for a period of 120 days. A total of 450 soil samples from highland, midland and lowland were screened for Listeria spp. Out of 180 and 165 samples from midland and lowland respectively, one sample each was found to be positive for L. innocua. The samples were from Ernakulam and Thrissur districts respectively. None of the samples from high land showed positive results. The occurrence of Listeria spp. in midland and lowland was found to be 0.56 and 0.61 per cent respectively. The overall occurrence was 0.44 per cent. No L. monocytogenes could be isolated. All the isolates showed resistance against ceftriaxone, cefixime and cefuroxime. The growth of organism was found to be more in laterite soil compared to loam and saline soil. More growth was found to be in sterile soil than in non sterile soil. In laterite soil at 25^0 C the organism survived for 105 days whereas, in laterite soil at 37^0C the organism survived only for 90 days. After 105 days no organism could be detected in any of the soil conditions in laterite soil. In sterile soil without moisture at 25°C significantly higher ($p<0.05$) growth was recorded in laterite soil on day 0, day 45 and day 105

compared to saline and loam soil. The organic carbon, potassium and electrical conductivity were found to be significantly higher ($p<0.05$) in laterite soil compared to saline and loam soil. The pH, phosphorous content and temperature were significantly higher ($p < 0.05$) in saline soil than the other types of soil. The findings suggest that contamination of soil with *L. Mononcytogenes* through animal excreta, sewage or manure can cause the organism to survive in soil for considerable period, which can lead to contamination of vegetation and crops posing threat to animals and public health. In order to reduce the risk of food contamination and infections due to Listeria, it is important to adopt appropriate farming and husbandry practices that lessen the chances of environmental contamination.

Development of improved diagnostic for detection of bovine intestinal schistosomosis

An abattoir survey was conducted in Thrissur which revealed that 46 per cent of cattle slaughtered in Thrissur district harboured schistosomes. There was no statistically significant difference either in the occurrence or in the intensity of infection during different seasons.Protein profile of the three antigens viz., excretory-secretory antigen (ESA), whole worm antigen (WWA) and egg antigen of *S. spindale* were analysed and Dot ELISA and plate ELISA to detect anti-schistosome antibody was standardised with ESA, WWA and egg antigen. The sensitivity and specificity of ESA was established in this study and forms the first evidence of *S. spindale* ESA being utilised for immunodiagnosis. Anti-schistosome antibodies could be detected in 172 (33.72 per cent), among a total of 510 sera tested using plate ELISA. Molecular detection of Schistosoma spp. was standardised using primers which were designed to target genomic and mitochondrial sequences. Primers targeting 18S rRNA and 28S were found unsuitable for a diagnostic PCR protocol as they yielded positive signals with *Fischoederius elongatus* and *Gastrothylax crumenifer*, as well. Primers targeting the partial sequence of mitochondrial DNA produced a specific 454 bp product with Schistosoma spp. only, which facilitated the development of a PCR protocol to detect infection from faecal samples. The protocol could detect as low as 0.225 pg of DNA. Comparative analysis of plate ELISA, dot ELISA, PCR and routine microscopy for ova detection showed that copro-PCR was the best option when faecal samples of cattle suffering from clinical schistosomosis were to be examined for detecting the infection. Plate ELISA which was equally specific but more sensitive than PCR, could detect antibodies during clinical and subclinical infections as well, thus offering a superior option during epidemiological surveys and disease outbreaks.



Immuno blotting of ESA of S. spindale

Schistosome in mesenteric veins

Detection and molecular identification of Cryptosporidium species in cattle, buffalo and goats

An overall incidence of 77 per cent was observed in farm animals like cattle, buffaloes and goats in Kerala. Morphological tests and molecular tests identified *Cryptosporidium andersoni, C.pestis, C.parvum, C.bovis* and *C. ryanae* in animals. Among the conventional tests, Direct faecal smear staining was found to be satisfactory and consistent when compared to normal saline sedimentation staining, sheathers floatation , sheathers floatation sedimentation staining and modified Kinyoun's Acid fast staining PCR-RFLP was standardised to detect five species. Novel record of C.galli and C. muris in bovines. In the drug trials, Azithromycin @ 10mg/kg body weight per day for 5 days was useful to reduce oocysts excretion and clinical symptoms in calves.

Pathology of experimental coccidiosis and evaluation of curative effects of *Holarrhena antidysenterica* in broiler chicken

The present study entitled pathology of experimental coccidiosis and evaluation of curative effects of *Holarrhena antidysenterica'* was undertaken in 100-day old broiler chicks. The birds were infected with 40,000 sporulated oocysts of *Eimeria tenella* at 15 days of age. The *Holarrhena antidysenterica* had a slight effect in improving the total erythrocyte count and

reducing the total leucocyte count occurring in this disease. The test drug was effective in reducing the gross-lesion scores of the affected birds.

The microscopic lesions observed were desquamation of the caecal epithelium, denuded villi, atrophy of the villi, infiltration of the submucosa with inflammatory cells, either hypertrophy or destruction of the submucosal glands, fibrinous exudation from the lamina propria, haemorrhagic enteritis etc. The caecaltonsilar lymphoid tissue showed either hyperplasia or depletion.

Thus, the results of the present study revealed that dried and powdered bark of *H. antidysenterica* showed curative effect in caecal coccidiosis of broiler chicken and maximum effect was at the rate of 0.2 per cent level in feed followed by a moderate effect at 0.3 per cent and mild effect at 0.1 per cent in feed.

Effects of untreated and detoxified Jatropha deoiled seed cake in broiler chicken and their amelioration with Triphala

A study was undertaken to evaluate the toxicopathological effects of *J. curcas* deoiled seed cake in general and to assess the methods of detoxification and amelioration utilizing chicken as a model. Haemato-biochemical parameters such as Hb, VPRC, TLC, TEC, serum protein, albumin and superoxide dismutase levels showed a significant reduction in untreated JSC fed group II. Triphala supplemented groups III and IV and detoxified JSC fed group V showed significant reduction in these values but were lower in magnitude when compared with group II indicating an ameliorating effect. A significant increase in AST, creatinine and tissue lipid peroxidation was observed in group II. Group III, IV and V showed significant increase in these parameters than control birds, but were lower when compared with those of group II. These were due to protective action of triphala on group III and IV and considerable detoxification in group V. Among the groups III, IV and V, group IV showed highest protective effect protection in Jatropha toxicity

Congestion of liver and kidneys and catarrhal enteritis were the major gross lesions in group II. Intensity of these lesions was reduced in triphala treated and detoxified JSC given groups. Major histopathological lesions in group II were cloudy swelling and vacoulation of hepatocytes, periportal hepatitis and severe sinusoidal congestion of liver, intertubular haemorrhages and degeneration of tubular epithelium of kidney, inter-muscular haemorrhages in the heart and fusion of villi, goblet cell hyperplasia and necrosis at the tip of the villi of intestine. In groups III, IV and V birds, mild degenerative changes of liver and kidneys and

mild goblet cell hyperplasia of intestine were the major lesions observed. The present study revealed triphala could be used as an effective hepatoprotective agent in J. curcas toxicity.

Efficacy of antimicrobial peptides from Lactic acid bacteria against selected mastitic bacterial pathogens

Study aimed to assess the efficacy of purified antimicrobial peptides of lactic acid bacteria (LAB), isolated from partially decayed samples of food items, against selected clinical isolates of mastitis bacterial pathogens, viz., E*scherichia coli (E.coli)*, *Staphylococcus aureu*s *(S.aureus)* and *Streptococcus agalactiae* (*S.agalactiae*). The crude culture extracts (CCE) from LAB isolates were concentrated and purified by salting out method followed by dialysis. Partially purified peptides (Tp -5 CRp -2 CRp -3) from three LAB isolated from tomato and carrot showed a significantly higher inhibitory spectrum, with zone of inhibition ranging from 11.66±0.33 to 12.66±0.33 mm diameter against different test pathogens. The inhibitory efficiency of all the three peptides was found to be significantly superior to the peptides from reference strain *Lactococcus lactis* NCIM-2114. Minimum inhibitory concentration (MIC) of the purified peptide samples ranged between 0.79±0.09 to 1.11±0.09 µg/ml against different test pathogens. The activity of peptides was completely lost after treatment with protease, thereby confining their protein character. The strong antimicrobial spectrum against major bovine mastitis bacterial pathogens advocates the high prospect of using these new peptides in formulating teat dip, teat seal or intra mammary infusion for preventing mastitis.

Effect of multi species probiotic combination on *Helicobacter pylori* infection in vitro and in murine model

A study was conducted to assess the efficacy of various probiotics to modulate chronic inflammatory conditions on the gastrointestinal system of male wistar rats caused by *Helicobacter pylori*. The mechanism and the duration of action of induction of chronic atrophic gastritis and the metastatic changes were studied. The results of the study suggest that, probiotic combination *L. acidophilus, L. rhamnosus and B. bifidum a*s an alternative treatment strategy against *Helicobacter pylori* infection on an intake for twelve weeks at the rate of 10 7 cfu/g per day even after the induction of chronic atrophic gastritis condition.

Climatic adaptation and stress evaluation of crossbred cattle of Kerala

The study was conducted to reduce the effects of thermal stress in crossbred cattle of Kerala by classifying the state into zones based on Temperature Humidity Index (THI), assessing stress status and adaptability in these zones and recommending suitable ameliorative strategies for high stress zones.

The classification was based on past ten year's daily meteorological data. Six statistically different zones with average THI values ranging from75.5to 93.4 were identified (L1, L2, H1, H2, H3, H4). Stress status and adaptability of crossbred cattle in these zones were assessed based on physical, physiological, haematological, bio chemical and management parameters. Average THI inside cattle sheds, panting and salivation response, incidence of mastitis and incidence of reproductive problems were significantly higher in H4 than all other zones, similar in H2 and H3 and lower in L1 and L2. The production performance was significantly better in L1 than all other zones. Decrease in body weight in high stress zones was observed indicating a possible adaptation change. In a uniformly managed farm in a high stress zone, four ameliorative interventions, T1WF (intermittent wetting plus forced ventilation), T2F (forced ventilation alone) T3W (intermittent wetting alone) and T4R (roof wetting) were compared with T5C (control group without any intervention). The timing and duration of each treatment was standardised by fixing specific THI cut –offs suitable to high THI zone. T1WF, T2F, T3W and T4R improved milk production by 15.6 per cent, 8.14 per cent, 15.4 per cent, and 14.3 per cent respectively as compared to the control group.

The welfare benefits of these interventions may far exceed the economic benefits. The possibility of improving the zonation by incorporating more locations and assessing the long term effects of these interventions in other possible combinations needs further study.

Utility of decorticated cottonseed meal as an alternative to soyabean meal in broiler diets

An experiment was conducted at the Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy to study the utility of decorticated cottonseed meal (DCSM) as an alternative to SBM in broiler diets. Two hundred, day-old straight run commercial broiler chicks (Vencobb- 400) were allotted to five dietary treatments with four replications per treatment and 10 birds per replicate. Five isocaloric and isonitrogenous rations were formulated viz., T_1- Standard broiler chickens ration based on maize and SBM (Control ration) whereas in T_2, T_3, T_4 and T_5SBM of control ration was replaced by 25, 50, 75 and 100 per cent DCSM respectively on protein basis. Different performance parameters viz. body weight, feed consumption and feed efficiency were recorded at weekly intervals. During last three days of the experiment metabolism trial to determine nutrient utilization was conducted. At the end of study randomly selected six birds from each treatment were sacrificed to study processing yields and losses.

Statistical analysis of data on sixth week body weight, cumulative weight gain, cumulative feed intake and cumulative feed efficiency revealed no significant ($p<0.05$)

difference between T_1, and T_2. Per cent ready-to-cook yields and total losses were found to be statistically similar in T_1 and T_2. Significant ($p<0.05$) difference was observed between mean per cent values of calcium digestibility. Livability recorded during the experiment period was 100 per cent in T_1, T_2 and T_4. From the results it could be inferred that control group (T_1) and the group with 25 per cent replacement of SBM by DCSM T_2) were equally good and comparable in terms of all performance parameters. Thus study envisaged that 25 per cent SBM from broiler chicken's ration can be replaced by DCSM on protein basis.

Standardization of ration for Gramasree cockerel for meat purpose

An experiment was conducted at the Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy to standardize the ration of Gramasree cockerel for meat purpose. Two hundred and eighty eight, day-old male chicks were allotted to six dietary treatments as follows: ration containing 22 per cent CP and 3100 kcal ME/ kg; ration containing 20 per cent CP and 3100 kcal ME/ kg; ration containing 18 per cent CP and 3100 kcal ME/kg; ration containing 22 per cent CP and 2800 kcal ME/ kg; ration containing 20 per cent CP and 2800 kcal ME/ kg and ration containing 18 per cent CP and 2800 kcal ME/ kg.

From six weeks onwards, body weight of birds fed with diet containing 20 per cent CP and 2800 kcal ME/ kg (T_5) and 22 per cent CP and 3100 kcal ME/ kg were significantly ($p<0.01$) higher. The cumulative feed consumption was significantly ($p<0.01$) higher in birds fed with diet containing 20 per cent CP and kcal ME/ kg (T5) at all periods. The mean cumulative FCR was better in T_2 and T_1 when compared to all other treatments. The study on processing yields and losses revealed that different level of protein and protein x energy interaction had no significant effect on mean eviscerated yield, ready-to-cook yield, abdominal fat, giblet yield and losses at all slaughter periods. Based on the results obtained in the present study, it could be concluded the Gramasree cockerels can be reared up to 10 weeks of age with the diet 20 per cent CP and 3100 kcal ME/ kg to get more profit.

Development and evaluation of functional chicken nuggets

The study was carried to develop a suitable formulary for functional chicken nuggets by fortification with functional/bioactive components, *viz.*, omega-3 eggs, dietary fibre and natural antioxidants and to evaluate their shelf life under different packaging system during refrigeration storage.

The functional chicken nuggets were standardized with omega-3 enriched egg (7.5per cent), oat bran (4.0per cent) and natural antioxidants garcinia (1.0per cent) + rosemary (0.25per cent). The addition of selected functional ingredients improved the emulsion stability, cooking

yield, flavour, juiciness and overall acceptability and was comparable with control for all sensory attributes. The standardized product had significantly low protein and fat percentage leading to substantial reduction in calorie per 100 g of product. The conventional chicken nuggets had 234 kcal and standardized nuggets had only 204 kcal and the newly developed product also had a substantial content of omeg-3 fatty acid like linolenic acid 0.39, ecosapentaenoic acid, 0.53 mg and docosahexaenoic acid 0.15 mg per 100 g and it contain dietary fibre 4g/100g and natural antioxidants like garcinia and rosemary which is lacking in chicken product. The novel product so prepared is economically comparable to that of conventional chicken nuggets.

The standardized products were vacuum and aerobically packed and stored at 4±1°C to compare with control. The pH value for functional chicken nuggets decreased upto 10th day and then increased but in contrary to this, the control chicken nuggets showed gradual increase in pH upto 15th day of storage. Lipid oxidation product (TBARS values) significantly increased with increase of storage period but were well below the acceptable limits for both control and functional chicken nuggets. TBARS value was markedly less in vacuum packaged functional chicken nuggets. For Total Viable Count and Psychrotrophic counts no significant difference was observed between vacuum and aerobic packaged samples, but it was significantly lower for test samples than control during storage period. Standardized functional chicken nuggets exhibited good sensory attributes and keeping quality throughout storage period. Functional chicken nuggets under both packaging conditions were well acceptable even on 15th day of refrigerated storage at 4±1°C.

Hurdle technology for development of shelf stable barbecued chicken

A suitable formulary for preparation of shelf-stable barbecued chicken (SBC) by using different hurdles like humectants (HG)- Glycerol and acidulants (AL) viz., Lactic acid (LA) and Glucono-Delta-Lactone (GDL) and irradiation and to compared the shelf life at ambient temperature of the vacuum packed developed product with that of control (without hurdles). The barbecued chicken was standardized with 2 per cent glycerol desorption solution and blends of 0.2 per cent LA and 0.2 per cent GDL. The addition of HG and AL significantly ($p<0.05$)

reduced the product Aw , pH, moisture:protein ratio and significantly ($p<0.05$) increased the protein and calorie content of the SBC compared to control. The standardized product had significantly ($p<0.05$) higher scores for appearance and colour, sourness and overall acceptability than that of control product.

For storage study, the SBC after packaging was made into two groups viz., T 1 - NIR (non-irradiated) and T 8 -IR (irradiated at 2.5 KGy) and these treatment groups were compared with control (without hurdles) at ambient temperature of storage. The pH value of all the samples significantly increased during storage period. No significant changes were observed in Aw of controls and treatment samples during storage.The TBARS and tyrosine values were significantly increased throughout the storage period, but were well below the acceptable limits for control and SBC. For Total Viable Count and Yeast and mold counts, significantly ($p<0.05$) lower count was noted in irradiated sample during storage period. However, T 2 –IR exhibited off-odour during sensory evaluation from day of irradiation and it became very adverse on sixth day of storage. From the above studies it can be inferred that SBC incorporated with HG and AL had a shelf-life upto 3 days at ambient temperature storage and was comparable with control for sensory attributes and can be marketed without any cold chain upto 3 days.

Effect of varying levels of dietary energy and protein on growth performance of broiler chicken

An experiment was conducted to study the effect of different levels of dietary energy and protein on growth, nutrient utilization, carcass traits and cost of production of broiler chicken. Results indicated significant difference ($P\leq 0.05$) for the effect of energy, protein or interaction of energy and protein on weekly body weight, cumulative feed consumption and cumulative FCR. The study concluded that energy protein levels had significant effect on broiler growth, carcass and nutrient utilization. Birds fed on diet containing low protein and high energy throughout the experimental period had better performance and provided more profit.

Effect of dietary incorporation of 'Ksheerabala' residue on growth performance in Malabari kids

An experiment was conducted in Malabari kids for a period of three months to assess the effect of dietary incorporation of Ksheerabala residue on their growth performance. From a critical evaluation of the results obtained in the study it could be inferred that kids fed with ration containing 20 per cent Ksheerabala residue had similar growth rate as that of kids fed with control ration and kids fed with 10 per cent ksheerabala residue had significantly lower growth rate. Moreover, feed cost per kg gain was lowest for diet containing 20 per cent Ksheerabala

residue. The study concluded that inclusion of Ksheerabala residue at 20 per cent level in kid starter can be economical without affecting growth rate.

Effect of phase feeding on growth in pre-ruminant crossbred calves

A feeding trial was conducted with eighteen cross bred calves aged one week for a period of 20 weeks, divided into two phases viz. phase I (milk feeding phase, up to six weeks) and phase II (weaned phase, from six to 20 weeks) to assess the effect of phase feeding on growth in pre-ruminant crossbred calves. Critical evaluation of the results obtained in the present study revealed that calves can be reared on calf starter containing 15 per cent CP during milk feeding phase (zero to six weeks) as it supported growth similar to that of calves reared on calf starters containing 18 per cent and 24 per cent CP. Similarly, in weaned phase (six to 20 weeks) calves can be reared on calf starter containing 18 per cent CP as it supported growth similar to that of calves fed with calf starter containing 21 per cent and 24 per cent CP. On summarizing the overall results of the study, it could be inferred that phase feeding can be economically practiced in pre-ruminant crossbred calves with calf starter containing 15 per cent CP in milk feeding phase and 18 per cent CP in weaned phase.

Dietary supplementation of probiotic, prebiotic and synbiotic on growth performance and carcass characteristics in crossbred pigs

An experiment was carried out for a period of 131 days in forty weaned (twenty castrated male and twenty female) Large White Yorkshire x Desi piglets to study the effect of dietary supplementation of probiotic, prebiotic and synbiotic on growth performance and carcass characteristics. The results of the study indicate that dietary treatments were similar ($P>0.05$) in various factors such as average daily gain, digestibility of nutrients, plasma biochemical parameters and carcass characteristics. However, the diet supplemented with synbiotic had better body weight gain at second and third fortnight. The cumulative feed conversion efficiency of synbiotic supplemented group was higher ($P<0.05$) throughout the experimental period except for fourth and fifth fortnight. Faecal microbial load was reduced ($P<0.05$) by synbiotic supplementation showing lowered values for total viable count and coliform count. From the overall results it can be concluded that supplementation of synbiotic at 0.2 per cent level can be used as feed additive in crossbred pigs.

Effect of dietary supplementation of betaine hydrochloride on growth and nutrient utilization in broiler chicken

An experiment was conducted to study the effect of dietary supplementation of betaine hydrochloride (betaine HCl) on growth and nutrient utilization in broiler chicken. Overall results indicated significant effect of betaine HCl supplementation on production efficiency factor (PEF), protein efficiency ratio (PER) and energy efficiency ratio (EER) ($P \leq 0.01$). The study concluded that betaine HCl can be included in broiler diet up to 750 PPM for attaining higher body weight gain with better feed conversion ratio and better return over feed cost.

Publications

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Awards and honours received by faculty and students

1. Dr. Siju Joseph has got Best teacher award 2014-15
2. Dr Bindu Lakshmanan won First rank and Gold medal for PhD from KVASU in 2015
3. Best poster presentation award in Kerala Veterinary Science Congress, 2014 was given to Dr. Janus.A for Actinobacillosis in a cow- a case report: Janus. A, P. V. Tresamol., Dhanya., Rathish. R. L and K. Vinodkumar.
4. Dr. Naicy Thomas was presented with Best paper award in 27th Kerala Science Congress, KSCSTE
5. Best MVSc thesis award for thesis entitled, "Metagenomic analysis of gut microflora of guinea fowl for identification and evaluation of probiotic Lactobacillus sp." Was awarded to Dr. Vineetha P G in IPSACON 2015.
6. Dr. Vineetha P G has received IPSA Ayurvet Award, 2015 for the best research article "Vineetha P.G., Simmi Tomar, V.K. Saxena, Raj Narayan, J.K. Patra1 and Adil Khan 2015. Effect of Lactobacillus spp. mixed culture isolated from gastrointestinal tract of domesticated Japanese quail in combination with prebiotic on competitive exclusion of Escherichia coli. Indian Journal of Poultry Science, 50(2): 143-147 "published in Indian Journal of Poultry Science
7. Dr Rajani C V was awarded IInd prize for the paper "Dose dependant impact of arsenic on oxidative stress and sperm functional attributes - an in vivo study" authored by Pushpa Rani. G., Ravindra. J. P., Rajani. C. V., Parthipan, S., Somashekar, L., Arangasamy, A. and Selvaraju, S. at National Conference on Stress and Health: Frontiers of Research in Stress related Diseases and Management (SHDM 2015), February 12th and 13th 2015 Organised at Maharani's science College for Women, Bengaluru, 560 001(poster presentation)
8. Dr. Biju Chacko was awarded 1st prize for the best oral presentation in "Animal production Science", section for the paper entitled, "Comparison of the efficacy of complete feeds having varying levels of neutral detergent fibre (NDF) with the conventional grass – concentrate feeding system for dairy cows of Kerala" in the Kerala Veterinary Science Congress held at Kottayam from 8-11-14 to 9-11-14.
9. Dr. Lucy K.M was selected for Best Teacher Award for 2013-14 of CVAS, Mannuthy. received 0n 06.08.2014
10. Dr. Mohan Bhattacharya Silver Jubilee Medal and Award for Best Paper in Histology, Histochemistry and Electron Microscopy' was given to Dr. Indu V. R for 'Histology,

Histochemistry and Ultrastructure of the Rectal Patch in Goats'- Authored by Indu V. R., Lucy, K.M., Ashok, N., Maya, S. and Chungath, J.J.in the XXXth Annual Convention and National Symposium of Indian Association of Veterinary Anatomists held at Veterinary College, Kolkata from 16th to 18th December 2015.

11. Indu V. R has won 'Dr. K.S. Roy Award for Best Paper in Histoenzymology and Immunohistochemistry' for 'Immunohistochemistry of the Pharyngeal Tonsil in Goats'- Authored by Indu V. R., Lucy, K.M., Ashok, N., Maya,S. and Chungath, J.J.in the XXXth Annual Convention and National Symposium of Indian Association of Veterinary Anatomists held at Veterinary College, Kolkata from 16th to 18th December 2015.
12. Second Prize for the Best Oral Presentation Award was received by Sumena K.B for the presentation "Comparative studies on Keel bones of Black Drongo, Domestic fowl and Duck" authored by Sumena K.B. and Lucy K. M., in the 7th Kerala Veterinary Science Congress, from 14th -15th November, 2015.
13. Sumena K.B has got first Prize for the Best Poster Presentation Award for the presentation of Dietary habits and attitudes of adolescent Kani tribals. Authored by Sumena K.B., Jasmine Rani K., and Leena K.B. in the National seminar on Food, health & Agro-biodiversity changing paradigms, 2015.
14. Dr. Sajitha I S in Veterinary Pathology Congress-2015, the prize for oral presentation, Prof. S. Ramachandran Memorial Molecular Oncology award
15. Dr.S. Anoop was awarded with Best Teacher Award KVASU for the year 2015.
16. Dr Sudheesh S Nair has been selected for Best Paper Award and Oral presentation in 7th Kerala Veterinary Science Congress -14-15 Nov 2015
17. Dr. Unnikrishnan M.P., Best scientific article 2014 by Indian Society for the study of Animal Reproduction, Kerala Chapter.
18. Dr Bindya Liz Abraham, Best Oral Presentation Award in the International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" and Annual Convention of Society for conservation of domestic Animal Biodiversity (SOCDAB) 13-14th February, Madras Veterinary College, Chennai (2015)
19. Dr Bindya Liz Abraham- Best Oral Presentation Award in the International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" and Annual Convention of Society for conservation of domestic

Animal Biodiversity (SOCDAB) 13-14 th February, Madras Veterinary College, Chennai (2015)

20. Dr. A. M. Srivastava award for Outstanding M.V.Sc. Research Work/Thesis in Anatomy at National level, in the XXIX Annual Convention of IAVA and National Symposium, College of Veterinary Science and Animal Husbandry Chhattisgarh Kamdhenu Vishwavidyalaya, Durg, 11th to 13th February, 2015 was given to Dr. Fathima Rahim, Major Guide: Dr. K. M. Lucy.
21. Dr. Prashanth Kumar K.S., Major Advisor: Dr Indu V Raj has got Dr. A. M. Srivastava gold plated silver medal and award for the Outstanding M.V.Sc. Research Work/Thesis in Anatomy during XXX Annual convention of IAVA and National Symposium at Kolkatta in December, 2015.

Achievements

1. John Abraham and Joby Bastian. Patent granted for Design No. 258646/2013-Drinking bowl for cattle.

Schools and Centres

1. School of Applied Animal Production and Biotechnology, Mannuthy

About the centre

Modern Biotechnology has tremendous potential to improve animal productivity and health. School of Animal Production and Biotechnology (SAAPBT) has been established in KVASU for conducting research, education and training programmes in identified and frontier areas of Biotechnology such as genetic engineering, hybridoma technology, Molecular Diagnostics, Animal forensics, Reproductive Biotechnology and Animal Genomics. The school was undertaking two new post graduate programmes in the Academic year 2014-15 M.V.Sc. Animal Biotechnology, and M .Sc. Animal Biotechnology. These course were designed to build up technically trained manpower resource base, empowering them with all skills necessary to use biotechnology as a tool for improvement of human and animal health and livestock production including molecular diagnostics, improved vaccines, wild life conservation and forensics and epidemiological and climate change studies. State-of-the-art laboratory facilities for research in various areas of biotechnology are available in SAAPBT.

Trainings conducted.

- Hands on Training on Basic Molecular Biology Techniques from 13th January to 20th January 2014.
- Hands on Training on Basic Molecular Biology Techniques from 28th January to 3rd February 2014
- Hands on Training on Basic Molecular Biology Techniques from 22nd May to 28th May 2015
- Hands on Training on Basic Molecular Biology Techniques from14th July to 20th July 2015
- Hands on Training on Basic Molecular Biology Techniques from 12th to 14th May 2015
- Hands on Training on Basic Molecular Biology Techniques from 19th to 21st May 2015
- Hands on Training on Basic Molecular Biology Techniques from 2nd to 4th June 2015

Research Activities

i. State Plan Project

- Strengthening of School of Applied Animal Production and Biotechnology-P.I. Dr. T.V. Aravindakshan- 36 Lakh

ii. Masters /Doctoral Research projects

- Single nucleotide polymorphism analysis of fecundity genes (*BMPR1B,GDF9 & BMP15)* in Malabari and Attappady Black goat breeds of Kerala- Reshmi Sasi-(13-MSVM-02)
- Single nucleotide polymorphism analysis of *thyroid hormone responsive and insulin like growth factor binding protein-3* genes in goat-Anjan Behera-(13-MSVM-03)

Major activities/Achievements

- Two students successfully completed MSc. Animal Biotechnology Programme in the year 2014-15.
- Conducted seven hands on trainings on Molecular Biology and Bioinformatics for research scholars, students and faculties from different universities in India.

Publications

- Training Manual on "Basic Molecular Biology Techniques"

2. School of Applied Animal Nutrition and Feed Technology, Mannuthy

About the School

The School of Animal Nutrition and Feed Technology is established with objectives to undertake research projects in the field of Animal nutrition and also to impart training to various stake holders in dairy sector. A diploma course in feed technology is being offered to enhance man power in feed mill operations

Trainings conducted

- Class on Silage making to dairy farmers on 05.01.15

Research Activities

i. KVASU Research projects.

- Effect of supplementation of energy and undegradable protein on milk production in crossbred dairy cattle.

  Fundging agency: KSCSTE

  PI: Dr Ally K

  Co-PI: Dr Shyama K & Dr Joseph Mathew

Major activities/Achievements

- More than 200 progressive farmers have been advised regarding dairy cattle farming and feed formulation during the year 2014-15.
- Dr. Biju Chacko was awarded 1st prize for the best oral presentation in "Animal production Science", section in the Kerala Veterinary Science Congress held at Kottayam from 8-11-14 to 9-11-14.
- Technology developed during the period under report: ration formulation software in Malayalam " Ksheeraprabha" for balancing the feeding pattern of dairy cattle in Kerala.
- Through revolving fund scheme 12050 kg of feed supplement for pigs and 5300 kg of mineral mixture for cattle was sold. Total turnover of revolving fund project was Rs. 9.73 Lkahs

Publications

- Anuraj K.S, Sreeparvathy M, Shyama K, Dipu M T and Hari R , Dried Tuna waste silage as an alternative protein source for swine feeding. *Indian. J.Sci.Res. Tech.* 2014 2(3):49-52. Online available at. http://www.indsrt.com
- Anuraj K. S, Shyama K and Hari Abdul Samad., Effect of feeding dried tuna waste silage on blood lipid profile in large white Yorkshire pigs. Paripex. *Indian Journal of Research*. Issue 7 vol 3 24-25 July 2014

3. School of Bio Energy and Farm Waste Management, Mannuthy

About the centre

The School of Bio-energy and Farm Waste Management was established with Dr. Francis Xavier (Professor Farms) as the Implementing officer and Dr. Joseph Mathew (Prof and Head CVAS, Pookode and Dr. Deepak Mathew (Assistant Professor, CVAS, Mannuthy to carry out teaching and research in the highly advanced and cutting edge technology of bio-energy (No.KVASU/DAR/R2/3579/2011 dated 27.04.2012) The school established an Animal Fat Biodiesel Laboratory, 1st of its kind in India at Pookode campus on 06/05/2014. The bio-diesel plant was established as a pilot plant to demonstrate the cutting edge technology of utilisation of waste for the production of renewable fuel, for further research and not as a commercial production plant.

Research Activities

i. **Masters /Doctoral Research projects**

M.Tech research Project

Dileep Balakrishnan	2014	Mechanical Engineering, Govt. Engineering College, Calicut	Optimisation of Chicken oil biodiesel blend for IC Engine

Major activities/Achievements

A pilot biodiesel plant with the following facility was established at Pookode

- 50 Litre per batch biodiesel plant with reactor, recirculation pump, electric heater with temperature controller, condenser, separator, methoxide vessel, washing unit, HDPE tanks, vacuum drying unit, Biodiesel storage tank and biodiesel pump
- Biodiesel research desk, with serological water bath, lab stirrers, 3-necked flasks, condenser etc
- Brook field viscometer with UL- adapter
- Hunter colour lab analyser
- Exhaust gas analyser
- pH meter, etc.
- Semi automatic flash point analyser

Publications

- John Abraham and Ramesh Saravanakumar, 2014 Effect of two methods of fat extraction on the proximate composition of poultry carcass meal. *Indian. Vet. J.*, 91(3): 16-18.
- John Abraham, Ramesh Saravana Kumar, Kulkarni V.V, Sivakumar, K. Singh A. P and Visha. P,2014 Yield and quality Characteristics of rendered chicken oil. *J. Am. Oil Chem. Sot.* 91 (1): 133-141.
- John Abraham and Ramesh Saravanakumar, 2014 Scope of Producing Biodiesel from Poultry Fat. *Energy Blitz*. IV (III):19-23.

4. School of Zoonoses Public Health and Pathobiology

About the School

Established in the year 2012 under the ICAR - EFC grant

Objectives:

- To generate, transfer and apply knowledge in the concerned disciplines or the protection and promotion of animal and human health and their well-being in consonance with the theme of 'Health for all in 21st century' and the mission will be routed through: education, research, industry support and public and Institutional Services
- To promote an interdisciplinary approach on education, research and diagnosis of infectious, metabolic and toxic conditions
- To produce a database on the various diseases
- The collaborating departments : Dept. of Veterinary Public Health , Dept. of Veterinary Microbiology, Dept. of Veterinary Parasitology, Dept. of Veterinary Pathology and Dept. of Veterinary Epidemiology and Preventive Medicine

Research Activities

i. KVASU Research projects:

- Strengthening of School:- Quality assurance of meat and meat products with special reference to food borne pathogens of public health significance : - Multiplex PCR was standardized for the simultaneous detection of *L. monocytogenes*, *Y. enterocolitica*, *S. aureus* and *S. enteric Typhimurium.* The amplified products of all four organisms could be detected clearly as they are of different sizes(*hly*A-456bp, *ail*-351bp , *stm*-915bp and *nuc*-270bp).The standardized m PCR was assessed for sensitivity by artificially inoculating meat with different concentrations of each reference organisms and was able to detect at the level of 1cfu/g of the organism.Multiplex PCR using DNA of cross reacting bacterial strains did not show amplification which indicated that the technique was highly specific.
- Development of lateral flow assay for the rapid detection of leptospirosis in animals

Major activities/Achievements

- Infrastructure developed by construction of training hall for conduct of training for farmers, veterinarians, para-veterinarians and students

- Data generation on the occurrence of food borne pathogens in Kerala so that control measures can be implemented.
- Detection of four food borne pathogens simultaneously by common enrichment and multiplex PCR has made detection procedures easier
- Pilot study on the occurrence of *Campylobacter* spp. in foods of animal origin
- Field level rapid diagnosis of leptospirosis could be achieved using lateral flow test

5. Centre for Advanced Studies in Poultry Science, Mannuthy

About the centre

The Department of Poultry Science of College of Veterinary and Animal Sciences was established in 1972 and later upgraded and given the status of Centre for Advanced Studies in Poultry Science (CASPS) in 1985 as recognition for its contribution in various fields of activities. The department has successfully completed 12 External Aided Projects, 9 PhD projects and 80 MVSc. Projects. Establishment of AICRP on Poultry improvement, Release of crossbred chicken for backyard- Gramasree & Gramalakshmi, release of high yielding ILM-90, ICAR Revolving Fund poultry project, NATP project on Ducks and successfulconduct of IV World Water Fowl conference, RKVY project etc. are the significant milestones of the department.

The major objectives of the department include

- Promote and undertake research on all aspects of poultry science
- Conducting training to students and farmers.
- Human recourse development in the area of poultry science.
- Production and supply of quality chicks to farmers.
- Provide consultancy service for farmers and entrepreneurs

1. Trainings conducted

- Farmers counseling on all working days
- IV batch of Hatchery Management training of 25 days duration for farmers (50 nos.) sponsored by AHD
- Training in Current Trends in Layer Farming for Kudumba Sree Units 28.08.2014 to 30.08.2014
- Training on Egger Nursery and Layer Management 19-9-14 to 20-9 -14
- Training programme on quail rearing 10-3-15 to 11-3-15

- Training programme on Egger Nursery and poultry farming 19-3-15 to 20-3-15
- Various farmer-scientist interaction classes were handled by departmental staff during the period

2. Research Activities

i. KVASU Research projects.

- Sustainable poultry production through women self help group of Kerala-19.75 lakhs
- Establishing a centre for meat type duck production at LRS, Thiruvazhamkunnu-105 lakhs
- Strengthening of Integrated Rural Poultry Production Centre at LRS, Thiruvazhamkunnu- 96 lakhs
- Poultry improvement for Eggs (25per cent state share of AICRP on Poultry for Eggs)-16.25 lakhs
- Selection of eighth week body weight in Kuttanad ducks to produce a broiler meat line-10 lakhs
- Athulya pullet production and feed production for Aiswarya project- 28 lakhs
- Sustainable Poultry Production for self help groups-19.75 lakhs
- Augmenting backyard poultry production in Kerala-35 lakhs
- Conservation and popularization of native chicken varieties in Kerala-15 lakhs

ii. Masters /Doctoral Research projects

- Influence of energy level and particle size of feed on production performance of Athulya layer chicken (PhD project)
- Development of meat line of kuttanad ducks (PhD project)
- Selection for egg production in native chicken and performance of its crossbreds with White Leghorn (PhD project)
- Performance of crossbred layer of Australop & RIR with genetically improved White leghorn under backyard system (MVSc. Project)
- Standardization of ration for Gramasree cockerels for meat purpose (MVSc. Project)

3. Major activities/Achievements

- Dr. Harikrishnan S. (PhD scholar) selected as INSPIRE FELLOW, DST, New Delhi
- Dr. Vineetha. P. G. (assistant Professor on contract) received “AVITECH-Young

Scientist Award" in the IPSACON 2014

- Dr. Harikrishnan S. received First prize in Oral presentation in the IPSACON 2014
- Dr. Ajith Babu B. received Third prize in Oral presentation in the IPSACON 2014

4. Publications

- Arun R.U., Binoj Chacko, Narayanankutty K and Harikrishanan S (2014). Effect of feed particle size on slaughter parameters in boriler chicken. International Journal of Scientific Research 3.35-37
- Harikrishnan, S., Narayanankutty, K., Binoj Chacko, Anitha, P., Arun, R.U and Prasoon, S. (2014). The effect of various egg sanitizing agents on the microbial and duckling qualities of Kuttanad duck eggs. *International Journal of Development Research*. 4 (2). 283-285.
- Harikrishnan, S., Narayanankutty, K., Binoj Chacko and Anitha, P. (2014). The Effect of Various Sanitizing Agents on the Economics of hatching Kuttanad Duck Eggs. *The Indian Journal of Field Veterinarians.* 9: (3). 67-68.
- Arun, R. U., Binoj Chacko., Anitha P., Harikrishnan, S., Prasoon, S. and Vimal Antony. (2014). Effect Of Feed Particle Size On Performance Of Broiler Chicken. *International Journal of Development Research.* 4 (3).
- Stella Cyriac, Leo Joseph and Gibin George T. Effect of age on processing yields and losses of Kuttanad ducks (*Anas platyrhynchos domesticus*) (2014). *Int.J. Sci. and Res.* 3(6): 2820-2822.
- Dr.Vimal Antony, Dr.Anitha P. Dr.Arun R.Unni, Dr. Binoj Chacko. (2014). Effect of Beak Trimming on growth performance of Japanese Quil Chicks. International journal of Scientific research. Vol.3. Issue. 7 Page .53 – 55

Books

1. Muttakkozhikal. muttathum. mattuppavilum
2. Aiswarya padhathi
3. Ini. ottakapakshikalum
4. Mriga Samrakshanam – Ulpadana…
5. Hatcherikal, Mutta Viriyikkanum…
6. Varumanathinayi…Kadakal ….
7. Tharavanu Tharam
8. Valarthupakshi Mekhala
9. Hatchery Oru Puthenthozhil…
10. Managing Hatcheries
11. Veettuvalappile Kozhi Valarthal
12. Tharavu Valarthal, irachikkum muttaykum

6. Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy

About the centre

The Department of Animal Breeding and Genetics of College of Veterinary and Animal Sciences was upgraded and given the status of Centre for Advanced Studies in Animal Genetics and Breeding (CASAGB) in 1986 as recognition for its contribution in various fields of activities.

The Department offers Under Graduate, Masters and Doctoral Programmes in Animal Genetics and Breeding. Courses offering at UG level include basic concepts of Biostatistics, Animal Genetics and Breeding with practical experience in solving problems. At post graduate level, courses on Population Genetics, Cytogenetics, Molecular Genetics, Immunogenetics, Conservation Genetics and Biometric Genetics are elaborated.

Post graduate students of Animal Genetics and Breeding and Animal Biotechnology are encouraged to undertake research activities on recent advancements of Animal Genetics, Breeding and Biotechnology. Further, the present research is more concentrated on the applications of Next Generation Sequencing technologies such as whole exome sequencing, metagenome analysis, transcriptome analysis and ddRAD sequencing. Learning support for the department is also provided by a Bioinformatics lab, Computer lab with internet facilities and facilities for data analysis related to Animal Breeding.

Trainings conducted

- Training on Basic molecular biology techniques (7 days)- 3
- Training on Introduction to Bioinformatics Tools (3 days)- 2

Research Activities

i. KVASU Research projects (25per centof ongoing EAPs)

- ICAR Field Progeny Testing Scheme-7 lakhs
- AICRP on goat Improvement (Malabari)-8 lakhs

ii. Plan projects

- Establishment of a germplasm repository for domestic animal diversity of Kerala- 2.82 Lakhs
- Modernization of Vechur Cattle Conservation Centre- 31.12283 Lakhs
- Augmenting of biotechnology and molecular biology research in KVASU- 8.692 lakhs
- Development of cloning and transgenic research facilities- 20500

- Strengthening of Rabbit Research Station Mannuthy- 9 lakhs
- Establishment of animal biotechnology laboratory- 32.853 lakhs
- Evaluation of lactation performance and establishment of system of milk recording in cross bred cows of Kerala for sire evaluation-65000
- DNA repository of crossbred animals- 32.853 lakhs

iii. Masters Research projects

Pruthviraj D. R.	2015	Dr. A. P. Usha	Expression profile and genetic variability of porcine beta-defensin-1 gene
Pragathi K. S	2015	Dr. K. Anilkumar	Characterisation of Superoxide dismutase 2 (SOD2) gene in cattle and buffaloes
Karthikeyan, A.	2015	Dr Radhika.G	Evaluation and expression profiling of L-selectin and Osteopontin genes in relation to mastitis in cattle

iv. PhD projects

Radhika.G	2015	Dr.K.C.Raghavan	Diversity analysis among goat genetic groups of Kerala
Lali F. Anand	2015	Dr.Anilkumar K.	Single Nucleotide Polymorphism of production associated loci in crossbred cattle of Kerala
Naicy Thomas	2015	Dr. Thirupathy V.	Expression profile and genetic variability of genes encoding Nerve Growth Factor and Insulin like Growth Factor 1 in goats

5. Major activities/Achievements

- The existing research facilities in the Molecular Biology Laboratory have been strengthened. The routine maintenance and repair works of the facilities have been carried out to maintain all the equipment in the functional state. Molecular Biology

consumables have been purchased to support the ongoing research programmes of the Centre. 5 Training programmes were conducted in Molecular Biology Techniques and Bioinformatics

- DNA samples were collected from 80 more animals in this financial year, which was added to the already established DNA repository
- In Progeny testing scheme high pedigreed bulls with dams yield above 4500 kg in lactation are used for inseminating the cows of farmers in the field ensured progenies having 500 kg milk yield more than their contemporaries.
- Under AICRP on Goats progenies of bucks recorded a better body weight of 1.6 and 1.9kg compared to contemporaries at six, nine months of age, respectively. As capacity building, 395 farmers and 48 vocational students have been trained in goat rearing in collaboration with Agriculture/Animal Husbandry/Rural Development Departments and Milk co-operative unions in 44 training sessions.
- Developed an easy to use Weight measuring tape to record the body weight of goats in the field.
- A semen freezing laboratory has been established with facilities for semen collection, evaluation, freezing, analysis of post-thaw motility and long term storage of frozen semen samples of cattle. All the required equipment for semen freezing have been procured and installed and necessary physical modifications of the laboratory have been completed. Total doses of frozen semen - Vechur-1300 doses Kasargode-700 doses. The nuclear herd of Vechur and Kasargode cattle has been further expanded through selective breeding and the performance of Vechur cattle for production and reproduction parameters have been recorded.
- Production parameters at birth and weaning of purebred rabbits were recorded. 987 numbers of seed rabbits could be provided to interested rabbit farmers and KVKs/ Govt. farms during the project period during 14-15 project period. Incidence of diseases in the stock was assessed for seasonal effects from the mortality and post mortem records maintained in the farm. The addition of various prebiotic components to feed seemed to alter the nutrient availability and incidence of gastrointestinal infections. A collaborative pilot study of these factors was done along with the Dept. Animal Nutrition. A detailed investigation yielded results that could be beneficial in strengthening the rabbit production in the state.

7. Centre for Animal Adaptation to Environment and Climate Change Studies

About the centre

Foreseeing the risks the livestock sector would be facing in the changing climatic scenario, the Kerala Veterinary & Animal Sciences University (KVASU) has established 'Centre for Animal Adaptation to Environment and Climate Change Studies (CAADECCS) to excel in climate change education, research and extension in the field of Animal Agriculture under the Directorate of Academics and Research with ICAR special grant during XI Plan. The CAADECCS is the first of its kind among the State Veterinary Universities of the country which serves as the nodal agency dealing with research and capacity building on all the aspects of climate risk management in relation to animal agriculture including weather insurance and provide information to the planners/ policy makers for implementing strategies to mitigate the ill effects of climate change/variability so as to sustain and enhance the rural livelihoods through livestock production and management.

Research Activities

i. KVASU Research projects.

- State Plan Project: Strengthening & Refurbishing CAADECCS for Climate Change preparedness in Livestock Sector

ii. Masters /Doctoral Research projects:

- PG Diploma-Climate Services in Animal Agriculture
- PG Diploma in Climate Services
- Ph.D. - Climate Change in Animal Agriculture

The above three post-graduate programs have been launched during the Academic year 2014-15. Due to ambiguity in late introduction of the program, no student opted for these courses. However, steps are being taken to admit the students for the year 2015-2016.

Major activities/Achievements:

- Dr. G. GirishVarma. Implementing Officer, CAADECCS and Dr GSLHV Prasada Rao, Consultant Professor attended a state level Media seminar on impact of Climate Change in Kerala as resource personnel, organised by Malayala Manorama, Kottayam on 18th July 2014.
- Dr. GSLHV Prasada Rao Consultant Professor attended the National Symposium on Climate Change - Issues and Strategies, held at Waltair from 9 to 11 October, 2014

- Dr. GSLHV Prasada Rao Consultant Professor attended the Second International Conference on Bio- Resources and Stress Management, held at Acharya N.G. Ranga Agricultural University, Hyderabad from 7 to 10 January 2015

Publications

Journals

- Abdul Niyas P.A., Chaidanya K, Shaji S, Sejian V, Bhatta R, Bagath M, Rao G.S.L.H.V.P., Kurian, E.K. and Girish, V. 2015. Adaptation of Livestock to Environmental Challenges. J Vet Sci Med Diagn 4:3
- Chaidanya K, Shaji S, Abdul Niyas P A, Sejian V, Bhatta R, Bagath M, Rao G.S.L.H.V.P., Kurian, E.K. and Girish, V. 2015. Climate Change and Livestock Nutrient Availability: Impact and Mitigation. J Vet Sci Med Diagn 4:3

Books

- Rao, G.S.L.H.V.P., Girish Varma, G. and Kumar K.N.K. 2014. Automatic Weather Station-Hourly Weather Data and THI (24.07.2013-30.06.2014). Centre for Animal Adaptation to Environment and Climate Change Studies, KVASU, Thrissur, Kerala. Publication 1/2014,246p.

8. Centre for Livestock Development and Policy Research, Thiruvananthapuram

About the centre

The CLPR had been set up as autonomous centres of the Kerala Veterinary and Animal Sciences University (KVASU) at Thiruvananthapuram in June 2013. The centres organize capacity building programmes for the various stakeholders of livestock sector, such as farmers and extension workers. Organise exhibitions and seminars on behalf of the University. Conduct need based researches in different fields. Provide consultancy services for farmers and entrepreneurs and sell publications of the University on request. Act as an intermediary between the headquarters of University and the Government departments at the Secretariat, Thiruvananthapuram.

Trainings conducted

One day workshop on Intellectual Property Rights was organised jointly by Regional Research and Training Centre (RRTC), KVASU, Thiruvananthapuram and Patent Information Centre, KSCSTE, Government of Kerala on 19.08.2014 at Kerala State Veterinary Council Seminar Hall, Peroorkada, for the officers of Department of Animal

Husbandry and Department of Dairy Development. The workshop was inaugurated by the Worshipful Mayor of Thiruvananthapuram Corporation Adv. K. Chandrika

Research Activities

i. KVASU Research projects

- An Analysis of Livestock, Dairy and Poultry Statistics & Production, Estimates of milk, meat, egg and other livestock products of Kerala and its comparison with the national data.[6.5lakhs]
- Study on Population Dynamics and Sustainability of Livestock Sector with Respect to Different Agro - Climatic Zones in Kerala.[5.25 lakhs]
- Study on the Recent Trends and Patterns in Cattle Holdings in Kerala.[10 lakhs]
- The Present Status, Coordination and Control of Zoonotic Diseases in Kerala with Special Reference to Rabies.[3.25 lakhs]

Publications

- Knowledge of dairy farmers on scientific cattle management practices.2014. Indian Journal of Social Research, 55(2): 255-261.
- Scale to measure attitude of pet dog owners towards computer usage.2014.Indian Journal of Social Research,55(1):

9. Centre for One Health Education Advocacy Research and Training, Pookode

About the centre

COHEART was established at KVASU in the year 2014 as per the decisions of the 10th Academic Council and 26th Board of Management. COHEART envision to be a Global Centre for Excellence in One Health Education, Advocacy, Research and Training. The centre aims to support in achieving sustainable health of man, animal and its surrounding environment through leadership, partnership, research and training in One Health domains. The objective of the centre is (1) *EDUCATION* of a new cadre of health professionals about One Health - the linkages between animal, human and environmental health. (2) *ADVOCACY* for collaboration as an encouragement for professionals to work together. (3) Conducting *RESEARCH* to understand the health threats and disease processes that occur at the interface of human and animal activities and their effects on the environment. And (4) *TRAINING AND CAPACITY BUILDING* to improve community's preparedness and response to hazards affecting man, animal and the environment.

Trainings conducted

- COHEART organized a brain storming workshop on 24/03/2015 on "How Wayanad can emerge as a safe food destination". The participants belonged to panchayat office, health service department and from veterinary sectors of Wayanad district.
- COHEART, KVASU in association with Department of Health Services and Animal Husbandry Department conducted One Day "Stakeholders workshop to develop strategies for Control of Kyasanur Forest Disease (KFD) in Wayanad" on 11/2/2015.
- COHEART organized one day awareness training programme on "Towards Food Safety- Quality meat and milk production" for Panchayath presidents, vice-presidents, members, health standing committee chairman and health officials of Wayanad district.
- Awareness training programme on "Safe food for safe future" was organized by COHEART for VII, VIII and IX Standards of Kendriya Vidyalaya, Kalpetta.
- COHEART organized one day training programme for Kendriya Vidyalaya, Kollam school students on "Food Safety and Hand Hygiene on 26/04/2014.
- School students from Kendriyavidyalaya, Naval base, Ernakulam were trained on Hygiene and Diseases on 28/04/2014.
- COHEART co-organized Training on Total mixed ration on 5th August, 2014 for the farmers. A book on the topic was released and distributed to the farmers.
- On 2/05/2014, COHEART organized training programme for school students of Kendriya Vidyalaya, Idukki.
- Two batches of three day residence training programme on "Quality Assurance of Foods of Animal Origin with Special Reference to Hygienic Meat Production" was organized by COHEART during 5-7th May and 12-14th May, 2014. The training was intended to enlighten the participants on the current trends on the safety and quality management of foods of animal origin and clean meat production. A total of 98 officials from diverse field's *viz.*, Food safety officers, designated officers, Assistant Commissioner from Commissionerate of Food Safety and Veterinarians working in slaughter houses had participated.
- COHEART organized a Training on "Hygienic handling and processing of milk" for Chilling plant workers of Pulpally Milk society, Pulpally on 01/06/2014, World Milk Day

- Training on “Hygienic Meat Production” was organized by COHEART on 04/04/2014 for slaughter house workers of Malabar Meat factory under the management of Brahmagiri development society.
- The College of Dairy Science and Technology Mannuthy in association with COHEART, KVASU and Indian Dairy Association (Kerala Chapter) celebrated World Milk Day 2014. The key message conveyed during the day long celebrations included, quality of milk should come as a commitment of farmers itself and scientist play a key role in facilitating it.
- As a part of the world health day 2015 COHEART handled as session on “safe food from farm to fork” at Panamaram Community Health Centre, Wayanad. Furthermore, various programmes were organized at Kendriya Vidyalaya, Kalpetta.
- COHEART celebrated World Antibiotic Awareness week 2015 by handling a special session for BVSc students and School Students on Antimicrobial resistance and how can it be controlled.

Research Activities

KVASU Research projects

State plan 2013-14 project on “Capacity building for various stakeholders addressing food safety and food security”.

Major activities/Achievements

- Best paper award at National Symposium of Indian Society of Veterinary Medicine 2015for the study to determine the prevalence of methicillin resistant Staphylococcus aureus (MRSA) among canines
- Outstanding One Health Surveillance Award to Dr. Prejit, Officer-In-Charge, COHEART during the 2015- Annual Conference of International Society for Disease Surveillance (ISDS) held at Colorado, USA from December 8-10, 2015.
- Invitation and travel grant by Skoll Global Threats, San Francisco, to attend a 2 day workshop on “One Health regional collaboration in South Asia” at Kathmandu, Nepal from May 29 and 30, 2014. The workshop stressed on the need for strengthening “one health” approach to the management of emerging and re-emerging zoonotic diseases in South Asia

- Dr. Prejit successfully completed the online course "One Health, One Medicine: A Global Health Approach" Offered by the Department of Public Health and Preventive Medicine St. George University, Grenada, West Indies.
- COHEART participated in the workshop to strengthen One Health regional collaboration in South Asia that was co-organized by Connecting Organizations for Regional Disease Surveillance, EcoHealth Alliance, the International Society for Infectious Disease, the Program for Monitoring Emerging Diseases, and the Skoll Global threats Fund from May 29 to 30, 2014.

10. Centre for Pig Production and Research, Mannuthy

About the centre

The major objective of the centre is to conduct research on different aspects of pig production, to operate as an instructional farm to students, to function as a demonstration unit to farmers, to maintain purebred nuclear stock of animals for supply of quality piglets to farmers. Centre also conserves indigenous Ankamali pigs, to evaluate the performance of indigenous pigs and their crosses with exotic breeds.

ICAR- funded All India Coordinated Research Project has been under operation since 1993 to evaluate the performance of indigenous pigs and their crosses with exotic breeds. The three breed crosses of pigs with better growth rate and lean meat are also produced and distributed to farmers for fattening purposes.

Trainings conducted

- Farmers' training for 12 farmers during March 2015 regarding profitable pig farming
- Internship training to 96 students
- Entrepreneurial training on pig production using food waste

Research Activities

i. KVASU Research projects

Name of Project	Financial outlay (lakhs)
Conservation and maintenance of Ankamali pigs of Kerala	15
Evaluation of performance of crossbred pigs	17

Dietary intervention for early weaning of piglets	15
Scaling up of production of piglings	70
Strengthening of Centre for pig production, Mannuthy	20
Establishment of AI facility at CPPR	15
Total	**152.00**
EAP	
AICRP on pigs	55.30
Mega seed project on Pigs	11.10
Total	**66.40**

Masters /Doctoral Research projects

- Characterisation of candidate gene and their association with litter traits in pig - PhD
- Development and Evaluation of a Model for Wastewater management in pig farms
- Assessment of biogas production potential of monogastric farm animal waste
- Effect of dietary supplementation of probiotic, prebiotic and synbiotic on growth performance and carcass characteristics in crossbred pigs
- Litter performance of Large white Yorkshire pigs raised in different farrowing housing system
- Expression profile and genetic variability of *porcine beta-defensin (pBD-1)* gene.

11. Centre for Wildlife Studies, Pookode

About the centre

KVASU Centre for Wildlife Studies, Pookode, was established in 2011 as a multidisciplinary station of the University. Here, intramural veterinary, wildlife biology and molecular biology experts work with extramural multidisciplinary subject area experts to train students who are passionate about conservation, in a truly interdisciplinary manner. The Centre runs the Master of Science (Wildlife Studies) course open for all bioscience graduates since 2011. Thirty six students have completed the course since its inception. There are currently forty three students. The alumni work in various organizations like Wildlife Institute of India – Dehradun, Kerala Forest Research Institute – Peechi, SACON-Coimbatore, Kerala State Forest Department, UNDP *etc*. Others pursue PhD/higher studies at reputed universities like

KVASU, IIITM-K, IISER, Central University of Kerala & Tamil Nadu *etc*. The priority of the Centre is training and empowerment of all bioscience graduates, including veterinarians, for conservation action and research. Many of the alumni are recipients of national and international awards like Young Scientist award of KFRI/KSBB and fellowships like INSPIRE, Young Woman Scientist Award of DST, CSIR JRF *etc*. The Centre is also involved in social outreach activities aimed at the empowerment of youth from tribal and other socio-economically backward communities of Wayanad as well as helping farmers suffering from human-wildlife conflict.

Research Activities

i. **Masters /Doctoral Research projects**

Population and foraging ecology of Nilgiri Langur (trachypithecus johnii) in Ranni division of Pathanamthitta, Kerala. The study indicated that the langurs spent most of the time for feeding followed by moving and resting. The prevalence of endoparasites in Asian Elephant (Elephas maximus indicus) was studied in South Wayanad Forest Division. Screening for diseases was conducted in Asiatic Wild Dogs (Cuon alpinus) in Wayanad, Kerala. Molecular detection of bacteria of mycobacterium tuberculosis complex (mtbc) and mycobacterium avium complex (mac) was conducted in Indian Grey mongoose. Behaviour of captive gaur was studied at Thiruvananthapuram Zoological Garden, Kerala, and Sri Chamarajendra Zoological Garden, Mysore, Karnataka. Bat species abundance, roost characteristics and selected Rhinolophid bat species call parameters (R. rouxii, R. beddomei and R. pusillus) and diet composition (one fruit bat Cynopterus brachyotis, two species of insectivorous bats Rhinolophus beddomei and R. rouxii) were studied at the South Wayanad Forest Division. A survey was conducted on Malabar Slender Lorises (Loris lydekkerianus malabaricus) in rubber plantations of Kottayam district of Kerala.

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