वार्षिक प्रतिवेदन
ANNUAL REPORT
2014-15

भाकृअनुप–राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो
करनाल–132001 (हरियाणा) भारत
ICAR-National Bureau of Animal Genetic Resources
Karnal-132001 (Haryana) INDIA

वार्षिक प्रतिवेदन
ANNUAL REPORT

2014 - 15

भाकृअनुप–राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो
करनाल – 132001 (हरियाणा) भारत

ICAR-National Bureau of Animal Genetic Resources
Karnal - 132001 (Haryana) India

Credit Line...

Published by

Dr. Arjava Sharma, Director
ICAR-National Bureau of Animal Genetic Resources
Karnal - 132001 (Haryana) India

Compiled by

Dr. NK Verma, Principal Scientist
& I/C, PME Cell

Editors

Dr. NK Verma, Principal Scientist
Dr. RS Kataria, Principal Scientist
Dr. AK Mishra, Principal Scientist
Dr. Saket Kumar Niranjan, Senior Scientist
Dr. Indrajit Ganguly, Senior Scientist

Photographs

I/C, P&E Unit

Assistance

Dr. PS Dangi, A.C.T.O.
Ms. Indu Bala, Steno Gr.III
Sh. Satpal, Tech. Officer

Printing

Intech Printers & Publishers
343, 1st Floor, Mughal Canal Market,
Karnal - 132001, Haryana
Tel: 0184-4043541, 3292951
E-mail: jobs.ipp@gmail.com

Contents

FOREWORD

It is my pleasure to present the Annual Report of ICAR- National Bureau of Animal Genetic Resources, Karnal (Haryana) for the period 2014-15, containing a brief account of the activities and achievements of this Institute. Since its inception in 1984, the institute has been striving hard for identification and characterization of the genetic potentials associated with different attributes of Indian farm animal genetic resources. During the year, we completed the phenotypic characterization of some lesser known populations of indigenous livestock, which included Kajali sheep, Singharey goat, Rajapalyam and Chippiparai dogs. The characterization of Siri cattle, Mouli and Yalaga sheep, Sikkim Black goat and Kaunayen chicken is in progress. Under ex-situ conservation program, 7600 semen doses of cattle (Gaolao and Tharparkar) and buffalo (Toda) were added to the Gene Bank of the Bureau. Jaffarbadi buffalo semen has also been utilized in its breeding tract for supporting conservation and improvement of the breed. Under breed registration programme, seven new breeds of livestock and poultry and one male parent line of chicken were registered. These included, Belahi and Gangatiri cattle, Katchaikatty black sheep, Pantja goat, Kharai camel, Agonda Goan pig, Mewari chicken and PD1(Vanraja) male parent line of chicken. Under the Network Project on AnGR, characterization of Purnea cattle, Binjharpuri cattle, Assamese cattle, Kosali cattle, Marwari sheep, Poonchi sheep, Tibetan sheep, Bundelkhandi goat, Bhakarwal goat, pig population of Assam, Jalori camel, Arunanchali yak and mithun, Donkeys of Rajasthan, Hazra chicken, Ducks of Assam and conservation of Bargur cattle, Ongole cattle and Harringhata chicken was undertaken.

High genetic diversity was observed in Koraput sheep at molecular level while genetic characteriztion of Odisha and Chattisgarhi buffalo is in progress. Candidate genes related to milk traits highlighted the near absence of taurine influence in the naturally evolved Ladhakhi cattle. Various candidate genes for production (DGAT1, GH, GHR, PIT1, Leptin, CAPN1, CAST, Titin, Ankirin etc.), reproduction (GDF9, BMP15, Kiss1 etc.) and endurance (Myostatitn, MCT, CD147 etc.) were characterized in different indigenous breeds. Data on 541 farm individuals from 3 breeds (Gir, Sahiwal and Tharparkar) using 4 STR loci was generated and analysed to develop breed signature with high accuracy. The Institute continued to provide consultancy services to various semen banks for cytogenetic screening of breeding bulls.

IRC meetings were held in time. An expert consultation meet on "Strategies for enhancing milk productivity of indeginous cattle" was organised in collaboration with ICAR and National Academy of Veterinary Sciences (NAVS). Awareness among masses on AnGR was generated by holding exhibitions, brainstorming sessions and lectures. A brainstorming session on Animal Genetic Resources of Sikkim state was organized at Gangtok in collaboration with Sikkim Livestock Development Board, Gangtok (Sikkim). ICAR sponsored short course on "Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources" was organized. I visited Vienna (Austria) to impart training to the international participants of IAEA-sponsored training in the capacity of Expert Lecturer. Apart from this, a number of distinguished persons visited the Institute which included Dr. Jimmy Smith, Director General, ILRI, Nairobi (Kenya), teams from USDA and Bangladesh.

I am grateful to Dr S Ayyapan, Secretary (DARE) & DG, ICAR, Dr K M L Pathak, DDG (AS), Dr R S Gandhi, ADG (AP&B) and Dr Vineet Bhasin, PS for their constant support and guidance for the overall development of this Institute. With a sense of pride and satisfaction, I congratulate all the scientists, technical, administrative officers and other staff members of the bureau whose contributions have been reflected in this report. Feedback and suggestions for the improvement are always welcome.

(ARJAVA SHARMA)
DIRECTOR

EXECUTIVE SUMMARY

National Bureau of Animal Genetic Resources and National Institute of Animal Genetics were set up on 21st September, 1984. These institutes started at Regional Station of National Dairy Research Institute, Bangalore. Bureau and the institute were then shifted to Karnal in 1985 and temporarily housed in NDRI Campus before shifting to its own campus at Makrampur, Karnal in 1994. Both, Institute and the Bureau were merged to function as a single unit as National Bureau of Animal Genetic Resources in 1995. National Bureau of Animal Genetic Resources has been the nodal organization in India with the mandate 'Identification, evaluation, characterization, conservation and utilization of livestock and poultry genetic resources of the country'. The objectives of the Institute are-

- To conduct systematic surveys to characterize, evaluate and catalogue farm livestock and poultry genetic resources and to establish their National Data Base.
- To design methodologies for ex-situ conservation and in-situ management and optimal utilization of farm animal genetic resources.
- To undertake studies on genetic characterization using modern techniques of molecular biology.
- To conduct training programmes as related to evaluation, characterization and utilization of animal genetic resources.

Total expenditure under Non-plan and Plan (combined) was Rs. 1179.332 Lakhs against the total receipt of Rs. 1186.00 Lakhs during financial year of 2014-2015. Under Network project, total expenditure was Rs. 178.72 Lakhs, which included release of Rs. 170.00 Lakhs, against Receipt of Rs. 180.00 Lakhs. Revenue generated was Rs. 21.68 Lakhs against the target Rs. 22.00 Lakhs.

Seven new breeds of livestock - two breeds of cattle, one breed each of goat, sheep, pig, camel and chicken were registered. The breeds are Belahi cattle of Haryana and Chandigarh, Gangatiri cattle of Uttar Pradesh and Bihar, Pantja goat of Uttarakhand and Uttar Pradesh, Katchaikatty Black sheep of Tamil Nadu, Kharai camel of Gujarat, Agonda Goan pig of Goa, Mewari chicken of Rajasthan. After including these newly registered breeds, total number of indigenous breeds in the country is now 151. One chicken line was also registered first time by the Bureau.

Indigenous cattle of Sikkim known as "Siri" was characterized through survey conducted in East district of Sikkim. A total of 68 animals of different age and sex were recorded for physical, morphometric characteristics and performance. Body colour of Siri cattle varies from brown with white spots to black. Ears are small. Tail reaches up to the hock. Udder is small. The daily milk yield ranges from 2.0 to 6.50 kg. Bullocks are used for draft purpose and a pair of bullock may plough about one acre of land in 6-8 hours.

Ladakhi cattle adapted to high altitude was characterized phenotypically through surveying the Ladakh area. Body colour of animals is black, brown and black with white patches. Horns are curved. Hump and dewlap are small. Ears are small to moderate in length and horizontal in orientation. Tail is long, touching almost to ground. Udder is small. Temperament of the animal is docile.

A survey was undertaken for characterization of Mouli and Yalaga sheep populations of Karnataka state. Data on body biometry and body weight were recorded. Mouli sheep are large sized with wide phenotypic variations. Animals

are tall with deep body and long legs. Coat colour is white with or without brown spots/patches. A brown ring is present around the eyes. A few flocks were typical Madgyal type. Noseline is typical Roman or comparatively straight. Both the sexes are polled.

Yalaga sheep are medium sized. White coat colour consisted thick small hair. A hair tuft is present in the thigh region. Face is white, white with black or brown patches of varying size to complete black. Extremities, except face and ears, are white. Muzzle is black brown or pink. Wattles are present in all the animals. Males are horned and females are polled.

Kajali, a mutton type sheep was surveyed and distributed in Sangrur, Barnala, Ludhiana, Moga and adjoining districts of Punjab. The Adult body weights of males and females are 56.98 ± 1.02 and 43.23 ± 0.36 kg, respectively. Kajali sheep has two types / colour variants, distinguished primarily on the basis of colour – 1) Black (Kali) Kajali- with complete black or black- brown body and 2) White (Chitti) Kajali - with white body and black or dark brown face and ear. The animals are large in size with well-built body, having Roman nose, long and pendulous ears and long tail touching to ground. The both sexes are generally polled. Average greasy wool production is 800 to 1000 g.

Interview based survey data on production and reproduction status, threat status and breed merits of five ecotypes (Madgyal, Solapuri, Sangamneri, Lonand and Kolhapuri) of Deccani sheep were collected from their distribution areas. Discriminant Analysis classified the five ecotypes in distinct groups. Principal Component Analysis (PCA) was performed on Madgyal, Solapuri and Kolhapuri ecotypes using 14 morphometric traits. The PCA extracted two components with a total variance ranging from 66.3% to 71% in the three ecotypes.

Survey was conducted to characterize the Sikkim goat population- Singharey and Sikkim Black goats. Singharey goats constitute the major part of the Sikkim goat population and can be distinguished from other populations by the facial stripes. The eyes are bright and small. The ears are short to medium semi pendulous with round tip. The under belly is generally light brown or white. Legs are short, stout, medially black or white. Black top line is seen in many of these goats.

Sikkim goat germplasm constitute goats with coat colour brown, black, white, and mixture of these colours. These goats are distinct from Singharey goats in respect of coat colour, type of horns and their size and also from Black Bengal in their body size. Sikkim Black goats are of medium size. Head is proportionate to body. Face, horns and tail are longer than that of Singharey goats. These goats are slightly shorter than Singharey goats. Sikkim goats are reared mainly for meat purpose.

Survey has been conducted in Thoubal and Imphal West districts of Manipur to characterise local chicken called "Kaunayen". Plumage colour is black or brown with patches of white, black or golden feathers. Comb is red in colour and is of pea type. Body weight is about 2.5 to 3kg. Egg production is about 35 to 45 per annum. These are fighting type birds. Eggs were medium in size with an average of 42.43±.07g. Shell colour is brown.

Chippiparai dog distributed in Tirunelveli, Madurai, Virudhunagar and Thoothukudi districts of southern Tamil Nadu was characterized. Chippiparai dogs are medium in size with varying coat color from fawn to dark brown, brownish black and black. Ears are medium and flat, with very few in erect position. The age at sexual maturity in dogs ranges from

12-16 months. These animals are kept by the breeders for guarding and hunting as well as for their hobby.

Microsatellite based genotypic data recorded across 20 markers was analysed to estimate the genetic variability in Ladakhi cattle. A total of 200 alleles were detected across the 20 loci with mean number of 9.95 alleles per locus. The various within breed diversity measures in terms of observed number of alleles (9.95), effective number of alleles (4.84), observed heterozygosity (0.75) and expected heterozygosity (0.79), indicating sufficient genetic variability. The average inbreeding coefficient (F) was 0.037.

The data on 541 farm individuals from 3 breeds (Gir, Sahiwal and Tharparkar) using 4 STR loci was generated and analysed to develop breed signature. F_{ST} values were 0.173, 0.281 and 0.235 between Gir and Sahiwal, Gir and Tharparkar and Sahiwal and Tharparkar, respectively. Selection of loci was attempted and finally eight loci were able to assign 100% individuals belonging to the farms of these three breeds and 93% when added the field samples. All the individuals from organized farms were found to be correctly assigned and 3 breeds formed different clusters. These loci were used to develop a multiplex PCR kit. The kit was tested and validated to be used for Sahiwal, Gir and Tharparkar cattle breeds assignment.

Cytogenetic study was carried out for Kalahandi and Paralakhemundi, which revealed typical riverine buffalo cytogenetic constitution with 50 chromosomes. 811 bp mitochondrial D-loop region of 30 Kalahandi and 19 Paralakhemundi buffaloes was amplified and sequenced. By comparative analysis across nine riverine and swamp breeds/populations, 81 variable sites were observed resulting in 57 haplotypes. Median joining network analysis based on haplotypes sharing, has also shown both the Odisha buffalo populations grouping with other riverine buffalo breeds.

Pilot surveys were conduct in about 41 villages of Dhamtari, Kanker, Mahasumund, Bilaspur, Kawarda and Baster districts of Chhattisgarh. Phenotypic characterization was done and biometric measurements on about 140 adult Chhattisgarhi buffalo were recorded. Cytogenetic analysis of Chhattisgarh buffalo samples revealed riverine type with chromosomal number fifty. The candidate genes affecting the fat production traits - FASN (Exon 38, 39, 40, 41, 42) and 3' UTR of STAT1 were also studied for variation in Chhattisgarhi buffalo, using PCR-RFLP technique. Only Exon 40 of FASN gene was found to be polymorphic.

A total of 13 DQA alleles were identified in swamp buffaloes, which corresponded to two major groups, DQA1 (11 alleles) and DQA2 (2 alleles). For DQB, total 16 alleles were identified corresponding to three major groups i.e. DQB1, DQB2 and DQB3.

SNP markers in the heat shock protein (HSP) genes in four different breeds of Indian sheep were studied. Promoter region of HSP90AA1 containing 7 already reported SNPs with an amplicon size of 499 bp was amplified. The region revealed three novel SNPs at 112, 244 and 248 nt position. The tetra- primer ARMS PCR protocol was developed for -660 and -601 nt position in the promoter region of HSP90AA1. Genotyping protocol was developed for the 112 nt position SNP (G/C) using the allele specific primers and 42 samples of the Madras Red Sheep were genotyped. GG, GC and CC genotypes had a frequency of 0.40, 0.40 and 0.19; respectively.

Study was to conducted to evaluate the comparative changes in total antioxidant capacity (TAC) and free radical scavenging activity of milk during lactation in cattle and buffalo. In Sahiwal and Karan Fries cows, TAC of milk was significantly ($p<0.05$) higher in colostrum followed by early, peak, mid and late lactation stages. On the other side, percentage scavenging activity of 1,1-diphenyl-2-picrylhydrazyl (DPPH) showed no difference across lactation stages in Sahiwal and Karan Fries cows. In Murrah buffaloes, percentage scavenging activity of DPPH was significantly higher in colostrum and early lactation stages compared to peak, mid and late lactation stages. Data suggested that antioxidant levels change during different stages of lactation and are higher in colostrum and early lactation stages as compared to later part of lactation.

Expression of endogenous proteases across various lactation stages in Sahiwal cows and Murrah buffaloes was studied. All the genes encoding different endogenous proteases showed an increase in expression during course of lactation. The analysis showed lower expression of different proteases during early lactation.

The expression patterns of the milk casein genes (CSN1S1, CSN1S2, CSN2, CSN3, LALBA), and fat metabolism genes (FABP3, BTN1A1, ACACA, SCD, GPAM) were evaluated in Sahiwal cattle. Expression pattern of all casein genes was higher during early and peak lactation period as compared to mid and late lactation. Their mRNA abundance level was significantly high during early lactation and gradually decreased in late lactation stages. Expression level of SCD, FABP3 and GPAM etc. was significantly higher in early lactation (10 to 30 days) compared to mid and late lactation periods.

To decipher subfertility in bovines, sequence variation in zinc finger domain of bovine PRDM9 gene was studied in indigenous, exotic and crossbred cattle. Four alleles (A, B, C and D) and nine genotypes (AA, BB, CC, DD, AB, BC, CD, AC and BD) for PRDM9 gene have been recorded. Number of zinc fingers in this domain of PRDM9 gene was 6, 7, 8 and 9 in A, B, C and D allele; respectively.

Distribution pattern of allelic variants at important candidate genes- κ-CN, β-CN, β-LG,α-LA, bGH, Pit-1, PRL, BTN-1,-3 and DGAT-1 across 72 animals of Ladakhi cattle. Ladakhi cattle have maintained the indicine characteristics at most of the studied loci. Variant E was observed at κ-CN that has not been reported in any other Indian native cattle breeds and at BTN-3 loci, new novel variants were observed in Ladakhi cattle.

Comparative evaluation of neutrophils/ lymphocytes (N/L) ratio was evaluated to assess the physiological stress in bovines. The N/L ratio was highest in both Holstein Friesian and Karan Fries cows, while lower in Sahiwal cows and Murrah buffaloes. Data provided evidence that Sahiwal cows and Murrah buffaloes have better cellular tolerance than exotic, crossbred cows to summer stress.

Impact of seasonal variation on transcription of major chaperones in PBMCs of Sahiwal, Holstein Friesian cows and Murrah buffaloes was determined. The HSP transcripts in Sahiwal cows showed non-significant or minimum change in expression with change in season. Combined expression values for HSP70, HSP40, HSP60 and HSP90 genes together showed maximum and significant induction in Holstein Friesian cows compared to Sahiwal cows.

Ten well-known reference genes from different functional categories that could serve as suitable ICG during studies in Indian cattle adapted to high altitude and tropically adapted were tested. On the basis of relative gene expression stability and stepwise exclusion, genes were arranged in descending order of stability: RPS9=RPS15>HMBS >GAPDH>B2M >RPL4 >EEF1A1 >UXT >ACTB > HPRT. Lgorithmic methods geNorm, Normfinder and BestKeeper have demonstrated that RPS15, GAPDH, RPS9 and HMBS are the most stable internal control genes.

An extender containing citrate buffer, sugar, egg yolk and antibiotics along with a cooling protocol has been standardized for freezing of caprine epididymal semen and frozen semen doses prepared using this protocol.

Total 7,600 frozen semen doses of Cattle (Gaolao and Tharparkar) and Buffalo (Toda) have been procured and added to repository in Gene Bank during last year. The National Gene Bank at NBAGR now stores 1,29,174 frozen semen doses belonging to forty four breeds of seven species (Cattle, Buffalo, Goat, Sheep, Camel, Equine and Yak).

Under Network project, Characterization of Budelkhandi, Bhakarwal Goat, Marwari, Poonchi Sheep, Tibetan sheep, Mithun, Purnea, Binjharpuri, Assamese, Kosali cattle, pig population of Assam, Jalori camel, Arunachali Yak, Donkeys of Rajasthan, Hazra chicken, Duck of Assam was carried out. Conservation of Bargur cattle, Ongole cattle and Harringhata chicken was carried out by respective Network Project centers. Assessment of genetic variability in Tibetan sheep by microsatellite markers was carried out.

NBAGR is providing consultancy service of cytogenetic screening of breeding males to various agencies throughout the country with the aim to check the spread of chromosomal defects and to keep the herds free of such genetic defects as per the policy of Government of India. During the year a total of 113 breeding cattle and buffalo bulls and 40 pigs were screened for their cytogenetic parameters.

A total of 11 Research projects were completed during last year. At present 21 research projects including one externally funded and one National Fellow projects are on-going.

Total 43 research papers were published in National and International Journals of high impact factor. 27 technical/popular articles were published. 12 Monographs and training manuals were also published by the institute.

Seven patent applications were published in the Journal of Indian Patent Office and the first examination requests for three patent applications were submitted to the Indian Patent Office, New Delhi.

Under RFD, NBAGR achieved a composite score of 99.50% and received excellent rating.

In the Bureau library, to keep track of the current scientific / technical developments, 44 journals (11 foreign and 31 Indian journals) were subscribed. Books and journals worth Rs. 10, 21,195/- were procured in the library.

Nine exhibitions on AnGR were organized at various places to showcase institute's activities and sensitize farmers about the benefits of indigenous animals.

The Institute Research Committee (IRC) meetings were held on time. The progress of research projects was reviewed during mid term IRC meeting.

Scientists deputed for training within the country and attended the workshops, symposia and conferences.

Foundation Day of Bureau, Biodiversity day, Republic Day and Independence Day, Taru Diwas, ICAR Foundation day were celebrated at NBAGR campus.

A three day Training program entitled "Next generation sequencing analysis: from technology to application" was conducted.

One day workshop on 'Characterization of Manipuri Chicken' was organized on 21.11.2014 at Keishamthong, Imphal (W) in collaboration with CAU, Imphal.

An interactive workshop on 'Breed Registration Process' was organized jointly by DAHD&F, GOI and NBAGR on 28.01.2015 at NBAGR.

A brainstorming session on Animal Genetic Resources of Sikkim state was organized on 19.11.2014 at Gangtokin collaboration with Sikkim Livestock Development Board, Gangtok.

Ten days ICAR sponsored short course on "Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources" was organized. A total of 21 participants attended the course.

A number of distinguished persons visited the Institute. Dr. Jimmy Smith, Director General, ILRI also visited Institute.

Director, NBAGR visited Austria, Vienna to impart training to the international participants of IAEA-sponsored training in the capacity of Expert Lecturer.

NBAGR scientists taught various course in Dairy Cattle Breeding and Animal Biotechnology Divisions of NDRI. Also guided the students for masters degree.

At present 29 scientific, 17 technical, 19 administrative and 5 skilled staff persons are working at the Institute. Six scientist, 2 technical and 3 skilled staff were promoted to higher grades/posts.

One principal scientist has been appointed to the post of Director, ICAR-CIRC, Meerut and transferred. One principal scientist and one technical officer superannuated during the year.

History and Profile

- About Bureau
- Divisions' Profile
- Organogram
- Financial Outlay

About Bureau

The need for the establishment of National Institute of Animal Genetics was accepted in principle during 4th Five Year Plan. During 5th and 6th Five Year Plan, various government agencies coordinated the efforts for the establishment of this Institute. Therefore, National Bureau of Animal Genetic Resources (NBAGR) and National Institute of Animal Genetics (NIAG) were set up on 21st September, 1984. These institutes started at Regional Station of National Dairy Research Institute, Bangalore. Bureau and the institute were then shifted to Karnal in 1985 and housed temporarily in NDRI main Campus before shifting to its own campus at Makrampur, Karnal in 1994. Both Institute and the Bureau were merged to function as a single unit as National Bureau of Animal Genetic Resources in 1995.

National Bureau of Animal Genetic Resources has been the nodal organization in India with the mandate and objectives as given below:

MANDATE

'Identification, evaluation, characterization, conservation and utilization of livestock and poultry genetic resources of the country.

OBJECTIVES

- To conduct systematic surveys to characterize, evaluate and catalogue farm livestock and poultry genetic resources and to establish their National Data Base.
- To design methodologies for *ex-situ* conservation and *in-situ* management and optimal utilization of farm animal genetic resources.
- To undertake studies on genetic characterization using modern techniques of molecular biology.
- To conduct training programmes as related to evaluation, characterization and utilization of animal genetic resources.

Divisions' Profile

As per ICAR letter.No. AS 5/21/2012.IA.I dated 22.07.2013 following divisions have been created to achieve the institute's mandate and objectives:

1. Animal Genetic Resource Division
2. Animal Genetics Division
3. Animal Biotechnology Division

In addition to this, two units namely Livestock Information Unit and Network Project Unit are functioning to support the divisional activities.

Animal Genetic Resource Division

Animal Genetic Resource (AGR) Division has been engaged in developing formats for breed characteristics, survey strategies and breed description methodologies. The present form of Animal Genetic Resources (AGR) division came into existence after a number of transformations. In 1987, Animal Genetic Resources and Animal Conservation divisions were merged into Animal Genetic Resources and Conservation Section. In 1991 a new section of Animal Gene Bank was created which was reframed as Animal Physiology and Reproduction section during 1991-92. Reorganization continued and in 1992-93 the then NBAGR had one section and two units viz Livestock Information and Management Section, Animal Genetic Resource Unit and Animal Conservation and Gene Bank Unit. During 1994-95 the sections and units were again reframed as: a) Information and Management Unit/Computer Unit b) Animal Genetic Resources and Conservation Section c) Animal Physiology and Reproduction Section. In 1996, the Animal Physiology and Reproduction Section was merged into Animal Genetic Resources and Conservation Section. In 1997 the section was renamed as 'Animal Genetic Resources Division' and since then the division continues in its present form.

At present Animal Genetic Resources Division along with its 'National Gene Bank' is engaged in phenotypic characterization, sustainable utilization and conservation of indigenous livestock and poultry breeds. The phenotypic characterization is accomplished through systematic/pilot field surveys to assess socio-economic status of the farmers, flocks/herd structure, population status, feeding, breeding and management practices, phenotypic characteristics, body biometry, reproduction and production performance, and marketing of live animals and products. The production performance of local breeds is evaluated and recorded under agro-climatic conditions of their habitat. The surveyed breeds/populations are documented in the form of breed monographs, breed descriptors and breed calenders in addition to research publications. Based on the information, new strategies have been formulated for improvement and conservation of the breeds under field conditions. The *in situ* conservation has been implemented for breeds of various livestock species. In addition, the division is also working in the frontier areas of long term ex-situ conservation of germplasm.

Animal Genetics Division

The major research thrust in initial years of National Institute of Animal Genetics (NIAG) was on characterization of indigenous genetic resources using cytogenetics and biochemical polymorphism studies. The initial research projects encompassed studies of chromosomal profile of cattle, buffalo, sheep, goat, pigs and camel. Since cattle, buffalo and goats had relatively more information available, so emphasis was laid on species, like camel, pigs, equines and poultry. The cytogenetic studies also encompassed research on chromosomal abnormalities in relation to abnormal phenotypes

and reproductive disorders. The work on immunogenetic and biochemical genetics included characterization of cattle erythrocyte antigens and their applications, preparing typing reagents and to build a national blood center. The other major studies included antigens of bovine major histocompatibility complex and genetics of humoral immune response, bovine cytokines and major genes of phagocytic functions.

On merging of the two institutes, all the scientists working in the fields of cytogenetics, immunogenetics, and molecular genetics became the part of Animal Genetics Division, which was established in the year 1996 and formally approved in 2014. The division has five principal scientists and two senior scientists at present. In the year 1997, a major change in the focus of the divisional research activities was observed, most of the research projects en compassed work on molecular characterization and biodiversity analysis of native breeds of cattle, sheep, poultry, pigs and other livestock species using molecular markers especially microsatellites. To understand the nature of mitochondrial DNA diversity, maternal lineages and evolutionary relationships amongst native breeds, efforts were also made using mitochondrial D-loop marker. Significant work was also continued in the field of immunology especially on the MHC and bovine interleukins in Indian cattle. In recent years, sizeable progress has been made in sequence characterization and identification of single nucleotide polymorphism (SNPs) at several candidate gene loci influencing trait of functional importance viz; milk yield/ composition, wool, meat, growth and development, adaptive, thermo tolerance, disease resistance in our native breeds from different livestock species. The division has successfully completed the NAIP and DBT projects. Animal Genetics Division is also providing consultancy services in term of karyotyping the breeding bulls and screening of major genetic disorders.

Animal Biotechnology Division

Animal Biotechnology Division came into existence w.e.f. 16.01.2014 from the erstwhile DNA Fingerprinting Unit by the Council's orders. Present strength of the Division is seven scientists supported by four technical staff, working in diverse fields as per institute's mandated activities. Besides assigned tasks of genetic characterization work on various livestock species, major emphasis is on utilizing genomic tools for the identification and evaluation of genes, and transcripts involved in adaptation, disease resistance and various production related traits, in order to explore the unique attributes of indigenous livestock species. Other than institutional projects, the division currently, has one National Fellow project on "Genome data mining to unravel molecular basis of thermo tolerance and adaptation to diverse environments in native cattle and buffaloes" and a DBT project on "Whole genome based SNP mining and development of breed signatures for dairy and dual-purpose indigenous cattle" as externally funded projects. Two NAIP funded research projects "Toll-like receptors in farm animals: evolutionary lineages and application in disease resistance" and "Analysis of mammary gland transcriptome and proteome during lactation and involution in indigenous cattle and buffalo for identification of probable mammary biomarkers" have been completed successfully, recently in the division. Two more external grants one from National Fund scheme of ICAR and another from DRDO have been approved.

Two of its scientists have been awarded Dr. P.G. Nair best scientific worker award. Four scientists of the division are also members in NDRI biotechnology faculty, involved in teaching and

guiding of Masters and Ph.D. students. Division has been regularly publishing quality research work in various international journals of high repute in the field as well as organizing training programme for researchers of NARES. One patent on differentiation of cattle and buffalo meat and milk has also been filed from the division. Major scientific achievements of the division are:

- Prevailing genetic status and interbreed genetic relationships of indigenous livestock species- cattle, buffalo, sheep and goat established.
- Identification and distribution of pure swamp, riverine and hybrid buffaloes in northeast Indian states, accomplished using mitochondrial D-loop sequencing, cytogenetic tools and microsatellite markers.
- Transcriptome analysis of buffalo and cattle helping in identification of genes influencing adaptation to stress and milk production.
- New alleles/SNPs identified for various traits of economic importance like disease resistance, meat quality, reproduction and allelic diversity across breeds/populations documented.

Livestock Information Management Unit

This Unit is engaged in digitization of information on animal resources and to provide it to the users in an easily retrievable format. This section also provides LAN, Internet and computing facilities to the institute. The Leased Line connectivity was upgraded to 20 Mbps in June 2014. Another Leased Line has been provided through National Knowledge Network in June 2014. The section is also looking after registration of livestock and poultry genetic resources.

Network Project Unit

The Network project was initiated in 1996 with the following objectives:

- To characterize the breeds in terms of both qualitative and quantitative traits
- Molecular genetic characterization and candidate gene studies in indigenous breeds
- To develop the breed descriptors
- To conserve the germplasm

There were 8 centers in VII plan for characterization of breeds. In IX and X plan 12 new centers in each plan were undertaken for characterization of breeds. Genetic characterization was also commenced in IX plan by establishing 3 core labs. In-situ and ex-situ conservation activities were also initiated from IX plan onwards. In XI plan one more core lab was established in NEH region and buffalo genomics work was also taken up. During current XII plan 17 new breeds/populations have been undertaken for characterization and work on 4 at risk breeds has been started for conservation.

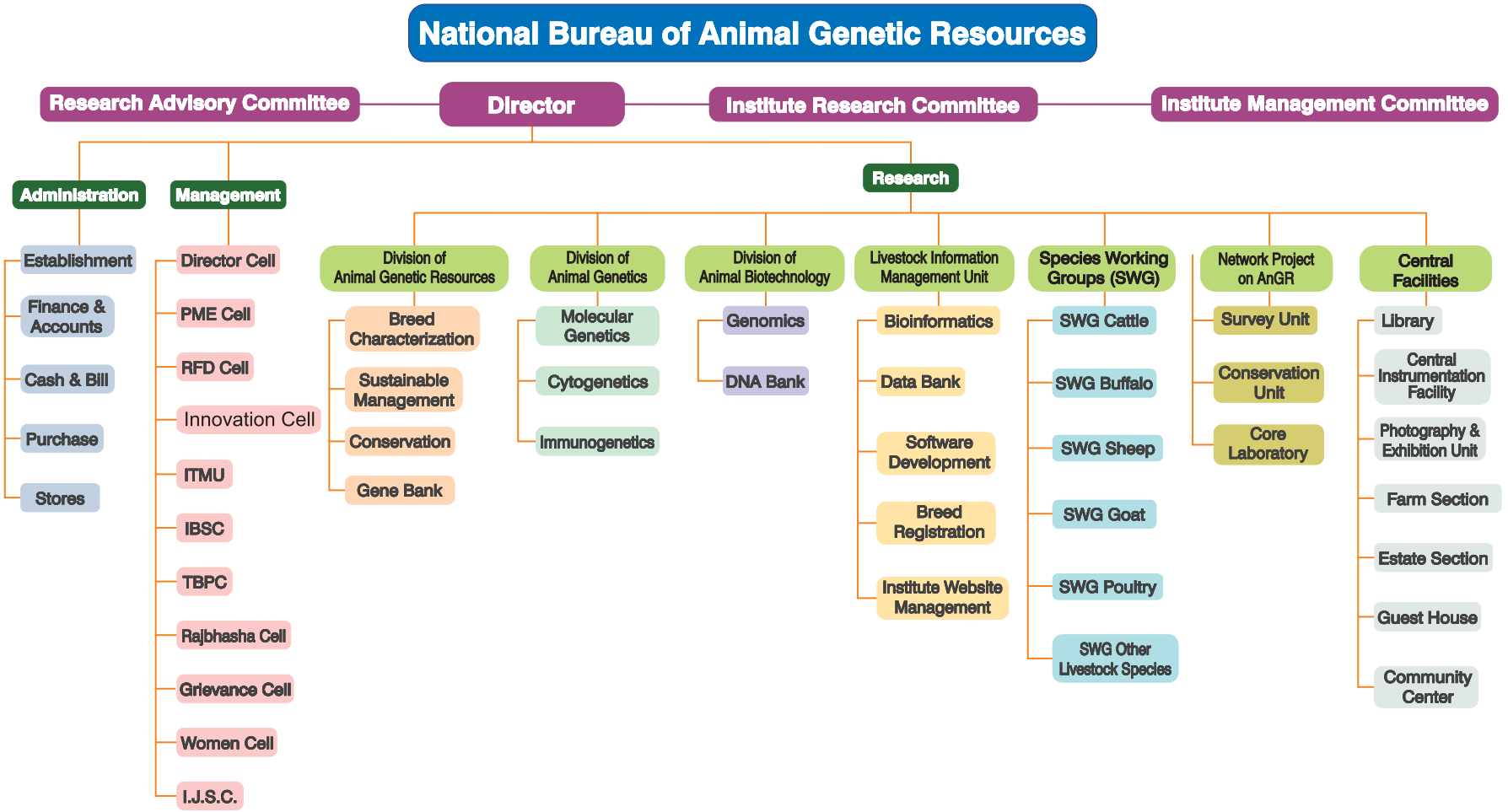
The updated achievements include phenotypic and genetic characterization & development of breed descriptors of 11 breeds of cattle (Deoni, Ongole, Gir, Umblachery, Bachaur, Dangi, Amritmahal. Khillar, Gaolao, Tho Tho, Gangatiri), 3 breeds of buffalo (Jaffarabadi, Nagpuri, Surti), 8 breeds of sheep (Changthangi, Deccani, Mecheri, Mandya, Rampur Bushair, Banpala, Coimbatore, Chhota-Nagpuri), 5 breeds of goat (Osmanabadi, Barbari, Attapady, Ganjam, Mehsana), 2 breeds of chicken (Aseel, Ankleshwar), Kutchi Camel, Spiti Horse and Arunachali Mithun.

Conservation of AnGR includes 5 cattle breeds (Krishna Valley, Ponwar, Kherigarh, Kangayam,

Nagori), 3 buffalo breeds (Pandharpuri, Jaffarabadi, Toda), 3 sheep breeds (Magra, Nilgiri, Kilakarsel), 2 goat breeds (Beetal, Surti) and Spiti horse.

Various candidate genes for production (DGAT1, GH, GHR, PIT1, Leptin, CAPN1, CAST, Titin, Akirin, etc.), reproduction (GDF9, BMP15, BMPR1B, Kiss1 etc.) and endurance (Myostatin, MCT, CD147, IGF, ACTN, ADRB2) were characterized in indigenous breeds in core labs of diffrent regions. The Indian breed specific SNPs in these genes were identified and associated with traits in buffalo, cattle, goat and horses. The novel SNPs have been added to the SNP database of various species. Various new loci of PCR-RFLP have been established for genotyping of identified SNPs in large populations.

Under Buffalo Genomics, more than 100 GB DNA sequence data has been generated from one female Murrah buffalo providing nearly 30 fold coverage. The first version of assembly was constructed with Illumina paired end and mate pair short read sequencing using the cattle genome (Btau 4.0 assembly) as a reference. The assembly has read depth of 17-19X. The buffalo assembly represents ~ 91%-95% coverage in comparison to the cattle assembly Btau 4.0. The assembly has 185,150 contigs. The mitochondrial genome is fully covered by a single contig. Whole genome comparison between this assembly and of cattle revealed 52 million mismatches/indels. The present analysis also unveils about 300 structural variants in the buffalo genome.


National Bureau of Animal Genetic Resources
Research Advisory Committee
Director
Institute Research Committee
Institute Management Committee
Administration
Establishment
Finance & Accounts
Cash & Bill
Purchase
Stores
Management
Director Cell
PME Cell
RFD Cell
Innovation Cell
ITMU
IBSC
TBPC
Rajbhasha Cell
Grievance Cell
Women Cell
I.J.S.C.
Research
Division of Animal Genetic Resources
Breed Characterization
Sustainable Management
Conservation
Gene Bank
Division of Animal Genetics
Molecular Genetics
Cytogenetics
Immunogenetics
Division of Animal Biotechnology
Genomics
DNA Bank
Livestock Information Management Unit
Bioinformatics
Data Bank
Software Development
Breed Registration
Institute Website Management
Species Working Groups (SWG)
SWG Cattle
SWG Buffalo
SWG Sheep
SWG Goat
SWG Poultry
SWG Other Livestock Species
Network Project on AnGR
Survey Unit
Conservation Unit
Core Laboratory
Central Facilities
Library
Central Instrumentation Facility
Photography & Exhibition Unit
Farm Section
Estate Section
Guest House
Community Center

Financial Outlay

Budget Estimate (in Lakh) for Plan, Non-Plan & Network Project of NBAGR along with expenditure for the financial year 2014-15 (Rs. In Lakhs)

Sr. No.	HEAD	NON-PLAN		PLAN		Network Project	
		Receipt	Expenditure	Receipt	Expenditure	Receipt	Expenditure
01.	Capital						
	i) Works	0.00	0.00	40.00	39.97	0.00	0.00
	ii) Other capital expenditure	10.00	8.70	36.00	34.44	0.00	0.00
	Total Capital	10.00	8.70	76.00	74.41	0.00	0.00
02.	Revenue					180.00	178.72
	i) Establishment expenses	707.00	706.10	0.00	0.00	0.00	0.00
	ii) Traveling Allowance	4.00	4.00	10.00	10.00	0.00	0.00
	iii) Research & Operational expenses	43.00	43.00	75.00	74.98	0.00	0.00
	iv) Administrative Expenses	75.50	75.33	107.00	106.99	0.00	0.00
	v) Miscellaneous expenses	6.50	6.27	2.00	2.00	0.00	0.00
	Total Revenue	836.00	834.70	194.00	193.97	180.00	178.72
03.	Pension & Retirement benefits	70.00	67.54	0.00	0.00	0.00	0.00
	Grant Total	916.00	910.94	270.00	268.38	180.00	178.72*

*Includes Releases of Rs. 175.00 lakhs

Revenue Generated during the year 2014-15

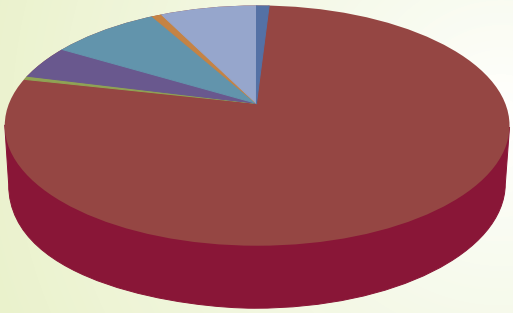
Sr. No.	Head of Account	Amount (Rs)
1.	Sale of Publication & Advertisement	62,815
2.	Licence fee	2,04,209
3.	Training Programs - Income	1,88,868
4.	Hostel and Guest house rent	2,98,670
5.	Sale of Technology	69,550
6.	Sale of farm Produce	5,84,000
7.	Others Misc. Revenue Receipts	7,60,015
	Total	21,68,127

Revenue Target Fixed : 22.00 Lakhs

Target Achieved : 21.68 Lakhs

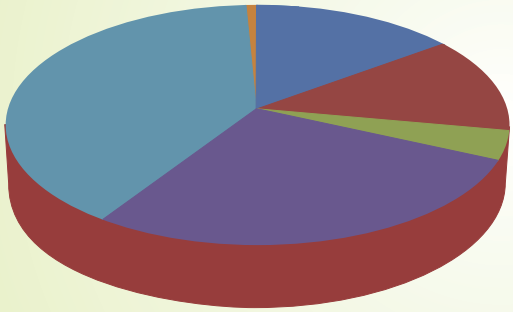
FINANCIAL OUTLAY

Funds Utilization under Non-Plan



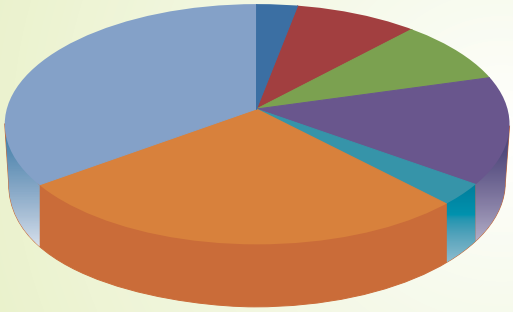
- Other Capital Expenditure
- Establishment Expenses
- Travelling Allowance
- Research & Operational Expenses
- Administrative Expenses
- Misc. Expenses

Funds Utilization under Plan



- Works
- Other Capital Expenditure
- Traveling Allowance
- Research & Operational Expenses
- Administrative Expenses
- Misc. Expenses

Revenue Generated



- Sale of Publication & Advertisement
- Licence Fee
- Training Programs - Income
- Hostel and Guest House Rent
- Sale of Technology
- Sale of Farm Produce
- Others Misc. Revenue Receipts

Research Accomplishments

- Livestock Information Management
- Phenotypic Characterization
- Genetic Characterization and Functional Genomics
- Ex situ Conservation
- Network Project on AnGR

Livestock Information Management

Breed registration Committee in its meeting on 6th January, 2015 at New Delhi approved registration of seven new breeds of livestock and poultry and one line of chicken. This includes two breeds of cattle, one breed each of goat, sheep, pig, camel and chicken. After including these newly registered breeds, total number of indigenous breeds in the country is 151, which include 39 for cattle, 13 for buffalo, 24 for goat, 40 for sheep, 6 for horses & ponies, 9 for camel, 3 for pig, 1 for donkey and 16 for chicken. The committee also considered registration of lines/ strains of chicken for the first time and approved a line of chicken PD1 developed by ICAR-DPR, Hyderabad for registration.

S.N.	Breed	Home Tract	Accession Number
CATTLE			
01	Belahi	Haryana and Chandigarh	INDIA_CATTLE_0532_BELAHI _03038
02	Gangatiri	Uttar Pradesh and Bihar	INDIA_CATTLE_2003_GANGATIRI_03039
GOAT			
01	Pantja	Uttarakhand and Uttar Pradesh	INDIA_GOAT_2420_ PANTJA _06024
SHEEP			
01	Katchaikatty Black	Tamil Nadu	INDIA_SHEEP_1800_ KATCHAIKATTYBLACK_ 14040
CAMEL			
01	Kharai	Gujarat	INDIA_CAMEL__0400_ KHARAI _02009
PIG			
01	Agonda Goan	Goa	INDIA_PIG_3500_ AGONDAGOAN _09003
CHICKEN			
01	Mewari	Rajasthan	INDIA_CHICKEN_1700_ MEWARI _12016
CHICKEN-Synthetic			
01	PD1 (Vanaraja Male Line)	Directorate of Poultry Research, Hyderabad	INDIA_CHICKEN_001_PD1_13001

Belahi Cattle: It is a dual purpose (milk and draught) cattle breed found in Panchkula, Naraiangarh, Ambala, Yamuna Nagar Districts of Haryana, and Chandigarh. These are reared by Gujjars in migratory and pastoral management system. Body colour pattern is unique - reddish brown with white face, neck and dewlap region) Head is straight and broad with prominent poll. Small to medium sized sickle shaped horns. Average daily milk yield is 3.25kg and lactation milk yield is about 1000kg. Incidence of disease is less in these cattle.

Gangatiri Cattle: These are white or greyish white, medium sized cattle found in Ghazipur, Ballia, Varanasi, Mau, Mirzapur and adjoining districts of Uttar Pradesh, and Bhabhua, Buxar and Bhojpur districts of Bihar. Eyelids, muzzle, hooves and tail switch are generally black. Horns are directed upwards and inwards with pointed tips. Forehead is straight with shallow groove in the middle. Ears are long and horizontal. Hump and dewlap are small to medium in size. Gangatiri cattle are well adapted in low/medium input

production system, medium milk producer and possess good draftability.

Pantja Goat: These are medium sized dual purpose (meat and milk) goats adapted to harsh climate conditions of Tarai region. The home tract of this breed consist of Udham Singh Nagar and Nainital districts of Uttarakhand, and adjoining districts of U.P. These goats have peculiar morphological characteristics resembling deer. Body colour is brown to fawn dorsally and lighter colour ventrally with white streak on either side of the face. Head is slightly convex. Ears are pendulous. Horns are triangular and twisted, upwards and backwards. These are early maturing and prolific (twining >65%) goats.

Katchaikatty Black Sheep: These are maintained in small flocks in Vedipatti taluka of Madurai district of Tamil Nadu. Animals are medium in size, compact body and black in colour. Coat type is hairy. Face is of moderate length and concave with depression. Forehead is moderately broad. Ears are short and stumpy. Eyes are prominent. Female are polled while males have widespread and outwardly twisted horns. Tail is short and slender. Adult body weight is about 34kg. Animals are well known for ram fighting during festivals or sports.

Kharai Camel: The breeding tract of this camel comprises of Kachchh district of Gujarat. These are well adapted to both dry-land as well as coastal ecosystems. They have excellent swimming capacity in sea water and graze mainly on mangrove and other saline species. Kharai camel has typically thick neck region and medium body size than Kachchhi camel. Chest pad is short and does not touch humerus of fore legs during walking. They produce smooth, soft and long wool which can be used for preparation of soft clothes/stoles. Less affected by common skin diseases including dermatitis. Kharai camel can thrive on high saline water and tolerate high Total Dissalved Solids.

Agonda Goan Pig: These are indigenous pigs of North Goa and South Goa. These are small sized having short snout and are wild in nature with rough bristles. These pigs are mostly black in colour with white patches on legs and face in some cases. Litter size varies from 2 to 12. Weight at slaughter is about 65kg and dressing percentage is 74. Agonda Goan pigs are suitable for scavenging in local climatic conditions and preferred for sausage making by local sausage industry (cottage industry) which is very popular pork dish in this region.

Mewari Chicken: This breed is native to Ajmer, Sirohi, Jaipur, Udaipur, Bhilwara, Dungurpur, Banswara, Rajsamand, Chittorgarh and Pratapgarh districts of Rajasthan. These birds are reared in backyard both for egg and meat with little or no input i.e. free range/ scavenging system. Average flock size is about 15. Birds are medium to small in size. Plumage colour varies from light to dark brown, and grey. Males have bright gold and bronze feathers forming a "Shawl" or Cape over the back of the bird from neck to lower back. The tail is composed of long arching feathers that initially

look black but shimmer with blue, purple and green in good light. Comb is red in colour and is of single type. Wattles are red and are large sized in males. Adult weight is about 1.9kg in cocks and 1.2kg in hens. Age at first egg is about 6.7 months. Annual egg production ranges from 37 to 52. Egg weight averages about 53g. Females are broody in nature.

PD1 (Vanaraja male line): It is the first registered line of chicken in India. It has been developed by ICAR-Directorate of Poultry Research, Hyderabad for higher shank length and is used as male parent line for Vanaraja commercial a dual purpose backyard poultry. The birds of this line have pea comb, red plumage colour, yellow colour skin and shank, brown eggs, 74.14mm average shank length at 6 weeks and 644g average body weight at 6 weeks. Body weight at 52 weeks ranges from 2.9 to 4.7kg in males and from 2.1 to 4.7kg in females. Average age at first egg is 173.5 days. Hen-day production up to 52 weeks is 85. Average egg weight at 40 weeks is 55.19g. Live weight at slaughter ranges from 0.8kg to 2.1kg and dressing percent from 61 to 73. Mortality is 3.93% up to 6 weeks and 4.88% from 7 to 20 weeks of age.

Phenotypic Characterization

Siri cattle

To characterize the indigenous cattle of Sikkim, a survey was conducted in north and south Regu areas of East district of Sikkim. A total of 29 farmers from 5 villages were interviewed and 68 animals of different age and sex were recorded for physical, morpho-metric characteristics and performance. It was observed that all indigenous cattle were Siri in the surveyed area and were available only in remote areas where AI facility is lacking. Major crops grown in the area included rice, maize, finger millet, pulses, mustard, and soyabean. Large cardamom (spices) farming is providing good earnings to the farmers.

Sikkim had 140467 cattle heads in the year 2012 including 126519 crossbred and 13948 indigenous. It was observed that in the state all indigenous cattle were Siri. Siri cattle population has shown drastic decline from 61687 to 13948 during the years 2007 to 2012. Keeping this in view the state government has started a conservation program on Siri cattle under field in which milk recording is going on for selection and multiplication of elite germplasm.

The body colour varies in different colour patterns, brown with white spots (34), black with white spots (13), brown (11) and black (10). Skin was grey. Muzzle and eyelids were black. Hump was specific, cervico-thoracic and covered with long hairs. Dewlap was small in cows. Poll was prominent. Forehead was convex, wedge shaped with white patches. Ears were smaller in length and horizontal in orientation. Horns were smaller in length and curved outward, foreword and then upward. Udder was small, not well developed and milk veins were not prominent. Sizes of fore and rear udder were small. Teats were small 5-12 cm long and either funnel or cylindrical in shape. Tips of the teats were either round or funnel. Naval flap was almost absent. Tail was up to the hock with black, brown and gray switch. Temperament was docile.

The birth weight ranged from 10 to 18 kg. The daily milk yield ranged from 2.0 to 6.50 kg. Under the Siri field recording program, daily milk yield was recorded from 1.5 to 8.5 kg. A pair of bullock may plough about 1.0 acre of land in 6-8 hours. Bullocks were used for 3 to

4 months in a year for draft purpose. The age at first calving, lactation length and calving interval ranged from 40-60 months, 200-240 days, 450 to 600 days, respectively. The ten different body measurements were recorded on 68 animals of different age and sex. All the data were analyzed according to age and sex. The average body length, height at wither, heart girth, paunch girth, horn length, ear length, face length, face width, tail length without switch and with switch in cows (25) were 106.32±1.40 cm, 114.20±1.55 cm, 157.80±2.52, 162.16±2.61 cm, 16.48±0.79 cm, 18.24±0.26 cm, 40.88±0.75 cm, 20.84+0.37, 75.56±2.29 cm and 95.56±6.59 cm, respectively.

Ladakhi cattle adapted to high altitude

During the period under report, visit was conducted to 11 villages of Ladakh region and farmers were interviewed to know the habitat, status, management and utility of Ladakhi cattle adapted to high altitude. Data on physical traits, morophometric measurements, was collected. Animals of Ladakhi cattle were small in size with cylindrical type of body. Body colour varied from black, brown and black with white patches. Horns were curved with upward, outward then forward orientation with pointed tips. Hump and dewlap were small. Head was small. Face was short and concave. Ears were small to moderate in length and horizontal in orientation. Udder was small, not well developed and milk veins were not prominent. Tail was long, touching almost to ground with black and brown switch. Temperament of the animal was docile. The average body length, height at wither, horn length, horn width, ear length, face length, face width, tail length without switch and with switch in cows were 86.22±1.44 cm, 93.24±0.88 cm, 15.08±1.06 cm, 9.8±0.25, 14.25±0.33 cm, 36.43±0.45 cm, 14.36+0.19, 63.26±1.53 cm and 88.95±2.03 cm, respectively.

Typical Ladakhi cattle

Mouli and Yalaga sheep

A survey was undertaken in September 2014 for characterization of Mouli and Yalaga sheep populations of Karnataka state. During survey 12 flocks of Mouli sheep in Kaladadoddi, Todagundi, Nagathana, Managuli and Takkalaki villages of Bijapur district, and 16 flocks of Yalaga in Mustigeri, Kerur, Aminagad, Madapur and Agasnakoppa villages of Bagalkot district were covered. Data on body biometry and body weight were recorded on 10 rams, 74 ewes and 32 lambs of Mouli and 16 rams, 99 ewes and 44 lambs of Yalaga sheep. Information were collected on household, livestock holding, management practices, breeding, lambing and sale of lambs for the two sheep populations. Blood samples from 25 and 33 animals of Mouli and Yalaga sheep were collected at random. DNA has been isolated and purified.

Mouli and Yalaga flocks are housed in open enclosures with or without a thatched shed. Flocks are grazed from 8-9 am to 6-7 PM. Flock migration was reported from November to

March. Sheep are vaccinated against ET, PPR and FMD. Surplus male lambs are marketed at about 3 months of age for Rs 4000-5000 in Mouli and for Rs. 3500-4000 in Yalaga sheep.

Mouli sheep are large sized with wide phenotypic variations. Animals are tall with deep body and long legs. Average body length, height at wither, chest girth and body weights were 77.6±0.52 cm, 79.6±0.41 cm, 81.7± 0.46 cm, and 40.5±0.86 kg in ewes, and 87.4±2.36 cm, 88.3±1.42 cm, 91.9±1.98 cm and 60.9±4.79 kg in rams. Coat colour is white with or without brown spots/patches. A brown ring is present around the eyes. In some of the flocks, either Kenguri sheep were present or some of the sheep were brown coloured. Hooves are brown or light gray. Muzzle is pink or brown. A few flocks were typical Madgyal type. Noseline is typical roman or comparatively straight. Both the sexes are polled. Age at first breeding in rams

Mouli ram

and age at first lambing in ewes ranged from 18 to 24 months.

Yalaga sheep are medium sized. Average body length height at wither and body weights were 71.4±0.32 cm, 74.2± 0.28 cm and 33.0±0.45 kg in ewes and 81.9±1.39 cm, 85.1±0.98 cm and 60.2±2.49 kg in rams. White coat colour consisted thick small hair. A hair tuft is present in the thigh region. Face is white, white with black or brown patches of varying size to complete black. Black or brown colour may extend upto neck. Hooves and horns in males are brown. Extremities, except face and ears, are white.

Yalaga ram

Muzzle is black brown or pink. Wattles are present in all the animals. Males are horned and females polled. Horns are thick, corrugated and curved in males. Tail is small and thin. Udder is well developed.

Kajali sheep

The Kajali is a mutton type sheep which is distributed in Sangrur, Barnala, Ludhiana, Moga and adjoining districts of Punjab. The Adult body weight of males and females were 56.98 ± 1.02 and 43.23 ± 0.36 kg, respectively which varies from 30 to 76 kg in males and 26 to 67 kg in females. The overall body length, height, chest girth, ear length and tail length were 73.97± 0 .28, 73.36 ± 0.20, 84.23 ± 0.27, 21.33 ± 0.08 and 55.83± 0.37 cm respectively (Table 1). The diameter of tail at base was 14.80 (5) cm and ear width was 10.85± 0.19 (47) cm. Body weight (kg) of male lambs in the age groups of birth, 0-1, 1-3, 3-6 and 6-12 months were 4.30± 0.74, 9.37 ± 0.57 , 19.60 ± 0.99, 26.47 ± 1.56 and 33.58 ± 1.80, respectively and corresponding figures in female lams were 3.62 ± 0.52, 9.72 ± 0.83, 17.56 ± 0.54, 22.96 ± 0.54 and 30.50 ± 1.44 respectively. Kajali sheep in Punjab (India) has two types / colour variants distinguished primarily on the basis of colour viz., 1. Black (Kali) Kajali- with complete black or black- brown body with about 41.57 % white tail (varied from 6 to 55 cm), and 2. White (Chitti) Kajali - with white body and black or dark brown face and ear. The colour of the face and ear in Chitti Kajali is spread over with

varying degree and pattern even up to 95% of face and ear.Out of total animals surveyed 54.99 % animals are of Kali Kajali and 45.01 % were of white Kajali (chitti Kajali) type. The animals are found to be large in size with well-built body having Roman nose, long and pendulous ears and long tail touching to ground. Out of total animals 64.57 % were of Roman nose and rest was off slightly convex type. The average flock size was 56.45. The flocks consist of 50.94 Kajali and 5.51other sheep. The Kajali sheep flocks comprising 1.97 male, 36.06 female and 12.91 lambs. The both sexes are polled however in some males horn were also noticed. Breeding is through natural service and females show sexual maturity at about 10 to 12 months. Majority of farmers reported that twining varied from 5 to 10 %. The average family members involved in sheep rearing was 1.98. The 84.13 % fameres rearing Kajali were. The majority of farmers (56.25%) grazed their sheep from 10 or 11 AM to 6 PM (8-10 hrs). The sheep are primarily maintained on grazing however 8.12 % farmers provide concentrate to sheep especially during breeding season, pregnant ewes and to lambs. The 67.21 % also provide fodder to sheep during scarcity period. The sheep are generally shorn twice a year in the month of February- March and August – September. The majority of farmers (64.44 %) reported average greasy wool production 800 to 1000 g. The lambing % was 80 to 90 %. Age and weight at puberty in females were 10 to 12 months and 25-30 kg. The results reveal that the Kajali sheep is phenotypically different from other sheep breeds of the region and needs registration and improvement programme for its proper utilization.

Chitti Kajali

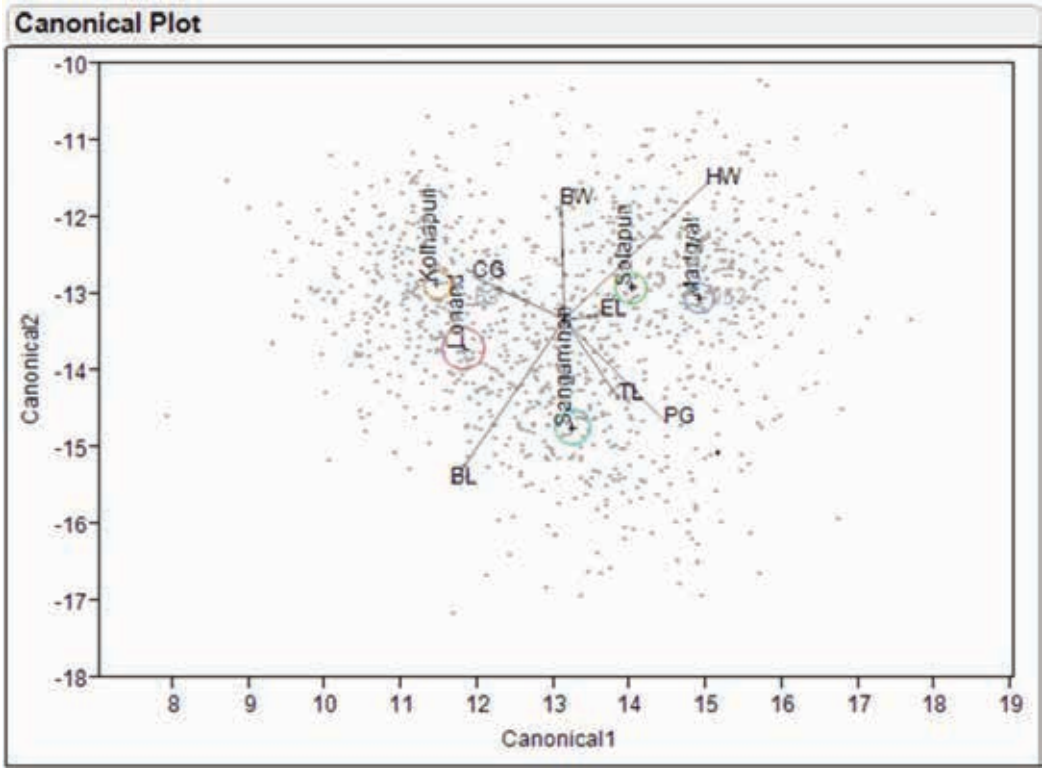
Kalli Kajali

Table: Body weight (kg) and biometry (cm) of adult Kajali sheep

Traits	Body Weight	Body Length	Height	Chest Girth	Paunch Girth	Ear Length	Face Length	Face Width	Tail Length
Overall	45.69±0.42 (486)	73.97 ± 0.28 (491)	73.36 ±0.20 (491)	84.23 ±0.27 (491)	85.81 ±0.35 (491)	21.33 ±0.08 (488)	22.05 ± 0.07 (491)	10.90 ± 0.07 (491)	55.83 ±0.37 (490)
Sex	**	**	**	**	**	NS	**	**	**
Male	56.98±1.02 (87)	79.92 ± 0.71 (87)	78.84 ± 0.51 (87)	89.89 ±058 (87)	91.34 ± 0.75 (87)	21.47 ± 0.20 (87)	23.77 ± 0.16 (87)	12.07 ± 0.16 (87)	60.71 ± 1.02 (87)
Female	43.23 ±0.36 (399)	72.69 ± 0.71 (404)	72.18 ± 0.17 (404)	83.02 ± 0.27 (404)	84.62 ± 0.75 (404)	21.30 ± 0.09 (401)	21.68 ± 0.07 (404)	10.65 ± 0.07 (404)	54.78 ± 0.37 (403)
Range M	30-76	66-98	69-90	76-103	76-112	17-26	19-27	9-16	35-79
F	26-67	58-86	62-88	68-103	58-107	15-27	12-29	8-14	31-80

Ecotypes of Deccani sheep

Interview based survey data on production and reproduction status; threat status and breed merits of five ecotypes of Deccani sheep were collected from their distribution areas. The number of shepherds interviewed ranged from 21-40. The shepherds were asked to rank the sheep ecotype on a scale based on the factors-level of crossbreeding, maintenance of pure stock, growth, meat quality, fertility, prolificacy, market value, traditional association to the sheep, socio-cultural functions and socio-cultural rituals associated to the ecotype. Data on morphometric traits of the five ecotypes were analyzed using classical discriminant analysis and principal component analysis. Morphometric traits based Discriminant Analysis classified the five ecotypes in distinct groups. Principal Component Analysis was performed on Madgyal, Solapuri and Kolhapuri ecotypes using 14 morphometric traits. The PCA extracted two components with a total variance ranging from 66.3% to 71% in the three ecotypes. In the varimax rotated principal component factor analysis, two factors were extracted for each ecotype, although with varying degree of factor loadings. The first factor in each case had high loadings for variables related to body size, whereas second factor was loaded in favour of body shape. PCA was able to define the morphological structure of the ecotypes and identified traits with greater variability. The principal component based regression models were more appropriate than the use of original correlated variables in predicting the body weight as multicollinearity problem was eliminated.



Principal Component Analysis of Deccani ecotypes

Sikkim goats

Sikkim is one of the smallest states of India and located in the eastern Himalaya. It is bounded by the independent Himalayan kingdoms of Nepal to the west and Bhutan to the east; by the Tibet Autonomous Region of China to the north and northeast; and, in India, by West Bengal state to the south. Singharey is a typical native goat of Himalayan region and the adjoining areas of Sikkim. As informed by the local people these goats have been surviving in the Himalayan terrain and rocky mountain slopes of Sikkim since ancient times which has become a native tract of Singharey goats. Although, Singharey goats are spread through out the Sikkim but concentration of these goats is more in West district of Sikkim. Sikkim goat germplasm constitute goats with coat colour brown, black, White, mixture of these colours mixed with white and grey hair on the body. Sometimes big patch of white or black color is also seen on their body.

The mean measures for height at withers, body length, chest girth, paunch girth, face length, horn length, ear length and tail length of three month aged animals were 36.48±0.87, 42.83±0.83, 47.48±1.25, 51.96±1.51, 12.13±0.29, 1.95±0.14, 11.43±0.37, 8.83±0.29 cm and 10.39±0.41; respectively in females and 34.48±1.76, 39.91±1.31, 45.09±1.41, 49.09±0.02, 11.70±0.48, 2.60±0.37, 10.30±0.35, 8.22±0.29 cm and 10.21±0.57 kg; respectively in males. The average values for same traits in animals of upto six month age were 44.39±0.99, 49.17±0.83, 53.48±1.15, 58.22±1.98, 13.78±0.34, 4.17±0.29, 11.91±0.23, 9.35±0.25 cm and 13.65±0.56 kg respectively in females and 43.08±1.50, 47.58±1.31, 54.58±1.76, 60.67±2.43, 14.33±0.36, 5.58±0.57, 11.17±0.58, 8.50±0.51cm and 14.08±0.71 kg; respectively in males. Body measurements of animals of age 12 months were 48.55±0.99, 52.52±0.90, 57.81±0.86, 63.42±1.46, 14.97±0.23, 5.87±0.41, 12.55±0.34, 10.16±0.38 cm & 17.17±0.50 kg respectively in females and 46.71±0.87, 50.57±0.88, 61.71±1.86, 66.90±1.82, 15.33±0.39, 8.62±0.58, 12.00±0.35, 10.10±0.37 cm & 18.76±0.95 kg respectively in males. The averages for different biometric traits of adult animals having age more than 18 months were 51.39±0.56, 59.47±0.47, 69.41±0.48, 77.76±0.83, 16.71±0.14, 9.56±0.30, 12.92±0.16, 10.55±0.16 cm & 28.07±0.45 kg respectively in females and 55.86±0.69, 61.94±0.69, 72.96±0.70, 78.29±0.91, 17.48±0.16, 14.55±0.44, 13.12±0.18, 11.33±0.19 cm & 32.31±0.76 kg respectively in males.

Singharey goats constitute the major part of the Sikkim goat population. They can be distinguished from other populations by the facial stripes. The eyes are bright and small. The head is medium in length. The ears are short to medium semi pendulous with round tip. The ears have black or white margin on the apical half. Rudimentary ears were also observed in few cases The horns are strong, flat, thicker at the base but pointed at the tip, orienting upward and backward. The under belly is generally light brown or white. Legs are short, stout, medially black or white. Black top line was seen in many of these goats. In breeding bucks, a black colour ring was observed around the neck. Udder and teats are moderately developed.

Facial features of Singharey goat

Singharey Buck

The means with standard errors for height at withers, body length, chest girth, paunch girth, face length, horn length, ear length and tail length of three month aged animals were 36.57±1.11, 43.07±1.00, 47.21±1.58, 51.00±2.08, 12.07±0.18, 2.00±0.18, 11.21±0.46 & 9.00±0.38 cm; respectively in females and 33.86±2.23, 41.14±1.28, 46.00±1.54, 51.21±2.72, 11.86±0.63, 2.46±0.42, 10.43±0.29 & 8.64±0.40 respectively in males. The average values for same traits in animals of upto six month age were 45.81±1.02, 49.94±1.05, 52.69±1.47, 55.81±2.32, 13.69±0.46, 4.56±0.34, 11.94±0.25, &13.88±0.75 in females and 41.33±2.23, 46.33±1.67, 53.33±2.79, 57.83±4.44, 14.00±0.37, 4.83±0.91, 11.367±1.05, 8.17±0.75, 12.83±1.01 in males. Body measurements of animals of age 12 months were 50.93±1.02, 53.12±1.47, 57.87±1.31, 64.07±1.75, 14.93±0.30, 6.53±0.67, 12.67±0.61 &10.00±0.43 in females and 47.15±1.01, 50.00±1.22, 62.15±2.45, 66.00±2.00, 15.62±0.49, 8.38±0.64, 11.85±0.50 & 9.85±0.36 in males. The averages for different biometric traits of adult animals having age more than 18 months were 52.52±0.71, 60.29±0.66, 67.98±0.59, 74.52±1.25, 16.16±0.19, 8.84±0.33, 13.48±0.18 &10.88±0.24 respectively in females and 55.67±0.93, 61.48±0.86, 71.66±0.85, 76.47±1.16, 17.20±0.22, 14.58±0.57, 12.92±0.24 & 11.89±0.25 respectively in males. The body weights were increasing with age and were 27.33±0.65 kg in adult females and 31.03±0.92 in males (table 4).

Table : Average body measurement of Singharey goats

AGE GROUP	SEX	N	Body Height	Body Length	Chest Girth	Paunch Girth	Face Length	Horn Length	Ear Length	Tail Length	Body Weight
3 MONTH	F	15	36.57±1.11	43.07±1.00	47.21±1.58	51.00±2.08	12.07±0.18	2.00±0.18	11.21±0.46	9.00±0.38	10.53±0.62
	M	16	33.86±2.23	41.14±1.28	46.00±1.54	51.21±2.72	11.86±0.63	2.46±0.42	10.43±0.29	8.64±0.40	10.31±0.91
UP TO 6 MONTH	F	16	45.81±1.02	49.94±1.05	52.69±1.47	55.81±2.32	13.69±0.46	4.56±0.34	11.94±0.25	9.56±0.27	13.88±0.75
	M	06	41.33±2.23	46.33±1.67	53.33±2.79	57.83±4.44	14.00±0.37	4.83±0.91	11.367±1.05	8.17±0.75	12.83±1.01
UP TO 12 MONTH	F	15	50.93±1.02	53.12±1.47	57.87±1.31	64.07±1.75	14.93±0.30	6.53±0.67	12.67±0.61	10.00±0.43	16.80±0.73
	M	13	47.15±1.01	50.00±1.22	62.15±2.45	66.00±2.00	15.62±0.49	8.38±0.64	11.85±0.50	9.85±0.36	18.62±1.17
ADULT	F	56	52.52±0.71	60.29±0.66	67.98±0.59	74.52±1.25	16.16±0.19	8.84±0.33	13.48±0.18	10.88±0.24	27.33±0.65
	M	64	55.67±0.93	61.48±0.86	71.66±0.85	76.47±1.16	17.20±0.22	14.58±0.57	12.92±0.24	11.89±0.25	31.03±0.92

Sikkim Black goats with jet black uniform colour were seen more in the north district of Sikkim. These goats are distinct from Singharey goats in respect of coat colour, type of horns and their size and also from Black Bengal in their body size.

A flock of Sikkim Black goats

Sikkim Black goats are of medium size. Head is proportionate to body. Face, horn and tail are longer than that of Singharey goats. These goats are slightly shorter than Singharey goats. Nose is flat. The horns are strong, grey in colour, broader at base, pointed at tip, curving backward. Muzzle is black, hooves are grey. Underbelly is also black. Beard is seen in few animals but present in both sexes.The average measurements of Sikkim Black goats for height at withers, body length, Chest girth, paunch girth, face length, horn length, ear length and tail length in adult female goats were 50.06±0.85, 58.75±0.73, 70.65±0.73, 79.57±1.17, 17.11±0.20, 10.17±0.53, 12.70±0.23, 10.35±0.24 cm; respectively, whereas for males the average measurements were 54.70±1.19, 61.80±1.39, 75.97±1.48, 82.30±1.76, 17.90±0.29, 15.070±.77, 13.50±0.36 and 12.20±0.40cm. The average body weight for adult females was 28.48±0.72 kg and for males 34.87±1.56 kg.

The preliminary information recorded from the breeding tract indicated that these goats are maintained on semi-extensive management by small and marginal farmers of Sikkim mainly for meat purpose. The animals are taken to hill forests in the morning and are brought back in the evening by 6.00 p.m. In the night they are kept in a temporary structure. Goat houses are made of bamboo sticks and wooden logs with no proper arrangement of electric and water supply. The floor of goat house were raised from the ground in many cases. This type of flooring keeps the house neat and clean as all the droppings do not accumulate an the floor. The raised flooring also provide good ventilation. In some houses, the mangers are also made on the outer wall.

Housing pattern for Sikkim goats

Goats are kept on local vegetation available in the jungle. Stall fed goats are kept on local grass, crushed maize and tree leaves.

Stall feeding of Sikkim goats

Singharey goats have moderately developed udder but with small conical shaped teats. Milk production is approximately 300 – 500 ml per day. However, milking the goat is not practiced on regular basis. The milk is left for kids suckling. The male goats mature and becomes able to serve at the age of 9-10 months. In majority of cases, the males are castrated at younger age (3 months). The age of maturity in female goats also varies between 9-12 months. The gestation period ranges between 145-155 days. Twinning is very common in these goats. Breeding is through natural mating.

Kaunayen chicken of Manipur

Survey has been conducted in Thoubal and Imphal West districts of Manipur. Information on flock structure and size, management practices, mortality, reproduction and production has been collected from 366 farmers through interview. Phenotypic characters and body weights have also been recorded. A one day workshop on

Characterization of Manipuri chicken was organized on 21.11.2014 at Keishamthong, Imphal (W) in collaboration with CAU, Imphal to generate awareness among breeders and apprise them about the importance of the project and the information required for characterising and documenting indigenous chicken of Manipur. The breeders suggested that fighter type indigenous chicken of Manipur should be named as 'Kaunayen' instead of Coman.

Kaunayen chicken of Manipur

Plumage colour is black or brown with patches of white, black or golden feathers. Comb is red in colour and is of pea type. Body weight is about 2.5 to 3kg. Egg production is about 35 to 45 per annum. These are fighting type birds and look similar to other such birds like Aseel, Danki, etc. but the breeders informed that these are better adapted and can fight for longer duration as compared to Aseel.

Eggs were medium in size with an average of 42.43±.07g. Shell colour was brown. Shell was quite strong having average thickness of 0.36±0.01mm. Yolk was yellow in colour in about 85 percent and deep yellow in 15 percent of eggs. Albumen was thick in more than 85 percent of eggs. On an average, an egg was composed off 51 percent albumen, 37 percent yolk and 12 percent shell (including membranes).Blood spots were present in about 14 percent of eggs while meat spots were absent. Albumen index, yolk index and haugh units were 0.07±0.01, 0.38±0.01, 76.88±2.35 respectively.

Chippiparai dog

Chippiparai dog is distributed in Tirunelveli, Madurai, Virudhunagar and Thoothukudi districts of southern Tamil Nadu. Chippiparai name came after the village called Chippiparai in Madurai district. Chippiparai dogs are also called as Kanni or vettai naai (hunting dog). Chippiparai dogs are medium in size with coat colors varying from fawn to dark brown, brownish black and black. Majority of the animals are with fawn coat colour (70%) which is called as Pullai, 20% of animals with black coat colour called as Kanni and 10% of animals with brown or brownish black coat colour called as Sevalai. The animals with dorsal black coat have white markings on both sides above inner canthus of the eyes whereas in case of animals with other coat colour there are black circles around the eyes particularly lower eyelids, sometimes extending up to head. The ear size is medium and flat, with dropping (52%), semi dropping (47%) and erect type (2%). The erect type ears are called as *Kutthu kaathu*. The adult body weight of adult Chippiparai animals is 20.52±0.35 kg (n=128). The bitches attain sexual maturity at an age of about 12-14 months and duration of oestrus ranges between 12 to 25 days. The age at first whelping is about 20 months.

Chippiparai dog

The age at sexual maturity in dogs ranges from 12-16 months. The dogs are being maintained mainly with non-vegetarian food and utilized for guarding and hunting. These animals are kept by the breeders as their hobby and as a pride of their owners.

Genetic Characterization & Functional Genomics

Ladakhi Cattle

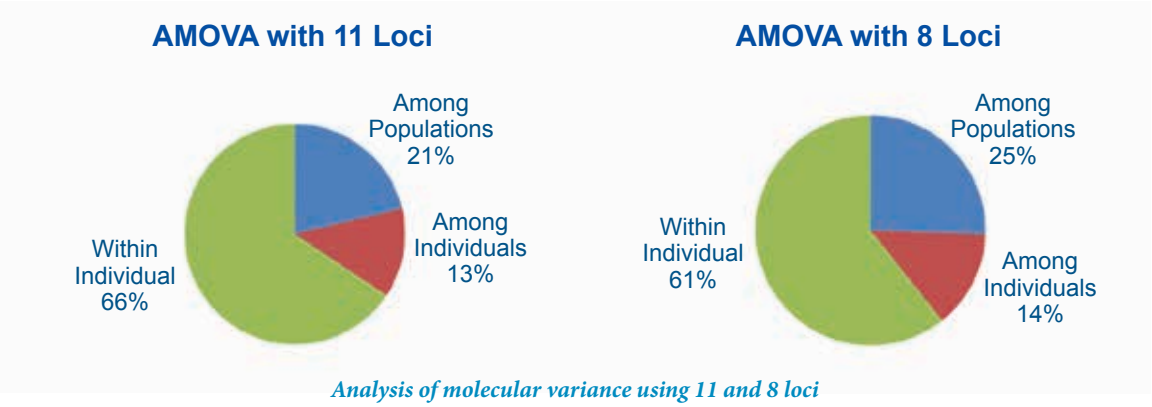
Microsatellite based genotypic data recorded across 20 markers was analysed to estimate the genetic variability in terms of allelic diversity and heterozygosity values. A total of 200 alleles were detected across the 20 loci with mean number of 9.95 alleles per locus. The various within breed diversity measures in terms of observed number of alleles (9.95), effective number of alleles (4.84), observed heterozygosity (0.75) and expected heterozygosity (0.79) for Ladakhi cattle revealed sufficient genetic variability. To assess the overall genetic structure of Ladakhi and other cattle breeds, various estimates for *F*-statistics were calculated. The values were significantly different from zero ($P<0.05$). The average inbreeding coefficient (F_{IS}) in Ladakhi cattle was 0.037. The interbreed differentiation between Ladakhi and other cattle populations depicted by F_{ST} reflected high genetic divergence between different cattle breeds.

Breed signature for Sahiwal, Gir and Tharparkar cattle

The data on 541 farm individuals from 3 breeds (Gir, Sahiwal and Tharparkar) using 4 STR loci was generated and analysed. Based on different criteria for selection of loci like Fst, Numbers of alleles, heterozygosity etc. different combinations of loci were used for assigning the individuals to three populations. The top ranking loci for each breed were identified. Hundred percent correct assignment could be achieved for all the three breeds with 11 loci. The F_{ST} values were 0.173, 0.281 and 0.235 between Gir and Sahiwal, Gir and Tharparkar and Sahiwal and Tharparkar, respectively. Further selection of loci was attempted and finally 8 loci were able to assign 100% individuals of these three breeds. The F_{ST} values further increased between pair of breeds. The Analysis of Molecular Variance revealed among population variance of 21 and 25% for 11 and 8 loci respectively. However after adding field samples for all the breeds the correct assignment was down to 93%.

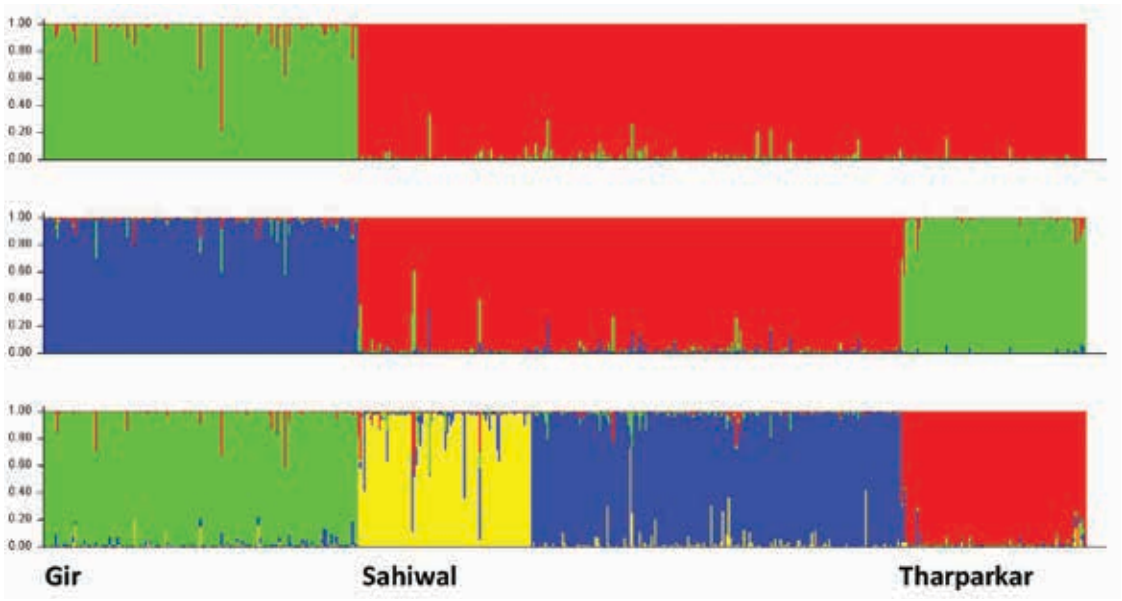
The 'Structure' software was run to assign the individuals to different populations. All the individuals from organized farms were correctly assigned and 3 breeds formed different clusters. However the assignment of field samples for these three breeds was less precise. The field samples revealed a great amount of gene flow between the three breeds studied.

Eight loci were used to develop a multiplex PCR kit. All the microsatellite loci were modified to have same melting and annealing temperature. These loci were tagged with different dyes to overcome identification of overlapping alleles. The kit was tested and validated to be used for Sahiwal, Gir and Tharparkar cattle breeds; assignment.

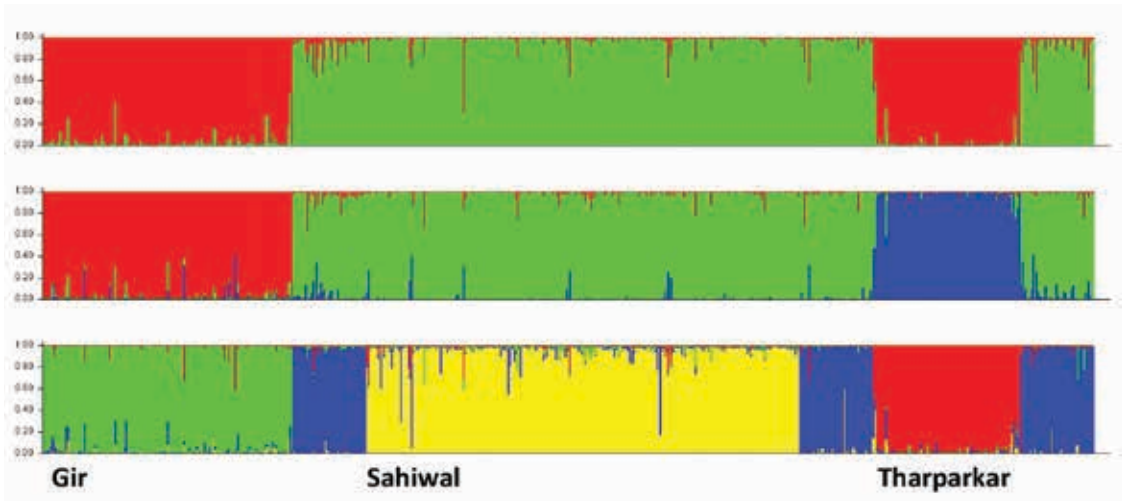


Analysis of molecular variance using 11 and 8 loci

Farm Animals



Farm and Field Animals

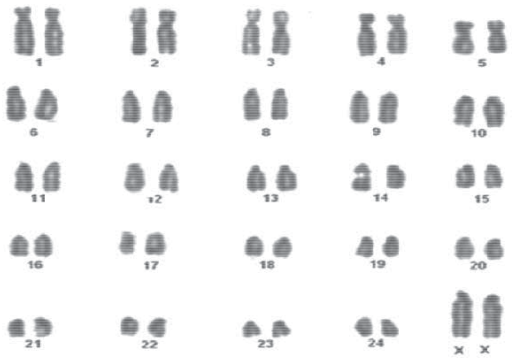


Structure results for breed assignment in cattle (K= 2, 3 and 4) using 8 loci

Odisha buffaloes

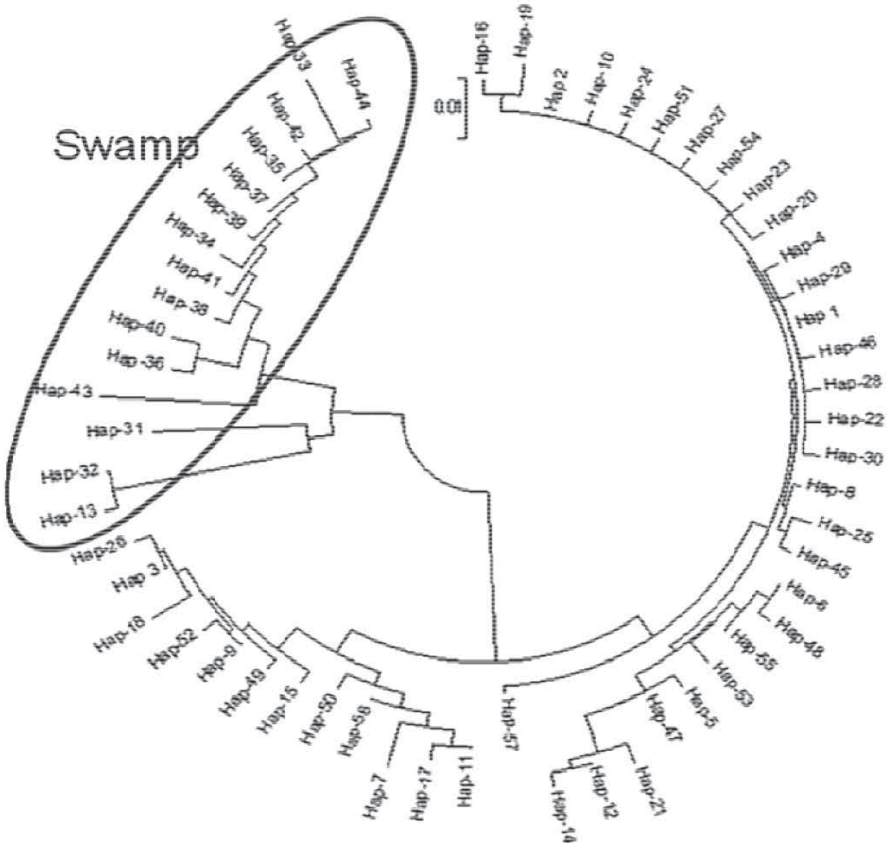
Blood samples were collected from animals representing Kalahandi and Paralakhemundi buffaloes of Odisha in the breeding tract, for karyotyping and DNA isolation and further genetic analysis. Information on socio-economic and management practices including production and reproduction traits of local buffaloes also collected. Preliminary survey shows both Kalahandi and Paralakhemundi buffaloes to be having an overlapping breeding tract with animals having similarities in phenotypic appearance.

AI using Murrah semen is being practiced in urban and peri-urban areas of both Kalahandi and Gajapati districts in the breeding tracts. Cytogenetic studies have shown both Kalahandi and Paralakhemundi having typical riverine buffalo cytogenetic constitution with 2n chromosomes

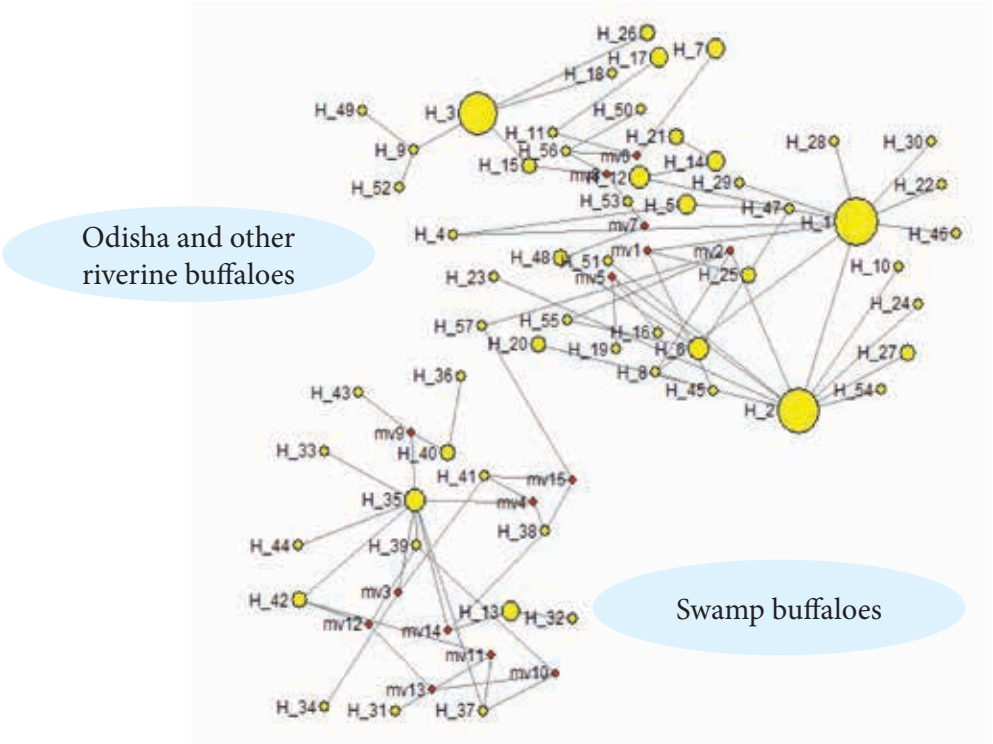


Typical riverine karyotype of female Paralakhemundi buffalo

number of 50. Primers have been designed and 811 bp mitochondrial D-loop region of 30 Kalahandi and 19 Paralakhemundi buffaloes amplified and sequence data generated. By comparative analysis across nine riverine and swamp breeds/populations, 81 variable sites were observed resulting in 57 haplotypes. Median joining network analysis based on haplotypes sharing, has also shown both the Odisha buffalo populations grouping with other riverine buffalo breeds.



Mitochondrial haplotypes diversity based phylogenetic analysis of riverine and swamp buffaloes.



Median joining network analysis of Odisha buffaloes based on mitochondrial haplotype sharing with other riverine and swamp buffaloes

Chhattisgarh buffalo

Pilot surveys were conducted in about 41 villages of Dhamtari, Kanker, Mahasumund, Bilaspur, Kawarda and Baster districts of Chhattisgarh including Lohandi Guda block and Kondagao block to explore the buffalo genetic resource of Chhattisgarh. Phenotypic characterization was done and biometric measurements on about 140 adult Chhattisgarhi buffalo were recorded. Socio-economic and management practices including production and reproduction traits of local buffaloes were also collected through farmers' interviews. Cytogenetic analysis of Chhattisgarh buffalo samples revealed it to be riverine type with chromosomal number fifty (N=50). The candidate genes affecting the fat production traits - FASN (Exon 38, 39, 40, 41, 42) and 3' UTR of STAT1 were also analysed for variation in Chhattisgarh buffalo, using PCR-RFLP technique. Only Exon 40 of FASN gene was found to be polymorphic, while other regions were monomorphic.

Genetic diversity at MHC-DQA and DQB loci in swamp buffalo

Swamp buffalo (*Bubalus bubalis carabanesis*), a bovine specific to North-East region of India is reared mainly for meat and draft. As an attempt to assess the genetic diversity and fitness of swamp buffaloes, Major Histocompatibility Complex (MHC), a group of immune response loci were studied in local swamp buffalo populations from NE region. To assess genetic diversity at MHC class II loci, about 930 and 290 bp genomic regions corresponding to DQA and DQB genes, respectively encompassing exon 2, were amplified in 90 swamp buffaloes. Amplified products of both the genes were digested with HaeIII and HinfI restriction enzymes. PCR-RFLP analysis of DQA gene for both the enzymes revealed a total of seven allelic patterns, whereas DQB gene had six and seven restriction patterns for HinfI and HaeIII, respectively. Based on PCR-RFLP analysis, PCR samples from eight animals having different haplotypes of DQA

and DQB genes were cloned, for further studies. Colony PCR-RFLP was carried out to identify the clones having different alleles and plasmid DNA of selected clones was isolated and sequenced. A total of 13 DQA alleles were identified in swamp buffaloes, which corresponded to two major groups, DQA1 (11 alleles) and DQA2 (2 alleles). For DQB, total 16 alleles were identified corresponding to three major groups i.e. DQB1, DQB2 and DQB3. High ratio (more than 1) of dN/dS for DQA and DQB alleles overall, indicated positive selection for MHC class II diversity in Indian swamp buffaloes. Further, presence of more than two different clones of DQA and DQB from an individual confirmed the duplication of DQ genes in swamp buffaloes. Moreover, most of the amino acid variations were seen at the peptide binding sites. Results thus revealed high allelic diversity as well as duplication of DQA and DQB loci in indigenous swamp buffaloes, indicating higher fitness of the population being under positive selection.

Heat stress protein genes in Indian sheep

SNP markers in the heat shock protein (HSP) genes in four different breeds of Indian sheep were studied. A total of 195 DNA samples of 4 different sheep breeds (Chokla=47, Marwari=52, Magra=54 and Madras Red=42) were isolated. Thirteen different primer sets were designed for the amplification of different regions of HSP70 and HSP90 genes and the identification of SNPs by allele specific and tetra-primer ARMS PCR. The fragments of HSP90 genes, which were successfully amplified included, HSP90AA1 exon 6- exon 7 complete exons with an amplicon size of 490 bp and complete exon 9 with an amplicon size of 354 bp. HSP90AA1 partial exon 8 with an amplicon size of 258 bp. Promoter region of HSP90AA1 containing 7 already reported SNPs with an amplicon size of 499 bp was also successfully amplified. DNA sequence analysis of 6 samples of this fragment revealed three novel SNPs at 112, 244 and 248 nucleotides position. The tetra-primer ARMS PCR protocol was developed for -660 and -601 nt position in the promoter region of HSP90AA1.

Genotyping protocol was developed for the 112 nt position SNP (G/C) using the allele specific primers. 42 samples of the Madras Red Sheep were genotyped, where GG, GC and CC genotypes had a frequency of 0.40, 0.40 and 0.19; respectively. The allele frequencies of G and C alleles were 0.60 and 0.39; respectively. Different physio-biochemical and haematological parameters were measured for three different breeds of the sheep under unstressed condition. The Hb%, PCV% and TEC values of Chokla, Marwari and Magra breed were found to be 9.58, 9.62, 10.64; 33.97, 34.58, 39.82 and 8.27, 8.79, 9.93; respectively. The average values for the temperature, respiratory rate, pulse rate, Hb%, PCV% and TEC were found to be higher in Magra than Marwari and Chokla breed of sheep.

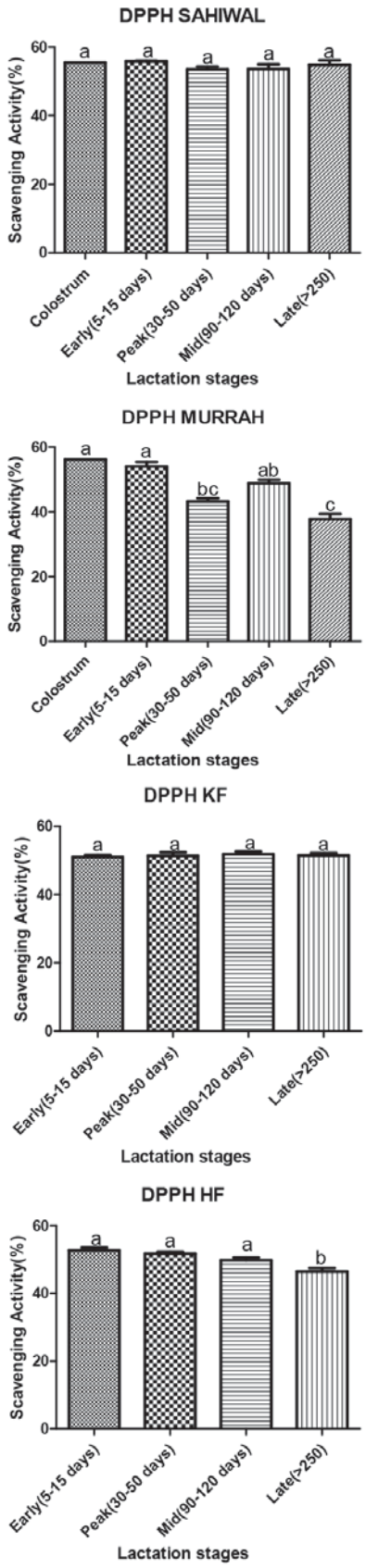
Antioxidant capacity and free radical scavenging activity of bovine milk

Milk from dairy animals contains several enzymatic and non-enzymatic antioxidants constituents, which are crucial to prevent the production of reactive oxygen species and help to activate the body antioxidant defense mechanism. The aim of this study was to evaluate the comparative changes in total antioxidant capacity and free radical scavenging activity of milk during the course of lactation in different cattle types and buffaloes. Milk samples from 200 healthy animals of Sahiwal cows (Indian native cattle), Karan Fries cows (Cross-bred), Holstein Friesian cows (exotic cattle) and Murrah buffaloes (Riverine buffaloes) were collected at different

lactation stages; colostrum, early lactation (5-15 days), peak (30-60 days), mid (100-140 days) and late lactation (>215days). Total antioxidant capacity (TAC) of milk was measured by ferric reducing/antioxidant power assay (FRAP) and free radical scavenging activity was evaluated using 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals. TAC in milk was observed to be higher during colostrum and early lactation in comparison to peak and mid lactation periods. In Sahiwal and Karan Fries cows, TAC of milk was significantly ($p<0.05$) higher in colostrum followed by early, peak, mid and late lactation stages. Also, in Holstein Friesian cows, TAC was significantly higher in early stage than mid and late lactation stages, whereas in Murrah buffaloes, no significant difference was observed across different lactation stages. On the other side, percentage scavenging activity of DPPH showed no difference across lactation stages in Sahiwal and Karan Fries cows. Whereas, in Murrah buffaloes, percentage scavenging activity of DPPH was significantly higher in colostrum and early lactation stages compared to peak, mid and late lactation stages. In HF cows, no significant differences were found in early, peak and mid lactation stages, but it decreased significantly in late lactation. These data suggest that antioxidant levels change during different stages of lactation and are higher in colostrum and early lactation stages as compared to later part of lactation. So the colostrum and milk produced throughout early lactation stages has additional antioxidants to supply immunity to the young or new born calves.

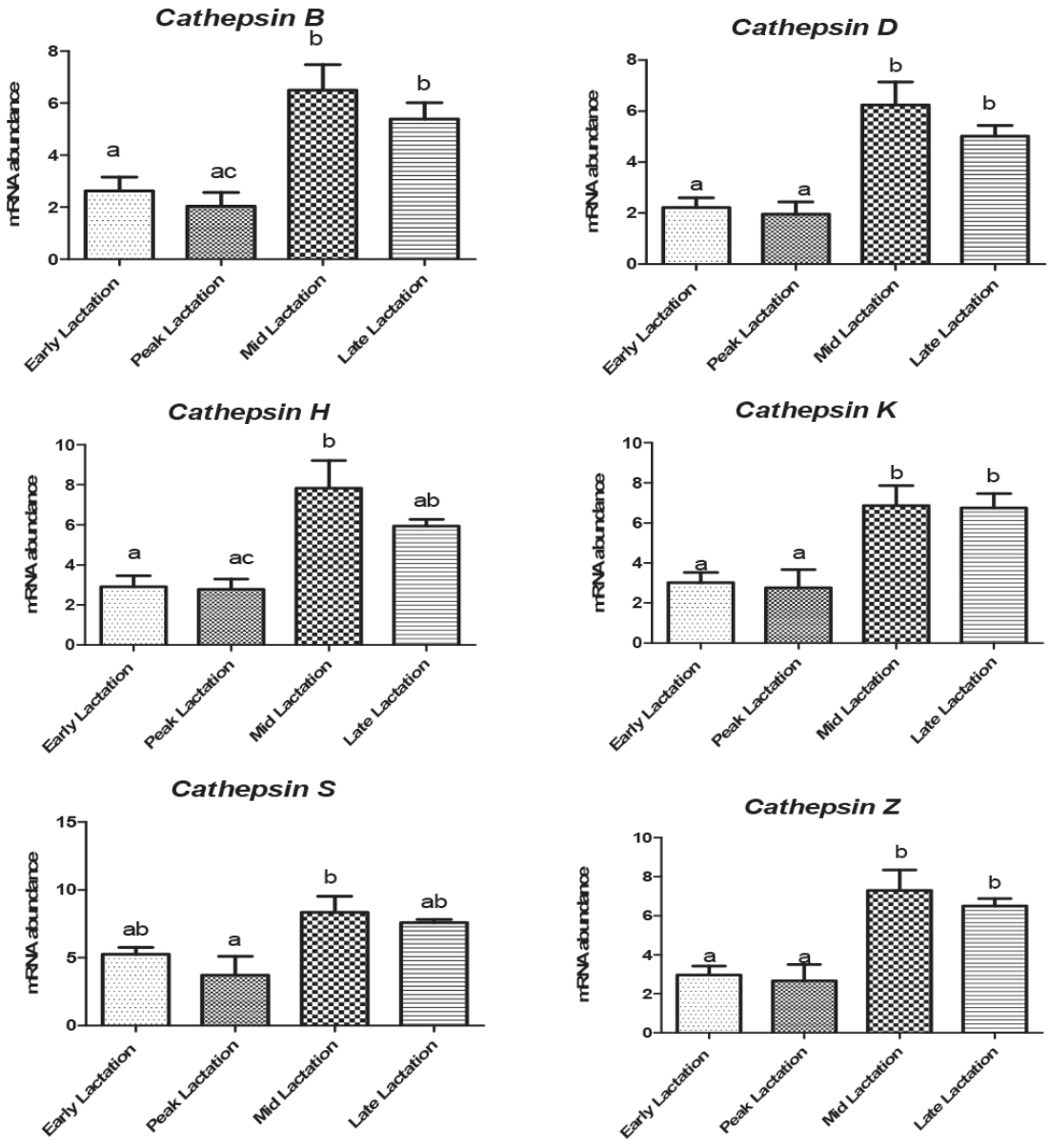
Expression kinetics of proteases in milk derived somatic cells

Proteases are important class of enzymes that play physiologically significant roles in milk and its products by affecting its flavour, texture and



Scavenging activity measured by DPPH assay during different stages of lactation of Sahiwal cows, Murrah buffaloes, Karan Fries cows and Holstein Friesian cows.

longevity. The expression of these endogenous proteases varies from species to species as well as across different stages of lactation. However till date no significant studies have been conducted on the comparative expression profiling of these proteases among different species and the expression kinetics associated with them are poorly understood. The present study was conducted to assess the relative mRNA levels of different classes of proteases (cathepsins, plasminogen and ubiquitous-proteosome pathways associated genes) across various lactation stages in Sahiwal cows and Murrah buffaloes. For this study, fresh milk samples were collected from 40 animals including 20 each of Sahiwal cows and Murrah buffaloes (5 animals each of 4 stages) during different stages of lactation *viz.* early (5-25 days), peak (30-60), mid (90-120 days) and late (>240). After isolation of milk derived somatic cells (MSC), the cells

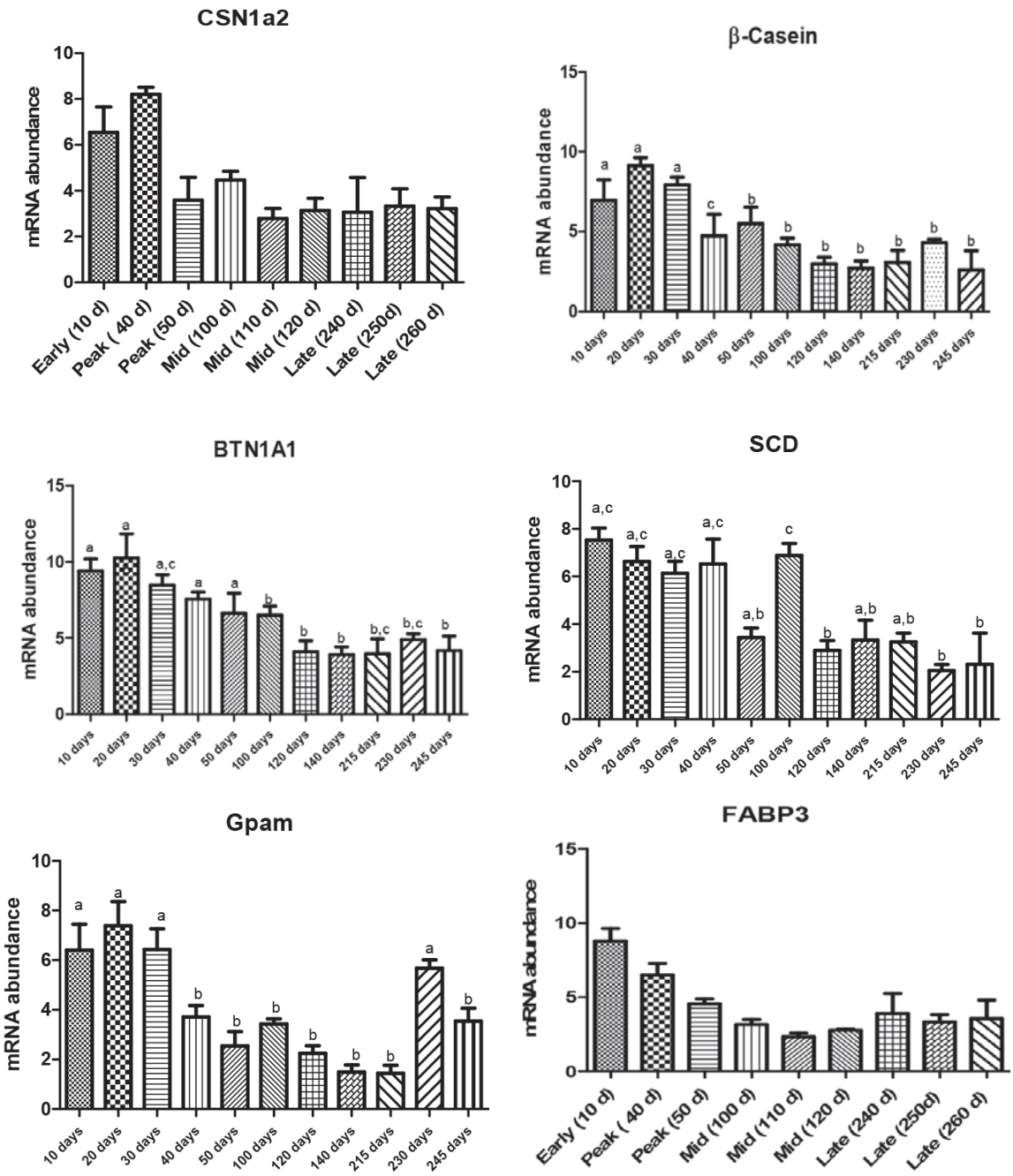


Relative mRNA level of cathespsin protease genes in Murrah buffalo milk somatic cells during different lactation stages. Values are expressed as means± SE. Different letters indicate significant differences between lactation stages ($p<0.05$)

were subjected to RNA isolation and expression analysis. Comparative expression patterns of different classes of proteases; Cathepsin B (*CTSB),* Cathepsin D *(CTSD),* Cathepsin H *(CTSH),* Cathepsin K *(CTSK),* Cathepsin S *(CTSS),* Cathepsin L *(CTSL),* Cathepsin Z *(CTSZ),* Urokinase type plasminogen activator *(PLAU),*Tissue plasminogen activator *(PLAT)* and Atrophin 1 (*ATRO1*) and protease inhibitors (*SERPIN E2* and *SERPIN F2*) were evaluated in MSC during different lactation stages of Sahiwal cows and Murrah buffaloes. All the genes encoding different endogenous proteases showed an increase in expression during course of lactation. Our analysis showed lower expression of different proteases during early lactation. While the cells from late lactation stage showed highest expression level for most of the proteases especially, the cathepsins. Further, we also analyzed Serpine B1 and Serpine 1-(Plasminogen activator inhibitor) genes associated with plasminogen pathways. They also had increased expression during late lactation as compared to early lactation. The observed trend of expression pattern of studied proteases genes was similar in both the species however; the expression levels were comparatively higher in buffaloes.

Expression profiling of milk caseins and fat metabolism genes in mammary epithelial cells of Sahiwal cows

At present not much information is available about the expression profile of major milk and fat related genes in mammary gland or milk derived mammary epithelial cells (MEC) of Indian native cow. The present study was therefore aimed to determine relative mRNA expression pattern of important milk caseins and fatty acid synthesis genes in MEC of Sahiwal cows. Use of MEC isolated from milk has been speculated to be a good alternative to mammary gland tissues in order to understand the expression profile of important genes associated with lactation, in particular large dairy animals where obtaining biopsies is sometimes difficult. In the present investigation, MECs were isolated from fresh milk, using Dyna Beads coated with anticytokeratin 18 antibodies. The milk samples were collected from 16 healthy multiparous Sahiwal cows during different stages of lactation: early (0-20), peak (30-50), mid (90-120) and late (>240). Milk samples (2-3 liters per animal) from selected animals were collected early morning (between 5:00-6:00 AM.) and brought to laboratory in sterile jars and stored at 4°C till further processing. A total of 52 MEC samples were purified from different lactation stages and subjected for expression analysis. The expression patterns of the milk casein genes (*CSN1S1, CSN1S2, CSN2, CSN3*) (*LALBA*), and fat metabolism genes (*FABP3, BTN1A1*, *ACACA, SCD, GPAM*) were evaluated. For normalization of expression data, 10 known housekeeping genes (HKGs) from different functional classes were evaluated. A panel of four best stable HKGs; eukaryotic translation elongation factor 1 alpha (EEF1A1), ribosomal protein L4 (RPL4), glyceraldehyde-3-phosphate dehydrogenase (GAPDH), actin-beta (ACTB) were identified through geNorm, NormFinder and BestKeeper analysis. Expression pattern of all casein genes was higher during early and peak lactation period as compared to mid and late lactation. Their mRNA abundance level was significantly high during early lactation and gradually decreased in late lactation stages (>240 days). Similarly, expression level of *SCD, FABP3* and *GPAM* etc. was significantly higher in early lactation (10 to 30 days) compared to mid and late lactation periods. These results provide the understanding of stage specific expression pattern of important milk and fat related genes in mammary epithelial cells of



Relative mRNA level of milk caseins and fat metabolism genes in milk purified epithelial cells of Sahiwal cows during different days of lactation.

Sahiwal cows. Findings could be a step forward in understanding the molecular regulation of milk fat-protein synthesis in mammary gland of Indian native cows.

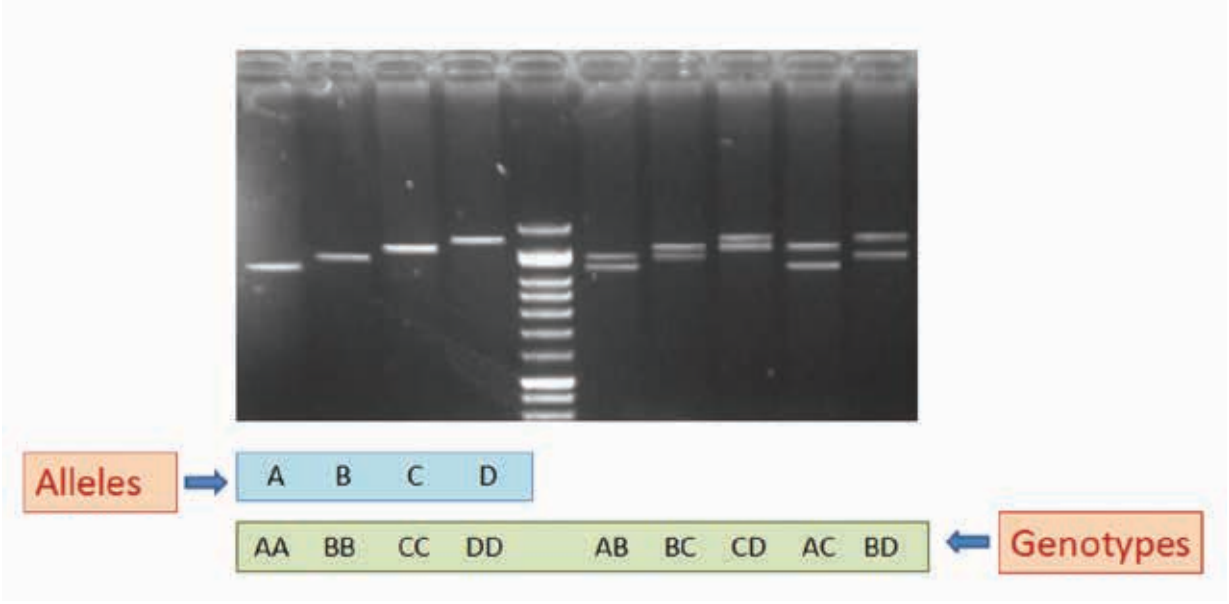
Molecular basis of male sub-fertility or sterility in bovines

Sequence variation in zinc finger domain of PRDM9 gene in bovines was studied. Blood samples were collected and DNA was isolated from indigenous cattle, exotic cattle (Jersey and Holstein Friesian)and crossbred cattle (Karan Swiss, Karan Fries, Frieswal and Jersey cross). Primers were designed to amplify zinc finger domain of PRDM9 gene on the basis of *Bos taurus* gene sequence available (GenBank accession no. KJ020105). PCR conditions were standardized and specific amplification was recorded in four bovine species viz. cattle,

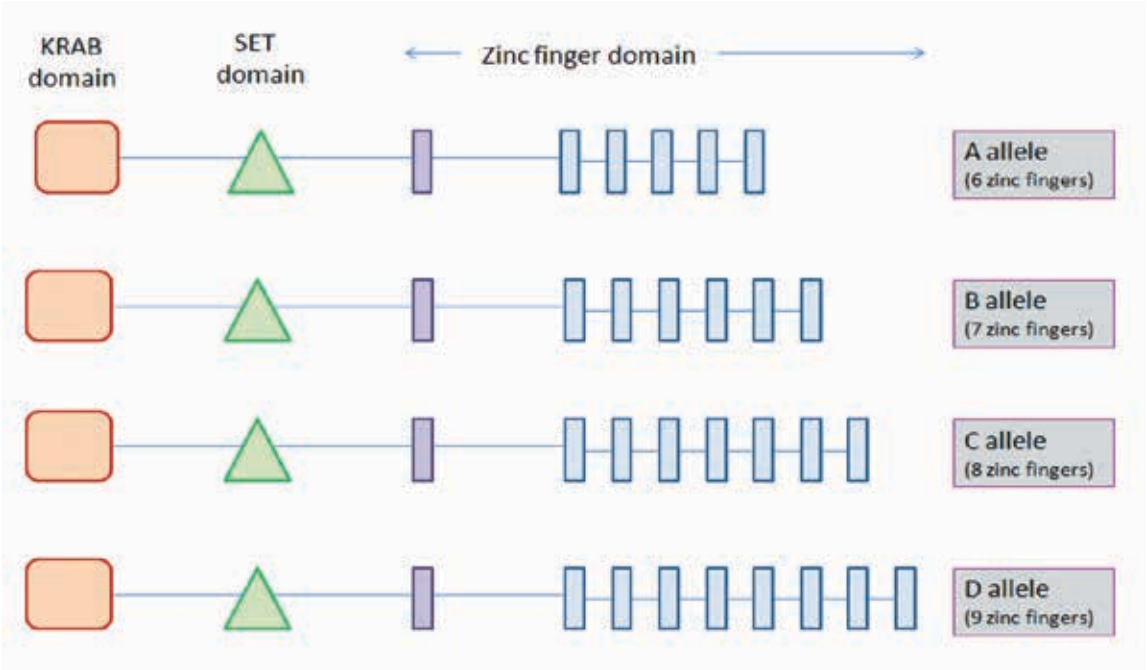
buffalo, yak and mithun. Four alleles (A, B, C and D) and nine genotypes (AA, BB, CC, DD, AB, BC, CD, AC and BD) for PRDM9 gene have been recorded in these species. Cloning and sequencing of the 4 alleles revealed that the number of zinc fingers in this domain of PRDM9 gene is 6, 7, 8 and 9 in A, B, C and D allele respectively.

Allelic profile of candidate genes related to milk traits in Ladakhi cattle

Local cattle from Ladakh region of India have developed over the years under natural selection and can survive very well under at extreme climatic conditions. These Ladakhi cattle are highly evolved germplasm, hence might possess unique alleles or combinations of alleles. Even



Alleles and genotypes observed in PRDM9 gene across different species

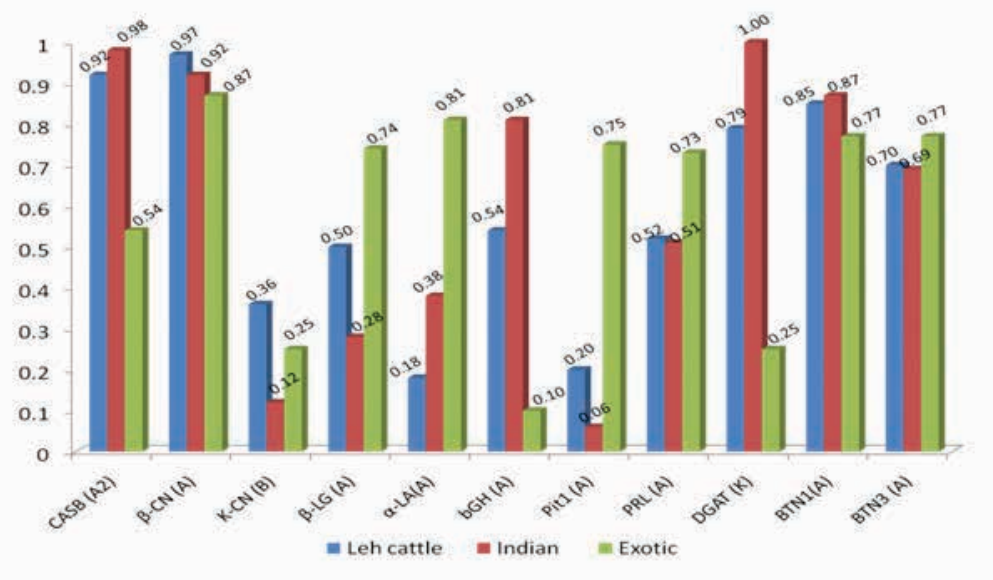


Pictorial representation of PRDM9 gene in bovines

with the survival under extreme conditions, this local cattle provides around 3-4 kg of milk, hence it is pertinent to study the allelic profile at the candidate gene loci affecting dairy traits. The present study assessed the distribution pattern of allelic variants at important candidate genes including Kappa-casein (κ-CN), Beta-casein (β-CN), Beta-lactoglobulin (β-LG), Alpha-lactoglobulin (α-LA), bovine Growth Hormone (bGH), Pituitary transcription factor (Pit-1), Prolactin (PRL), Butyrophilin1, 3 (BTN-1, -3) and Diglycerol Acyltransferase (DGAT-1) across 72 animals of Ladakhi cattle. Overall, the observed allelic frequency pattern in Ladakhi cattle was similar to other studied Indian native cattle breeds as compared to taurine cattle breeds. Ladakhi cattle have maintained the indicine characteristics at most of the studied loci (e.g., *Msp* I- allele at bGH, K allele at DGATI, A2 allele at β-CN1, A allele at β-CN2, A allele at BTN1). Also, the predominance of A2 allele at beta casein loci strongly suggested that milk from Ladakhi cattle is A2 milk. In addition to already identified variants, variant E was observed at κ-CN that has not been reported in any other Indian native cattle breeds and at BTN-3 loci, variants novel to Ladakhi cattle were observed. The present findings also highlighted the near absence of taurine influence/introgression effect on the naturally evolved Ladakhi cattle.

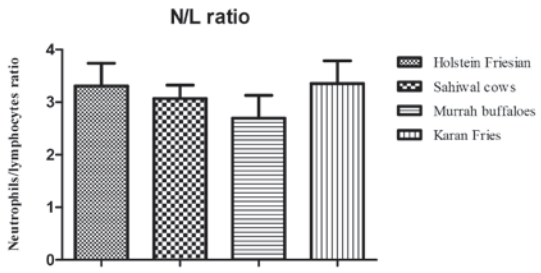
Neutrophils/Lymphocytes (N/L) ratio as indicator of heat stress in bovines

An attempt was made to undertake comparative evaluation of neutrophils/lymphocytes (N/L) ratio, which is considered as good measure to assess the physiological stress across cattle types



Allelic frequency distribution across Ladakhi cattle, tropically adapted Indian cattle and exotic cattle at various loci

and Murrah buffaloes. This study included a total of 50 healthy heifer animals, 10-12 each of Sahiwal cows, Karan Fries cows, Holstein Friesian cows and Murrah buffaloes. All the samples were collected at high temperature humidity index (THI 85). The neutrophil/lymphocyte (N/L) ratio was highest in both Holstein Friesian and Karan Fries cows while lower in Sahiwal cows and Murrah buffaloes. The relative numbers of white blood cells in circulation indicate the level of physiological stress. In general, release of stress hormones in animals causes alterations



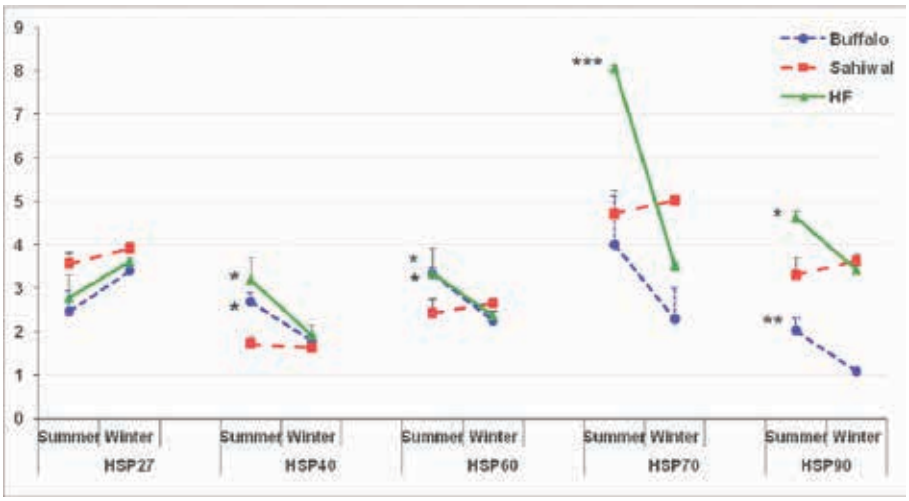
Neutrophil/ lymphocyte (N/L) ratio across species

of numbers of two of the five leukocyte types; that is an increase in neutrophils and a decrease in lymphocytes. The reason for these alterations is not clear, but since it occurs predictably, detection of these alterations can be used by researchers to indirectly infer increases in stress hormones and physiological stress in animals. Several studies with different species have shown that stress conditions result in a redistribution of white blood cells involved in the defense and immunological response against antigens, such as an increase of neutrophils, a decrease of lymphocytes and thus, a higher N/L ratio appeared to be a reliable indicator of levels of physiological stress. The data presented here provides evidence that Sahiwal cows and Murrah buffaloes have better cellular tolerance than exotic, crossbred cows to summer stress.

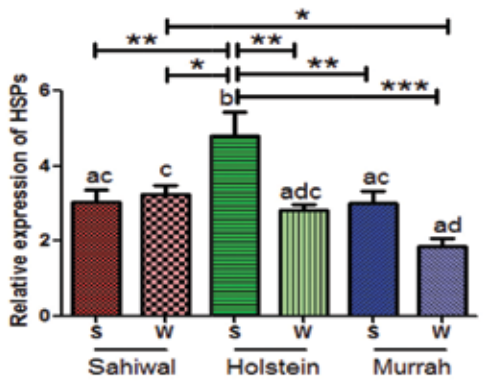
Transcriptional stability of heat shock protein genes in cattle

The major objective of this study was to determine whether seasonal variation has impact on transcription of major chaperones in PBMCs of Sahiwal, Holstein Friesian cows and Murrah buffaloes or not. A total of 15 lactating animals, 5 each of Sahiwal cow, Holstein Friesian cow and Murrah buffalo were included for this study. Blood samples were collected during hot summer (month of July with average temperature of 41±1°C and temperature humidity index ≥ 85) and cold winter (month of December with average temperature of 12±1°C and temperature humidity index ≤72).

The HSP transcripts in Sahiwal cows showed non-significant or minimum change in expression with change in season. This provides an evidence for its better cellular tolerance and adaptability than that of exotic Holstein cows. On the other hand, Holstein Friesian animals with higher abundance of four major HSP transcripts (*HSP*90, *HSP*70, *HSP*60, and *HSP*40) during summer season indicated their lower tolerance to environment heat load especially in tropical climatic conditions. Pooled expression data for all the HSPs together showed similar trend to



Transcriptional stability of different heat shock protein genes in PBMCS of Sahiwal cors in comparison to Murrah buffaloes and Holstein cows across summer and winter season (Significance at *p<0.05, **p<0.01 and ***P<0.001).



Pooled expression profile for HSP genes together during summer and winter (Significance at *p<0.05, **p<0.01 and ***p<0.001).

that of individual *HSP* mRNA. The combined expression values for *HSP70*, *HSP40*, *HSP60* and *HSP90* genes together showed maximum and significant induction in Holstein Friesian cows compared to Sahiwal cows. Higher expression of *HSPs* in Holstein cows could be related to the higher stress state of animals, requiring more production of heat shock proteins to cope up with the summer stress.

Identification of suitable internal control gene (ICG) to normalize hypoxia regulatory genes in cattle

10 well-known reference genes from different functional categories that could serve as suitable ICG during studies in Indian cattle adapted to high altitude and tropical conditions were tested. The expression studies of hypoxia responsive genes in native cattle and exotic cattle would provide comparative baseline data to understand the underlying alterations in cellular tolerance towards hypoxic stress. This study was planned with the assumption that circulating peripheral blood mononuclear cells (PBMC) could be a useful model to understand differential response of cattle to high altitude stress condition. The study included a total of 8-12 healthy heifer animals each of Sahiwal cows, Karan Fries cows, Holstein Friesian cows maintained under normoxic condition, and Ladakhi cows, HF crosses and Jersey cows maintained at high altitude hypoxic conditions. The candidate internal control genes included in the present study were; *ACTB, B2M, GAPDH, RPS9, RPS15* and *RPS23, HPRT1*, and *UXT*. The present study utilized geNorm, NormFinder and BestKeeper software to find out the most appropriate ICG. In geNorm analysis, all the genes exhibited expression stability (M) values below 0.5. On the basis of relative gene expression stability and stepwise exclusion of the gene with the highest M value, genes were arranged in descending order of stability: *RPS9=RPS15>HMBS >GAPDH>B2M >RPL4 >EEF1A1 >UXT >ACTB > HPRT*. Similar

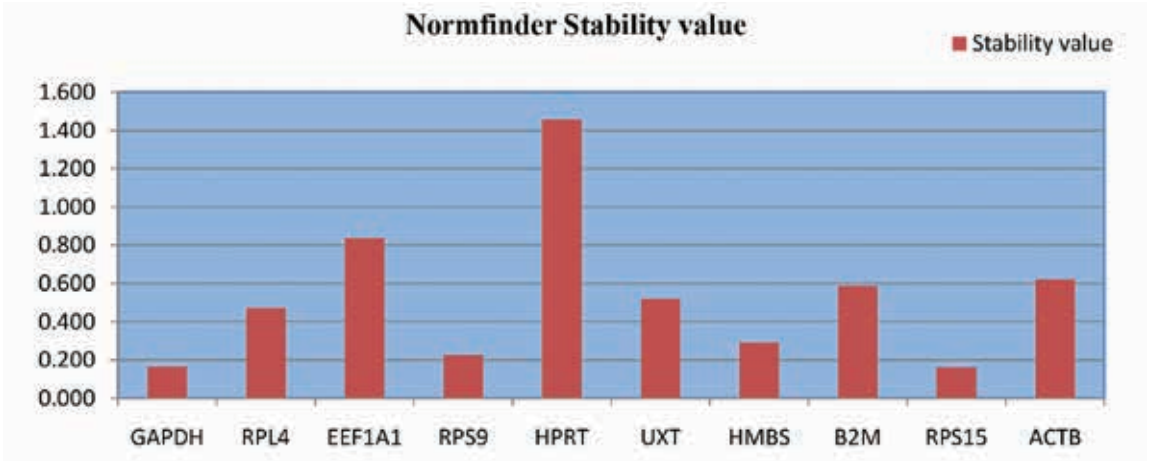


Fig. Ranking of ICG based on Normfinder analysis.

to geNorm, Normfinder also identified *RPS15* as most stable and *HPRT* as least stably expressed genes. There was good agreement between geNorm and Normfinder outcome, albeit slight variation was observed in the ranking of other genes. The BestKeeper algorithm was used to calculate gene expression variation based on C_T values. Each of the 10 candidate reference genes showed consistent expression levels. *RPS9, RPS15, GAPDH, HMBS* exhibited higher coefficient of correlation (r) to the bestkeeper index, lower coefficient of variance (CV) and standard deviation (SD), pointing towards their expression stability. In the present investigation, all three algorithmic methods geNorm,Normfinder and BestKeeper have demonstrated that *RPS15, GAPDH*, *RPS9* and *HMBS* are the most stable internal control genes and geometric means of these 4 ICG could be used for the normalization of expression data in PBMC of tropical vs. high altitude cattle breeds.

Cytogenetic Screening for Chromosomal defects

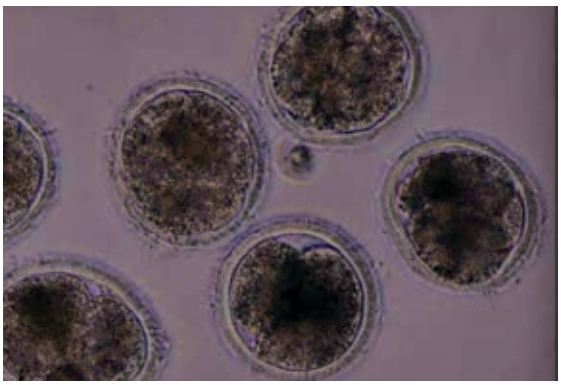
NBAGR is providing consultancy service of cytogenetic screening of breeding males to various agencies throughout the country with the aim to check the spread of chromosomal defects and to keep the herds free of such genetic defects as per the policy of Government of India. During the year a total of 113 breeding cattle and buffalo bulls and 40 pigs were screened for their cytogenetic parameters.

Ex Situ Conservation

Total 7,600 frozen semen doses of Cattle (Gaolao and Tharparkar) and Buffalo (Toda) have been procured and added to repository in Gene Bank during last year. Jaffarabadi buffalo semen stored in Gene Bank has also been utilized in its breeding tract for supporting conservation and improvement. The National Gene Bank at NBAGR now stores 1,29,174 frozen semen doses belonging to forty four breeds of seven species (Cattle, Buffalo, Goat, Sheep, Camel, Equine and Yak).

Utilization of cauda epididymal spermatozoa for cryopreservation of caprine genetic biodiversity

An extender containing citrate buffer, sugar, egg yolk and antibiotics along with a cooling protocol has been standardized for freezing caprine epididymal semen and frozen semen doses prepared using this protocol. The storage of testis at low temperature indicated suitability of utilizing them for extraction of epididymal sperms for their conservation, even after extended hours post slaughtering of bucks. *In vitro* fertilization revealed that frozen epididymal spermatozoa retaind the fertility potential.



In vitro fertilization of goat ova by epididymal sperm and zygote formation

Network Project on AnGR

Characterization of Budelkhandi Goat, Bhakarwal Goat, Marwari sheep, Poonchi Sheep, Tibetan sheep, Mithun, Purnea Cattle, Binjharpuri Cattle, Assamese cattle, Kosali Cattle, pig population of Assam, Jalori camel, Arunachali Yak, Donkeys of Rajasthan, Hazra chicken, Duck of Assam and conservation of Bargur cattle, Ongole cattle and Harringhata chicken was carried out by their respective centers.

Bundelkhandi goat

Bundelkhandi goats are found in almost all parts of Bundelkhand region. The region is located in

Bundelkhandi goat

the Indo-Gangetic plains on Vindhya hilly tract in central India. Goat-rearing is sustainable even in fragile environment of Bundelkhand region. It is dual type goat yielding both meat and milk. Some goat keepers make 'Khoya' from the goat milk and sell it to the local market. Mostly grazing alone is preferred, only few farmers offer concentrate ration to lactating & pregnant does. Bundelkhandi goat seems to be of medium size with good posture. Chest is wide, legs are long and strong, horns are of medium size, twisted and slightly outward in orientation. Tail is bushy. Ears are medium and pendulous.

Bhakarwal goat

Migration route of Bhakarwal goat has been delineated in Kathua, Rajouri and Reasi districts. During April to September the breeders of Bhakarwal goat remain at highland pastures and from October to March they stay in their native tract. Bhakarwal goats are primarily known to be reared for excellent quality meat and animal products like hair and milk are other items of utility.

Poonchi sheep

Migration route of Poonchi sheep in three different districts namely Poonch, Rajouri and Reasi, has been delineated. Bhakarwal, Gujjars and other nomadic communities rearing the Poonchi sheep population have been provided with medicines (dewormer and anthelmithatic) and other veterinary aid for improvement and conservation strategy. Males of Poonchi have been identified for conservation and germplasm propagation in the native track of Poonch, Rajouri and Reasi districts in the farmers herds. Wool samples have been collected for analysis of different wool quality parameters.

Marwari sheep

Marwari sheep survey was conducted in three districts i.e. Jodhpur, Jalore and Barmer. Ninety Five sheep flocks from Jodhpur district, 84 flocks from Jalore and 119 flocks from Barmer were surveyed. Computerization of data is under process.

Marwari sheep

Tibetan sheep

Tibetan sheep population has been ascertained, numbering 215 only. Wool is sub-white, full of gloss, equal and long fiber, high compactness, high elasticity and big pull with average annual wool yield 700 gm and staple length 11.86 cm and staple diameter 29.08 cm with bundle strength 12.71 and bundle yield 76.56. Prevalence of gastrointestinal parasitic infections was recorded to be 26.53 per cent. Among the helminthes, *Haemonchus* spp. infection was predominant (24.49 per cent). Migratory route has been studied on transhumance tract. Sheep spends

Tibetan sheep

Purnea cattle

approximately 6 months in cold desert and 6 months on alpine pastures. Clear seasonal weight dynamics exists with loosening of weight upto 14.83 percent during lean season.

Mithun

4 districts in Nagaland (Kohima, Phek, Longleng and Tuensang) were selected for carrying out the survey work on Nagaland Mithun. In the survey area Mithun population was 1670. Health and vaccination camps were also conducted at these mithun rearing villages for motivating the mithun owners with some inputs.Morphometric measurements of a total of 86 mithuns were also recorded so far.

Purnea Cattle

Araria, Purnea and Katihar districts were selected for survey. So far, 948 farmers were approached for studying the characteristics of Red Purnea cattle, in which 1100 animals belonging to the age of 0-3 years and 1074 animals belonging to the age of 3-7 years have been studied for morphological and conformation characteristics. Purnea are medium to small sized cattle mainly reared for milk purpose. Average face length is 47.3 cm with the forehead being slightly concave. The muzzle, eyelashes and hooves are mostly black in colour. Dewlap is small in females but medium in size in males. Horns are generally small, with an average being 8.9 cm, and oriented laterally and slightly forward. Udder is small and round in shape. Teats are short and tube shaped. Tail is long and switch is black in colour. Purnea cattle plays a vital role in its breeding tract by providing substantial support in terms of milk and dung to a greater extent, and draught power to a smaller extent

Binjharpuri Cattle

Survey work is being carried out in three adjoining districts Jajpur, Kendrapara and Bhadrak. Binjharpuri forms around 50% of the total cattle population, reared. Graded Hariana and Jersey crossbred cattle are also reared in the villages by the farmers. Resource poor farmers prefer local Binjharpuri. Binjharpuri are of medium size with prominent horns, narrow and long face, mostly white in colour and yield around 2 to 5 kg of milk in a day. Bullocks are mainly used for ploughing and threshing purpose. No major reproductive problems are reported by the farmers. River water is the main source of drinking for the animals during grazing.

Cattle of Assam

Three district Sibasagar, Sontipur and Barpeta have been surveyed. Proportion of local cattle in surveyed areas is 92.46, 90.93 and 95.78 per cent respectively. Average density per hectare of

cultivable land for the three districts is 5.12, 4.26 and 5.11 respectively. Average land holding per family is 1.85 acre. These cattle are mostly fed on natural grasses with provision of little bit of concentrate. They are reared both for milk and work power. Breeding of the animal is generally through natural service only.

Kosali Cattle

Three districts of plain region of Chhattisgarh (Rajnandgoan, Baloda bazaar and Bilaspur) were selected for survey work. A total of 1093 animals have been covered. Approximately 70% farmers are sub marginal/marginal. Animals are smaller in size with stumpy, small and slightly inward horn, horizontal ear and poor milk production. Bullock pairs are used for cleaning of weed from the paddy crop or aeration in the crop and it is locally called **"BYASI".**Coat color of breed is commonly red followed by white and black. They have excellent capacity of heat tolerance and disease resistance and can thrive well under the poor feed stuffs available in the state. Main fodder source for animals is paddy straw with only seasonal availability of the green fodder.

Pig population of Assam

846 pigs of 301 villagers were identified and surveyed in Dhemaji. Missing, Bodo, Nepali, Assamese, Hajong and Bengali communities are the main pig rearers of Dhemaji District. Mostly local (Doom) pigs are major contributor of pig population of the area. Doom pigs are of medium size with stout body. They are predominantly black in colour with long snout and small ears. Bristles are thick and long and spread from head to back along the spine. Average weight at birth and weaning is 250 gm and 5.5 kg, respectively. Adult body weight is 47 Kg. Dressing percentage of carcass is 72-75%. They are reared under backyard as well as scavenging system,

Pig of Assam

Mewari and Jalori camel

Survey in the 2 districts encompassing 10 villages has been initiated for Jalori Camel and information from 48 camel owners and 126 camels has been recorded. Survey in 6 districts encompassing 11 villages has been initiated for Mewari Camel and information from 43 camel owners and 262 camels has been recorded. Milk recording in the field has been initiated. To create awareness about Animal Genetic Resources and Camel in particular an Aakashwani programme from Bikaner, Jodhpur, Udaipur and Kota Radio stations has been launched.

Arunachali yak

West Kameng and Tawang District of Arunachal Pradesh were selected and survey was conducted on 700 animal. Milk production was recorded for

Arunachali yak

three location and data was analyzed. A training programme on Documentation of Yak Genetic Resources (Characterization of Arunachali Yak) was organized during 08-10th September, 2014.

Donkeys of Rajasthan

Twenty two biometric indices on 50 donkeys (including seven foals of less than one year of age) from Bikaner district were recorded for assessing their phenotypic characteristics. The donkeys are light grey, dark grey and brown in colour. Tail switch is non-distinct and pole is prominent. Nasal bone is concave, whereas forehead is convex in shape. Zebra marking is observed on legs of few donkeys, shoulder strip, dark outline markings, light colored under parts were recorded. Ears are erect. White markings of muzzle, eyes, legs and belly are common. Hair are of medium length, dull in appearance and straight. The foals have long hair with glossy appearance. Colour of skin is black in donkeys. In most of the donkeys tails is either above or up to the hock, but in few donkeys it is beyond hock. Sheep breeders maintain 1-3 donkeys usually.

Hazra chicken

Three districts Mayurbhanj, Keonjhar and Deogard were covered under the study. Flock size ranges from 5 to 30 birds and they are kept for meat and game (Cock fighting). Backyard system of poultry keeping is very common in these areas. During night birds are kept in the bamboo cages or closed houses. Water is provided to the birds in earthen pots. Most prevalent colors are dark red, black and spotted (black and white). Comb and ear lobes are red.

Duck of Assam

Three districts Sonitput, Sivsagar and Barpeta were selected for survey. Average land holding per family was recorded to be 0.47 hectare in the survey area. Ducks are kept in confined kutcha house during the night time only. Birds are allowed for scavenging with supplementation of kitchen waste and rice bran. Pond is the source of water for these birds.

In situ Conservation

Bargur Cattle

University has identified area and is establishing a research station in Bargur tract.The equipments have been procured. After screening, 5 young bulls have been procured.

Ongole Cattle

Guntur, Prakasam and Krishna districts were identified for implementation the project in the breeding tract. In 40 villages a total of 1050 artificial inseminations have been carried out by Goplamitrs and LRS using pedigreed bulls semen in Guntur district. Pregnancy verification has been done in 530 cows and conception rate was found to be 45%.Awareness programs was conducted on importance of Ongole cattle, feeding, breeding and various management aspects at LRS lamfarm, Guntur.

Haringhata Black chicken

Cluster of approximately fifty households of mainly Haringhata Black Chicken keepers under

Haringhata black chicken

back yard mode and isolated by geographical boundaries was identified in village Sonakhali, under Birohi Gram Panchayat of Haringhata block. Agreement has been executed with each household to take the challenge of production of 300 Haringhata Black chicks of 4 weeks age annually.Each Household was provided assistance to construct or extend night shelter for 25 birds. Each household has been given 15 birds of 8 weeks age that have been vaccinated and dewormed, one plastic feeder (8 kg capacity), one plastic drinker (3 lit capacity), 100 feet nylon net and 50 kg feed. Vice Chancellor and Additional Director, ARD, Govt. of West Bengal launched the programme. Management of the birds and their subsequent vaccination and deworming were carried out. Second supply of 50 kg feed per household was given after two months of first supply. The birds have reached into egg at approximately at 165 days of age. Body weight recorded at 165 days was 1.6±0.03 kg for Cock and 1.2±0.1 kg for hen. Households are ready to start incubation of eggs.

Genetic variability in Tibetan sheep

Blood samples (5-6 ml) collected from the Tibetan sheep (20) were processed and genomic DNA was extracted from whole blood using Phenol-Chloroform protocol. Quality and quantity of isolated DNA was estimated and samples were prepared for diversity analysis using microsatellite markers. Microsatellite markers (25) recommended for ovinenes were used for the diversity analysis of Tibetan sheep population. These were chosen from literature related with sheep diversity studies aiming to analyze highly polymorphic markers spread across the genome. PCR amplification was performed in a reaction volume of 25 µl on i-cycler. Reaction mixture consisted of 50–100 ng of genomic DNA, 200µM of each dNTP, 50 pM of each primer and 0.5units of Taq DNA polymerase. The amplification was carried out using a Touchdown programme for all microsatellite loci. The PCR products were analyzed on ABI-3100 DNA sequencer. Data is being analyzed for the genetic diversity estimation.

Milk metabolomics based characterization of indigenous, exotic and crossbred cows

Major components of the milk has been characterized in cattle, however there is clearly a lack of understanding of differences in the metabolites present in cow milk of indigenous and exotic cattle. Estimation of milk metabolite profiles is as an essential pre- requisite to identify the biomolecule/s which can explain nutritional or technological edge of milk from indigenous cows. Thus the project was planned and initiated with the objectives to identify variations in the metabolite profile of milk from *Bos indicus, Bos taurus* and their crosses which can explain nutritional or technological edge of milk from indigenous cows. After exhaustive review of literature, various milk metabolites of lipid, protein, carbohydrates and minerals as well as vitamins were shortlisted.

Milk samples were processed following different approaches to standardize protocols for sample preparation that can be analyzed and quantified for identification of different metabolites. Liaison has been established with Government Livestock Farm, Hisar for selection of cows and Punjab Biotechnology Incubator, Mohali for analysis of milk metabolites. Milk samples were collected from selected animals of *Bos Taurus* (Holstein Friesian), *Bos indicus* (Sahiwal) and cross bred (HFxSahiwal) cattle from GLF, Hisar. Sampling was done so as to minimize the variables affecting milk composition (season, parity, lactation stage, feed and fodder and health condition). Samples are being processed for metabolite quantification.

Research Projects & Publications

- Research Projects
- Publications
- Patents and Technologies
- Awards

Monograph # 84/2014
ISBN: 978-93-83537-19-8

Goat genetic resources of India

BUNDELKHANDI GOAT

– An important germplasm of Bundelkhand region

NK Verma
Priyanka Mishra

ICAR – NATIONAL BUREAU OF ANIMAL GENETIC RESURRCES
(An ISO 9001:2008 certified Institute)
Karnal-132 001 (Haryana), India

Cattle Genetic Resources of India

BELAHI

(MIGRATORY CATTLE FROM NORTH HIMALAYAN FOOT HILLS)

Vikas Vohra, Monika Sodhi, S.K. Niranjan,
A.K. Mishra, B.K. Joshi & Arjava Sharma

CAR - National Bureau of Animal Genetic Resources
.T. Road, By Pass, P.O. Box 129, Karnal - 132 001 (Haryana), INDIA

Sikkim Black Goat – A Newly Explored Germplasm

NK VERMA
RAK AGGARWAL
REKHA SHARMA
PS DANGI
NT BHUTIA

ICAR - National Bureau of Animal Genetic Resources

Sheep genetic resources

KORAPUT SH

Sanjeev Singh
K. N. Raja
Reena Arora
Indrajit Ganguly

ICAR-National Bureau of Animal Genetic Resources
G.T. Road By Pass, P.O. Box 129, Karnal - 132 001 (Haryana), INDIA

CHICKEN BREEDS OF INDIA

Harringhata Black

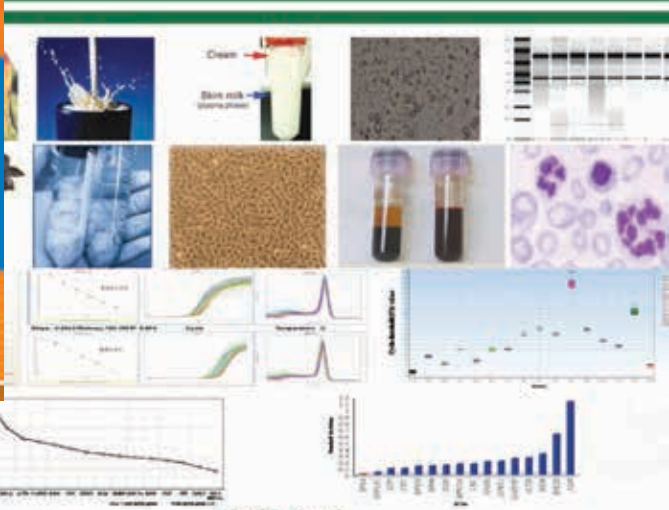
P.K. Vij
M.S. Tantia
S. Pan
R.K. Vijh

National Bureau of Animal Genetic Resources

Technical Bulletin

On

nce Gene Panels for Application in Transcriptomic Research in Indian Cattle and Buffaloes



NBAGR, Karnal

Manishi Mukesh, Monika Sodhi, Ankita Sharma, Amit Kishore, Umesh K. Shandilya, Sandeep Mann, Neha Kapila, Pradeep Jatav, RS Kataria, Poonam Yadav, Jigyasa Aggarwal, Manjula Miglani, Ramneek Kaur, MS Tantia, Inderjeet Ganguly, Arif Chandra, Preeti Verma, Parvesh Kumari, Naresh Yadav, K Khate and BP Mishra

NDRI, Karnal

Ashok Mohanty, Nishant Varshney, Surender Singh, Sudarshan Kumar, Dhruba Malakar, Jai Kaushik, Ajay Dang and Sunita Grover

Division of Animal Biotechnology
National Bureau of Animal Genetic Resources
Karnal-132001, Haryana, India

Research Projects

Completed Research Projects

1. Phenotypic and genetic characterization of Koraput sheep - Sanjeev Singh, KN Raja, Reena Arora, Indrajit Ganguly and Sanat Mishra, (CEO, OLRDS, Bhubaneswar).
2. Characterization of non-descript goat genetic resources of Rohilkhand region of Uttar Pradesh and Uttarakhand - SP Dixit, PS Dangi, RS Barwal, Neel Kant (GBPUAT) and VikasVohra (w.e.f. 14.07. 2011).
3. Assessment of cattle genetic introgression in the domestic yak populations -S Jayakumar and Karan Veer Singh.
4. Profiling of milk constituents, identification of SNPs and their association with milk traits in non-traditional dairy animals (NTDA) - Karan Veer Singh, S Jayakumar and ZS Malik (LUVAS, w.e.f. June, 2014).
5. Development and validation of human tissue plasminogen activator gene construct in mammalian cell culture system - Indrajit Ganguly and Sanjeev Singh.
6. Utilization of cauda epididymal spermatozoa for cryopreservation of caprine genetic biodiversity - RAK Aggarwal and D Mallakar (NDRI, Karnal).
7. Development of breed signature for Sahiwal, Gir and Tharparkar cattle - MS Tantia and Monika Sodhi (w.e.f. 01.4.2013).
8. Analysis of mammary gland transcriptome and proteome during lactation and involution in indigenous cattle and buffalo for identification of probable mammary biomarkers - M Mukesh, (BP Mishra CCPI-up to 24.02.11), RS Kataria and Monika Sodhi (w.e.f. January, 2012) -July 2008 to March 2012, extended up to 31st May, 2014. (NAIP).
9. Bio-prospecting of genes and allele mining for abiotie stress tolerance - RK Vijh - April, 2009 to March, 2012, Extended up to 30th June, 2014 (NAIP).
10. Establishment of National Agricultural Bioinformatics Grid (NABG) in ICAR - Avnish Kumar, DK Yadav, Dinesh Kumar (up to 18.05.2012), B Prakash and PK Vij. April, 2010 to March, 2012, Extended up to March, 2013, up to March, 2014 and up to 30th June, 2014 (NAIP).
11. Harmonizing biodiversity conservation and agricultural intensification through integration of plant animal and fish genetic resources for livelihood security in fragile ecosystem - Arjava Sharma (w.e.f. 01.10.13), Anand Jain, PK Vij, NK Verma, RAK Aggarwal KN Raja and VikasVohra (w.e.f.10.07.2012) (BK Joshi up to 30.09.2013, MS Tantia up to 30.06.2011) - September, 2009 to March, 2013, extended up to 30th June, 2014 (NAIP).

On-Going Research Projects

1. Characterization and evaluation of indigenous cattle of meghalaya, Nagaland and Sikkim states - RK Pundir, PK Singh and PS Dangi (from Nov, 2014) - April, 2014 to March, 2017.
2. Characterization and evaluation of ladakhi cattle - Monika Sodhi, M Mukesh, RK Pundir and Vijay Bharti (DRDO) - April, 2014 to March, 2017.
3. Identification, characterization and evaluation of buffalo population(s) of Chhatisgarh state - Vikas Vohra, RS Kataria and Mohan Singh (CoVAS-CKV) - April, 2014 to March, 2017.
4. Phenotypic and genetic characterization of buffalo populations of Odisha - RS Kataria, SK Niranjan, Vikas Vohra (NBAGR), Sanat

Mishra and SK Das (OUAT, Odisha) - April, 2014 to March, 2018.

5. Characterization of Kajali sheep in its native tract - AK Mishra, KN Raja, Vikas Vohra and Yashwant Singh (GADVASU-Bathinda) and Sanjeev Singh (w.e.f.01.04.2014). April, 2013 to September, 2015.

6. Classification of ecotypes of Deccani sheep - Dinesh Kumar Yadav, Reena Arora and Anand Jain - April, 2012 to March, 2016.)

7. Identification, characterization and evaluation of lesser known sheep populations of Karnataka state- Anand Jain, VS Kulkarni, Reena Arora and Dinesh Kumar Yadav- April, 2014 to March, 2017.

8. Characterization of Sikkim goats - NK Verma, RAK Aggarwal, Rekha Sharma and PS Dangi - April, 2013 to September, 2015.

9. Characterization of indigenous dog breeds of Tamil Nadu - KN Raja, PK Singh, AK Mishra, Indrajit Ganguly and P Devendran (TANUVAS) - April, 2013 to September, 2015.

10. Phenotypic and genetic characterization of donkeys of Andhra Pradesh - Rahul Behl, SK Niranjan, RK Vijh, (DK Sadana up to 31.12.14) and MV Dharma Rao (Lam, LRS, Gantoor, AP) - April, 2014 to September, 2015.

11. Phenotypic characterization of indigenous chicken (Kaunayen) of Manipur - PK Vij, MS Tantia and Th. Ranadhir Singh (CAU, Imphal-Manipur) - April, 2014 to March, 2016.

12. Deciphering the molecular basis of male sub-fertility or sterility in bovines - Sonika Ahlawat, Rekha Sharma and Sachinandan De (NDRI) and Reena Arora (from Nov. 2014) - April, 2014 to March, 2018.

13. Identification of allelic diversity of MHC class II DR and DQ genes in domesticated indigenous yak (*Bos grunnieons*) and mithun(*Bos frontalis*) - SK Niranjan, RS Kataria, Jyotsana Behl, TK Biswas (NRC-YAK), Taba Heli (KVK Pampumpare) - April, 2013 to March, 2016.

14. Molecular and physio-biochemical evaluation of heat stress protein genes in Indian sheep breeds - Sanjeev Singh, Indrajit Ganguly, KN Raja, HK Narula (CSWRI) R Venkataramanan (TANVASU) and Anita Ganguly (LUVAS) - April, 2014 to March, 2018.

15. Haplotypic diversity of Indian cattle breeds based on Y-Chromosome specific markers - Indrajit Ganguly and Sanjeev Singh - April, 2014 to March, 2017.

16. Development of geographical information system on farm animal genetic resources of India - Avnish Kumar and PK Vij (Arjava Sharma- up to 05.08.2014) - April, 2014 to March, 2016.

17. Network Project on Animal Genetic Resources - Arjava Sharma (w.e.f.01.10.2013) Director NBAGR, Project coordinator and MS Tantia (I/c, Network Project) - 1992-Contd.

18. Milk metabolomics based characterization of indigenous, exotic and crossbred cows - Rekha Sharma, M S Tantia, RAK Aggarwal, Sonika Ahlawat and Ajit Dua (PBTI-from Dec., 14) - April, 2014 to March, 2017.

19. Whole genome based SNP mining and development of breed signatures for dairy and dual-purpose indigenous cattle - SP Dixit, S Jayakumar, AK Dang (NDRI), MA Iquebal (IARI), Dinesh Kumar (IASRI) and Avtar Singh (NDRI) - 8th July, 2014 to 7th July, 2017. (DBT)

20. Genome data mining to unravel molecular basis of thermo tolerance and adaptation to diverse environment in native cattle and buffaloes -Manishi Mukesh -May, 2011 to March, 2016. (National Fellow)

Publications

Research papers

1. Ahlawat S, Sharma R, Maitra A, Roy M andTantia MS (2014). Designing, optimization and validation of tetra-primer ARMS PCR protocol for genotyping mutations in caprine Fec genes. *Meta Gene* **2**: 439–449.

2. Ahlawat S, Sharma R, Maitra A, Borana K, Tantia MS and Prakash V (2015).Association analysis of a novel SNP in GPR54 gene with reproductive traits in Indian goats. *Indian Journal of Dairy Science,* **68**:39-44.

3. Ahlawat S, Sharma R, Maitra A and Tantia MS (2015). Current status of molecular genetics research of goat fecundity. *Small Ruminant Research,* **125**: 34-42.

4. Arora R, Yadav HS and Yadav DK (2014). Identification of novel single nucleotide polymorphisms in candidate genes for mutton quality in Indian sheep, *Animal Molecular Breeding*, **4**: 1-5 (doi: 10.5376/amb.2014.04.0001).

5. Behl JD, Sharma A, Kataria RS, Verma NK, Kimothi SP, Bhatia AK, Sodhi M, Behl R and Joshi BK (2014). Genetic polymorphisms in the bovine Toll like receptor 4 (TLR 4) and monocyte chemo attaractant protein-1 (CCL2) genes: SNPs distribution analysis in *Bos indicus* Sahiwal cattle breed. *Animal Biotechnology*, **25**(4): 250–265.

6. Chakraborty D, Singh A, Tantia MS, Verma A and Chakravarty AK (2015). Genetic polymorphism of BoLA-DRB3.2 locus in Sahiwal cattle. *Animal Science Reporter*, **9**:33-40.

7. Dhanasekaran S, Biswas M, Vignesh AR, Ramya R, Raj GD, Tirumurugaan KG, Raja A, Kataria RS, Parida S and Subbiah E. (2014). Toll-Like receptor responses to Peste des petits ruminants virus in goats and water buffalo. *PLoS ONE* **9**: e 111609. doi:10.1371/journal.pone.0111609.

8. Dixit SP, Jayakumar S, Tyagi AK, Saroha V, Sharma A and Nagda RK (2015). Association of novel SNPs in the candidate genes affecting caprine milk fatty acids related to human health. *Meta Gene,* **4:**45–56.

9. Dubey PK, Goyal S, Yadav AK, Sahoo BR, Kumari N, Mishra SK, Niranjan SK, Arora R, Mukesh M and Kataria RS (2014). Genetic diversity analysis of the thyroglobulin gene promoter in buffalo and other bovines. *Livestock Science* **167**: 65-72. (http://dx.doi.org/ 10.1016/ j.livsci. 2014.06.007)

10. Dubey PK, Goyal S, Mishra SK, Mukesh M, Mishra BP and Kataria RS (2015). Sequence characterization and expression analysis of mammary gland derived osteopontin gene of river buffalo. *Indian Journal of Animal Sciences,* **85**: 161-164.

11. Gupta AK , Chauhan M, Bhardwaj A, Gupta N, Gupta SC, Pal Y, Tandon SN and Vijh RK (2014). Comparative genetic diversity analysis among six Indian breeds and English Thoroughbred horses. *Livestock Science*. http://dx.doi.org/10.1016/j.livsci.2014.01.028.

12. Iquebal MA, Ansari MS, Sarika, Dixit SP, Verma NK, Aggarwal RAK, Jayakumar S, Rai A and Kumar D (2014). Locus minimization in breed prediction using

artificial neural network approach. *Animal Genetics* doi10.111/age.12208.

13. Jatav P, Sodhi M, Sharma A, Shandilya UK, Kishore A, Mohanty A, Mishra BP, Mann S, Kataria RS, Kaushik J and Mukesh M (2014). Expression Analysis of Solute Carrier (SLC2A) Genes in Milk Derived Mammary Epithelial Cells during Different Stages of Lactation in Sahiwal (Bos indicus) Cows. *Advances in Dairy Research,* **2**: 117. doi: http://dx.doi.org/10.4172/2329-888X.1000117.

14. Joshi J, Salar RK, Banerjee P, Sharma U, Tantia MS and Vijh RK (2015). Assessment of Genetic Variability and Structuring of Riverine Buffalo Population (*Bubalus bubalis*) of Indo-Gangetic Basin. *Animal Biotechnology*, **26**:148-155, DOI: 10.1080/10495398.2014.955613.

15. Kharche SD, Goel AK, Jindal SK, Ranjan R, Rout PK, Agarwal SK, Goel, P, Saraswat S, Vijh, RK, Malakar D, Bag S, Sarkhel B and Bhanja S K (2014). Development of parthenote following in vivo transfer of embryos in Capra hircus. *In Vitro Cellular & Developmental Biology - Animal* **50**: 893-898.

16. Kishore A, Mukesh M, Sobti RC, Kataria RS, Mishra BP, Sodhi M (2014). Analysis of genetic variations across regulatory and coding regions of kappa-casein gene of Indian native cattle (*Bos indicus*) and buffalo (*Bubalus bubalis*). *Meta Gene*, **2**: 769–781.

17. Kishore A, Mukesh M, Sobti RC, Keviletsu Khate, Mishra BP and Sodhi M (2015). Single Nucleotide Polymorphism in Exon 4 and Promoter Regions of β- Lactoglobulin Gene in Native Cattle (*Bos indicus*) Breeds of India. *Advances in Dairy Res*., 2:3; http://dx.doi.org/10.4172/2329-888X.1000125

18. Kumar S, Deb R, Singh U, Ganguly I, Mandal D. K, Singh R, Sharma S, Sengar G, Singh R, Kumar M and Sharma A (2014). SNPs at exonic region of aquaporin-7 (AQP7) gene may affect semen quality parameters among crossbred bulls. *Journal of Genetics,* **93**: e108–e112.

19. Kumar S, Singh U, Ganguly I, Deb R, Singh R, Mann S, Sengar G, Mandal DK, Kumar M and Sharma A (2014). Protamine 3 expression in crossbred bull spermatozoa may not be a prognostic marker for differentiating good and poor quality semen. *African Journal of Biotechnology*, **13**:1999-2003.

20. Kumari N, Goyal S, Dubey PK, Singh S, Niranjan SK, Gupta N, Prasad A and Kataria RS (2014). Cloning and sequence characterization of lactoferrin gene of Indian riverine buffalo. *Indian Journal of Animal Sciences,* **84**: 761-766.

21. Maitra A, Sharma R, Ahlawat S and Tantia MS (2014). Novel genetic polymorphisms in caprine *GPR54* gene associated with reproductive functions. *Indian Journal of Animal Sciences,* **84**: 1196–1201.

22. Maitra A, Sharma R, Ahlawat S**,** Tantia MS, Roy M and Prakash V (2014). Association analysis of polymorphisms in caprine KiSS1 gene with reproductive traits. *Animal Reproduction Science,* **151**: 71–77.

23. Mishra P, Ali AS, Aggarwal RAK, Dixit SP, Dash SK, Dangi PS, Tyagi N and Verma NK (2014) Phenotypic characterization and microsatellite markers based genetic evaluation of Kalahandi goats. *Indian Journal of Animal Science* **85**: 266-270.

24. Mishra P. Dixit SP, Aggarwal RAK, Dangi PS, and Verma NK (2014). Genetic diversity estimation in Black Bengal type goat population using microsatellite markers.

Wayamba Journal of Animal Science, **7**:1044-1050.

25. Prasad S, Ali SA, Banerjee P, Joshi J, Sharma U and Vijh RK (2014). Genetic Characterisation of Malvi Camel using microsatellite markers. *DHR International Journal of Biomedical and Life Sciences*, **5**: 286-296.

26. Prasad S, Ali SA, Banerjee P, Joshi J, Sharma U and Vijh RK (2014). Identification of SNPs and their validation in camel (Camelus bactrianus and Camelus dromedarius). *IOSR Journal of Agriculture and Veterinary Science*, **7**:65-70.

27. Pundir RK, Malik, S, Singh PK, Sharma D and Sadana DK (2014). Indigenous cattle of Tripura-characterisation and performance evaluation. *Indian Journal of Animal Sciences,* **84**:974-977.

28. Pundir RK, Singh PK, Neelkant, Sharma D, Kumar S, Tiwari R, Singh CV and Prakash B (2014). Characterization and evaluation of hill cattle of Garhwal. *Indian Journal of Animal Research,* **48**:322-328.

29. Rana S, Singh S, Dureja V, Joshi J, Banerjee P, Sharma U and Vijh RK (2014). Evolutionary Lineage and relationship of Himalyan Region Goats. Special issue, *DHR-IJBLS*, **5** (1): 336-351.

30. Sahoo BR, Dubey PK, Goyal S, Bhoi GK, Lenka SK, Maharana J, Pradhan SK and Kataria RS (2014). Exploration of the binding modes of buffalo PGRP1 receptor complexed with meso-Diaminopimelic acid and Lysine-type peptidoglycans by molecular dynamics simulation and free energy calculation. *Chemico-Biological Interactions,* **220**: 255-268

31. Saroha V, Kumar D, Sharma A, Jayakumar S, Tyagi AK, Nagda RK and Dixit SP (2014). Quantitative analysis of fatty acid in Indian goat milk and its comparison with other livestock. *Journal of Livestock Science,* **5**: 1-8.

32. SarohaV, Kumar D, Sharma A, Jayakumar S, Tyagi AK, Nagda RK and Dixit SP (2014). Sources of Variation of Fatty Acids in Milk of Indian Goat . *DHR International Journal of Biomedical and Life Sciences* **5**:352-361.

33. Sharma A, Dutt G, Jayakumar S, Saroha V and Dixit SP (2014). Sequence characterization and genetic variability analysis of GHR, IGF1 and IGFBP-3 genes in nine Indian goat breeds. *Journal of Applied Animal Research*, **42**: 361-365.

34. Sharma R, Maitra A, Ahlawat S, Roy M, Mandakmale S and Tantia MS (2015). Identification of novel SNPs in *INHBB* gene of Indian goat. *Indian Journal of Animal Sciences* **85**: 55–59.

35. Singh LV, Sharma A, Singh N, Kaur N, Jayakumar S, Dixit SP, Gupta N and Gupta SC (2014). Comparative sequence analysis in the exon 5 of growth hormone gene in the various livestock species of India. *Animal Biotechnology,* **25**:69-72.

36. Singh S, Raja KN, Ganguly I and Arora R (2014). Prediction of Body Weight from body biometry in Koraput sheep by regression analysis. *Indian Veterinary Journal*, **91**: 24-27.

37. Sodhi M, Kishore A, Sharma A, Shandilya UK, Kumari P and Mukesh M (2015). Differential expression of heat shock proteins in tissues of riverine buffaloes (*Bubalus bubalis). Indian Journal of Animal Sciences*, **85**:397-403

38. Verma NK, Aggarwal RAK, Sharma Rekha, Dangi PS and Bhutia NT (2014). Sikkim Black: A newly explored germplasm of Sikkim state. *Journal of Veterinary Science and Technology,* **5**:110.

39. Verma NK, Mishra P, Aggarwal RAK, Dixit SP, Dangi PS and SK Dash (2015). Characterization, Performance, and genetic diversity among goats of Odisha. *Indian Journal of Animal Science*, **85**: 165-171.

40. Yadav DK and Arora R (2014). Genetic discrimination of Muzaffarnagri and Munjal sheep of northwestern semi arid zone of India based on microsatellite markers and morphological traits. *Indian journal of Animal Sciences*, **84**: 527–532.

41. Yadav P, Kumar P, Mukesh M, Kataria RS, Yadav A, Mohanty AK and Mishra BP (2015). Kinetics of lipogenic genes expression in milk purified mammary epithelial cells (MEC) across lactation and their correlation with milk and fat yield in buffalo. *Research in Veterinary Sciences,* **99**:129-36.

42. Yadav P, Singh DD, Mukesh M, Kataria RS, Yadav A, Mohanty AK and Mishra BP (2014). Expression profiling of glucose transporter 1 (GLUT1) and apoptotic genes (BAX and BCL2) in milk enriched mammary epithelial cells (MEC) in riverine buffalo during lactation. *Animal Biotechnology*, **25**:151-9.

43. Zargar, R, Urwat U, Malik F, Shah RA, Bhat MH, Naykoo N A, Khan F, Khan HM, Ahmed SM, Vijh RK and Ganai NA (2015). Molecular characterisation of RNA binding motif protein 3 (RBM3) gene from Pashmina goat. *Research in Veterinary Science,* **98**:51-58.

Technical / popular Articles

1. Arora R (2014). Microsatellite markers in defining diversity and population structure of farm animals, in compendium of ICAR-Short Course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources. ICAR-NBAGR, Karnal. pp. 45-51.

2. Arora R, Sodhi M and Mukesh M (2014). Analytical approaches for microsatellite markers, in compendium of ICAR- Short Course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources. ICAR-NBAGR, Karnal. pp: 52-60.

3. Deshpandey U and Singh S (2014). NGS short read QC analysis, preprocessing and handling of RNA seq data for differential expression analysis using CLC bio software. in: compendium of lectures for ICAR-Short course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources, ICAR-NBAGR, Karnal, pp: 253-256

4. Ganguly I, Ganguly A and Singh S (2014). Real time PCR based gene expression analysis and an overview of copy number variations in training manual on Molecular tools and bioinformatics approaches for livestock genome analysis, ICAR-CIRC, Meerut. pp: 191-203.

5. Ganguly I, Singh S, Sodhi M and Mukesh M (2014). Expression analysis of candidate genes through Real time Quantitative PCR in compendium of lectures for ICAR-Short course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources, ICAR-NBAGR, Karnal. pp: 206-218.

6. Ganguly I, Sodhi M, Singh S and Raja K N (2014). Genetic Diversity of Mammalian Y-Chromosome with Special Reference to Bovine in compendium of lectures for ICAR-Short course on Advanced Molecular

and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources, ICAR-NBAGR, Karnal. pp: 76-85.

7. Pundir RK (2014). Estimation of breeding values from phenotype to genotype in dairy cattle. In: Compendium of lectures for ICAR-Short course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources, ICAR-NBAGR, Karnal. pp: 169-174.

8. Pundir RK (2015). Predicting breeding values from phenotype and genotype in compendium of lectures of National training program on advanced tools for analysis of phenomic and genomic data, Karnal. pp: 97-102.

9. Raja K N and Ganguly I (2015). Genome Data Analysis using Bioinformatics tools. compendium of lectures for National training programme on advanced tools for analysis of phenomic and genomic data, Karnal. pp: 7-14.

10. Raja KN and Mishra AK (2014). Good conservation practices of indigenous dairy animals for promoting organic farming in compendium of Model training course on Good dairy farming practices: A way forward for organic farming, ICAR- NDRI Karnal, pp: 61-64.

11. Raja KN and Mishra AK (2014). Prospects of backyard poultry for livelihood promotion in rural areas in compendium of Extension management for livestock development ICAR-NDRI, Karnal, pp: 35-47.

12. Sadana DK, Singh PK, Pundir RK and Mishra AK (2015). Crossbreeding versus Indigenous cattle breeds for livelihood security of small holder farmers in XII Agricultural Science Congress (compendium), held at ICAR-NDRI Karnal from 3rd Feb to 6th Feb 2015, pp: 10.

13. Sharma A, Ganguly I, Thakur K, Verma P and Mukesh M (2014). RNA Isolation and Real time-Quantitative Polymerase Chain Reaction in compendium of lectures for ICAR-Short course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources, ICAR-NBAGR, Karnal, pp: 219-223.

14. Singh S and Bedekar MK (2014). DNA microarray and its applications in diseases diagnosis. *International Journal of Science and Research*, **3**: 1572-1573.

15. Singh S and Ganguly I (2014). Next Generation platform for the RNA seq data generation and analysis in compendium of lectures for ICAR-Short course on Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources, ICAR-NBAGR, Karnal, pp: 242-247.

16. Vohra V, Niranjan S K, Mishra A K and Joshi B K. 2014. Belahi: Catle pastoralism in the Himalayan foothills, In: *Proc. Aust Soc Animal Prod.*,**50**: 317.

17. बानिक एस, पंकज पी के, नस्कर एस, पुरूषोत्तम आर और गांगुली आई (2014)। शुकर प्लान का परिदृश्य। पशुधन प्रकाश **5**:33–35.

18. गांगुली ए, बिसला आर एस, भनोट वी, सिंह एस और गांगुली आई (2014)। डेयरी पशुधन में दुग्ध ज्वार और कैल्सियम की कमी को नियन्त्रित करने के उपाय। पशुधन प्रकाश **5**: 106–108.

19. सिंह पी के, पुंडीर आर के, सदाना डी के और असीजा के (2014). राजस्थान राज्य के अवर्णित एवं महत्वपूर्ण गोवंशी समूह: नारी तथा संचौरी। पशुधन प्रकाश, **5**: 1–7.

20. सिंह एस पी, गोयल एस और सिंह एस (2014)। उत्तर प्रदेश में बकरी पालन की उपयोगिता पशुधन प्रकाश **5**: 36–42.

21 सिंह एस, राजा के एन और गांगुली आई (2014)। कोरापुट–एक काम ज्ञात भेड़ नस्ल। पशुधन प्रकाश, **5**: 8–10.

22. वर्मा एन के (2014)। सिक्किम प्रदेश की बकरियों का गुण निर्धारण। पशुधन प्रकाश **5**: 19–22.

23.बीरबल सिंह गोरखमल, मनीषी मुकेश, मोनिका सोढ़ी, एवं सुरेश सिंगला (2014) क्लोनिंग द्वारा पशु जैवविविधता सरंक्षण, पशुधन प्रकाश, **5**: 26–29.

24.मनीषी मुकेश, प्रवेश कुमारी, बी के जोशी, प्रीती वर्मा, संदीप मान एवं मोनिका सोढ़ी (2014) जैव विविधता – मानव जाति की जीवन रेखा: पशु धन प्रकाश, **5**: 60–66

25.मोनिका सोढ़ी, प्रीती वर्मा, संदीप मान, प्रभात कुमार विजय भारती, प्रवेश कुमारी एवं मनीषी मुकेश (2014) लेह – लद्दाख क्षेत्र की कठिन परिस्थितियों में पशु अनुवांशिक संसाधनो का मूल्य और महत्व, पशु धन प्रकाश, **5**: 49–59.

26.सविता देवी, रेखा शर्मा सोनिका अहलावत एमएस टांटिया (2014) बकरी का दूध गाय के दूध का बेहतर विकल्प, पशुधन प्रकाश **5**: 67–72

27.सिंह पीके, पुंदीर राके, सदाना डीके व असिजा के. (2014). राजस्थान राज्य के अवर्णित एवंम महत्वपूर्ण गोवंश समूह: नारी तथा संचौरी,पशुधन प्रकाश, **5**:1

Books Published

1. NAIP Project Component 4 Buffalo as the Focal species - A Synthesis by R K Vijh (2014). The book was submitted to the World Bank by NAIP and consisted of six chapters and presented the history, work carried out in NAIP and future perspective of the projects in the area of Basic and Strategic Research in Buffaloes.

2. Vijh RK and Gokhale S (2014) Identification of Quantitative Trait Loci for milk yield, fat and protein percentage in buffaloes- Buffalo Reference Family - Germplasm Catalogue published by Component 4 NAIP. The book was released in the Final meeting with the World Bank and was released by World Bank, DG ICRISAT, FAO representative, Director General, ICAR at the Terminal Workshop of Component 4 on 19-20th March, 2014.

3. Singh U, Kumar S, Mukhopadhyay CS, Deb R, Alyethodi RR, Alex R, Dhama K and Ganguly I (2015). Bioinformatic approaches for livestock genome analysis. Satish Serial publishing house. ISBN 978-93-84053-01-7

Book Chapters

1. Srivastva AK, Pathak KML, Joshi BK, Singh PK and Kumaresan A (2014). Farm Animal Genetic Resources in India: Diversity, Conservation and Management. In Farm Animal Genetic Resources in SAARC Countries: Diversity, Conservation and Management. Published by SAARC Agricultural Centre, BARC Complex, Farmgate, Dhaka-1215, Bangladesh. Pp: 119-249. ISBN No. 978-984-33-8230-6.Printed at Tithi Printing and Packaging, 28/C-1 Toyen Bee, Circular Road, Motijheel, Dhaka- 1000.

2. Ganguly I, Ganguly A, Singh S and Singha H (2014). Real time PCR for Quantification of m-RNA levels in Bioinformatic approaches for livestock genome analysis. Satish Serial publishing house. ISBN 978-93-84053-01-7. Chapter 7, pp: 157-178.

3. Joshi BK, Sodhi M, Sharma R and Mukesh M(2015). Methodologies and Applications of Transgenesis and Cloning in Farm Animals in section "Methodologies and Applications of Trangenesis and Cloning in Farm Animals" for compiled book "*Biotechnology: Progress and Prospects Eds:*

SM Paul Khurana and Machiavelli Singh , Studium Press LLC, Texas, U.

4. Raja K N and Ganguly I (2015). Basic bioinformatics tools for molecular data analysis in Bioinformatic approaches for livestock genome analysis. Satish Serial publishing house. ISBN 978-93-84053-01-7. Chapter 1, pp: 1-14.

5. Ganguly A and Ganguly I (2015). Climate change and human health in Vegetables and Human Health (Ed. Rana, M.K.). Scientific Publisher, Jodhpur, Rajasthan, Chapter 2, pp. 22-36.

Monograph/Bulletin/Compendium

1. Cattle Genetic Resources of India "BELAHI: migratory cattle from north Himalayan foot hills by Vohra V, Sodhi M, Niranjan SK, Mishra AK , Joshi BK and Sharma A, by ICAR- National Bureau of Animal Genetic Resources, Karnal.

2. Chicken breeds of India – Harringhata Black (# 83) by Vij PK, Tantia MS, Pan S and Vijh RK by ICAR-National Bureau of Animal Genetic Resources, Karnal.

3. Sheep Genetic Resources of India- Koraput sheep by Singh S, Raja KN, Arora R and Ganguly I. Monograph # 85/2015. ISBN-978-93-83537-18-1.

4. Bundelkhandi Goat- An important germplasm of Bundelkhand region by Verma NK and Mishra P Monograph # 84/2014, ISBN: 978-93-83537-19-8.

5. A leaflet entitled 'Sikkim Black goat-A newly explored germplasm (# 86/2015) by Verma NK, Aggarwal RAK, Sharma R, Dangi PS and Bhutia NT.

6. A Training compendium on ICAR sponsored short course on "Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources" by Mukesh M, Sodhi M, Ganguly I, Singh S, Thakur K and Kataria RS held at NBAGR, Karnal from 01 to 10 December, 2014.

7. Development of three dimensional (3D) cell culture of buffalo mammary epithelial cells (BuMECs) and comparative expression analysis with conventional monolayer (2D) cell culture by Mukesh M, Shandilya UK, Sharma A, Sodhi M, Kapila N, Kataria RS, Mann S, Verma P, Kumari P, Mohanty A, Singh S, Malakar D and Kaushik JK.

8. Reference gene panels for application in transcriptomic research in Indian cattle and buffaloes by Mukesh M, Sodhi M, Sharma A, Kishore A, Shandilya UK, Mann S, Kapila N, Jatav P, Yadav P, Aggarwal J, Miglani M, Kaur R, Tantia MS, Kataria RS, Ganguly I, Chandra A, Verma P, Kumari P, Yadav N, Khate K, Mishra BP, Mohanty A , Varshney N, Singh S, Kumar S, Malakar D, Kaushik JK, Dang A and Grover S Published by ICAR-NBAGR, Karnal, Haryana-132001.

9. Establishment of three-dimensional (3D) culture of buffalo mammary epithelial cells by Shandilya UK, Sharma A, Sodhi M, Kapila N, Kishore A, Kataria RS, Mann S, Kumari P, Verma P and Mukesh M (2014). Published by NBAGR, Karnal.

10. Test for differentiation of cattle and buffalo meat & milk by Kataria RS, Dubey PK, Niranjan SK and Sodhi M (2015). NBAGR Leaflet No. 87/2015.

11. Training Manual on Next Generation Sequencing Data Analysis: From Technology to Application Vijh RK and Jeere A (2015) for the training held from 28th to 30th January, 2015.

Patents and Technologies

Seven patent applications were published in the Journal of Indian Patent Office and the first examination requests for three patent applications were submitted to the Indian Patent Office, New Delhi. The details of these applications are as follows as:

1. Technology entitled "A Kit for parentage verification in Goats" (application number 50/DEL/2013) invented by Dr. R.K. Vijh *et al* was published on 22nd August 2014 and FER was filed on 5th Jan 2015.
2. Technology entitled "A Kit for parentage verification in Indian Ruminant Livestock" (application number 298/DEL/2013) invented by Dr. R.K. Vijh *et al* was published on 22nd August 2014 and FER was filed on 5th Jan 2015.
3. Technology entitled "PCR based DNA test for the differentiation of cattle and buffalo meat and milk" (application number 607/DEL/2013) invented by Dr. R.S. Kataria *et al* was published on 12th September 2014 and FER was filed on 14th November 2014.
4. Technology entitled "QTLs for milk yield in buffaloes" (application number 1889/DEL/2013) invented by Dr. R.K. Vijh *et al* was published on 2nd January 2015.
5. Technology entitled "QTLs for somatic cell count in buffaloes" (application number 1890/DEL/2013) invented by Dr. R.K. Vijh *et al* was published on 2nd January 2015.
6. Technology entitled "QTLs for milk fat percent in buffaloes" (application number 2426/DEL/2013) invented by Dr. R.K. Vijh *et al* was published on 20th February 2015.
7. Technology entitled "QTLs for milk protein percent in buffaloes" (application number 2427/DEL/2013) invented by Dr. R.K. Vijh *et al* was published on 20th February 2015.

Awards

1. **राकेश कुमार पुंडीर, प्रमोद कुमार सिंह व देविंदर कुमार सडाना. 2014. राजस्थान की कांकरेज, सांचोरी व नारी गायों में बहु–रुपीविधि द्वारा शारीरिक माप के आधार पर विभेदीकरण. प्रथम पुरस्कार, अनुसंधान लेख, राजभाषा विभाग, सितम्बर, 2014, राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल 132001 हरियाणा।**
2. Raja K N, Singh P K, Mishra A K, Ganguly I, Devemndran P, Saravanan R and Kathirvel S.2015. Best Poster award: 2015: Charecteriztion of Chippiparai dog breed- an unexplored canine genetic resources of Inda, in international symposium on Sustainable management of Animal genetic Resources for livelihood security in developing countries & XII annual convention of SOCDAB, held at TANUVASU, Chennai, Feb.13-14, .2015.
3. Award for the Best Stall of the Exhibition during the National Sheep and Wool Fair at CSWRI, Avikanagar on 12th November 2014.
4. Ankita Sharma, Jigyasa Aggarwal, BP Mishra, Monika Sodhi, Anita Yadav, Amit Kishore, Ashok K Mohanty, Ajay Dang, Ranjit S Kataria and Manishi Mukesh. Best poster award on "Establishing stage specific transcriptome signature of buffalo mammary gland using heterologous bovine microarray platform" during XII Agricultural Science Congress at NDRI Karnal from Feb 3-6, 2015.

Result Framework Document

- RFD 2014-15
- RFD evaluation report 2013-14

भाकृअनुप
ICAR

Result Framework Document (RFD)

for

National Bureau of Animal Genetic Resources, Karnal

(2014-2015)

Address: P.B. No. 129, GT Road byepass, Near Basant Vihar

Karnal – 132 001

Website: www.nbagr.res.in

Section 1: Vision, Mission, Objectives and Functions

Vision

Striving for excellence in innovative research to identify genetic potential of indigenous livestock for improvement and conservation.

Mission

To protect and conserve indigenous animal genetic resources for sustainable utilization and livelihood security

Objectives

1. Identification, evaluation, characterization and conservation of indigenous farm livestock genetic resources
2. Documentation on institute activities.
3. Human resource development in the area of identification, evaluation, characterization and utilization of animal genetic resources.

Functions

1. Characterization and evaluation of livestock and poultry breeds of the country.
2. Conservation of economically important and endangered breeds of farm animal species.
3. Characterization of functionally important genes of farm animal species.
4. Establishment and maintenance of data bank on farm animal genetic resources of India.
5. Capacity building in the field of molecular biotechnology for breed characterization at genome level.
6. Creating awareness about the maintenance, conservation and management of farm animal genetic resources.

Section 2: Inter se priorities among Key Objectives, Success Indicators and Targets

S. No.	Objective (s)	Weight	Action (s)	Success Indicator (s)	Unit	Weight	Target/Criteria value				
							Excellent	Very Good	Good	Fair	Poor
							100%	90%	80%	70%	60%
1	Identification, evaluation, characterization and conservation of indigenous farm livestock genetic resources	60	Phenotypic/ genetic characterization and evaluation of AnGR	Breed / population / strain characterized	Number	20	8	7	6	5	4
			Part / complete characterization / expression profiling of gene	Gene fragment characterized	Number	20	38	32	26	20	14
			Conservation of germplasm	Semen doses cryopreserved / disseminated	Number	20	16200	13500	10800	8100	5400
2	Documentation on institute activities	12	Breed descriptors / monographs / bulletins / manuals / leaflets	Documents published	Number	12	13	11	9	7	5
3	Human resource development in the area of Identification, evaluation, characterization and utilization of animal genetic resources	8	Awareness programmes & capacity building on AnGR through trainings and exhibitions	Awareness programmes / events organized	Number	8	11	9	7	5	3
*	Publication and Documentation	5	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	No.	3	20	18	16	14	12

S. No.	Objective (s)	Weight	Action (s)	Success Indicator (s)	Unit	Weight	Target/Criteria value				
							Excellent	Very Good	Good	Fair	Poor
							100%	90%	80%	70%	60%
			Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	2	30 June, 2014	02 July, 2014	04 July, 2014	07 July, 2014	09 July, 2014
*	Fiscal resource management	2	Utilization of released plan fund	Plan fund utilized	%	2	99	98	96	94	92
*	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD for 2014-2015 for Approval	On-time submission	Date	2	15 May, 2014	16 May, 2014	19 May, 2014	20 May, 2014	21 May, 2014
			Timely submission of Results for 2013-2014	On-time submission	Date	1	May, 1 2014	May 2, 2014	May 5, 2014	May 6, 2014	May 7, 2014
*	Enhanced Transparency / Improved Service delivery of Ministry/ Department	3	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	2	100	95	90	85	80
			Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	1	100	95	90	85	80
*	Administrative Reforms	7	Update organizational strategy to align with revised priorities	Date	Date	2	Nov.1 2014	Nov.2 2014	Nov.3 2014	Nov.4 2014	Nov.5 2014

S. No.	Objective (s)	Weight	Action (s)	Success Indicator (s)	Unit	Weight	Target/Criteria value				
							Excellent	Very Good	Good	Fair	Poor
							100%	90%	80%	70%	60%
			Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC).	% of Implementation	%	1	100	90	80	70	60
			Implementation of agreed milestones for ISO 9001	% of implementation	%	2	100	95	90	85	80
			Implementation of agreed milestones of approved Innovation Action Plans (IAPs).	% of implementation	%	2	100	90	80	70	60

Section 3: Trend Values of the Success Indicators

S. No.	Objective	Action	Success Indicator	Unit	Actual Value for FY 2012-2013	Actual Value for FY 2013-2014	Target Values for FY 2014-2015	Projected Values for FY 2015-2016	Projected Value for FY 2016-2017
1	Identification, evaluation, characterization and conservation of indigenous farm livestock genetic resources	Phenotypic/ genetic characterization and evaluation of AnGR	Breed/ population/ strain characterized	Number	5	7	7	8	9
		Part/complete characterization / expression profiling of gene	Gene fragment characterized	Number	18	32	32	34	35
		Conservation of germplasm	Semen doses cryopreserved / disseminated	Number	11500	15000	13500	14000	14500
2	Documentation on institute activities	Breed descriptors / monographs / bulletins/ manuals/leaflets	Documents published	Number	9	11	11	12	13
3	Human resource development in the area of Identification, evaluation, characterization and utilization of animal genetic resources	Awareness programmes & capacity building on AnGR through trainings and exhibitions	Awareness programmes / events organized	Number	7	9	9	10	11
*	Publication and Documentation	Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Research articles published	No.	35	18	18	20	22
		Timely publication of the Institute Annual Report (2013-2014)	Annual Report published	Date	-	-	30 June, 2014	-	-
*	Fiscal resource management	Utilization of released plan fund	Plan fund utilized	%	98.7	98.8	96	98	99

S. No.	Objective	Action	Success Indicator	Unit	Actual Value for FY 2012-2013	Actual Value for FY 2013-2014	Target Values for FY 2014-2015	Projected Values for FY 2015-2016	Projected Value for FY 2016-2017
*	Efficient Functioning of the RFD System	Timely submission of Draft RFD for 2014-2015 for Approval	On-time submission	Date	-	-	16 May, 14	-	-
		Timely submission of Results for 2013-2014	On-time submission	Date	-	-	May 2, 2014	-	-
*	Enhanced Transparency / Improved Service delivery of Ministry/Department	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Degree of implementation of commitments in CCC	%	-	-	95	-	-
		Independent Audit of implementation of Grievance Redress Management (GRM) system	Degree of success in implementing GRM	%	-	-	95	-	-
*	Administrative Reforms	Update organizational strategy to align with revised priorities	Date	Date	-	-	Nov.2, 2014	-	-
		Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC).	% of Implementation	%	-	-	90	-	-
		Implementation of agreed milestones for ISO 9001	% of implementation	%	-	-	95	-	-
		Implementation of milestones of approved Innovation Action Plans (IAPs).	% of implementation	%	-	-	90	-	-

Section 4 (a): Acronyms

S.No	Acronym	Description
1	AnGR	Animal Genetic Resources
2	A.H	Animal Husbandry
3	KVK	Krishi Vigyan Kendra
4	NGO	Non Government Organization
5	SAU	State Agricultural University
6	ICAR	Indian Council of Agricultural Research
7	IPR	Intellectual Property Right
8	NBAGR	National Bureau of Animal Genetic Resources
9	SVUs	State Veterinary Universities
10	CCC	Citizens' / Clients' Charter
11	IAPs.	Innovation Action Plans
12	MSC	Mitigating Strategies for Reduction of potential risk of corruption

Section 4 (b): Description and definition of success indicators and proposed measurement methodology

	Success Indicator	Description	Definition	Measurement	General Comments
1	Breed / population / strain characterized	Evaluation and characterization means data generation on morphological, bimerical traits, on animals in their respective native tract. Genetic characterization will involve microsatellite based genotyping. Information on performance traits through interaction with farmers is also included.	Country has a large animal diversity which needs to be defined in terms of phenotypic and genotypic characterization so as to assign them the status of a breed or a population with unique characteristics and thereafter initiate programme for their improvement and conservation depending on their number.	Number	The undefined animal population across different species needs to be defined as breeds / populations with unique characters so as to have a well defined breeding plan for their improvement / conservation.

	Success Indicator	Description	Definition	Measurement	General Comments
2	Genes fragment characterized	The gene fragment is characterized to know the genetic diversity at allele/ nucleotide/aminoacid level.	The traits are controlled by whole/ part gene. To understand the level and extent of genetic variability exhibited by a trait it is necessary to know the expression profile of a gene fragment controlling a particular trait.	Number	Gene characterization forms a part of genetic diversity study.
3	Semen doses cryopreserved/ disseminated	The ex situ conservation will be in the form of cryopreservation of semen. Semen will also be distributed for utilization in the field.	Cryopreservation of semen is an ex situ method of conserving the breed for either posterity or/and their use for faster multiplication of germ plasm.	Number	These are the methodologies used for conservation/improvement/ faster multiplication of breeds/ strains outside their natural habitats depending on the need in view of their available numbers or uniqueness of character(s).
4	Documents published	Documents includes the breed descriptor, breed monograph, leaflet, training manual etc.	After completing the characterization of a breed/population/strain, the information generated need to be compiled in the form of a document which may be in the form of descriptor / monograph/ leaflet. Training manual is prepared for the trainee participants. It provides the information on knowhow in the field of AnGR characterization and conservation.	Number	Documentation is important in this era of IPR/patent to save the interest of stake holders.
5	Awareness programmes / events	Programmes / events refer to the exhibitions / fares organized to create the awareness and capacity building among masses on AnGR.	The awareness programmes help in updating the knowledge of the stake holders, field functionaries and animal husbandry department officials dealing with the indigenous animal genetic resources	Number	Awareness programmes are necessary for sensitization of the people involved in the conservation and improvement programmes of animal genetic resources.

Section 5: Specific performance requirements from other departments that are critical for delivering agreed results

Location Type	State	Organization Type	Organization Name	Relevant Success Indicator	What is your requirement from this organization	Justification for this requirement	Please quantify your requirement	What happens if your requirement is not met
STATE	All states of India	SAUs/State departments of AH, KVKs and NGOs, SVUs	SAUs/State departments of AH, KVKs	Breed/ population/ strain characterized	To locate true to type animals for measurements and blood sampling and to interact with farmers in their local language..	Since the AnGR is located in different states of the country. Interaction is required with farmers in their local language	20%	The target value will be affected.
STATE	All states of India	ICAR Institutions/ SAUs/State AH departments of AH, KVKs and NGOs,SVUs	ICAR Institutions, SAUs/State departments, and NGOs	Semen doses cryopreserved / disseminated	Collaboration for collection of semen doses.	NBAGR is not having any animal farm of its own. Since the AnGR is located in different states and Institutions of the country	20%	The target value will be affected.

Section 6: Outcome / Impact of activities of Department/Ministry

S.N.	Outcome/Impact	Jointly responsible for influencing this outcome/ impact with the following Organizations/Departments/ Ministry (ies)	Success Indicator (s)	Unit	2012-13	2013-14	2014-15	2015-16	2016-17
1	Enhancement in number of descript breeds	State AH departments, Livestock Development Board, State Veterinary Universities, NGOs	Breed / Population / strain characterized	Number	5	7	7	8	9
2	Cryopreserved germplasm for posterity.	State Livestock semen banks	Semen doses preserved/ disseminated	Number	11500	15000	13500	14000	14500
3	Documents developed on AnGR	-	Documents published	Number	9	11	11	12	13
4	Enhanced knowledge and capacity building on indigenous AnGR	-	Awareness programmes organized & capacity building on AnGR through trainings and exhibitions	Number	7	9	9	10	11

Annual RFD Performance Evaluation Report for 2013-14

Name of the Division: Animal Science Division

Name of the Institution: National Bureau of Animal Genetic Resources, Karnal

RFD Nodal Officer: Dr. NK Verma,

S. No.	Objective(s)	Weight	Action(s)	Success Indicator(s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
1.	Identification, evaluation, characterization and conservation of indigenous farm livestock genetic resources	70	Phenotypic and genetic characterization and evaluation of AnGR	Breed/ population/ strain characterized	Number	40	7	6	4	3	2	7	100	40	116.6	-
			Part/complete characterization and expression profiling of gene	Genes fragment characterized	Number	20	32	30	28	26	24	32	100	20	106.7	-
			Conservation of germplasm	Semen doses conserved/ disseminated	Number	10	12500	12000	10000	9000	8000	15000	100	10	125	Additional efforts and availability of semen
2.	Documentation on institute activities	10	Breed descriptors / monographs / bulletins/ manuals/leaflets	Documents published	Number	10	12	10	8	7	6	11	95	9.5	110	-

S. No.	Objective(s)	Weight	Action(s)	Success Indicator(s)	Unit	Weight	Target / Criteria Value						Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%	Achievements	Raw Score	Weighted Score		
3.	Human resource development in the area of Identification, evaluation, characterization and utilization of animal genetic resources	9	Ttrainings and exhibitions related with animal genetic resources.	Programmes/ events organized	Number	9	9	8	7	6	5	9	100	9	112.5	-
4.	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	2	15/05/13	16/05/13	17/05/13	20/05/13	21/05/13	06/05/13	100	2	100	-
			Timely submission of Results for RFD (2012-13)	On-time submission	Date	1	01/05/13	02/05/13	05/05/13	06/05/13	07/05/13	17/04/13	100	1	100	-
5.	Administrative reforms Improving internal efficiency / responsiveness / service delivery of Ministry / Department	4	Implement ISO 9001 as per the approved actioWn plan Prepare an action plan for Innovation	% Implementation	%	2	100	95	90	85	80	100	100	2	100	-
				On time submission	Date	2	30/07/13	10/08/13	20/08/13	30/08/13	10/09/13	24/07/13	100	2	100	-

S. No.	Objective(s)	Weight	Action(s)	Success Indicator(s)	Unit	Weight	Target / Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%		Raw Score	Weighted Score		
6.	Improving internal efficiency / responsiveness / service delivery of Ministry / Department	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	%	2	100	95	90	85	80	100	100	2	100	-
				Independent Audit of public grievance redressal system	%	2	100	95	90	85	80	100	100	2	100	-

Total Composite Score: 99.50%

Rating: Excellent

Training and Capacity Building

- Trainings and Workshops Organized
- Trainings Attended
- Exhibitions Organized

Trainings and Workshops Organized

1. A three day training program entitled "Next Generation Sequencing Analysis: From Technology to Application" was organized at NBAGR Karnal in collaboration with Persistent System, Pune during 28th to 30th January, 2015. Total 11 Scientists from all over India were participated in the Training.

2. One day workshop on 'Characterization of Manipuri Chicken' was organized on 21.11.2014 at Keishamthong, Imphal (W) in collaboration with CAU, Imphal to generate awareness among breeders and apprise them about the importance of local chicken and the need for characterising and documenting indigenous chicken of Manipur.

3. An interactive workshop on 'Breed Registration Process' was organized jointly by DAHD&F, GOI and NBAGR on 28.01.2015 at NBAGR, Karnal. It was attended by a total of 56 participants which included Secretary, Joint Secretary, AHC and Asstt. Commissioner from DAHD&F, GOI; Principal Secretary (DAHD&F), Govt. of Haryana; Directors of SAHDs; CEOs of SLDBs; Officials from CCBFs, CHRS, CFSP&TI and Director and Scientists from NBAGR.

4. NBAGR in collaboration with ICAR and National Academy of Veterinary Sciences (NAVS) organized an Expert Consultation Meet on "Strategies for Enhancing Milk Productivity of Indigenous Cattle" on 20th October, 2014 at A.P. Shinde Hall, NASC Complex, New Delhi. Dr. Sanjeev Kumar Balyan, Hon'ble Union Minister of State (Agri & FPI) inaugurated the meet. Dr. S. Ayyappan, Secretary, DARE & DG, ICAR, Sh. Anup Kumar Thakur, Secretary, DAHDF, Dr. K M L Pathak, DDG(AS), Former DDGs, ADGs, CEOs, Directors, representatives from Gaushalas and NGOs attended the consultation meet.

5. A brainstorming session on Animal Genetic Resources of Sikkim state on 19th Nov, 2014

at Gangtok in collaboration with Sikkim Livestock Development Board, Gangtok. The programme was attended by Additional Director, DAHLF&VS, Deputy Directors and senior veterinary officers of Sikkim.

6. Organized ICAR sponsored short course on "Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources" from 01 to 10 December, 2014. A total of 21 participants from NAAS System (from ICAR institutes and SAUs) and other organizations

& general universities working in the area of animal science and biotechnology attended this course. Course Director was Dr Manishi Mukesh and Drs Monika Sodhi, RS Kataria, Indrajit Ganguly and Sanjeev Singh were the Course Coordinators.

Trainings Attended

Dr. Jaya Kumar, Scientist attended 21 days winter school on "Whole Genome Analysis and Functional "Omics" Technologies for Future Designer Milk Food" at NDRI between October 28, 2014 - November 17, 2014.

Drs. Monika Sodhi, Vikas Vohra and Indrajit Ganguly attended a three day training program entitled "Next Generation Sequencing Analysis: From Technology to Application" at NBAGR, Karnal during 28 - 30th January, 2015.

Dr. Jaya Kumar, Scientist attended 10 days short Course on "Advanced Molecular and Bioinformatics Approaches for Genome Characterization of Indigenous Animal Genetic Resources" at NBAGR between 01 to 10 December, 2014.

Dr. Jaya Kumar, Scientist attended Workshop on "Training Needs Assessment" for HRD Nodal Officers of ICAR organized on 26th February, 2015 at NAARM, Hyderabad.

Exhibitions Organized

Exhibitions on AnGR were organized at various places to sensitize farmers about the benefits of indigenous animals:

1. International Biodiversity Day, 22nd May 2014 at NBAGR, Karnal.

2. NBAGR Foundation Day 20th September 2014 at NBAGR, Karnal.
3. ICAR Institutes-SAU- Development departments and stake holders meet on 18th October 2014 at NDRI, Karnal.
4. Rabi Kisan Mela held at Indian Institute of Wheat & Barley Research, Karnal on 30th October 2014.
5. At National sheep and wool fair at CSWRI Avikanagar, 12 November 2014.
6. At NDRI Karnal Krishi Mela, organized by Agriculture Department Haryana on 27 November 2014
7. National Livestock championship held at Mukatsar, Punjab, 8-12 January, 2015.
8. Dairy Mela held at National Dairy Research Institute, Karnal from 25-27 February, 2015.
9. Agri Leadership Summit 2015 at leisure valley Gurgaon, organized by Agriculture Department Haryana on 13-15 March, 2015.

Other Activities

- Library
- Important Meetings
- Celebrations
- Swachh Bharat Abhiyan
- Distinguished Visitors
- Visits Abroad

Library

The NBAGR library has been playing an important role in serving the scientists and technical staff of the Bureau. Library Advisory Committee (LAC) is guiding force in the management of the library issues pertaining to purchase of scientific books/journals etc. The Bureau LAC was reconstituted on 19.5.2014.

Books and journals worth Rs. 10, 21,195/- were procured in the library during the period. Eleven foreign journals and thirty one Indian Journals have been subscribed for the benefit of scientific readers.

Total collection	4111
No. of books added	114
No. of Indian Journals subscribed	31
No. of Foreign journals subscribed	11
No. of News papers subscribed	07

Important Meetings

IRC Meeting

Institute research committee (IRC) meeting was held on 28th & 29th November, 2014 under the Chairmanship of Dr. Arjava Sharma, Director NBAGR. Progress report of on-going research projects was reviewed and also discussed the final report of completed projects.

IBSC Meeting

The Institutional Biosafety Committee of NBAGR, constituted for monitoring the research projects of the Bureau engaged in cloning/ recombinant DNA work/transgenics, which involve biosafety guidelines, held its six monthly meetings on 02.07.2014 and 30.01.2015. The research projects falling under the purview of IBSC were reviewed and necessary permissions granted.

Celebrations

Independence Day & Republic Day

Bureau celebrated the Independence Day on 15th August 2014 and Republic Day on 26th January, 2015 at office campus. Director, presided over the functions and hoisted the tricolor. The wards of staff presented the cultural programme. The prizes were distributed to the participants.

Taru Diwas

ICAR-NBAGR and Haryana Forest Department, Karnal celebrated ***"Taru Diwas"*** on 15.07.2014. Dr. Arjava Sharma, Director, ICAR-NBAGR presided over the function. Sh. Naresh Ranga, DFO, Karnal was the guest on the occasion and provided all logistics and plant saplings. Dr. Dinesh Kumar Yadav, Principal Scientist coordinated the function. Around 200 flowering, non-flowering and fruit trees were planted in front of and around the ICAR-NBAGR office building.

ICAR Foundation Day

The 86th ICAR foundation day was celebrated on 16.07.2014. Dr. Arjava Sharma, Director highlighted the activities of the Bureau and called upon the scientists to bring more laurels to NBAGR and ICAR. On this occasion, a special drive to plant trees in the campus was carried out. Sh. Navdeep Hooda, Conservator, Haryana Forest Department graced the occasion. Around 400 flowering, non-flowering and fruit trees were planted in the Bureau campus.

National Science Day

The Bureau celebrated 'National Science Day' on 28th February, 2015. More than 80 undergraduate and post-graduate students and teachers of five different degree colleges participated in the event, marked by activities like speech competition on the theme 'Science for Nation Building' and a poster competition on biodiversity. Lectures were delivered by Director NBAGR on Farm Animal Biodiversity to make students aware about livestock genetic resources of the country and also on career opportunities in biotechnology. The day was kept as 'Open day' for the outside students, wherein they visited various laboratories to understand about the activities of the institute. The students participated enthusiastically in the poster presentation competition. The winners of the competitions were awarded suitably with certificates and shields.

Swachh Bharat Abhiyan

As part of "Swachh Bharat Abhiyan" a campus cleanliness campaign was initiated, where in all the bureau staff participated actively. Second Saturday of every month has been ear-marked for such activities. Every staff member of the Bureau was appealed to contribute at least 100 hours in a year to this cause of national importance. A human chain by bureau staff was also formed in front of bureau premises on the National Highway (NH-1) to create awareness .

Distinguished Visitors

Following distinguished personalities visited the Bureau during the year and interacted with scientists.

1. Dr. R Kasiraj, General Manager (AB), National Dairy Development Board, Anand visited on 25.04.2014.

2. The World Bank Team consisting of Dr. Mohinder S. Mudahar and Dr. Miki Terasawa, World Bank Experts accompanied by NAIP Team consisting of Dr. S. Kochhar, National Coordinator, Component-4, Dr. P. S. Pandey, National Coordinator, Component-1 and Dr. P. Katihaa, Principal Scientist visited the Bureau on 23.08.2014.

3. Ms. Manjula Chawla, Serials Librarian, U.S. Library of Congress, American Center visited NBAGR, Karnal on 29.08.2014.

4. Mr. Paisho Keishing from North East Border Area Development Organization (NEBADO) Kasom Khillen Sub Division, Manipur, visited the Bureau on 15.09.2014.

5. Sh. Devinder Sharma, Agriculture and Livestock Expert and a well known Journalist {Hindustan Times Newspaper and the NDTV Channel} visited NBAGR, Karnal on 15.11.2014.

6. PNB Progressive Farmers from Centre for Agriculture and Rural Development (CARD), Noida visited NBAGR, Karnal on 25.11.2014.

7. Dr. Jimmy Smith, Director General, ILRI visited Various Laboratories of the Bureau on 04.02.2015.

8. Dr. Gurbachan Singh, Chairman, ASRB visited us on 05.02.2015.

9. State Progressive farmers from Baiti village, Uttar Pradesh visited the NBAGR, Karnal on 07.02.2015, to aquainted with Bureau activities.

10. A team of scientists from National Institute of Biotechnology, Bangladesh visited NBAGR, Karnal on 26.02.2015.

11. Dr. Diane Wray-Cohen, Senior Science Advisor, New Technologies and Production Methods Division, Foreign Agricultural Service, USDA, Washington; Mr. Joshua Lagos, Agricultural Attache, Dr. Santosh Kumar Singh and Dr. Vijay Intodia, Agricultural Specialists, USDA, New Delhi and Dr. SR Rao, Senior Advisor, Dept. of Biotechnology, Govt. of India visited the Bureau on 27.02.2015.

Visits Abroad

Dr. Arjava Sharma, Director, visited Vienna (Austria) during August 9-17, 2014 to impart training to the international participants of IAEA-sponsored training in the capacity of Expert Lecturer.


86
भारतीय कृषि अनुसंधान परिषद्

Personnel

- Bureau Staff
- Promotions
- Joinings/Transfers
- Superannuation


WELCOME

Bureau Staff (as on 31.03.2015)

Scientific Staff

Sl. No.	Name of Scientist	Designation
1.	Dr. Arjava Sharma	Director
2.	Dr. R.K. Vijh	Principal Scientist
3.	Dr. Anand Jain	Principal Scientist
4.	Dr. M.S. Tantia	Principal Scientist
5.	Dr. P.K. Vij	Principal Scientist
6.	Dr. N. K. Verma	Principal Scientist
7.	Dr. R.A.K. Aggarwal	Principal Scientist
8.	Dr. P.K. Singh	Principal Scientist
9.	Dr. R.K. Pundir	Principal Scientist
10.	Dr. R.S. Kataria	Principal Scientist
11.	Dr. Anil Kumar Mishra	Principal Scientist
12.	Dr. Monika Sodhi	Principal Scientist
13.	Dr. Jyostna Behl	Principal Scientist
14.	Dr. Satpal Dixit	Principal Scientist
15.	Dr. Dinesh Kumar Yadav	Principal Scientist
16.	Dr. Manishi Mukesh	Principal Scientist
17.	Dr. Reena Arora	Principal Scientist
18.	Dr. Avnish Kumar	Principal Scientist
19.	Dr. Rahul Behl	Senior Scientist
20.	Dr. Rekha Sharma	Senior Scientist
21.	Dr. Vikas Vohra	Senior Scientist
22.	Dr. Saket Kr. Niranjan	Senior Scientist
23.	Dr. Indrajit Ganguly	Senior Scientist
24.	Dr. Sanjeev Singh	Senior Scientist
25.	Dr. P. Kathiravan	Senior Scientist
26.	Dr. Karan Veer Singh	Scientist (S.S.)
27.	Dr. K.N. Raja	Scientist (S.S.)
28.	Dr. Jayakumar S.	Scientist
29.	Dr. Sonika Ahlawat	Scientist

Technical Staff

Sl. No.	Name	New Designation
1.	Dr. P. S. Dangi	Asstt. Chief Technical Officer
2.	Sh. S. K. Jain	Asstt. Chief Technical Officer
3.	Dr. P.S. Panwar	Senior Technical Officer
4.	Sh. Sanjeev Mathur	Senior Technical Officer
5.	Sh. Harvinder Singh	Senior Technical Officer

Sl. No.	Name	New Designation
6.	Sh. Sat Pal	Technical Officer
7.	Sh. Jamer Singh	Technical Officer
8.	Smt. Pravesh Kumari	Technical Officer
9.	Sh. Naresh Kumar	Technical Officer
10.	Sh. Ramesh Kumar	Technical Officer
11.	Sh. Rakesh Kumar	Senior Technical Assistant
12.	Sh. Subhash Chander	Senior Technical Assistant
13.	Sh. Ashok Kumar	Senior Technical Assistant
14.	Sh. Mahavir Singh	Senior Technical Assistant
15.	Sh. Om Prakash	Senior Technical Assistant
16.	Sh. Ramesh Chand	Senior Technical Assistant
17.	Sh. Balvinder Singh	Technician

Administrative Staff

S. No.	Name	Designation
1.	Sh. Jagtar Singh	Admn. Officer
2.	Sh. Sunil Kumar	F&AO
3.	Sh. Karambir	PS to Director
4.	Sh. Balkar Singh	AAO
5.	Sh. Pawan Kr. Gupta	AF&AO
6.	Sh. Ramesh Behl	Assistant
7.	Smt. Anita Chanda	PA
8.	Smt. Amita Kumari	PA
9.	Smt. Indu Bala, Steno	Steno Gr.III
10.	Smt. Shashi Bala	Assistant
11.	Sh. Jita Ram	Assistant
12.	Sh. Yoginder	Assistant
13.	Sh. Sopal	UDC
14.	Sh. Satish Kumar	UDC
15.	Sh. Shiv Chander	LDC
16.	Sh. Rajnish Kumar	LDC
17.	Smt. Neerja Kaul	LDC
18.	Sh. Naresh Kumar	LDC
19.	Sh. Babu Ram	LDC

Skilled Support Staff

1.	Sh. Krishan Lal	SSS
2.	Sh. Sewa Ram	SSS
3.	Sh. Ram Sagar	SSS
4.	Sh. Deepak	SSS
5.	Sh. Satbir	SSS

Promotions

1. Dr. Manishi Mukesh, National Fellow has been promoted to the next higher post of Principal Scientist w.e.f. 09.09.2012 vide ICAR O.O. dated 02.04.2014 & this O.O. dated 15.02.2014.

2. Dr. Dr. K. N. Raja, Scientist (SS) has been promoted to the next higher grade of Rs. 15600-39100+RGP 7000/- w.e.f. 06.01.2012 vide ICAR O.O. dated 21.04.14 & this O.O. dated 28.04.2014.

3. Dr. Vikas Vohra, Senior Scientist has been promoted to the next higher grade of Rs. 37400-67000+RGP 9000/- w.e.f. 02.04.2014

4. Dr. S. K. Niranjan, Senior Scientist has been promoted to the next higher grade of Rs. 37400-67000+RGP 9000/- w.e.f. 04.04.2014

5. Dr. Indrajit Ganguly, Senior Scientist has been promoted to the next higher grade of Rs. 37400-67000+RGP 9000/- w.e.f. 21.04.2014

6. Dr. Sanjeev Singh, Senior Scientist has been promoted to the next higher grade of Rs. 37400-67000+RGP 9000/- w.e.f. 29.06.2014

7. Sh. Ramesh Kumar, Senior Technical Assistant has been promoted to the next higher grade of Technical Officer w. e. f. 16.09.2013.

8. Sh. Harvinder, Technical Officer has been promoted to the next higher grade of Senior Technical Officer w. e. f. 14.05.2014.

9. Sh. Ram Sagar, SSS has been granted Financial Upgradation of Rs.5200-20200+2000/- GP w.e.f. 01.11.2014.

10. Sh. Deepak Rai, SSS has been granted Financial Upgradation of Rs.5200-20200+2000/- GP w.e.f. 01.11.2014.

11. Sh. Satbir, SSS has been granted Financial Upgradation of Rs.5200-20200+2000/- GP w.e.f. 16.12.2014.

Joinings/Transfer

1. Dr. Birham Prakash, Principal Scientist was selcted for the post of Director, ICAR-CIRC, Meerut. He was relieved from ICAR-NBAGR, Karnal on 14.08.2014 (AN) to join CIRC Meerut.

Superannuation

1. Sh. Moti Ram, Technical Officer attained superannuation from ICAR on 30.06.2014

2. Dr. D. K. Sadana, Principal Scientist attained superannuation from ICAR on 31.12.2014


स्थापना दिवस समारोह

हिन्दी खण्ड

- प्राक्कथन
- कार्यकारी सारांश
- हिन्दी अनुभाग की गतिविधियाँ


हिन्दी चेतना प्रतियोगिताएं
12-20 सितंबर 201
भा कृ अनु प - राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल (हरियाणा)

प्राक्कथन

राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो की गतिविधियों और उपलब्धियों से युक्त 2014–15 का वार्षिक प्रतिवेदन प्रस्तुत करते हुए मुझे अपार हर्ष हो रहा है। वर्ष 1984 में अपनी स्थापना के बाद से संस्थान भारतीय पशु संपदा के अनुवांशिक संसाधनों की विभिन्न विशेषताओं तथा आनुवंशिक क्षमताओं की पहचान करने के लिए निरंतर प्रयासरत है। इस वर्ष के दौरान जनादेश के अनुसार कजली भेड़, सिंघारी बकरी, राजपलयम और चिप्पीपरई श्वान के साथ–साथ देसी पशुओं की कम–ज्ञात आबादी के प्रारुपी लक्षण निर्धारण कार्य को पूरा किया गया है। सीरी गाय, माऊली एवं येल्गा भेड, सिक्किम बकरी और कोनायेन मुर्गी के लक्षण निर्धारण का कार्य प्रगति पर है। ब्यूरो के जीन बैंक में एक्स–सीटू संरक्षण कार्यक्रम के अंतर्गत गोवंश (गाओलाओ और थारपारकर) तथा टोडा भैंस की 7600 वीर्य खुराकों को शामिल किया गया है। संरक्षण और विकास कार्य के लिए जाफराबादी भैंस का वीर्य इसके प्रजनन क्षेत्र में उपयोग किया गया है। इस अवधि के दौरान पशुओं और मुर्गियों की सात नयी नस्लों तथा मुर्गी की एक मेल पेरेंट लाइन का पंजीकरण भी ब्यूरो द्वारा किया गया है। इनमें बिलाही तथा गंगातीरी गाय, कचईकटी ब्लैक भेड़, पंतजा बकरी, खराई ऊँट, अगोंदा गोवना शूकर, मेवाड़ी मुर्गी और पीडी1 (वनराजा) मुर्गियों की मेल पेरेंट लाइन शामिल हैं। पूर्णिया, बिन्झरपुरी, असमी तथा कोसली गाय, मारवाडी, पूँछी और तिब्बती भेड़, बुन्देलखंडी तथा भाकरवाल बकरी, आसाम के शूकर, जालोरी ऊँट, अरुनाचली याक तथा मिथुन, राजस्थान के गधों, हाजरा मुर्गी, आसाम की बत्तखों का लक्षणीकरण तथा बारगुर एवं ओंगोल गाय और हरिनघटा मुर्गियों का संरक्षण कार्य नेटवर्क परियोजना के अंतर्गत किया जा रहा है।

इसके अतिरिक्त, आणविक लक्षण निर्धारण से कोरापुट भेड़ों में उच्च आनुवंशिक विविधता की उपस्थिति की पहचान की गई। ओडिशा और छत्तीसगढ़ भैंसों के आनुवंशिक लक्षण निर्धारण का कार्य प्रगति पर है। दूध की विशेषताओं से सम्बंधित प्रतिभागी जीनों में स्वाभाविक रूप से विकसित लद्दाखी गायों में विदेशी नस्लों के प्रभाव की लगभग अनुपस्थिति देखी गई। देसी नस्लों में उत्पादन के लिए जीन (मेयोसटाटीन, डीजीएटी–1, जीएच, जीएचआर, पीआईटी–1, लेप्टिन, सीएपीएन–1, सीएएसटी, टीटीन, एनकिरिन आदि) पुनर्उत्पादन जीन (जीडीएफ–9, बीएमपी–15, किस–1 आदि) और अनुकूलन जीन (एमसीटी, सीडी 147 आदि) विभिन्न प्रतिभागी जीनों का लक्षण निर्धारण किया गया। 4 एस.टी.आर. चिन्हकों का उपयोग करके 3 गोवंश नस्लों (गिर, थारपारकर, और साहीवाल) के 541 फार्म पशुओं पर जानकारी पैदा की गई, जिसका उपयोग ब्रीड सिग्नेचर विकसित करने के लिए किया गया। इसके अतिरिक्त, संस्थान ने प्रजनक सांडों की साइटोजेनेटिक स्क्रीनिंग के लिए परामर्श सेवाएं प्रदान करने का कार्य जारी रखा और गोपशुओं में वंशानुगत बीमारियों का पता लगाने का कार्य आरम्भ किया है।

संस्थान में आई.आर.सी. बैठकों का नियमित रूप से आयोजन किया गया। भारतीय कृषि अनुसन्धान

परिषद् और एन.ए.वी. के सहयोग से "देसी पशुओं में दूध उत्पादकता बढ़ाने के लिए रणनीतियां" विषय पर एक विशेषज्ञ परामर्श कार्यशाला का आयोजन किया गया। संस्थान द्वारा पशु आनुवंशिक संपदा पर प्रदर्शनियों, मंथन सत्रों और व्याख्यानों के माध्यम से जनता के बीच जागरुकता पैदा की गई। सिक्किम पशुधन विकास बोर्ड, गंगटोक के सहयोग से सिक्किम राज्य के पशु अनुवांशिक संसाधनों पर एक बुद्धिशीलता सत्र का आयोजन किया गया। भारतीय कृषि अनुसन्धान परिषद् द्वारा प्रायोजित एक संक्षिप्त प्रशिक्षण सत्र "देसी पशु आनुवंशिक संसाधनों की जीनोम विशेषता के लिए उन्नत आणविक और जैव सूचना विज्ञान दृष्टिकोण" का आयोजन किया गया। मैंने, विशेषज्ञ व्याख्याता के तौर पर, अंतर्राष्ट्रीय प्रतिभागियों को प्रशिक्षण देने के लिए वियेना, आस्ट्रिया का दौरा किया। इसके अतिरिक्त, कई गणमान्य व्यक्तियों ने बड़ी संख्या में संस्थान का दौरा किया जिनमे डॉ. जिमी स्मिथ, महानिदेशक, इलरी, नैरोबी (कीनिया) प्रमुख हैं।

मै, डॉ. एस. अयप्पन, सचिव (डेयर) और महानिदेशक, भारतीय कृषि अनुसन्धान परिषद्, डॉ. के.एम.एल. पाठक, उप महानिदेशक (पशु विज्ञान), डॉ. आर.एस. गाँधी, सहायक महानिदेशक (प.उ. एवं प्र.) तथा डॉ. विनीत भसीन, प्रधान वैज्ञानिक का इस संस्थान के समग्र विकास हेतु लगातार समर्थन और मार्गदर्शन के लिए बहुत आभारी हूँ। गौरवान्वित भाव से मैं सभी वैज्ञानिकों, तकनीकी जिनके योगदान से यह वार्षिक प्रतिवेदन पूर्ण हुआ है और प्रशासनिक अधिकारियों को बधाई देता हूँ। सुधार और मार्गदर्शन के लिए आपके सुझावों का स्वागत है।

(आर्जव शर्मा)

निदेशक

कार्यकारी सारांश

राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो और राष्ट्रीय पशु आनुवंशिकी संस्थान, राष्ट्रीय डेरी अनुसंधान संस्थान के क्षेत्रीय केन्द्र बंगलौर में दिनांक 21 सितम्बर, 1984 को स्थापित किये गए। वर्ष 1985 में ब्यूरो तथा संस्थान को रा.डे.अ.सं. करनाल परिसर में अस्थाई रूप से स्थानान्तरित किया गया। वर्ष 1994 में इसे वर्तमान मकरमपुर कैम्पस स्थानांतरित कर दिया गया। वर्ष 1995 में इन दोनों संस्थानों का विलय राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो के रूप में हुआ। यह ब्यूरो भारत में पालतू पशु व कुक्कुट संसाधनों की पहचान, मूल्यांकन, गुण निर्धारण, संरक्षण और उनके सतत उपयोग के अधिदेश हेतु देश की एक अग्रणी संस्था है। ब्यूरो निम्न उद्देश्यों की प्राप्ति हेतु कार्यरत है:

- पालतू पशु व कुक्कुट आनुवंशिक संसाधनों के गुण निर्धारण, मूल्यांकन तथा सूचीबद्ध करने के लिए व्यवस्थित सर्वेक्षणों का संचालन और राष्ट्रीय आंकड़ा कोष की स्थापना करना।
- पशु आनुवंशिक संपदा के सर्वोत्तम उपयोग, एक्स–सीटू संरक्षण तथा इन–सीटू प्रबंधन के लिए तकनीकों का विकास करना।
- आणविक जीव विज्ञान की आधुनिक तकनीकों के प्रयोग से आनुवंशिक गुण निर्धारण पर अध्ययन करना।
- पशु व कुक्कुट आनुवंशिक संसाधनों के मूल्यांकन, गुण निर्धारण और उपयोग से संबंधित प्रशिक्षण, कार्यक्रमों का संचालन करना।

वित्तीय वर्ष 2014–15 के दौरान गैर योजना और योजना के तहत कुल प्राप्त रुपये 1186.00 लाख में से 1179.332 लाख रुपये व्यय हुआ। नेटवर्क परियोजना के अर्न्तगत कुल रु 178.72 लाख खर्च हुए। वर्ष के दौरान राजस्व प्राप्ति का लक्ष्य 22 लाख रु था जबकि प्राप्त राजस्व रु 21.68 लाख रहा।

पशुधन की 7 नई नस्लों का पंजीकरण किया गया, जिसमें 2 नस्लें गायों की एवं भेंड़, बकरी, शूकर, ऊँट एवं मुर्गी प्रत्येक की एक नस्ल थी। एक मुर्गी की मेल पेरेंट लाइन की पहली बार संस्थान द्वारा पंजीकृत की गई। पंजीकृत नस्लों में हरियाणा एवं चंड़ीगढ़ की बिलाही गाय; उ०प्र० एवं बिहार की गंगातीरी गाय; उत्तराखंड एवं उ०प्र० की पंतजा बकरी; तमिलनाडु की कचईकटी बलैक भेंड़; गुजरात की खराई ऊँट, गोवा की अगोण्डा गोवन सुअर नस्ल और राजस्थान की मेवाड़ी मुर्गी की नस्लें थी। इस प्रकार देश में अब तक पंजीकृत कुल नस्लों की संस्था 151 हो गई है।

सिक्किम की देशी गोवंशी नस्ल "सीरी" का सर्वेक्षण के द्वारा गुण निर्धारण किया गया। कुल 68 गोवंश, जो कि विभिन्न उम्र एवं लिंग, उनका शारीरिक माप, शारीरिक विशेषताएं, उत्पादन स्तर आदि का अध्ययन किया गया। इनके शरीर का रंग भूरे से काला होता है, भूरे रंग में सफेद रंग के धब्बे भी पाए जाते हैं। कान छोटे होते हैं। पूंछ टखने तक लम्बी होती है। थन छोटे होते हैं। दुग्ध उत्पादन 2 से 5 किग्रा. प्रति दिन होता है। एक जोड़ी बैलों से 6 से 8 घंटे में लगभग एक एकड़ खेत जोता जाता हैं।

ऊँचाई पर रखने हेतु अभ्यस्त लद्दाखी गोवंशी पशुओं का सर्वेक्षण के माध्यम से दृश्यरुपी लक्षणीकरण किया गया। गायों के शरीर का रंग काला, भूरा एवं कान सफेद धब्बो युक्त होता है। सींग मुड़े हुए होते हैं। कूबड़ एवं गलकम्बल छोटे होते हैं। कान छोटे एवं मध्यम आकार के होते हैं। पूंछ लम्बी होती है जो लगभग जमीन को छू रही होती है। थन छोटा होता है। स्वभाव विनम्र होता है।

कर्नाटक की माऊली एवं यलगा भेंड़ के अध्ययन हेतु सर्वेक्षण किया गया। शारीरिक माप एवं शरीर भार संबंधी आंकड़े एकत्र किये गए। माऊली भेंड़ बड़े शारीरिक आकार वाली होती है, लेकिन इनमें विभिन्नता अधिक पाई जाती है। इनके पैर लम्बे होते हैं, शरीर गहरा एवं जानवरों की ऊँचाई अधिक होती है। भेंड़ का रंग सफेद होता हैं जिसपर भूरे रंग के धब्बे भी पाए जाते हैं और बिना धब्बे के भी होते हैं। आँखों के चारों तरफ भूरे रंग की गोलाई पाई जाती है। कुछ समूह ठेठ मड़गयाल प्रकार के पाए गए। इनके नाक का आकार ठेठ रोमन प्रकार का होता है या तुलनात्मक रूप से सीधा होता है। नर एवं मादा दोनों सींग रहित होते हैं।

यलगा भेंड़ मध्यम आकार की होती है। खाल का रंग सफेद होता है जिस पर छोटे घने बाल होते हैं। जाँघ क्षेत्र में बाल का गुच्छा मौजूद होता है। चेहरा सफेद, काला या भूरे रंग में धब्बा युक्त सफेद धब्बे विभिन्न आकार के होते हैं जो कि पूर्ण काला तक होते हैं। चेहरे एवं कान के अतिरिक्त शरीर के सभी अंतिम छोर (एक्सट्रीमिटीज) सफेद होते हैं। थूथन काली–भूरी या

गुलाबी रंग की होती है। वैटल्स सभी जानवरों में पाया जाता है। नर सींग युक्त एवं मादा सींगरहित होती है।

कजली भेंड़ का सर्वेक्षण किया गया। यह भेंड़ पंजाब के संगरूर, बरनाला, लुधियाना, मोगा एवं आस–पास के ज़िलों में पायी जाती है। वयस्क नर एवं मादा का शरीर भार क्रमशः 56.98± 1.02 एवं 43.23± 0.36 किग्रा. होता है। इसकी दो किस्में पंजाब में पाई जाती हैं जिनका वर्गीकरण उनके शारीरिक रंग के आधार पर किया गया है। काली कजलीः इसका पूरा शरीर काला या काले – भूरे रंग का होता है तथा जिनकी पूंछ का अंतिम सिरा (लगभग 41.57 प्रतिशत) सफेद होता हैं। सफेद (चिट्टी) कजलीः जिसका पूरा शरीर–सफेद होता है लेकिन चेहरे एवं कान पर काले या काले–भूरे रंग के धब्बे पाए जाते हैं। जिनका वितरण चेहरे एवं कान पर विभिन्न स्तर का होता है। भेड़ों का शरीर सुगठित एवं बड़े आकार का होता हैं, नाक रोमन प्रकार की, लम्बे एवं लटकते कान एवं पूंछ भी लम्बी होती है। कुछ में पूंछ जमीन तक छू रही होती है। नर एवं मादा सींग रहित होते हैं। औसत ऊन उत्पादन 800 से 1000 ग्राम होता है।

डक्कनी भेंड़ नस्ल की पांचों इकोटाइप्स (मड्गयाल, सोलापुरी, संगमनेरी, लोनांड एवं कोल्हापुरी) की विशेषताओं का अध्ययन करने के लिए, उनके वितरण क्षेत्र से उनके उत्पादन एवं जनन संबंधित आंकड़ो का संग्रहण, साक्षात्कार आधारित सर्वेक्षण विधि द्व ारा किया गया। डिस्क्रिमिनेन्ट विश्लेषण ने इन पांचो इकोटाइप्स को 5 विभिन्न वर्गो में वर्गीकृत किया गया। 14 शारीरिक विशेषताओं संबंधी नस्लों (मार्फोमीट्रिक संबंधित) का प्रयोग, मडगयाल, सोलापुरी एवं कोल्हापुरी पर प्रिंसीपल घटक विश्लेषण (पी.सी.ए.) किया गया। पी.सी.ए. ने दो घटको को एक्स्ट्रेक्ट किया जिनका कुल वैरिएन्स 66.3 से 71 प्रतिशत था।

सिक्किम बकरी समूह : सिंघारी एवं सिक्किम काली बकरी का गुण निर्धारण करने के लिए सर्वेक्षण किया गया। सिंघारी, सिक्किम की कुल बकरियों का प्रमुख घटक है एवं इन्हें इनके चेहरे पर पाई जाने वाली धारियों द्वारा आसानी से पहचाना जा सकता है। आंखे चमकदार एवं छोटी होती हैं। कान छोटे एवं मध्यम आकार के होते हैं जिनका सिरा गोलाकार होता है एवं अर्ध लटकदार होते हैं। पेट का निचला हिस्सा सामान्यतः हल्का भूरा या सफेद रंग का होता है। पैर छोटे, मजबूत, एवं मध्यम काले या सफेद रंग के होते हैं। पृष्ठ भाग पर काले रंग की रेखा (काली टॉप लाइन) लगभग सभी बकरियों में पाई जाती है। सिक्किम बकरी समूह मिश्रण होता है ऐसी बकरियों का जोकि भूरी, काली, सफेद या इन तीनों मिश्रण के रंग की होती हैं। ये बकरियों, सिंघारी बकरी से उनके खाल के रंग, सींग के प्रकार एवं आकार के आधार पर भिन्न होती हैं, और ब्लैक बंगाल नस्ल से भी आकार के आधार पर भिन्न होती हैं। सिक्किम काली बकरी मध्यम आकार की होती हैं। सिर, शरीर के अनुपात में होता है। चेहरा, सींग एवं पूंछ, सिंघारी बकरी की तुलना में बड़े होते हैं। ये बकरियाँ आकार में सिंघारी से थोड़ी छोटी होती हैं। सिक्किम काली बकरी मुख्यतः मांस के लिए पाली जाती हैं।

मणिपुर की स्थानीय "कौनाएन" मुर्गी का गुण निर्धारण करने के लिए थौबाल एवं इम्फाल पश्चिमी ज़िलों का सर्वेक्षण किया गया। इनके पंख का रंग काला या भूरा होता है जिनपर सफेद, काले या सुनहरी रंग के धब्बे पाए जाते हैं। कलगी लाल रंग की होती है जो कि मटर के प्रकार (पी कॉम्ब) की होती है। शरीर भार लगभग 2.5 से 3 किग्रा. होता है। वार्षिक अण्डा उत्पादन 35 से 45 होता है। यह लड़ाकू किस्म की होती हैं। अण्डा मध्यम आकार का होता है जिसका औसत वजन 42.43 ± 0.07 ग्राम होता है। अण्डा भूरे रंग का होता है।

चिप्पीपरई श्वान का सर्वेक्षण किया गया जो कि दक्षिणी तमिलनाडु के तिरूनेलवली, मदुरै, विरूदधनगर एवं थूथूकुडी ज़िलों में पाई जाती है। चिप्पीपराई कुत्ते मध्यम आकार वाले होते हैं जिनका रंग हल्के खाकी (फॉन) से गहरा भूरा और काला होता है। कान मध्यम आकार के एवं सीधे समतल होते हैं। कुछ के कान खड़ी अवस्था में भी पाए जाते हैं। इनकी यौन परिपक्वता की उम्र 12–16 महीने होती है। लोग इन्हें रखवाली या शिकार या शौक के लिए पालते हैं।

लद्दाखी गायों की आनुवंशिक विभिन्नता का अध्ययन 20 चिन्हकों का उपयोग करते हुए माइक्रोसैटेलाइट आधारित आंकड़ा संग्रहित किया गया। कुल 200 एलील्स पाए गए, जिनकी औसत संख्या प्रति लोकस 9.925 पाई गई एलीलों की संख्या (9.95), प्रभावी एलीलों की संख्या (4.84), प्राप्त हेटरोजाईगोसिटी (0.79), पर्याप्त आनुवंशिक विभिन्नता को दर्शा रहे हैं। औसत अंतः प्रजनन गुणांक 0.037 था।

नस्ल हस्ताक्षर विकसित करने के लिए 4 एस.टी.आर. लोसाई का उपयोग करके 541 फार्म पशुओं की 3

नस्लों (गिर, साहीवाल और थारपारकर) पर आँकड़ा उत्पन्न और विश्लेषण किया गया। गिर और साहीवाल के मध्य गिर और थारपारकर तथा साहीवाल और थारपारकर के मध्य क्रमशः एफएसटीवैल्यू 0.173, 0.281, 0.234 रही। लोसाई के चयन का प्रयास किया गया और अंततः इन तीन पशु नस्लों के शत प्रतिशत पशुओं में 8 लोसाई आबंटित हुए और जब क्षेत्रीय नमूनों को शामिल किया गया तो प्रतिशत 93 रहा। संगठित बाड़ों से सभी पशुओं को सही ढंग से नियत पाया गया और 3 नस्लों के विभिन्न समूहों का गठन किया। इन लोसाई का प्रयोग मल्टीप्लेक्स पीसीआर किट विकसित करने के लिए किया गया। किट का परीक्षण किया गया तथा साहीवाल, गिर और थारपारकर पशु नस्लों पर इस्तेमाल के लिए मान्य किया गया।

उड़ीसा की कालाहांडी और परलखमुण्डी भैंसों के साईटोजेनेटिक अध्ययन के लिए क्रमशः 30 और 19 भैंसों के 811 बीपी माइटोकॉन्ड्रियल डी–लूप क्षेत्र के प्रवर्धन और अनुक्रमण से इनका विशिष्ट नदीय भैंस होनें का पता चला। तुलनात्मक विश्लेषण करके नौ नदीय और दलदलीय नस्लों/आबादियों में 57 हेपलोटाईप्स का पता चला। हेपलोटाईप्स शेयरिंग पर आधारित मीडियन जोयनिंग नेटवर्क विश्लेषण से उड़ीसा भैंस आबादी का अन्य नदीय भैंस नस्लों के साथ समूहीकरण का पता चला।

छत्तीसगढ़ के धमतरी, कांकेर, महासमुंद, बिलासपुर, कावर्धा और बस्तर ज़िलों के 41 गांवों में पायलट सर्वेक्षण किया गया। प्ररूपी लक्षण निर्धारण किया गया और लगभग 140 वयस्क छत्तीसगढ़ी भैंस पर दैहिक माप दर्ज किए गए। छत्तीसगढ़ भैंस के नमूनों के साईटोजेनेटिक विश्लेषण से गुणसूत्र संख्या 50 के साथ नदीय टाइप का पता चला। वसा उत्पादन लक्षण को प्रभावित करने वाले उम्मीदवार जीन एफएएसएन (एक्सॉन 38, 39, 40, 41, 42) और एस टी ए टी 1के 3′ युटीआर से भी पीसीआर–आरएफएलपी तकनीक का उपयोग कर छत्तीसगढ़ी भैंस में भिन्नता का अध्ययन किया गया। केवल एफएएसएन जीन के एक्सॉन 40 को बहुरूपी पाया गया।

दलदलीय भैंसों में कुल 13 डीक्यूए एलील की पहचान की गई जो कि दो बड़े समूहों, डीक्यूए। (11 एलील) और डीक्यूए 2 (2एलील) के लिए उत्तरदायी हैं। डीक्यूबी के लिए कुल 16 एलीलस के तीन प्रमुख समूहों के लिए डीक्यूबी 1, डीक्यूबी 2 और डीक्यूबी 3 पहचानित किये गये।

भारतीय भेड़ की चार अलग–अलग नस्लों में हीट शॉक प्रोटीन (एचएसपी) जीन में एसएनपी मार्करों का एचएसपी 90 एए1 के प्रमोटर को सफलतापूर्वक प्रवर्धित किया गया। 112, 244 और 248 पोजीशन पर तीन एलील्स की स्थिति के लिए विकसित किया गया था। जीनोटाइपिंग प्रोटोकॉल एलील विशिष्ट प्राइमरों का उपयोग एसएनपी (जी/सी) की स्थिति 112 पोजीशन के लिए विकसित किया गया था। मद्रास रेड शीप के 42 नमूने जीनोटाइप करके देखा गया कि जीन और जी जी, जी सी और सी सी जीनोटाइप की क्रमशः 0.40, 0.40 और 0.19 की आवृति थी।

गाय और भैंस में दुग्धकाल के दौरान टोटल एंटीऑक्सीडेंट क्षमता (टीएसी) और स्वच्छ दूध हेतु सकैवैंजिंग गतिविधि में तुलनात्मक परिवर्तन का मूल्यांकन करने के लिए अध्ययन किया गया। साहीवाल और करण फ्रीज़ गायों में दूध टीएसी की सक्रियता दुग्ध काल के प्रारम्भ, शिखर, मध्य और अन्तिम चरणों की अपेक्षा कोलोस्ट्रम में काफी उच्च थी। दूसरी ओर 1, 1–डाईफिनाइल–2 पिकरिल हाईड्राज़ाइल (डीपीपीएच) का प्रतिशत सकैवैंजिंग गतिविधि का साहीवाल और करण फ्रीज गायों में दुग्धकाल के चरणों में कोई अंतर नहीं दिखा। मुर्राह भैंसों में डीपीपीएच का प्रतिशत सकैवैंजिंग गतिविधि प्रारम्भ, मध्य और अन्त के दुग्धकाल के चरणों की तुलना में कोलोस्ट्रम और शीघ्र दुगधकाल चरण में काफी अधिक था। एंटीऑक्सीडेंट का स्तर दुग्धकाल के विभिन्न चरणों के दौरान बदलता है और दुग्ध्काल के बाद के हिस्से की तुलना में कोलोस्ट्रम और प्रांरभिक दुग्धकाल के चरण में उच्च होता है।

साहीवाल गायों और मुर्राह भैंसों में विभिन्न दुग्धकाल चरणों में अंतर्जात प्रोटीएज़ो की अभिव्यक्ति का अध्ययन किया गया। विभिन्न अभिव्यक्त अंतर्जात प्रोटिएज़ों के सभी जीनों में दूग्धकाल के दौरान वृद्धि देखी गई। विश्लेषण में प्रांरभिक दुग्धकाल के दौरान विभिन्न प्रोटिएज़ों ने निम्न अभिव्यक्ति दिखाई।

साहीवाल गायों में दुग्ध केज़िन जीन (सीएसएन 1 एस1, सीएसएन 1 एस2, सीएसएन 2, सीएसएन 3, एलएएलबीए की अभिव्यक्ति पैटर्न और वसा के चयापचस जीनों (एफएबीसी 3, बीटीएन 1 ए1,

एसीएसीए, एससीडी, जीपीएएम) का मूल्यांकन किया गया। मध्य और अन्तिम चरण के दुग्धकाल की तुलना में सभी कैज़िन जीनों में अभिव्यक्ति पैटर्न प्रारंभ और शिखर दुग्धकाल की अवधि के दौरान अधिक था। एमआरएनए स्तर बहुतायत जल्दी दुग्धकाल के दौरान काफी अधिक है और धीर–धीरे अन्तिम दुग्धकाल चरण में कमी पाई गई। एससीडी, एफएबीपी 3 और जीपीएएम की अभिव्यक्ति के स्तर के मध्य और अन्तिम काल से दुग्धकाल की अवधि की तुलना में प्रारंभिक दुग्धकाल (10 से 30 दिन) में काफी अधिक था।

मवेशी पशुओं में उप प्रजनन क्षमता के लिए पी.आर. डी.एम. 9 जीन में परिवर्तन का अध्ययन किया गया है। पीआरडीएम 9 जीन के लिए चार एलील्स (ए,बी, सी, और डी) और नौ जीनोटाइप (एए, बीबी, सीसी, डीडी, एबी, बीसी, सीडी, एसी और बी) दर्ज किये गये। पीआरडीएम 9 जीन के इस डोमेन क्षेत्र में जिंक फिंगर की संख्या ए,बी,सी और डी एलील में क्रमशः 6,7,8 और 9 थी।

लद्दाखी मवेशियों के 72 पशुओं में महत्वपूर्ण कैंडिडेट जींस एलीलिक पैटर्नस भिन्नता के अध्ययन – K-सीएन, β–सीएन, α–लैक्ट, बीजीएच, पिट–1, पीआरएल, बीटीएन – 1–3 और डीगेट – 1 से पता चलता है कि लद्दाखी मवेशियों ने इससे पूर्व देखी गई अधिक से अधिक विशेषताओं को बनाए रखा है। वैरिएन्ट – ई को के – सीएन पर देखा गया जो कि किसी अन्य भारतीय देशी पशु नस्लों में नहीं बताया गया है और बीटीएन – 3 लोकस पर नव वेरिएंट भी लद्दाखी पशुओं में देखा गया।

न्यूट्रोफिल/लिम्फोसाइट (एन/एल) का अनुपातिक तुलनात्मक मूल्यांकन गोवंश में शारीरिक तनाव का आकलन करने के लिए किया गया। एन/एल का अनुपात साहीवाल गायों और मुर्राह भैंसों में कम है, जबकि होल्स्टीन फ्रिज़ियन और करण फ्रीज़ दोनों गायों में सबसे ज्यादा था। साहीवाल गायों और मुर्राह भैंसों में गर्मी तनाव के प्रति विदेशी, संकर नस्ल की गायों की तुलना में बेहतर अनुकूलता का यह एक कारण हो सकता है।

साहीवाल गायों में एचएसपी ट्रांसक्रिप्ट के मौसम में परिवर्तन के साथ अभिव्यक्ति में गैर महत्वपूर्ण परिवर्तन दिखाया। एचएसपी 40, एचएसपी 60, एचएसपी 70, और एचएससी 90 जीनों की संयुक्त अभिव्यक्ति को एक साथ साहीवाल गायों की तुलना में होल्स्टीन फ्रिज़ियन गायों में अधिकतम और प्रभावी दिखाया।

उच्च पर्वतीय और उष्णकटिबंधीय क्षेत्रों में अनुकूलित भारतीय पशुओं के अध्ययन के दौरान विभिन्न कार्यात्मक श्रेणियों से 10 जाने–माने संदर्भ जीन का परीक्षण किया गया। तुलनात्मक जीन एक्सप्रेशन की स्थिरता के आधार पर और पदक्रम अपवर्जन से जींस को अवरोही क्रम में: आरपीएस 9 = आरपीएस 15 > एचएमबीएस > जीएपीडीएच > बी2एम > आरपीएल 4 > इइएफ 1 ए1 > युएक्सटी > एसीटीबी > एचपीआरटी : व्यवस्थित किया गया। एल्गोरिथम विधियों जीनॉर्म, नॉर्मफाइन्डर और बेस्ट कीपर की द्वारा आरपीएस 15 का प्रदर्शन उत्तम पाया गया और जबकि जीएपीडीएच, आरपीएस 9, आरपीएस 9 और एचएमबीएस सबसे स्थिर आंतरिक नियंत्रय जीन पाए गए।

साइट्रेट बफर, शर्करा अंडा जर्दी और एंटीबायोटिक दवाओं से युक्त एक प्रशीतित घोल का उपयोग अधिवृषणी वीर्य और जमे हुए ठन्डे वीर्य खुराक के लिए मानकीकृत किया गया।

गोवंश (गओलाओ और थारपारकर) और भैंस (टोडा) के कुल 7,600 जमे हुए वीर्य खुराक एकत्रित की गई और इसे पिछले वर्ष के दौरान जीन बैंक में भंडार में जोड़ा गया है। ब्यूरो के राष्ट्रीय जीन बैंक में अब सात प्रजातियों वीर्य संग्रहित है।

असम की बतख का लक्ष्ण निर्धारण कार्य के साथ बरगुर, ओंगोल गाय और हरिंनघटा मुर्गियों के संरक्षण का कार्य, सम्बंधित नेटवर्क केंद्र के माध्यम से किया गया है।

भारत सरकार की नीति के अनुसार ब्यूरो गुणसूत्र दोषों की जांच करने के लिए और आनुवंशिक दोषों से मुक्त रखने के उद्देश्य के साथ देश भर में विभिन्न एजेंसियों के लिए प्रजनक सांडो के साइटोजेनेटिक स्क्रीनिंग के लिए परामर्श सेवा प्रदान की गई। वर्ष के दौरान 113 प्रजनन भैंस और बैल सांडों तथा 40 सूअरों की साइटोजेनेटिक मापदंडों के लिए जांच की गई।

कुल 11 अनुसंधान परियोजनाओं को पिछले वर्ष के दौरान पूरा किया गया। वर्तमान में 21 अनुसंधान

परियोजनाए और एक बाहय वित्त पोषित और एक राष्ट्रीय फैलो परियोजना जारी है।

कुल 43 शोध पत्र उच्च प्रभावी राष्ट्रीय और अंतरराष्ट्रीय पत्रिकाओं में प्रकाशित किए गए। 27 तकनीकी/लोकप्रिय लेख प्रकाशित किए गए। 12 मोनोग्राफ और प्रशिक्षण मैनुअल भी संस्थान द्वारा प्रकाशित किए गए।

सात पेटेंट आवेदन भारतीय पेटेंट कार्यालय के जर्नल में प्रकाशित किए गए और तीन पेटेंट आवेदनों के लिए पहला परीक्षा अनुरोध भारतीय पेटेंट कार्यालय, नई दिल्ली को प्रस्तुत किया गया।

आरएफडी के तहत ब्यूरो ने 99.50 प्रतिशत का एक समग्र स्कोर हासिल करके उत्कृष्ट रेटिंग प्राप्त की है।

ब्यूरो पुस्तकालय ने वैज्ञानिक/तकनीकी विकास की 44 पत्रिकाओं (विदेशी 11 और 31 भारतीय) की सदस्यता ली। पुस्तकालय में पुस्तकों और पत्रिकाओं पर रू 10,21,195/– खर्च किये गए। संस्थान की गतिविधियों के कार्यों का प्रदर्शन करने और स्वदेशी पशुओं के लाभों के बारे में किसानों को बताने के लिए विभिन्न स्थानों पर पशु अनुवंशिक संपदा पर नौ प्रदर्शनियाँ लगाई गई।

संस्थान अनुसंधान समिति (आईआरसी) की बैठके समय पर आयोजित की गई। अनुसंधान परियोजनाओं की प्रगति मध्य अवधि आईआरसी की बैठक के दौरान समीक्षा की गई।

ब्यूरो के विभिन्न वैज्ञानिकों ने देश के भीतर प्रशिक्षण और कार्यशालाओं, संगोष्ठियों और सम्मेलनों में भाग लिया।

भारतीय कृषि अनुसंधान परिषद् का स्थापना दिवस 16 जुलाई, 2014 को ब्यूरो में मनाया गया।

"अगली पीढ़ी का अनुक्रमण विश्लेषण: तकनीक से प्रयोग तक" शीर्षक से एक तीन दिवसीय प्रशिक्षण कार्यक्रम आयोजित किया गया।

केन्द्रीय कृषि विश्वविद्यालय इम्फाल के सहयोग से केशमलोंग, इम्फाल में 21.11.2014 को 'मणिपुरी मुर्गियों की विशेषता' पर एक दिवसीय कार्यशाला की गई।

ब्यूरो में 'नस्ल पंजीकरण प्रक्रिया' पर एक इंटरैक्टिव कार्यशाला 28–01–2015 को डीएएचडी और एफ, भारत सरकार और ब्यूरो द्वारा संयुक्त रुप से आयोजित की गई।

सिक्किम राज्य के पशुधन आनुवंशिक संसाधन पर दिनांक 19.11.2014 को एक ब्रेन स्टॉर्मिंग कार्यशाला गंगटोक में, सिक्किम पशुधन विकास बोर्ड के सहयोग से आयोजित की गयी।

"एडवांस्ड मॉलीक्यूलर एण्ड बायोइन्फार्मेटिक अप्रोचेस फॉर जीनोम कैरेम्टराइजेशन ऑफ इंडीजिनस एनिमल जेनेटिक रिसॉसेज" शीर्षक पर भा.कृ.अनु.प. नई दिल्ली द्वारा प्रायोजित एक 10 दिनों का लघु अवधि प्रशिक्षण कार्यक्रम आयोजित किया गया, जिसमें कुल 21 प्रतिभागियों ने हिस्सा लिया।

वर्ष के दौरान कई विशिष्ट व्यक्तियों ने ब्यूरो का दौरा किया, जिसमें आई.एल.आर.आई. के महानिदेशक डा. जिमी स्मिथ प्रमुख रहे।

निदेशक, रा.प.आ.सं. ब्यूरो करनाल ने आस्ट्रिया विएना का दौरा किया, जहां पर उन्होंने विशेषज्ञ प्रवक्ता के रूप में, आई ए ई ए द्वारा प्रायोजित प्रशिक्षण कार्यक्रम में अन्तर्राष्ट्रीय प्रतिभागियों को प्रशिक्षण प्रदान किया।

संस्थान के वैज्ञानिक, एन.डी.आर.आई., करनाल एवं आई.वी.आर.आई., इज्जतनगर, बरेली के संकाय सदस्य के रूप में शामिल हैं। संकाय सदस्यों द्वारा स्नात्कोत्तर एवं विधा वाचस्पति के विद्यार्थियों में अध्यापन व शोध कार्यों में मार्गनिर्देशन हेतु कार्य किया जा रहा है।

वर्तमान में ब्यूरो में कुल 29 वैज्ञानिक 17 तकनीकी अधिकारी, 19 प्रशासनिक एवं 5 कुशल सहायक–कर्मचारी कार्यरत हैं। वर्ष के दौरान संस्थान के 6 वैज्ञानिकों, 2 तकनीकी अधिकारियों एवं 3 कुशल सहायक कर्मचारियों की समयानुसार पदोन्नति हुई।

ब्यूरो के एक प्रधान वैज्ञानिक डा. बी प्रकाश का चयन, निदेशक, भा.कृ.अनु.प. – केन्द्रीय गोवंश अनुसंधान संस्थान, मेरठ (उ.प्र.) के पद पर हुआ। वर्ष के दौरान एक प्रधान वैज्ञानिक एवं एक तकनीकी अधिकारी सेवा निर्वृत हुए।

राजभाषा प्रकोष्ठ की गतिविधियाँ

भाकृअनुप – राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल के राजभाषा अनुभाग द्वारा वर्ष 2014–15 के दौरान, राजभाषा के प्रचार–प्रसार हेतु विभिन्न कार्यक्रमों का आयोजन किया गया।

राजभाषा हिन्दी के प्रचार प्रसार हेतु की जाने वाली विभिन्न गतिविधियों के अंतर्गत राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो में दिनांक 23.05.2014 को ''पर्यावरण क्षरण से मानव जीवन पर दुष्प्रभाव'' विषय पर एक हिन्दी व्याख्यान का आयोजन किया गया, जिसके अतर्गत डा. अमिताभ सिंह, प्रोफेसर कैमिस्टरी, डा. प्रेम तिवारी प्रोफेसर हिन्दी, दिल्ली विश्वविद्यालय तथा श्री नरेश रंगा, डी.एफ.ओ. करनाल ने व्याख्यान प्रस्तुत किये। इस व्याख्यान कार्यशाला का आयोजन श्री राजीव रंजन, समिति शुरूआत करनाल तथा वन विभाग के सहयोग से राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो करनाल में किया गया। इस कार्यक्रम की अध्यक्षता संस्थान के निदेशक डा. आर्जव शर्मा ने की।

संस्थान में राजभाषा हिन्दी के प्रचार–प्रसार व स्टाफ सदस्यों को अपना दैनिक राजकीय कार्य राजभाषा में करने के लिये प्रोत्साहित करने के उद्देश्य से चलाई जाने वाली तिमाही हिन्दी व्याख्यान/कार्यशालाओं के अंतर्गत दिनांक 28.07.2014 को एक हिन्दी व्याख्यान का आयोजन किया गया। इसके अंतर्गत संस्थान द्वारा प्राधिकृत होम्योपैथिक चिकित्सक डा. के.एस. पोसवाल का "होम्योपैथिक पद्धति द्वारा रोगों से निदान" विषय पर व्याख्यान आयोजित किया गया।

प्रत्येक वर्ष की भांति इस वर्ष भी हिन्दी दिवस के अंतर्गत ब्यूरो में 12–20 सितम्बर 2014 तक राजभाषा के प्रचार–प्रसार व क्रियान्वयन के प्रति स्टाफ सदस्यों में जागरूकता बढाने हेतु हिन्दी चेतना पखवाड़ा के अंतर्गत विभिन्न हिन्दी कार्यक्रमों का आयोजन किया गया। निदेशक द्वारा गठित कार्यक्रम आयोजन समिति जिसके अध्यक्ष डॉ. आर. एस. कटारिया व आयोजन सचिव श्री सतपाल रहे, ने बड़े ही सुचारू रूप से सभी कार्यक्रमों का संचालन किया। इस अवधि के दौरान आयोजित की गयी विभिन्न गतिविधिओं का विवरण निम्नलिखित है :

दिनांक 12.09.2014 को स्टाफ के सभी वर्गों हेतु शब्दार्थ व अनुवाद प्रतियोगिता का आयोजन किया गया जिसमे वैज्ञानिकों, तकनीकी व प्रशासनिक वर्ग के सदस्यों ने व निदेशक महोदय सहित कुल 10 प्रतियोगियों ने भाग लिया। इस प्रतियोगिता में प्रथम पुरस्कार निदेशक डॉ. आर्जव शर्मा द्वितीय पुरस्कार संयुक्त रूप से डॉ. साकेत निरंजन व श्री कर्मबीर मलिक तथा तृतीय पुरस्कार श्री योगेंदर ने जीता।

दिनांक 15.09.2014 को एक हिंदी निबंध लेखन प्रतियोगिता का आयोजन किया गया। निबंध का विषय भारतीय कृषि अर्थ व्यवस्था में महिलाओं का योगदान रखा गया था। इस प्रतियोगिता में कुल 10 प्रतियोगियों ने भाग लिया। प्रथम पुरस्कार डॉ. सोनिका अहलावत, द्वितीय पुरस्कार श्री कर्मबीर मलिक तथा तृतीय पुरस्कार संयुक्त रूप से डॉ. मोनिका सोढ़ी व श्रीमती करुणा असीजा ने जीता।

दिनांक 16.09.2014 को पत्र लेखन प्रतियोगिता का आयोजन किया गया। पत्र लेखन का विषय "परित्यक्त पालतू पशुओं से शहर में पैदा होने वाली समस्याओं की ओर ध्यान आकर्षित करते हुए इसके समाधन हेतु उपायुक्त महोदय को पत्र लिखिए", रखा गया था। इस प्रतियोगिता में कुल 13 प्रतियोगियों ने भाग लिया। प्रथम पुरस्कार श्री कर्मबीर मलिक, द्वितीय पुरस्कार डॉ. साकेत निरंजन तथा तृतीय पुरस्कार श्रीमती प्रवेश कुमारी ने जीता।

दिनांक 16.09.2014 को ही सांय 3:00 बजे संस्थान के सभी स्टाफ सदस्यों हेतु कंप्यूटर पर सरलता से हिंदी टंकण के प्रशिक्षण के लिए एक

कार्यशाला का आयोजन किया गया। हिंदी टंकण के प्रशिक्षण के लिए करनाल स्थित कल्पना चावला कंप्यूटर एजुकेशन सेंटर से 4 प्रशिक्षकों ने अलग अलग प्रकार से कंप्यूटर पर ऑनलाइन, ऑफलाइन, प्रस्तुतीकरण व अभ्यास के माध्यम से हिंदी टंकण का प्रशिक्षण ब्यूरो स्टाफ को दिया। सभी उपस्थित वैज्ञानिकों, तकनीकी व प्रशासनिक स्टाफ सदस्यों ने इस प्रशिक्षण कार्यशाला में विशेष रूचि दर्शाई। इच्छुक स्टाफ सदस्यों ने प्रशिक्षकों से अपने कंप्यूटर में ऑफलाइन हिंदी टंकण की सुविधा डाउनलोड करवाकर चलाने का प्रशिक्षण प्राप्त किया। यह प्रशिक्षण कार्यक्रम आशानुकूल सफल रहा।

दिनांक 17.09.2014 को टिप्पणी मसौदा लेखन प्रतियोगिता का आयोजन किया गया। इस प्रतियोगिता में कुल 7 प्रतिभागियों ने भाग लिया। प्रथम पुरस्कार श्री योगेंदर, द्वितीय पुरस्कार श्री कर्मबीर मलिक तथा तृतीय पुरस्कार डॉ. अवनीश कुमार ने जीता।

दिनांक 18.09.2014 को ही स्टाफ सदस्यों के द्वारा वर्ष 2013–14 के दौरान किये गए हिंदी कार्यो का मूल्यांकन किया गया। इस प्रतियोगिता में कुल 05 प्रतियोगियों ने भाग लिया। जिसमें प्रथम पुरस्कार श्री कर्मबीर मलिक, द्वितीय पुरस्कार श्री बाबु राम को तथा तृतीय पुरस्कार संयुक्त रूप से श्री हरविंदर सिंह व श्री सोपाल को मिला।

इस वर्ष विशेषतः ब्यूरो वैज्ञानिकों, तकनीकी व शोध विद्यार्थियों के लिए हिंदी में शोध–पत्र लेखन प्रतियोगिता का आयोजन किया गया जिसमे कि पिछले 5 वर्ष के अंतर्गत किये गए शोध कार्यो को आधार बनाया गया था। इस प्रतियोगिता में प्रथम पुरस्कार डॉ. आर. के. पुंडीर व सहयोगी, द्वितीय पुरस्कार डॉ. मोनिका सोढ़ी व सहयोगी तथा तृतीय पुरस्कार डॉ. प्रताप सिंह पंवार ने जीता।

दिनांक 18.09.2014 को एक आशु भाषण प्रतियोगिता का अयोजन किया गया। प्रतियोगिता का संचालन डॉ. रेखा शर्मा वरिष्ठ वैज्ञानिक, ने छायाचित्रों के माध्यम से किया। इस प्रतियोगिता में कुल 17 प्रतिभागी रहे और प्रथम पुरस्कार डॉ. कर्णवीर सिंह, द्वितीय पुरस्कार डॉ. मोनिका सोढ़ी तथा तृतीय पुरस्कार श्रीमती अनीता चंदा ने जीता।

दिनांक 18.09.2014 को ही एक वाद–विवाद प्रतियोगिता का आयोजन किया गया जिसका विषय पश्चिमी सभ्यता का भारतीय संस्कृति पर प्रभाव रखा गया था। विषय के पक्ष व विपक्ष में बोलने हेतु प्रतियोगिओं को 5 मिनट का समय दिया गया। इस प्रतियोगिता के पक्ष में बोलने हेतु प्रथम पुरस्कार डॉ. रेखा शर्मा, द्वितीय पुरस्कार डॉ. मोनिका सोढ़ी ने जीता। विपक्ष में बोलने वालों में प्रथम पुरस्कार डॉ. कर्णवीर सिंह तथा द्वितीय पुरस्कार डॉ. अवनीश कुमार ने जीता।

दिनांक 12–19 सितम्बर के दौरान हुई लिखित व मौखिक प्रतियोगिताओं के विजेताओं को दिनांक 20.09.2014 को ब्यूरो के स्थापना दिवस समारोह के अवसर पर पुरस्कृत किया गया। इस अवसर पर मुख्य अतिथि डॉ. एस. के. बंद्योपाध्याय, माननीय सदस्य, भारतीय कृषि वैज्ञानिक चयन मंडल ने अपने अध्यक्षीय भाषण में आयोजित किये गए इन हिंदी कार्यक्रमों की सराहना करते हुए विजेताओं को पुरस्कार वितरित किये।

वार्षिक राजभाषा पुरस्कार वितरण समारोह के दौरान ही संस्थान की वार्षिक हिंदी पत्रिका पशुधन के चतुर्थ अंक (वर्ष 2013) में छपे शोध लेखों में से तीन श्रेष्ठ लेखों को पुरस्कृत किया गया। इस प्रतियोगिता में

प्रथम पुरस्कार डॉ. पी.के. विज, डॉ. एस.के. निरंजन, डॉ. एम.एस. टांटिया व डॉ. बी.के. जोशी, एन.बी.ए.जी.आर. करनाल, के शोध पत्र "पशुधन नस्ल पंजीकरण – राष्ट्रीय संपदा की सुरक्षा" को मिला।

द्वितीय स्थान डॉ. प्रदीप कुमार डोगरा, संजीत कटोच, यशपाल ठाकुर, वरुण संख्यान एवं राकेश कुमार, पशु चिकित्सा कॉलेज, हि.प्र.कृ.वि.वि. पालमपुर के शोध पत्र "हिमाचल प्रदेश की अमूल्य धरोहर – चमुर्थी घोड़ा" को मिला। तृतीय पुरस्कार डॉ. देव व्रत सिंह, पशु चिकित्सा व पशु विज्ञानं महाविध्यालय, गो.ब.पं. कृषि व प्रो. वि.वि., पंतनगर के शोध पत्र "पशुओं का उचित रख–रखाव" ने जीता।

वार्षिक राजभाषा पुरस्कार वितरण समारोह में ही संस्थान की वार्षिक हिन्दी पत्रिका पशुधन प्रकाश के पंचम अंक (वर्ष 2014) का विमोचन माननीय मुख्य अतिथि डॉ. एस. के. बंद्योपाध्याय, सदस्य कृ.वै.च.म. द्वारा किया गया।

ICAR-NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES

(An ISO 9001:2008 Certified Institute)

G.T. Road By-Pass, Near Basant Vihar, Karnal-132 001 (Haryana) India

Phone: 0184-2267918 (O), Fax: 0184-2267654

E-mail: director.nbagr@icar.gov.in; directornbagr@gmail.com

Website: www.nbagr.res.in