KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Pookode, Wayanad, Kerala

REPORT ON

RESEARCH ACTIVITIES 2021-22

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

Report on Research Activities 2021-22

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Contents

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

MESSAGE

The livestock sector plays a significant role in the socio-economic development of the country. This sector contributes to 16 per cent of the income of small households in India and provides employment to 8.8 per cent of Indians. More important are the opportunities for employment that this sector offers to the women of our country; it is estimated that women constitute 71 per cent of the labour force in the Indian livestock sector and that the dairy sector alone employs 75 million women. In Kerala, the livestock sector is one of the fastest growing sectors in the rural economy and the share of livestock in Gross State Value Added (GSVA) at constant prices from agriculture showed an increase from 27.8 per cent in 2019-20 to 28.21 per cent in 2020-21. Coming to milk production, the state ranks fourteenth in the country. Of the 25.24 lakh MT of milk produced in the state, the major share was produced by cross bred cows (93.54 per cent). It must be pointed out here that even though herd sizes are smaller in the state, the productivity of cattle in Kerala is higher than the national average. The average milk yield per animal in India for exotic or crossbred animals was 7.9 kg per day and the corresponding figure for Kerala was 10.2 kg per day. The productivity of 10.2 kg per day for cattle in Kerala was the second highest among the Indian states after Punjab (13.4 kg per day). This advantage for Kerala is undoubtedly due to the concerted efforts in the livestock research and development sector of the state from the 1950s onwards with the result that today, Kerala has the highest percentage of exotic and cross bred animals (94 per cent) when compared to India where only 26 per cent of cattle are either exotic or cross bred.

This research legacy that began in 1955 with the establishment of the first veterinary college in Kerala, continues today through the Kerala Veterinary and Animal Sciences University. The role of Kerala Veterinary and Animal Sciences University in the progress of the livestock sector of the state is immense. Significant development in animal production and health indicators over the years are the result of concerted research efforts undertaken by the scientists of the University. This year, the University has gone on to expand referral diagnostic and analytic services with the establishment of the referral analytical and diagnostic laboratory for supporting livestock farming and diagnosis of zoonotic diseases with RIDF (NABARD) assistance on the Mannuthy campus. This project covers 30 labs and BSL-3 standalone facility.

Our concerns have always been farmer problems; these are the starting point of research in the University. The University is very happy to state on record that we could act proactively and successfully develop an inactivated vaccine for the control of Riemerellosis which will benefit thousands of farmers in the state. The improvement of the livestock sector and livelihoods of our farmers remains the centre stone of all our research activities. It is without doubt that effective documentation of these efforts is essential for evaluating our progress and for disseminating new innovations to various categories of stakeholders in this sector. In this regard, I am indeed very happy to know that the University is bringing out a compilation of the research activities this year as well. I congratulate all who have engaged in this noble effort and earnestly hope that this document will be useful to those who delve into it.

Prof. (Dr.). M. R. Saseendranath

Vice-Chancellor

Dr. C. Latha
Director of Academics and Research

PREFACE

Research and development are central to the mandates of Kerala Veterinary and Animal Sciences University. Scientists of the university are engaged in arriving at solutions to farmer problems through research as well as in other basic research activities that seek to promote our understanding of scientific facts in veterinary and animal science. Over the last year, Kerala Veterinary and Animal Sciences University has played host to quite a number of external projects funded by various agencies of the Government of India and the Government of Kerala. Through these projects, scientific investigations have been undertaken with a view to make improvements in the animal husbandry sector.

It is also important that the findings of these studies are meticulously documented, from the view point of various stakeholders who could have interest in them and also from the point of view of documenting the progress of scientific investigation in veterinary and animal sciences for posterity. Our advancement both as a university and as a scientific community can be judged by tomorrow only if we keep a record of the progress that we make. Through this publication, the University seeks to document the growth that we have made in our understanding of different facets of veterinary, dairy and animal sciences. With the increased understanding today of the interlinked nature of the sciences, be it medical sciences or agriculture or even the humanities, there are a lot of people who would be interested in these findings for their personal understanding and also for progressing with these research findings from a different perspective. It is in this context that bringing out the Annual Research Report assumes significance.

A lot of work has gone into the making of this document and many people have been involved in various steps of its evolution, from collecting and processing information to designing the actual pages of this report. The University remains indebted to them for their valuable service. On my personal behalf, I congratulate all of them for their selfless work in engaging in this effort.

As tomorrow beckons from beyond the horizon, I hope that the contents of this publication will be useful to the various stakeholders in this sector. I also sincerely hope that the findings of these research projects will be useful in promoting the progress of science and the welfare of our farming community and state at large.

Dr. C. Latha

Director of Academics and Research

About the University

Established on 14th June, 2010 through Ordinance No.44/2010 and Act 3/2011 of the Government of Kerala, Kerala Veterinary and Animal Sciences University has emerged as a vibrant collective of dedicated professionals striving to improve the lives of various stakeholders in this the animal husbandry and dairy sector of the state. Since the formation of the University, over a decade ago, KVASU's focus on academic excellence and cutting edge research has brought laurels to the University, among which the Chancellor's Award for the Young Emerging University stands out. Over the years, the University continues to espouse the cardinal values of justice, liberty, equality, fraternity and human dignity in the journey towards professional excellence.

The University aims include the following:

- The implementation of new courses and curricula based on the advances in the field of Veterinary and Animal Sciences
- The advancement and dissemination of learning and knowledge in Veterinary and Animal Sciences, DairyScience and allied fields by fostering and promoting Veterinary and Animal Science research
- Undertaking extension activities
- Collaboration and co-operation with regional, national and international research institutions andexchange 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 otheragencies involved in policy making and implementation in the Veterinary and Dairy sectors

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

The 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. Verghese Kurien Institute of Dairy and Food 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 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

This year has been a remarkable one for the University as faculty members secured 17 externally aided projects, published 31 books/ book chapters, around 139 articles in peer reviewed journals and 77 articles in the compendia of various conferences that they attended. Other significant accomplishments include a total of 73 awards secured by faculty and students and one patent was also granted during this year.

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 germ plasm.
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 germ plasm, 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	Principal Investigator	Funding Agency	Title of the project	Total outlay (Rs)
1	Dr. V. Beena	RKVY-RAFTAR	Strengthening of Centre for Animal Adaptation to Environment and Climate Change Studies (CAADECCS) for Thermal Stress Assessment in Dairy cattle	170.00
2	Dr. Stella Cyriac	DBT	Genetic up-breeding of duck production to strengthen livelihood security in NER of India by converging conventional and molecular techniques	39.33
3	Dr. Jamuna Valsalan	DST SERB	Development of multi trait selection criteria in crossbred cattle of Kerala	28.57
4	Dr. Muhammad Aslam M.K.	DST - SERB	Comprehensive study on spermatozoa of Vechur and Crossbred bulls for identifying breed specific and fertility related biomarkers	27.38
5	Dr. Bibu John Kariyil	National Medicinal Plant Board	Bioactivity guided fractionation and isolation of bioactive compounds from *Thespesia populnea* medicinal plant with anticancer potential against triple negative breast cancer	21.38
6	Dr. S. Senthil Murugan (Mentor)	DST-WOSA	Lion-tailed Macaque (*Macaca silenus*): Feeding Ecology and Management of an endangered species in captivity	19.85
7	Dr. Ambily R.	ICMR	Molecular characterisation, antibiogram and geospatial analysis of leptospiral isolates from Kerala	19.07
8	Dr. Priya P. M	NABARD - ongoing	Evaluation of inactivated and subunit vaccines against riemerellosis among ducks in Kerala	18.50
9	Dr. Lali F. Anand	DST SERB	Genomic approach for genetic improvement and conservation of important aquaculture species, *Etroplus suratensis* and *Trachinotus blochii* under changing climate scenario	18.30

10	Dr Leena Chandrasekhar	SERB – TARE Project	Role of Parkin mediated mitophagy in metastatic melanoma in the *in vivo* mouse and *in vitro* anoikia models	18.00
11	Dr Bindu Lakshmanan	KSCSTE	Development of recombinant protein based diagnostic kit for visceral schistosomosis and sero-epidemiological study of the infection in ruminants. Kerala State Council for Science, Technology and Environment. Government of Kerala	12.57
12	Dr Radhika G	KSCSTE	Genetic Diversity Analysis among cattle genetic groups of Kerala using microsatellite markers	7.94
13	Dr. S. Senthil Murugan	M/s. Kemin Industries South Asia Ltd	Evaluation of dietary supplementation of exogenous fibrolytic enzymes on *in-vitro* nutrient digestibility for ruminants	7.00
14	K Syamala	NABARD	Sustainable parasite management using anaemia eye card in goats	5.93
15	Dr. A. K. Beena	KSCSTE, Student project	Milk as a reservoir of multiple drug resistant bacteria – an assessment	0.10
16	Dr. Aparna Sudhakaran V	KSCSTE, Student project	Microbiological quality profiling of pasteurized milk during refrigerated storage	0.10
17	Dr. Ligimol James	KSCSTE, Student project	Post pasteurization contaminating bacteria as shelf life determinants of pasteurized milk	0.10

Evaluation of inactivated and subunit vaccines against riemerellosis among ducks in Kerala

Inactivated and subunit vaccines against riemerellosis were prepared, which passed sterility, safety and purity testing. More than 2000 ducklings with feed and mineral mixtures were distributed to the identified women beneficiaries of Arimpur Grama Panchayath with the help of Govt. Veterinary Surgeon, Veterinary Dispensary, Arimpur. Field trials on the developed vaccines were performed. Analysis of the collected biomaterials is ongoing to check the efficacy and potency of the vaccines.

NABARD sanctions four projects in State

SPECIAL CORRESPONDENT
THIRUVANANTHAPURAM

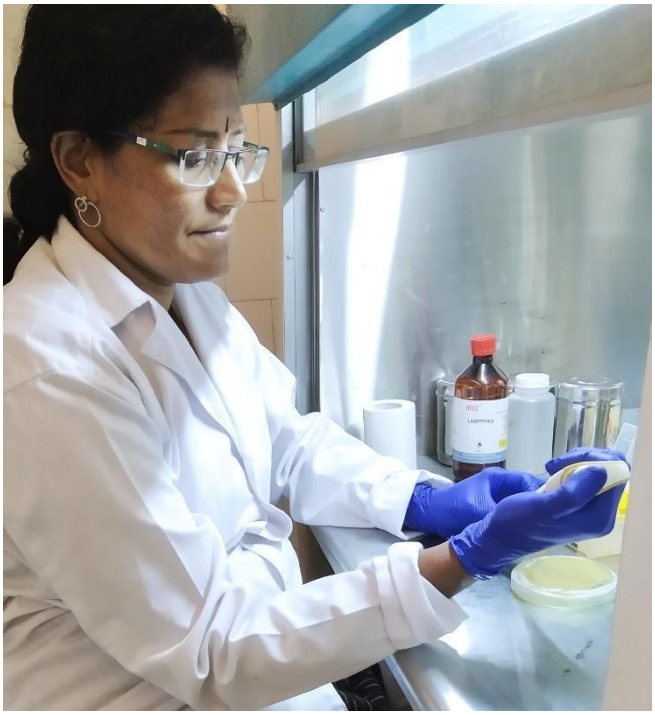
The National Bank for Agriculture and Rural Development (NABARD) has launched four projects to be implemented by various agencies across the State.

The package was sanctioned to mark the 40th foundation day celebrations of the bank.

The first project with a grant assistance of ₹18.50 lakh for the evaluation of vaccine against the bacterial disease 'Riemerellosis' in ducks was sanctioned to the Kerala Veterinary and Animal Sciences University, Thrissur. A grant assistance of ₹5 lakh has been sanctioned as the second project to provide long-distance wireless connectivity to tribal settlements in Nilambur in Malappuram district. The project to be completed in 10 days will be executed through an NGO Jan Shikshan Sansthan, Malappuram.

The third project involves up-skilling of 90 young fishermen in the repair of outboard motors of fishing vessels and is sanctioned to the South Indian Federation of Fisherman Societies with a grant assistance of ₹4.50 lakh.

NABARD has also sanctioned four training programmes with a grant assistance of ₹15 lakh to the Additional Skill Acquisition Programme.



Molecular characterisation, antibiogram and geospatial analysis of leptospiral isolates from Kerala

Blood and urine and samples were collected from suspected cases of leptospirosis. Out of 59 samples collected from cattle, goat and dog, nine samples were positive by MAT and two in PCR. Environmental samples from the premises of positive animals were also collected for analysis.

Lion-tailed Macaque (*Macaca silenus*): feeding ecology and management of an endangered species in captivity

Lion-tailed macaque is an endangered species and endemic to evergreen forest in the Western Ghats. It is necessary that habitats of the remaining population need to be assessed for their effective conservation. It was estimated that less than 4000 individuals were restricted in wild habitat of Western Ghats mountains located in southwestern part of India. Socially, primates form troop of 35 individuals, dominated by single male supported by 2 or 3 other adults. Lion-tailed Macaque is listed as an Endangered (IUCN, 2020) species and endemic in the rain forests of the Western Ghats and found mainly in silent valley national park located in southern part of Western Ghats in the border of Mannarkkad Taluk of Palakkad district, Nilambur Taluk of Malappuram district, Kerala and Nilgiris district of Tamil Nadu. During field survey, it was found that Lion-tailed Macaques preferably eaten flowers and seeds of *Cullinea exarillata* (Wild durian), flowers of *Litsea floribunda* (Pattuthali), fruits of *Ficus rescimosa* (Cluster Fig) and *Ficus exasperate* (Sand paper), ripened and un-ripened fruits of *Artocarpus heterophyllus* (Jack fruit), *Artocarpus hirsutus* (Wild Jackfruit), *Mangifera indica* (Mango) *and Psidium guajava* (Guava). The items consumed by Lion-tailed Macaque was analysed for its chemical composition and found that highest per cent of fibre (42.01), crude protein (21.79), crude fat (5.09), calcium (6.09) and phosphorus (8.66) were found in *Ficus microcarpa, Artocarpus hirsutus, Ficus beddomei, Ficus exasperata* respectively.

Strengthening of centre for animal adaptation to environment and climate change studies (CAADECCS) for thermal stress assessment in dairy cattle

RKVY-RAFTAR project is being implemented and has reached the final stage and is close to completion. The climate chamber is a high end research facility for climate related research in larger animals. There are two chambers, namely, the climate control chamber and the comfort zone chamber. Both chambers are well equipped for altering the temperature and humidity as per the study requirement from 5ºC to 50ºC ±1°C and 20per cent to 95per cent

±3per cent respectively. Additionally, there is provision for controlling the diurnal lighting, optional elevated humidity, air exchange control, and tight performance tolerances

Milk as a reservoir of multiple drug resistant bacteria - an assessment

Raw milk, pasteurized milk and sterilized milk were screened for the presence of multiple drug resistance bacteria. *Acinetobacter baumanii* DMSV01, *Staphylococcus nepalensis* DMT01 and *Acinetobacter baumanii* DMS01 were isolated from raw milk, pasteurized milk and sterilized milk respectively. Among the three isolates *Acinetobacter baumanii* DMSV01 was the most resistant isolate in terms of multiple drug resistance, thermal resistance and virulence properties. WHO reports *Acinetobacter baumanii* as the most serious ESKAPE organisms that effectively escape the effects of antibacterial drugs. Many studies have reported the presence of several virulence factors in *Acinetobacter baumanii*. Here both the isolates of *Acinetobacter baumanii* showed beta hemolysis which is an indication of its pathogenicity. *Staphylococcus nepalensis* DMT01 was isolated from pasteurized milk but no haemolysis was observed in blood agar plates. However all the three isolates were able to survive the processing condition hence need to be treated cautiously.

Microbiological quality profiling of pasteurized milk during refrigerated storage

Market samples (five samples each of four brands) of pasteurized milk were collected and divided into equal halves. Each of the half portion samples was distributed into different sterile containers and one of them was laboratory pasteurized at 63 degree celsius for 30 minutes. Both these were stored under refrigeration (at 7 degree celsius) till the onset of any perceivable defect. Analysis of both the refrigerated lots was carried out for Standard Plate Count (SPC), Psychrotrophic Count (PC) and titratable acidity and clot on boiling. It was observed that most of the pasteurised milk samples spoiled within 4 days of refrigerated storage. Some of the samples spoiled after a week of refrigerated storage. Also, psychrotrophic count was found to be increasing rapidly during refrigerated storage of pasteurized milk. Laboratory pasteurised milk samples spoiled after a week of refrigerated storage only. One of them spoiled after 12 days. Standard plate counts as well as psychrotrophic counts of laboratory pasteurized milks were much lower than that of pasteurized milks. Pasteurised milk samples showed significant SPC as well as psychrotrophic count even within the shelf-life period. This indicates poor microbiological quality even though acidity and clot on boiling tests demonstrated satisfactory results. Prolonged refrigerated storage have led to increase in microbial count indicating further decline in microbiological quality and also increase in acidity making milk unfit for use.

Laboratory pasteurization was seen to reduce microbial count of milk resulting in increased microbiological quality as well as shelf life. Hence boiling of pasteurized milk prior to consumption could ensure higher microbial quality and safety.

Post pasteurization contaminating bacteria as shelf life determinants of pasteurized milk

On analysing eight samples each of three brands of pasteurized milk collected from Mannuthy, Thrissur, marked differences were observed in their shelf life under refrigerated storage at 5°C. This study could isolate and confirm five bacterial isolates as post pasteurization contaminating organisms from the market samples of pasteurized milk. Among them, two isolates were genotypically identified as *Acinetobacter baumanii* and *Staphylococcus pasteurii*. On further characterizing these two isolates, *Staphylococcus pasteurii* was found to exhibit both proteolytic and lipolytic activities whereas *Acinetobacter baumanii* did not exhibit any of these activities. In agreement with this observation sterile milk inoculated with *Staphylococcus pasteurii* and stored under refrigerated condition milk was found to be spoiled in terms of curdling and settling into a mass on the fourth day of storage whereas no visible changes were occurred in the case of *Acinetobacter baumanii*.

Genetic up-breeding of duck production to strengthen livelihood security in Nort Eastern Region of India by converging conventional and molecular techniques

The research project funded by DBT, Government of India aims in the characterization of indigenous duck germplasm, improvement of meat type ducks and to develop improved location specific duck strains. Phenotypic characterization of Kuttanad (Chara and Chembally varietes) as well as White Pekin ducks has been completed. Molecular characterization of the Kuttanad duck for breed specific SNP biomarkers has been started. The SNP markers associated with growth hormone have been completed. The research to develop an improved meat line of Kuttanad ducks is going on. Crosses from the above selected population were developed and evaluated for identifying suitable males and females for achieving highest heterosis based on the body weight achieved at the 8^{th} week of age. Evaluation of carcass traits were also carried out.

Genomic approach for genetic improvement and conservation of important aquaculture species, *Etroplus suratensis* and *Trachinotus blochii* under changing climate scenario

Transcriptome data of muscle and of *Etroplus suratensis* maintained at different salinity was generated. Similarly, transcriptome profiles of muscle and liver tissues of *Trachinotus blochii* at different age group and growth characteristics maintained at Kodungaloor-Azhikode back

water system also generated. The genome level data generated has to be analyzed in detail to find out differentially expressed genes and gene variations in each category which can be further used to improve the growth characteristics and adaptive traits of these species.

Bioactivity guided fractionation and isolation of bioactive compounds from *Thespesia populnea* medicinal plant against triple negative breast cancer

The bark of *Thespesia populnea* was collected from different parts of Kerala. It was authenicated by NISCAIR, New Delhi. DNA barcoding of the bark of the plant was performed. Methanolic extract of the bark was prepared and chloroform fraction was separated. HPTLC profiling of the methanolic extract and chloroform fraction was performed. LC HRMS and GC HRMS analysis of the plant extract and chloroform fraction was performed.

Thespesia populnea

2. Network Projects

Sl No	Name of Principal Investigator	Name of the project	Outlay per annum (lakhs)
1	Dr. A. P. Usha	AICRP on pigs	68.50
2	Dr. Beena C. Joseph & Dr. S. Sanakaralingam	AICRP on poultry for eggs	65.97
3	Dr. A. P. Usha	Mega seed project on pigs	51.00
4	Dr. K. Anilkumar	ICAR Field Progeny Testing Program	42.62
5	Dr. Thirupathy Venkatachalapathy	AICRP on Goat Improvement	17.97
6	Dr Usha Narayana Pillai	Outreach Program on Ethnoveterinary Medicine	5.59
7	Rejeesh R	Network centre on Dairy Microbes under ICAR-NCVTC, NRCE, Hisar, Hariana	2.00

Outreach program on ethnoveterinary medicine

GC-MS analysis of methanolic leaf extract of *Acalypha indica* was done. Methanolic extract of *Acalypha indica* and essential oil of *Artemisia japonica* showed anti-inflammatory activity by membrane stabilization method. Evaluated anti-inflammatory activity of combinations of methanolic extract and essential oil by inhibition of protein denaturation method. In vivo acute oral and dermal toxicity study of methanolic extract and essential oil and its combinations were carried out in rat model. In vivo anti-inflammatory activity was carried out by Carrageenan-induced paw edema in rats using methanolic extract, essential oil and its combinations.

ICAR-field progeny testing scheme

During the period from 1992 to 31.12.2021 1,40,775 inseminations were done using semen supplied from the project. Number of female calves born were 12,131. Age at first calving of progenies was recorded as 1136 ± 13days. The average first lactation yield of progenies was 3388.71 ± 89.66 Kg. Socio- economic status of dairy farmers in Thrissur district is continuously collected and analysed. Feed supplements, mineral mixture, cow mats were supplied to the farmers. Awareness classes and seminars were conducted.

Development of multi trait selection criteria in crossbred cattle of Kerala

In the present study, genetic parameters of different production and fertility traits were estimated using advanced statistical softwares. Standardized fertility with different levels of milk production in crossbred cattle of Kerala. Standardized Voluntary Waiting Period in cattle as 55 days. Major fertility trait Daughters Pregnancy Rate (DPR) had low heritability (0.092±0.029) and had negative association with milk yield (-0.119. In the present study, an optimum model for the prediction of DPR was developed using seven regression models with different combinations of AFC, SP, and MY/LL traits as independent traits, the optimum model developed was DPR = 0.002(309-SP). Major candidate genes for production and fertility traits were identified. The following genes viz. *PRL*, *B4GALT1*, *CD14 POU1F1*,

STAT5A, TLR4, CAST, FSHR, DEFB4 had significant association with major traits and *MFGE8, PPP1R11 and LYZ* gene didn't have any association with production and fertility. Breeding value of sires used in the study were studied using phenotypic and genetic characters.

Network centre on dairy microbes under ICAR-NCVTC, NRCE, Hisar, Haryana

The department of Dairy Microbiology is partnering with ICAR-NCVTC's network project as one of the 'Network centres for Dairy Microbes' since 2017. Till date centre had identified, accessioned (Genbank and VTCC) and deposited 27 well defined lactic acid bacteria. These are also deposited to the repository maintained by ICAR-NCVTC at ICAR-NDRI (National Collection of Dairy Cultures). In addition to this, the centre had successfully assessed the physico techno textural characteristics of each of the isolates. The isolates belong to those collected from tribal area of Kerala such as Amboori, Thiruvananthapuram, Attappadi, Palakkad and remote villages of Wayanad. The centre is continuing the isolation part by collecting samples from different locales of the State. Assessing metabolic changes on altering pathways, assessment of probiotic characteristics and creation of better consortia for cheese and other fermented milk/cereal products are some of the researches that are progressing at the centre.

AICRP on poultry for eggs

The S-32 generation of IWN and IWP strains of White Leghorn were tested up to 72 weeks of age. Hen-housed egg production up to 72 weeks of age was 292.94 and 278.89 in IWN and IWP strain, respectively. The values of hen-day and survivors' egg production up to 72 weeks of age were 301.82 and 302.05, respectively in IWN and 293.61 and 293.02, respectively in IWP strain of White Leghorn belonging to S-32 generation.

The S-33 generation of IWN (849 hens) and IWP (859 hens) strains of White Leghorn were tested up to 28 weeks of age. The body weight recorded at 16 weeks of age was 1179.98g and 1112.60g for IWN and IWP strains, respectively of S-33 generation. The age at sexual maturity was 129 and 132 days in IWN and IWP strains, respectively of S-33 generation.

AICRP on Goat Improvement

Total of 197 farmers have been registered including 126 women. 3209 animals were registered under this project. Population growth recorded was 92.62%. Genetic trend of body weights was positive for all age groups. Kidding rate was 160.01. Percentage of singles, twins and triplets were 40.76, 48.03, 10.04 and 1.16, respectively. A total of 8 bucks were distributed among the farmers and multiplier flocks. Mortality rate was 3.30% in the project

area. As capacity building, 11 training on offline mode were conducted 262 farmers and 9 training on online mode to 327 farmers with 3-5 days duration. Published six research papers in the peer reviewed International / National Journals and four PG student works were also completed during 2021-22.

Distribution of Feed and Feed Supplements

AICRP in Pigs

The All India Coordinated Research Project on pigs has been operating at Mannuthy since 1993. The objective of the project was to study the performance of indigenous pigs under optimum management condition and to produce crossbreds by crossing indigenous gilts with exotic boars and to assess their performance in respect of their efficiency of feed conversion, production and reproduction.

As per the technical programme, a foundation stock of indigenous pigs was established in the Centre and the same were raised for cross breeding with Large White Yorkshire. A breeding unit of 41 indigenous gilts and 30 indigenous boars are maintained to study the performance of indigenous pigs under optimum conditions for two generations. Twenty four gilts are kept as reserve to get 36 normal farrowing. A total strength of 183 animals is maintained under the project and 346 piglets were produced during the period. The centre has produced crossbred pigs of 75% exotic inheritance by crossing Desi breeds with Large White Yorkshire. Inter-se mating of 75% crossbreds was done during the year 2021-22. An amount of Rs: 68.5 lakhs had been allotted during the financial year. The centre has successfully fulfilled the demand of the farmers by supplying 325 fattening piglets (75% crossbreds) and generated total revenue of Rs 6.30 lakhs during the year 2021-22. Crossbred pigs (75%) were produced by inter-se mating and their production, reproduction and carcass traits were studied. Artificial Insemination Programme has been continued to exploit the genetic potential of superior males

Fattening unit established by farmer (Mr. Dasan, Thrissur) with animals supplied from the centre

Fattening unit established by farmer (Mr.Francis Xavier, Palakkad) with animals supplied from the centre

Demonstration pen

Semen processing laboratory

Ankamali breed animals under AICRP Project

Sale of animals under AICRP Project at demonstration Pen

Water recycling

MEGA Seed Project

The Mega seed Project on Pigs was initiated in this Centre on 19-02-2015. Crossbred pigs (75%) were produced by inter-se mating. As per the technical programme, foundation stocks of indigenous pigs was established in the Centre and were used for cross breeding with Large White Yorkshire to evolve cross bred progenies. A total strength of 214 animals is maintained under the project and 518 piglets were produced. The centre has successfully fulfilled the demand of 46 farmers by supplying 454 fattening piglets (75% crossbreds) and also generated receipt of Rs. 10.82 lakhs including the sale of culled animals during the year 2021-2022. A comprehensive breeding schedule has been introduced for prompt selection / culling of the stock

Fattening unit established by the farmer (Shivaprasad, Perumbilavu P.O, Thrissur) using the animals supplied under the project

Fattening unit established by the farmer (Francis, Velur PO, Thrissur) using the animals supplied under the project

3. State Plan Projects

Sl. No	Name of Department/ Station	Title of Project	Total Outlay (Lakhs)
1	AICRP on Poultry for Eggs, Mannuthy	25per cent AICRP on poultry for eggs	24.00
2	AICRP on Poultry for Eggs, Mannuthy	Production and marketing of enriched eggs	10.00
3	AICRP on Poultry for Eggs, Mannuthy	Improving backyard poultry production by supplying crossbred chicks from improved hens	25.00
4	Animal Genetics and Breeding, CVAS, Pookode	Establishment of Bioinformatics Laboratory	8.00
6	Animal Nutrition, Mannuthy	Increasing the productivity of Cross breed Cattle at ULF & FRDS, Mannuthy	50.00
7	Animal Nutrition, Mannuthy	Strengthening of Analytical facilities of Animal Nutrition Department	8.00
8	Animal Nutrition, Mannuthy	Strengthening of rumen microbiology	5.00
9	Animal Nutrition, Pookode	Differential expression profile of FCR genes in broiler goat kids on soya bean based diet	8.00
10	Assistant Professor, Dept. of Animal Nutrition, Pookode	Establishment of Goat Nursery, semen preservation facility for the supply of kids in Wayanad District	12.00
11	Avian Research Station, Thiruvazhamkunnu	Developing waste management systems for effective utilization of farm, hatchery, feedmill and canteen waste	2.00
12	Base Farm, Kolahalamedu	Strengthening of Base Farm, Kolahalamedu as knowledge dissemination hub on latest technologies and innovations in dairy farming	55.00
13	Bioscience Research and Training Centre, Thiruvananthapuram	Laboratory at BRTC, TVM	30.00
14	Bioscience Research and Training Centre, Thiruvananthapuram	Capacity building programmes for various stakeholders of livestock sector	5.00

15	Bioscience Research and Training Centre, Thiruvananthapuram	Isolation and characterization of antibiotic resistant pathogens from chicken and raw milk samples of Thiruvananthapuram District	5.00
16	Bioscience Research and Training Centre, Thiruvananthapuram	Studies on Infectious bursal disease virus- host interactions	5.00
17	Bioscience Research and Training Centre, Thiruvananthapuram	Strengthening of Bioscience Research and Training Centre, Thiruvananthapuram	5.00
18	CAADECCS KVASU, Mannuthy	Livestock Advisory Based on Weather Forewarning	8.00
19	Centre for Advanced Studies in Poultry Science, Mannuthy	Conservation, characterization and popularization of native varieties of poultry in Kerala	30.00
20	Centre for Advanced Studies in Poultry Science, Mannuthy	Advanced Mycotoxin testing facility for poultry feed	8.00
21	Centre for Wildlife Studies, Pookode	Augmenting Academic/Training Activities of KVASU-CWS for Mitigating Adverse Effects of Climate Change and Human- Wildlife Conflict on Tribal People and Farmers of Wayanad	9.00
22	Clinical Medicine, Ethics and Jurisprudence, Mannuthy	Comprehensive health care of farm animals and pets- Mannuthy campus	8.00
23	Clinical Medicine, Ethics and Jurisprudence, Mannuthy	Establishment of a training hall for livestock farmers, entrepreneurs, veterinarians and para veterinarians	8.00
24	College of Dairy Science & Technology Kolahalamedu	Development of functional dairy foods	12.00
25	College of Dairy Science & Technology, Kolahalamedu	Development of Ready to Eat (RTE) based Functional Dairy	14.00
26	College of Dairy Science & Technology, Kolahalamedu	Technology Upgradation, Mechanisation, Shelf life enhancement of value addition of traditional dairy products of Kerala	14.00
27	College of Dairy Science and Technology, Pookode	Rheological characterization of locally available dairy products in Wayanad district.	8.00

28	College of Dairy Science and Technology, Pookode	Research on development of passion fruit juice incorporated low calorie ice-cream.	8.00
29	College of Dairy Science and Technology, Pookode	Development of antidiabetic whey jelly	4.00
30	College of Dairy Science and Technology, Pookode	Studies on extending shelf life and anti-oxidant properties of ghee using herbal isolates	4.00
31	College of Dairy Science and Technology, Pookode	Yeast Fermentation: Study on the symbiotic association of yeast and lactic acid bacteria in fermented milk products	4.00
32	College of Dairy Science and Technology, Pookode	Identification lactic phages from the dairy effluents and their effect on commercial starters	4.00
33	College of Dairy Science and Technology, Pookode	Enhancing milk production potential of genetically superior cows through scientific intervention for producing better progenies	3.00
34	College of Food Technology, Thumburmuzhy	Evaluation of bio-functional property of Nutmeg fruit and its utilization in the development of healthy drink	8.00
35	College of Food Technology, Thumburmuzhy	Process standardization of jackfruit enriched fermented and non fermented food products	8.00
36	College of Food Technology, Thumburmuzhy	Preparation of processed Rambutan pulp incorporated fruit beverages using seasonal and underutilized fruits in Kerala and study of the processing parameters and product properties	8.00
37	College of Food Technology, Thumburmuzhy	Development of fiber enriched muffins incorporating legumes and fruits.	8.00
38	College of Food Technology, Thumburmuzhy	Preparation of processed fruit beverages using seasonal and underutilized fruits in Kerala and optimization	8.00
39	Clinical Medicine, Ethics and Jurisprudence, Mannuthy	Comprehensive health care of farm animals and pets- Mannuthy campus	8.00
40	Department of Clinical Medicine, Ethics and Jurisprudence, Mannuthy	Establishment of a training hall for livestock farmers, entrepreneurs, veterinarians and para veterinarians	8.00

41	Department of Surgery and Radiology	Developing best anaesthetic practices and protocols for various classes of veterinary patients	8.00
42	Veterinary Physiology, Pookode	Assessment of health status of crossbred cattle during peripartum period and its impact on production performance	8.00
43	Statistics, CVAS, Mannuthy	Forecasting weather parameters and effects of disease outbreaks in Kerala	8.00
44	Poultry Science, Pookode	Establishing Breeder Farms in ILFC	12.00
45	Poultry Science, Pookode	Strengthening of Hatchery of poultry farm, ILFC, Pookode	10.00
46	Preventive Medicine, Mannuthy	Surveillance of infectious diseases, their management and seromonitoring of vaccination in university farm animals	8.00
47	Instructional Farm, Pookode	Strengthening of Fodder production at CVAS Pookode	15.00
48	Instructional Farm, Pookode	Establishment of Milk processing and packing unit at ILFC, Pookode	6.00
49	Instructional Farm, Pookode	Establishment of cow lift at ILFC, Pookode	2.50
50	Instructional Farm, Pookode	Establishment of TMR unit at ILFC, Pookode	13.00
51	Livestock Production Management	Assessing the performance of Murrah Buffalo Herd for Milk & Meat Production in Hot and Humid climate of Kerala	25.00
52	Livestock Production Management, CVAS, Mannuthy	Indicator based analysis of potentials and developing strategies for improving the livestock economy of the state	8.00
53	Livestock Production Management, CVAS, Mannuthy	Performance evaluation and need based intervention for enhancing production and productivity of Livestock enterprise	5.00
54	Livestock Production Management, CVAS, Mannuthy	Model bio-waste management by combined mechanical and biological process	5.00

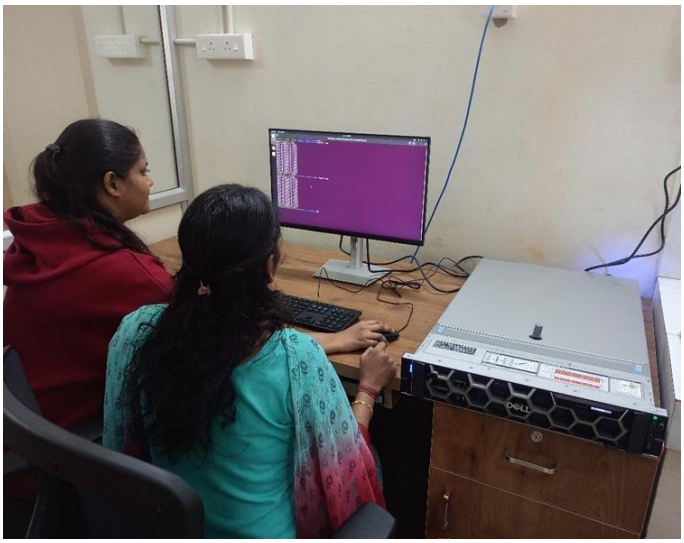
55	Livestock Production Management, Pookode	Strengthening of Pig farm and enhancing the production of quality piglets	8.00
56	Livestock Production Management, Pookode	Strengthening of Rabbit farm, ILFC, Pookode	6.00
57	Livestock Products Technology, Pookode	Mapping, standardisation and quality evaluation of traditional value added products from meat, poultry and egg in three southern districts (Pathanamthitta, Kollam and Thiruvananthapuram) of Kerala	8.00
58	Livestock Products Technology, Pookode	Mapping, standardisation and quality evaluation of traditional value added products from meat, poultry and egg in three southern districts (Pathanamthitta, Kollam and Thiruvananthapuram) of Kerala	8.00
59	Livestock Research Station, Thiruvazhamkunnu	Development of Silent Valley farm platform for sustainable livestock production	17.00
60	Livestock Research Station, Thiruvazhamkunnu	Conservation and evaluation of Malabari and Attappady Black goats	6.50
61	Poultry Science, CVAS, Mannuthy	Assessment of egg production, fertility and hatchability changes in crossbred chicken at different climatic conditions in Wayanad district and development of strategies to optimize chick number / breeder hen	8.00
62	Poultry Science, Pookode	Popularization of Backyard poultry in Wayanad	8.00
63	Poultry Science, Pookode	Hatchery waste disposal and its effective utilization.	4.00
64	Sheep and Goat Farm Mannuthy	Conservation and evaluation of Malabari and Attappady black goats	16.40
5	University Livestock Farm and Fodder Research and Development Scheme, Mannuthy	Strategies for Improving Fodder Production of Kerala State	22.00
65	University Veterinary Hospital, Kokkalai, Thrissur	Empowering Farm Animal Health care services for Enhancing Production	2.00

66	UVH, Kokkalai, Thrissur	Strengthening of Veterinary Clinical Laboratory at University Veterinary Hospital, Kokkalai.	6.00
67	Veterinary & Animal Husbandry Extension, Mannuthy	Revitalisation of the animal production sector in the post covid era through strengthening of farmer research linkages and optimisation or production, marketing and pricing strategies	8.00
68	Veterinary & Animal Husbandry Extension, Mannuthy	Strengthening of elephant study centre CVAS, Mannuthy for better welfare and conservation and of captive elephants in Kerala through efficient health care and management	5.00
69	Veterinary Anatomy, Pookode	Systemic anatomical studies on domestic and wild animals	8.00
70	Veterinary and Animal Husbandry Extension Education	Effect of COVID-19 pandemic on the livelihood of Dairy farmers of Wayanad district and measures for mitigation	8.00
71	Veterinary Biochemistry, Mannuthy	Assessment of antibacterial activities of goat lactoferrin conjugated silver nanoparticles	8.00
72	Veterinary Biochemistry, Pookode	Characterization and comparative antibiogram analysis of drug resistant *E.coli* isolates recovered from poultry settings	8.00
73	Veterinary Epidemiology and Preventive Medicine, Pookode	Preventive healthcare programme for livestock in rural areas of Wayanad district with special emphasis to mastitis and haemoprotozoan diseases”	8.00
74	Veterinary Microbiology, Mannuthy	Development of multiplex polymerase chain reaction assays for the detection of respiratory pathogens in goats and dogs-	81.00
75	Veterinary Microbiology, Mannuthy	Development of multiplex polymerase chain reaction assays for the diagnosis of common bacterial and viral agents associated with respiratory infections in goats and dogs	8.00

76	Veterinary Parasitology, CVAS, mannuthy	Detection and molecular characterisation of genes associated with drug resistance in nematodes and ticks affecting livestock of Kerala	8.00
77	Veterinary Parasitology, Mannuthy	Detection and molecular characterisation of genes associated with drug resistance in nematodes and ticks affecting livestock of Kerala	8.00
78	Veterinary Parasitology, Pookode	A recombinant antigen based ELISA for the detection of *Babesia gibsoni* infection in canine from northern zone of Kerala	8.00
79	Veterinary Pathology, Mannuthy	Project proposal for definitive diagnosis of common swine and canine diseases including canine tumours	8.00
80	Veterinary Pharmacology and Toxicology, CVAS, Mannuthy	Formulation of low cost plant based nanoparticle incorporated hydrogel with antibacterial wound healing activities for the treatment of wounds in animals	8.00
81	Veterinary Public Health, CVAS, Mannuthy	Spatial modeling of leptospirosis and antimicrobial resistance of foodborne pathogenic bacteria from beef and milk samples in Central Kerala	8.00
82	Veterinary Public Health, CVAS, Mannuthy	Strengthening of NABL accredited Quality Control Laboratory	4.00

Establishment of bioinformatics laboratory

A bioinformatics laboratory was established at the Department of Animal Genetics and Breeding. Under this project a Dell precision 7920 rack XCTO base workstation with Intel Xeon Silver 4216 processor, 2.1 GHz, 22 MB Cache 128 GB DDR4 RAM, and 10 TB disk space was procured. New 12 V 75AH C-10 batteries were procured for providing electric supply when there is no power. This project was a continuation of the state plan project 2020-21. Now the bioinformatics laboratory has 13 high end desktops which were procured under state plan 2020-21 and a desktop workstation. Training for postgraduate students on basic bioinformatics tools have been conducted and further more training are being scheduled. The workstation is used for the analysis of data generated from omics experiments.



Bioinformatics workstation at department of Animal Genetics and Breeding, CVAS, Pookode, Wayanad

Established pet food manufacturing unit

Objectives is to Developing balanced diet for different categories of pets and providing wholesome pet food to the pet lovers at reasonable cost. A state of art model for commercial pet food production is established. A pet food is formulated and developed for dogs. The pet food is tested for its food safety aspects and quality under storage conditions. The unit will provide basic knowledge to students and future entrepreneurs who are interested in the pet food industry.

Detection and molecular characterisation of genes associated with drug resistance in nematodes and ticks affecting livestock of Kerala

Benzimidazole resistance polymorphisms were detected in *Haemonchus* spp. from 6 organised goat farms in Thrissur by Real time PCR. This could confirm the resistance status in GI nematodes of goats. The use of Real Time PCR permitted simultaneous detection and quantification of resistance polymorphisms from pooled larval samples which made the process simpler and rapid. Molecular detection of deltamethrin resistance was done in cattle and dog ticks by PCR.

Project proposal for definitive diagnosis of common swine and canine diseases including canine tumours

Important swine diseases like PRRS, Parvo and Circo viral diseases were identified by PCR and IHC. Pathological features and the mechanism of immunosuppression in these conditions were elucidated. Molecular signaling pathways and stromal signaling were studied in canine mammary tumours.

Increasing the productivity of cross bred cattle at ULF & FRDS, Mannuthy

Improving the production efficiency of animals and the farm attained the highest milk production even in the history of 1250L/day during the month of November 2021. Technique of ensiling using silage bags with different additives were carried out and its effect on the feeding and production were studied. Doctoral and Masters Research were carried out with discipline like animal nutrition, animal physiology and livestock production management. Internship training to the students of BVSc & AH, B Tech Dairy Science were carried out. Simultaneously farmers were also trained in the modern aspects of dairy production.

Assessing the performance of Murrah buffalo herd for milk & meat production in hot and humid climate of Kerala

Sprinkler on the roof top of sheet were installed for alleviating heat stress on sheets. The hormonal levels of estrogen and progesterone were evaluated in Buffaloes. Training was carried out to internship students of BVSc & AH, BTech Dairy Science as well as farmers throughout the year.

Strategies for improving fodder production of Kerala state

Standardising the fertilisation practices was carried out on fodder production. Introduction of new varieties like hybrid Guniea Australian Napier and Super Napier under fodder plots was done and its yield and chemical composition were studied. Silage making was also practised

using silage bags and studied their chemical composition. Training to the internship students of BVSc & AH and BTech Dairy Science and farmers were carried out.

Spatial modeling of leptospirosis and antimicrobial resistance of foodborne pathogenic bacteria from beef and milk samples in central Kerala

Beef and milk samples were collected from central Kerala (Palakkad, Thrissur and Ernakulam) were subjected to the isolation of *E. coli*, *Salmonella* spp., *Campylobacter* spp. and *Klebsiella* spp. Only *E. coli* could be isolated from the beef samples. On studying the antibiogram of the samples, resistance was detected to Ampicillin and Cefotaxime in 88.26 per cent each, 76.47 per cent to Tetracycline and 64.70 per cent to Erythromycin. The genes *bla*TEM and *bla*CTXM were detected in 46.67 and 40 per cent respectively from ampicillin and cefotaxime resistant isolates. Tetracycline resistance genes were detected in 61.5 (tet*A*) and 38.46 (tet*B*) per cent isolates. Based on the data collected for the period 2015-2020 from different sources *Viz*., Directorate of health services, Kerala, Meteorological data from regional Agricultural Research stations, KAU, Livestock Census data (2019), Human census data (2011), Human Leptospira cases were significantly higher in central and southern districts of Kerala with more cases during the post monsoon period during the period 2016 and 2018. Seroprevalence of Leptospira in apparently healthy cattle in two panchayats of Alappuzha revealed a seropositivity of 40 per cent**.**

Advanced mycotoxin testing facility for poultry feed

About 300 samples of feed ingredients/ compounded feed were subjected to rapid estimation for aflatoxin B1 by ELISA method. Samples received from farmers/public and also research scholars of KVASU were screened for aflatoxin B1.

Conservation, characterization and popularization of native varieties of poultry in Kerala

Transcriptome analysis of pectoral muscle of Kuttanad meat line, Kuttanad control population and meat type Pekin ducks were done and the results were analysed and the Differentially Expressed Genes (DEGs) responsible for growth and also their SNPs were identified. They can be used as candidate genes for genomic selection in future.

Development of Silent Valley farm platform for sustainable livestock production

The project aims to develop and maintain a system to conduct long term experiments in ruminant farming. The platform will also develop fodder plots using a micro watershed based management approach to improve water conservation. Earthen bunds were constructed to

promote percolation and to channel drainage into the pond in the campus. In connection with the project, hybrid Napier varieties like CO-3, CO-5, Super Napier and Australian Napier were tested under trench and pit method of cultivation.

Paving of coir pith blocks

Conservation and evaluation of Malabari and Attappady black goats

Even though the total number of goats maintained under the project during 2021-22 was nearly 200, the floor space in the sheds was limited. The housing of nursing does and bucks emerged as an important infrastructure limitation. Therefore a new shed with provision five partitions to house bucks or nursing sows and a feed store were constructed. A backup water supply tank was also installed. The civil work was completed except for the installation of slatted floors.

Feed store and water tank

Doe/Buck shed

Forecasting weather parameters and effects of disease out breaks in Kerala

The precipitation profile of Kerala in the last 30 years (1991-2020) was analysed and it revealed that the highest monthly rainfall was recorded in the month of June whereas the lowest in January. Monthly rainfall forecast of the year 2022 for the state of Kerala revealed that rainfall would be high in July and low in February. Neural Network Autoregressive Model was used for rainfall forecasting. During the period 1991-2020 the highest rainfall was recorded in Idukki district in the year 2005 (5707 mm) and the lowest rainfall was recorded in

Thiruvananthapuram district in the year 2012 (1154.4 mm). Annual rainfall expected in the year 2022 in Kerala is 2953.56 mm.

In order to model and forecast the spread of COVID-19 in Kerala, available data on number of daily confirmed cases, recovered cases and number of deaths due to COVID-19 from 19th March 2020 to 11th February 2022 in Kerala and in its different districts were collected from the official website of the government of Kerala. The data revealed a non-linear trend and using Neural Network Autoregressive Model forecasts for the period 12th February 2022 to 18th February 2022 for Kerala and its different districts was done.

Differential expression profile of FCR genes in broiler goat kids on soya bean based diet

Differential expression profiling of Malabari kids fed on soya bean based kid starters was carried out and a total expenditure of Rs.3,05,277/- was incurred. It was found that rearing of Malabari kids on such a diet was found to have better FCR and provided economic benefits.

Assessment of egg production, fertility and hatchability changes in crossbred chicken at different climatic conditions in Wayanad district and development of strategies to optimize chick number / breeder hen

Main objective of this study was to understand the effect of different climatic conditions affecting egg production performance of crossbred chicken and hatchability patterns in different seasons. Data related to climatic conditions (temperature, relative humidity etc), egg production performance of the flock (Gramasree), hatchability etc are being monitored on a regular basis. November 2021 - January 2022 (winter), March 2022- May 2022 (summer) and July 2022 - September 2022 (Monsoon) were the time periods fixed for evaluation. Monsoon study is still going on. Analysis of samples already collected from the flock is progressing in the Department of Poultry Science utilizing the necessary chemicals and equipment purchased from the fund sanctioned.

Effect of COVID-19 pandemic on the livelihood of dairy farmers of Wayanad district and measures for mitigation

The research work was carried out among selected dairy farmers from three Taluks of the Wayanad district namely Vythiri, Sulthan Bathery and Manathavady. Based on the milk production data from secondary sources two top milk-producing dairy cooperative societies were identified from each Taluk. Theneri & Thariyodu Cooperative societies were selected from Vythiri Taluk, Sulthan Bathery and Meenenagadi Cooperative societies were selected from Sulthan Bathery Taluk and from Mananthavadi Taluk, Mananthavady and Kattimoola milk cooperative societies were selected for the study. A pretested, structured interview

schedule was prepared and a pilot study was conducted. Moreover, step-wise online webinars and interactive sessions were organised for farmers in connection with this project. Various mitigation strategies taken by dairy farmers for reducing economic losses during the COVID-19 pandemic were discussed during the session. An effective farmer- scientists interaction happened with the installation of digital communication facilities established in the department under this project.

Online lectures for livestock farmers conducted by Department of Veterinary and Animal Husbandry Extension Education

Characterization and comparative antibiogram analysis of drug resistant E.coli isolates recovered from poultry settings

The proposed project envisaged to study the transmission dynamics of antibiotic resistance in poultry settings. In the recent past, extended-spectrum beta lactamase (ESBL)-producing *Escherichia coli* is emerging at a rapid pace in the food production chain. The present study analysed the occurrence of ESBL-producing *E.coli* in the broiler chicken shops in and around Wayanad district to detect its possible presence in the food chain. The samples were collected aseptically from various broiler chicken shops located at Mananthavady, Sulthan Bathery and Vythiri taluk, and subjected to isolation and identification for the presence of *E. coli* and confirmed by PCR. The recovered isolates were further subjected to phenotypic (double disc test) and genotypic (PCR employing bla_{SHV}, bla_{CTXM} and bla_{TEM}) assays. On phenotypic

analysis, out of the 44 recovered isolates, 19 (43.18 per cent) were found positive for ESBL-producing *E. coli*. Further, the genotypic analysis yielded positivity in 38.60 per cent (17/44) and 31.80 per cent (14/44) of the *E. coli* isolates by bla_{CTXM} and bla_{TEM} genes, respectively; however, none of the isolates were found positive for bla_{SHV}. This study could establish the presence of ESBL-producing *E. coli* in the food chain and could serve as a baseline data, which may help in studying the evolution of ESBL-producing *E. coli* in the broiler sector of the state.

A recombinant antigen based ELISA for the detection of *Babesia gibsoni* infection in canine from northern zone of Kerala

A new recombinant antigen based ELISA for the detection of *Babesia gibsoni* was standardised. Out of 109 sera samples from dogs of northern zone of Kerala, screened for the presence of antibodies against *B. gibsoni* with this new recombinant antigen based ELISA revealed 63 positive cases.

Assessment of health status of crossbred cattle during peripartum period and its impact on production performance

The animals for the research were selected from the Instructional Livestock farm of CVAS, Pookode. Animals which are one month prior to calving were selected for the study and collected the blood, hematological parameters were analysed. Serum was separated in the laboratory and stored at -20°C for further oxidative stress analysis and mineral assay.

Augmenting academic/training activities of Centre for Wilf life Studies for mitigating adverse effects of climate change and human-wildlife conflict on tribal people and farmers of Wayanad

Studies were conducted on various aspects of wildlife science including nesting status of White Bellied Sea Eagle, butterfly diversity, antibiotic resistance of Salmonella in captive snakes, communal roosting behavior of water birds, nesting ecology of Woolly Necked Stork, age determination in Asian elephants, surgical management of spinal injury in snakes *etc.*

One of the highlights of the research activities of the Centre during 2021-22 was a study comparing the effectiveness of two different organic wild animal repellents in the farmland of farmers suffering from human-wildlife conflict in Vythiri Panchayath of Wayanad. These repellents were found to be effective in reducing wildlife activity in the farm land.

Field visit to a farmland in Vythiri Panchayath interacting with a farmer suffering from human-wildlife conflict, along with an elected public representative

Fixing of camera trap for studying human-wildlife conflict in farm land at the study site

Hatchery waste disposal and its effective utilization

A prototype machine has been showcased for the farmers to dispose of hatchery waste effectively. A model unit in the University which is running on solar energy. Around 100 kg organic fertilizer will be produced initially. Trials using Thumboormuzhi model aerobic composting are also being done.

Renovation of processing /utility sessions in KVASU dairy plant

Renovated the processing and utility sessions of KVASU dairy plant by installing equipments like can scrubber, ice cream freezer cum churner, nozzle atomizer and pedal operated liquid filling machine. Measures were taken to improve the quality and hygiene of the plant activities by making available provisions for sanitization, aseptic environment for quality evaluation of milk and milk products, personal hygiene utilities like head cap, mask and gloves.

Strengthening of quality assurance laboratory of KVASU dairy plant

Refurbished the quality control laboratory to improve the facilities for quality analysis of milk and milk products. Also upgraded the research and development facilities available in the dairy plant**.**

Livestock advisory based on weather forewarning

Provided advisory services to the farmers in collaboration with KAU. Improved the research facilities of the CAADECCS for conducting climate-related researches. The outcomes of

these researches will be conveyed to the farmers. Submitted articles in newspapers and conducted radio talks. Trained veterinary professionals from Animal Husbandry Department, Kerala on climate smart animal husbandry practices. Conducted an online National Seminar in collaboration with MANAGE, Hyderabad for veterinary professionals and students all over the country on "climate smart diarying". Nearly 300 participants from all over the country participated in the programme. The compendium was published as e-book. A malayalam textbook on "climate change - animal husbandry.

Empowering farm animal health care services for enhancing production

Extended services for early identification and management of diseases in farm animals to improve production in farm animals was achieved in this project. Additional care to 200 dairy cattle a year may help recovery from diseases and regaining production, which otherwise would have been lost permanently. Production in 200 cows regained on an average of 8 lit of milk per day per cow, for an average period of 5 months.200 cows x 8 liters x 150 days x Rs. 25/- per lit of milk = Rs. 6, 00, 000. 00 added to the economy of 200 farmers.

Strengthening of veterinary clinical laboratory at university veterinary hospital, Kokkalai

Establishment of a well-equipped diagnostic referral laboratory for prompt diagnosis of animal diseases catering the needs of the entire state. Also it is envisaged to satisfy the instructional and research needs of the students. Laboratory examination of clinical samples of about 200 cows in a year may help curing diseases and regaining production, which otherwise would have been lost permanently. Production in 200 cows regained an average of 8 lit of milk per day per cow, for an average period of 5 months. 200 cows x 8 liters x 150 days x Rs. 25/- per lit of milk = Rs. 60, 00, 000. 00 added to the economy of farmers. Andry sector" was prepared and submitted for publication.

Development of antidiabetic whey jelly

The plant based herbal drugs are emerging as the primary components of holistic approaches of diabetes management. We assessed the antioxidant and antidiabetic potential of the passion fruit leaf/Guava leaf extract and developed antidiabetic whey jelly by the incorporation of the potential plant extract. Whey is the principal by-product in dairy industry which is rich in protein and lactose. Development of whey jelly incorporated with herbal antidiabetic isolates will deliver antidiabetic product which can be consumed by all age groups.

Studies on extending shelf life and anti-oxidant properties of ghee using herbal isolates.

Ghee, an Indian name for clarified butterfat, has unique pleasing flavour and grainy texture and is considered as supreme cooking and frying medium. The major spoilage that occurs in ghee is development of off-flavors during storage due to autoxidation. Its quality is also deteriorated during deep frying due to thermal oxidation. Hence, we evaluated the oxidative and thermal stability of ghee incorporated with natural antioxidants in the form of pepper extract, ginger extract and curry leaves extract. Based on the results of this study, it is suggested that pepper extract or ginger extract or curry leaves extract could be used as a source of natural antioxidants for extending shelf life and thermal stability of ghee. Study on the symbiotic association of yeast and lactic acid bacteria in fermented milk products

Enumerated the yeast and lactic acid bacteria ratio present in naturally fermented milks. Isolated and characterized wild strains of yeast from fermented milks. Developed cereal based fermented milk products using yeast lactic acid bacteria consortium.

Identification lactic phages from the dairy effluents and their effect on commercial starters

Screened dairy effluents like raw milk, whey and waste water from effluent treatment plant for the presence of bacteriophages. Isolated and identified phages from effluent samples. Screened commercial starter culture for phage sensitivity.

Rheological characterization of locally available dairy products in Wayanad district

An understanding of the rheological properties of food materials has a direct effect on the optimization of processing stages such as production, handling, storage, and final quality. Understanding the relationship between structure and rheology is crucial for the design of food products with tailored mechanical functionality. Ten types of dairy product samples were collected from the different areas of Wayanad district. The samples include, curd, burfi, peda, gulab jamun, cheese, ghee, butter, paneer, milk powder and milk. In order to ensure the variation in samples, conscious decision is made to select local and branded products. The products were categorised and subjected to following major rheological analyses. Viz., Liquid products- Viscosity, Solid products -Texture Profile Analysis and Granular Products- Bulk density, From the results it has been concluded that, most of the branded products comply with the standards. Some of the locally made products were exceptionally good but many of the samples are not up to the standard.

Research on development of passion fruit juice incorporated low calorie ice- cream

This study investigated the effect of passion fruit juice incorporation in low calorie ice cream. Development of low calorie passion fruit ice cream was conducted through the analysis of a series of sensory, chemical and microbiological aspects. The optimum level of addition of passion fruit juice and aspartame in ice cream were determined. The proximate composition and energy value of the optimized product were also analysed.

Development of functional dairy foods

During the Financial Year 2021-22, under 3 research projects 'Development of functional dairy foods', 'Development of Ready to Eat (RTE) based Functional Dairy', 'Technology Upgradation, Mechanisation, Shelf life enhancement of value addition of traditional dairy products of Kerala' in the department of dairy technology, Skid mounted pasteuriser, ice-cream freezer, kulfi making machine khoa vat , milk packing machine etc. were purchased. Under 'Strengthening of the laboratory facilities in the Dairy Microbiology' BOD incubator, refrigerators and various chemicals and culture media were purchased, these are being utilized for conducting research and students practicals.

Evaluation of bio-functional property of nutmeg fruit and its utilization in the development of healthy drink

Nutmeg fruit was explored for its utilization in functional food industry and also an effective waste utilization in the nutmeg cultivation. Nutraceutical potential of nutmeg was evaluated and is utilized for production of different value added food products like candy, syrup, jam. Addition of 20-30 per cent concentration of nutmeg fruit pulp got maximum sensory acceptability for the products.

Process standardization of jackfruit enriched fermented and non fermented food products

Jackfruit seed makes up around 10 to 15per cent of the total fruit weight & have high carbohydrate and protein contents. Due to the lack of processing and preservation techniques, huge amount of jackfruit seeds is destroyed in India. So jackfruit seeds are explored for its high amount of protein and carbohydrate. Fermented milk product namely yogurt enriched with jackfruit seed powder was prepared and optimized for its contents. Jackfruit enriched chocolate spread was also developed in this project.

Development of fiber enriched muffins incorporating legumes and fruits

Owning to their variety, availability, and nutrient composition, legumes have been an important part of diet globally. Dietary fibre content, protein content, antioxidant activity and the total phenols of the muffins can be increased by the addition of the legume, simultaneously providing value addition to the underutilized legumes. Preparation of muffin

incorporated with horsegram flour at various levels and replacement of refined sugar with jaggery were done and optimized and analysed for its composition. Muffins with improved dietary and fibre and protein content could be prepared with added diversification for horsegram flour.

Preparation of processed fruit beverages using seasonal and underutilized fruits in Kerala and optimization

Different underutilized fruits and vegetables available seasonally in and around Kerala provides immense opportunities in value addition with blending and beverage production with familiar fruits. It also increases the nutritional values of the beverages. Bilimbi (*Averrhoa bilimbi*) an underutilized fruit, generally used in less amounts due to its oxalic acid was blended with orange juice simultaneously treating the bilimbi through various methods to reduce the oxalic acid levels, resulting in the beverage combination with significantly reduced oxalic acid content and improved ascorbic acid content.

Preparation of processed rambutan pulp incorporated fruit beverages using seasonal and underutilized fruits in Kerala and study of the processing parameters and product properties

Rambutan is a tropical fruit crop that has recently gained popularity in Kerala as a delicacy among the fresh fruits grown and savored by many. Being a seasonal crop, the formulation of various beverages incorporating the various seasonal crops and fruits can realise its potential, adding value while imparting the nutritious benefits to the products. Different combinations of rambutan pulp incorporated beverages were prepared and tested for acceptance to optimize the composition to develop a healthy and nutritious beverage

Developing waste management systems for effective utilization of farm, hatchery, feedmill and canteen waste"

The project was sanctioned to ARS, Thiruvazhamkunnu with a budget outlay of 2 Lakhs. The amount was utilized for maintenance of incinerator for handling various solid waste generated in ARS & CASM. Disposal pit was constructed in poultry farm complex for scientific disposal of dead birds after post mortem examination. A sock pit was constructed for leaching of water from the biogas slurry.

Capacity building programmes for various stakeholders of livestock sector

A total of 50 Dairy farmers attended the training programme. The farmers were trained on topics of Dairy cow nutrition. The farmers were provided with KVASU cattle feed- type II

(20 kgs) and mineral mixture (2 kgs). Feed-back was collected from the farmers regarding the training programme, their interest to procure the cattle feed and mineral mixture, topic of interest for future training and suggestions. The training classes were stated to be good to very good, which showed that the farmers are interested in the training classes and enthusiastic to learn. Out of the 50 farmers who attended the programme 71per cent were interested to buy the feed and mineral mixture.

Training for dairy farmers

Isolation and characterization of antibiotic resistant pathogens from chicken and raw milk samples of Thiruvananthapuram district

Fifteen meat samples were collected from different retail meat shops within Thiruvananthapuram district. Thirty milk samples were collected from different societies within Thiruvananthapuram district. The samples were subjected to bacteriological examination and organisms were isolated. Antibiogram was performed with the isolated bacteria to study the AMR pattern.

Surveillance of infectious diseases, their management and seromonitoring of vaccination in university farm animals

Regular screening of the animals in the farms of KVASU revealed high prevalence of haemoparasites among both cattle and goats. Monitoring of post vaccinal seroconversion for FMD vaccine revealed protective antibody response among all vaccinates

Studies on Infectious Bursal Disease virus-host interactions

Tissue samples from suspected cases of Infectious bursal disease were collected and subjected to RT-PCR for confirmation. Viral isolation was attempted using the positive samples. Experiments are being conducted to adapt the virus in the DF-1 cell line.

Development of multiplex polymerase chain reaction assays for the diagnosis of common bacterial and viral agents associated with respiratory infections in goats and dogs

Standardised multiplex PCR assay for detecting common bacterial and viral respiratory pathogens in goats and dogs. Samples collected from goats and dogs were screened using the assay

4. PhD, PG and B.Tech Projects

Sl. No	Title of the Thesis/Dissertation	Degree conferred	Department
1	Antineoplastic activity of baicalein and piperlongumine nanoparticles	Ph.D	Veterinary Pharmacology and Toxicology, Mannuthy
2	Production, quality attributes and consumption pattern of ethnic goan pork sausages	Ph.D	Livestock Products Technology, Pookode
3	Development of a blueprint for consumer handling of buffalo meat for optimum quality	Ph.D	Livestock Products Technology, Mannuthy
4	Institutionalised livestock service delivery system in Kerala	Ph.D	Veterinary and Animal Husbandry Extension, Mannuthy
5	Nutrient recycling potential of fly larvae for biowaste management	Ph.D	Livestock Production and Management, Mannuthy
6	Diagnosis and management of cardiovascular-renal axis disorder subtype H in dogs	Ph.D	Clinical Medicine, Ethics and Jurisprudence, Mannuthy
7	Detection of drug resistant and biofilm forming food borne pathogenic bacteria in retail chicken and mitigation using plant extracts	Ph.D	Veterinary Public Health, Mannuthy
8	Occurrence and molecular characterisation of Campylobacter spp. in sea foods and associated environment of Kerala and control of biofilm formation	Ph.D	Veterinary Public Health, Mannuthy
9	Streamlining surgical approaches of skin and mammary tissue / subcutaneous neoplasms in dogs with special reference to neo-adjuvant and adjuvant chemotherapeutic protocols	Ph.D	Department of Veterinary Surgery and Radiology, Mannuthy
10	Aetiology and therapeutic management of theileriosis in goats	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy
11	Antifungal resistance of dermatophytes isolated from dogs	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy

12	Antineoplastic activity of silver nanoparticles biosynthesised from seeds of *sesamum indicum* (sesame) in Dalton's lymphoma ascites	M.V.Sc	Veterinary Pharmacology and Toxicology, Mannuthy
13	Bacterial etiology of infertility in dogs with special reference to brucellosis	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy
14	Clinico-biochemical and molecular investigations of haemolytic anaemia in dogs	M.V.Sc	Veterinary Clinical Medicine, Ethics and Jurisprudence Mannuthy
15	Comparative study of berberine and capsaicin as efflux pump inhibitors in quinolone resistant *Staphylococcus aureus* isolates from bovine mastitis	M.V.Sc	Veterinary Pharmacology and Toxicology, Mannuthy
16	Cytotoxic, carcinogenic and genotoxic effects of carbosulfan in cultured mammalian cells	M.V.Sc	Veterinary Pharmacology and Toxicology, Mannuthy
17	Detection of elephant endotheliotropic herpes virus in Asian elephants (*Elephas maximus*)	M.V.Sc	Veterinary Epidemiology and preventive Medicine, Mannuthy
18	Development of copro-polymerase chain reaction for detection of economically important gastrointestinal strongyles in goats	M.V.Sc	Veterinary Parasitology, Mannuthy
19	Effect of reduced dietary crude protein supplemented with limiting amino acids on growth and carcass characteristics of Gramasree male chicks	M.V.Sc	Poultry Science, Mannuthy
20	Evaluation of omentum-based extra cellular matrix scaffolds for soft tissue repair	M.V.Sc	Veterinary Pathology, Mannuthy
21	Genetic variability and virulence factors of *Malassezia pachydermatis* isolated from dogs	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy
22	Identification of genes encoding extended spectrum beta lactamase production in *Escherichia coli* and *Klebsiella spp.* associated with bovine coliform mastitis	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy

23	Immunohistochemical analysis of P7056 kinase protein in superficial tumours of dogs	M.V.Sc	Veterinary pathology, Mannuthy
24	Molecular detection of virulence factors in S*taphylococcus aureus* associated with bovine mastitis	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy
25	Screening for methicillin resistant S*taphylococcus aureus* associated with caprine mastitis	M.V.Sc	Veterinary Epidemiology and preventive medicine, Mannuthy
26	Screening for parasitic infections among exotic and zoo birds	M.V.Sc	Veterinary Epidemiology and preventive Medicine, Mannuthy
27	Aetio-pathology of canine diarrhoea caused by enteropathogens	M.V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy
28	Antineoplastic activities of lactoferrin from Malabari goat	M.V.Sc	Veterinary Biochemistry, Mannuthy
29	Assessment of size evaluation methods in crossbred cattle of Kerala	M.V.Sc	Animal Genetics and Breeding, Mannuthy
30	Assessment of the livestock biodiversity management system under selected local self governments of Kerala	M.V.Sc	Veterinary Clinical Medicine, Ethics and Jurisprudence, Mannuthy
31	Association of Butyrophilin gene polymorphisms with milk yield and fat per cent in crossbred cattle of Kerala	M.V.Sc	Animal Genetics and Breeding, Mannuthy
32	Characterisation of bovine integrin beta 6 gene and analysis of its expression with reference to foot and mouth disease	M.V.Sc	Animal Genetics and Breeding, Mannuthy
33	Comparative efficacy of fermented soybean meal, probiotics and organic acids on growth performance in broilers	M.V.Sc	Poultry Science, Mannuthy
34	Development and evaluation of pet treat incorporating buffalo byproducts	M.V.Sc	Livestock Products Technology, Mannuthy
35	Development of organic briquettes from slaughter house	M.V.Sc	Livestock Products Technology, Mannuthy

36	Effect of feeding black soldier fly (*Hermetia illucens*) larvae meal on performance of meat type ducks	M.V.Sc	Poultry Science, Mannuthy
37	Effectiveness of illuminated fly traps for the control of dipteran biting fly annoyance in dairy farms	M.V.Sc	Livestock Production Management, Mannuthy
38	Evaluation of candidate genes associated with canine mammary tumour	M.V.Sc	Animal Genetics and Breeding, Mannuthy
39	Evaluation of oxidative stress in anaemia associated with haemoprotozoan infections in dogs	M.V.Sc	Veterinary Physiology, Mannuthy
40	Evaluation of rabbit farming under different management conditions	M.V.Sc	Livestock production Management, Mannuthy
41	Expression profiling of candidate genes affecting post thaw sperm parameters in Vechur cattle of Kerala	M.V.Sc	Animal Genetics and Breeding, Mannuthy
42	Expression profiling of Ecto-Nox disulfidethiol exchanger 2 (ENOX2) gene in response to heat stress in goats	M.V.Sc	Animal Genetics and Breeding, Mannuthy
43	Impact of enrichment of grazing meadow with automated water trough on the welfare of crossbred cattle	M.V.Sc	Livestock Production and Management, Mannuthy
44	Improving efficiency of production in early lactating dairy cows through augmentation of rumen biomass production	M.V.Sc	Animal Nutrition, Mannuthy
45	Livelihood security of dairy farmers affected by Kerala flood 2018	M.V.Sc	Veterinary and Animal Husbandry Extension, Mannuthy
46	Molecular characterisation and expression profiling of vasorin gene in native goats of Kerala	M.V.Sc	Animal Genetics and Breeding, Mannuthy
47	Protective effect of aqueous fraction of alcoholic extract of *Tamarindus indica* seed coat on acetaminophen induced hepatotoxicity in rats	M.V.Sc	Veterinary Pharmacology and toxicology, Mannuthy

48	Ultrasonographic ocular biometry for diagnosis of ophthalmic disorders in dogs	M.V.Sc	Veterinary Surgery and Radiology, Mannuthy
49	Wound healing activity and dermal pharmacokinetics of borneol incorporated k-Carrageenan hydrogel in diabetic wound model in rats	M.V.Sc	Veterinary Pharmacology and toxicology, Mannuthy
50	Comparative molecular phylogeny of Nilgiri langur (*Trachypithecus johnii*) using mitochondrial cytochrome B (CYTB) gene	M.V.Sc	Animal Genetics and Breeding, Pookode
51	Dermatological disorders in goats with special reference to mange and dermatophytosis	M.V.Sc	Veterinary Clinical Medicine, Ethics and Jurisprudence, Pookode
52	Molecular characterization of Vp1 gene of virulent infectious bursal disease virus from Kerala	M.V.Sc	Veterinary Microbiology, Pookode
53	Effect of supplementation of *Aspergillus oryzae* and leaf extract of *Psidium guajava* on growth and nutrient utilisation in crossbred female calves	M.V.Sc	Animal Nutrition, Pookode
54	Dietary incorporation of raw banana peel silage on growth and nutrient utilization in weaned Malabari kids	M.V.Sc	Department of Animal Nuitrition, Pookode
55	Histomorphology and Ultrastructure of thyroid and adrenal glands in Large White Yorkshire pigs reared at high and low altitudes	M.V.Sc	Department of Veterinary Anatomy, Pookode
56	Management of Feline lower urinary tract disease	M.V.Sc	Department of Clinical Medicine, Ethics and Jurisprudence, Mannuthy
57	Storage lesion and post transfusion studies of canine packed red blood cells using saline-adenine-glucose-mannitol additive in citrate-phosphate-dextrose-adenine solution	M.V.Sc	Department of Clinical Medicine, Ethics and Jurisprudence, Mannuthy
58	Suitability of saline-adenine-glucose-mannitol additive in citrate-phosphate-dextrose-adenine for storing packed red blood cells of goats	M.V.Sc	Department of Clinical Medicine, Ethics and Jurisprudence, Mannuthy

59	Evaluation of renal resistive index in dogs with acute and chronic renal disease	M.V.Sc	Department of Clinical Medicine, Ethics and Jurisprudence, Mannuthy
60	Clinico-pathological investigations on thrombocytopaenic dogs with haemostatic disorders	M.V.Sc	Department of Clinical Medicine, Ethics and Jurisprudence, Mannuthy
61	Genotypic characterisation of infectious bronchitis virus from Kerala	M.V.Sc	Veterinary Microbiology, Mannuthy
62	Histomorphology and physico-chemical evaluation of raw and decellularised tunica vaginalis of buffalo as a promising biomaterial in regenerative medicine	M.V.Sc	Veterinary Anatomy, Mannuthy
63	Occurrence of Campylobacter spp. in duck, quail, backyard chicken and associated environmental samples	M.V.Sc	Veterinary Public Health, Mannuthy
64	Isolation and identification of extended spectrum beta lactamase (ESBL) producing Klebsiella pneumoniae and Salmonella spp. from environmental samples	M.V.Sc	Veterinary Public Health, Mannuthy
65	Cloacal carriage and antimicrobial resistance profiling of extended spectrum beta-lactamase producing Escherichia coli and salmonella enteritidis in broiler chicken	M.V.Sc	Veterinary Public Health, Mannuthy
66	Isolation and molecular characterization of Escherichia coli pathotypes in drinking water and identification of the possible sources of contamination	M.V.Sc	Veterinary Public Health, Mannuthy
67	Detection of pathogenic leptospires in slaughtered cattle of Thrsssur	M.V.Sc	Veterinary Public Health, Mannuthy
68	Detection of colistin and quinolone resistant Salmonella enterica from poultry processing line	M.V.Sc	Veterinary Public Health, Mannuthy
69	Effect of partial replacement of soyabean meal with spent brewer's grain in broiler ration, supplemented with and without enzymes	M.V.Sc	Animal Nutrition, Pookode

70	Management of fracture of long bones using string of pearls plating technique in dogs	M.V.Sc	Veterinary Surgery and Radiology, Mannuthy
71	B-mode ocular ultrasonography for diagnosis and treatment evaluation in management of glaucoma in dogs	M.V.Sc	Veterinary Surgery and Radiology, Mannuthy
72	Comparison of multimodal anaesthesia protocols with isoflurane and sevoflurane maintenance in geriatric canine patients.	M.V.Sc	Veterinary Surgery and Radiology, Mannuthy
73	Comparative efficacy of 4 – aminopyridine and polyethylene glycol in combination with methyl prednisolone sodium succinate for the treatment of spinal cord injury in dogs	M.V.Sc	Veterinary Surgery and Radiology, Mannuthy
74	Clinical efficacy of midazolam - ketamine - isoflurane anaesthesia in butorphanol - xylazine premedicated bovines	M.V.Sc	Veterinary Surgery and Radiology, Mannuthy
75	Effect of cell density and serum starvation on vascular endothelial growth factor gene expression in canine adipose tissue derived cells.	M.V.Sc	Department of Veterinary Physiology, Pookode
76	Genetic variability of toll like receptor 4 and Beta Defensin 4 genes and its association with somatic cell score in crossbred cattle of Kerala	M.V.Sc	Animal Breeding, Genetics and Biostatistics, Mannuthy
77	Assessment of fertility and fecundity in female dogs by sonographic, hormonal and genomic studies	M.V.Sc	Animal Reproduction Gynecology and Obstetrics, Mannuthy
78	Intra-uterine ozone treatment for subclinical endometritis in crossbred dairy cows	M.V.Sc	Department of Animal Reproduction Gynecology and Obstetrics, Mannuthy
79	Impact of Kerala flood 2018 on the milk production and Socio-Economic status of dairy farmers in Ernakulam and Thrissur Districts	M.V.Sc	Livestock production and management

80	Evaluation of production performance of Athulya, native and IWNXnative crossbred layer under backyard system	M.V.Sc	Poultry Science, Mannuthy
81	Molecular characterization and seromonitoring of canine parvovirus following modified live cpv-2b vaccination in pups	M.V.Sc	Preventive Medicine, Mannuthy
82	Bacterial aetiology of infertility in dogs with special to brucellosis	M,V.Sc	Veterinary Epidemiology and Preventive Medicine, Mannuthy
83	Assessment of the impact of Kerala flood-2018 on the livestock farming systems of Pariyaram panchayath in Thrissur district of Kerala	M.V.Sc	Livestock Production and Management, Mannuthy
84	Radiographic evaluation of thorax to aid staging of superficial and mammary neoplasms in dogs	M.V.Sc	Department of Veterinary Surgery and Radiology, Mannuthy
85	Comparative evaluation of modified proximal perineal urethrostomy and tube cystostomy for the treatment of chronic obstructive urolithiasis in male goats	M.V.Sc	Veterinary Surgery and Radiology
86	Performance of Gramasree breeder birds fed with different sources of calcium	M.V.Sc	Animal Nutrition, Pookode
87	Performance and carcass traits of meat type ducks fed on varying dietary levels of metabolisable energy and methionine	M.V.Sc	Animal Nutrition, Pookode
88	Efficiency of two stage restricted flow anaerobic baffled biogas digester and gas purification systems	M.V.Sc	Livestock Production Management, Pookode
89	Diagnosis and Therapeutic Evaluation of Malasseziosis in Dogs	M.V.Sc	Veterinary Clinical Medicine, Ethics and Jurisprudence, Pookode
90	Clinico-pathological and therapeutic evaluation of pneumonia in goats with special reference to mycoplasmosis	M.V.Sc	Veterinary Clinical Medicine, Ethics and Jurisprudence, Pookode

91	Evaluation of the suitability of lactic acid bacterial isolates from natural sources for the preparation of curd	M.Sc	Dairy Science, Mannuthy
92	Assessment of antibacterial potential of silver nanoparticles biosynthesised using Trikatu	M.Sc	Veterinary Biochemistry, Mannuthy
93	Assessment of antibacterial potential of silver nanoparticles green synthesised using Nalpamaram	M.Sc	Veterinary Biochemistry, Mannuthy
94	Assessment of benzimidazole resistance polymorphisms in *Haemonchus contortus* in goats by real time PCR	M.Sc	Veterinary Biochemistry, Mannuthy
95	Autoregressive integrated moving average (ARIMA) model for forecasting production of milk, egg and meat	M.Sc	Statistics, Mannuthy
96	Characterisation of coding regions of 14-3-3 and 23kDa membrane protein genes of *Schistosoma spindale*	M.Sc	Veterinary Biochemistry, Mannuthy
97	Comparative analysis of antibacterial activity of vechur and crossbed cow milk-conjugated silver nanoparticles	M.Sc	Veterinary Biochemistry, Mannuthy
98	Comparison of auto-regressive integrated moving average (ARIMA) and multi-gene genetic programming models for temperature prediction in Thrissur of Kerala	M.Sc	Statistics, Mannuthy
99	Detection of antifungal agents in fermented dairy products and their impact on product quality	M.Sc	Dairy Science, Mannuthy
100	Detection of polymorphisms in the chicken bone morphogenetic protein 15 gene associated with egg production traits	M.Sc	Veterinary Biochemistry, Mannuthy
101	Developing model for lactation curve in Malabari goats	M.Sc	Statistics, Mannuthy
102	Development and evaluation of enrobed buffalo milk paneer	M.Sc	Dairy Science, Mannuthy

103	Development and quality evaluation of synbiotic yoghurt prepared with *Lactobacillus rhamnosus* GG and flour of C*icer arietinum*	M.Sc	Dairy Science, Mannuthy
104	Effect of flood on the livestock sector in Kadukutty panchayath of Thrissur district	M.Sc	Statistics, Mannuthy
105	Effect of l-threonine concentration on glyA gene	M.Sc	Dairy Science, Mannuthy
106	Evaluation of anti-bacterial potential of peptides in whey from fermented goat milk	M.Sc	Dairy Science, Mannuthy
107	Fatty acid profile of crossbred cow milk	M.Sc	Veterinary Biochemistry, Mannuthy
108	Detection of biofilm forming strains of *Escherichia coli* and *Staphylococcus aurues* associated with canine pyometra	M.Sc	Veterinary Microbiology, Mannuthy
109	Fatty acid profile of Vechur cow milk	M.Sc	Veterinary Biochemistry, Mannuthy
110	Forecasting rainfall in Thrissur district of Kerala using artificial neural network	M.Sc	Statistics, Mannuthy
111	Forecasting the price of poultry meat in Kerala	M.Sc	Statistics, Mannuthy
112	Green synthesis of silver nanoparticles using dashmula churna and evaluation of its	M.Sc	Veterinary Biochemistry, Mannuthy
113	Green synthesis of silver nanoparticles using Triphala and assessment of its antibacterial potential	M.Sc	Veterinary Biochemistry, Mannuthy
114	Impact of Covid-19 lock down on dairy co-operatives in Thrissur district of Kerala State	M.Sc	Livestock production and management, Mannuthy
115	Isolation and antibiogram of C*orynebacterium pseudotuberculosis* from goats	M.Sc	Veterinary Microbiology, Mannuthy
116	Isolation of Infectious Bursal Disease virus in embryonated chicken eggs	M.Sc	Veterinary Microbiology, Mannuthy
117	Modelling and forecasting the spread ofcovid-19 in Kerala	M.Sc	Statistics, Mannuthy

118	Molecular characterization of partial mitochondrial 16S rRNA gene to identify meat from avian species	M.Sc	Veterinary Biochemistry, Mannuthy
119	A study on efficiency of detergents and their application in dairy sector	M.Sc	Dairy Science, Mannuthy
120	Development of time series model for forecasting red meat price in Kerala	M.Sc	Statistics, Mannuthy
121	Utilization of date seed a by-product from cake industry for the preparation of cupcake	B.Tech	Food Technology, VKIDFT, Mannuthy
122	Development of Chocolates containing Brahmi (*Bacopa Monnieri*)	B.Tech	Food Technology, VKIDFT, Mannuthy
123	Higher fibre and vitamin C contents in Mung Beans Microgreens than in its Sprouts	B.Tech	Food Technology, VKIDFT, Mannuthy
124	Preparation and characterization of gluten free cake enriched with jackfruit powder	B.Tech	Food Technology, VKIDFT, Mannuthy
125	Gluten- free cake incorporated with moringa leaves	B.Tech	Food Technology, VKIDFT, Mannuthy
126	Utilisation of nutmeg (*Myristica fragrans* houtt) fruit for the preparation of value added products	B.Tech	Food Technology, VKIDFT, Mannuthy
127	Development of horse gram and green gram fortified cake	B.Tech	Food Technology, VKIDFT, Mannuthy
128	Development of ragi based jackfruit seed flour cookies	B.Tech	Food Technology, VKIDFT, Mannuthy

Histomorphology and ultrastructure of thyroid and adrenal glands in large white Yorkshire pigs reared at high and low altitudes

Morphological, histological and ultrastructural characteristics of thyroid gland and adrenal gland of Large White Yorkshire pigs (*Sus scrofa domesticus*) reared at high and low altitudes in Kerala. Topographically, the thyroid gland was located on the ventral aspect of the trachea just caudal to the larynx. In 80per cent of specimens collected, the position was just caudal to the larynx. However, in the rest of the specimens, the thyroid gland was observed much caudally and even close to the manubrium sterni. The thyroid gland appeared as a single gland but careful dissection revealed its two lobes: right and left lobes those were connected by an indistinct isthmus. Average weight of the thyroid gland was lower at high altitude for both the genders, wherein, in between the genders it was seen to be higher in females than in males. The thyroid follicle had a maximum diameter of 301.35 µm. The thyroid diameter of follicles was more in the central area and it reduced towards the peripheral area. Parafollicular or C-cells were also present in 3 locations *viz.* interfollicular, intrafollicular and parafollicular position. The average length of the left lobe was lower than the right lobe in both male and female pigs. The adrenal glands were located cranio-medially or entirely on medial surface embedded within perirenal fat. The boundary between the deeper part of the capsule and zona glomerulosa layer revealed a group of relatively undifferentiated 'capsular' cells. The junction of zona glomerulosa and zona fasciculata presented lightly stained undifferentiated cells were observed.

Thyroid gland showing

1-Ventral surface of intact thyroid gland

2-Dorsal surface of intact thyroid gland

3-Left lobe,

4-Right lobe

Management of feline lower urinary tract disease

Higher occurrence of FLUTD was reported in male middle aged Persian cats fed with dry diet. Feline idiopathic cystitis was the most common cause of (FLUTD) followed by urethral plugs, urinary tract infection and neurogenic disorder. The management of FLUTD included a combination of medical, dietary and multi model environmental enrichment (MEMO)

therapy. Out of the 25 cats studied, 18 survived and seven died, mainly due to recurrent urethral obstruction. To summarize, early detection of signs of FLUTD, accurate diagnosis, institution of surgical, medical and dietary interventions along with managemental practices for stress reduction is essential to treat and prevent recurrence.

Storage lesion and post transfusion studies of canine packed red blood cells using saline-adenine-glucose-mannitol additive in citrate-phosphate-dextrose-adenine solution

Time dependent variations in canine packed RBCs stored in CPDA-SAGM additive for 42 days and efficacy of transfusion of stored RBCs were studied. Decrease in glucose, pH and GSH levels and increase in malondialdehyde and potassium level was noticed during storage period. No significant variation in haemoglobin and volume of packed red blood cells was recorded. Red blood cell morphology was studied by light microscopy and scanning electron microscopy. No microbial growth was detected on culture studies. Administration of packed RBC resulted in clinical improvement and improvement in haematological parameters. It can be concluded that CDA-SAGM is a suitable storage media for canine packed RBCs and packed RBCs stored up to 14 days in CPDA-SAGM additive at 4^{o}C were found to be efficient in managing anaemia.

Suitability of saline-adenine-glucose-mannitol additive in citrate-phosphate-dextrose-adenine for storing packed red blood cells of goats

Storage lesion studies of packed red blood cells from 10 selected goats were carried out using CPDA / SAGM bags upto 42 days. During storage the pH of the stored blood remained stable whereas glucose showed a significant reduction. Potassium, malondialdehyde and reduced glutathione levels increased throughout thestorage. Haemoglobin and volume of packed red cells did not show any significantchange during storage. Haemolysis of RBCs was analysed using osmotic fragilitytest. The mean cell fragility of pRBCs did not show a major change from day 14 to 42of storage. Anisocytosis and poikilocytosis was recorded in light microscopy. In SEM only a few acanthocytes and dacrocytes were recorded. The study suggests that CPDA-SAGM is a suitable storage media for caprine pRBCs.

Evaluation of renal resistive index in dogs with acute and chronic renal disease

Occurrence of AKI was more common in middle aged dogs while geriatric dogs were more prone to CKD. Aetiologies of AKI were multifactorial, early recognition with appropriate treatment can reverse the condition. Analysis of blood parameters like complete blood count, serum creatinine, BUN, urinalysis, UPC ratio and grey-scale ultrasonography aided in diagnosis of renal disease. Characterisation of both AKI and CKD into various stages would

help in better assessment and management. Renal resistive index was increased in both AKI and CKD conditions. Renal resistive index positively correlated with serum creatinine level. No correlation was found between RRI and blood pressure and RRI and UPC ratio. Normalisation of RRI might be observed after effective treatment in dogs with AKI. Evaluation of RRI was useful for the diagnosis, follow up and prognosis of renal diseases.

Clinico-pathological investigations on thrombocytopaenic dogs with haemostatic disorders

The occurrence of infectious/ inflammatory thrombocytopaenia, thrombocytopaenia due to neoplasia, disseminated intravascular coagulation and miscellaneous diseases accounted for about 68, 6.4, 3.9 and 21.7 percent. Hypoantithrombinemia and elevated D dimer with normal to mildly elevated coagulation parameters could be used as markers for early identification of hypercoagulable state in thrombocytopaenic dogs. Hypoantithrombinemia with severely prolonged coagulation parameters indicated hypocoagulable state that guarded theprognosis. Prolonged prothrombin time, activated partial thromboplastin time, elevated levels of fibrinogen degradation products or D dimer, low antithrombin III concentration and presence of schistocytes could be used as a marker for DIC.

Diagnosis and management of cardiovascular-renal axis disorder subtype H in dogs

Thirty non azotaemic dogs with clinical signs suggestive of cardiovascular dysfunction formed the part of this study. Dilated cardiomyopathy and acquired valvular diseases were the two types of cardiac disorders diagnosed in these dogs. In dogs with DCM, tall R waves, were observed on ECG, elevated vertebral heart score on radiography, gross enlargement of all cardiac chambers and increased left atrium to aorta diameter ratio, large E-point septal separation, lowered values of separation, lowered values of ejection fraction and fractional shortening were documented on radiography. In dogs with valvular disease, variability in R-R interval and low amplitude QRS complex on ECG bronchial and vascular pattern on radiography and varying degrees of valvular regurgitation on echocardiography were recorded. Decline in serum inosine values and microalbuminuria was recorded. Ultrafiltration was performed in six dogs and was found useful in the management of dogs with volume overload and refractory to diuretics.

Clinico-biochemical and molecular investigations of haemolytic anaemia in dogs

The haemolytic anaemia group is a highly heterogenous group which clearly indicated the presence of multiple factors associated with haemolysis in dogs. The major factors of haemolysis in the agro geoclimatic zone were blood parasites, erythrocyte oxidative stress

and micro angiopathic haemolytic anaemia. Dogs with chronic haemolysis also suffer from varying degrees of erythroid suppression in the bone marrow as indicated by a low reticulocyte count. Red cells in dogs under study had a stable erythrocyte membrane which is not osmotically fragile. Pre-published mutations of erythrocyte pyruvate kinase and erythrocyte phosphofructokinase enzymes were absent. Erythrocyte structural abnormalities associated with pre-documented alpha spectrin and beta spectrin mutations were not found. A silent mutation which did not change the aminoacid residue was detected in the beta spectrin (*SPTB*) gene.

Isolation and antibiogram of *Corynebacterium pseudotuberculosis* from goats

Twelve isolates of *Corynebacterium pseudotuberculosis* were obtained from 25 abscess cases in goats. All were susceptible to tetracycline.

Detection of biofilm forming strains of *Escherichia coli* and *Staphylococcus aurues* associated with canine pyometra

A total 25 samples were collected, which included uterine discharges from cases of closed pyometra and anterior vaginal swabs from open pyometra for biofilm forming *S. aureus* isolates, tissue culture plate method showed higher sensitivity than tube and Congo red agar methods and for *Escherichia coli*, Congo red agar method showed higher sensitivity than other two methods. The biofilm forming strains showed higher degree of antibiotic resistance in comparison with non-formers, indicating it as one of the major reasons for failure of antibiotic therapy in pyometra.

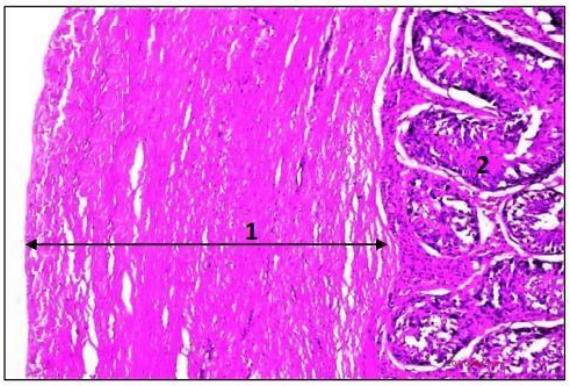
Genotypic characterisation of infectious bronchitis virus from Kerala

Genotypic characterisation of infectious bronchitis virus from Kerala-Out of the 103 samples collected, 32 were found to be positive for the disease with detection primers that targeted the hypervariable region 3 of S1 subunit of S gene. All the 32 samples were positive for RT-PCR targeting the S1 subunit of S gene, N and M genes. The representative amplicons of the above mentioned genes were sequenced, analysed and compared with current vaccine strain H120 and sequences of other Indian IBV isolates available in the GenBank. On nucleotide sequence and amino acid profile analysis, it was found that variations exist among isolates as well as with vaccine strain and other Indian isolates. On phylogenetic analysis based on these genes, the isolates clustered with each other and also with isolates from different parts of India. The representative amplicons of S1 subunit of S gene when subjected to RFLP, generated restriction patterns similar to the vaccine strain, Massachusetts type.

Histomorphology and physico-chemical evaluation of raw and decellularised tunica vaginalis of buffalo as a promising biomaterial in regenerative medicine

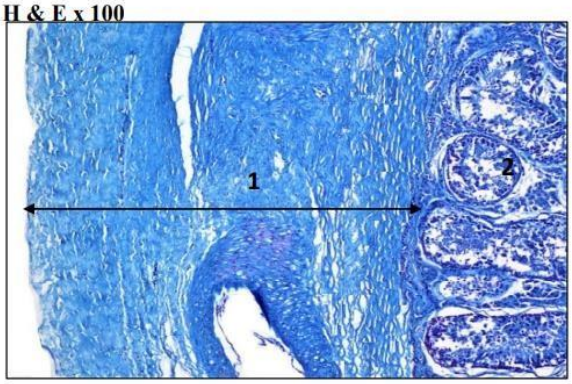
The study entitled Histomorphology and physico-chemical evaluation of raw and decellularised tunica vaginalis of buffalo as a promising biomaterial in regenerative medicine' was undertaken to develop an acellular matrix from buffalo bull tunica vaginalis by a newly standardised decellularisation technique. Ten pairs of testes were collected hygienically from ten healthy adult Murrah buffalo bulls slaughtered at the Meat Technology Unit, College of Veterinary and Animal Sciences, Mannuthy. For decellularization, the fresh parietal layer of tunica vaginalis removed from the testes samples were processed as per the newly standardised protocol using trypsin-EDTA with triton-X-100 as detergent. The histomorphological, ultrastructural and physico-chemical characteristics of the raw and decellularised tunica vaginalis were compared and efficiency of decellularisation was evaluated by histological staining techniques, total DNA quantification and scanning electron microscopy. It was observed that the average weight of the left testis in adult Murrah buffalo bulls with and without parietal layer of tunica vaginalis (PTV) was more than that of the right testis and exhibited a statistically significant difference. The outer parietal layer of tunica vaginalis that lined the scrotum could easily be separated out from the testis. The vertical span of PTV of left testis was more than that of the right and the difference was statistically significant. Histologically the PTV consisted of a thin mesothelium and dense regular connective tissue made up of thick collagen bundles, a few elastic fibres and reticular fibres supported by blood vessels, smooth muscle fibres and nerves. It was observed that the decellularised PTV were devoid of cells and genetic materials such as DNA while maintaining its overall tissue histoarchitecture. The physico-chemical characteristics like mean thickness, tensile strength and collagen concentration of decellularised buffalo PTV samples were significantly reduced while the collagen solubility per cent and percentage weight loss after collagenase degradation were significantly higher in decellularised PTV than raw PTV samples. It was concluded that the samples of parietal layer of tunica vaginalis of buffalo prepared by using the newly standardised decellularisation technique showed acceptable physico-chemical properties required for a biologic scaffold. It may be used as a biomaterial in regenerative medicine after extensive clinical screening.

1. Testicular capsule
2. Seminiferous tubule



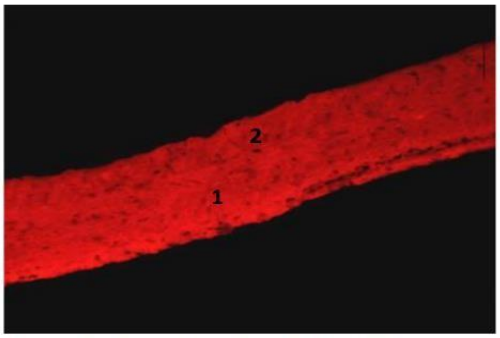
C.S of testicular capsule. H & E x 100

3. Testicular capsule
4. Seminiferous tubule



C.S of testicular capsule. PAS-Alcian blue method x 100

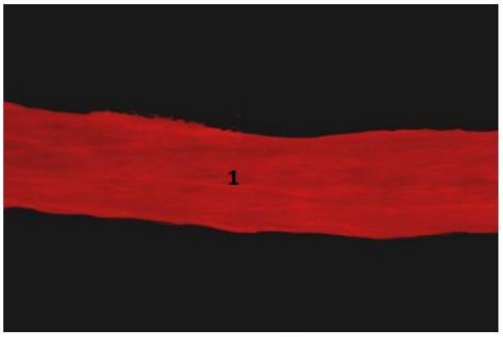
1. Collagen
2. Nucleus



C.S. of parietal layer of tunica vaginalis. Picrosirius red method for collagen fibres x 40 (Fluorescence)

1. Collagen

1



C.S. of acellular matrix developed from separated parietal layer of tunica vaginalis (Trypsin-EDTA-treated). Picrosirius red method for collagen x 40 (Fluorescence)

1. Collagen fibres
2. Cells

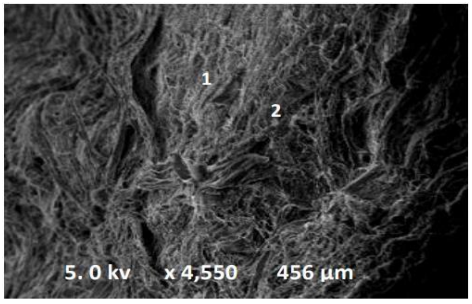


Fig. 53 Surface view of separated parietal layer of tunica vaginalis (Before decellularisation). SEM x 4550

1. Collagen fibres

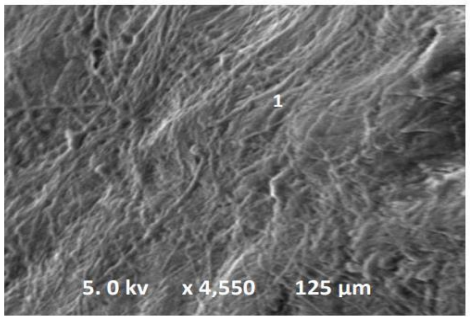


Fig. 54 Surface view of separated parietal layer of tunica vaginalis (Trypsin-EDTA-treated). SEM x 4550

Detection of drug resistant and biofilm forming food borne pathogenic bacteria in retail chicken and mitigation using plant extracts

The prevalence of *E. coli*, *Salmonella* spp. and *Campylobacter* spp. from retail chicken of Kerala was 54.17, 14.33 and 17.17 per cent, respectively.The highest per cent of resistance was detected to nalidixic acid in *E. coli* and to tetracycline in *Salmonella* spp. and *Campylobacter* spp.The aqueous cold extract of *C. guianensis* was found to have good antibacterial property against drug resistant *E. coli*, *Salmonella* spp. and *Campylobacter* spp

Occurrence of *Campylobacter* spp. in duck, quail, backyard chicken and associated environmental samples

Occurrence of the organism in duck rearing facility was 10, 8 and 2 per cent from cloacal swabs, soil and drinking water samples respectively. The overall occurrence in quail rearing facility was 10.45 per cent. Multiple antimicrobial resistance (MAR) index of the Campylobacter isolates was within the range of 0.06-0.89.

Isolation and identification of extended spectrum beta lactamase (ESBL) producing *Klebsiella pneumonia*e and *Salmonella* spp. from environmental samples

Out of the 420 water (Pond, river and paddy field) and soil samples collected from Thrissur district, 58.57 per cent and 12.62 per cent samples, respectively contained *Klebsiella pneumoniae* and *Salmonella* spp. Totally 68 *K. pneumonia* and 20 *Salmonella* spp. isolates were confirmed as extended spectrum beta lactamase producers.

Cloacal carriage and antimicrobial resistance profiling of extended spectrum beta-lactamase producing *Escherichia coli* and *Salmonella* enteritidis in broiler chicken

Escherichia coli and *Salmonella* spp. were detected in 77.8 and 9.2 per cent of broiler chicken cloacal samples from Kottayam and Kollam. *Escherichia coli* isolates showed resistance to ampicillin, cephalosporins and amoxicillin-clauvanic acid.

Isolation and molecular characterization of *Escherichia coli* pathotypes in drinking water and identification of the possible sources of contamination

Escherichia coli, ETEC, EAEC and EHEC were detected in 51.09, 0.20, 12.87 and 5.35 per cent of water samples. Occurrence of *E. coli* in drinking water had highly significant association with the distance of well from the septic tank.

Detection of pathogenic leptospires in slaughtered cattle of Thrissur

Seropositivity of leptospirosis in slaughtered cattle and slaughterhouse workers in Thrissur from two organized slaughter houses were 44.24 and 32 per centAmong cattle slalughtered in Thrissur, the predominant serovar detected were Sejroe, Grippotyphosa and AustralisThe predominant serovars detected in slaughterhouse workers were Djasiman and Bataviae.

Occurrence and molecular characterisation of *Campylobacter* spp. in sea foods and associated environment of Kerala and control of biofilm formation

Occurrence of *Campylobacter* spp. in seafoods was 12.24 per cent, 11.76 per cent, 13.51 per cent in marine fishes, crustacean and molluscs respectively. The *C. jejuni* NCTC 11168, and *C. coli* survived for 150 days in autoclaved water at 25°C.Sanitisers like hot water, chitosan, bleaching powder and aqueous extract of *Eichhornia crassipes* (water hyacinth) were effective on biofilms of the *C. jejuni* and *C. coli* at various combination treatments.

Detection of colistin and quinolone resistant *Salmonella enterica* from poultry processing line

A total of 450 samples consisting 75 samples each of cloacal swabs, caecal contents and carcass rinsates of birds from processing lines of two poultry processing plants *viz*., Plant A from Thrissur and Plant B from Ernakulam was collected. Of the 450 samples assessed, 64 were positive for *Salmonella* spp. by conventional culture technique (45 from Plant A and 19 from plant B). Out of 64 positive isolates 43 harboured *inv*A gene (67.18 per cent) and 35 found to be *Salmonella enterica* as confirmed by targeting *iro*B gene by PCR. All the *Salmonella enterica* positive isolates were subjected to antibiotic resistance testing by Kirby-Bauer disc diffusion method. The isolates showed high resistance to levofloxacin and

enrofloxacin (45.71 per cent each) followed by nalidixic acid (42.85 per cent). Among the resistant isolates five isolates harboured mutations in *gyr*A gene and six isolates harboured *qnr*S gene whereas none of the isolates harboured *oqx*AB gene and mutations in *par*C gene. Out of 35 *Salmonella enterica* isolates, three isolates (8.57 per cent) were resistant to colistin with minimum inhibitory concentration (MIC) of ≥ 4µg/mL. Two colistin resistant isolates showed synonymous mutations in *pmr*A and *pmr*B genes.

Effect of partial replacement of soyabean meal with spent brewer's grain in broiler ration, supplemented with and without enzymes

A study was conducted to investigate the effect of partial replacement of soyabean meal (SBM) with spent brewer's grain (SBG) in broilers, supplemented with and without enzymes, on the basis of growth performance, nutrient utilisation and techno - economics of broilers. The results of this study indicated that birds of T3, fed on the diet containing 10 per cent SBG with enzyme supplementation consumed less feed, had higher body weight gain, showed better FCR and higher profit, than chicks in all the other groups. Therefore, it can be concluded that replacement of SBM with SBG at the level of 10 per cent, with enzyme supplementation, at the rate of 500g per tonne of feed, can be recommended for optimum growth performance as well as greater profit, in broilers.

Dietary incorporation of raw banana peel silage on growth and nutrient utilization in weaned Malabari kids

A study was conducted to assess the effect of dietary incorporation of raw banana peel silage on growth performance, nutrient utilisation and techno - economics of production, in weaned Malabari kids. Based on the preliminary laboratory trial, it was found that the combination of raw banana peel with three per cent jaggery, ensiled for 24 days gave good quality silage with yellowish brown colour, fruity odour and pH of 3.90. The above method was used for preparation of silage in bulk and was used for subsequent in vivo study, viz., feeding trial. A feeding trial of 60 days duration was conducted in eighteen Malabari kids, divided into three groups, T1, T2 and T3; T1 was fed with concentrate mixture and green fodder, T2 with concentrate mixture green fodder and 100 g raw banana peel silage and T3 with concentrate mixture, green fodder and 200 g raw banana peel silage. The results showed that kids fed on a diet containing raw banana peel silage at 100 g level on DM basis (T2), ie., 10 per cent level, had similar DMI, FCE and digestibility coefficients of nutrients as that of an unsupplemented control diet (T1). Both T2 and T1, were better than T3, the diet containing raw banana peel silage at 200 g level on DM basis, ie., 20 per cent level, in all aspects. Among T1 and T2

which were more or less comparable and statistically similar, T2 was better than T1 as it elicited a better production performance by way of significantly higher ADG, higher total weight gain, better FCE and lower cost per kg gain than T1. Therefore, it can be concluded that raw banana peel silage can be safely incorporated as an alternative livestock feed in the rations of kids upto 100 g on DM basis (10 per cent), replacing green fodder, without affecting growth performance, with economic benefits.

Effect of supplementation of *Aspergillus oryzae* and leaf extract of *Psidium guajava* on growth and nutrient utilisation in crossbred female calves

In Kerala, crossbred cattle feeding is restricted to grazing on low-quality forages with meagre allowances of concentrates and this necessitates the supplementation of feed additives for better utilisation of low quality feed resources. The probiotic culture of *Aspergillus oryzae* is widely used in ruminant nutrition because of its buffering function in stabilizing the rumen environment and stimulation of microbial activity especially fibrolytic activity. *Psidium guajava* leaves are antimethanogenic in action and the biological activities of these leaves include improving rumen fermentation and nutrient utilization in livestock. Hence a preliminary screening of the synergistic supplementation of different levels of A. oryzae and *P. guajava* leaf extracts at 0, 0.5, 0.25, and 0.125 per cent respectively in the total mixed ration (TMR) of concentrate: roughage (60:40) on dry matter (DM) basis was studied using in vitro gas production technique (IVGPT) with a view to estimate the metabolisable energy, digestible organic matter, methane production and in vitro degradable nitrogen (IVDN). The percentage of IVDN was significantly ($p<0.01$) higher for the treatment group supplemented with the herbal extract-probiotic mixture at 0.25per cent level. The percentage of methane production was significantly ($p<0.01$) lower for the treatment groups supplemented with the herbal extract-probiotic mixture at 0.5per cent and 0.25per cent with values of 8.42per cent and 10.8per cent respectively. The results indicated that synergistic supplementation of *P. guajava* leaf extract and *A. oryzae* probiotic culture each at 0.25per cent level in the TMR gave the best performance in terms of methane mitigation and optimum availability of IVDN for improved growth performance in crossbred dairy calves.

Management of fracture of long bones using string of pearls plating technique in dogs

The study was conducted in nine dogs presented with fractures of long bones to University Veterinary Hospitals located at Mannuthy and Kokkalai from March 2019 to December 2020. Preoperatively fracture was diagnosed by orthopaedic and radiographic examination. Fracture stabilization by open reduction and internal fixation was resorted to in all the nine dogs

following standard AO principles using 3.5mm string of pearls plates and cortical screws. This resulted in good fracture fixation and immobilization. Postoperatively, all the dogs progressed sound at walk (Grade I) by the end of eighth postoperative week. Radiographic examination revealed periosteal and endosteal callus formation from second postoperative week onwards. Obliteration of fracture line and radiographic union of fracture fragments were evident on sixth postoperative week. Complete radiographic union of fractured bone with minimal callus formation was observed by eighth post operative week in six dogs with stable fixation. The SOP plate application was found to be effective in providing early pain free ambulation and also in managing fractures of long bones in dogs.

B-mode ocular ultrasonography for diagnosis and treatment evaluation in management of glaucoma in dogs

The study was conducted in 75 dogs of various breeds between three months to 15 years of age presented from August 2019 to December 2020 to University Veterinary Hospitals at Mannuthy and Kokkalai. The present study was conducted in animals presented with various ocular affections. B-mode ultrasound scan was performed with manual restraint. Corneal desensitization was achieved by using topical anesthetic, 0.5per cent proparacaine hydrochloride. Biometry for ocular parameters like axial length of the eye (D1), vitreous chamber depth (D2), lens diameter (D3) and lens depth (D4) were recorded in all the dogs which differed significantly within the same group and between groups and between normal eyes and affected eyes. B-mode ultrasound scan is a non-invasive and versatile diagnostic modality which was helpful in diagnosing various disease conditions which otherwise would have been missed with conventional techniques.

Comparison of multimodal anaesthesia protocols with isoflurane and sevoflurane maintenance in geriatric canine patients

The study was undertaken with the objective of evaluating efficacy of propofol induced, isoflurane manitained anaesthesia with diazepam-butorphanol premedication for surgical procedures in geriatric dogs. All the dogs were subjected for thorough clinical and pre-anaesthetic evaluation before subjecting for anaesthesia. Preanaesthesia was carried out in all animals by administering diazepam @ 0.25 mg /kg body weight (B.W.) and butorphanol @ 0.2 mg/kg (B.W.) given intravenously at one minute interval. After ten minutes the patients were subjected to pre-oxygenation for three minutes using marks. Propofol (1per cent w/v) was administered as a slow bolus intravenous injection to effect to induct general anaesthesia. Surgical plane of anaesthesia was maintained with isoflurane in oxygen using isoflurane

vapourizer incorporated Bain's circuit system. All the vital parameters like blood pressure and electrocardiographic examination and anaesthetic parameters were monitored at all stages of anaesthesia. Haematological, plasma/serum biochemical studies and blood gas analysis were also coducted.The quality of sedation, induction, maintenance and recovery from general anaesthesia were good without any complication. Variations in physiological, haematological and plasma/serum biochemical parameters were within the normal acceptable range. Electrocardiographic parameters, blood pressure and blood gas parameters were within the regular standard range in all the dogs. The anaesthetic protocol was found be safe in the geriatric dogs.

Comparative efficacy of 4 – aminopyridine and polyethylene glycol in combination with methyl prednisolone sodium succinate for the treatment of spinal cord injury in dogs

The study was conducted in fourteen dogs with clinical signs of spinal cord injury (SCI). The dogs were randomly divided onto two groups, Group I and II. All the animals were administered with methyl prednisolone succinate (30 mg/kg body weight) IV on the day of presentation. Group I dogs were additionally administered with polyethylene glycol (4000 Da, 30 per cent solution) @ 4 ml/kg body weight twice at 48 hours interval followed by tapering doses of prednisolone acetate for 10 days Group II animals with 4 – aminopyridine (4-AP) @ 0.5mg/kg body weight followed by oread administration of 4-AP @ 1 mg/kg body weight three times daily for 10 days. Clinical and neurological progress of the animals were studied at weekly interval for eight weeks. Among Group I animals, 71.4per cent had recovered from the condition and 42.8per cent in Group II by the end of sixth week. The recovery was found to beearlier among the animals of Group I.

Clinical efficacy of midazolam - ketamine - isoflurane anaesthesia in butorphanol - xylazine premedicated bovines

The study was conducted in six crossbred cattle aged nine months to five years and weighing 92 to 375 kg, to evaluate clinical efficacy of midazolam - ketamine - isoflurane anaesthesia in butorphanol - xylazine premedicated bovines. Animals were premedicated with IV administration of butorphanol and xylazine at the dose rate of 0.05 and 0.02 mg/kg body weight respectively. On achieving sedation anaesthesia was induced by IV administration of ketamine and midazolam at the dose rate of 4.0 and 0.2 mg/kg body weight respectively. Anaesthesia was maintained through cuffed endotracheal tube connected with semiclosed system in large animal inhalant anaesthesia machine, using isoflurane 2.30 ± 0.21per cent in 100per cent oxygen. The degree of sedation was moderate and time for sedation was 8.67 ±

1.48 minutes. Induction time for anaesthesia was 4.33 ± 0.61 minutes. The quality of induction was excellent. Respiratory rate and rectal temperature decreased significantly after induction, while the heart rate remained elevated. Capillary refill time increased significantly 30 minutes after induction and peripherals oxygenation remained low. Recovery from anaesthesia was smooth in all the animals, with an overall time of 34.33 ± 5.78 min. The results showed the protocol adopted was suitable for safe anaethesia in cattle

Effect of cell density and serum starvation on vascular endothelial growth factor gene expression in canine adipose tissue derived cells.

Present experiment was conducted to study the effect of cell density and serum starvation on vascular endothelial growth factor (*VEGF*) gene expression in canine adipose tissue derived mesenchymal stromal cells (M.SCs). Subcutaneous fat tissue sample was collected from adult dog presented at the Department of Veterinary Surgery and Radiology, CVAS, Pookode. The tissue pieces were washed and digested using 0.2per cent collagenase type III and filtered using 40µm filter to isolate the adipose tissue derived stromal cells which were seeded in DMEM (Dulbecco's Modified Eagle's Medium) supplemented with 15per cent FBS (Fetal Bovine Serum) for the primary cell culture. As primary culture attained 70-80per cent confluency, subculture was done till fourth passage. Growth curve and population doubling time of the *in vitro* expanded canine adipose tissue derived M.SCs of cells were calculated by using 0.4per cent trypan blue exclusion test. Fourth passage cells were seeded in different seeding densities (10^3/cm^2; 3x 10^3/cm^2; 6 x 10^3/cm^2) within six well cell culture plates and were grown for 72h (pre- incubation) in normal serum rich(+) growth media. After pre-incubation, cells were further incubated for 36h replacing with either serum rich(+) or serum free(-) media at respective time intervals (Zero h; 12h; 24h; 36h). At the end of incubation period, treated/adherent cells were harvested from each well and total RNA was isolated and cDNA was synthesized. Expression of *VEGF* in different groups was analysed by real time PCR using specific primers designed for *VEGF* keeping the expression of *GAPDH* as reference. Among the different seeding density and serum starvation combination experimented, we could not find any significant impact on the expression of *VEGF*, but we observed a significant increase in *VEGF* expression in canine adipose tissue when used at a higher cell seeding density (6x10^3/cm^2). These findings suggest that cell therapy using stromal cells derived from subcutaneous canine ASCs, regulated with high seeding density may be a novel therapeutic option to enhance angiogenesis thereby provide therapeutic

benefits in pathological vascular conditions including wound repair, ischemic damage, microvascular permeability, and diabetes.

Genetic variability of toll like receptor 4 and beta defensin 4 genes and its association with somatic cell score in crossbred cattle of Kerala

In the present study, single nucleotide variations in exon 3 of *TLR4* and exon 1 and 2 of *DEFB4* associated with somatic cell score (SCS) and 305 Days Milk Yield (305DMY) was identified. On sequencing, C to T transition, one non-synonymous change at 2021th position of ORF of exon 3 of *TLR4* was identified. Monomorphic band patterns were obtained for 192 bp fragment of exon 1 of *DEFB4*.The heritability estimates for SCS and 305 DMY were 0.003±0.340 and 0.359±0.076. The average breeding value of 200 crossbred cattle sired by 78 bulls for SCS was 4.16 and for 305DMY was 2743.60 kg.

Assessment of fertility and fecundity in female dogs by sonographic, hormonal and genomic studies

Quantitative analysis of RI, PI, PSV, EDV and S/D ratio of the ventral perineal artery did not differ significantly between high fecundity and low fecundity groups. Ventral perineal artery haemodynamic indices are not a suitable index for evaluating the canine fecundity and fertility. Serum progesterone profile during 21st day of dioestrum reveals that mean progesterone level is not an indicator of fertility or fecundity in canines. Partial characterization of *LHCGR* gene revealed novel polymorphisms in the exon-1 in high fecundity group

Intra-uterine ozone treatment for subclinical endometritis in crossbred dairy cows

Ozone (O_3) alone or in combination and PG analogue alone resulted in eliminating the superficial inflammatory cells present in the endometrium. O_3 calibrated at 55 µg/mL and bubbled in 60 mL of distilled water for 20 minutes produced ozonized sterile solution and a dose of 60 mL infused in to the uterine lumen was an effective treatment for SCE. O_3 alone or in combination is successful in treating SCE in cattle and is promising as an alternative therapy to routine antimicrobial therapies to improvise the reproductive performance.

Medical ozone preparation

Intra-uterine Ozone therapy

Commercial dog breeding ventures of Thrissur and Ernakulam districts of Kerala – A multidimensional analysis of economic viability and determinants of profitability

Commercial dog breeding in Kerala is a promising venture with the potential to reduce unemployment among the youth and as a major means of livelihood. However, the state lacks an authentic information on profile of commercial dog breeders engaged in this business, its economic viability, production efficiency, and factors affecting profitability. Under these circumstances, the present study was conducted among the commercial dog breeders of Kerala with the objective to estimate the production efficiency, economic viability, and the determinants of profitability along with the assessment of their socio personal, socio-economic profile and the level of knowledge adoption in scientific dog management practices. The study was conducted among 60 dog breeding units randomly selected from the Thrissur and Ernakulam districts of Kerala. Scientific Scales were developed using standard techniques to assess the respondents' knowledge and adoption in scientific dog management. The data collection was done using personal interviews with structured pre tested interview schedule, electronic surveys, e-mails, telephonic interviews, focus group discussions and secondary data such as newsletter, annual reports, official documents and other publications were also used. Data were tabulated and analysed with the help of appropriate tools by using statistical package for social sciences (SPSS) version 24.0.

The results shown that all the commercial dog breeders were male, majority of them were middle-aged. Nearly half of them are graduated. Majority of them had high level of knowledge and adoption in scientifically recommended dog management practices, of which level of adoption was significantly correlated with profitability of commercial dog breeding ventures. All the commercial dog breeding ventures studied were profitable and economically viable. The variable cost formed the major portion in commercial dog breeding ventures

which was 89.25 per cent of the total cost. The profitability of the venture determined by ended on the factors like years of experience for the breeder, the total number of puppies born in a year, the total number of animals kept in that year, labour cost, veterinary health care expense, and level of adoption. The research improved our understanding on economic activities and diverse practices by the commercial dog breeders, better insight to their knowledge and adoption of scientific breeding and threw light on the strategies to be dog breeders will undoubtedly have a positive impact on the success of the sector.

Evaluation of candidate genes associated with canine mammary tumour

Canine mammary tumour is a common disease reported in female dogs especially from middle age to old age. Several molecular markers aiding in early prediction and likelihood of breast cancer are available in case of human beings, whereas such an advancement is lacking in CMT and hence the present study. Blood samples and data for the study were collected from 50 mammary tumour affected and 50 normal dogs. In present study, the polymorphisms within the promoter region of *BRCA1* and exon 11 of *BRCA2*, which were considered to be the region of mutation hotspots in respective gene, were evaluated for its association with the risk of CMT. The relative expression of *TIMP2* was compared between normal and CMT affected mammary tissue samples.

High resolution melt curve analysis of *BRCA1* showed three different melt curves and genotypes were identified as CC, CT and TT. All animals in the study which showed TT genotype, were found to be CMT affected and TT genotype was completely absent among the normal animals under present study. The present study came up with a novel finding that seven out of the 11 dogs with TT genotypes were presented with recurrent cases of CMT, which strongly indicated high penetrance of the variant -1173C>T of *BRCA1* with CMT and it might be proposed as one of the markers for predicting the prognosis of CMT. Screening of the population for the presence of missense variant A4304G within exon 11 of *BRCA2* was done by PCR-RFLP and three different patterns were identified for genotype AA, AG and GG respectively. In the current study a significant association of the considerate polymorphism with CMT could not be obtained. The relative expression profiling of *TIMP2* was done from mammary tissue samples from 13 CMT affected glands and six mammary glands collected from normal animals. It was observed that the *TIMP2* showed significantly reduced expression ($p<0.05$) in tumour affected glands than the normal glands. There was a 10-fold increase in expression of TIMP2 in normal glands when compared to mammary tumour samples. The expression analysis of TIMP2 showed that it plays a very

crucial role in the invasion and progression of mammary tumour and down regulation of the gene may result in the tumour aggressiveness.

Effect of reduced dietary crude protein supplemented with limiting amino acids on growth and carcass characteristics of gramasree male chicks

An experiment was conducted to study the effect of reduced dietary crude protein supplemented with limiting amino acids viz. methionine, lysine, threonine and tryptophan on growth and carcass characteristics of Gramasree male chicks from day-old to eight weeks of age.

Two hundred and eighty, day - old chicks were randomly allotted into five dietary treatments with four replicates having 14 chicks each in a completely randomized design. The different dietary treatments in this study include a control diet (T1) formulated as per ICAR (2013) nutrient requirements for Indian improved native breeds formulated as per ICAR (2013) nutrient requirements for Indian improved native breeds and their crosses with 21 percent CP and 2800 kcal ME/Kg using corn, soya bean meal, wheat bran and de-oiled rice bran. The other treatment diets T2, T3, T4 and T5 were prepared by reducing the CP content to 20, 19, 18 and 17 percent, respectively with 2800 kcal ME/Kg and supplementation of synthetic amino acids to meet the requirements of first four limiting amino acids viz. methionine, lysine, threonine and tryptophan at 0.46, 1.10, 0.70 and 0.20 percent levels respectively.

Based on the overall result of this study, it could be concluded that, the dietary crude protein level of Gramasree male chicks can be reduced up to 17 percent with limiting amino acids supplementation to reduce the feed cost without affecting the growth performance of birds for rearing up to eight weeks of age. Also, the use of limiting amino acid supplementation to low CP diets was also effective in reducing nitrogen excretion in birds thus to prevent environmental pollution. Further research in Gramasree male chicks is needed to determine the level up to which CP can be reduced using synthetic amino acids without altering their performance.

Molecular characterisation and expression profiling of Vasorin gene in native goats of Kerala

The Vasorin gene (VASN) regulates the Transforming Growth Factor β (TGF- β) signalling pathway and influence the number of follicles recruited for maturation and ovulation. The present study was carried out to identify the single nucleotide polymorphisms (SNPs) in VASN and their association with prolificacy and weaning weight in Malabari and Attapady

Black goats. Relative expression of VASN in various reproductive tissues of Malabari does were analysed.

The exon 2 of VASN containing the complete coding sequence was sequenced to identify the presence of single nucleotide polymorphisms (SNP) as five overlapping fragments of length 575 bp, 609 bp, 700 bp, 552 bp and 496 bp. Among the five fragments of VASN, a novel SNP (G to A) was identified at the 440 th position of 496 bp fragment. The SNP was at the 521st position of the 3' UTR region of exon 2. A total of 198 animals (135 Malabari and 63 Attapady Black) were screened for polymorphism using high resolution melt analysis (HRM). Two genotypes GG and GA were identified and evaluated for association with production traits. The GA genotype demonstrated a significantly ($p \leq 0.05$) higher height at withers and body length compared to GG genotype indicating a potential role in growth traits. But, in this study, association analysis of the reproductive trait (litter size) to VASN polymorphism indicated no significant difference between the two genotypes. The relative expression of VASN mRNA were studied using GAPDH as housekeeping gene. Relative expression of VASN was significantly ($p \leq 0.05$) higher in the uterus compared to ovary and fallopian tube. This suggested that VASN have a role in uterine wall development rather than a direct effect on reproductive performance.

Association of butyrophilin gene polymorphisms with milk yield and fat per cent in crossbred cattle of Kerala

Genetic variability of butyrophilin (BTN1A1) gene in 151 crossbred cattle of Kerala was investigated and a total of 17 single nucleotide polymorphisms (SNPs) were detected while 13 being novel. Association of SNPs G21A, A465G and G506A with milk production traits 305 day milk yield, fat yield, fat per cent, SNF yield and SNF per cent was deduced after genotyping animals using high resolution melt (HRM) curve analysis. Two genotypes GG (0.86) and GA (0.14) were revealed for G21A polymorphism. The genotypes for SNP A465G were KK (0.25) and KL (0.75). Similarly, for polymorphism G506A two genotypes MM and MN were identified with frequencies 0.25 and 0.75, respectively. Based on the polymorphisms studied using Chi-square analysis, the population was detected to be in H-W equilibrium only with respect to G21A. General linear model-univariate analysis was carried out to study the association with milk production traits by considering herd, season of calving and parity of the animal as non genetic factors and trait as a dependent variable. Association analysis of G21A revealed significantly higher association of GA genotype ($P \leq 0.05$) with 305-day milk yield (GG:2720.74±122.92 kg; GA:3250.20±183.24 kg), fat yield

(GG:106.55±4.32 kg; GA:126.30±13.35 kg), SNF yield (GG:211.52±9.20 kg; GA:246.90±13.70 kg) and GG genotype for SNF per cent (GG:7.80±0.04 per cent; GA:7.65±0.07 per cent). Similarly, MN genotype of G506A had shown a significantly higher association (P≤0.05) with 305-day milk yield (MM:2358.06±141.46 kg; MN:3097.51±121.92 kg), fat yield (MM:94.14±5.00 kg; MN:119.95±4.31 kg), SNF yield (MM:183.14±10.50 kg; MN:239.08±9.03 kg) and MM genotype for fat per cent (MM:4.10±0.08 per cent; MN:3.90±0.70 per cent). At the same time KK genotype of A465G had shown a statistically significant higher association (P≤0.01) with fat per cent (KK:4.14±0.08 per cent; KL:3.91±0.07 per cent) and SNF per cent (KK:7.86±0.06 per cent; KL:7.73±0.05 per cent) only. The current study recommends alleles G, K and M as favourable for considering. [Lk1] SNPs G21A, A465G and G506A, respectively for breeding programmes in crossbred cattle of Kerala

Expression profiling of candidate genes affecting post thaw sperm parameters in Vechur cattle of Kerala

Cryopreservation of sperms have been adopted to aid the efforts for conservation and improvement of the Vechur cattle, a threatened indigenous cattle breed of Kerala. Oxidative stress and reactive oxygen species (ROS) in the spermatozoa are generated from both endogenous and environmental sources, like freezing and thawing of frozen semen which might be responsible for causing infertility due to decrease in sperm quality parameters. This necessitates the use of good freezability semen for cryoconservation.

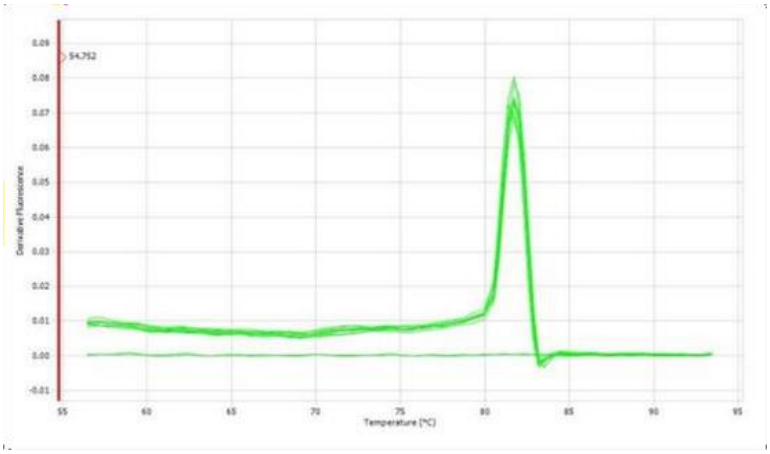
Semen from 20 Vechur bulls was collected and those with more than 70 per cent progressive motility were selected for cryopreservation. Based on the post thaw motility bulls were grouped into GFR (andgt;40 per cent) and PFR (andlt;40 per cent). Three ejaculates from three bulls in each group were collected and cryopreserved. Fresh and post thaw semen from two groups was used to isolate RNA. Three candidate genes HSP90AA1, PRDX6 and SOD1 were selected for expression profiling. Relative quantification was performed by qPCR with BACTIN and PPIA as internal control genes.

Statistical analysis revealed a significant (pandlt;0.05) downregulation of HSP90AA1 and PRDX6 from fresh to post thaw (GFR and PFR) semen. While there was no significant difference between GFR and PFR in case of HSP90AA1, a significant (pandlt;0.05) downregulation in PFR from GFR for PRDX6 was revealed. No significant difference in expression of SOD1 was detected between the bulls of different groups.

Genomic DNA was isolated from the blood of Vechur cattle(n=78). Complete coding sequence of SOD1 consisting of five exons along with flanking intronic regions was amplified using polymerase chain reaction (PCR) with custom designed primers. Sequence analysis revealed presence of two single nucleotide polymorphisms (SNPs) g.1992Gandgt;A and g.2097Aandgt;T (I95F) in intron 1 and exon 2, respectively. The population was genotyped using high resolution melt curve (HRM). Gene and genotype frequencies were calculated and the population was found to be in HWE. The current study suggests PRDX6 as a promising gene for selecting bulls based on sperm parameters.

Expression profiling of Ecto-Nox disulfidethiol exchanger 2(*ENOX2*) gene in response to heat stress in goats

A study was undertaken with an objectives to find out the expression profile of ENOX2 gene in response to heat stress and identify single nucleotide polymorphisms (SNPs) in Malabari and Attapaddy Black goats of Kerala. Based on physiological parameters both breeds are grouped as heat stress susceptible (HSS) and heat stress tolerant (HST). The relative expression of *ENOX2* gene is higher in HSS compared to HST group. Higher expression of 5.27 fold was noticed in Malabari whereas in Attapaddy black it was 1.74 fold. Two novel SNPs were detected at intron 1 (g.142 A>T) and exon 2 (g.154 G>A). Two genotypes AA, BB were observed in the 245bp fragment (E1-I1) with a frequency of 0.21 and 0.79 in Attapaddy black. Only BB genotype was observed in Malabari goats. Two genotypes, AA and AB were observed in 245bp fragment (I1-E2-I2) with overall frequency of 0.18 and 0.82, respectively. The AB genotype was abundant in both the population. The temperature humidity index (THI) had significantly high correlation with rectal temperature, respiratory rate and heart rate in both breeds. The present study concludes that Attapaddy black is more heat tolerant than Malabari goat and the *ENOX2* gene can be considered as a promising candidate gene for selection of heat resilient goats.



Assessment of sire evaluation methods in crossbred cattle of Kerala

The study was conducted to assess the four sire evaluation methods namely Least Square method (LS), Best Linear Unbiased Prediction-Least square Maximum Likelihood method (BLUP-LSML, Best Linear Unbiased Prediction- Sire Model (BLUP-SM) and Best Linier Unbiased Prediction- Sire Model (BLUP-SM) for two traits, Age at first Calving (AFC) and First Lactation Milk Yield (FLMY). Records of 898 crossbred cows sired by 203 bulls spread over a period of 18 years from 2002 to 2019 were used as study material The average age at first calving (AFC) was 1041.61 ± 6.7 days and the average First Lactation Milk yield (FLMY)was 2780.17 ± 15.22 Kg. Sire batches had significant effect on both the traits studied. The calving period had significant effect on FLMY. The breeding values of the sires were estimated by four sire models were compared. The accuracy of the models were compared using Coefficient of Determination, Coefficient of Variation, Product Moment Correlation, Spearmans Rank Correlation, Root Mean Square error, Mean Absolute error and Mean Absolute percentage error. The BLUP-SM model showed lowest error variance and highest coefficient of determination. Considering all the results BLUP-SM model is found to be the most accurate method for sire evaluation of AFC and FLMY in crossbred cattle of Kerala.

Evaluation of production performance of Athulya, native and IWN X native crossbred layer under backyard system

An experiment was conducted to evaluate the production performance of Athulya, native and IWN x native crossbred layers under backyard system. The IWN and IWP strains used for producing Athulya in the present study belonged to S31 generation and the native bird evaluated belonged to S4 generation of the native chicken which were maintained at AICRP on Poultry for Eggs, Mannuthy. The IWN x native crossbreds were produced by crossing IWN strains of white leghorn belonging to S31 generation and native birds belonging to S4 generation. One hundred, day- old female chicks of each groups were reared upto 14 weeks of age under deep litter system at AICRP on poultry for eggs, Mannuthy before distributing to households. Thirty households from Subash Nagar and Kozhukkully area of Thrissur district were selected for the study. At fourteen weeks of age, 50 birds from each group were randomly selected and allotted to 10 households as a set of five to each. Thus total 150 birds were distributed among 30 households. The production performance of the birds were evaluated from 15 to 40 weeks of age.

The study revealed that the performance of native birds in respective of different traits makes them a suitable bird for backyard poultry rearing compared to Athulya and crossbreds.

Impact of Kerala flood 2018 on the milk production and socio-economic status of dairy farmers in Ernakulam and Thrissur districts

The results of the study indicated that the flood 2018 significantly impacted milk production. This was evident from the data on milk procurement during the rainy season, that was significantly different for both Ernakulam and Thrissur districts for the three years studied with the figures for 2017-18, 2018-19 and 2019-20 in Ernakulam being 9.79 ± 1.75, 9.17 ± 1.65 and 9.52 ± 1.56 Lakh litres respectively and that for Thrissur district being 6.73 ± 1.15, 6.14 ± 1.06 and 6.38 ± 1.08 Lakh litres, respectively.

The major economic constraint reported by the respondents during the flood included the high cost and non-availability of feed and fodder. The lack of an early warning system was the major communication constraint reported by 84 per cent of the respondents. The important technical constraint experienced by the respondents was their inability to milk or sell their animals. From the infrastructural point of view, the lack of animal shelters was reported by 81.3 per cent to be a major problem faced by them during the flood. A major area of concern, that was a fall out of the flood 2018, is the issue of psychological distress experienced by a large number of affected farmers with 82 per cent of the livestock farmers studied reporting this issue. The livestock farmers responded proactively to a medium extent to the flood with the adoption of precautionary measures by 82 per cent of them. The study also shed light on the fact that 46.7 per cent of the respondents had a medium level of perception towards the effectiveness of the government support system.

Coordination and enhanced activities by government agencies, nongovernmental and other relevant community organizations to create awareness about the effects of climate change and to foster responsible environmentally conscious behaviour through appropriate communication methods along with support for the mitigation efforts of livestock farmers are imperative to contain further damage on account of such natural calamities in livestock sector.

Molecular characterization and seromonitoring of canine parvovirus following modified live cpv-2b vaccination in pups

Faecal sample from 21 dogs with clinical signs suggestive of parvo viral enteritis were screened by PCR for detection of Canine parvo virus (CPV). Sequencing revealed more similarity with CPV 2 a. Change in amino acid position at 440 from threonine to alanine

indicated presence of new CPV 2a. High titre low passage modified live vaccine could induce protective titres in vaccinated pups by day 30 irrespective of their maternally derived antibody status at the time of vaccination.

Screening for methicillin resistant *Staphylococcus aureus* associated with caprine mastitis

CNS (51.51 per cent) is the major pathogen followed by Coliform (19.69 per cent), *S. aureuso* (15.15per cent), Streptococci (9.09per cent) and Micrococci (4.54 per cent). Among *S. aureus* isolates the most commonly observed resistance phenotypes were against Gentamicin (100per cent), Cotrimoxazole (70per cent), Amoxicillin-sulbactam (60per cent), Cef-sulbactam (50per cent) and Methicillin (50per cent). Among CNS isolates, the most commonly observed resistance phenotypes were against Methicillin (74.28per cent), Gentamicin (68.57per cent), Amoxicillin-sulbactam (54.28per cent) and Enrofloxacin (51.42per cent). Twenty per cent (2/10) of *S. aureus* isolates were found to have mec A gene coding for Methicillin resistance.

Aetiology and therapeutic management of theileriosis in goats

The present study envisages the identification of aetiological agent, clinical, haemato-biochemical alterations associated with the disease and assessment of the efficacy of the therapeutic protocols adopted. Out of the one hundred goats studied, 62 per cent were positive for theileriosis, 15 per cent for anaplasmosis and three percent with combined infection of theileria and anaplsama. *T. ovis* in nine goats (36 per cent) out of 25 goats. Mixed infection of *T. ovis* and *T. luwenshuni* could be detected in four goats (16 per cent) were seen among 25 goats. Major clinical signs observed were anaemia, fever, lymph node enlargement, anorexia and respiratory distress. Effectiveness of three treatment regimens, buparvaquone @ 2.5 mg per kg I/M and oxytetracycline dihydrate @ 20 mg per kg I/M, buparvaquone @ 2.5 mg per kg I/M and marbofloxacin @ 2 mg per kg I/M and buparvaquone @ 1.25 mg per kg I/M and imidocarb @ 0.6 mg per kg I/M were compared, and the first treatment protocol was found to be the treatment of choice for caprine theileriosis

Detection of elephant endotheliotropic herpes virus in Asian elephants (*Elephas maximus*)

A total of 31 elephants presented to Teaching Veterinary Clinical Complex, Mannuthy, and those under private ownership (Thrissur districts), temples and Department of Forests and Wildlife, Kerala from Thiruvananthapuram, Pathanamthitta and Ernakulam during 2019-2020

were included in this study. The animals were subjected to physical examination and assessment of haemato-biochemical parameters. The faecal examination revealed strongyle ova in 22.7 per cent cases and strongyloides ova and larva in 9.7 per cent cases. Trunk wash samples were collected for PCR. Out of 31 samples, one yielded positive for EEHV and EEHV1 genotype. Sequencing of the positive PCR product confirmed amplicon similarity to EEHV1. The remaining 30 elephants failed to give the amplicons for EEHV. Haemato-biochemical studies revealed leukopenia, lymphocytosis and hypoalbuminemia in the affected animal.

Bacterial aetiology of infertility in dogs with special to brucellosis

A total of 60 dogs including 10 control group dogs with a normal breeding history and the remaining 50 dogs with various reproductive problems were selected. The main clinical signs noticed were persistent greenish grey vaginal discharge (76 per cent), mid to late term (45 to 60 days) abortion (85 per cent), orchitis/epididymitis (45.46 per cent), scrotal oedema and azoospermia (27.27 per cent). Out of 60 sera samples screened for brucellosis with Rose Bengal Plate Test (RBPT), 26 (43.33 per cent) dogs from the test group were detected as reactors. Stamp stained smears prepared from aborted foetal stomach contents revealed red coccobacillary organisms against blue background in 10 (20 per cent) positive cases, suggestive of Brucella organism. Out of twelve *Brucella* spp. positive samples, eleven samples (91.67 per cent) yielded amplicons with a 100 per cent homology to *B. abortus* on sequencing. This study recommends treating all urogenital infections in with antibiotics only if required, and if done, to be in accordance with the culture and sensitivity pattern of antibiotics. Dogs of reproductive age should be regularly screened for brucellosis and animals tested positive should not be used for further breeding purposes.

Screening for parasitic infections among exotic and zoo birds

Haemoproteus columbae was identified by species specific PCR and sequencing of genus specific PCR product from pigeons, budgerigars, parrots and cockateils. *Plasmodium* spp. and *Leucocytozoan* spp. could not be detected by either microscopy or molecular method among exotic pet birds. Screening of GI parasites revealed an overall prevalence of 69.6 per cent (119 /171) and 6.9 per cent (5/72) in exotic and zoo birds respectively. *Ascaridia* spp. was noticed in 48 per cent and 5.5 per cent of exotic and zoo birds respectively. *Capillaria* spp. was detected in 11.1 per cent and 1.38 per cent of exotic and zoo birds respectively whereas *Eimeria* spp. (26.9 per cent) and tapeworm ova (2.9 per cent) were present only in exotic pet birds. Mixed infections were noticed in 20.5 per cent pet birds. Based on

micrometry, the parasites identified from exotic pet birds were *Ascaridia galli*, *Capillaria obsignata* and *Eimeria labbeana* and those from zoo birds were *Ascaridia galli* and *Capillaria caudinflata*.

Identification of genes encoding extended spectrum beta lactamase production in *Escherichia coli and Klebsiella* spp. associated with bovine coliform mastitis

Predominant gram negative isolates were *E. coli* (56per cent) followed by Klebsiella (44 per cent). Antibiotic sensitivity by in vitro disc diffusion assay revealed that 92.8 per cent *E. coli* and 90.90 per cent Klebsiella were multidrug resistant. Most commonly observed resistance phenotype was against Amoxicillin, Cefoperazone, Clindamycin and Enrofloxacine while highest sensitivity was for Miropenem (100 per cent) Analysis for the presence of genes for ESBL production using genotypic methods that targeted bla- CTX-M, bla-MLX and bla-TEM and Carbapenemase genes bla- OXA, bla-NDM Seven (63.63 per cent) out of 11 isolated *K. pneumonia* and none of *E. coli* isolates had genes resistant for ESBL production. bla- CTX-M (57.14per cent) was the most prevalent gene followed by bla SHV (42.86 per cent). Whereas none of the isolates were found to carry bla- TCM, bla- OXA, bla- NDM genes.

Molecular detection of virulence factors in *Staphylococcus aureus* associated with bovine mastitis

Staphylococcus aureus was detected and confirmed by PCR using 16SrRNA and 23SrRNA in 23 isolates. The 4 selected virulence factors were screened and all isolates possessed coa and muc gene whereas hla gene was identified in nine isolates and none of them possessed PVL gene. All the three treatment protocols (oxytetracycline, Cefoperazone- Sulbactam, Ciprofloxacin) for mastitis were found to be equally effective. No statistical significance could be noticed between clinic therapeutic efficacy of the drugs

Genetic variability and virulence factors of *Malassezia pachydermatis* isolated from dogs

Out of 250 dogs screened, 164 dogs were found positive for yeast on cytological evaluation. Females between the age group one to six years were most susceptible to infections. Labrador Retrievers and Pugs were the most susceptible breed. Thirty one isolates were obtained on Sabouraud Dextrose Agar without lipid supplementation, yielded amplicons of size approximately 776 bp specific for *M. pachydermatis* on Polymerase Chain Reaction (PCR) with Internal Transcribed Spacer primer. The positive samples were subjected to PCR using the primer FM1 and 11 genotypes were classified. All isolates adhered to polystyrene plate at various levels ranging from 42.01 to 78.17 per cent. Hydrophobicity differed amongst

different genotypes ranging from 33.75 and 56.9 per cent. The range of OD values for biofilm were between 0.26 to 0.37 at 620 nm by crystal violet staining assay. A moderate negative statistical correlation was found between biofilm formation and hydrophobicity, whereas other factors were not correlated.

The study revealed that multiple genotypes could colonize different anatomical sites of same animal, with differences in virulence factors. This warrants studies with larger sample size including more virulence factors to understand the role of pathogenesis of the disease.

Antifungal resistance of dermatophytes isolated from dogs

A total of 100 dogs were screened for dermatophytosis from December 2020 to September 2021 from Teaching Veterinary Clinical Complex (TVCC), Mannuthy and University Veterinary Hospital (UVH), Kokkalai. Out of total 100 samples, 25 samples (25 per cent) yielded a positive culture for dermatophytosis on SDA (Sabourauds Dextrose Agar). Five species of dermatophytes including *T. mentagrophytes*, *T. rubrum*, *M. gypseum* *M. nanum* and *E. floccosum* were isolated in the present study. Among them *T. mentagrophyte* (44 per cent) had higher occurrence followed by *T. rubrum* (24 per cent), *M. gypseum* (20 per cent) *M. nanum* (8 per cent) and *E. floccosum* (4 per cent). Dermatophytosis was most commonly seen in puppies of less than six months of age (48 per cent) than young (36 per cent) and adult dogs (16 percent). Pure breeds of dog (92 per cent) were more infected with dermatophytosis than non-descriptive breeds (8 per cent). There was no significance difference noticed in sex wise predisposition of dermatophytosis. Seventy-six per cent dermatophytosis cases were presented as localized lesions and 24 per cent were presented as generalized lesions in the present study. Occurrence of dermatophytosis was high during summer and spring season than winter. Molecular characterization of dermatophyte isolates was carried out by using three sets of primers (ITS1-ITS4, B2F-B4R and TR1- TR2). Antifungal sensitivity was carried out by broth microdilution technique on 25 isolates with 4 antifungal agents (fluconazole, ketoconazole, miconazole and griseofulvin).Four isolates of *T. mentagrophytes*, four isolates of *T. rubrum* and three isolates of *M. gypseum* had high MICs for fluconazole (64 µg/ml), while ketoconazole, miconazole and griseofulvin had the lowest MIC values for all the isolates.

Assessment of the impact of Kerala flood-2018 on the livestock farming systems of Pariyaram panchayath in Thrissur district of Kerala

Climate change poses existential threat on all forms of life on earth. Flood is one of the major fallouts of it. Tropical humid zones experiences worst form of rain related disasters in the

recent times. Kerala, a tropical humid state of India experienced one of the most destructive flood events of the century during August 2018. It had heavy impact on every sector including animal husbandry. Based on this event, a study was conducted to assess the impact of Kerala flood 2018 on livestock farming system of Pariyaram Panchayat in Thrissur district of Kerala. The entire Panchayat was demarcated into affected and unaffected wards and detailed survey on faming system and physio chemical analysis of soil and water were conducted. Pre and post flood livestock system of the flood affected area differed significantly regarding herd strength, milk production and feeding pattern. There were long term changes on water and soil quality of the flood affected area of the Panchayat when compared with the non-affected areas of panchayat. The pH of water of the unaffected area was 6.433±0.24 whereas that of the affected area was 5.982-0.05. Not only pH, detailed physio chemical analysis revealed that the flood had changed the water quality parameters like turbidity and chloride. In soil, calcium content changed significantly after the flood. Sampling was done sufficiently late in the same season next year to elicit the real long term effect which has significance on livestock and agricultural systems. This study indicates that water and soil quality is a key factor to be monitored at local level to maintain the quality of farming systems after heavy floods.

Nutrient recycling potential of fly larvae for biowaste management

The fly larva plays a pivotal role in nutrient recycling of biowastes. This study was to find the nutrient recycling efficiency of fly larvae in biowastes, and to assess the nutrient content of fly larva and economic viability of bioconversion. The flies that colonized biowaste were identified in the pilot study. The five different biowastes viz. cow dung (BW-1), pig manure (BW-II), poultry manure (BW-III), poultry slaughter waste (BW-IV) and food waste (BW-V) were subject for the study. The climatic parameters, fly and larval activity, physicochemical parameters and proximate principles of substrate and leachate were recorded in the three different seasons viz summer. (S-1), monsoon (S-II) and post monsoon (S-III). The biomass yields from the biowastes were also recorded. The results showed that primary colonizers, *Chrysomya* sp. were significant in poultry slaughter waste while Black soldier fly (BSF) was significantly found in food waste. During the study period, the climatic variables, temperature (°C), relative humidity (per cent) and rainfall ranged from 28 to 30°C, 75 to 84 per cent and 15 to 359 mm respectively. Significant ($p<0.05$) reduction in weight (kg) was observed in BW-IV with a final weight of 1.97 kg. Significantly high temperature (°C) of 40.28°C was observed in middle layer of BW-V in phase-I of S-1. Significantly low pH was recorded in

BW-V (3.5), and significantly high pH was observed in BV-III (7.96). Carbon dioxide emission was significantly higher in BW-V (49.9 per cent), while ammonia and hydrogen sulphide were significantly higher in BW-IV which were 100 and 347.63 ppm respectively.

The highest significant larval biomass yield of 33.42 g (BSF) was from BW-V during S-1 which was significant with other substrates. The crude protein (CP) of *Chrysomya larva*, ranged between 49 to $1 per cent while for BSF larvae it was 36 to 38 per cent. Highest significant BOD of 36.73 g/l and COD of 52.57 g/l were recorded from BW-IV. The reduction in weight of biowaste on dry matter basis was highest for BW-V in S-1 (59.8 per cent) while it was below one per cent for BW-1, II and III. The highest total biomass yield of 445.16 g BSF larvae was obtained from BW-V in S-I. The BW-IV gave an yield of only 11.6 g larva during the S-1. The economic analysis revealed that production cost of one unit of CP with BSF larva was Rs. 0.30 to 0.45 which was lower than that of soyabean (Rs 1.00). This study concluded that nutrient recycling using BSF larva in food waste (BW-V) was economically viable.

Evaluation of rabbit farming under different management conditions

Analysis of SWOT about rabbit production system in Thrissur and Malappuram districts of Kerala was conducted. Sixty rabbit units were selected randomly out of the rabbit farmers of the two districts. The rabbit units were classified small (1-10 doe unit) and medium (>10 doe unit). Thirty farms from each category was selected for analysis. Women were mainly involved in the activities of small (76.7 per cent) and medium (63.3 per cent) rabbit farms. Out of the total respondents 21.7 per cent were new to this field and had less than one year of experience and 33.3 per cent of them had five to 10 years of experience. Annual cost of management for a single doe was observed maximum among medium farmers (Rs. 6766.99), whereas minimum was found in small farmer group (Rs.4818.37). Annual sale of broiler rabbits from a single doe account for the major profit among small (Rs.9664.15) and medium (Rs.12575.81) farmers group. The profit per month from a single doe unit in small and medium farmers found to be Rs.549.68 and Rs.661.59 respectively. A cost benefit ratio of 2.36, 2.17 were noticed among small and medium farmer groups respectively. This study used the analysis of strengths, weaknesses, opportunities and threats to assess internal and external factors affecting the viability and sustainability of rabbit farms in Kerala. In the small and medium rabbit farms for all the SWOT factors had Kendall's 'W' value ranges from 0.005 to 0.017 and 0.006 to 0.069 respectively. Based upon outcomes, most important strengths and opportunities could be combined into a functional strategy that vitalizes the

rabbit production systems. Litter size at birth was calculated as 6.23 ± 0.21 and 6.73 ± 0.19 for small and medium rabbit farms respectively. Litter size at weaning was calculated as 5.33 ± 0.16 and 5.83 ± 0.14 for small and medium rabbit farms. The result showed that there was significant difference ($P<0.05$) in litter size at weaning and no significant difference in litter size at birth between small and medium rabbit farms. The result showed that there was significant difference ($P<0.05$) in the sale price of rabbits (549.68 ± 5.78, 661.59 ± 7.89) between small and medium rabbit farms. This means that the medium rabbit farmers were getting comparatively more market price than small rabbit farmers.

Effectiveness of illuminated fly traps for the control of dipteran biting fly annoyance in dairy farms

Small dipteran biting flies of the genera Culex, Culicoides, Phlebotomus Simulium, Stomoxys and Haematobia cause annoyance to domestic animals and animal handlers. Besides, these they act also as vectors of infectious diseases. Effective fly control methods with reduced reliance on chemical control need to be developed to reduce fly population. So a study was conducted on various aspects of dipteran fly annoyance in cattle to develop and evaluate the effectiveness of an innovative illuminated fly trap for the control of dipteran biting flies in dairy farms. The study comprised of a preliminary survey among 100 livestock farmers of Thrissur district selected randomly by using a structured interview schedule regarding the fly annoyance. The survey revealed that dung pits (74 per cent) and biogas plants (26 per cent) were the predominant waste management practices adopted by dairy farmers, Majority of respondents (54 per cent) disposed the animal waste at a distance of less than 10 m from the shed. The flies were prevalent in all the farms (100 per cent) followed by ticks (87 per cent). All the respondents practised chemical methods to control flies in their farms, while only 7 per cent of the respondents resorted to mechanical methods. Six per cent of the respondents used light and colour for trapping the flies as a mechanical method. The major constraints faced by dairy farmers with regard to use of fly traps were the unavailability of traps (94per cent) and complexity in preparing the traps (94per cent) followed by lack of knowledge about illuminative traps (93per cent) and unawareness about modern trapping methods (93per cent). In the present study illuminated fly traps were prepared by using red, blue and yellow coloured plastic pots containing white LED bulbs of 3 W, 5 W and 7 W with castor oil spread on the surface of the pots. Effectiveness of colour and intensity combination was tested in six farms selected randomly (with more than ten cows) of Thrissur district of Kerala in a 3X3 factorial design. Black pot without light acted as control.

Detailed study was also conducted at University Livestock Farm (ULFandFRDS) of College of Veterinary and Animal Sciences, Mannuthy. Ten spots equidistant from each other were selected in the farm with one trap catering to three animals forming a treatment group. T5 (blue with 5 W; 405-411 Ix) was found to be the most effective combination. The common dipteran flies of veterinary importance trapped belonged to the family Culicidae, Muscidae and Pychodidae. Besides this, small insects belonging to order Hymenoptera, Lipidoptera, Hemiptera and Coleoptera were also identified. All the seven fly avoidance behaviours were significantly higher in control group when compared with treatment group and it was significantly so at 1 PM. Fly activity was predominantly higher during 6 PM - 10 PM. Expenditure for installing the traps in a cattle farm having ten cattle, was estimated to be only Rs. 1990 per year. Hence light traps can cost effectively replace the use of insecticide to a great extent. Illuminated fly trap is cheap, eco-friendly and effective method against small biting flies causing annoyance in cattle of tropical humid zone.

Impact of enrichment of grazing meadow with automated water trough on the welfare of crossbred cattle

Grazing practices of cattle in meadows enriched with automatic drinking water facility was evaluated. The improvement in animal welfare was studied. Lactating cows and heifers (18 each) were selected for the period of study during the summer months of February and March 2021 at Base Farm, Kolahalamedu, Idukki, Kerala. Animals were divided into three groups and each group comprised of six lactating cows and six heifers. In group T1 animals were allowed to a grazing meadow enriched with an automatic drinking water trough and in T2 animals were allowed to a meadow without provision for water. Animals in the T3 group were kept stall fed throughout the study period. Body temperature and respiration rates were higher in the grazing groups (T1 and T2) compared to the stall-fed group. At the end of the study period, the lactating cows of T1 showed significantly reduced levels of serum cortisol. The total grazing activity of lactating cows provided with drinking water was significantly lower than lactating cows without the provision of water. Moreover, these animals showed significantly higher rumination activity than T2 at 12:00 noon. Lactating cows and heifers in the T1 group consumed 78.26 +3.86 and 26.98 ± 2.81 litres of water respectively and the frequency of visits to the water trough was 9.20± 0.67 and 8.46±0.64 respectively. The blood parasites and endoparasites infestations among all the experimental animals at the end of the experiment showed no significant difference. In general, as the ambient temperature increased, grazing activities in animals of both T1 and T2 started to reduce by 11:00 am. The

heat load index was more in the meadows than in the shed which necessitates the regulation of grazing duration and time. It could be concluded that grazing of animals in meadows enriched with automated water trough significantly reduced the serum cortisol level and animals exhibited relatively increased comfort level while grazing.

Characterisation of bovine integrin beta 6 gene and analysis of its expression with reference to foot and mouth disease

The study was carried out to identify single nucleotide variations in Integrin beta 6 (*ITGβ6*) gene, to evaluate its association with Foot and mouth disease infection and to compare the expression profile in the infected and non-infected cattle. The exons 1, 2 and 14 of *ITGβ6* were analysed for polymorphism detection. Similar banding patterns (AA with two bands) were observed for exon 1 in all the animals studied. The PCR-SSCP analysis of exon 2 revealed two genotypes BB (two bands) and BC (three bands) and on further sequencing one synonymous SNP, c.29G>A was revealed. The genotype BC was significantly ($p \leq 0.01$) higher in non-infected cattle. Three banding patterns (two, three and four bands) were observed for exon 14 and further sequencing revealed a synonymous SNP, c.133C>T and a non-synonymous SNP, c.135G>A. The diplotypes II (CC, GG) and HI (CT, GG) were identified in crossbred cattle while an additional diplotype IJ (CC, GA) was observed in Vechur cattle. The diplotype HI was significantly ($p \leq 0.01$) higher in non-infected cattle. The relative expression of *ITGβ6* was downregulated by 0.49 fold in the infected group than the non-infected group.

Comparative efficacy of fermented soybean meal, probiotics and organic acids on growth performance in broilers

An experiment was conducted in Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy to compare the comparative efficacy of fermented soya bean meal (FSBM), probiotics, and organic acids in the diet on growth performance of broilers for a period of 42 days. A total of 160, day old chicks were randomly allotted into 5 dietary treatment groups viz., T1, T2, T3, T4 and T5 with four replicates of eight birds each in a completely randomized design. The Birds in T1 (Control) group were fed with corn, Soyabean meal based standard broiler ration (SBR) formulated as per BIS (2007), T2 group was fed with diet containing FSBM (Complete replacement of SBM by FSBM), T3 group was fed with SBR plus probiotics mixture at 0.5 g/Kg, T4 group was fed with SBR plus organic acid mixture at 1 g/kg and T5 group was fed with SBR plus combination of probiotics at 0.5 g/kg and organic acids at 1g/Kg. The birds in FSBM group had lower

production cost/kg body weight compared to probiotic and organic acid groups. The growth performance and carcass characteristics ileal microbial count, small intestinal histomorphometry and serum lipid profile of birds in FSDM group were similar to that of probiotics and organic groups. Therefore, FSDM can be recommended as an effective and a cheaper alternative to commercial probiotics and organic acids in broilers diet.

Effect of feeding black soldier fly (*Hermetia illucens*) larvae meal on performance of meat type ducks

An experiment was conducted at Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy, Kerala to study the effect of feeding black soldier fly (*Hermetia illucens*) larvae meal on meat type duck and performance and carcass characteristics from zero to eight weeks of age. Ninety six day old ducklings were randomly allotted into four dietary treatment with four replicates having six ducklings each in a completely randomized design. The different dietary treatments in this study were T1 – control group formulated as per IS 1374 (2007) specifications, T2 – with 5 percent black soldier fly larvae meal (BSFLM) inclusion, T3 – with 10 percent BSFLM inclusion and T4 – with 15 percent BSFLM inclusion.

Based on the overall results of the study, it could be concluded that the dietary inclusion of BSFL meal in meat type duck ration upto 15 percent was profitable and did not negatively affect the body weight gain and feed intake. It is better to rear commercial meat type ducks upto 6 weeks of age than up to 8 weeks of age. However, further researches in meat type ducks are required to determine the highest level of BSFLM inclusion in duck ration with out any adverse effect on production performance.

Institutionalised livestock service delivery system in Kerala

The present study was undertaken to analyse the effectiveness of livestock services delivered by the institutions based on their mandates, to assess the core competency of the veterinary professionals in delivering livestock extension services and to identify the constraints perceived by them in livestock service delivery. An ex- post-facto research design was adopted for the study. A total of 160 veterinary professionals were taken for the study. Out of them 12 veterinarians from DVC, 20 veterinarians from VPC, 103 veterinarians from VH and VD, 15 veterinarians from SRCMPU and 10 veterinarians from KVK were selected using stratified proportionate random sampling method. The result showed that majority of the veterinarians working under SAHD perceived curative services (63.70 per cent), production services (58.51 per cent), preventive services (42.22 per cent), diagnostic services (46.66 per

cent), extension services (54.07per cent) and miscellaneous services (56.29 per cent) as average services provided by them. With respect to SRCMPU majority of the veterinarians perceived curative services (60.00 per cent), production services (53.34per cent), preventive services (53.34 per cent), extension services (60.00 per cent) and miscellaneous services (60.00 per cent) as average services provided by them. About KVK, majority of the veterinarians perceived on farm trails (50.00 per cent), front line demonstrations (60.00 per cent), capacity development activities (50.00 per cent), data documentation (40.00 per cent), training programme (50.00 per cent) and extension activities (50.00 per cent) as average services provided by them.

Further, majority of the veterinarians rated livestock extension core competencies as important in their routine work and they had medium level of knowledge about these competencies. With respect to farmers perception towards livestock service delivered by SAHD, SRCMPU and KVK, majority of them perceived livestock service as average service provided by these institutions and most of them were not satisfied with these services. In the light of findings from the study, it is concluded that there is a lot of scope for improvement of livestock services in the state through suitable policy interventions.

Livelihood security of dairy farmers affected by Kerala flood 2018

An ex post facto research was conducted in Kerala to assess the livelihood security of dairy farmers affected by Kerala flood 2018. Based on secondary data, 180 flood affected dairy farmers from three districts namely, Thrissur, Idukki and Ernakulam were randomly selected as respondents. For qualitative studies, 24 respondents were selected by employing purposive sampling. The data were collected through personal interview method using a structured pretested interview schedule. Analyses of socio economic characters of the flood affected dairy farmers revealed that majority were old and were males, practiced agriculture as their main occupation and dairying as their secondary occupation. Majority were educated up to secondary school level, had medium sized family, owned less than 100 cents of agricultural land, medium sized herd, had more than ten years of dairying experience, earned low income from dairying and medium annual gross income. Majority of flood affected dairy farmers used television and newspaper in mass media and contacted veterinary surgeons in interpersonal source. More than half of the farmers were not exposed to training. Majority of the respondents possessed medium knowledge on disaster management. Just more than half of respondents had favourable attitude towards disaster management system. The livelihood security of flood-affected dairy farmers was determined to be moderate. Human and social

capitals scored good while financial and physical capitals scored moderate and the natural capital scored poorly. Lack of institutional support during flood disaster, meagre compensation, poor maintenance of drainage structures, non availability of credible weather information and shortage of feed during flooding were major constraints faced. The respondents possessed higher level of adoption of flood coping mechanisms. The major constraint faced by the leaders of panchayat, was the inability of state and central governments to provide a holistic strategy for rescue and rehabilitation. The activities of NGO in disaster management were impaired by lack of clear laws and policies. The officials were plagued by lack of communication and training. Higher educational institutions were involved in providing material and technical assistance services to flood disaster victims.

Antineoplastic activities of lactoferrin from Malabari goat

The in vivo anti-tumour activity of Malabari goat lactoferrin was studied in DLA induced solid tumours in Swiss albino mice of 6-8 weeks. Three doses of MgLf viz 50, 100 and 150 µg were injected intratumourally, among which the dose of 150 µg was found to be significantly efficient in terms of reduction in tumour volume and tumour weight to body weight ratio of the animals under study. Further comparative analysis of the best effective dose of MgLf with the standard chemotherapeutic drug, Cisplatin as well as their combinatorial therapy was also performed in terms of tumour volume, tumour weight: body weight, histopathology and immunohistochemical expression of caspase-3. The combination therapy was found to be more effective than the other groups. Immunohistochemistry analysis of the tumour tissues revealed significantly strong expression of the apoptotic protein caspase-3 in the treatment groups compared to the control group. Hence it was concluded that Malabari goat lactoferrin possesses the potential to considerably inhibit the proliferation of cancer and that it could be exploited to be developed as a novel anti-cancer or chemoprotective drug.

Assessment of the livestock biodiversity management system under selected local self governments of Kerala

The study made an in-depth analysis of the Farm Animal Biodiversity Management System (FAnBMS) of Biodiversity Management committees (BMCs) under selected Local Self Governments of Kerala. Five BMCs each from six districts, two each from northern, central, and southern zones were selected purposively based on key informants' technique. Study documented implementation of eco-management practices with special reference to FAnGR using a content validated inventory with four domains, administered among BMCs.

Biodiversity documentation domain topped with most BMCs showing high level of implementation. conversely, access and benefit sharing domain displayed very low and Biodiversity education and Conservation and sustainable use domains showed medium level of implementation. Study identified the most pertinent strengths, weaknesses, opportunities, and threats pertaining to FAnBMS through iterative rating of a pre-prepared SWOT inventory, primarily by BMC members followed by their supervisors. Key strengths included Convener's leadership, and BMCs' authority as local environmental guards. Topmost weakness was members lack of proper understanding of biodiversity regulations. Key opportunities included empowerment training from KILA and leadership of LSGs. Important threats pertaining to indigenous livestock included lack of public awareness of its importance, lack of incentives to conserve it and inadequate research. Quantified SWOT matrix techniques brought out pertinent strategies for further development of FAnBMS. Study explored veterinarians' perception of potential of various IFAnGR management strategies, under five different domains. Key strategies included monetary and non-monetary incentives to conserver farmers, promotion of integrated farming, traceability of animals and products, cryopreservation of germplasm for threatened populations, nucleus herds outside natural habitats, trademarks, certification marks and GI for premium products, traditional knowledge documentation using PBR tool, periodically updated FAnGR database, characterization of IFAnGR, national and international mobilization of funds, technologies and resources, trainers training to build resource pools, capacity building of field technical personnel in animal breeding services and strengthening BMCs' linkages with animal husbandry organizations.

The findings of the study imply strategic emphasis on the following measures:

i. Strengthening of grass root level biodiversity governance through capacity building of BMC members in biodiversity management
ii. Legal empowerment of BMC authorities with respect to biodiversity laws, rules, and regulations
iii. Promotion measures for custodian farmers of indigenous livestock through monetary and non-monetary incentives including insurance schemes, capacity building,technical support, and marketing facilities.
iv. Application of advanced geo-spatial technologies in animal identification and traceability.
v. Make use of genomics in fast-paced breed improvement.
vi. Enhance accessibility of certified elite indigenous germplasm among farmers.

vii. Devise and implement schemes promoting integrated farming and agro ecosystem approach.
viii. Projects for conservation and sustainable development of unique local livestock populations of socio-economic and cultural value under the leadership of BMCs.
ix. Initiatives of BMCs in cryopreservation of germplasm of indigenous farm animals which are at the verge of extinction.
x. Promotion of trademark, certification mark and geographical indication as marketing tools for premium products of indigenous livestock.
xi. Strategic use of ABS tool for economic prosperity of local communities.
xii. Systematic scientific validation, updation, and digitization of PBR.
xiii. Enhancement of efficiency of BMCs in FAnGR management through networking with Animal husbandry organizations
xiv. Building institutional resource pools in farm animal biodiversity management through trainers training programmes.
xv. Fast paced characterization of indigenous livestock populations.

Aetio-pathology of canine diarrhoea caused by enteropathogens

The VP2 gene of CPV (amplicon size - 583 bp), HSP70 protein gene of *Cryptosporidium* spp. (amplicon size - 150 bp), 16S-rRNA gene of *Giardia* spp, (amplicon size - 292 bp), cpa toxin gene of *C. perfringens* (amplicon size - 324 bp) and eae gene of *E. coli* (amplicon size - 815 bp) were targeted in polymerase chain reaction. Forty dogs with diarrhea were selected for the study. Presence of CPV was detected in fourteen dogs (35 per cent), *C. perfringens* were detected in seven (17.5 per cent) and E. coli in one sample (2.5 per cent). No amplicons could be detected corresponding to cryptosporidium and giardia organism. Transmembrane M protein of CCoV was amplified in ten samples under RT-PCR after extraction of RNA using RNAiso Plus reagent. Twenty-six out of the 40 diarrhoeic dogs (65 per cent) recovered under therapeutic management involving antibiotics and supportive therapy based on the findings.

Protective effect of aqueous fraction of alcoholic extract of *Tamarindus indica* seed coat on acetaminophen induced hepatotoxicity in rats

The present study was undertaken to evaluate hepatoprotective and antioxidant effects of aqueous fraction of methanolic extract of *Tamarindus indica* seed coat (AMTS) on acetaminophen (APAP) induced hepatotoxicity in rats. The study also assessed the nephroprotective effect of AMTS against APAP induced renal damage.

Male Wistar rats were divided into 6 groups (n=6) and received distilled water (normal control) and APAP control groups or 100 mg/kg silymarin (reference drug control) or AMTS (50, 100 and 200 mg/kg dose levels) orally for 10 days on daily basis and on 8 th day, all the animals except from normal control group were subjected to hepatotoxic induction using APAP.

The treatment with AMTS significantly reversed the APAP induced abnormal levels of hepatic serum marker enzymes (ALT, AST and ALP), serum total protein, liver index and hepatic antioxidant parameters (lipid peroxide and GSH) in a dose dependent manner. Besides, APAP induced rise in serum biomarkers of renal function (BUN and creatinine) were resolved by AMTS treatment. The histological examination of liver and kidney revealed near-normal architecture in AMTS-200 mg/kg treated group similar to silymarin, endorsing its hepato-and nephroprotective effects. Moreover, AMTS was found to be safe upto the orally tested limit dose level of 2000 mg/kg as per OECD guidelines.

The phytochemical screening of AMTS revealed the presence of alkaloids, tannins, flavonoids, phenolic compounds, saponins and steroids, while GC-MS analysis showed the presence of methyl isopalmitate, 9-octadecenoic acid (Z)-methyl ester and β-sitosterol as the major chemical constituents. The subsequent in silico molecular docking study unveiled remarkable binding affinity of β-sitosterol against CYP2E1 and FXR suggestive of the probable targets of action of AMTS.

Thus, results of the study indicated the protective effect of AMTS on APAP induced hepato-and nephrotoxicity, which could be partly attributed to its antioxidant activity and the study also warrants further investigation to explore its effect on CYP2E1 and FXR.

Wound healing activity and dermal pharmacokinetics of borneol incorporated k-Carrageenan hydrogel in diabetic wound model in rats

Aggressive wound care is critical to avoid complications in normal and diabetic wounds. Hence, the present study was designed to formulate a novel borneol incorporated hydrogel with combined benefits of mechanical properties of hydrogel and pharmacological properties of borneol. The hydrogels are three dimensional hydrophilic networks which have the ability to absorb high amount of water and drugs within its polymeric structure, without itself getting dissolved in water. Borneol is a bicyclic monoterpenoid alcohol with wound healing, analgesic and anti-inflammatory properties. Hence this can be proposed as a promising agent in the treatment of diabetic wounds.

Antibacterial activity of the borneol was evaluated. K-carrageenan-Gelatin hydrogel was prepared and the film was cross-linked by 5per cent acidic glutaraldehyde solution followed by incorporation of 10per cent borneol into the gel. Formulated wound dressing material was characterized for morphological, physical, chemical and biomedical properties. In vivo wound healing study was performed in experimentally induced wound in diabetic and non-diabetic rats to evaluate the efficacy of the material. Twenty four female Sprague Dawly rats was fed with high fat diet for eight weeks followed by consecutive 4 days streptozotocin injection at a dose rate of 10mg/kg intra-peritoneal for induction of diabetes. Diabetes was confirmed by periodic blood glucose estimation. Under anaesthesia, an excisional wound of 1 cm^2 was created on the dorsal neck in all the experimental rats (both non-diabetic and diabetic) and were treated with 10per cent borneol ointment and 10per cent borneol incorporated hydrogel and daily percentage wound healing was assessed.

Borneol incorporated hydrogel was found to be highly effective in non- diabetic wound, whereas both borneol ointment and borneol incorporated hydrogels were equally effective in diabetic wounds. Presence of borneol could not be detected in blood using HPLC method and hence dermal pharmacokinetics could not be done. Histopathology of healed wound verified that borneol and borneol incorporated hydrogel showed well developed granulation tissue formation and neovascularization. From the results obtained show that crosslinked κ-carrageenan-gelatin hydrogel can be effectively used as a novel drug delivery polymer system for topical wound dressing material.

Ultrasonographic ocular biometry for diagnosis of ophthalmic disorders in dogs

The study was conducted in 75 dogs of various breeds between three months to 15 years of age presented from August 2019 to December 2020 to University Veterinary Hospitals at Mannuthy and Kokkalai. The present study was conducted in animals presented with various ocular affections. B-mode ultrasound scan was performed with manual restraint. Corneal desensitization was achieved by using topical anesthetic, 0.5per cent proparacaine hydrochloride. Biometry for ocular parameters like axial length of the eye (D1), vitreous chamber depth (D2), lens diameter (D3) and lens depth (D4) were recorded in all the dogs which differed significantly within the same group and between groups and between normal eyes and affected eyes. B-mode ultrasound scan is a non-invasive and versatile diagnostic modality which was helpful in diagnosing various disease conditions which otherwise would have been missed with conventional technique

Streamlining surgical approaches of skin and mammary tissue / subcutaneous neoplasms in dogs with special reference to neo-adjuvant and adjuvant chemotherapeutic protocols

The present study was conducted on clinical cases of skin and mammary tissue / subcutaneous neoplasms among the dogs presented to University Veterinary Hospitals of Kerala Veterinary and Animal Sciences University at Kokkalai and Mannuthy. Occurrence of 295 cases of neoplasms in dogs with respect to signalment and anamnesis were studied over a period of three years from October 2017 to September 2020. Thirty six cases of neoplasms consisting of 18 mammary neoplasms and 18 skin/ subcutaneous neoplasms were subjected to detailed study in three groups based on TNM staging of neoplasms. Group I animals (TNM stage T_A N_{0-1} M_0) were subjected to curative-intent surgery alone with minimum 2 cm wide margin radical resections including deep fascial planes. Group II animals with ill-defined surgical margins and inflammatory changes (TNM stages T_A N_1 M $_{0-1}$) were subjected to neoadjuvant chemotherapy at biweekly intervals. This was followed by surgical excision. In Group III- animals (TNM stages T_A N_1 M $_1$) with poorly differentiated surgical margins with metastatic changes in lymph node and confirmed pulmonary metastasis were subjected to surgical excision followed by adjuvant chemotherapy at biweekly intervals. The neoadjuvant and adjuvant chemotherapies in Group II and Group III were carried out using (VBL-P) protocol (vinblastine at 2 mg/ gm intravenously and prednisolone at 1 mg/kg body weight intramuscularly) and (DOX-P) protocol (doxorubicin at 18 mg/ m2 and prednisolone at 1 mg/kg bodyweight intramuscularly) in six animals each in both groups. The surgical approaches to various types of neoplasms were streamlined with special reference to the TNM staging considering the anatomic location and gland/ part involved. Skin closure techniques were studied using single/ bipedicle flaps, local flap or axial pattern flap. Neoadjuvant chemotherapy with VBL-P protocol was found highly beneficial in defining surgical margins and resulted in improvement of surgical fitness of patients owing to the platelet enhancing effect. DOX-P protocol was found marginally effective in neoadjuvant and adjuvant chemotherapy with moderate cardiotoxicity and GI toxicity. Grading of neoplasms provided a valuable insight in designing future treatment strategies and for palliative management. The results of haematological and biochemical parameters were statistically analyzed. The response to treatment was assessed by Modified Karnofsky performance scales in dogs and Response Evaluation Criteria in Solid Tumours (RECIST) guidelines. The survival status of the animals after treatment was compared by plotting survival curve using

Kaplan Meier analysis and results were interpreted using the Log Rank Test. The mean survival time was found less in Group III, compared to Group II and Group I.

Radiographic evaluation of thorax to aid staging of superficial and mammary neoplasms in dogs

Three way thoracic radiographs of twenty- four dogs consisted of superficial or mammary neoplasms (twelve animals each) were studied in two groups to detect radiographically evident cardio-pulmonary, metastatic and paraneoplastic changes. The radiographic findings were correlated with FNAC of primary tumour mass and histopathology. The detectability of the cardiopulmonary lesions in various views were studied to develop a protocol of radiographic interpretation for TNM (Tumour- Node- Metastasis) staging of superficial and mammary neoplasms in dogs. The detectability of the pulmonary lesions were more appreciated in the left lateral view followed by right lateral and ventrodorsal views. The pulmonary metastases were evident in epithelial tumours (squamous cell carcinoma, sebaceous adenocarcinoma and hepatoid gland carcinoma) mesenchymal tumours (liposarcoma) and round cell tumours (malignant fibrohistiocytoma) of TNM stage- T2-3 N0-1b M1 diagnosed by FNAC of primary tumour mass and histopathology. The FNAC of primary tumour masses had malignancy features in cases of mammary neoplasms which consisted of stage V ductal carcinoma, tubulo-papillary carcinoma, solid carcinoma, mesenchymal spindle cell carcinoma and medullary mammary carcinoma with evident pulmonary metastases.

Comparative evaluation of modified proximal perineal urethrostomy and tube cystostomy for the treatment of chronic obstructive urolithiasis in male goats

Twelve clinical cases of chronic obstructive urolithiasis in male goats presented to University Veterinary Hospitals of Kerala Veterinary and Animal Sciences University at Kokkalai and Mannuthy during a period of twelve months from March 2019 to March 2020 were selected for the study with the objective to comparatively evaluate two surgical techniques - modified proximal perineal urethrostomy (MPPU) and tube cystostomy for the surgical management. A significant difference between haematological and biochemical parameters was observed on day 0 and day 14 within groups. A direct access to proximal perineal urethra provided quick relief and the technique was found effective in managing chronic caprine obstructive urolithiasis with intact urinary bladder. Tube cystostomy provided direct visual assessment of urinary bladder, precise fixing of Foley's catheter and retrieval of uroliths. The MPPU technique demanded high levels of skill and accuracy to locate the perineal urethra. Tube

cystostomy technique was found to be more invasive, it was identified as an effective approach for correcting cystorrhexis resulted form obstructive urolithiasis. Functional patency of normal urethra was regained in five out of six animals of each group by third post-operative week. Urinalysis revealed alkaline urine in all animals, hematuria in seven animals, proteinuria in six animals and relatively higher specific gravity on the day of presentation which returned to normal on 14th post-operative day in nine animals. Microscopic examination of urine sediments revealed the presence of erythrocytes, struvite crystals and epithelial cells. Analysis of the retrieved calculi using FTIR-ATR confirmed bandwidths of the infrared wavelength identical to the standard wavelength of magnesium ammonium phosphate.

Immunohistochemical analysis of P7056 kinase protein in superficial tumours of dogs

The highest incidence of canine superficial tumours was seen in the age group of 7-9 years and more cases were seen in male dogs than females. More cases of superficial tumours were recorded in non-descript dogs. Grossly, canine superficial tumours were predominantly greyish white coloured and or oval in shape. The canine superficial tumours were classified into epithelial/melanocytic tumours and mesenchymal tumours based on histopathological features. On grading of malignant canine superficial tumours, squamous cell carcinomas were graded as grade I and II. Fibrosarcoma and malignant fibrous histiocytoma were graded as grade II and III respectively. Immunohistochemistry for p70S6K revealed that majority of the cases showed strong to moderate expression. All malignant tumours showed strong to moderate expression of p70S6K protein. The expression of p70S6K protein in squamous cell carcinoma showed increased expression in higher grade compared to low grade. The protein p70S6K, identified as a key protein in cell signalling pathways in many human cancers was significantly expressed in superficial tumours of dogs as per our study. The preliminary work done by us thus established the oncogenic role of p70S6K in canine superficial tumours and systematic study need to be done to delineate the molecular mechanism involved.

Immunohistochemical analysis of p70S6 kinase protein in mammary tumours of dogs

A higher risk for mammary tumour occurrence was observed in dogs aged between 10-15 years and out of twenty- five cases, only one case was reported in a male dog. Dachshund was the breed affected mostly followed by Labrador and Crossbred. Gross pathological features like shape, size, colour and consistency showed variations and histological classification of the tumours was done. Simple carcinomas were classified into ductal carcinoma, tubulopapillary carcinoma, solid carcinoma, comedocarcinoma, cribriform

carcinoma and majority of them were either grade II or III where as all the mixed tumours were classified as grade II. Immunohistochemistry was performed to study the expression of p70S6K protein in all the cases of canine mammary tumours. Most of the tumours were strongly positive or were moderately positive for the expression of the protein. High grade malignant tumours showed strong to moderate expression of p70S6K protein. Benign mammary tumours in the present study were having weak expression of the protein. It has been reported that mTOR pathway and its downstream molecules including p70S6K are aberrantly expressed and have significant role in the progression of many human cancers. But no systematic studies are there with respect to canine mammary tumours. The present study thus is a preliminary work that could identify a novel biomarker protein in canine mammary tumours which could be used as a suitable target for diagnosis and therapy. A systematic study with higher sample size is warranted to identify the key regulators of the pathway in canine mammary tumours.

Evaluation of omentum-based extra cellular matrix scaffolds for soft tissue repair

At present, many biomaterials fail to perform in clinical translation due to low biomechanical properties and poor biocompatibility outcome. Therefore, the present study was designed to evaluate the biomechanical properties and cellular and tissue responses of glutaraldehyde uncross-linked decellularised bovine omental scaffold (GUOS) and glutaraldehyde cross-linked decellularised bovine omental scaffold (GCOS) and compared with an established material, decellularised bovine pericardial scaffold (DBP). Biocompatibility was assessed in a full thickness abdominal wall defect (1.5cm × 2cm) soft tissue repair rat model. Six Sprague Dawley rats from each group sacrificed on weeks 2 and 6 were evaluated grossly and microscopically. Results revealed that GCOS had the lowest biomechanical values for tensile strength, Young's modulus, elongation at break and strain at maximum load compared to GUOS and DBP scaffolds. Similar to DBP scaffold, GUOS and GCOS also did not reveal any cellular remnants upon examination by haematoxylin and eosin staining, Masson's trichrome staining and scanning electron microscopy. Alcian blue stained sections revealed that the GAG contents were preserved in the decellularised matrices. Furthermore, histopathological observations and special staining results revealed that GUOS had better remodelling potential in terms of neovascularisation, collagen deposition and neo-muscle formation which evinced active tissue remodeling response compared to GCOS and DBP scaffolds. "Reactivity score" revealed that GUOS had minimal or no-reaction (0) at both time periods, whereas GCOS was designated as minimal or non-reactive (2.55) at week 2 and

slightly reactive (4.05) at week 6. The present study revealed that omentum-based scaffolds are capable of providing physical support as well as developing functional tissue via modulation of host cells into the lost soft tissue part. Furthermore, 0.2 percent glutaraldehyde cross-linked bovine omental scaffold as an inductive bioscaffold neither underwent degradation nor produced any hernia/wound dehiscence during the study period. Hence, omental scaffolds are an attractive option to clinical translation for soft tissue repair.

Antineoplastic activity of baicalein and piperlongumine nanoparticles

The research was undertaken to find out the antineoplastic activity of biosynthesised baicalein and piperlongumine nanoparticles in Daltons Lymphoma Ascitis (DLA) cells. The study was carried out in three phases. In Phase 1, silver nanoparticles were synthesised and characterised by UV-Vis spectroscopy, X-Ray Diffraction (XRD) and Field emission Scanning Electron Microscopy (FESEM). The characterisation revealed that the particles synthesised were within the range of nanoscale (1-100nm), crystalline nature and had spherical shape. In Phase II, both the pure compounds and nanoparticles were screened for in vitro cytotoxic activity in DLA cell lines-by MTT assay. Based on the per cent inhibition obtained using MTT, IC50 value for baicalein (BCLN) was 59.41 µg/ mL whereas for AgNP synthesised from BCLN (B-AgNP), the value reduced to 50.22 µg/ mL. Similarly, the IC50 value for piperlongimine (PPLM) was 4.028 ± µg/ mL while the value reduced to 1.25 µg/ mL for AgNP synthesised from PPLM (P-AgNP). Cell viability assessed after incubation with IC50 of test compounds for three hours using trypan blue exclusion assay revealed that all test substances showed an average of 42.47 per cent cytotoxicity in three hours. Acridine orange/Ethidium bromide (AO/EB) staining was done to assess the apoptotic changes in cells exposed to various test compounds for 24h. The cells collected after exposure to IC50 of test compounds for 24 hours were subjected to DCF DA assay for intracellular ROS generation, DNA fragmentation assay and JC1 staining to analyse mitochondrial transmembrane potential (MMP). The relative expression of Bcl2, Caspase-3 and p53 was assayed in the cells keeping GAPDH as reference gene. In vitro studies revealed that among the treatments, PPLM and P-AgNP showed significant apoptotic changes, ROS generation, DNA fragmentation and MMP changes. BCLN and B-AgNP also showed in vitro antineoplastic activity. In both the cases, biosynthesised nanoparticles showed remarkable in vitro antineoplastic potential than pure compounds. In Phase II, acute oral toxicity test of biosynthesised nanoparticles as per OECD guidelines was performed and in vivo antineoplastic properties of nanoparticles was evaluated in DLA induced solid tumour in

mice. No toxicity symptoms or loss in body weight were observed in animals that undergone acute toxicity test for *in vivo* study, fifty four tumor positive mice were selected and randomly allocated into nine groups with six animals in each group. Normal control (Group I) also comprised of six animals. Group II was administered with 5-FU at 20mg/kg orally. Group III served as tumour control. Group IV and V received baicalein nanoparticle at 50mg/kg and 100mg/kg respectively. Piperlongumine nanoparticle was given to Group VI and VII received at 50mg/kg and 100mg/kg respectively. Group VIII and IX received pure compounds, baicalein and piperlongumine respectively at 100mg/kg. Chemically synthesised nanoparticle at 100mg/kg was administered to Group X. All the treatments were given orally for 10 days. Animals were sacrificed and tumour masses were collected on day 11 to assess ratio of tumour weight to body weight, tumour volume, to estimate levels of lipid peroxidation and reduced glutathione. Standard staining using HandE, special staining using AO/EB, relative gene expression studies of Bcl2, Caspase 3 and p53 using Real time PCR were also carried out in tumour masses. All treatment groups showed an increase in lipid peroxidation and decrease in reduced glutathione levels. There was a down regulation of Bcl2 and up regulation of Caspase-3 and p53 in treated groups compared to tumour control group. As revealed in *in vitro* study, PPLM and P-AgNP showed significant in vivo antineoplastic property than other treatments. From the study, it can be concluded that biosynthesised nanoparticles produced more antineoplastic activity than the respective pure compounds from which they were synthesised and in the current study, P-AgNP at 100mg/kg was showing the most potent antineoplastic action against DLA cells.

Cytotoxic, carcinogenic and genotoxic effects of carbosulfan in cultured mammallan cells

Carbosulfan a carbamate class of insecticide, is commonly used in agricultural practices for soil, foliar and seed treatment. There is a paucity of data about the cytotoxic, carcinogenic and genotoxic effects of carbosulfan. The data so obtained could be useful in elucidating the various health hazards in humans and animals due to the environmental exposure to carbosulfan. Hence the present study was envisaged to evaluate the cytotoxic, carcinogenic and genotoxic effects of carbosulfan in cultured mammalian cells. The cytotoxic effect was evaluated using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay in CHO-K1 cells. The mean cell viability per cent of carbosulfan at 12.5, 25, 50, 100, 250 and 500 µg/mL was found to be 96.93 ± 2.40, 95.66 ± 3.36, 91.89 ± 5.31, 73.28 ± 3.08, 34.24 ± 1.67 which proved carbosulfan to be cytotoxic. Carbosulfan treatment at 100, 250 and 500

µg/mL showed loss of basic cytoskeletal structure and cellular contact with reduction in cell density, cell shrinkage, cell detachment and debris formation. Carbosulfan treatment showed induction of oxidative stress as revealed by significant ($p \leq 0.00$) increase in the intracellular reactive oxygen species (ROS) generation in CHO-K1 cells. The DNA fragmentation studies showed significant ($p \leq 0.00$) concentration dependent increase in the per cent of DNA fragments in carbosulfan treated CHO-K1 cells. It was observed to produce significant ($p \leq 0.001$) DNA damage in comet assay as evident by significant ($p \leq 0.001$) increase in tail length, tail moment and olive tail moment. Carbosulfan treatment at 50 µg/mL showed time dependent carcinogenicity in BALB/c 3T3 clone A31 cells using cell transformation assay revealing the carcinogenic potential of carbosulfan. Genotoxicity measured using in vitro chromosomal aberration test revealed that carbosulfan treatment induced significant ($p \leq 0.001$) concentration and time dependent chromosomal aberrations like breaks, gaps and exchange in chromatid, breaks, gaps and exchange in chromosome, chromosome fragments, dicentric chromosome, centromeric disruption, ring formation, pulverised chromosome and multiple aberrations. In vitro micronucleus formation test also showed significant ($p \leq 0.001$) concentration and time dependent increase in the number of binucleate cells with micronuclei (BNMN). The above results proved carbosulfan to be genotoxic. Hence the present study concluded that carbosulfan produced cytotoxicity, carcinogenicity and genotoxicity in cultured mammalian cells due to the ROS mediated oxidative stress.

Comparative study of berberine and capsaicin as efflux pump inhibitors in quinolone resistant *Staphylococcus aureus* isolates from bovine mastitis

Researches on natural products from plants which can be used as plausible candidates to combat antimicrobial resistance will be of utmost importance. Hence, a study was undertaken to assess the antibacterial activity and resistance modulation through down regulation of efflux genes norA, norB, and norC by two plant alkaloids berberine and capsaicin against quinolone-resistant *S. aureus* from bovine mastitis. Disc diffusion assay and broth microdilution assay was performed to assess the antibacterial activity of berberine and capsaicin alone (at various concentrations viz 8 g/L to 0.25 g/L) and in combination of antibiotics with enrofloxacin, norfloxacin and nalidixic acid. Resistance modulating potential through efflux pump inhibition by berberine and capsaicin in combination with quinolones at sub inhibitory concentration in down regulating norA, norB, and norC efflux genes was executed by reverse transcription and quantitative real-time PCR. Antibiofilm assay was conducted for various combinations of quinolones with berberine and capsaicin using congo

red agar plate method. In silico studies were carried out using autodock software to analyse the binding of berberine and capsaicin to NorA protein. The findings of disc diffusion assay revealed that berberine and capsaicin in combination with enrofloxacin, norfloxacin and nalidixic acid increased the zone of inhibition significantly (p-value < 0.05) in a dose-dependent manner. Checkerboard assay showed that berberine lowered the MIC of antibiotics tested up to eight fold and capsaicin up to four fold. The combination of enrofloxacin with berberine exhibited synergy and with capsaicin exhibited partial synergy. The combination of norfloxacin with test compounds exhibited partial synergy and the combination of berberine and capsaicin with nalidixic acid exhibited additivity. Gene expression studies indicated downregulation in the expression of norA and norC genes, while norB was not expressed in any of the isolates. Berberine and capsaicin in combination with quinolones could inhibit the biofilm formation by *S. aureus* isolates in a dose-dependent manner. In silico studies revealed that capsaicin bind to NorA protein. To consolidate, berberine and capsaicin can be promising drug molecules in modulating the drug resistance mediated by the Nor efflux pumps in *S. aureus* from bovine mastitis. Thus, berberine and capsaicin can be used as an adjunct to antibiotics for the treatment of bacterial diseases.

Antineoplastic activity of silver nanoparticles biosynthesised from seeds of *Sesamum indicum* (Sesame) in Dalton's lymphoma ascites

The present study was done to find out the antineoplastic activity of silver nanoparticles biosynthesised from seeds of *Sesamum indicum* (Sesame) in Dalton's lymphoma ascites. The study was carried out in two phases. The seeds of *Sesamum indicum* (*S. indicum*) were collected, dried, sieved with sieve. Then the seed were subjected for defatting with n-hexane and dried. The dried residue was packed in thimble and aqueous extract was made in Soxhlet apparatus followed by concentrating the extract in rotary evaporator. The aqueous extract of *S. indicum* (AESI) was screened for the phytochemicals and it revealed the presence of steroids, alkaloids, glycosides, tannins, flavonoids, phenols and diterpenes. The silver nanoparticles were synthesised from AESI (S-AgNPs) and characterized by UV-Vis spectroscopy and X-Ray Diffraction. The characterisation revealed that the particles synthesised were within the range of nanoscale (1-100nm) and of crystalline nature. The synthesised silver nanoparticles were subjected to in vitro and in vivo studies. The study was conducted in two phases. In phase I, the plant extract and the synthesized silver nanoparticles were analysed for in vitro cytotoxic activity in DLA cells by using MTT assay. Based on the per cent inhibition obtained using MTT, IC_{50} value for AESI was 112.86 µg/ mL, whereas the

silver nanoparticles biosynthesised from AESI (S-AgNPs) was found to have reduced value as 71.4 µg/ mL. The trypan blue dye exclusion assay was done to assess the viability of cells following the incubation with IC_{50} concentration for three hours and it showed an average of 46.28 percent cytotoxicity for all test substances. The apoptotic changes with the cells following the treatment for 24 h was appraised by Acridine orange/Ethidium bromide (AO/EB) staining. The relative expression of Caspase-3 was analyzed in the cells by keeping GAPDH as reference gene. In vitro studies indicated that AESI and S-AgNPs showed significant cytotoxic activity and apoptotic changes. The biosynthesized silver nanoparticles showed considerable anticancer activity than the aqueous extract alone. In phase II, the acute oral toxicity study was done for the biosynthesized silver nanoparticles according to the OECD guidelines. Animals under the acute toxicity study showed no toxic signs and body weight loss and the dose for the in vivo study was fixed. The in vivo study comprised of forty-two DLA tumour positive mice, which was randomly selected and allotted into seven groups having six animal in each group. Tumour control without any treatment (Group I) also had six animals. Group II tumor positive animals served as a vehicle control. Group III animals were given with cisplatin, orally, at a dose of 10 mg/kg body weight respectively. Group IV and V was administered with S-AgNPs at 50 mg/kg and 100 mg/kg respectively. Group VI animals received sesame aqueous extract at 100 mg/kg. Group VII animals received chemically synthesized nanoparticles at 100 mg/kg. All the treatments were given orally for 10 days. On day 11, the animals were sacrificed and tumour masses were collected for assessing the ratio of tumour weight to body weight and volume of tumour., Standard staining using Haematoxylin and Eosin (HandE), special staining using AO/EB, relative gene expression of Caspase 3 by employing Real time PCR were done with tumour masses. There was an upregulation of Caspase-3 in treated groups compared to tumor control. As indicated previously in in vitro studies, sesame aqueous extract and S-AgNPs showed significant antineoplastic activity in animals than other treatments. From the study, it can be concluded that biosynthesised silver nanoparticles from the extract gave rise to greater antineoplastic activity than the plant extract against DLA cells.

Performance of Gramasree breeder bird fed with different sources of calcium

A feeding trial was conducted for 90 days to assess the effects of supplementing free-choice feeding of egg shell powder and shell grit on semen and egg production characteristics of Gramasree birds. The egg shells were collected from the local market, washed and the membrane was removed before being powdered into a coarse particle size of more than 2

mm. Similarly, shell grit with more than 2 mm particle size was used. The free-choice feeding of egg shell powder and shell grit was given to male Gramasree birds and found that semen qualities like semen volume, colour, sperm concentration and sperm motility were not influenced and similar results were obtained between the treatment groups. The serum Ca and P content and tibial-ash were similar in all the treatment groups. The tibial calcium content was significantly ($p<0.01$) different between the treatment groups. It was observed that average calcium intake from egg shell powder and shell grit intake was only 0.26 and 0.30 g/bird/day, respectively during the experimental period and it did not differ significantly among treatments. However, their feed intake during the period was significantly different ($p<0.01$) and body weight also differ ($p<0.01$) between the treatment groups. The free-choice feeding of egg shell powder and shell grit to Gramasree laying hens recorded as hen day egg production of 57.40 per cent and hen housed egg production of 54.33 per cent from 32 to 44th weeks of age in egg shell powder was similar to shell grit treatment group. The mean hatchability recorded in the egg shell powder group was 83.83 per cent and in the shell grit group was 82.45 per cent. Like that, the fertility rate was 94.87 and 94.58 per cent for G4 and G5 group birds. The mean feed efficiency to produce a dozen eggs was 4.14 and 4.23 in egg shell powder and shell grit group birds, respectively. The mean value of external and internal egg quality parameters was not significantly different among the groups. It was observed that the mean egg shell powder intake was 5.06 g/bird/day and provided 2.04 g of calcium/day/bird during the experimental period, without affecting feed intake between the groups. The cost of production per egg calculated was Rs. 7.74 in egg shell powder and Rs. 8.15 in shell grit group birds.

Performance and carcass traits of meat type ducks fed on varying dietary levels of metabolizable energy and methionine

A study was conducted to investigate the effect of varying dietary levels of metabolisable energy and methionine on growth performance, carcass traits, ileal digestibility and techno - economics of meat type ducks. A feeding trail of eight weeks (56 days) duration was conducted in 120, day-old meat type ducks (Vigova super M), with eight treatments (G1, G2, G3, G4, G5, G6, G7 and G8) each treatment having three replicates, with five ducklings in each replicate. The basal diet (R1) was prepared with BIS (IS:1374., 2017) specified methionine and energy levels and fed to G1 birds. Experimental rations R2 and R3 were prepared with 10 and 20 per cent more than basal diet (R1) methionine content by supplemented with synthetic DLM and fed to G2 and G3, respectively. Experimental ration

R4 was prepared with 10 percent less than BIS specified level of DLM. The experimental ration R5 to R8 were prepared with 10 per cent less ME than basal diet (R1) level. Experimental ration R5 was prepared with BIS specified level of DLM. R6 and R7 were prepared with 10 and 20 per cent more than basal diet (R1) DLM. Experimental ration R8 was prepared with 10 per cent less DLM than BIS recommendation.

The growth performance results recorded in this study revealed supplementation of 10 per cent more DLM at basal diet level energy in the G2 (5790.28 g) group has shown significantly ($P<0.01$) lower feed intake and improved feed conversion efficiency. However, cumulative body weight gain between the groups was similar except the G8 group which was fed a diet with 10 per cent less energy and methionine at eight weeks of age. The carcass quality studies revealed that Group G3 showed significantly ($P<0.05$) higher slaughter weight and carcass weight as compared to other groups at eight weeks of age. In this study, no significant effect was observed in breast yield, but leg yield was significantly higher in G6 (26.74 g) compared to the control group. Abdominal fat yield significantly reduced in the G7 (1.42 per cent) group related to the G1 (1.82) group however, no significant difference in giblet yield. The ileal nutrient digestibility studies indicated that the birds which received 10 per cent more methionine at basal level energy had significantly higher dry matter digestibility (74.96) and crude protein digestibility (80.00) as compared to control. In this study ducks received 20 per cent more methionine at both energy levels, G3 (915.51 µm) and G7 (928.88 µm) groups showed higher ileal villi height and mucosal thickness as compared to all other groups. The net profit per kg live weight was more in the G2 group. From this study, it may be concluded that additional supplementation of methionine at a 10 per cent level could achieve better feed efficiency, carcass yield with more net profit in meat-type ducks.

Efficiency of two stage restricted flow anaerobic baffled biogas digester and gas purification systems

In single stage biogas digester, all the stages of anaerobic digestion take place in a single reactor limiting the biogas production due to the difference in the environment between the acid producing and methane producing microorganisms. To overcome this problem a new two stage anaerobic baffled digester was designed based on the principle that VFAs produced by acidogenic bacteria, reduce the pH of the digester while the methanogenic bacteria operate in strictly defined alkaline pH range of 6.8-8.5. The newly designed digester was compared with a similar capacity single stage digester by co-digesting kitchen waste with cow dung in

1:1 proportion. The performance of the digesters during summer and winter season was studied. During monsoon season, the digester temperature was held constant by circulating hot water produced by solar water heater through the water jacket around the digester. The biogas produced from the two different digesters was upgraded with two different purification systems T1 and T2. The biogas production was significantly (P <0.01) higher in two stage digester (1.96 ± 0.57m3 /d) than the single stage digester (1.66 ± 0.51m3 /d). The hydraulic retention time (HRT) could be significantly reduced by 6.67 days by the restricted flow baffle which is the design peculiarity of two stage digester. The organic loading rate (OLR) of two stage digester (20.01 ± 0.36 kg VS d-1m-3) was significantly (P <0.01) higher than the single stage digester (12.07 ± 0.32 kg VS d-1m-3), due to the increased efficiency of digestion by the phase separation. During summer season the biogas production was significantly (P <0.01) higher than winter season, in both the digesters. The biogas production in single stage and two stage digesters was highest (2.51 ± 0.04 and 2.95 ± 0.09 m3 /d) when the digester temperature was maintained at 37.76 ± 0.36 and 36.25 ± 0.31 ºC, by circulating hot water through the water jacket. The T2 purification system could remove 99.28per cent of water, 95.80per cent of H2S and 78.70per cent of CO2, and upgraded the CH4 concentration to 92.45per cent which was 7.42 per cent more than T1. Thus it was conclusively proved that the new purification system (T2) was very efficient.

Production, quality attributes and consumption pattern of ethnic goan pork sausages

The study was conducted in the department of Livestock Products Technology to analyse the production, processes and consumption pattern of ethnic Goan pork sausage, their quality characteristics and to characterise the fermentative microbial flora from the sausages by using molecular techniques. To study the production pattern and traditional processes involved, a field survey was conducted in the five taluks of Goa, wherein a total of 50 production units were surveyed. From the study, it was concluded that the traditional sausage making was a micro enterprise mostly handled by elderly women having low level of food safety knowledge index. The results of the consumer study (n = 210) indicated that a majority of consumers had a moderate Knowledge, Attitudes, beliefs and Practices Index (KABPI). The results of correlation analysis, regression analysis, PCA, and CA revealed a significant association of consumer indices with socio-demographic variables of the consumers. Storage study was conducted to evaluate the shelf life of three different types of Goan pork sausage viz., Smoked sausage (S1), Sun-dried sausage (S2), Sun-dried cum smoked sausage (S3) at different intervals (days 7, 30, 60, 90, 120, 150, and 180). The results of comparison of

physico-chemical, microbiological, colorimetric and sensorial characteristics revealed that S1 was stable up to 180 days at ambient temperature, while S2 could only last up to 12 days owing to their high moisture content and high pH and S3 registered a shelf life of 60 days at room temperature. In accordance to the various parameters adopted during the study, Goan Pork sausages could be classified as "dried fermented smoked sausages". Further, there were no traces of benzo (a) pyrene compounds detected while evaluating the presence of carcinogenic compounds. A total of 15 isolates of Lactobacilli were identified during the PCR amplification of 16s rRNA followed by gene sequence analysis. The predominant lactobacilli identified were *Limosilactobacillus fermentum* (60per cent), *Lactobacillus rhamnosus* (6.66per cent) and *Lactobacillus brevis* (6.66per cent).

Diagnosis and therapeutic evaluation of malasseziosis in dogs

Prevalence of Malasseziosis among dogs with dermatological problems was found to be 14.7 per cent. Impression smear and cultural examinations were carried out to detect Malasseziosis in dogs. Total DNA extracted from the pure cultures of isolates were subjected to PCR targeting the LSU rRNA gene of *Malassezia* spp. and the amplicons were sequenced. Two species of Malassezia yeasts i.e. *Malassezia pachydermatis* and *Malassezia japonica* were identified using nucleic acid sequencing. An excellent clinical response (by 14th day itself) was noticed in all the dogs treated with oral itraconazole and topical application of neem oil.

Clinico-pathological and therapeutic evaluation of pneumonia in goats with special reference to mycoplasmosis

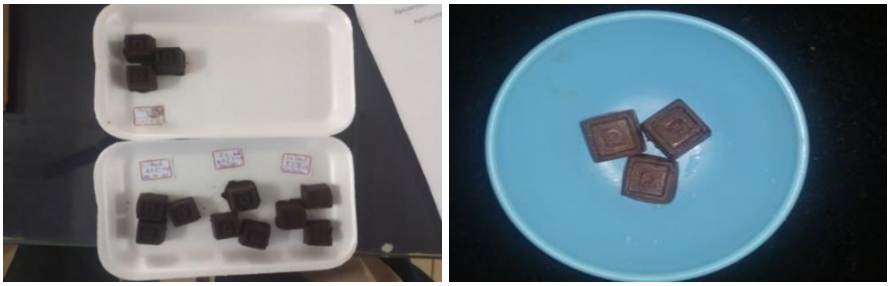
Respiratory mycoplasmosis in goats of Wayanad district was studied during January to December, 2020 and found higher prevalence of caprine respiratory mycoplasmosis among goats with respiratory symptoms (84.82 per cent), especially in young ones and in winter season. Cough, dyspnea, nasal discharge, lethargy, ocular discharge, anorexia and fever were the major clinical signs. Significant increases in RBC, WBC, neutrophils and eosinophil counts along with significant increase in values of AST and albumin were observed when comparing the hemato-biochemical values between the infected and control group. Ampllicons from genus specific PCR of Mycoplasma DNA from nasal swabs of affected goats upon sequencing were identified as *Mycoplasma ovipneumoniae*. Higher rates of complete recovery in the affected goats after five days of treatment was seen in goats treated with Oxytetracycline using clinical scorecard method.

Utilization of date seed a by-product from cake industry for the preparation of cupcake

A study carried out under the Food Technology Programme, VKIDFT, Mannuthy assessed the level of replacement of refined wheat flour with date seed powder in sponge cake from 5 to 20 per cent found that the most acceptable product was obtained on 12.5 per cent replacement. Addition of date seed powder in the sponge cake was found to increase the crude fibre, crude protein and total solids content. The study concluded that date seed appears as a promising functional ingredient to increase the nutritional quality of the cake.

Development of chocolates containing brahmi (*Bacopa monnieri*)

Brahmi chocolate with 6% brahmi powder was developed in a research work conducted under Food Technology Programm, VKIDFT, Mannuthy. The study assessed the moisture, protein, fat, ash, carbohydrate, phenolic contents, antioxidant, antimicrobial activities, textural properties and storage stability of the product.



Brahmi incorporated chocolate

Higher fibre and vitamin C contents in mung beans microgreens than in its sprouts

On comparing the nutritional aspects of microgreens to that of the sprouts of mung beans, a research work conducted under Food Technology Programme, VKIDFT, Mannuthy found that microgreens had double the fibre content and lower protein and fat content than that of sprouts. Microgreens had higher Ca, Mg, Fe and Zn contents and lower K content than the sprouts. The microgreens showed a remarkably higher vitamin C content compared with the sprouts. There was no appreciable increase in the total chlorophyll content of microgreens than that of sprouts. On considering the ease of production and usage, both the sprouts and microgreens are found to be healthier alternative for the consumers, but the results of the study indicates that microgreens are a better alternative than the sprouts.

Microgreens with 7 days of growth

Mung Bean Sprouts

Preparation and characterization of gluten free cake enriched with jackfruit powder

Gluten free cake was prepared using a formulation of rice flour with jackfruit powder and flaxseed flour in a research work conducted under Food Technology Programme, VKIDFT, Mannuthy. The prepared cake was found to be rich in protein, crude fiber, fat and minerals. The cake prepared using the rice flour (20 %), flax seed flour (40%) and jack fruit flour (40%) was found to have superior sensory characteristics and nutritional value. Proximate analysis found that the gluten free cake had a fat per cent of 15.31, protein per cent of 11.083, moisture per cent of 27.76, total solids per cent of 72.24 and ash per cent of 1.08.

Gluten- free cake incorporated with moringa leaves

A study carried out under the Food Technology Programme, VKIDFT, Mannuthy developed gluten free cake containing 4 per cent moringa leaves powder without compromising the sensory characteristics. Addition of moringa leaves powder in gluten free cake enhanced its nutritional value by increasing the contents of ash (2.42% to 2.7%), fibre (2.3% to 3.6%), vitamin C (1.45 mg/100g to 7.7 mg/100g), calcium (110.268 ppm to 202.932 ppm) and iron (9.59 ppm to 10.945 ppm). Moisture content of the developed product (33.813%) was found to be lower than that of the control (37.554%).

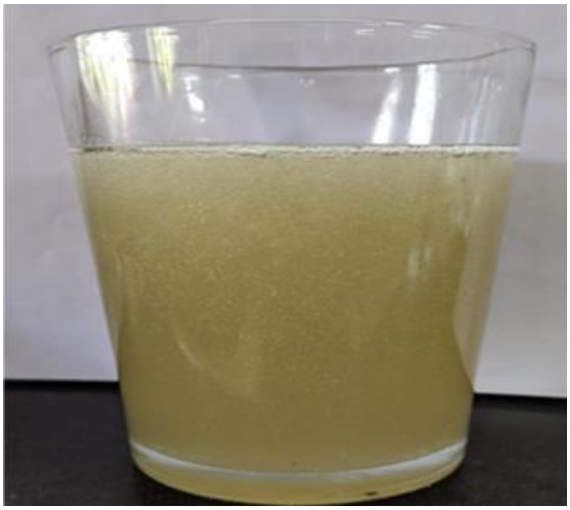
Gluten- free cake incorporated with moringa leaves

Utilisation of Nutmeg (*Myristica fragrans* houtt) fruit for the preparation of value added products

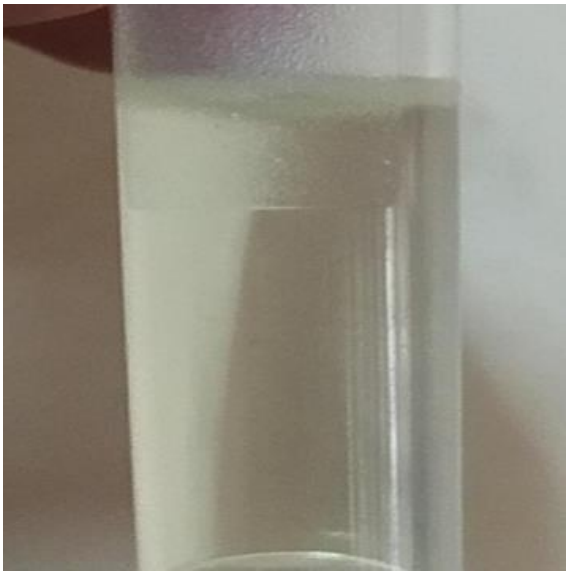
Research work conducted under Food Technology Programme, VKIDFT, Mannuthy developed value added products from nutmeg fruit; candy, syrup, jam and essential oil. Sensory studies revealed that candy made with 20 per cent nutmeg fruit pulp, syrup made with 25 per cent nutmeg fruit pulp and jam made with 30 per cent of nutmeg fruit pulp exhibited high hedonic scale rating. Yield of essential oil from nutmeg (*Myristica fragrans* Houtt.) fruit was 1.48± 0.02 per cent. Chromatogram obtained from GC-MS analysis of essential oil showed 11 peaks. Major bioactive components present in essential oil were: Terpinen-4-ol (24.10%), γ-Terpinen (12.13%), α-Terpineol (9.73%), α-Terpinene (9.41%),

1R-α-Pinene (7.69%), Terpinolen (6.53%), Limonene (5.50%), β-Pinene (4.18%), Myristicin (3.91%), 3-Carene (2.96%), α-Phellandrene (2.60%), β-Phellandrene (2.43%), Elemicin (1.74%), β-Cadinene (1.26%), β-Linalool (0.78%),m-Cymene (0.77%), β-Phellandrene (0.68%), Caryophyllene (0.49%), Camphene (0.38%), Copaene (0.38%), D-Fenchyl alcohol (0.37%), Borneol (0.32%), Isoeugenol (0.30%), 3-Thujene (0.15%), α-Caryophyllene (0.10%) and α-Bergamotene (0.09%). The study also determined the total soluble solids, moisture, pectin, fat, protein, total phenol carbohydrate, vitamin B5, vitamin C, total ash, heavy metals, alkaloid, crude fibre contents, total acidity and DPPH radical scavenging activity of nutmeg fruit, candy, syrup and jam.

Nutmeg fruit jam



Nutmeg fruit syrup



Nutmeg fruit essential oil

Nutmeg fruit candy

Development of horse gram and green gram fortified cake

In this study conducted under Food Technology Programme, VKIDFT, Mannuthy fortification of cake with legumes was attempted as a means to improve the nutritional profile. Fortification of cake with horse gram and green gram enhanced the protein and mineral content. It also increased the phenolic content and thus improved the antioxidant activity. Microwave treatment of green gram resulted in the best sensory attributes for the developed cake. Germination was more acceptable in case of the treatment of horse gram. The ash content was high for the raw horse gram fortified cake (1.38%) compared to the control cake (0.94%). Protein content in the cakes was proportional to the protein content of the flours. Maida flour had a protein percentage of 12.25%, the raw green gram flour had a protein percentage of 22.75% and the raw horse gram a protein percentage of 22.81%. Addition of these flours caused a proportional increase of 10.21% and 10.25% respectively, whereas the control cake only has a protein content of 6.65%. Mineral content of the cakes also increased significantly. Raw green gram and raw horse gram cakes had an increase in the ash content; 1.32% and 1.38% respectively whereas the control cake had an ash content of 0.94%. Antioxidant activity and the total phenol content of the cake were also increased markedly by the addition of the legume. The study has suggested fortification of cake with legume floor as an effective strategy to improve the nutritional quality without compromising the sensory attributes of the product.

Development of ragi based jackfruit seed flour cookies

In this study conducted under Food Technology Programme, VKIDFT, Mannuthy cookies were prepared using ragi, wheat and jackfruit seed flours. Cookies were evaluated for appearance, aroma and taste, texture and overall acceptability. The results revealed that the appearance, aroma, taste, texture and overall acceptability were changed with the incorporation of jackfruit seed flour. A combination of 50 per cent ragi flour, 15 per cent wheat flour and 9.5 per cent jackfruit seed flour was adjudged as the best on sensory analysis of all the six samples tested.

Stages in the preparation of ragi based jackfruit seed flour cookies

Publications

Book Chapters Published

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Full papers/ Abstracts in conference proceedings

1. Patgiri, S. Rajani, C. V. Patki, H.S., Raghu, N.K., Surjith, K.P. and Indu,V.R. Histomorphological characteristics of Pancreas in Crossbred pigs (Sus scrofa domesticus) In: Proceedings of 13th Kerala Veterinary Science Congress held at CVAS, Thrissur between 13th-14th November, 2021.
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7. Vidya, P., Ambily, R., Ashtamy, M. G., Mathews, L. K., Sankar, S. and Mini, M. 2021.Isolation and identification of *Corynebacterium bovis* from skin lesion of a cow.In: Compendium of 13th Kerala Veterinary Science Congress;13th and 14th November,2021, Mannuthy. Indian Veterinary Association, Kerala. p. 43. Abstract No. KVSC-SIO2.
8. Greeshma, R., Priya, P.M., Mathews, L.K., Vidya, P and Mini, M. 2021. Isolation and identification of *Riemerella anatipestifer* from a small-scale broiler duck farm in Kerala. In: Compendium of 13th Kerala Veterinary Science Congress;13th and 14th November,2021, Mannuthy. Indian Veterinary Association, Kerala. p.95.Abstract No. KVSC-SIP1.
9. Akhila, J., Ambily, R.. Mini, M., Mani, B. K. and Nair, S. R. 2021. Isolation and identification of *Candida tropicalis* from an African grey parrot. In: Compendium of 13th Kerala Veterinary Science Congress; 13th and 14th November, 2021, Mannuthy. Indian Veterinary Association, Kerala. p. 98. Abstract No. KVSC-SIP2.
10. Ashtamy, M. G., Ambily, R., Vidya, P., Mathews, L. K., Mani, B. K., Sarika, N. and Mini, M..2021. Isolation and identification of *Salmonella* Pullorum from a backyard flock of poultry. In: Compendium of 13th Kerala Veterinary Science Congress;13th and 14th November,2021,Mannuthy.Indian Veterinary Association, Kerala.p. 101.Abstract No. KVSC-SIP3.
11. Bindu Lakshmanan. 2021. An update on schistosomes-prospects for future research. Lead paper presented during the XXXth National Congress of Veterinary Parasitology

and National Symposium on “Fundamentals of integrated Parasite Management and its relevance in One Health” College of Veterinary Science, Parbhani, 14th-16th, Dec 2021: pp.177

12. Karthika, R., Devada, K., Bindu Lakshmanan, Syamala K,Vijayakumar K and Pooja G Mankani.2021. Molecular detection of *Toxoplasma gondii* in aborted fetuses of goats in Thrissur, Kerala. XXXth National Congress of Veterinary Parasitology and National Symposium on “Fundamentals of integrated Parasite Management and its relevance in One Health” College of Veterinary Science, Parbhani, 14th-16th, Dec 2021: pp.177
13. Karthika, R., Devada, K., Bindu Lakshmanan, Syamala K,Vijayakumar K and Pooja, G Mankani.2021. First report on molecular detection of *Neospora caninum* in aborted fetuses of goats in Thrissur, Kerala. XXXth National Congress of Veterinary Parasitology and National Symposium on “Fundamentals of integrated Parasite Management and its relevance in One Health” College of Veterinary Science, Parbhani, 14th-16th, Dec 2021: pp.177
14. Shaik Nikhat Reena, Bindu Lakshmanan, Radhika, R., Reshmi, R., Merin Das, V. J., Anjali, V. 2021. Occurrence of *Joyeuxiella* spp. in household cats (Felis catus) in Thrissur, Kerala. Kerala Veterinary Science Congress,13-14th November,2021, CVAS, Mannuthy
15. Merin Das, V. J., Bindu Lakshmanan, Priya, M. N., Reshmi, R., Shaik Nikhat Reena. 2021. Concurrent infection of *Spirometra* spp. and *Sarcocystis* spp. in a household kitten (*Felis catus*). Kerala Veterinary Science Congress,13-14th November,2021, CVAS, Mannuthy
16. Reshmi Raveendran, Merin Das, V J., Shaik Nikhat Reena, Bindu Lakshmanan, Anoop, S., Sudheesh, SN., Soumya Ramankutty, John Martin, KD., Giggin, T., Thamaraiselvi, P., Ann Mary, K S ., Fathima Jamal, B Aswanui Raj.2021. Report on verminous ophthalmia associated with *Setaria digitata* in Kerala. Kerala Veterinary Science Congress,13-14th November,2021, CVAS ,Mannuthy
17. Reshmi Raveendran, Dharamshaw CA, Merin Das V J, Nikhat Reena Shaik, Syamala K, Bindu Lakshmanan.2021. Variability in faecal egg count of Strongyle infection to native goat breeds of Kerala under Semi intensive system. XXXth National Congress of Veterinary Parasitology and National Symposium on “Fundamentals of integrated Parasite Management and its relevance in One Health” College of Veterinary Science, Parbhani, 14th-16th, Dec 2021

18. Syamala, K., Devada, K., Bindu Lakshmanan, Raji, K.., Lucy Sabu and Thirupathy. V.R. 2021. Combined targeted selective treatment -A sustainable solution for management of parasitism with limited chemotherapy. XXXth National Congress of Veterinary Parasitology and National Symposium on "Fundamentals of integrated Parasite Management and its relevance in One Health" College of Veterinary Science, Parbhani, 14th-16th, Dec 2021:
19. Syamala K., Devada, K., Bindu, L., Raji, K and Thirupathy, V.R. .2021. Development and validation of anaemia eye colour chart for detecting clinical anaemia in goats of Kerala. 13th Kerala Veterinary Science Congress 13-14th November ,2021, CVAS, Mannuthy One health -A strategic imperative for Veterinary profession in fight against the pandemic.
20. Syamala K., Devada, K., Bindu, L., Raji, K and Thirupathy, V.R. 2021.Detection of rare polymorphisms in isotype 1beta tubulin gene of haemonchus contortus in goats of Kerala Conference on Advances in Microbial Technologies (AIMT-2021), Amity Institute of Microbial Technology, Rajasthan, Dec. 01-02, 2021
21. Syamala K., Devada, K., Bindu, L.,.Raji, K and Thirupathy, V. R. 2021. Influence of rainfall and season on epidemiology of gastro-intestinal parasite in goat flocks of Kerala. International conference on agriculture, climate change and life science IMRF institute of higher education and research, Andra Pradesh, March 05-06, 2021, pp 50.
22. Radhika, R., Dalbin, P.B., Asha Rajagopal., Lucy Sabu., Devada, K. Morphological and Molecular identification of *Haemonchus placei* in Cattle of Kerala. XXXth National Congress of Veterinary Parasitology and National Symposium on "Fundamentals of integrated Parasite Management and its relevance in One Health" College of Veterinary Science, Parbhani, 14th-16th, Dec 2021:
23. Asha Rajagopal, Lucy Sabu, Radhika R., Devada, K. and Gleeja V.L. 2021. Standardisation of larval development assay using discriminating dose criterion. Conference on Advances in Microbial Technologies (AIMT-2021), Amity Institute of Microbial Technology, Rajasthan, Dec. 01-02, 2021
24. Asha Rajagopal, Lucy Sabu, Radhika R., Devada, K. and Usha, P.T.A. 2021. Evaluation of egg hatch assay in the detection of benzimidazole resistance. International conference on agriculture, climate change and life sciences, IMRF institute of higher education and research, Andra Pradesh, March 05-06, 2021, pp 50.
25. Priya, M. N. Bindu Lakshmanan, Asha Rajagopal, Shameem, H, Priya, P.M and Devada, K. Sensitivity of ESA IgG ELISA for serodiagnosis of intestinal

schistosomosis. International conference on agriculture, climate change and life sciences. IMRF institute of higher education and research, Andra Pradesh, March 05-06, 2021, pp 33

26. Priya, M. N., Lakshmanan, B., Priya, P. M., Rajagopal, A., Shynu, M. and Shameem, H. 2021. Seroprevalence of intestinal schistosomosis among cattle in different Agro-Ecolological Zones of Kerala. Conference on Advances in Microbial Technologies (AIMT-2021), Amity Institute of Microbial Technology, Rajastan, Dec. 01-02, 2021
27. Latha and Reeja.2021. The Soft gender in Veterinary profession-problems and prospects. IVA lady Vets convention on 8/03/22.
28. Latha, C and Jisna, J. 2021. One health stratergy and control of zoonoses. At 13th Kerala Veterinary Science congress held on 12-14 Nov 21
29. Binsy Mathew, Latha,C., Sunil B., Sethulekshmi, C., Mini M. and Radhika, G.2021. Point mutation in parC gene as molecular mechanism of ciprofloxacin in C jejuni isolated from retail chicken in Kerala. At 13th Kerala Veterinary Science congress held on 12-14 Nov 21
30. Vrinda Menon, K.2021. Chemical contaminants in milk and milk products. Refresher course on Quality challenges in dairy sector for Dairy farm instructors 4th -7th October, 2021
31. Latha C. 2021. Significance of Veterinary Public Health in society. Compendium of lectures of SVS, Published by KVASU.
32. Subrahmanyeswar, G. and Senthil Murugan, S. 2020. “Effect of supplementing rumen protected omega-3 fatty acids on performance of lactating cows. In the two days Online National Seminar on “Feed Additives for Improving the Efficiency and Sustainability of Milk Production in Dairy Animals” organised by the Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, SDAU, Sardarkrushinagar, Gujarat during July 20-21.
33. Sreeja. S. J, Biju Chacko and six other authors. “Effect of partial replacement of soybean meal with spent brewer’s grains on carcass traits, sensory attributes and techno – economics of broiler chicks” in Session – IV titled “Sustainability and Policy in Food Production Systems” the International Conference on “Convergence of Technology and Policy for Sustainable Meat Production” organized by Association of Meat Scientists and Technologists (AMST) and Meat Technology Unit (MTU), LPT, KVASU and held online from 25th to 28th October 2021.

34. Merin Sneha, C. T., Surej Joseph Bunglavan, Biju Chacko and five other authors. "Evaluation of carcass characteristics in broilers supplemented with Chlorella vulgaris extract as feed additive" in Session – IV titled, "Sustainability and Policy in Food Production Systems" the International Conference on "Convergence of Technology and Policy for Sustainable Meat Production" organized by Association of Meat Scientists and Technologists (AMST) and Meat Technology Unit (MTU), LPT, KVASU and held online from 25th to 28th October 2021.
35. Amritha. A, Senthil Murugan, S., Biju Chacko and two other authors."Effect of dietary supplementation of Methionine on carcass yield of meat type ducks" co-authored by in Session – IV titled, "Sustainability and Policy in Food Production Systems" the International Conference on "Convergence of Technology and Policy for Sustainable Meat Production" organized by Association of Meat Scientists and Technologists (AMST) and Meat Technology Unit (MTU), LPT, KVASU and held online from 25th to 28th October 2021.
36. Amritha. A, Senthil Murugan, S., Biju Chacko and two other authors. "Egg shell powder as a free choice calcium source for Gramasree male birds" of Sabarinath, E. in Scientific Session titled, "Equine, Camel and Wild Animal Reproduction" the International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology" organized by the Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy of KVASU and held online from 27th to 29th December 2021.
37. Biju Chacko. "Strategic Interventions for the Revival of the Dairy Sector of India, in the Post Covid Scenario" in the Souvenir titled, "Recent Advances in Agriculture, Engineering and Biotechnology for Food Security" of the International Conference organized by the Mahima Research Foundation and Social Welfare 194, Karaundi, Banaras Hindu University, Varanasi-221005 and sponsored by CSIR and DBT and held at Ludhiana, Punjab p: 13 (Abstract).
38. Sabarinauth, E., Senthil Murugan, S., Biju Chacko, Surej Joseph Bunglavan, Promod K. 2022. "Shell Grit as Free Choice Calcium Source for Gramasree Male Birds". Presented in the 34th Kerala Science Congress p.325-326.
39. Rasanath, K., Chacko, B., Murugan, S., Prasad, A., Surej, J.B., Sunanda, C. and Justin, D. 2021. "Effect of complete feed containing conventional and unconventional protein rich feed ingredient on milk production in early lactating dairy cows" in Session V: Livestock and Poultry Production of the 13th Kerala Veterinary Science Congress. Proc. p. 326.

40. Amritha. A, Senthil Murugan, S, Biju Chacko, Surej Joseph Bunglavan, Muneer, A.M.K, Sabarinath, E. and Merin Sneha, C. T. 2021. “Effect of dietary energy and methionine on carcass traits of meat type ducks” in Session V: Livestock and Poultry Production of the 13th Kerala Veterinary Science Congress. Proc. p. 326.
41. Merin Sneha, C. T., Surej Joseph Bunglavan, Biju Chacko, Senthil Murugan, S, Aswathy, P. B., Amritha. A. and Sabarinath, E. 2021. “Evaluation of blood haematological parameters and immune organ status in broilers supplemented with Chlorella vulgaris extract as feed additive” in Session V: Livestock and Poultry Production of the 13th Kerala Veterinary Science Congress. Proc. p. 327.
42. Sabarinath, E., Amritha. A, Senthil Murugan, S, Biju Chacko and two other authors. “Egg shell powder as a free choice calcium source for Gramasree male birds” in Scientific Session titled, “Equine, Camel and Wild Animal Reproduction” the International Symposium on “Novel Knowledge, Innovative Practices and Research in Theriogenology” organized by the Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy of KVASU and held online from 27th to 29th December 2021. Won the 2nd prize
43. Niyas, E., Abhilash, R. S., Jayakumar, C., Kurien, M. O., Anil, K. S. and Lekshmi Bhai, K. 2021. Evaluation of periovulatory follicular and hormonal dynamics in crossbred dairy cows with normal and prolonged oestrus. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
44. Sophia, X., Jayakumar, C., Abhilash, R. S., Magnus, P.K. and Dhanush, K. B. 2021. Maternal and neonatal outcome following elective cesarean section in dogs based on progesterone levels. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
45. Sophia, X., Jayakumar, C., Deepak, J. and Vinayakumar, R. H. 2021. Successful Management of metritis in a queen cat. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
46. Revathy, M. M., Abhilash, R. S., Jayakumar, C., Magnus, P. K., Raji, K. and Kurien, M. O. 2021. Effect of sperm capacitation and fertilisation medium on bovine in vitro fertilisation. International Symposium on Novel Knowledge, Innovative Practices and

Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.

47. Aja, T. N., Becha, B. B., Jayakumar, C. and Harshan, H. M., 2021. Response to vincristine based on cytomorphological charecterisation of canine transmissible venereal tumours. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
48. Niyas, E., Lekshmi Bhai, K., Jayakumar, C., Arya Krishnan* and Hemanth Ajayan. 2021. Feline mucometra- A case report. 2021. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
49. Bareera Vallikkadan, Hiron, H. M., Jayakumar, C. and Sophia, X. 2021. Management of dysticia in a cow complicated with rupture of bladder. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
50. Urmila, S., Lekshmi Bhai, K., Niyas, E., Harshan, H. M. and C. Jayakumar 2021. Preservability of Malabari Buck Semen in Liposome based Extender under Refrigeration. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
51. Princy, J., Harshan, H. M., C. Jayakumar and E.S. Nikhila. 2021. An evaluation of dystocia in crossbred does with precervical uterine torsion. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
52. Swathish., V. S., Anzeena Hind P., Harshon, H. M., Jayakumar, C. 2021. Resolution of Postpartum uterine prolapse in guinea pig (Cavia pocellus) by hydropropulsion technique followed by surgical management. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
53. Simon, S., Anzeena Hind, P. and Rinu Thomas, 2021. A novel therapeutic protocol for successful management of cystic endometrial hyperplasia- hyperplasia-pyometra complex in female dogs. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.

54. Anzeena Hind, P., Amritha, A and Jayakumar, C. 2021. Surgical management of unilateral torsion in a queen cat. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
55. Nithish, N. N. H., Jayakumar, C., Simon, S., Abhilash, R. S. and Niyas, E. 2021. Efficiency of combination therapy with ozone and PGF2α pplication in management of subclinical endometritis in cattle. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 2021. 27th to 29th December 2021. Held at Mannuthy, Thrissur.
56. Magnus, P. K., Jayakumar C., Naicy T., Lali F.A., Hiron M. Harshan, Abhilash R.S., Ajitkumar S. 2021 Uterine smooth muscle expression of ACTA2, ACTG2, MLCK4 AND MYH2, PKC genes in canine primary uterine inertia. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 27th to 29th December 2021. Held at Mannuthy, Thrissur.
57. Magnus, P. K., Jayakumar C., Naicy T., Lali F.A., Hiron M. Harshan, Abhilash R.S., Ajitkumar S. 2021.Progesterone, oestrogen and cortisol profile in canine primary uterine inertia. International Symposium on Novel Knowledge, Innovative Practices and Research in Theriogenology, 27th to 29th December 2021. Held at Mannuthy, Thrissur.
58. Manoj, S., Thankachan A., Francis A., Ajith Y. Pillai, U.N Concurrent trypanosomiasis and theileriosis in a cross bred holstein friesian calf. Proceedings of 13th Kerala Veterinary Science Congress 2021, pp.514-516.
59. Panicker, V.P., Athira N., Kumar A., Pillai U.N., Krishna G.U., Kumar V., Ajith Y. Development and evaluation of absolute quantification based qPCR assay for the detection of *Babesia gibsoni* in dogs. Proceedings of 13th Kerala Veterinary Science Congress 2021, pp 104-106.
60. Sherin, B.S., M.M. Varsha, S. Seeja, K.B. Nithina, P. Preena and Muraleedharan,K. Sonographic evaluation of abdominal organs with hematuria. Proceedings of 13th Kerala Veterinary Science Congress 2021, pp.194
61. Varsha, M.M., Sherin, B.S., Seeja, S., Nithina, K.B., Preena, P. and Muraleedharan, K.2021. Neoplastic conditions of the lymphoid and myeloid tissue in dogs: A clinical and laboratory evaluation. Proceedings of 13th Kerala Veterinary Science Congress 2021, pp.194

62. Anaina, S., Preena, P. and Vijayakumar, K.2021. Diagnosis and management of ehrlichiosis and associated acute renal failure in a Labrador dog. Proceedings of 13th Kerala Veterinary Science Congress 2021, pp.357
63. Neeraja, E.S., Preena, P., Tresamol, P.V., Usha Naryana Pillai and Vijayakumar, K.2021. Ocult babesiosis in a litter of Persian cats. Proceedings of 13th Kerala Veterinary Science Congress 2021, pp.428
64. Archana. C., Beena, A.K., Murugadas, V., Rahila, M. P., Ligimol, J., Rajakumar, S. N. 2021. Detection and characterization of lytic phages affecting Lactobacillus spp from dairy effluents of Kerala. In proceedings International Conference on biotechnology for resource efficiency, energy, environment, chemicals and health. pp:261
65. Lakshmi, S., Archana, C., Aswini, K. V., Sumi, M. G. and Rahila, M.P. (2021). Phenotypic and genotypic diversity of indigenous *limosilactobacillus fermentum* isolated from household curd.In proceedings of National Conference on recent trends in biology.pp-7
66. Archana, C., Beena, A. K., Linsha, C. K. 2022. Application of yeast lactic acid bacteria consortium from Dahi for the development of a novel cereal based fermented milk product. In proceedings of 34th Kerala Science Congress. p:88.
67. Beena, A. K., James, L. and Aparna S.V.2021. Multifunctional roles of lactic acid bacteria in dairy industry. International conference on 'Convergence of technology and policy for sustainable meat production', 25th to 28th October, 2021
68. Aparna S.V., Beena, A.K., James,L., Shamila., Shahana,S., Sayanth and Sreerag .2021. Evaluation of process hygiene indicators of local and branded ice-creams. International conference on 'Convergence of technology and policy for sustainable meat production'. 25th to 28th October, 2021
69. Mariya Divanshi A.S., Aparna S.V., Beena, A.K., James, L.,Aysha C.H. and Athira,S. 2021. Bioremediation potential of lactic acid bacteria against cadmium and lead. International conference on 'Convergence of technology and policy for sustainable meat production'. 25th to 28th October, 2021
70. Jayaraman, A., James., Beena,A.K. and Aparna S.V. 2021. A comparison between probiotic attributes of four strains of *L. fermentum*isolated from different sources.Abstract book International virtual conference on 'Recent Trends and Innovations in Microbiology'15th July, 2021.4p.
71. Mariya Divanshi A.S., Aparna S.V., Beena, A.K., James,L., and Aysha C.H.2021. Optimization of cadmium biosorption by lactic acid bacteria isolated from neonatal

fecal sample.Abstract book International virtual conference on 'Recent Trends and Innovations in Microbiology'15th July, 2021.39p.

72. Amrutha T.A. and Beena,A.K. 2021.Isolation and Functional Characterization of *Lactococcus lactis* DMP01 from potato. Abstract book International virtual conference on 'Recent Trends and Innovations in Microbiology'15th July, 2021.48p.
73. Sreevishnu Rajmohan T. and BeenaA.K.2021.Carbonation of raw milk for the control of coliforms. Abstract book International virtual conference on 'Recent Trends and Innovations in Microbiology'15th July, 2021.43p.
74. Frazana Beegum M.A. and James,L. 2021. Screening of lactic acid bacteria isolated from various sources to use as a potential biopreservative agent for paneer. Abstract book International virtual conference on 'Recent Trends and Innovations in Microbiology'15th July, 2021.41p
75. Junaid, N. Stella Cyriac, Vineetha P. G. and Pramod S. 2021. Phenotypic characterisation of Kuttanad ducks with respect to its morphometric characters. Proceedings of 13th Kerala Veterinary Science Congress. pp. 261-263
76. Krithiga, K., Arathi Rajan, Geetu Rose Varghese, Neetha, R.L., Neethu Krishnan, Dipyaman Patra, Arathy V. Warrier and Priya Srinivas."Mast cells as indicators of recurrence in spontaneous cases of canine mammary carcinomas". Poster presentation in the Kerala Veterinary Science Congress 2020 conducted in the online platform from 12th-14th November 2021 conducted by The Indian Veterinary Association (Kerala).
77. Krithiga, K., Arathi Rajan, Geetu Rose Varghese, Neetha, R.L., Neethu Krishnan, Dipyaman Patra, Arathy V. Warrier and Priya Srinivas. "Chemotherapeutic effect of cisplatin and plumbagin on cancer stem cells in REM 134 canine mammary carcinoma cell line". Poster presentation in the International Veterinary Pathology Congress 2021 Rajasthan University of Veterinary and Animal Sciences, Bikaner, Indian Association of Veterinary Pathologist and Indian College of Veterinary Pathologists, held during 17 - 19 December, 2021 conducted from Bikaner

Awards and honours received by faculty and students

1. Dr. C Latha - NAVS Fellowship on 25.09.21
2. Dr. C Latha. - A.T. Sherikar Outstanding Public Health Veterinarian award in May 2021
3. Dr. Patki Harshad Sudhir - Best oral presentation (1st rank) in 'Assistant Professor' category in 2nd international Online conference in Veterinary anatomy Organised By CVAS, Gannavaram, SVVU, Tirupati held between 16th-18th December, 2021
4. Dr. Rajani C. V - Best oral presentation (2nd rank) in 'assistant professor' category in 2nd international Online conference in Veterinary anatomy Organised By CVAS, Gannavaram, SVVU, Tirupatiheld between 16th-18th December, 2021
5. Dr. Ambily V. R. - First prize in oral presentation. Kerala veterinary science congress. 2021.
6. Dr. Sangeetha S. Gireesh. Third prize in oral presentation. Kerala veterinary science congress. 2021.
7. Dr. Bindu Lakshmanan. IAAVP Women Scientist Award 2020 awarded on 14.12.2021 at the 30th NCVP at CVS, Parbhani, Maharashtra
8. Dr. K Syamala. 'Mrs Saraswathi Anandan Award' (2021) for the best Ph.D thesis on XXXth National Congress of Veterinary Parasitology and National Symposium on "Fundamentals of integrated Parasite Management and its relevance in One Health" College of Veterinary Science, Parbhani, 14th-16th, Dec 2021.
9. Dr. K. Syamala - Best oral presentation in Advances in Microbial Technologies AIMT2021, AMITY University, Rajasthan on 1-2/12/2021
10. Dr. K. Syamala - Best paper (Poster presentation) International conference on Convergence of technology and policy for sustainable meat production, 25-28th October 2021., CVAS, Mannuthy
11. Dr. K. Syamala - Best oral presentation in 13th Kerala Veterinary Science Congress, 14th-15th November 2021, CVAS, Mannuthy
12. Dr. K. Syamala - Best oral presentation in XXXth National Congress of Veterinary Parasitology and National Symposium on "Fundamentals of integrated Parasite Management and its relevance in One Health" College of Veterinary Science, Parbhani, 14th-16th, Dec 2021

13. Dr. R. Radhika - 3rd prize in oral presentation in XXXth National Congress of Veterinary Parasitology and National Symposium on “Fundamentals of integrated Parasite Management and its relevance in One Health” College of Veterinary Science, Parbhani, 14th-16th, Dec 2021:
14. Dr. Muhammad Aslam M. K - Best Veterinarian Award, IVACON - 2021, IVA National Chapter
15. Dr. Muhammad Aslam M.K - President's Recognition Award, IVA Kerala, 2021
16. Dr. K. M. Lucy - KVASU Best Teacher award received on 26.04.2021
17. Dr. S. Maya - Adarsh Vidya Saraswati Rashtriya Puraskar (National Award of excellence- 2021) constituted by Glacier Journal Research foundation- Global management council, Ahmedabad.
18. Dr. K.M. Lucy - Best paper presentation- poster in Bovine Gynaecology and Obstetrics session as part of “Novel Knowledge, Innovative Practices and Research in Theriogenology”- The seminar organized by the Animal Reproduction, Gynaecology and Obstetrics under the aegis of KVASU and ISSAR from 26.12.2021 to 28.12.2021.
19. Dr. Sumena K. B - Third prize for the Best paper in session IV in the Kerala Veterinary Science Congress 2021 organized with focal theme of “One health-A strategic imperative for veterinary profession in fight against the pandemic” during 12th to 14th November 2021 at College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala
20. Dr. N. Ashok - Fellow IAVA award 2021-in the XXXV Annual Convention of IAVA and National Symposium on “Modern concepts in Anatomy: New era tools in Health and Diseases" organized by Department of Veterinary Anatomy, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar conducted from 10th to 12th of March, 2022.
21. Dr. N. S. Sunilkumar - Dr. C. Vijayaragavan Memorial silver jubilee medal and award for best paper presented in Avian Anatomy in the XXXV Annual Convention of IAVA and National Symposium on “Modern concepts in Anatomy: New era tools in Health and Diseases" organized by Department of Veterinary Anatomy, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar conducted from 10th to 12th of March, 2022.

22. Dr. Binsy Mathew - Best poster presentation award at International e symposium on One Health concept:Oppurtunities and perspective in present scenario on 28th and 29th May 2021
23. Dr Deepthi Vijay - Best Essay Award at International e symposium on One Health concept: Oppurtunities and perspective in present scenario on 28th and 29th May 2021
24. Dr. Binsy Mathew - Second best oral presentation award at AMST conference Organised by LPT, KVASU, AFST and IDA Mannuthy 25-28th Oct 21
25. Dr. Binsy Mathew - Second best oral presentation award at the 13 th Kerala Veterinary Science Congress held on 13th and 14th Nov 21 organised by IVA
26. Dr. Deepthi Vijay. Best poster presentation award for the work entitled "Quantitative and qualitative estimate of antimicrobial usage in dairy herds of Punjab" authored by, under the theme III; "Health" in the National symposium of Indian Society for Buffalo Development on Scientific interventions to address challenges for sustainable buffalo production during 10-11 December, 2021
27. Dr. Biju Chacko - Secured the award of first prize for best paper by oral presentation in the International Conference on Recent Advances in Agriculture, Engineering and Biotechnology held at Banaras Hindu University, Varanasi from 25-9-2021 to 26-9-2021 for the paper entitled, "Strategic Interventions for the Revival of the Dairy Sector in India, in the Post COVID Scenario".
28. Dr. Bibin Becha B - Best Scientist Award – 2021 by Tamilnadu Association of Intellectuals and Faculty (TAIF) and GRABS Educational Charitable Trust (Issued on 13th June 2021 at Chennai)
29. Dr. Amritha Aravind - Best paper presentation, small ruminant and swine reproduction; International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology" 27th to 29th December, 2021, CVAS, Mannuthy, Thrissur, Kerala
30. Dr. Abhilash R S - Best paper presentation, Reproductive Biotechnology; International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology" 27th to 29th December, 2021, CVAS, Mannuthy, Thrissur, Kerala
31. Dr. Magnus Paul - Best paper presentation, Companion Animal Reproduction; International Symposium on "Novel Knowledge, Innovative Practices and Research

in Theriogenology", 27th to 29th December, 2021, CVAS, Mannuthy, Thrissur, Kerala

32. Dr. Magnus Paul - Best paper presentation - poster, Companion Animal Reproduction; International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology", 27th to 29th December, 2021, CVAS, Mannuthy, Thrissur, Kerala
33. Dr. Rahila M. P. - Dr. Verghese Kurien Birth Centenary Award for Best Young Researcher in Dairy Science South Zone
34. Ms. Archana Chandran (Assistant Professor) - First prize in poster competition held as part of international webinar on "Eco health Paradigm: Towards sustainability and global health" organized by department of Veterinary Public health and livestock Products technology, KVASU and COHEART
35. Ms. Archana Chandran (Assistant Professor) - Received Best Poster award (Agriculture and food science category) in 34th Kerala Science Congress
36. Dr. Aparna Sudhakaran Assistant Professor, Department of Dairy Microbiology - Best poster award – International e-symposium on 'Probiotics, Prebiotics and Gut Microbiome: Key regulators for Human and Animal Health, 11th November, 2021
37. Ms. Archana Chandran., Dr. A. K. Beena - Best poster in International Webinar on 'Ecohealth paradigm: Towards Sustainability and Global Health, 3rd and 4th August, 2021, Organized by Department of Veterinary Public health and Livestock Products Technology, Centre for one health Education Advocacy, Research and Training and School of zoonoses, public health and pathology
38. Dr. Simanta Patgiri - Best oral presentation (1st rank) in 'Postgraduate category 'in 2nd international Online conference in Veterinary anatomy Organised By CVAS, Gannavaram, SVVU, Tirupatiheld between 16th-18th December, 2021
39. Dr. Simanta Patgiri - Best poster presentation award in International conference and annual symposium of Indian Association of Veterinary anatomists (IAVA) held at LUVAS, Hisar from 10th-12th March, 2022.
40. Dr. Parvathy J - First prize in poster presentation. Kerala veterinary science congress. 2021.
41. Dr. Krishna Nath M.R - First prize in oral presentation. Kerala Veterinary Science Congress. 2021.

42. Dr. Kamalu S. Kumar - First prize in oral presentation. Kerala Veterinary Science Congress. 2021.
43. Dr. Rohini B.G. - Second prize in oral presentation. Kerala Veterinary Science Congress. 2021.
44. Dr. Gouree Krishna U. - Third prize in oral presentation. Kerala Veterinary Science Congress. 2021.
45. Dr. Roshni Moses - 3rd Prize for Review article writing competition on viral disease affecting livestock and poultry (PG Category) organized by IVA,CVAS Mannuthy, Kerala in 2021
46. Dr. Ashtamy M. G. - 1st place in poster presentation in Kerala Veterinary Science Congress, 2021
47. Dr. Akhila Joy - 2nd place in poster presentation in Kerala Veterinary Science Congress, 2021
48. Dr. Greeshma Raju - 3rd place in poster presentation in Kerala Veterinary Science Congress, 2021
49. Dr. Lina Kunjamma Mathews - 2nd place in oral presentation in Kerala Veterinary Science Congress, 2021
50. Dr. Vidya P - 3rd place in oral presentation in Kerala Veterinary Science Congress, 2021
51. Karthika R - Best Oral Presentation Award for the paper entitled “First report on molecular detection of *Neospora caninum* in aborted goat faetuses in Thrissur, Kerala” authored by Karthika R, Devada K, Bindu Lakshmamnan, Syamala K, Vijayakumar K and Pooja G Mankani at the 30th NCVP (14-16. Dec 2021).at CVS, Parbhani, Maharashtra
52. Karthika R - Second best poster presentation award for the poster entitled “Molecular detection of Toxoplasma gondii in aborted fetuses of goat in Thrissur, Kerala” authored by Karthika R,Devada K, Bindu Lakshmamnan, Syamala K, Vijayakumar K and Pooja G Mankani at the 30th NCVP(14-16. Dec 2021). at CVS, Parbhani, Maharashtra.

53. Dr. Alphine Joseph - Second prize in the Review Article Writing Competition organized by the Indian Veterinary Association, Kerala, Kerala Veterinary and Animal Sciences University and IVA, College of Veterinary and Animal Sciences, Mannuthy

54. Dr. Annie V. Raj - First prize for the Best paper in Basic Veterinary Science session in the Kerala Veterinary Science Congress 2021 organized with focal theme of "One health-A strategic imperative for veterinary profession in fight against the pandemic" during 12th to 14th November 2021 at College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala

55. Dr. Alphine Joseph - First prize for best paper(Poster presentation) in the International conference on convergence of technology and policy for sustainable meat production organized by AMST and MTU, KVASU from 25th to 28th October, 2021 at MTU, KVASU, Thirssur, Kerala.

56. Dr. Alphine Joseph - First position in the second national web conference on advances in teaching and research in veterinary Anatomy in India held at NTR college of Veterinary Science, Gannavaram, AP, from 16th to 18th December, 2021.

57. Dr. Abhin Raj K. P. - Second best oral presentation award for "Morpholoical and morphometrical studies on the testes of Large White Yorkshire boars (*Sus scrofa domesticus*)" authored by., Abhin Raj K.P Sreeranjini A.R., Maya S., Vasudevan V.N. and Sunilkumar N.S. in Basic Veterinary Sciences session, in the Post-graduate student category in the International conference on "Relevance of Veterinary Profession during Covid-19 pandemic" Organized by Indian Veterinary Association, CVAS Mannuthy unit and KVASU during May 2021.

58. Dr. Sridevi P. - Second best poster presentation award for "Characterization of Anatomical development and AFP gene expression changes in liver of embryonic and Day-old turkey poults" authored by Sridevi P., Sreeranjini A.R., Radhika G., Lucy K.M., Ashok N., Maya S., Sumena K.B, and Sunilkumar N.S. in Basic Veterinary Sciences session, in the faculty and others category in the International conference on "Relevance of Veterinary Profession during Covid-19 pandemic" Organized by Indian Veterinary Association, CVAS Mannuthy unit and KVASU during May 2021.

59. Swetha P. T. - Best poster presentation award at International e symposium on One Health concept: Oppurtunities and perspective in present scenario on 28th and 29th May 2021

60. Murugavel - Best poster presentation award at International e symposium on One Health concept: Oppurtunities and perspective in present scenario on 28th and 29th May 2021

61. Athulya T. R. - First prize for poster presentation on the topic Antimicrobial susceptibility profiles and genotypic resistance pattern of *Campylobacter jejuni*isolates from backyard chicken rearing facilities at the International Webinar on Ecohealth paradigm: towards sustainability and Global Health on 3rd and 4th of August 2021

62. Sruthy C. - Secured third prize for poster presentation on the topic Detection of Extended Spectrum Beta Lactamase (ESBL) producing enterotoxigenic (ETEC) and enteroaggregative *E. Coli* (EAEC) isolates from drinking water, human, animal and environmental sources the International Webinar on Ecohealth paradigm: towards sustainability and Global Health on 3rd and 4th of August 2021

63. Swetha P. T. - First place in best poster presentation award at AMST conference Organised by LPT, KVASU, AFST and IDA Mannuthy 25-28th Oct 21

64. Dr. Amritha. A. - Awarded Best (First) Poster Presentation for the paper Effect of dietary methionine supplementation on carcass yield of meat type ducks , co-authored by Amritha A. - Senthil Murugan and other authors in International Conference on Convergence of Technology and Policy for Sustainable Meat Production Organized by Meat Technology Unit and Kerala Veterinary and Animal Sciences University and Association of Meat Scientists and Technologists

65. Dr. Sudharsan C. - Awarded Best (First) Oral Presentation for the paper Carcass composition of broiler chicken supplemented with poly-unsautrated fatty acid rich Rapeseed oil, co-authored by Sudharsan C., Senthil Murugan and other authors in International Conference on Convergence of Technology and Policy for Sustainable Mea Production Organized by Meat Technology Unit and Kerala Veterinary and Animal Sciences University and Association of Meat Scientists and Technologists

66. Dr. Sreeja. S. J. - Won the 3rd prize for the paper titled, “Effect of partial replacement of soybean meal with spent brewer’s grains on carcass traits, sensory attributes and techno – economics of broiler chicks” co-authored by Sreeja. S. J, Biju Chacko and six other authors in Session – IV titled, “Sustainability and Policy in Food Production Systems” the International Conference on “Convergence of Technology and Policy for

Sustainable Meat Production" organized by Association of Meat Scientists and Technologists (AMST) and Meat Technology Unit (MTU), LPT, KVASU and held online from 25th to 28th October 2021.

67. Dr. Merin Sneha C. T. - Won the 2nd prize for the paper titled, "Evaluation of carcass characteristics in broilers supplemented with *Chlorella vulgaris* extract as feed additive" co-authored by Merin Sneha C. T, Surej Joseph Bunglavan, Biju Chacko and five other authors in Session – IV titled, "Sustainability and Policy in Food Production Systems" the International Conference on "Convergence of Technology and Policy for Sustainable Meat Production" organized by Association of Meat Scientists and Technologists (AMST) and Meat Technology Unit (MTU), LPT, KVASU and held online from 25th to 28th October 2021.

68. Dr. Sabarinath. E. - Won the 2nd prize for the paper titled, "Egg shell powder as a free choice calcium source for Gramasree male birds" co-authored by Amritha. A, Senthil Murugan, S, Biju Chacko and two other authors in Scientific Session titled, "Equine, Camel and Wild Animal Reproduction" the International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology" organized by the Animal Reproduction, Gynaecology and Obstetrics, CVAS, Mannuthy of KVASU and held online from 27th to 29th December 2021

69. Dr. Ambily K. G. - Best Young Scientist Award- (2021) for the Poster Presentation entitled "Fractionation and supplementation of SDS in cryopreservation extender improves cryopreservability of boar semen" co-authored by Hiron M. Harshan, C. Jayakumar, M. P. Unnikrishnan, A. P. Usha and S. Selvaraju, presented in the scientific session on Small Ruminant and Swine Reproduction in the International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology "held at CVAS, Mannuthy from 27th to 29th December, 2021

70. Dr. Swathish V S. - Best Poster Presentation Award- - Second (2021) for the research paper entitled "Resolution of postpartum uterine prolapse in guinea pig (cavia porcellus) by hydropropulsion technique followed by surgical management" which was presented in the scientific session on Equine, Camel and Wild Animal Reproduction in the International Symposium on "Novel Knowledge, Innovative Practices and Research in Theriogenology " held at CVAS, Mannuthy from 27th to 29th December, 2021

71. Dr. Arya Krishnan - Best Young Scientist Award- (2021) for the Poster Presentation entitled “Feline mucometra a case report“ co-authored by Niyas E., Lekshmi Bhai K, Urmila S, Hemanth Ajayan which was presented in the scientific session on Clinical Case Presentation in the International Symposium on “Novel Knowledge, Innovative Practices and Research in Theriogenology “ held at CVAS, Mannuthy from 27th to 29th December, 2021
72. Ms. Mariya Divanshi Major Advisor - Dr. Aparna Sudhakaran V Department of Dairy Microbiology Secured second prize in poster presentation for the topic entitled “Optimisation of cadmium biosorption by lactic acid bacteria isolated from neonatal fecal sample” ain the “International Virtual Conference on Recent Trends and Innovations in Microbiology” organized by Department of Microbiology, Mohanlal Sukhadia University, Udaipur on July 15, 2021
73. Ms. Mariya Divanshi Major Advisor - Dr. Aparna Sudhakaran V Department of Dairy Microbiology Secured Best Poster (first prize) entitled “Bioremediation potential of lactic acid bacteria against cadmium and lead”. International conference on ‘Convergence of technology and policy for sustainable meat production’. 25th to 28th October, 2021.

Schools and Centres

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

About the centre

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 and it is also planned to offer a PG diploma in feed technology, in distant mode, in the coming years.

Major activities/Achievements

- Establishment of pet food manufacturing unit- in the completion phase

Publications

- Jasmine, R. K., Dildeep V, Ally K, Syam Mohan, K. M, Aravindakshan T. V. and Anil K. S. 2022. In vitro assessment of nutrient digestibility and microbial biomass production of total mixed ration supplemented with different levels of thermostable yeast in crossbred dairy cows. *J. Indian Vet. Assoc.* **20**(1): 23-32

2. 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 courses 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

- "Skill Development Training on Molecular Biology and Bioinformatics tools for Advanced Life Science Research" from 3rd February to 17th February 2021.
- "Skill Development Training on Molecular Biology and Bioinformatics tools for Advanced Life Research" from 8th February to 21st February 2022
- "Skill Development Training on Molecular Biology and Bioinformatics tools for Advanced Life Research" from 30th March to 13th April 2022

Research Activities

i. **KVASU Research projects.**
   - State Plan Project 2021-2022- Strengthening of School of Applied Animal Production and Biotechnology-P.I. Dr. T. V. Aravindakshan- 5lakhs

ii. **Masters /Doctoral Research projects**
   - Lysozyme Gene Polymorphism in Cross Bred Cattle, Murrah Buffaloes and its association with Mastitis Resistance- Remya John- (19-MSVM-07)
   - Characterisation of Protamine 1 and Protamine 2 Genes affecting male fertility in Vechur Cattle of Kerala- Surumi Haris- (19-MSVM-08)
   - Major activities/Achievements
   - Two students successfully completed M.Sc. Animal Biotechnology Programme in the year 2021-2022.
   - Conducted three hands on trainings on Molecular Biology and Bioinformatics for research scholars, students and faculties from different universities in India.

Publications

- Amrutha Anand, Bindu Lakshmanan, T. A. Kajal, Siju Joseph, T. V. Aravindakshan and Jain Jose. (2021) "Deltamethrin resistance in Rhipicephalus sanguineus and Rhipicephalus (Boophilus) microplus tick population in Kerala". *J. Vet. Anim. Sci.* **52** (1): 19- 25.
- Amrutha, A., Bindu, L., Siju, J. and Aravindakshan, T.V. 2021. Genotyping of Deltamethrin Resistance in Rhipicephalus (Boophilus) microplus Population in Kerala, South India. *Acta Parasitologica*. 1-8.
- Amrutha, A., Bindu, L., Kajal, T. A., Siju, J. and Aravindakshan, T. V. 2021. Deltamethrin resistant alleles predominate in Rhipicephalus sanguineus sensu lato in South India. *Exp. Appl. Acarol.* 1-12.

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

Sl. No	Name of Student	Affiliation	Project
1.	Dr. Vijin V. L	19-DVP-04, Ph.D Scholar, LPM, COVAS Pookode	Rearing of Large White Yorkshire Pigs in different feeding systems for meat and biodiesel production
2.	Dr. Shradha Shetty [18-MVP-10]	M.V.Sc Scholar, LPM, COVAS Pookode	Evaluation of two stage restricted flow anaerobic baffled bio-gas digester and gas purification systems

Major activities/Achievements

Granted Patent: Inventor: John Abraham and Ramesh Saravanakumar.2014. Applicant: Tamil Nadu Veterinary and Animal Science University. No. IN 371344 (219/CHE/2014)-Bio-diesel production from rendered chicken oil, Date of Grant: 07/07/2021

Publications

- Shradha Shetty, John Abraham, Balusami C, Sabin George and Renuka Nayar. 2021. Biogas production and composition from single stage and two stage digesters in hilly areas. The pharma Innovation Journal 2021; 10 (3): 256-258.
- Shradha Shetty, John Abraham, Balusami C and shehnaaz. *2020.* Mechanism of Methane Production in Biogas Plants and its Upgrading Methods. *Int. J. Livestock Res.* **10**(8): 25-32
- John Abraham and Jyothi, S.B. 2019. Advances in Bio-methanisation Technologies. *J. Indian Vet. Assoc.* 17 (2): 07-14

Booklet Published

- John Abraham., Vrindha K. Menon., Deepak Mathew. 2019. Veedukalile Jaiva Malinya Samskaranam. School of Bioenergy and farm waste management. KVASU, Pookode

4. School of Zoonoses Public Health and Pathobiology

About the School

- 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: Veterinary Public Health , Veterinary Microbiology, Veterinary Parasitology, Veterinary Pathology and Veterinary Epidemiology and Preventive Medicine

Training conducted

- The workshop on 'Culture of Responsibility was organized by the School of Zoonoses Public Health and Pathobiology for the Post graduate and PhD students at College of Veterinary and Animal Sciences, Mannuthy

Research Activities

KVASU Research projects

- Strengthening of School of Zoonoses Public Health and Pathobiology-
  Prevalence of *Coxiella burnetii* in goats in Thrissur - The organism could not be detected from vaginal swab and milk samples of goats with the history of abortion

Major activities/Achievements

- Development of short videos on bat zoonoses, water purification, pet bird handling and management and collection of samples for rabies

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 M.V.Sc. Projects. Establishment of AICRP on Poultry improvement, Release of crossbred chicken for backyard- Gramasree and Gramalakshmi, release of high yielding ILM-90, ICAR Revolving Fund poultry project, NATP project on Ducks and successful conduct of IV World Water Fowl conference, RKVY project etc. are the significant milestones of the department.

Sl. No	Name of PI and Department	Funding Agency	Title of Project	Total Outlay (Lakhs)
1	Dr.P.Anitha	State Plan	Advanced Mycotoxin testing facility for poultry feed	8.00
2.	Dr.P.Anitha	State Plan	Conservation, characterization and popularization of native varieties of poultry in Kerala	30.00

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 major objectives of the centre are i) Improving the genetic potential of livestock for efficient growth and increased production ii) Research in molecular genetics, genomics and animal breeding iii) Conservation of native animal genetic resources and act as germplasm repository for domestic animals and iv) Undergraduate, Master's and Doctorate studies and research on Animal Breeding and Genetics The major components of CASAGB are i) Animal Breeding and Genetics ii) Cattle Breeding - Vechur conservation, ICAR- Field Progeny Testing Schemeiii) Goat Breeding - ICAR- All India Coordinated Research Project (Malabari Field) and iv) Rabbit Breeding

Trainings conducted

- Skill development Training on Molecular Biology and Bioinformatics tools for Advanced Life Science Research -03-02-2021 to 17-02-2021- 14 days
- Training on Scientific Goat rearing – 7 batches 2/10/2021- 5/10/2021; 19/10/2021-13/10/2021; 13/11/2021-15/11/2021; 23/12/2021-31/12/2021 by ICAR AICRP.
- Farmers Seminar on Cattle rearing and management – 1 batch 15/10/2021

i. Externally Aided Projects

- ICAR Field Progeny Testing Scheme -75per cent ICAR Share + 25per cent State share (18.8 lakhs)
- AICRP on goat Improvement (Malabari) (75per cent ICAR Share+ 25per cent State share (11.3 lakhs)
- Development of multi trait selection criteria in crossbred cattle of Kerala - Financial Outlay 28.57 lakh
- Genetic Diversity Analysis among cattle genetic groups of Kerala using microsatellite markers KSCSTE - Financial Outlay 16.88 lakh
- Addressing the Production Challenges of Native Goat Breeds of Kerala through Genomic Approach – AHD- Financial Outlay- 17.6 Lakhs
- Genomic approach for genetic improvement and conservation of important acquaculture species, etroplus suratensis and trachintous blochii under changing climate scenario- DST TARE - 18.7 Lakhs

ii. KVASU Research Activities

- Enhancing milk production potential of genetically superior cows through scientific intervention for producing better progenies" - 3 lakhs
- Comprehensive approach to address the production challenges of smallholder Rabbit Farming in Kerala- 10 lakhs
- Strengthening of "Centre for Advanced Studies in Animal Genetics and Breeding"-3 lakhs.
- Establishment of a germplasm repository for domestic animal diversity of Kerala- 12 lakhs
- Conservation centre for Vechur and Kasargode cattle- 50 lakhs

iii. Masters /Doctoral Research projects

Dharamshaw C.A.	2021	Dr. Elizabeth Kurian	Molecular characterisation and expression profiling of *vasorin* and adam 17 gene in native goats of Kerala
Kiyevi G. Chrishi	2021	Dr.Jamuna Valsalan	Genetic variability of *toll like receptor 4* and *beta defensin 4* genes and their association with somatic cell score in crossbred cattle of Kerala
Katam Divya	2021	Dr. Elizabeth Kurian,	Expression profiling of candidate genes affecting post thaw sperm parameters in Vechur cattle of Kerala
Potu Hemanth	2021	Dr. Lali F. Anand	Association of Butyrophilin gene polymorphisms with milk yield and fat per cent in crossbred cattle of Kerala

Major activities/Achievements

By ICAR-FPT, 1,40,775 inseminations were done using semen supplied from the project Number of female calves born from 1992 to 31.12.2021 is 12,131. Considering an advantage of 500kg per animal compared to contemporaries in first lactation, estimated increased milk production of the progenies in the first lactation is 60,65,500Kg. At the current day price of Rs 40/kg milk, the farmers got an additional advantage of 24.262 crores by rearing progenies of field progeny testing programme. The age at first calving of progenies was recorded as 1136 ± 13days in the progenies of the first batch of bulls to 964.1± 7.70 days in the progenies of 15th batch of bulls. During the period from 1992 to 31.12.2021, 39043 pregnancies were confirmed.

By ICAR- AICRP, enhanced productivity of Malabari goat in their habitat, developed germplasm resource centers for Malabari goat breed 3) Validated and implement breeding, feeding, and health control technologies in the field for improved goat production and health 4) Capacity building of stakeholders and goat keepers for sustainable and profitable goat husbandry.

By genetic Diversity Analysis among cattle genetic groups of Kerala - Vilwadiri cattle was identified as distinct cattle genetic group.

Publications

- Akshatha G. Desai, T. Naicy, T. V. Aravindakshan, V. N. A. Muhasin, L. Bindu, G. H. Akhil. 2021. Genetic Variability Analysis of Early Growth Response 2 (EGR2) Gene in Native Goat Breeds of Kerala. *Indian J. Anim. Res.* 55(10): 1132-1136
- Jamuna Valsalan, Tina Sadan, Thirupathy Venkatachalapathy, Kulangara Anilkumar and Thazhathu Veettil Aravindakshan. 2021. Identification of novel single-nucleotide polymorphism at exon1 and 2 region of B4GALT1 gene and its association with milk production traits in crossbred cattle of Kerala, India. *Anim. Biotech*. DOI: 10.1080/10495398.2020.1866591
- Jamuna Valsalan, Tina Sadan, K. Anilkumar and T. V. Aravindakshan. 2021. Evaluation of nongenetic factors affecting reproduction and production traits in Crossbred dairy cattle of Kerala. *Ruminant Sci*. **10**(1).37-42.
- Jamuna Valsalan, Tina Sadan, K. Anilkumar and T. V. Aravindakshan.2022. Estimation of co-variance components and genetic parameters of fertility and production traits in crossbred cattle of Kerala. *Theriogenol*. **181**: 126-130

- Priyadharshini M, Anilkumar K and Jamuna Valsalan. 2021. Influence of genetic and non-genetic factors on age at first calving and first lactation milk yield of crossbred cattle in Kerala. *Pharma Innov. J.* 1016-1020.
- Kiyevi G. Chishi, Jamuna Valsalan, Anilkumar and T. V., Aravindakshan. 2021. Genetic variability of toll like receptor gene and its association with somatic cell score in crossbred cattle of Kerala. *J. Vet. Anim. Sci*.
- Divya, K., Kurian, E., Naicy, T., Manoj, M., Harshan, M. H., Priya, M. and Aravindakshan, T. V. 2021. A novel SNP identified in intron 1 of Superoxide Dismutase 1 (*SOD 1*) in Vechur cattle of Kerala. *Rumin. Sci*.
- Dharamshaw, C. A., Kurian, E., Naicy, T., Aravindakshan, T. V., Abhilash, R. S. and Venkatachalapathy, R.T. 2021.Expression profiling of *ADAM17* gene in ovary, fallopian tube and uterus of Malabari goat. *Rumin. Sci*.

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 and 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.

Trainings conducted

- Officers of the Animal Husbandry Department attended classes in CAADECCS on climate change and Animal Husbandry as a part of their three months training programme. Dr. V. Beena took class on the topic "An introduction to the activities of CAADECCS" and Dr. S. Harikumar on "Thermal stress management in dairy cattle."
- Online training programme jointly organized by CAADECCS, KVASU and MANAGE

- The collaborative online training programme jointly organized by Centre for Animal Adaptation to Environment and Climate Change Studies (CAADECCS), Kerala Veterinary and Animal Sciences University (KVASU) and National Institute of Agricultural Extension Management (MANAGE), Hyderabad on "Climate Smart Dairying in the Context of Global Warming" was held during 4-7th May 2021
- Handled sessions on workshop organised jointly by KAU and KILA

Research Activities

i. KVASU Research projects

- "Livestock Advisory Based on weather Forewarning" RSP/21-22/XIV-6 with a total financial outlay of Rs 8 lakhs (seven lakhs only) under the state Plan Schemes for the year 2021-2022

The released amount was effectively utilized for the conduct of CAADECCS. An animal weighing balance with cage -1000kg, Thermal imager, four Portable Temperature and Relative humidity logger and its USB interface adapter, Infrared thermometer, lux meter, Absolute pressure measuring instrument were purchased for research purposes. Improved the infrastructure facility. The amount was also spent for improving the facilities of the Centre for effective dissemination of information to the farmers. In collaboration with KAU weekly bulletins containing tips on animal husbandry practices being distributed to farmers of Thrissur, Palakkad and Ernakulum districts using messengers, online services like email and WhatsApp. From 2019 onwards CAADECCS has been successful in recording all the important weather parameters from the surface observatory established in CVAS Mannuthy Campus in collaboration with the Indian Meteorological Department (IMD). and also we are routinely providing weather information to various newspapers, online and television Medias. Furthermore, hourly/daily/monthly/yearly data recorded from automatic weather station is effectively utilized for various research works.

ii. Masters /Doctoral Research projects

- One M.V.Sc. student from Department of Veterinary Physiology, CVAS, Mannuthy completed M.V.Sc research in collaboration with CAADECCS and submitted thesis on "Association of Temperature Humidity Index with Physiological, Biochemical and Behavioural Parameters in Native and Crossbred Goats", under the supervision of Dr V Beena

Major activities/Achievements

- CAADECCS has successfully completed nine years since its foundation and has achieved excellence in serving the needs of farmers, extension workers, policy makers and professionals associated with livestock production
- CAADECCS also conducted a four-day online national training programme with MANAGE, Hyderabad from 04-05-21 to 07-05-21. Nearly 300 participants from all over the country including faculty members from various state Agriculture/Veterinary Universities and veterinary professionals from various state animal husbandry departments participated in the training. The renowned scientists from various national institutes like IMD, IVRI, NDRI, NIANP and also from KAU and KVASU were the resource persons for the training.
- Published various articles in farm journals and delivered radio talks for bringing awareness among the farmers regarding the consequences of climate change on their livestock and the remedial measures to tackle these impacts.
- Further, several awareness programmes both for professionals and farmers were organized at different parts of the state

Publications

Articles Published in Research Journals

- Jisha., G. Girish Varma., V.L. Gleeja.K., A.Prasad., V. Beena., Karthiayini and V. Sejian. 2021. Annual temperature profile of Thrissur: a climate change perspective. *J. Vet. Anim. Sci*. **52**(1):26-31
- Sasi, D., Harikumar, S., Prasad, A., Beena, V., Gleeja, V. L. and Nameer, P. O. 2021. Structural and microclimatic characteristics of dairy cattle shelters in Kerala. *J Indian Vet Assoc.* **19**(1):33-42
- Debia Yamin., V. Beena., B. Ramnath., R. Thirupathi Venkatachalapathy and Aziz Zarina (2021). Association of temperature humidity index during summer with haematological parameters in native and crossbred goats of Kerala *J.Vet.Anim.Sci.* **52**(3): 222-227
- Ibraheem Kutty C., Harikumar S., Shajeesh J. and Bibin Becha B. 2021. Comparison of weather parameters inside and outside the cattle house as a causative factor of thermal stress under humid tropic. *J. Indian Vet. Assoc*. **19** (3):61-72

- Evaluation of glutathione peroxidase in anemia associated with hemoprotozoan infections in dogs Rohil Chopra, V. Ramnath, V. Beena, K. Raji, and Arun George: J. Vet. AS- Manuscript No. 262/27/11/2
- Aishwary Vibhuti R. Thirupathy Venkatachalapthy, Pramod S, T.V. Aravindakshan and V. Beena Expression profilingof Ecto-NOX Disulfide-Thiol Exchanger 2 (ENOX2) gene during heat stress in Attappady black and Malabari goats JVAS- Manuscript No. 273/06/01/22

Publication of E-book on Climate Smart Dairying in the Context of Global Warming

- This e-book is a compilation of resource text obtained from various subject experts for Collaborative Online Training Programme of KVASU-CAADECCS and MANAGE, Hyderabad, Telangana on Climate Smart Dairying in the Context of Global Warming conducted from 04-07 May, 2021. This e-book is designed to educate extension workers, students, and research scholars, academicians related to veterinary science and animal husbandry about Climate Smart Dairying in the Context of Global Warming.

- Given for publishing a Malayalam book entitled “MRIGASAMRAKSHANAVUM MAARUNNA KAALAVASTHAYUM” to Director of Entrepreneurship

- It is a book prepared focusing on Animal Husbandry and the changing climatic conditions, a relevant topic in current situation. It was compiled by incorporating chapters prepared by several resourceful personalities who are experts in the subject and is edited by Dr. V. Beena and Dr. S. Harikumar.

8. Centre for Livestock Development and Policy Research, Thiruvananthapuram

About the centre

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

- Online training on scientific feeding of layer on 22-03-21 to poultry farmers
- Orientation training programme for beneficiaries (Tribal farmers) of state plan project on scientific cattle management at tribal development hall Kulathupuzha on 24-03-2021.

Research Activities

i. KVASU Research projects.

Strengthening of CLPR: Outlay- 5 Lakh

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.

- National level training in collaboration with MANAGE: Training programme for veterinary professionals on "ICT tools for knowledge management and control of emerging zoonoses and animal health threats" from September 14-17, 2021
- World Day for Laboratory Animals – April 24- COHEART along with Students club of Mumbai Veterinary College celebrated the day with an online session on Scope, Prospects, Importance of lab animals and associated Zoonotic risk". The session was handled by Dr Jayant Hole. Dr. Hole has more than a decade of experience in veterinary and laboratory animal medicine.

Research Activities

i. **KVASU Research projects.**

- UNDP funded project on "GREEN RECOVERY PATHWAY FOR INDIA: TRANSITIONING TOWARDS A GREEN AND RESILIENT COVID-19 RECOVERY" UNDER RAPID FINANCING FACILITY (RFF) Project ID 125347
- GIZ funded project on "Developing Situation analyses to understand the impact of Zoonotic Diseases and Ecosystem health curriculum development

Major activities/Achievements

- COHEART partnered with ASPIC and ReAct Asia Pacific to organize Student Research Champions for AMR (SRC4AMR) 2021
- PG Diploma in One Health: for the year 20 students have joined that includes MBBS, BVSc, PhD and BAMS. Course is offered in Synchronous and Asynchronous with weekly online classes or activities
- PG Certificate in One Health Surveillance
- PG Certificate in Community based disaster management.
- One Health Mentorship programme for UG students.
- Internship opportunity to students of other university. Recently, a student from *Sree Chitra* Tirunal Institute for Medical Sciences and Technology completed 2 months internship at COHEART

- Project work for external universities: COHEART provides research opportunity for M.Sc students outside University. Seven such projects have been successfully completed.
- Facilitating activities for International Veterinary Students Association, Pookode (COHEART being the nodal centre) Total- 151 students enrolled as members
- IVSA Pookode in collaboration with COHEART celebrated World Zoonoses Day with a week-long event including social media quiz sessions, photo facts, posters on zoonoses, and a webinar.
- Dr. Jess Vergis Co-ordinator COHEART delivered an interactive session in Red FM (Radio channel) on the 'Zoonotic diseases and its Control strategies' in connection with the World Zoonoses Day- 2021 on 6th July, 2021
- Dr. Prejit received One Health Photography Award by OHDI, Africa- Recipient of certificate of achievement for emerging the first runner-up at the One Health Photo Competition organized by OHDI, Africa
- Dr. Jess Vergis delivered an awareness video talk on 'Zika Virus infection: A Public Health Perspective' in the Farm Information Bureau Live, Government of Kerala on 11th July 2021.
- Serinmary P R, a fourth-year BVSc and AH student at the college of veterinary and animal sciences Pookode was awarded the 'IVSA Excellence Award' during the 69th IVSA Symposium Special General Assembly.
- Dr. Jess Vergis delivered an interactive session on the 'Control strategies of emerging infectious diseases in connection with the World Veterinary Day- 2021 on 24th April 2021 in Red FM (Radio channel).
- World biodiversity day is celebrated on 22nd May every year globally with its mission to promote biodiversity issues. Students for One health, COHEART along with the students club at Mumbai veterinary college celebrated the day with session on "BIODIVERSITY AND US" by Ms. Gargi Geedh from Green Works Trust Organisation.

Publications

- Hitziger M, Berezowski J, Dürr S, Falzon LC, Léchenne M, Lushasi K, Markosyan T, Mbilo C, Momanyi KN, Özçelik R, Prejit N, Zinsstag J, Rüegg SR. System Thinking and Citizen Participation Is Still Missing in One Health Initiatives - Lessons from Fifteen Evaluations. Front Public Health. 2021 Jun 4;9:653398

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 as well their crosses with exotic pig 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. Mega seed project on pigs funded by ICAR has started functioning since 2015. The strategic breeding programmes for more than two decades evolved a new crosbred variety of pig with remarkable disease resistance, heat tolerance, lean meat production and feed conversion efficiency. The new pig variety Mannuthy white, with better adaptability and growth rate was developed and released from this centre. The three breed crosses of pigs with better growth rate and lean meat are also produced and distributed to farmers for fattening purposes.

Training conducted.

- Internship training to final year students

Research Activities

i. KVASU Research projects.

Name of Project	Financial outlay (lakhs)
Scaling up of production of piglings	68.00
Evaluation of performance of crossbred pigs (25per cent share of AICRP on pigs)	24.00
Conservation and maintenance of Ankamali pigs of Kerala	4.00
Wastewater management for eco-friendly swine production	2.00
Artificial insemination for improving reproductive efficiency in pigs	4.00
Total	**102**
EAP	

AICRP on pigs	68.50
Mega Seed project on pigs	51.00
Total	**119.50**

ii. Masters /Doctoral Research projects

- Storage quality of liquid semen of LWY boar supplemented with cholesterol loaded cyclodextrin - Masters research by Shylesh
- Preservability of boar cauda epididymal sperm, post incubation with specific seminal plasma fractions - ongoing Masters research
- Efficacy of oestrus synchronisation on breeding performance of pigs - on going
- Effect of oestrus synchronisation on breeding performance of pigs

Major activities/Achievements

The centre has successfully fulfilled the demand of the farmers by supplying fattening piglets (crossbreds) Crossbred pigs (75 per cent) were produced and their production, reproduction and carcass traits were studied. The breeding stock number was increased; the health status of farm stock was improved with utmost care and management. A comprehensive breeding schedule has been introduced for prompt selection / culling of the stock.

Publications

- Ambily, K, G., Malati Naik, Hiron M Harshan, Jayakumar, C., Unnikrishnan, M.P., and Usha, A.P. 2021. Assessment of quality in specific fractions of LWY boar semen. *J. Vet. Anim. Sci*. **52** (2): 155-160.
- Ambily, K, G., Hiron M. Harshan, Jayakumar, C., Unnikrishnan, M. P., and Usha, A. P. 2021. Electrophoretic profile of seminal plasma proteins of fractions of sperm rich fraction in boar semen. (Abstract published in the proceedings of Kerala Veterinary Science congress 2021

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 and 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

Masters Research projects

- Population density, spatial use, and habitat preference of Micrixalus saxicola (Jerdon, 1853) using Spatial-explicit capture-recapture method in South Wayanad Forest Division
- Nesting Preference and Nutritional Analysis of Malabar Grey Hornbill In Wayanad, Kerala
- Gastrointestinal parasites of selected primate species in Silent Valley National Park, Kerala
- Illegal trade trends and assessment of Gastrointestinal parasites in captive Indian Star Tortoise (Geochelone elegans) at Chinnar Wildlife Sanctuary, Kerala
- Microhabitat preference of Golden-backed frog (Indosylvirana sp.) in Riparian habitats of South Wayanad Forest Division

- Dissemination of antibiotic resistant bacteria in wildlife; A study on the prevalence of resistant E. coli in Livestock, Carcass and Vulture in Wayanad Wildlife Sanctuary
- Investigate Selected Strigiformes: Evaluate Their Con-Specific Call Response, Interspecies Response and Habitat Preference In Wayanad Wildlife Sanctuary, Kerala
- Diversity, distribution, and habitat specificity of Macrofungi in Periyar Tiger Reserve, Kerala
- Resource preference by butterflies at mud-puddling sites in Peechi-Vazhani Wildlife Sanctuary
- Assessment of population density and age-sex composition in Bonnet Macaques (Macaca radiata) of South Wayanad Forest Division, Kerala
- Effect Of Land Use Change On Soil Fungi Diversity and Soil Aggreagte Stability
- Butterfly species composition, density and diversity using distance-sampling methods in Peechi-Vazhani Wildlife Sanctuary, Kerala
- Phylogenetic analysis of mitochondrial genes in feral and domestic cats for patterns of hybridization with jungle cat
- Occurrence of Skeletal Growth Marks (SGMs) in Road-killed Snakes of South Wayanad Region
- Foraging and nutrient composition of food items of Malabar and Grizzled Giant Squirrels (Ratufa indica and R. macroura) in Chinnar Wildlife Sanctuary, Kerala
- Phytochemical analysis of leaf extract and seed germination capacity of Senna spectabilis and its invasion effect on native plant species in Wayanad Wildlife Sanctuary, Kerala
- Debarking behavior of Asian elephants (Elephas maximus) in Wayanad Wildlife Sanctuary
- Gastrointestinal parasites of selected vulture species (White-rumped vulture Gyps bengalensis and Red-headed vulture Sarcogyps calvus) in Wayanad Wildlife Sanctuary
- Diversity and host preference of Mistletoes in Wayanad Wildlife Sanctuary

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Pookode, Wayanad, Kerala