DEDICATED TO ANIMAL GENETIC RESOURCES OF INDIA

भाकृअनुप–रापअनुसंब्यूरो *समाचार-पत्र*

ICAR-NBAGR *Newsletter*

Volume 16
Number 2

जुलाई - दिसम्बर, 2020
July - December 2020

From the Director's Desk

Conservation of genetic diversity is a long term commitment: more than any of us to live for.....

I am delighted to present this issue of the Bureau's Newsletter to our readers and stakeholders that aims to provide a glimpse of the activities undertaken during July to December, 2020 in the area of characterization and conservation of indigenous germplasm. India is appropriately positioned as one of the world's 12 mega-biodiverse nations because of an exceedingly vast spectrum of biodiversity that accounts for approximately 11.6 percent of the global livestock population. Conservation of farm animal biodiversity has assumed special significance in recent times in the wake of rapidly dwindling livestock biodiversity. Keeping in view this alarming situation, the scientists of the Bureau are putting sincere efforts to ensure sustainable management and utilization of livestock and poultry diversity of the country. These efforts are reflected in this document in the form of achievements in cryopreservation of germplasm, characterization of indigenous lesser-known populations, identification of bioactive peptides in animal products, and development of tests to detect genetic diseases in bovines.

Hon'ble Prime Minister Sh. Narendra Modi in his "Mann ki Baat" radio address on 30th August 2020, urged people to adopt local breeds of dogs. He emphasized the exemplary contribution of dogs to our security and police forces, and during times of disaster highlighting their better adaptation to the Indian environment. I am happy to share the information that for the first time, three Indian dog breeds namely Rajapalayam, Chippiparai and Mudhol Hound have been registered and notified in the Gazette of India. Thus, the total number of registered breeds of AnGR of the country has now reached 200, which includes 50 breeds of cattle, 17 of buffalo, 44 of sheep, 34 of goat, 9 of camel, 7 of horses and ponies, 10 of pig, 3 of the donkey, 2 of duck, one each of yak and geese, 19 of poultry and 3 of dogs. Active involvement of NBAGR in *ex situ* conservation of AnGR in the form of cryopreservation of semen samples, DNA and somatic cells from various breeds deserves special appreciation.

Even the unforeseen challenges of COVID19 pandemic could not deter us from timely organization of different meetings such as Breed Registration Committee meeting, Institute Research Committee meeting, Annual Review meeting of Network Project on AnGR as well as meeting with State Animal Husbandry Departments. It was gratifying to see successful organization of webinars, *Kisan Divas,* Breed Conservation Award ceremony and Hindi Pakhwada as well as celebration of Foundation Day of the institute, Constitution Day and Independence Day following the directives of COVID19 management. I seize this opportunity to convey my best wishes to all the colleagues who superannuated during the last six months and wish them a healthy and prosperous life ahead. I hope the information in this newsletter will be beneficial for the livestock keepers, policy planners and researchers associated with AnGR of the country. Suggestions for future improvement are always encouraged.

[R.K. Vijh]

Highlights of this Issue...


भारत का राजपत्र
The Gazette of India

ICAR-NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES

PB No. 129, G.T. Road By-Pass, Near Basant Vihar, Karnal-132 001 (HARYANA) INDIA

Tel. 0184-2267918, Fax: 0184-2267654

Email: director.nbagr@icar.gov.in, directornbagr@gmail.com

Website: www.nbagr.res.in

Institute Profile

The need for the establishment of an institute that can look after the characterization and conservation of Indian indigenous livestock was accepted in principle during the 4th Five Year Plan. During the 5th and 6th Five Year Plans, various government agencies coordinated the efforts for the establishment of twin institutes in the form of the National Bureau of Animal Genetic Resources (NBAGR) and National Institute of Animal Genetics (NIAG). The two institutes came into being on 21st September 1984 at the Regional Station of National Dairy Research Institute, Bangalore. These institutes were shifted to NDRI main campus at Karnal in 1985 and to its campus at Karnal in 1994. In 1995, the two institutes were merged to function as a single unit- the National Bureau of Animal Genetic Resources.

Mission

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

Mandate

Identification, evaluation, characterization, conservation, and sustainable utilization of livestock and poultry genetic resources

Co-ordination and capacity building in animal genetic resources management and policy issues

Activities

Characterization and documentation of native AnGR

- Survey and documentation of entire livestock and poultry population in the country with a target of zero non-descript
- Identification and characterization of unique populations qualifying for breed across the country
- Registration and notification of all types of livestock and poultry populations - breeds, lines, strain, variety in the country

Conservation of native breeds of livestock and poultry species

- *In situ* conservation of threatened breeds of livestock and poultry
- Cryopreservation of germplasm – semen, somatic cells, and DNA of all registered breeds

Genomics for population structure, uniqueness, and genetic improvement of native AnGR

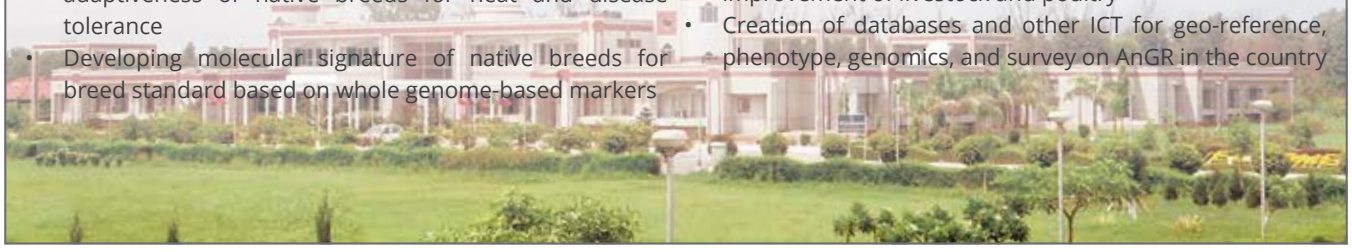
- Assessing genomic diversity and uniqueness of all registered livestock and poultry breeds
- Transcriptome and metabolome for evaluating adaptiveness of native breeds for heat and disease tolerance
- Developing molecular signature of native breeds for breed standard based on whole genome-based markers
- Creation of *De novo* and reference assemblies for native breeds of high importance
- Creation and validation of DNA Chip for native cattle and buffalo and other species for genetic improvement
- Establishment of National Bovine Genome Centre for indigenous breeds

Valuation of native AnGR

- Valuation of native AnGR based on their social, cultural, economic, and other non-marketing values
- Identification of biomolecules in milk, meat, and other produce/products specially obtained from native germplasm and their utility for human nutrition and health
- Developing tests and providing consultancy services for the screening of genetic diseases in livestock species

Information - Policy - Capacity building for AnGR management

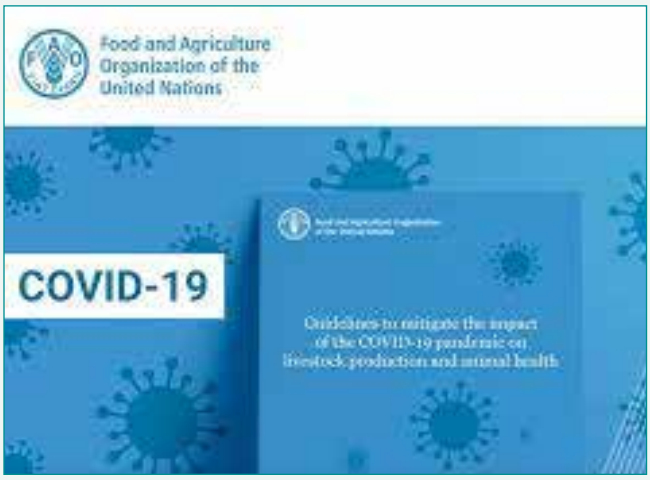
- Organizing training and sensitization programs for management and conservation of AnGR in the country
- Developing and supporting policies for AnGR management for the government agencies
- Assessing the impact of government policies for the improvement of livestock and poultry
- Creation of databases and other ICT for geo-reference, phenotype, genomics, and survey on AnGR in the country



Sectoral News

Connotation of COVID-19 pandemic on Farm Animal Genetic Resources

By the end of December 2019, the world awoke to a public health crisis due to the emergence of Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2 or COVID-19). It is affecting key sectors that contribute to global food security, nutrition, and livelihoods, including the livestock sector. The lockdown imposed to cope with the health issues has negatively affected the livestock and its related industries. The effects of COVID-19 on the livestock sector are still largely unquantified and yet to be fully felt. Formal assessments have not yet been possible, but current observations reveal disruptions to livestock value chains. This is mainly ascribed to the limitations of animal movement, the decrease of production inputs' availability, the shortage of workers due to the lockdown/curfew, the strong decrease in the purchasing power of the consumer, and the intensification of health care tasks. Lessons from past epidemics indicate these disruptions are likely to grow, along with their dire, socio-economic consequences. Fortunately, actions can be taken to protect this sector and its activities, services, and products upon which the world relies. A greater effort hitherto is necessary to take a holistic view on the impact on each of the sub-sectors and associated value chains through the collection of primary data all over the country and analyzing it through intellectual groups and apex organizations for arriving at the quantitative figures. The expected post-pandemic economic recession might also result in reductions of the financial commitment to animal research by funding agencies, governments, and the private sector. More so as the field of AnGR conservation has generally received limited financial support. The Covid19 pandemic should be seen as a wake-up call for humanity, to reflect and rethink. Possible effects of the COVID-19 crisis on local breed diversity conservation and mitigation measures include:



- Endangered breeds in fragile socio-economic contexts are particularly exposed to population decline and stochastic perturbations expected following the COVID-19 pandemic.
- The interest of richer societies for short food chains, natural food, and traceability of products can create opportunities for local breeds' production systems in the context of COVID-19.
- National surveys on the breed diversity status following COVID-19 should address negative situations and opportunities.
- COVID-19 has revealed risks, fragilities, and inequalities for our food systems. The aim is to build resilience at all levels. Agroecology, which implies conserving breed diversity, can play an important role.

Germplasm Registration

First time registration of Indigenous breeds of dogs

ICAR-National Bureau of Animal Genetic Resources, Karnal (NBAGR) is the nodal agency for the registration of newly identified germplasm of livestock and poultry of the country and has also been given temporary authority for registration of dog germplasm of the country. Dogs are mainly used for shepherding, guarding, herding, hunting, sniffing, sports and companionship. In the livestock production system, their contribution can be recognized in shepherding and herding of large herds of sheep and goats and other livestock species in general. Some of the native dogs were also developed as sniffers, which have a high potential of utility in the army. Although there are some native dog populations, which are utilized for different purposes including agriculture, however, they were not recognized as native breeds.

The Breed Registration Committee, chaired by Deputy Director General (Animal Sciences), ICAR in its meeting held online on 16th September 2020, approved the registration of three breeds of dog, first time in the country. After including these newly registered breeds, the total number of indigenous breeds of livestock, poultry, and the dog in the country is now 200, which includes 50 for cattle, 17 for buffalo, 34 for goat, 44 for sheep, 7 for horses & ponies, 9 for camel, 10 for pig, 3 for donkey, 1 for yak, 19 for chicken, 2 for duck, 1 for geese and 3 for dog.

Newly registered Indian dog breeds

Breed	Home Tract	Accession number
Rajapalayam	Tamil Nadu	INDIA_DOG_1800_RAJAPALAYAM_19001
Chippiparai	Tamil Nadu	INDIA_DOG_1800_CHIPPIPARAI_19002
Mudhol Hound	Karnataka	INDIA_DOG_0800_MUDHOL HOUND_19003

Rajapalayam dog: Rajapalayam dog is mainly distributed in Virudhunagar, Tirunelveli, and Madurai districts of Tamil Nadu. These dogs are medium in size with a compact body. The coat color

is white. Skin, nostrils, and eyelids are pink. Eyes are golden. Height at wither ranges from 55 to 72 cm in males and 38-70 cm in females. Adult body weight ranges 14 to 32 Kg. Rajapalayam dogs are utilized for guarding farms and farmhouses. They possess the attributes of high obedience and easy trainability. Barking is medium pitched. Estimated population is 3,000-4,000.

Chippiparai dog: Chippiparai dogs are mainly found in Thoothukudi, Tirunelveli, Virudhunagar, and Madurai districts of Tamil Nadu. The estimated population is about 6,000. Chippiparai dogs (*Kanni* or *vettainaai*) are medium in size. Coat color varies from fawn to dark brown, brownish-black, and black. Black dogs have white markings on both sides above the eyes or black circles around the eyes. Eyes are golden and oval. Ears are medium in size and drooping or semi drooping. Height at wither ranges from 60 to 76 cm in males and 54 to 70 cm in females. Adult body weight ranges from 13.6 to 32.5 Kg. The utility of this dog is mainly for guarding and hunting, but they are also kept as a hobby and

pride by the owners. These dogs are high in obedience and easy to train.

Mudhol Hound dogs: These are also known as *Pissouri* Hound or *Lahori* Hound. These dogs are mainly distributed in the Bagalkot and Vijayapur districts of Karnataka. The estimated population is about 1,500. They are strongly built, having high stamina and endurance. The body is symmetrical with an elegant and lean look. Coat colors mainly include white, brown, patchy, brindle, black, fawn along spotted. The head is proportionately small. Skull is long and narrow. Eyes are dark brown or hazel colored, oval, and obliquely placed. Ears are medium, thin, triangular, and set high. The chest is long and deep. The abdomen is well tucked. The tail is long, tapering and slightly curved. Height at withers ranges from 73 to 80 cm in males, and 61 to 74 cm in females. Adult body weight ranges from 21 to 40 Kg. The gait of the Mudhol Hound, with an aerodynamic body, gives an effortless stride, giving a flying appearance. Mudhol Hound dogs

are used for guarding and shepherding. These dogs are also high in obedience and easy to train.

Gazette Notification of Germplasm

Three Indian dog breeds notified for the first time

Gazette is an important official means of communication of government information including laws and regulations about the issues in and out of the land. Gazette notification in the agriculture sector is implied for the varieties of different agriculture crop species that are already issued for the registration by the Department of Agriculture, Cooperation & Farmers Welfare. However, such safeguards for the protection of farm animal breeds were not present till September 2019. After realizing the need to protect the valuable agricultural genetic resource biodiversity specific to indigenous farm animal germplasm in the country and claiming its sovereignty over the germplasm, the Gazette notification for the livestock and poultry breeds was initiated by the Government of India in October 2019 and 183 registered breeds were notified for the first time by the Government of India [Gazette Notification: Ministry of Agriculture and Farmers' Welfare, No. 3364 (S.O. 3699(E)) (October 14, 2019)].


भारत का राजपत्र
The Gazette of India

On November 13, 2020, three registered native dog breeds were notified by the Govt. of India [Ministry of Agriculture and Farmers' Welfare, No. 3589 (S.O.4086(E)) (November 13, 2020)]. The notified breeds of the specified states received the statutory recognition and were recognized as notified breeds for the whole of India for keeping and rearing for various purposes as mentioned in the notification.

Research Content

Characterization of Palamu goat of Jharkhand

Palamu, a small-sized goat also known as *Medini* is named after its native tract (Palamu, Latehar, and Garhwa) in Jharkhand state. The coat color is black throughout the body. Head profile is slightly convex, ears are directed downwards approximately 45° from horizontal axis and horns are straight with backward and upward orientation. Muzzle, eyelids, and hooves are black, the body is cylindrical, the udder is small and pendulous and the teats are conical shaped. Adult body weights in males and females are 29.89±0.72 and 22.71±0.41 Kg, respectively. The average age at first kidding of Palamu goat is 12.15±1.21 months with a kidding interval of 7.69±1.31 months. Twinning is common except in first kidding. The average litter size is 1.35±0.06.

For genetic characterization of Palamu goat, 23 microsatellite markers were amplified successfully. A total of 190 alleles were detected. Sufficient polymorphism was evident from the allele frequency data. ILSTS82 showed the highest number of observed alleles per locus (20), while RM4 and ILSTS05 showed the lowest (4) with 9.14±1.995 mean number of alleles. The expected number of alleles varied from 1.487 (ILSTS065) to 7.548 (ILSTS30) with a mean value of 4.151±0.906. Palamu goat had substantial genetic variation based on its gene diversity in addition to the average number of alleles per locus. The observed and expected heterozygosity values were 0.637± 0.139 and 0.692±0.151, respectively. Observed heterozygosity was lower than expected showing a departure from Hardy-Weinberg Equilibrium (HWE) and the possibility of inbreeding. The population has heterozygote deficiency to the tune of 8.8% (F_{IS} value=0.088). The population did not suffer from a recent genetic bottleneck (last 40-80 generations). The results suggest the existence of a distinct goat population harboring sufficient genetic variation for scientific management.

(Contributed by Dr. MS Tantia)

Genetic characterization of native "Dang" buffaloes

A unique buffalo population has been identified in ravine areas of the Chambal division of Madhya Pradesh. These buffaloes are well adapted to the ravine conditions with hot climate, sparse vegetation and stony terrain and perform well for milk production.

To analyse the genetic diversity of these buffaloes, blood samples were collected from 11 native "Dang" buffaloes in their breeding tract and 11 quality checked DNA samples were custom sequenced by ddRAD. A total of 2,21,349 SNPs and 22,054 InDels were identified at a read depth of 10. A total of 27,610 SNPs after filtration were used for downstream genetic diversity analysis.

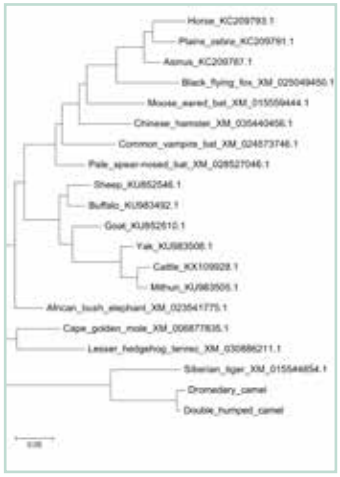
Table: Genetic diversity estimates of the native "Dang" buffaloes (1) in comparison to Murrah (2) and Swamp buffaloes (3)

Pop ID	Ho	SE	Ho	SE	He	SE	He	SE	Fis	SE
1	0.3022	0.0051	0.6978	0.0051	0.2804	0.0036	0.7196	0.0036	0.0025	0.0395
2	0.3436	0.0012	0.6564	0.0012	0.3298	0.0009	0.6702	0.0009	0.0139	0.0011
3	0.2334	0.0011	0.7666	0.0011	0.241	0.001	0.759	0.001	0.0526	0.0013

Ho - Observed heterozygosity; SE - Standard error; He - Expected heterozygosity

(Contributed by Dr. Jayakumar S)

Unique genetic architecture of PRDM9 gene in camel



Inferred phylogeny of camel PRDM9 and its orthologs

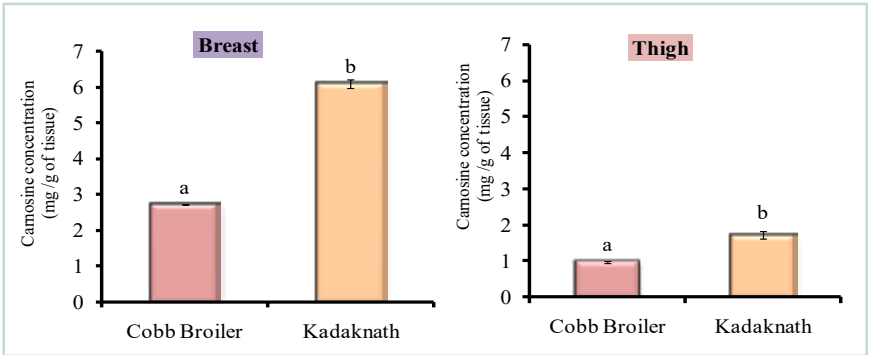
PRDM9 gene encodes a protein with an immensely variable zinc-finger (ZF) domain that determines the site of meiotic recombination genome-wide. There is a strong variability in the number of encoded zinc fingers in PRDM9 not only across species but also within species, making it the fastest evolving gene in the genome. The architecture of the PRDM9 Zinc finger (ZF) domain was explored in two Camelid species (*Camelus dromedaries* and *Camelus bactrianus*). Sequence analysis revealed highly conserved domain architecture with the presence of 3 and 4 ZFs in dromedary and Bactrian camels, respectively. The conserved sequence of PRDM9 in camels was a surprising observation since the gene is known to harbor tremendous variability in other species. Typical evolutionary features of the PRDM9 ZF domain i.e concerted evolution and positive selection were invariably absent in both the one-humped dromedary and two-humped Bactrian camels. The fertility of hybrids of dromedary and Bactrian camels, despite being taxonomically distinct species can be attributed to the lack of sequence variability in PRDM9 in the two species. Phylogenetic analysis underpinned clear demarcation of camels from other livestock species.

(Contributed by Dr. Sonika Ahlawat)

Kadaknath chicken: Superior bio-active dipeptide- carnosine content and functional attributes

Kadaknath is the only all-black chicken among the 19 diverse chicken breeds of India. Its meat is used as a folk medicine for invigorating and medicinal properties. It is arousing interest among consumers for the expectations of pharmacological benefits. However, scientific evidence for these claims is still wanted. Thus, Kadaknath meat was explored and compared with the commercial Cobb-400 broiler meat, to look for the functional traits that might be contributing towards the acclaimed benefits. Meat (Breast and thigh) was collected from chickens of two groups (n=20/ group) at their commercial slaughter age. Meat extract was evaluated by numerous *in vitro* methods. Carnosine (β-alanyl-L-histidine) and its methylated derivative anserine (β-alanyl-1-methyl-L-histidine) are functional dipeptides endowed with several biological functions including anti-aging, anti-glycation, anti-oxidation, etc. Therefore, quantitative analysis of carnosine and anserine was performed using HPLC. Carnosine content was significantly different among the Kadaknath and Cobb groups ($p<0.05$) as well as among the two types of meat cuts; breast and thigh. Carnosine content in Kadaknath breast meat was more than double of the Cobb broiler being 6.10±0.13 and 2.73±0.1 mg/g of wet tissue, respectively. Similarly, the thigh meat of Kadaknath was a richer source of carnosine.

Quantitative RT-PCR identified a significant abundance of carnosine synthase 1 (CARNS1) and solute carrier family 36, member 1 (SLC36A1) genes in Kadaknath breast in comparison to the Cobb broiler. Protein concentration (g/100g of tissue) in Kadaknath breast (25.25 ± 0.31) and thigh (19.98 ± 0.29) meat was significantly ($P < 0.05$) higher than that of the Cobb. The superior antioxidant capacity of Kadaknath meat was established by more than one *in vitro* assay. Free radical scavenging assays and metal chelation ability unequivocally identified the better functional property of Kadaknath meat. Similarly, it had a much potent ability to inhibit the formation of advanced glycation end products implicated in age-related and diabetic complications. The nutritional and functional characteristics of meat add value to the unique Indian Kadaknath chicken and will act as a fundamental step in the development of a brand name for Kadaknath products. These findings will impel the research targeting the commercial potential of its meat in the fields of functional foods, cosmeceuticals, and nutraceuticals.



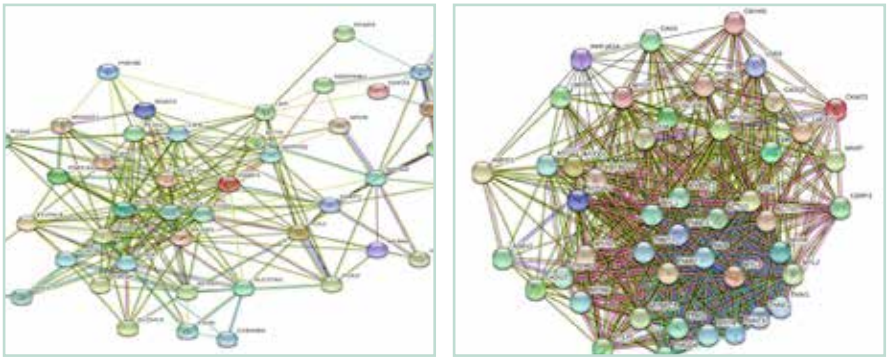
Carnosine concentration in meat extracts of commercial Cobb broiler and Kadaknath chicken (N=20, each). Different superscripts within the same graph differ significantly (P≤ 0.05)

(Contributed by Dr. Rekha Sharma)

Indian goat breeds: Distinctness of skeletal muscle transcriptomics

Barbari, a dual purpose prolific breed is well adapted to the Gangetic plains and used both for its meat and milk. Chevon from Barbari goat is considered of good quality and this breed is preferred for commercial goat farming. Changthangi goat, on the other hand, is famous for its fine fibre quality. It thrives well in the cold desert region of Ladakh in the north. The prominent morphological differences between the two breeds may help underpin the genetic variations underlying muscle traits. Therefore, the differential expression of genes in *longissimus thoracis* muscles between meat and wool-type Indian goat breeds was analyzed. RNA sequencing data was generated from four biological replicates of Barbari and Changthangi goats. Samples with a RIN value > 8.0 were used for library preparation. Paired-end reads (100 bp) were generated using Illumina HiSeq 2500 platform. More than 93% of data was of high quality in both Barbari and Changthangi goats. An average of 94% reads aligned to the goat (*Capra hircus*) reference assembly ARS1. Genes showing higher expression in both breeds were mainly involved in ribosomal binding and translation (*EEF1A1, RPS11, RPS19, RPSA,* and *RPS18*). However, a clear demarcation could be observed between the two breeds in terms of the expression of genes associated with lipid metabolism (*FASN, SCD, THRSP, DGAT2* and *FABP3*). Most significant genes with high connectivity identified by gene-protein network analysis were associated with the triacylglycerol biosynthesis pathway in Barbari goat. Highly interactive genes identified in Changthangi goat were mainly associated with muscle fibre type. The study provides an insight into the differential expression of genes which may be reflective of genetic selection or adaptation in Barbari and Changthangi goat breeds.

(Contributed by Dr. Reena Arora)



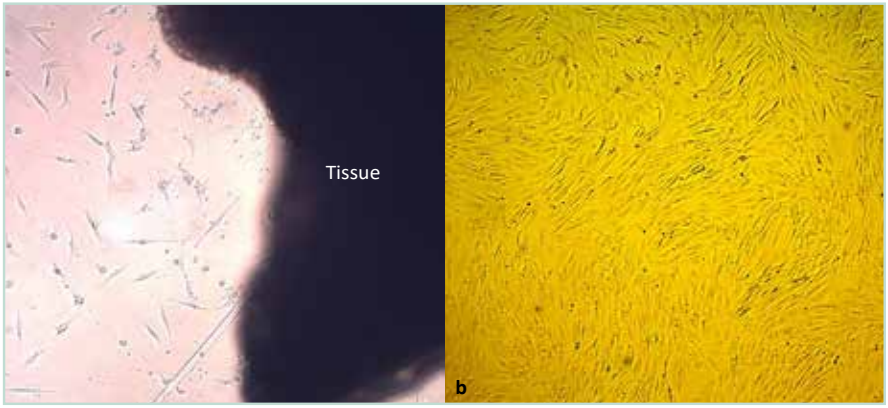
(a) (b)

Gene-protein interaction network of core differentially expressed genes in (a) Barbari and (b) Changthangi goats.

Cryoconservation of Germplasm

The germplasm repository at ICAR-NBAGR is being strengthened by preserving the diversified forms of germplasm (semen, embryos, DNA, epididymal sperms, and somatic cells). Three thousand and fifty semen doses of Nili Ravi buffaloes have been procured for long-term cryopreservation in Gene Bank during July-December, 2020.

Ear marginal tissues from four populations of three species were utilized for the establishment of cell lines by attachment cell culture method followed by cell cryopreservation technique. These include Mewari and Jalori camel, Halari donkey, and Zanskari horse. The primary culture was established using the explant culture technique. The fibroblast-like cells showed typical fusiform morphology with centrally located oval nuclei. Cells were free from microbial contaminations. The growth curve at passage-5 represented typically S-shaped curve as the cell population passed through the lag, logarithmic, and plateau phases. The cells were cryopreserved from the 4th to 6th passage stocking at least 30 cryogenically-preserved vials (1×10^{6} cells/ml) per animal. These newly established cell lines of indigenous livestock preserve precious genetic resources at the cellular level and provide invaluable materials for genomic, post-genomic, and somatic cell cloning research.



a) Cells emerging from ear tissue explant in primary culture b) Near confluence cells on the day 6 of culture (x40 magnification)

Livestock Production and Health Management

Cytogenetic screening and DNA testing of breeding bulls for genetic diseases

The cytogenetic screening was conducted on 109 bovine males being reared for semen production at various government farms. A total of 10 cattle males were screened for Bovine Leukocyte Adhesion Deficiency (BLAD), citrullinemia, Factor XI deficiency (FXID), and deficiency of Uridine monophosphate synthase (DUMPS, for HF only). All the bulls were found to carry normal karyotype and genotypes for the investigated diseases.

Technology

A total of 8 technologies were developed and 4 complete patents were filed to the Indian Patent Office, New Delhi

S. No.	Name of the Technology	Inventors	Patent Application number and date
1	High Density Chip of Indigenous Zebu Cattle (*Bos indicus*)	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor and Meenal Raheja	202011046970 dated 28th October 2020
2	High Density Chip of Indigenous Riverine buffaloes (*Bubalus bubalis*)	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor and Meenal Raheja	202011046971 dated 28th October 2020
3	High Density SNP Chip of indigenous backyard poultry breeds	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor, Meenal Raheja, Reena Arora and Sonika Ahlawat	202011057421 dated 31st December 2020
4	High Density Chip of *Capra hircus*	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor, Meenal Raheja, Reena Arora and Sonika Ahlawat	202011057422 dated 31st December 2020
5	Medium Density SNP Chip of Bactrian and Dromedarian Camel	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor, Meenal Raheja, Reena Arora, Sonika Ahlawat and Rekha Sharma	Provisional application
6	High Density SNP chip of Swamp Buffaloes (*Bubalus bubalis*)	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor and Meenal Raheja	Provisional application
7	Linkage Disequilibrium SNP Chip of Riverine Buffalo (*Bubalus bubalis*) for Economic Dairy Traits	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor, Meenal Raheja	Provisional application
8	Linkage Disequilibrium SNP Chip of Indigenous Cattle (*Bos indicus*) for Economic Dairy Traits.	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor and Meenal Raheja	Provisional application

Human Resource Development

- A webinar on **'The promise of livestock genomics'** was organized on 26th November 2020 at ICAR-NBAGR, Karnal. An overwhelming response of 200 participants from about 50 institutions, including ICAR-Institutes, Animal Husbandry Departments, KVKs, Universities, and Colleges from all over India was received for registration. Two lectures by experts on livestock genomics were delivered. The lectures were followed by deliberations among all participants.

- An overview on '**Lesser-Known Animal Genetic Resources of India'** was developed through a Webinar organized on 5th October 2020 at NBAGR, Karnal. Information on more than 30 lesser-known populations having the potential to be recognized as breeds was acquired from all states of the country after deliberations with the experts. A total of 66 participants, including scientists of the Bureau, attended the webinar.

Meetings

- **Breed Registration Committee (BRC) Meeting:** A meeting of BRC was held on 16th September 2020 by virtual mode. The meeting was chaired by Dr. BN Tripathi, Deputy Director General (Animal Sciences), ICAR. Three dog breeds - Rajapalayam and Chippiparai of Tamil Nadu and Mudhol Hound of Karnataka were approved for registration as the new dog breeds. ICAR-NBAGR also allotted the Accession numbers to these newly registered breeds.
- **Institute Research Committee Meeting:** Virtual meeting of the Mid-term Institute Research Committee (IRC) was held online on 28-29th October 2020 to discuss the progress of ongoing projects as well as the final reports of completed projects. The meeting was chaired by Dr. RK Vijh, Director (Acting) & Chairman IRC, ICAR-NBAGR on the 28th October 2020, and by Dr. Anand Jain, Principal Scientist, ICAR-NBAGR (Chairman Nominee) on 29th October 2020. The meeting was conducted keeping in view the directives of COVID-19 management.
- **Meeting with State Animal Husbandry Department:** As a part of the characterization of AnGR of the northeast region, an online meeting of NBAGR scientists was held with the Mizoram state Animal Husbandry and Veterinary department officials, sensitizing them about the project to be implemented and 'NBAGR Data' mobile app for field data collection. Twenty officials participated in the meeting.
- **Annual Review meeting of Network Project on Animal Genetic Resources:** It was held online on 17th July 2020 under the chairmanship of Dr. BN Tripathi, DDG (Animal Sciences) to discuss the final report (2017-20) of the project. All the PIs and coordinators of characterization and conservation units attended the meeting.
- An online meeting for finalization of EFC of ICAR-NBAGR was held on 6th July 2020 under the chairmanship of Dr. BN Tripathi, DDG (AS), ICAR. Twenty-one scientists participated in the deliberations.
- 12th ITMC meeting was held on 21st August 2020 to approve the two Patent applications filed by the Bureau for further submission to the Intellectual Property Office, New Delhi.

Linkage With States

Linkages were made with the state animal husbandry department of Mizoram and Madhya Pradesh as well as with state agricultural universities of Maharashtra, Goa, and Gujarat for undertaking the characterization of AnGR.

Mizoram: An online meeting was conducted with the Animal Husbandry and Veterinary Department officials of Mizoram state, to brief them about the NBAGR performa for collecting information on the socio-economic status of farmers and phenotypes of livestock and poultry species. There was active participation from both sides and officials shared the information about local chicken, hill cattle, and Mithun resources that can be taken up for characterization.

Madhya Pradesh: An online meeting was conducted by NBAGR scientists (Functional Group-7) with the Animal Husbandry Department officials of Madhya Pradesh, briefing them about the work to be carried out. The technical program to be followed for the characterization of state animal genetic resources was explicitly discussed.

Celebrations

- 37th Foundation Day of NBAGR: Bureau celebrated its foundation day on 21st September 2020. On this occasion, the best workers of the institute were felicitated with awards. Dr. Sonika Ahlawat, Scientist

(SS) was awarded the prestigious PG Nair Award 2020 for her outstanding contributions towards the advancement of science for the characterization and conservation of indigenous AnGR. Sh Satish Kumar, Sh. Balwinder Singh and Sh. Ram Sagar received the awards in Administrative, Technical and Supporting Staff categories, respectively.

- Independence Day being a very auspicious day for the Indians was celebrated in the Bureau campus to pay homage to all freedom fighters. The program was conducted in line with all the precautionary measures as per the COVID guidelines.
- Constitution Day: Also known as 'Samvidhan Divas', was celebrated on 26th November 2020 to commemorate the adoption of the Constitution of India. An online oath-taking ceremony to promote constitution values among staff was organized.
- संस्थान में 8-21 सितंबर 2020 तक "हिंदी पखवाड़ा 2020" का आयोजन किया गया जिसमे हिंदी की लेखन एवं पोस्टर प्रतियोगिताओं का आयोजन किया गया. विजेताओं को नकद पुरस्कार वितरण करने के लिए प्रक्रिया पूर्ण की गई.
- संस्थान राजभाषा कार्यान्वयन समिति की बैठक 4 सितंबर 2020 को आयोजित की गई.

- 31 अक्टूबर, 2020 को "सरदार वल्लभाई पटेल की जयंती – राष्ट्रीय एकता दिवस" कार्यक्रम के अंतर्गत संसाधन के सभी स्टाफ सदस्यों ने इस दिन "राष्ट्रीय एकता दिवस प्रतिज्ञा" ली।
- भारतीय केन्द्रीय सतर्कता आयोग के कार्यक्रम के अंतर्गत राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल, में 28 अक्टूबर से 2 नवम्बर, 2020 सप्ताह को "सतर्कता जागरूकता सप्ताह" कार्यक्रम के रूप में मनाया गया। इस जागरूकता कार्यक्रम के अंतर्गत ब्यूरो के सभी स्टाफ सदस्यो ने दिनाँक 28 अक्टूबर, 2020 को सत्यनिष्ठा की प्रतिज्ञा ली।

Kisan Divas and Breed Conservation Award:

ICAR- National Bureau of Animal genetic Resources Karnal organized online *"Kisan Divas* and Breed Conservation Award – 2019 ceremony on 23rd December 2020. The purpose of the award is to promote individual livestock keepers/communities/ Institutions engaged in indigenous breed conservation. The chief guest of the function was Dr. VK Saxena, ADG (AP&B), ICAR, New Delhi. Following organizations/farmers were awarded for the conservation of native breeds:

Breed	State	Name of Organization / Farmer
Kankrej Cattle	Gujarat	Dantiwada Agricultural University, Sardarkrushinagar- Dist. Banaskantha
Ongole Cattle	Andhra Pradesh	Sh Mullapudi Narendranath, Old town, Dist. Tanuku
Jaffrabadi Buffalo	Gujarat	Junagadh Agricultural University, Dist. Junagadh
Chilika Buffalo	Odisha	Sh Upendra Nath Jena, Kurupal, P.O: Badajhad and Mr PS Krushna Prasad, Dist. Puri
Changtangi Goat	Ladakh (UT)	Sh Tsering Angchuk, Kharnak Village, Dist. Leh
Konkan Kanyal goat	Maharashtra	Livestock Research Station, Nileli Dist.Sindhudurg
Kadaknath Chicken	Madhya Pradesh	Krishi Vigyan Kendra, Dist. Jhabua

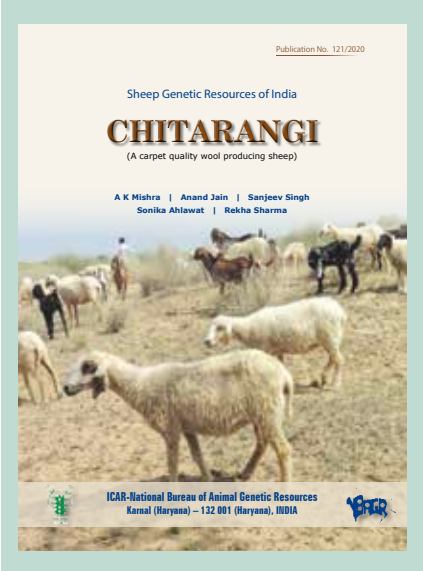
Swachh Bharat Mission: In consonance with the call of Hon'ble Prime Minister, cleanliness was maintained through activities under Swachh Bharat Mission on the concept of Mahatma Gandhi's vision, "Sanitation is more important than independence." *Swachhta Pakhwada* was celebrated during 16th-31st December 2020. *Swachhta Pledge* was taken by the staff members and different activities were organized in which all staff participated enthusiastically. Sanitary measures to contain COVID-19 spread were taken as per guidelines of the council and GoI.

COVID-19 management: The Bureau premises were sanitized at regular intervals to minimize the spread of the ongoing pandemic. Directives about social distancing, regular hand washing, and use of face masks were followed by the staff. Forty-five staff members were randomly screened for Covid-19 infection. To ward off the stress due to the COVID-19 scenario, a one-day training program on "Effective health management for enhancing the work efficiency of ICAR employees" was conducted on 1st September 2020. Lectures on "Stress management for enhancing work efficiency under Covid-19 scenario" and "How cognitive behaviour therapy (CBT) helps to enhance work efficiency?" were delivered by experts.

Covid appropriate behaviour of NBAGR staff....

Documentation of AnGR / Breed Monograph / Bulletin

- Mishra AK, Jain A, Singh S, Ahlawat S and Sharma R (2020) Sheep genetic resources of India: Chitarangi (a carpet quality wool-producing sheep), p 40, ICAR-NBAGR, Karnal 132001.



- Scientific magazine "Pashudhan Prakash", dedicated to native AnGR was published in Hindi by the Institute.
- A monograph (78 pages) entitled "Kathani cattle: A cattle genetic resource from Vidarbha region of Maharashtra" was published under Network Project on AnGR.
- Unknown/lesser-known livestock breeds were documented in the form of an e-publication book entitled "Lesser Known Animal Genetic Resources of India: An Overview".
- Breed Descriptors for Ladakhi yak and Ladakhi donkey populations were prepared, which will act as baseline data required for the registration of these populations as breeds.

Transfer

1. Sh. Raj Kumar, Adm. Officer was transferred to ICAR-National Research Centre on Equines, Hisar on 26.09.2020. Additional charge of Adm. Officer, NBAGR was given.
2. Dr. Jayakumar, S. was transferred to ICAR-Directorate of Poultry Research, Hyderabad on 30.09.2020.

Promotion

1. Sh. Harvinder Singh was promoted to the next higher grade of ACTO w.e.f. 14.05.2019.

2. Sh. Rakesh Kumar was promoted to the next higher grade of STO w.e.f. 01.01.2020.
3. Smt. Neerja Kaul was promoted to the post of UDC w.e.f. 17.03.2020.

Superannuation/Retirement

ICAR-NBAGR bid adieu to five colleagues during this period. They provided years of devoted and invaluable service. We own a debt of gratitude to all the following members:

1. Dr. N.K. Verma, Principal Scientist superannuated on 31.08.2020.
2. Dr. Anand Jain, Principal Scientist retired on 31.10.2020.
3. Dr. P.K. Vij, Principal Scientist retired on 31.10.2020.
4. Dr. R.K. Vijh, Principal Scientist superannuated on 30.11.2020 and reappointed as Principal Scientist and Director (Act.).
5. Sh. Ramesh Chand, TO retired voluntarily w.e.f. the forenoon of 31.08.2020.

We wish them a wonderful retired life.
Hope the new journey is filled with joy and contentment!

Dr. N.K. Verma

Dr. Anand Jain

Dr. P.K. Vij

Dr. R.K. Vijh

Sh. Ramesh Chand

Editors:	Dr Rekha Sharma, Dr Sonika Ahlawat, Dr M S Dige	*Production & Design:*	Dr S K Niranjan, Incharge, PME Cell, ICAR-NBAGR
Compilation:	Dr P S Dangi, CTO, PME Cell	*Production Assistance:*	Sh. Karambir Malik, Smt. Anita Chanda
Photographs:	P&E Section, ICAR-NBAGR; Applicants of breed for registrations; scientists of NBAGR	*Publisher:*	Director, ICAR-NBAGR

Biodiversity is our most valuable but least appreciated resource....Edward O Wilson