DEDICATED TO ANIMAL GENETIC RESOURCES OF INDIA

भाकृअनुप–रापअनुसंब्यूरो समाचार-पत्र
ICAR-NBAGR Newsletter

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Azadi Ka Amrit Mahotsav

"Biodiversity of India is a unique treasure for the entire humankind. We have to preserve it, conserve it and explore further"

Hon'ble Prime Minister Shri Narendra Modi (Mann ki Baat radio address, 23rd February 2020)

New Leadership at NBAGR

Dr. BP Mishra joined as 8th Director of ICAR-NBAGR, Karnal on 4th May 2021. Previously, he was Joint Director (Research) from 2014-2021 and Acting Director (2020-21) of ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly (UP). Dr. Mishra is an exceptional leader with extensive research experience of over 32 years in animal sciences. The scientific community at NBAGR always admires his audacity and skills when it comes to building and inspiring teams. He is a scientist turned director and came with the vision that all the native Indian AnGR and poultry resources would be characterized by the NBAGR in collaboration with the stakeholders. He brings new energy to the NBAGR to scale up scientific inquisitiveness. He is not just a great cultural fit for NBAGR as an institution, but also the community. The Bureau family is delighted to welcome Dr. Mishra, to lead a team of knowledgeable and dedicated people that have carved a niche for themselves at the national platform.

From the Director's Desk

I am immensely pleased to putforth to our readers the Bureau's Newsletter which chronicles the achievements of NBAGR during the year 2021. The diverse animal genetic resources of the country are the backbone of the Indian economy and represent a reliable cushion against adversities such as climate change, diminishing pastures and emerging diseases. To respond effectively to these challenges, it is critical to characterize and protect the AnGR diversity in accordance with the Sustainable Development Goal Agenda of the United Nations. Keeping this in view, the Secretary, DARE & Director General, ICAR, Dr Trilochan Mohapatra launched the "Mission towards Zero Non-descript AnGR in India" through a National Workshop that attracted participation of representatives of different research institutes, State Animal Husbandry Departments, NGOs, societies and farmers. I am fortunate to be leading a team of scientists that are committed to accomplish this mission, which is reflected from strenuous efforts in fostering linkages with stakeholders and the animal husbandry officials of different states. Strategies and roadmap for the documentation of the native AnGR was discussed through interface meetings with five states and one union territory of the country in year 2021.

During the year, Dharwadi buffalo of Karnataka and Manda buffalo of Odisha were registered and gazette notified. In addition, many prospective populations such as Monyul cattle, Manipuri cattle, Hoafa dog and Changkhi dog were characterized to enable their recognition as distinct breeds in future. Genetic characterization of Alambadi cattle and donkeys of Braj region of Uttar Pradesh was accomplished through the microsatellite markers. The genetic diversity of cryopreserved germplasm in the National Gene Bank of the Bureau was also assessed as per the FAO guidelines. Our scientists expanded their research to the recent domains of genomics to unravel genes contributing to adaptability of native cattle in tropical regions and superior mutton quality attributes of the Bandur sheep. I am happy to share that the National Gene Bank of the institute was strengthened with semen doses from 7 breeds belonging to three species and somatic cells from 3 breeds of camel, 2 of goat and one each of cattle and pig. Also, the DNA repository was enriched with the germplasm of 169 breeds/populations of AnGR.

The progress of the institutional as well as out funded research projects was evaluated through the timely organization of the RAC and IRC meetings. Despite the COVID19 restrictions, the Bureau successfully organized the SOCDAB National Webinar (Virtual mode) and ISAGB National Conference (Hybrid mode) which facilitated fruitful dialogue between researchers, academicians, policy makers and other stakeholders with regard to sustainable utilization and management of AnGR. I seize this opportunity to appreciate the efforts of the Bureau in recognizing the contribution of livestock keepers engaged in conserving our indigenous germplasm by bestowing them with Breed Saviour Awards and Breed Conservation Awards. Active participation of the staff members in various national celebrations, campaigns and events under the Azadi ka Amrit Mahotsav deserves appreciation.

I hope you enjoy reading the current issue of NBAGR's Newsletter. Suggestions for improvement may be sent at director.nbagr@icar.gov.in.

[B.P. Mishra]

HIGHLIGHTS OF THIS ISSUE...

ICAR-NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES

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

Tel. 0184-2961000, Fax: 0184-2960460

Email: director.nbagr@icar.gov.in

Website: https://nbagr.icar.gov.in

Institute Profile

With the realization of the unique significance of native animal and poultry genetic resources and their potential utilization at global level, a need was felt by the ICAR in 1960s for establishing an organization which could undertake the responsibility of evaluating, certifying and conserving the country's rich and diverse germplasm resources. The establishment of two different institutes- National Bureau of Animal Genetic Resources (NBAGR) and National Institute of Animal Genetics (NIAG) was approved, in principle, during IV Five-Year-Plan. The Institute was set up on 21st September, 1984 at the campus at National Dairy Research Institute (Southern Regional Station), Bangalore and further shifted to Karnal on 19th July, 1985. Finally, NBAGR and NIAG were merged in 1995.

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 of the country.
- Coordination and capacity building in animal genetic resources management and policy issues.

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.

Major activities

Identification, characterization and documentation of native AnGR in country

- Survey and documentation of entire livestock and poultry population in the country with a target of Zero Non- Descript AnGR.
- Identification and characterization of homogenous populations qualifying for breed.
- Registration and notification of all types of livestock and poultry populations.

Conservation of native breeds of livestock and poultry species

- *In situ* conservation of threatened breeds of livestock and poultry.
- Cryopreservation of germplasm of all registered breeds
- Assessing risk status of native breeds.

Genomics for population structure and diversity of native AnGR

- Assessing genomic diversity and uniqueness of all registered livestock and poultry breeds.
- Developing molecular signature for breed standard of native breeds.
- Creation of genome assemblies for native breeds of high importance.

Trait identification and characterization of native AnGR for value addition

- Characterization of unique products and identification of biomolecules in milk and meat of native germplasm and their effect/utility for human nutrition and health.
- Transcriptome and metabolome for evaluating adaptive and endurance traits of native breeds.

Policy support and capacity building for AnGR management

- Creation of databases and other ICT on AnGR for policy support in the country.
- Developing policy support for AnGR management in states.
- Organizing training and sensitization programs for AnGR management.
- Providing consultancy services to government agencies for policy support.

Sectoral news

We are now at a poignant moment in the journey to the climactic year 2030, by when the world is committed to achieve the ambitious sustainable development goals (SDGs) it set out for itself in 2015. The United Nation's Sustainable Development Goals call for collective efforts to translate the 2030 agenda into a global reality. ICAR-NBAGR is committed to the principles and targets of the SDG 2, with the following target and corresponding indicators:

Sustainable Development Goal 2: Zero Hunger (Total targets 8; https://sdgs.un.org/goals/goal2)

Target 2.5: By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

Indicator 2.5.1: *Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities*

Indicator 2.5.2: *Proportion of local breeds classified as being at risk of extinction*

Food and Agriculture Organization (FAO) is the international agency for global monitoring of these two indicators, through an online database Domestic Animal Diversity Information System (DAD-IS, http://www.fao.org/dad-is/en/). The DAD-IS possesses the global information about the domestic populations for each of the country, that is provided by respective National Coordinators.

Germplasm Registration

Registration of new breeds of indigenous livestock

ICAR-NBAGR is the nodal agency for the registration of newly identified germplasm of livestock and poultry of the country. Newly identified breeds are approved by the Breed Registration Committee (BRC) of ICAR headed by the Deputy Director General (Animal Sciences). ICAR- NBAGR has registered two new breeds of buffalo - Dharwadi of Karnataka and Manda of Odisha on the recommendations of 8th BRC meeting held on 16th August, 2021. Total number of indigenous breeds now stands at 202 in the country, which include 50 for cattle, 19 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 of dog.

Dharwadi buffalo of Karnataka

The Dharwadi buffalo has been registered as 18th buffalo breed with Accession number: INDIA_BUFFALO_0800_DHARWADI_01018. Dharwadi buffalo is distributed in 13 districts of Karnataka. These are medium sized buffalo reared mainly for milk purpose. Daily milk yield ranges from 1.5 to 8.7 litres. Average percentage of milk fat is 6.9. The milk is used for preparation of famous *Dharwad Peda* that is accorded with Geographical Indication (GI) tag.

Dharwadi buffalo

Mission towards Zero Non-descript AnGR in India

Launch of mission

'Mission towards Zero Non-Descript AnGR in India' was launched by Dr. T Mohapatra, Secretary, DARE & Director General, ICAR during a National Workshop (virtual) organized by ICAR-NBAGR on 11th August, 2021. The interactive event was attended by 215 participants including Directors/ senior officers of State Animal Husbandry Departments, scientists and researchers of SAU/SVUs, ICAR Animal Science institutes, Bureaus, NGOs, Societies and farmers. The workshop was conceptualized to initiate the documentation of all the native AnGR in collaboration with the stakeholders. Participants, especially the representatives of NGOs and breed societies and farmers also shared the socio-economic impact of previously registered breeds. Dr. B.N. Tripathi, Deputy Director General (AS), ICAR; and Dr. Praveen Malik, Animal Husbandry Commissioner, Govt. of India also addressed the participants.

Interface meets with five states-Chattisgarh, Jharkhand, Maharashtra, Rajasthan and Uttar Pradesh and Union Territory of Ladakh have also been conducted to senstize the local agencies (AHD/SAU/SVUs) for mission activities (Pls see page 9).

Field surveys for identification of new potential breeds under the mission

Bureau's scientists have made visits to Ladakh, Maharashtra, Jharkhand, Mizoram and Meghalaya. At present, projects on documentation of AnGR are being implemented in 22 states in collaboration with State Animal Husbandry Departments, KVKs, ICAR institutes and SVUs. Ten new populations of native livestock and poultry have been identified till now and are being characterized in their respective breeding tracts falling in various states. These are- Malluck sheep, Malra goat and Changkhi dog of Ladakh (UT); Balona buffalo and native buffalo of Gadchiroli and Chandrapur districts and Khamgaon cattle of Maharashtra; Native buffalo of Jharkhand, native cattle of Meghalaya; native cattle, mithun and chicken of Mizoram.

Survey in Ladakh (UT)

Balona buffalo and Khamgaon cattle of Maharashtra

Manda buffalo of Odisha

Manda has been assigned with accession number: INDIA_BUFFALO_1500_ MANDA_01019 as the 19th breed of indigenous buffalo. Manda buffalo is distributed in Koraput, Malkangiri and Nawarangapur districts of Odisha. It is a sturdy buffalo, well adapted to hill ranges of Eastern Ghats and plateau of Koraput region of Odisha. It is reared for draught, milk and manure. Daily milk production ranges between 1.2 to 3.7 litres. The average fat percentage in milk is 8.4.

Manda buffalo

Gazette Notification of newly registered breeds

Gazette Notification provides statutory recognition, thereby becoming important for claiming sovereignty over and protecting our native animal germplasm. The Gazette notification for the native livestock and poultry breeds has earlier been initiated by the Ministry of Agriculture & Farmers Welfare, Government of India in October, 2019. Newly registered breeds-Dharwadi buffalo of Karnataka and Manda buffalo of Odisha have been notified by the Government of India on 8th October 2021. Till date, 202 registered breeds of livestock, poultry and dog species have been gazette notified by four Gazette notifications by the Government of India. One Gazette for notification of 2 chicken lines has also been published.

Gazette notification of native breeds of livestock, poultry and dog

S.N.	Gazette number	Release date	Number of native breeds notified
1	3364 (S.O. 3699(E)	October 14, 2019	184 breeds of livestock and poultry
2	1420 (S.O.1583(E)	May 22, 2020	13 native breeds of livestock and poultry
3	1421 (S.O.1584(E)	May 22, 2020	2 lines of chicken
4	No. 3589 (S.O. 4086(E)	November 13, 2020	3 native breeds of dog
5	3839 (S.O.4174(E)	October 8, 2021	2 native breeds of livestock and poultry

New populations characterized

Monyul cattle

"Monyul" cattle of Tawang and West Kameng districts of Arunachal Pradesh was characterized. The Monyul cattle are reared by the Monpa community for milk, manure, and agricultural work. These cattle are smaller than Siri cattle of Sikkim. The coat color is generally black; however, animals with shades of brown are also present. White patches may also be present in some animals, specifically on the head, legs, and lower abdomen. The body is covered with thick hair coat. The tail is also hairy and reaches well below the hock. Horns are small to medium in size and point forward. Hump is visible in adult males. Monyul cows generally produce 2 to 3 kg milk in a day.

Monyul cattle of Arunachal Pradesh

(Contributed by Dr. SK Niranjan)

Manipuri cattle

Manipuri cattle were characterized through survey in the Imphal West, Imphal East and Bishnupur districts of Manipur. They are small and sturdy with compact body. The body color varies from brown, reddish, black, grey and white spotted on black or brown. The

Manipuri cattle

face is medium in length with short and horizontally oriented ears. Eyes have black rings in majority of the animals. Horns grow upward, outward and curve anteriorly. The hump is of moderate size in bulls, but small in cows. The mean values of height at withers, body length, and chest girth, are 104.85±0.31, 108.27±0.30 and 138.22±0.73 cm, respectively. The back and the loin are almost in the same plane. Manipur cattle are known for their exceptional draft capabilities, and are in high demand in the neighbouring states.

(Contributed by Dr. Sonika Ahlawat)

Haofa dog

Haofa "the dog of the Tangkhuls" is considered a rare indigenous hound dog of Manipur. Ukhrul and Kamjong district of Manipur state is the original breeding tract. However, these are also distributed in other districts of the state, particularly in the valley districts of Imphal west and Imphal East. The most common color is black, and black with white stripes around the neck, ventral part and tip of the limbs. Head is medium in size with trapezoid shape. Forehead is usually prominent

Hoafa dog of Manipur

with straight nasal bridge. Eyes are golden with an oval shape. The ears are medium, erect and usually cropped at an early age. The dog is fondly reared by the Tangkhul Nagas as pet because of its gentleness, obedience and loyalty to its owners.

(Contributed by Dr. Sonika Ahlawat)

Nageshwari duck

North East India is famous for different duck breeds reared by farmers under traditional system of management. The indigenous ducks in the region include Nageshwari ducks, Pat/desi ducks, China hans (Muscovy), Raj hans and Sylhete meat duck. Nageshwari ducks are found to be distributed in the Barak valley of Assam bordering Meghalaya, Tripura, Mizoram and the neighbouring country Bangladesh. The Barak valley basin is an agriculture rich area and hence, very much suitable for duck farming. The Nageshwari ducks are locally called "Nagi" or "White breasted Nageshwari" due to the presence of a white patch on the breast. Adult ducks are usually kept under free-range system of rearing, which forage in the rice fields all through the day. For night shelter, bamboo

house known as 'Ugartol' are made, which are shifted from time to time in the field area. Ducks lay eggs inside Ugartol where paddy straw is usually used as bedding materials for laying eggs. The average age at first egg of Nageshwari duck is around 188 days (range: 174-198 days). The average annual egg production in Nageshwari ducks varies from 140 to 150. Farmers use traditional brooders for hatching Nageshwari duck eggs.

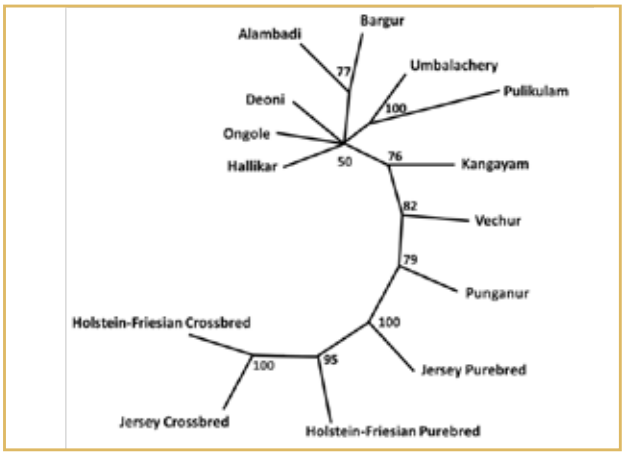
Nageshwari ducks

(Contributed by Dr. Karan Veer Singh)

Genetic Characterization and diversity analysis

Alambadi cattle of Tamil Nadu

Native Alambadi cattle of Tamil Nadu were genetically characterized using 27 genome-wide microsatellite markers. The mean observed number of alleles per locus in Alambadi was 6.52 and ranged from 3 (ETH3) to 11 (CSRM60) across different loci. The genetic variability of Alambadi cattle in terms of mean observed and expected heterozygosity was 0.67 and 0.70, respectively. Estimate of heterozygote deficiency (F_{IS}) showed a positive mean value of 0.06. A qualitative test to assess the genetic bottleneck in Alambadi cattle was carried out by plotting proportion of different alleles against allele frequency class. The loss of rare alleles is expected to distort the normal L-shaped distribution of allele frequencies in the event of recent genetic bottleneck. The study revealed no such mode shift in Alambadi cattle. Further, mitochondrial diversity analysis of Alambadi cattle revealed that they are distinct from Hallikar and cluster at the same node with Bargur cattle.

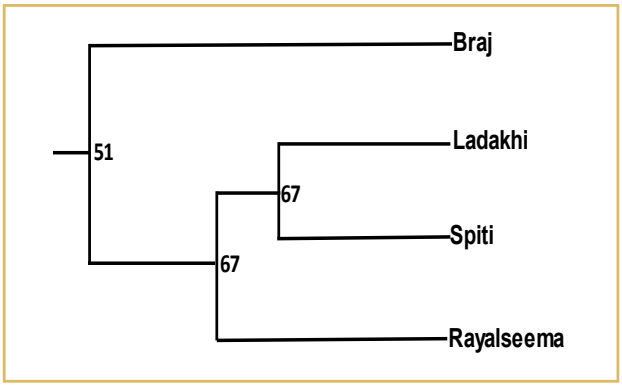


UPGMA tree derived from pairwise Nei's genetic distance among zebu, taurine and crossbred cattle (numbers at nodes indicate percent bootstrap values of 10000 resampled data sets).

(Contributed by Dr. Raja KN)

Native donkeys of *Braj* region of Uttar Pradesh

The grey type donkeys of *Braj* region of Uttar Pradesh in India were genetically characterized using ten microsatellite primers and resolved for alleles on automatic DNA sequencer. At these loci, the PCR product size ranged from 75-95 bp (HTG6) to 251-277 bp (COR18). The observed number of alleles varied from 4 (HTG15) to 10 (HTG7 and AHT4) with a mean of 7.50 ± 1.96. The observed heterozygosity ranged from 0.46 (HTG6 and NVHEQ54) to 0.79 (COR18) with a mean of 0.66 ± 0.12. The mean genetic diversity estimate (F_{IS}) was 0.16. The cumulative parent exclusion probability of these loci was 0.999766 indicating their suitability for parentage testing in these donkeys. When these donkeys were compared based on the allelic frequency data at these loci to the brown type donkeys of Ladakh, Spiti and Rayalseema regions in the union territories/states of Ladakh, Himachal Pradesh and Andhra Pradesh, respectively, they clustered independently from these three donkey populations in a dendrogram based on Goldstein's average square distances indicating their genetic distinctness.



UPGMA dendrogram of four Indian donkey populations after 1000 bootstraps of the data

(Contributed by Dr. Rahul Behl)

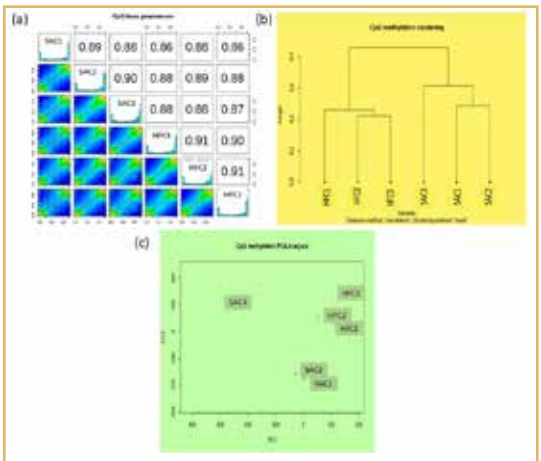
Evaluation of genetic diversity in *ex-situ* conserved cattle and buffalo bulls

Genetic diversity in germplasm of native breeds cryopreserved at the National Semen Bank, ICAR-NBAGR was assessed using microsatellite markers. Cryopreserved semen of 192 bulls representing 19 cattle breeds (Amritmahal, Bargur, Dangi, Frieswal, Gangatiri, Gir, Hariana, Kangayam, Kankrej, Kherigarh, Khillar, Krishnavalley, Nagori, Ongole, Ponwar, Punganur, Rathi, Sahiwal, Tharparkar, Vechur) was evaluated. The highest observed heterozygosity was detected in Red Kandhari (0.85±0.07), while lowest was found in the Amritmahal (0.62±0.1). Further, Hariana cattle 0.71±0.04) and Amritmahal (0.44±0.06) were recorded with highest and lowest expected heterozygosity, respectively. FSTAT analysis elucidated the F_{IS}, F_{IT}, and F_{ST} values to be 0.11 ± 0.04, 0.05 ± 0.04 and 0.15 ± 0.01, respectively for all the populations. This information is important to assess the genetic diversity of cryopreserved germplasm in accordance with the FAO's guidelines.

(Contributed by Dr. Amod Kumar)

Trait identification and characterization

Epigenetic regulation of heat stress response in native cattle



Correlation, clustering and PCA plot analysis based on CpG10 methylation level. a) Heat map & correlation analysis based on CpG10 data among Sahiwal (SAC) and Holstein (HFC) samples. b) Hierarchical clustering by methylation levels of CpG10 in different samples of SAC and HFC. (C) PCA analysis show two different groups in samples of SAC and HFC showing distinctness of the methylation pattern between both the cattle types.

A study was carried out to characterize changes in genome wide methylation patterns in PBMCs of native cows (Sahiwal) and exotic cows (Holstein Frisian) during hot summer conditions. The study utilized reduced representation bisulfite sequencing (RRBS). Raw sequence data were generated in Sahiwal (15.1 GB) and HF cows (15.7 GB). RRBS reads were detected almost across all chromosomal regions, suggesting genome wide coverage of variation in methylation status. The number of CpG_{10} per sample ranged from 14.6 million to 33.6 million in Sahiwal (SAC) and 20.1 million to 30.7 million in Holstein cows (HF). The mean percentage of CpG methylation was 61.1 in Sahiwal and 60.6 in Holstein cows. The percentage of CHG and CHH was 4 and 4.67 in SAC and 3.70 and 4.53 for HF cows. The mean percentage of uniquely mapped reads was 20.6% with 13.5% of reads mapping to multiple locations in Sahiwal cows and 18.1% of uniquely mapped reads with 13.4% of reads mapping to multiple locations in HF cows. For downstream analysis, Sahiwal cows were considered as test while Holstein cows as control, respectively. High positive correlation across all the samples of Sahiwal as well as all the samples of HF cows was observed as shown in the heat map (Pearson's correlation coefficient). Cluster analysis and PCA plot, based on CpG10 (i.e., CpGs ≥10x read coverage) methylation levels showed that both Sahiwal and HF cow groups formed two different clusters indicating the distinctness in their methylation pattern. A total of 7094 differentially methylated cytosines (DMCs) were identified, out of which 4433 were hypermethylated and 2661 were hypomethylated in Sahiwal cows. While in Holstein cows, 2661 DMCs were hypermethylated and 4433 were hypomethylated indicating that epigenetic signatures related to heat stress response are mostly breed specific. The top 10 hypermethylated genes in the PBMCs were identified in both the groups during summer season. These genes were further associated with the molecular pathways in heat tolerant Sahiwal cows and heat sensitive Holstein cows. These findings may contribute to better understand the functional role of genes in making native cattle better adapted to high ambient temperature generally prevalent in tropical regions.

(Contributed by Dr. Manishi Mukesh)

Bioprospecting based characterization of Mandya sheep mutton

Mutton from Bandur sheep breed of Karnataka is favoured by consumers for its unique flavor and fetches a higher price than other local breeds. ICAR-NBAGR investigated the mutton quality traits of this breed preferred by consumers. Research revealed a higher back fat thickness in Bandur animals as compared to local sheep. Tenderness of different muscles (*longissimus dorsi, brachicephalicus, bicep, semimembranosus, psoas major, semitendinosus and tricep)* was also greater in Bandur sheep. The amino acid and fatty acid analysis revealed a significantly higher level of oleic acid and histidine in Bandur. Higher content of oleic acid has been positively correlated with overall palatability while histidine is an essential amino acid required in the diet. The discovery of higher fat content, tenderness of muscles, oleic acid and

histidine will add value to the mutton from Bandur sheep. Genes associated with muscle tenderness viz., *HSPB1*, *DNAJB5*, *HSPA6*, were over expressed in Bandur sheep. The highly connected genes identified by transcriptomics (*CNOT2, CNOT6*, *HSPB1, HSPA6, MAP3K14* and *PPARD)*, form potential biomarkers for unique muscle traits of Bandur sheep. The phenotypic and genetic evaluation of mutton quality characteristics of Bandur and local sheep has enabled to establish the superior quality/taste of Bandur sheep mutton, which will augment sustainable conservation of Bandur sheep and its recognition as a Geographical Indicator.

(Contributed by Dr. Reena Arora)

Cryopreservation of germplasm

The National Gene Bank at NBAGR functions with the objective of cryopreservation of germplasm with maintaining the indigenous livestock biodiversity of the country. The germplasm in the form of semen and somatic cells of native breeds are cryopreserved for long term preservation in the bank. At present, the Gene Bank has the cryopreserved germplasm of 48 native breeds in form of semen (2.5 lakh doses) and 20 breeds in form of somatic cells (4,800 vials).

Cryopreservation of native breeds germplasm in National Gene Bank during five years

Germplasm	Particulars	2017	2018	2019	2020	2021
	Semen doses	**10,000**	**31,875**	**19,410**	**29,000**	**21,180**
Semen		**Cattle:** Kankrej Gir Sahiwal Bargur Dangi Rathi Khillar Nagori	**Cattle:** Dangi Khillar Nagori Rathi Bargur **Goat:** Gaddi **Buffalo:** Pandharpuri	**Cattle:** Kankrej Sahiwal Dangi Nagori Rathi **Horse:** Marwari Zanskari	**Buffalo:** Murrah Bhadawari Nili Ravi	**Horse:** Marwari Manipuri Zanskari **Donkey:** Halari **Cattle:** Sahiwal Red Sindh Badri
	No. of Vials	**877**	**1521**	**650**	**360**	**970**
Somatic cells		**Horse:** Manipuri **Camel:** Kutchi	**Horse:** Marwari **Mithun:** Nagaland **Yak:** Laddakhi **Donkey:** Laddakhi	**Donkey:** Kutchchhi **Camel:** Kharai Bikaneri Jaisalmeri	**Horse:** Zanskari **Donkey:** Halari	**Camel:** Mewari Jalori Marwari **Goat:** Sirohi Rohillkhandi **Cattle:** Tharparkar **Pig:** Ghurrah

DNA Bank - a viable option for germplasm cryopreservation

DNA Bank repository has been created for 169 breeds/populations of native animals and poultry for long term conservation at the institute.

Technologies

Following technologies (SNP Chips) were developed and patents have been filed during 20-21

S.N.	Title of Patent	Inventors	Year
1	Medium Density SNP Chip of Bactrian and Dromedarian Camel	RK Vijh, U Sharma, P Kapoor, M Raheja, R Arora, S Ahlawat and R Sharma	2021
2	Linkage Disequilibrium based Low Density SNP Chip of Riverine buffaloes (*Bubalus bubalis*)	RK Vijh, U Sharma, P Kapoor and M Raheja	2021
3	High Density SNP Chip of Swamp Buffaloes (*Bubalus bubalis*)	RK Vijh, U Sharma, P Kapoor and M Raheja	2021
4	Linkage Disequilibrium based Low Density SNP Chip of Indigenous cattle (*Bos indicus*)	RK Vijh, U Sharma, P Kapoor and M Raheja	2021

Linkages with stakeholders

The bureau has developed the linkage with the following State Animal Husbandry Departments to work together for the documentation of the native AnGR in their state.

Interface meet of Chhatisgarh state

Interface Meet with stakeholders of Ladakh (UT): First State-wise interface meet was held with Ladakh (UT) with the theme "Characterization and Documentation of Animal Genetic Resources of Ladakh: A Mission towards Zero Non-Descript Population" on 6th September, 2021. The meeting had the confluence of 95 delegates from Ladakh Autonomous Hill Development Council (LAHDC) Leh, DRDO, ICAR, SKAUST, SAHD, NGOs, etc. Shri Tashi Namgyal Vakzee, Hon'ble Executive Councilor, LAHDC also graced the meeting.

Interface Meet with stakeholders of Chhattisgarh: Bureau organized an interface meet on 'Characterization and Documentation of Animal Genetic Resources of Chhattisgarh: A Mission towards Zero Non-Descript Population' on 15th September 2021 through video conferencing. The meeting was attended by 205 participants of ICAR, DSVC Kamdhenu Vishwavidyalaya, Durg, Deptt of Animal Husbandry, Govt of Chhattisgarh, KVKs, NGOs etc.

Discussion with Director, Animal Husbandry Department, Jharkhand

Interface Meet with stakeholders of Jharkhand: The meeting was held in 2 phases. First was on 28th September 2021 when NBAGR scientists interacted with the Director, Animal Husbandry Department, Jharkhand at his office (Ranchi) wherein, three state officers were also present. The scientist team also attended the meeting wherein 51 veterinary officers were present.

Interface Meet with stakeholders of Maharashtra: ICAR-NBAGR, organized its 3rd interface meet (online) for 'A Mission towards Zero Non-Descript Populations' with Maharashtra state on 25th October 2021. Overall 125 participants belonging to the Dept. of Animal Husbandry, Maharashtra, State University, ICAR institutes, NGOs etc participated in this meeting.

Interface Meet with stakeholders of Rajasthan: Fifth state-specific interface meet was held with Rajasthan. It was on the theme "Characterization and Documentation of Animal Genetic Resources of Rajasthan: A Mission towards Zero Non-Descript Populations" on 16th November, 2021. The meet had a congregation of 102 participants of ICAR, MPUAT, RAJUVAS, and Dept. of Animal Husbandry, Rajasthan.

Interface Meet with stakeholders of Uttar Pradesh: NBAGR organized its sixth Interface meet for Uttar Pradesh on 7th December, 2021. The virtual meet was attended by 195 participants of ICAR, SAU/SVUs, Dept. of Animal Husbandry, KVKs, various Degree Colleges, UP Livestock Development Board etc.

Mera Gaon Mera Gaurav: Under various extension programmes, 12 events were organized in different villages of Karnal and the Bureau scientists delivered talks on native breeds and their management, increasing milk production in dairy animals and generated awareness about public health, cleanliness, plantation, water conservation and gender equality.

Glimpses of the extension activities under Mera Gaon Mera Gaurav

Major events

Various events were organized by ICAR-NBAGR to engage the stakeholders and public in emerging scientific and social issues. Organization of these events also underlines Bureau's commitment in making our AnGR and societies more sustainable.

List of events organized in the year 2021

SN	Theme of the Event	Event title	Date of event	No. of participants	Type of participants
1	**World Water Day**	Student's Interaction at Government High School, Baldi, Karnal	22.3.2021	120	Students
2	**COVID-19 Management**	COVID-19 vaccination camp	17.4.2021	26	Staff members
3	**International Biodiversity Day**	Webinar on "Recognising Pastoralists for their Knowledge, Local Breeds and Biodiversity Conservation"	22.5.2021	75	Participants from six countries
4	**COVID-19 Management**	COVID-19 vaccination camp	15.7.2021	29	Staff members
5	**75th Independence day**	Plantation drive	15.8.2021	45	Staff members
6	**National Campaign on Food and Nutrition for Farmers**	Webinar on Food and nutrition for healthy life	26.8.2021	45	Staff members
7	**AKAM Lecture Series**	Webinar on "Sustainable Agriculture: Adapting to climate change"	27.8.2021	63	Staff/ICAR members
8	**International Year of Millets- 2023**	Gosthi on Poshan Vardhak Maha Abhiyan	17.9.2021	100	School children
9	**Rashtriya Swachhta Abhiyan**	Tree Plantation Campaign	17.9.2021	60	Staff members
10	**AKAM Lecture Series**	Webinar on "Nutri-cereals and their role in human health"	17.9.2021	48	Staff members
11	**AKAM Lecture Series**	Webinar on "Value addition of native AnGR"	21.9.2021	100	Staff/ICAR members
12	**AKAM Lecture Series**	Webinar on "FAO Guidelines on Genomic Characterization of Animal Genetic Resources"	11.10.2021	58	Staff/ICAR members
13	**Special National Swachhta Abhiyan**	Waste to Wealth	12.10.2021	103	Farmers/ students/ staff
14	**Special National Swachhta Abhiyan**	Waste to Wealth	12.10.2021	20	Staff members
15	**Mahila Kisan Diwas**	Organization of "Gosthi on Mahila Kisan Diwas"	15.10.2021	150	Women farmers
16	**World Food Day**	Gosthi on "World Food Day" at Subri, Karnal	16.10.2021	100	School children
17	**Special Swachhta Campaign**	Special Swachhta Campaign	26.10.2021	60	Staff/RA/SRF
18	**AKAM Lecture Series**	Webinar on "Application of Multi -Omics in Animal Production"	27.10.2021	48	Staff/ICAR members
19	**Special National Swachhta Abhiyan**	Cleanliness drive by staff members	30.10.2021	75	Staff/RA/SRF/ Students
20	**Special National Swachhta Abhiyan**	Cleanliness drive by staff members	30.10.2021	55	Students/ staff
21	**National Unity Day**	Workshop on "Self Reliance with integrity"	30.10.2021	35	Staff
22	**National Unity Day**	Security parade of the Guards (National Unity Day)	31.10.2021	51	Staff/ security men
23	**AKAM Lecture series**	Genomics Based Dairy Animal Breeding	12.11.2021	65	Staff/ICAR
24	**National campaign on "Agriculture and Environment: the Citizen Face"**	Students interaction	26.11.2021	50	Students
25	**AKAM Lecture Series**	Sustainable Use and Genetic Improvement of Indigenous Livestock Breeds	30.11.2021	55	Staff/ICAR
26	**Special National Swachhta Abhiyan**	Webinar on "Cleanliness and Health	22.12.2021	35	Staff/RA/SRF
27	**Kisan Diwas & Breed Conservation Award**	Kisan Diwas & Breed Conservation Award	23.12.2021	80	SAHD, SAU/SVUs, ICAR , NGOs/ Societies, farmers

*AKAM Lecture Series: Azadi ka Amrit Mahotsav

Training programme

Two days online training programme on "Effective health management for enhancing work efficiency of ICAR employees" on 10th and 16th June, 2021 was conducted. A total of four lectures were organized during the programme. Bureau's 42 employees attended the training. Topics included "Steps to overcome fear and anxiety during crisis", Pre and post COVID care with Ayurveda, Guidelines of health ministry on health management during COVID-19.

Foundation Day celebrations

ICAR-NBAGR celebrated its 38th foundation day with joy on 21st September, 2021. Dr M L Madan, Haryana state Vigyan Ratna and Former DDG (AS), ICAR was the Chief Guest and Dr Arjava Sharma, and Dr B Prakash were the Guests of honor. The Foundation Day lecture was delivered through virtual mode by Padma Shree-Prof. Anil Kumar Gupta, CSIR Bhatnagar Fellow. On the occasion, P G Nair Award for Best scientist was conferred to Dr Reena Arora, PS working in the area of genomics of native AnGR. Mr Karambir Malik for administrative, Mr Subhash Chandra for technical and Mr Deepak Kumar for supportive categories were also bestowed with the Best Staff worker awards. To make the visitors aware of our AnGR diversity, a thematic platform - *Selfie point* was also inaugurated on this occasion.

SOCDAB National Webinar

ICAR-NBAGR in association with the Society for Conservation of Domestic Animal Biodiversity organized National Webinar (online) on "Harnessing Potential of Indigenous Animal Genetic Resources

Revisiting SOCDAB 2021

Tree plantation in the Bureau

Farmers meeting at Kunjpura, Karnal

for Enhancement of Productivity and Profitability," during February 11-12, 2021 at ICAR-NBAGR, Karnal. About 200 delegates attended the Seminar.

ISAGB National Conference

National Conference on "Animal Breeding Strategies in the Era of Genomics and Phenomics" was organized by the Indian Society of Animal Genetics and Breeding and ICAR-NBAGR during 17-18 December 2021. Dr. T Mahapatra, Secretary (DARE) & Director General, ICAR graced the inaugural session as the chief guest. The Guest of Honour were Dr. ML Madan, Former

Glimpses of ISAGB, 2021

DDG (AS) and former VC Mathura and Akola, and Dr K M Bujarbaruah, Former DDG (AS), & Former VC AAU, Assam. Dr T J Rasool, President ISAGB also graced the occasion. Dr P Thangaraju and Dr T J Rassol were conferred with lifetime achievement award and fellowship of the ISAGB. Dr R K Sethi, Dr R S Gandhi, Dr Vineet Bhasin, Dr B P Mishra and DR V K Saxena were also bestowed with the fellow awards of the ISAGB.

International Biodiversity Day

ICAR-NBAGR organized the webinar "Recognising Pastoralists for their Knowledge, Local Breeds and Biodiversity Conservation", in collaboration with SEVA on the occasion of International Biodiversity Day (22.5.2021). About 75 participants from six countries attended the programme. Three pastoralist farmers were also awarded with Breed Savior Award for conserving the native livestock populations. This award has been instituted in the year 2012, in collaboration with National Biodiversity Authority and SEVA - an NGO to recognize the native breeds and their keepers, mainly under pastoralism. The award is hosted by ICAR-NBAGR on the International Biodiversity Day every year.

Breed Conservation Award

The award was instituted in 2017 by ICAR-NBAGR to promote individual livestock keeper's /communities/ Institutions for conservation of indigenous breeds in the country. The award is conferred on the occasion of 'Farmers Day' on 23rd December every year. The award carries a cash Prize of Rs. 10,000/- and a certificate/citation is given under the three categories - *Large ruminants, small ruminants and other species*. The award is coveted by the farmers across the country, and receives coverage from the National Media. Till date, 10 organizations and 13 farmers have been felicitated with this award. This year the proud recipients of this award are listed in table:

Breed conservation award ceremony

Breed conservation awardees-2021

Category	Awardee	Breed conserved
Individual category		
Large ruminants	Sh. Marreddy Venkata Reddy, Guntur, Andhra Pradesh	Punganur Cattle
Small ruminants	Sh. Nandu Ram, Palampur, Distt. Kangra, Himachal Pradesh	Gaddi Goat
	Sh. Prabhulal Gurjar, Malpura, Tonk	Malpura Sheep
Institution/Community		
Large ruminants	Shri Yagna Purushdas Gaushala, BAPS Gaushala Trust, BAPS Swaminarayan mandir Sarangpur, Botad (Gujarat)	Gir Cattle
Small ruminants	ICAR-Central Institute of Research on Goats, Makhdoom, Mathura, Uttar Pradesh 281122	Muzaffarnagri sheep
Other species	ICAR-National Research Centre on Pig, Guwahati, Assam	Ghungroo Pig
	AICRP on Poultry Breeding, Mannuthy-Thrissur, Kerala	Tellichery Chicken

Meetings

IMC meeting: Institute Management Committee meeting (Virtual) was held on 27th February, 2021. Various management issues of the institute were discussed and decisions were taken.

RAC Meeting: Online meeting of Research Advisory Committee (RAC) of ICAR-NBAGR was held on 16th April, 2021. The meeting was chaired by Dr P Thangaraju, Former Vice Chancellor TANVAS, Chennai wherein current research programmes along with future activities of the institute were discussed.

IRC Meeting: Institute Research Committee (IRC) meeting was held on 23-24th August, 2021 under the chairmanship of Dr. BP Mishra, Director, ICAR-NBAGR; wherein 45 projects were reviewed and discussed. The projects related to characterization and documentation of non-descript AnGR of various states were also initiated.

हिंदी प्रकोष्ठ की गतिविधियां

- संस्थान राजभाषा कार्यान्वयन समिति की दो तिमाहियों (जुलाई से सितंबर और अक्तूबर से दिसंबर 2020) की वर्चुअल बैठक दिनांक 18-10-2021 तथा जनवरी से मार्च और अप्रैल से जून 2021 तक की वर्चुअल बैठक दिनांक 29-07-2021 को संपन्न हुई। इन बैठकों में राजभाषा प्रकोष्ठ द्वारा निष्पादित कार्रवाई की पुष्टि सर्वसम्मति से की गई। संस्थान में राजभाषा के प्रगामी प्रयोग से संबंधित आंकड़ों की समीक्षा की गई और राजभाषा हिंदी के प्रयोग की प्रगति को बल देने हेतु विभिन्न निर्णय लिए गए।
- हिंदी पत्रिका पशुधन प्रकाश का विमोचन एवं नव अंक प्रकाशन: संस्थान की वार्षिक हिंदी पत्रिका "पशुधन प्रकाश" के ग्यारहवें अंक (वर्ष 2020) का विमोचन 5 मई 2021को निदेशक महोदय के कर-कमलों द्वारा हुआ। पत्रिका का बारहवां अंक (वर्ष 2021) का भी प्रकाशन हो चुका है।
- वर्ष 2020-21 के दौरान राजभाषा में उत्कृष्ट प्रगति हेतु नराकास करनाल से संस्थान को द्वितीय पुरस्कार प्राप्त हुआ।
- डॉ अनिल कुमार मिश्र जी को करनाल नगर स्तरीय राजभाषा गौरव पुरस्कार के साथ नराकास करनाल द्वारा सम्मानित किया गया।
- डॉ. संजीव कुमार जी के द्वारा लिखित हिंदी निबन्ध के लिए नराकास करनाल द्वारा आयोजित नगरस्तरीय हिंदी निबन्ध प्रतियोगिता हेतु प्रोत्साहन पुरस्कार मिला।

Editors: Rekha Sharma, Sonika Ahlawat, M S Dige

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