वार्षिक प्रतिवेदन

ANNUAL REPORT

2023

भाकृअनुप-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो

ICAR-National Bureau of Animal Genetic Resources

Vision

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

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.

गौरवशाली भारतीय पशु जैव-विविधता
का सजग एवं सतत प्रहरी....

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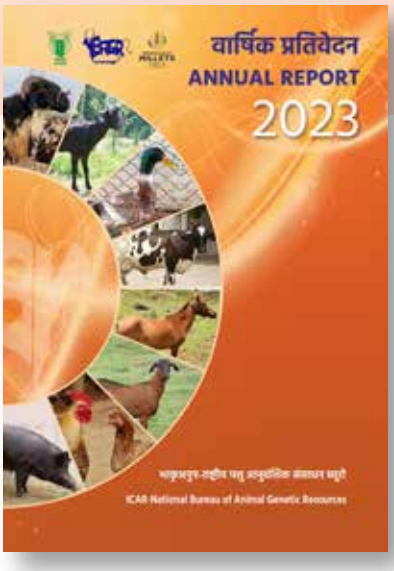
ICAR-National Bureau of Animal Genetic Resources

Contents

Coverpage: 8 new indigenous animal breeds registered during 2023.

Credit Line



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From the Director's Desk

I am pleased to present the "Annual Report - 2023" of the ICAR-National Bureau of Animal Genetic Resources (NBAGR) to our esteemed stakeholders. This report encapsulates the significant achievements of ICAR-NBAGR throughout the year, as we remained steadfast in our scientific endeavors towards the identification, characterization, conservation, evaluation, and sustainable utilization of Animal Genetic Resources (AnGR). It is with great pride that we share our ongoing efforts to document and preserve the rich biodiversity of AnGR in India.

The year 2023 has been pivotal for us, particularly with our proactive strides in the "Mission towards Zero Non-descript AnGR of India," launched in August 2021. Our resolute commitment to this mission has driven us to identify and characterize native animal germplasm across diverse terrains, including remote areas like the Andaman and Nicobar Islands. Through extensive surveys and collaborative efforts with state animal husbandry departments, agricultural universities, NGOs, and stakeholders, we have deepened our understanding of genetic diversity and uniqueness in our indigenous breeds. Notably, we have identified 15 new homogeneous populations across 14 states, marking significant progress towards our goal towards zero non-descript AnGR.

I am pleased to announce that India was elected Vice-chairperson and represented Asia in the 12th Session of the Intergovernmental Technical Working Group (ITWG-AnGR) on Animal Genetic Resources at the FAO headquarter in Rome. This global recognition underscores our leadership in AnGR conservation and management.

In 2023, ICAR-NBAGR achieved significant milestones in documenting and conserving indigenous AnGR. With the registration of eight new breeds, including the Arawali chicken from Gujarat, Andamani duck, Andamani goat and Andamani pig from the Andaman and Nicobar Islands, Anjori goat from Chhattisgarh, Bhimthadi horse from Maharashtra and Frieswal cattle from Uttar Pradesh, the total number of registered indigenous breeds in India now stands at 219. The registration of Frieswal cattle, the country's first synthetic breed, stands out as particularly noteworthy. Additionally, the registration of three breeds from the biodiversity hotspot of the Andaman and Nicobar Islands highlights our commitment to preserving regional biodiversity.

Our research initiatives have yielded substantial outcomes, such as exploring key markers for analyzing native cattle admixture, assessing genome-based inbreeding in Indian goat breeds, and uncovering climate-specific genomic regions in native goat breeds. Additionally, we conducted transcriptome analysis to evaluate heat stress in indigenous buffalo and skin transcriptome profiling in Changthangi sheep, advancing our understanding of breed-specific adaptations.

Aligned with our commitment to conservation, ICAR-NBAGR introduced the Breed Watchlist-2022 to assess the risk status of indigenous breeds. We have initiated *in-situ* conservation units for critically threatened breeds like the Teressa goat and nineteen at-risk indigenous breeds have been cryopreserved at the National Gene Bank, fulfilling sustainable development goals (2.5.1 and 2.5.2).

We also celebrated the establishment of the Ladakhi Cattle Breed Society on the International Day for Biological Diversity in Ladakh, underscoring our dedication to regional breed conservation efforts.

Our research activities gained momentum through 28 institutional projects and six externally funded projects, selected through rigorous screening by the Institute Research Committee, Research Advisory Committee, and external funding agencies. I extend my heartfelt congratulations to all scientists and research scholars for their publications in esteemed national and international journals and their recognitions at various scientific platforms.

Looking ahead, we are committed to fostering stakeholder engagement and promoting collaboration through initiatives such as the Breed Conservation Awards-2023 and participation in both national and international events. We celebrated our Foundation Day with great enthusiasm and also organized a five-day Skill Development Training Programme on "Basic Bioinformatics Tools for Genome Analysis," which attracted 76 participants from diverse fields across 18 states. Additionally, we held interactive meetings with the Animal Husbandry Statistics Division, DAHD, to discuss the technical modalities for conducting the Breed-wise Livestock Census at the national level. These efforts underscore our dedication to excellence and knowledge sharing, aiming to inspire broader participation in conserving India's livestock biodiversity.

I extend my gratitude to all staff members for their invaluable contributions to the Bureau's progress and achievements. Their dedication and perseverance have been instrumental in fulfilling our mandate. I express sincere thanks to Dr. Himanshu Pathak, Secretary DARE and DG, ICAR, and Dr. R. Bhatta, DDG (AS) ICAR for their continuous support and guidance, and acknowledge the cooperation received from Dr. G. K. Gaur, ADG (APB) ICAR, in all our endeavors.

I trust that the "Annual Report 2023" of ICAR-NBAGR will serve as a valuable repository of information for all custodians of AnGR in the country. We welcome suggestions for further enhancement as we continue to advance our mission.

Jai Hind !

(BP Mishra)

निदेशक की कलम से...

मुझे अपने सम्मानित हितधारकों के समक्ष आईसीएआर-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो (एनबीएजीआर) की "वार्षिक रिपोर्ट - 2023" प्रस्तुत करते हुए प्रसन्नता हो रही है। यह रिपोर्ट पूरे वर्ष आईसीएआर-एनबीएजीआर की महत्वपूर्ण उपलब्धियों को समेटे हुए है, क्योंकि हम पशु आनुवंशिक संसाधनों (एएनजीआर) की पहचान, लक्षण वर्णन, संरक्षण, मूल्यांकन और सतत उपयोग की दिशा में अपने वैज्ञानिक प्रयासों में दृढ़ रहे। यह बहुत गर्व की बात है कि हम भारत में पशु आनुवंशिक संसाधनों की समृद्ध जैव विविधता को प्रलेखित और संरक्षित करने के अपने चल रहे प्रयासों को साझा करते हैं। वर्ष 2023 हमारे लिए महत्वपूर्ण रहा है, विशेष रूप से अगस्त 2021 में शुरू किए गए "भारत के जीरो नॉन-डिस्क्रिप्ट एएनजीआर की ओर मिशन" में हमारी सक्रिय प्रगति के साथ। इस मिशन के प्रति हमारी दृढ़ प्रतिबद्धता ने हमें अंडमान और निकोबार द्वीप समूह जैसे दूरदराज के क्षेत्रों सहित विविध इलाकों में देशी पशु जर्मप्लाज्म की पहचान करने और उनकी विशेषता बताने के लिए प्रेरित किया है। राज्य पशुपालन विभागों, कृषि विश्वविद्यालयों, गैर सरकारी संगठनों और हितधारकों के साथ व्यापक सर्वेक्षण और सहयोगात्मक प्रयासों के माध्यम से, हमने अपनी स्वदेशी नस्लों में आनुवंशिक विविधता और विशिष्टता की अपनी समझ को समृद्ध किया है। विशेष रूप से, हमने 14 राज्यों में 15 नई सजातीय आबादी की पहचान की है, जो गैर-वर्णित AnGR को कम करने के हमारे लक्ष्य की दिशा में महत्वपूर्ण प्रगति को दर्शाता है।

मुझे यह घोषणा करते हुए खुशी हो रही है कि भारत को FAO के अंतर सरकारी कार्यसमूह का उपाध्यक्ष चुना गया और रोम में एफएओ मुख्यालय में पशु आनुवंशिक संसाधनों पर अंतर-सरकारी तकनीकी कार्य समूह (आईटीडब्ल्यूजी-एएनजीआर) के 12वें सत्र में एशिया का प्रतिनिधित्व किया। यह वैश्विक मान्यता एएनजीआर संरक्षण और प्रबंधन में हमारे नेतृत्व को रेखांकित करती है।

2023 में, आईसीएआर-एनबीएजीआर ने स्वदेशी एएनजीआर के दस्तावेजीकरण और संरक्षण में महत्वपूर्ण मील के पत्थर हासिल किए। गुजरात से अरावली मुर्गी, अंडमान और निकोबार द्वीप समूह से अंडमानी बत्तख, अंडमानी बकरी और अंडमानी सुअर, छत्तीसगढ़ से अंजोरी बकरी, महाराष्ट्र से भीमथड़ी घोड़ा और उत्तर प्रदेश से फ्राइज़वाल गोवंश सहित आठ नई नस्लों के पंजीकरण के साथ, भारत में पंजीकृत कुल देशी नस्लों की संख्या अब 219 हो गई है। देश की पहली सिंथेटिक नस्ल, फ्राइज़वाल गोवंश का पंजीकरण विशेष रूप से उल्लेखनीय है। इसके अतिरिक्त, अंडमान और निकोबार द्वीप समूह के जैव विविधता हॉटस्पॉट से तीन नस्लों का पंजीकरण क्षेत्रीय जैव विविधता को संरक्षित करने के लिए हमारी प्रतिबद्धता को दर्शाता है।

हमारे शोध पहलों ने पर्याप्त परिणाम दिए हैं, जैसे कि देशी गोवंश के मिश्रण का विश्लेषण करने के लिए प्रमुख मार्करों को खोजना, भारतीय बकरी की नस्लों में जीनोम-आधारित अंतःप्रजनन का आकलन करना और देशी बकरी की नस्लों में जलवायु-विशिष्ट जीनोमिक क्षेत्रों को उजागर करना। इसके अतिरिक्त, हमने देशी भैंसों में हीट स्ट्रेस का मूल्यांकन करने के लिए ट्रांसक्रिप्टोम विश्लेषण और चंगथांगी भेड़ों में त्वचा ट्रांसक्रिप्टोम प्रोफाइलिंग का संचालन किया, जिससे नस्ल-विशिष्ट अनुकूलन की दिशा में ज्ञान की वृद्धि हुई। संरक्षण के प्रति हमारी प्रतिबद्धता के अनुरूप, ICAR-NBAGR ने देशी नस्लों की जोखिम स्थिति का आकलन करने के लिए ब्रीड वॉचलिस्ट-2022 की शुरुआत की। हमने टेरेसा बकरी जैसी संकटग्रस्त नस्लों के लिए इन-सीटू संरक्षण इकाइयाँ शुरू की हैं, और उन्नीस जोखिमग्रस्त देशी नस्लों को राष्ट्रीय जीन बैंक में क्रायोप्रिजर्व किया गया है, जिससे सतत विकास लक्ष्य (2.5.1 और 2.5.2) पूरे हुए हैं। हमने लद्दाख में अंतरराष्ट्रीय जैविक विविधता दिवस पर लद्दाखी गोवंश नस्ल सोसायटी की स्थापना में भी सहयोग प्रदान किया, जो क्षेत्रीय नस्ल संरक्षण प्रयासों के प्रति हमारे समर्पण को रेखांकित करता है।

हमारी शोध गतिविधियों ने 28 संस्थागत परियोजनाओं और छह बाहरी रूप से वित्तपोषित परियोजनाओं के माध्यम से गति प्राप्त की, जिनका संस्थान अनुसंधान समिति, अनुसंधान सलाहकार समिति और बाहरी वित्त पोषण एजेंसियों द्वारा सघन जांच की गई। मैं सभी वैज्ञानिकों और शोध विद्वानों को प्रतिष्ठित राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं में उनके प्रकाशनों और विभिन्न वैज्ञानिक प्लेटफार्मों पर उनकी मान्यता के लिए हार्दिक बधाई देता हूं। हम नस्ल संरक्षण पुरस्कार-2023 जैसी पहलों और राष्ट्रीय और अंतर्राष्ट्रीय दोनों कार्यक्रमों में भागीदारी के माध्यम से हितधारक जुड़ाव को बढ़ावा देने और सहयोग को बढ़ावा देने के लिए प्रतिबद्ध हैं। हमने अपने स्थापना दिवस को बड़े उत्साह के साथ मनाया और "जीनोम विश्लेषण के लिए बुनियादी जैव सूचना विज्ञान उपकरण" पर पांच दिवसीय कौशल विकास प्रशिक्षण कार्यक्रम का आयोजन किया, जिसमें 18 राज्यों के विभिन्न क्षेत्रों से 76 प्रतिभागियों ने भाग लिया। इसके अतिरिक्त, हमने राष्ट्रीय स्तर पर नस्ल-वार पशुधन जनगणना आयोजित करने के तकनीकी तौर-तरीकों पर चर्चा करने के लिए पशुपालन सांख्यिकी प्रभाग, DAHD के साथ इंटरैक्टिव बैठकें कीं। ये प्रयास उत्कृष्टता और ज्ञान साझा करने के प्रति हमारे समर्पण को रेखांकित करते हैं, जिसका उद्देश्य भारत की पशुधन जैव विविधता के संरक्षण में व्यापक भागीदारी को प्रेरित करना है।

मैं ब्यूरो की प्रगति और उपलब्धियों में उनके अमूल्य योगदान के लिए सभी कर्मचारियों के प्रति आभार व्यक्त करता हूँ। उनके समर्पण और दृढ़ता ने हमारे अधिदेश को पूरा करने में महत्वपूर्ण भूमिका निभाई है। मैं डॉ. हिमांशु पाठक, सचिव डेयर और महानिदेशक, आईसीएआर एवं डॉ. आर. भट्टा, उप-महानिदेशक (पशुविज्ञान) आईसीएआर को उनके निरंतर समर्थन और मार्गदर्शन के लिए हार्दिक धन्यवाद व्यक्त करता हूँ, और हमारे सभी प्रयासों में डॉ. जी.के. गौर, सहायक महानिदेशक (एपीबी) आईसीएआर के सहयोग की सराहना एवं आभार व्यक्त करते हैं । मुझे विश्वास है कि आईसीएआर-एनबीएजीआर की “वार्षिक रिपोर्ट 2023” देश में एएनजीआर के सभी संरक्षकों के लिए सूचना के एक मूल्यवान भंडार के रूप में काम करेगी। हम अपने मिशन को आगे बढ़ाने के लिए आगे की वृद्धि के लिए सुझावों का स्वागत करते हैं।

जय हिन्द !

(बीपी मिश्रा)

Executive Summary

Institute's profile

ICAR-National Bureau of Animal Genetic Resources (NBAGR), one of the six Bureaus under the Indian Council of Agricultural Research (ICAR) has been established in 1984, with a mission to protect and conserve indigenous farm Animal Genetic Resources (AnGR) for sustainable utilization and livelihood security in the country. With the specific mandate - 1) Identification, evaluation, characterization, conservation and utilization of livestock and poultry genetic resources of the country; and 2) Coordination and capacity building in animal genetic resources management and policy issues; the Bureau has a number of activities including conducting survey to explore and characterize new potential populations, further document and register such populations; prioritization and conservation of indigenous breeds, identifying unique traits and their evaluation and utilization, encompassing all the states. The Bureau is nodal agency for the breed registration in the country. The Framework for the registration and Gazette Notification of animal breeds, evolved by the Bureau is unique in the world. As an animal Bureau of the country, it also coordinates with various national and international agencies including the UN's Food & Agriculture Organization, pertaining to the AnGR. It is also a nodal agency for UN's Sustainable Development Goal (SDG) 2 Indicator 2.5.1 and 2.5.2.

Mission towards Zero Non-Descript AnGR of India

Bureau initiated the "Mission towards Zero Non-Descript AnGR of India' on 11th August, 2021. Under the Mission, Bureau organized State Interface Meets with various animal stakeholders including Animal Husbandry Deptts. State Agricultural/Veterinary Universities, Livestock Development Boards/Biodiversity Boards/ NGOs of the states to sensitize them for documentation of AnGR in the respective states. During 2023, three Interface Meets for Arunachal Pradesh, Kerala and Andaman & Nicobar Islands states have been organized. By the end of 2023, Interface Meets with 15 states and one UT has been competed under the mission. Under the Mission, three more institutional projects were initiated for survey and documentation of AnGR in various states in collaboration with state stakeholders. Total 18 projects under the mission encompassed almost all of the states of the country.

After launch of the Mission, Bureau scientists surveyed in various states & UT to explore and identify new homogenous populations of livestock, poultry and dog. During 2023, surveys were conducted in 14 states/ UTs - Himachal Pradesh, Andhra Pardesh, Gujarat, Uttar Pradesh, Madhya Pradesh, Rajasthan, Odisha, Tamil Nadu, Maharashtra, Arunachal Pradesh, Nagaland, Meghalaya and Union Territories of Andeman & Nicobar and Ladakh. During 2023, fifteen new populations were identified. All that exploration under the Mission has resulted in identification of 48 new populations. Eight new populations have been characterized under the Mission during 2023. Many of the populations are also under characterization by the Network Project Units.

Registration of animal breeds

ICAR-NBAGR registered seven new breeds of indigenous livestock species and one synthetic cattle breed in the country during the year 2023. After including these breeds, total number of registered breeds has been reached to 220, including 54 for cattle,

20 for buffalo, 39 for goat, 45 for sheep, 8 for horses & ponies, 9 for camel, 14 for pig, 3 for donkey, 3 for dog, 1 for yak, 20 for chicken, 3 for duck, 1 for geese and 1 for synthetic cattle. ICAR Breed Registration Committee (BRC), the apex body for registration of newly identified animal breeds in the country in its 11th meeting held on 5th December, 2023, approved the registration of these livestock breeds of different states. Registration of new breeds initiates various development programs and policy formation in the country. Brief description of new breeds is as follows-

Aravali chicken is a dual purpose chicken used for meat and egg, distributed in Banaskantha, Sabarkantha, Aravalli and Mahisagar districts of Gujarat State. Males have birchen, while females shafty and/or laced plumage patterns. These birds show excellent heat tolerance. In adult males, the average body weight is 2 Kg. Female produces 72 eggs annually, on average.

Andamani duck is a dual purpose breed, distributed in Nimbudera to Diglipur region of Andaman & Nicobar Islands (UT). The whole body of these birds is covered with black plumage with white markings under the neck extending up to the belly. The average adult body weight for drake is 1406 gm. The average annual egg production is 266 eggs

Anjori goat is a medium sized goat, used for meat purposes. It is distributed in Raipur, Durg, Rajnandgaon, Kanker, Dhamtari, and Mahasamund districts of Chhattisgarh state. The majority of animals are brown in colour. It is hardy and well-adapted to the local climate. The average adult body weight for males is 35 kg and for females is 28 kg.

Andamani goat is a medium sized animal, reared for meat purposes in the Middle and North Andaman districts of Andaman & Nicobar Islands (UT). These goats are well adapted to the tropical hot-humid climate of the island. Meat is preferred for its excellent quality by the local people. The average adult body weight of males is 29 kg. The average milk production per lactation is 29 kg.

Bhimthadi horse is distributed in the Pune, Solapur, Satara, and Ahmadnagar districts of Maharashtra. The average height of a stallion is about 130 cm and of a mare is 128 cm. The predominant coat colour is liver chestnut. The chest barrel is well-developed. Bhimthadi horses are mainly used for transportation of household materials during the migration of the pastoralist people.

Andamani pig is a native to the islands of Andaman & Nicobar (UT) and is mainly reared for meat (pork). These pigs are sturdy and medium in size. The coat is mostly black and sometimes rusty grey. They are fast runners and have evolved to thrive under a low-input management system. The average adult body weight is 71 kg in males and 68 kg in females.

Macherla sheep is a meat purpose sheep breed of Guntur, Krishna, and Prakasam districts of Andhra Pradesh and nearby regions of Telangana. It is medium to large. The coat color is white with large black or brown patches on the body, face and legs. The average adult body weight for males is 43 kg.

Frieswal is synthetic dairy cattle with Sahiwal (37.5%) and Holstein Friesian (62.5%) inheritance, developed by ICAR-Central Institute for Research on Cattle, Meerut. It is capable of producing about 7000 kg of milk yield in a standard lactation with a peak yield of about 41 kg. This breed is acclimatized to all agro-climatic regions of the country.

Characterization of native AnGR

Phenotypic characterization of many of newly identified homogenous populations were carried out in various states, including NEH. This year characterization of Vagwari cattle and Dungri Goats of Rajasthan, Molai Aadu goat of Tamil Nadu, Local Zanskari Sheep of Ladakh, Nagal pig of Nagaland, Gola pig of Odisha, Sikkimese yak and Rampur Hound dog of Uttar Pradesh was carried out. Characterization of many of new populations like Monbah, Umarda, Khamgaon, Banka,

Jammu Hill, Ruhelkhandi, Gangavathi, Nattukuttai, Jhari, Periyar cattle, Jharkhandi buffalo, Belona, Melghati, Telangana buffalo, Bustar buffalo, Goa buffalo , Seemanchali, Bhadarwah, Kow -Debar, Sira, Malvi sheep, Champaran, Battisi, Tanjavur, Macherela, Totapuri gaot, Bustar pig, Meitei-yen, Shikhar/Ramar, Mrui chicken, Mala, Charka, chicken, Peri duck, Bakerwal dog, Tyaji pony and Braj donkey also been initiated under Network project during this year. Summary of newly characterized populations is given below-

***Vagwari cattle* of Rajasthan** are small-sized, light grey or grey, with compact body, but bulls are darker, and their necks, shoulders, hump, and quarters are nearly black. They have small hump, short neck, thin and short legs, straight face, small and straight forehead with prominent poll. The horns are grey, medium-sized, sickle-shaped and curved upward and inward with blunt tips. The mean values of body length, height at withers and chest girth for adult females were 94.6±0.38, 97.6±0.33 and 131.9±0.56 cm, respectively. Age at first breeding of males is around four years, while that of females is around four to four and a half years. The daily milk yield is from one to three litres.

Dungri Goats of Rajasthan are small-sized and either black or reddish-brown in appearance. Tufted hairs (black or brown) can be seen on the thighs. The medium-sized, drooping ears have a leaf-like appearance. The face is triangular and convex. The horns are small, bent rearward, somewhat upturned, normally screwed, though they can occasionally be round. The mean values of body length, height at withers and chest girth for adult females were 58.9±0.24, 65.7±0.23 and 68.8±0.25 cm, respectively. A Dungri goat's daily milk output can range from 300 to 500 ml. First kidding usually occurs between 15 and 17 months of age. Twining percentages range from 10% to 15%.

Molai Aadu goat of Tamil Nadu is predominantly found in Gobichetti palayam, Sathyamangalam and Bhavani taluks of Erode district of Tamil Nadu. The coat colour of the animals is white in colour and few animals are also with black or brown patches with nostrils, udder and teat. More than 80% animals are polled; hence they are also called as Molai Aadu. The Molai Aadu goat is having very high twining rate and quadruplets with good mothering ability. Females attains sexual maturity at an age of 12-14 months and age at breeding is 14-16 months. The mean of most important biometric traits viz., Body length, Height at withers, Chest girth, Paunch girth, and Body weight were 63.462±0.790, 68.038±0.404, 73.820±0.539, 79.481±0.686, and 34.445±1.100 (kg), respectively.

Zanskari goat of Ladakh are having compact body covered with hairs. The ears are small in size and erect. The live weight of buck ranges from is 18-45 kg and doe ranges from 15-30kg. Kidding takes place once a year, normally single, the average age at first kidding is 20 months. Breeding is natural, Nov- Dec, Twining not reported age of first kidding 2-2.5 yrs, Main Lambing season April-May, weaning of the young one is normally done at 4 months of age. The average Body Length, Body Height, Chest Girth, Pauch Girth of female goat were 55.60±0.99, 55.09±0.62, 71.29±1.08 and 77.09±1.43, cm.

Zanskari sheep of Ladakh are small to medium-sized animals exhibit resilience. Their ears, though small in size, are of particular interest, being short and tubular with a distinctive drooping appearance. For female Zanskari sheep, the average body length (BL), height (Height), chest girth (CG), paunch girth (PG) are 52.74±0.75, 54.66±0.52, 73.36±0.92, 80.05±1.07, respectively.

Nagal pig of Nagaland are long, deep-bodied and black pigs. They have a short snout and black hooves. Their top line is slightly concave. Very few pigs have white hooves, and white patches on legs below the hock, on the tip of the muzzle and on the tail switch. They have

large, wide and dropping ears, partially obscuring their vision. The mean***± S.E.*** values of body length, height at withers, heart girth and neck girth of sows were 124.8±1.07, 69.5±0.59,107.1±0.89 and 87.9±0.81 cm, respectively. The estimated mean body weight of sows was 101.3±2.5 kg, while that of boars was 117.2±4.0 kg. Nagal pigs are raised under intensive backyard management

Gola pig of Odisha is found in Puri, Ganjam and Jajpur district of Odisha. These medium to large-sized pigs are characterized by their striking black coat color adorned with distinct white markings on their legs, head, and abdomen. Adapted to harsh climatic conditions, these resilient pigs thrive on zero input, making them a sustainable choice for local farmers. With straight and pointed snouts, along with short and erect ears, Goal pigs exhibit a flat-shaped belly and full hoof placement. Their bristles range from medium to long in size, adding to their distinctive appearance. Known for their excellent reproductive performance, these pigs typically yield litters sized between 6 and 10 with minimal piglet mortality.

Sikkimese yak of Sikkim are mainly black in color but have variation ranging from pure brown, grey and white to dual colored black and white, brown and white etc. T he average daily milk yield in Sikkimese yak is 1.44 kg with peak yield of 1.95 kg. The lactation length of the animal is about 7 months. On an average, a female yak required 2 services per conception and gave birth to 6-7 off springs in her lifetime. Production system is mainly pastoral and 100 % natural service is practiced. The average age at first mounting in bulls is 43 months whereas the age at first mating is 48 months.

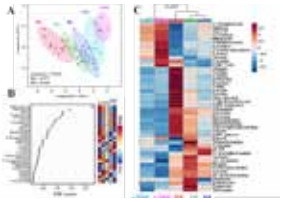
Rampur Hound dog originated in the Rampur area of Uttar Pradesh, however, animals are also distributed in Lucknow, Tamil Nadu, Haryana. Few breeders from Tamil Nadu, Maharashtra and near Gurugram in Haryana also maintain these dogs. The dog is believed to be developed by Nawab of Rampur by crossing the English grey hound and Thazi hound. The dogs are maintained as a guard dog by the breeders and the dogs are excellent trainable animals. Four coat colours were observed during the field visit i.e Black coat colour, Brindle, Light brown and Fawn colour. Animals are about 69.02±1.03 cm in height at withers.

In order to reveal the genomic composition and to discover the genetic uniqueness of non-descript cattle populations of Maharashtra, Jharkhand and Bihar using the GGP 50K SNP genotyping platform. A total of 74,151 SNPs were genotyped with the average call rate was 93%. The Average Minor Allele Frequency found to be 0.33054 and heterozygosity proportion of 0.39762. The common SNPs (51,600) found across the platforms used for genotyping reference and target populations were extracted. Among top 1,000 markers from each of the statistics, 553 were found common and further used for PCA and admixture analysis.PC1 explained 92.23% variance and differentiated exotic and indigenous cattle populations under the study, while PC2 distinguished Kangayam, Ongole, Vechur and Gaolao from other indigenous populations. The targets were analysed for breed composition which revealed Kamgaon found to have its own unique composition ~44%; and remaining populations viz., Sahabadi, Jharkandi found to have significant admixture from indicine ancestors, and crossbred were highly admixed.

In the study of Genomic Diversity in Indian Goats a total of 51,705 ROH and 21,271 consensus regions were identified. The mean number of ROH per animal peaked in the meat breed Jharkhand Black (2693) and was lowest in the Changthangi (60). The average length of ROH (ALROH) was highest in Kanniadu (KAN) (974.11 Kb) and lowest in Tellicherry (T) (146.98 Kb). Long ROH are typically associated with recent inbreeding, while short ROH are linked to ancient inbreeding. ROH patterns indicated lower levels of consanguinity in dairy (Jakhrana and Surti) and pashmina-producing breeds (Changthangi), while recent inbreeding was apparent in meat breeds (Jharkhand Black, Kanniadu, Sangamneri, and Tellicherry).

An attempt was made to assess the mitochondrial DNA variations and to identify the lineages contributing to Indian domestic donkeys. The length of mitochondrial genomes in the investigated animals varied from 16660 to 16664. Comparative analysis of the mitogenomes revealed presence of 201 variable sites contributing to 27 haplotypes. The haplotype and nucleotide diversity were 0.989 and 0.00395, respectively, suggesting high maternal genetic diversity. This study supports previous hypothesis of domestication of donkeys in the African continent and further spread across the globe following desertification of the Sahara.

A pilot study on livestock Ecosystem Services (ESS) was studied in Arunachal Pradesh. The study was conducted mainly for assessing the ESS provided by the mithun and pig and overall in Zero and KraDaadi districts. Mithun is contributing seven each of provisioning and regulating and one cultural services to the local society and environment. Similarly, pig six provisional, three regulating and one cultural services. Urbanization and land uses had the most significant negative impact on AnGR diversity.



Evaluation and trait characterization of native AnGR

An effort was made to characterise the metabolome signatures of colostrum and mature milk of Ladakhi and Sahiwal cows. A total of 40 defatted samples of colostrum, (0-day: N=20), and mature milk (>60 days: N = 20) were evaluated and identified 46 metabolites from different classes such as amino acids, benzenoids, carbohydrates, fatty acyls, nucleic acids, organic compound, organic nitrogenous compounds. The majority (30/46) of the metabolites were enriched in colostrum while their level declined in mature milk. Only three metabolites such as UDP-glucose, N-acetyl glucosamine and betaine were present in higher abundance in colostrum of Sahiwal cows as compared to Ladakhi cows. Mostof metabolites studies werefound to be relatively high in Ladakhi cow's mature milk as compared to Sahiwal cow's maturemilk.

An effort was made to characterise the proteome signature of colostrum and mature milk of Ladakhi cows from high altitude and Sahiwal cows from low altitude. The SDS-PAGE profiles demonstrated that the ultracentrifugation method yielded better protein separation and resolution compared to the acid precipitation method. The principal component analysis showed significant differences in proteomic patterns between colostrum and mature milk from both the breeds. The PCA score plot illustrated a clear differentiation between colostrum (0-day) and mature (50-60 days) milk samples of Ladakhi cows, primarily along PC1 and PC2 axes.

Study was conducted to extensively investigates genetic diversity, population structures, and the identification of potential genes and pathways associated with goat breeds adapted to India's tropical and temperate ecosystems. Employing Illumina NOVASEQ 6000 platform with 150 bp paired-end chemistry, the sequencing of 55 goat samples was carried out, representing four Indian goat breeds from the tropical ecosystem and three from the temperate ecosystem. Principal Component Analysis (PCA) underscored increased diversity in the Changthangi and Kanni Adu breeds, distinguishing them notably from other breeds in the study. Prominent candidate genes under selection were identified and found to be associated with various traits, including hair/fiber qualities and adaptive traits, cold adaptation, body weight gain and feed efficiency, stress responses, and heat tolerance among others.

Impact of heat stress on variation in sperm cell transcripts during the hot summer season in Murrah buffalo breeding bulls, has been analysed. All the samples were having RIN values below 3.4, lower RIN values characteristic of sperm RNA. The sequences were aligned with the *Bubalus bubalis* UOA_WB_1 genome assembly using STAR aligner and StringTie assembler. On an average 87.39% of the reads aligned onto the

reference genome. The findings of the transcriptome study in Murrah bull spermatozoa indicate possible role of mitochondrial adaptive gene expression in coping heat stress.

Transcriptomics Analysis of Host Response to Bovine Anaplasmosis was conducted**.** Comparative analysis of the transcript levels between healthy and infected cattle identified 999 differentially expressed genes (DEGs) meeting the criteria of log2 fold change ≥2.0, P <0.05 and FDR <0.05. Among these DEGs, 676 were up-regulated and 323 were down-regulated in the infected animals as compared to the healthy ones. Ingenuity Pathway Analysis (IPA) identified the role of cytokines in mediating communication between immune cells as one of the most significant pathways in the infected animals.

An Axiom-based high-density (HD) SNP chip was designed and validated for indigenous goats. The array was designed using a panel of 225 samples from 15 diverse goat breeds of India. In total, more than 38 million high quality SNPs were subjected to stringent filtering and 626,975 SNPs were finally tiled on the array. The HD chip (Axiom_Cahi) was validated by genotyping 443 samples from 26 indigenous goat breeds/populations. The results revealed 95.83% markers to be highly informative and polymorphic in Indian goats. Goat populations from similar agroecological areas were shown to be closely related. Phylogenetic analysis suggested stratification of breeds by geographic proximity.

To delve into the genetic disparities contributing to distinctive traits, a comparative global gene expression profiling was executed on four biological replicates of skin from Changthagi and Muzzafarnagari sheep. The analysis revealed 149 up-regulated genes and 2,139 down-regulated genes in Changthangi sheep compared to Muzzafarnagri sheep, with a p-adjusted value (padj) of ≤0.05 and a $\log_2$ fold change of ≥1.5. Among the up-regulated melanogenesis-related genes in Changthangi sheep were *TYR, TYRP1, DCT, SLC45A2, PMEL, MLANA* and *OCA2,* reaffirming the pivotal role of melanin in both the animals' black coat color and UV protection at high altitudes.

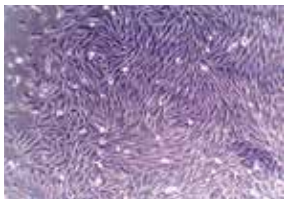
To unlock the genomic intricacies associated with production traits and adaptation, a comprehensive exploration of indigenous chicken germplasm was undertaken using modern genomic tools. For this purpose the transcriptome profiling of breast tissue from two indigenous backyard poultry breeds of India – Ankaleshwar, a mainland breed, and Nicobari, a breed adapted to islands was conducted. A total of 12,790 transcripts were found to be common across both breeds, with 657 expressed exclusively in Ankaleshwar and 169 in Nicobari. The predominant genes expressed across both groups were primarily associated with muscle structure, contraction, and energy metabolism.

A comprehensive comparative analysis of the skeletal muscle transcriptome was conducted on four biological replicates each of Aseel and Punjab Brown, a meat-type breed in India. In both breeds, the highly expressed genes were closely linked to muscle contraction and motor activity. Differential expression analysis revealed 961 up-regulated and 979 down-regulated genes in Aseel, with a $\log_2$ fold change threshold of ±2.0 (padj<0.05). Genes associated with fatty acid beta-oxidation, ATP formation by chemi-osmotic coupling, response to oxidative stress and muscle contraction showed higher expression.

The bacterial diversity analysis of Chilika buffalo curd demonstrated a high microbial diversity. The sequencing analysis revealed the presence of various bacterial species, including Lacticaseibacillus rhamnosus, Lactobacillus paracasei, Lactobacillus casei, Lentilactobacillus farraginis, Lactobacillus delbrueckii, Lactobacillus fermentum, and Limosilactobacillus fermentum. Metabolite composition in Chilika and Chilika Grade curd samples was investigated using NMR spectroscopy. The analysis revealed a rich abundance of various metabolites such as lactate, lactose, glucose,

galactose, threonine, Guanidoacetate, glycine, citrate, and acetate.

The study was conducted to identify the deleterious mutations in Murrah buffalo. Among these SNPs, a subset of 4,742 variants were identified as non-synonymous utilizing the SnpEff tool. Using the VEP (Variant Effect Predictor) tool, a total of 980 missense variants were identified as deleterious based on the SIFT score. Out of these, further analysis using various prediction tools such as PANTHER, PredictSNP, MAPP, PolyPhen-1, PolyPhen-2 SNAP, and PhD-SNP revealed that 47 missense SNPs were commonly predicted as deleterious across all of these tools.



Conservation of native AnGR

During 2023, the germplasm of a total of 24 breeds was cryopreserved in the form of semen and somatic cells in the National Gene Bank of the Bureau. 18050 semen doses of 9 breeds and 1760 somatic cell vials of 15 breeds were cryopreserved. Under Medium & Long-term conservation of AnGR under (SDG) Indicator 2.5.1, the bureau has cryopreserved the germplasm- Semen of 63 indigenous breeds/populations, -and Somatic cell of 49 breeds/populations have been cryopreserved at the National Gene Bank of the Bureau upto 2023. As a special effort through somatic cell cryopreservation, fourteen indigenous breeds at risk as per the Breed Watch List were conserved by 2023.

National Bovine Genomic Centre – Indigenous Breeds

Cattle and buffalo unified genomic chips were developed by pooling the genomic data from ICAR-National Bureau of Animal Genetic Resources (NBAGR), National Dairy Development Board (NDDB), BAIF Development Research Foundation and National Institute of Animal Biotechnology (NIAB) by following the ICAR guidelines and Data transfer. Both the chips were validated by ICAR-NBAGR, Karnal and NDDB, independently.

Network Project on AnGR

Twenty-four new NWP centres were initiated across the country for characterization and conservation of indigenous AnGR. Total centres are now twenty seven, which are involved in characterization of 43 indigenous livestock and poultry populations and conservation of five critical breeds-Tibettan and Karnah sheep, Mewari camel, Zanskari pony and Halari donkey.

Research projects and publications

The research endeavors of the bureau were accomplished under 28 institute projects, 6 externally funded projects and one IAEA International project. 47 research papers including 36 in International Journals were published by the scientists of the Bureau during the year.

Awards and recognitions

Research efforts of the Bureau scientists and scholars were appreciated in the form of best presentation awards during conferences/seminars and fellowship of scientific societies. India was elected Vice-chairperson and represented Asia in the 12th Session of the Intergovernmental Technical Working Group (ITWG-AnGR) on Animal Genetic Resources at the FAO headquarters in Rome. This global recognition underscores our leadership in AnGR conservation and management.

Capacity building

Bureau have organized a five-day Skill Development Training Programme on "Basic Bioinformatics Tools for Genome Analysis," from October 16 to 20 2023, which attracted 76 participants from diverse fields across 18 states. Additionally, various interactive meetings with the Animal Husbandry Statistics Division, DAHD,

to discuss the technical modalities for conducting the Breed-wise Livestock Census at the national level were also conducted. Bureau have also organised a "National symposium on "Advances in Genetics and Genomics for Sustainable Livestock Transformation & XVII Annual Convention of Indian Society of Animal Genetics & Breeding" from November 16 -17, 2023.

Farmers awareness programme

Bureau organized various SCSP / farmers awareness Programs and set up 6 exhibitions at various parts of the country.

Celebrations

Kisan diwas was celebrated on 23 Dec 2023 and Breed Conservation Award-2023 conferred to 8 farmers and 9 organization for their outstanding efforts for conservation of native breeds. International Biodiversity Day, Rashtriya Ekta Diwas, Mahila Kisan Diwas, World Food Day, National Unity Day, Republic Day, and Independence Day were celebrated with full zeal during the year. Active participation of the Bureau staff was evident in various events such as Rashtriya Swachhta Abhiyan and Waste to Wealth campaign. Ladakhi Cattle Breed Society on the International Day for Biological Diversity in Ladakh was established.

Meetings

Review of progress of different research projects was ensured by timely organization of Institute Research Committee (IRC), Research Advisory Committee (RAC) and annual review meeting of network project. The externally funded projects of the institute were also reviewed by the respective funding agencies. Various management issues of the institute were discussed during the Institute Management Committee meeting.

Personnel

Three heads, one Assistant and one SSS joined the bureau during the year- 2023. Many distinguished personnel visited the bureau.

कार्यकारी सारांश

संस्थान का प्रोफाइल

आईसीएआर-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो (एनबीएजीआर), भारतीय कृषि अनुसंधान परिषद (आईसीएआर) के तहत छह ब्यूरो में से एक है, जिसकी स्थापना 1984 में हुई थी, जिसका उद्देश्य देश में सतत उपयोग और आजीविका सुरक्षा के लिए स्वदेशी कृषि पशु आनुवंशिक संसाधनों (एएनजीआर) की रक्षा और संरक्षण करना है। विशिष्ट अधिदेश के साथ - 1) देश के पशुधन और कुक्कुट आनुवंशिक संसाधनों की पहचान, मूल्यांकन, लक्षण वर्णन, संरक्षण और उपयोग; और 2) पशु आनुवंशिक संसाधन प्रबंधन और नीतिगत मुद्दों में समन्वय और क्षमता निर्माण; ब्यूरो के पास कई गतिविधियां हैं जिनमें नई संभावित आबादी का पता लगाने और उनकी विशेषता बताने के लिए सर्वेक्षण करना, ऐसी आबादी को और अधिक दस्तावेजित करना और पंजीकृत करना; स्वदेशी नस्लों का प्राथमिकता निर्धारण और संरक्षण, विशिष्ट लक्षणों की पहचान करना और उनका मूल्यांकन और उपयोग, सभी राज्यों को शामिल करना शामिल है। ब्यूरो देश में नस्ल पंजीकरण के लिए नोडल एजेंसी है देश के पशु ब्यूरो के रूप में, यह AnGR से संबंधित संयुक्त राष्ट्र के खाद्य एवं कृषि संगठन सहित विभिन्न राष्ट्रीय और अंतर्राष्ट्रीय एजेंसियों के साथ समन्वय भी करता है। यह संयुक्त राष्ट्र के सतत विकास लक्ष्य (SDG) 2 संकेतक 2.5.1 और 2.5.2 के लिए एक नोडल एजेंसी भी है।

भारत में शून्य अवर्णनीय पशु आनुवंशिक संसाधन की ओर मिशन

ब्यूरो ने 11 अगस्त, 2021 को "भारत में शून्य अवर्णनीय AnGR की ओर मिशन" की शुरुआत की। मिशन के तहत, ब्यूरो ने पशुपालन विभागों, राज्य कृषि/पशु चिकित्सा विश्वविद्यालयों, पशुधन विकास बोर्डों/जैव विविधता बोर्डों/राज्यों के गैर सरकारी संगठनों सहित विभिन्न पशु हितधारकों के साथ राज्य इंटरफेस मीट का आयोजन किया ताकि उन्हें संबंधित राज्यों में AnGR के दस्तावेजीकरण के लिए संवेदनशील बनाया जा सके। 2023 के दौरान, अरुणाचल प्रदेश, केरल और अंडमान और निकोबार द्वीप समूह राज्यों के लिए तीन इंटरफेस मीट का आयोजन किया गया है। 2023 के अंत तक, मिशन के तहत 15 राज्यों और एक केंद्र शासित प्रदेश के साथ इंटरफेस मीट का आयोजन किया जा चुका है। मिशन के तहत, राज्य हितधारकों के सहयोग से विभिन्न राज्यों में AnGR के सर्वेक्षण और दस्तावेजीकरण के लिए तीन और संस्थागत परियोजनाएं शुरू की गईं। मिशन के तहत कुल 18 परियोजनाओं में देश के लगभग सभी राज्य शामिल हैं। मिशन के शुभारंभ के बाद, ब्यूरो के वैज्ञानिकों ने पशुधन, मुर्गी और कुत्तों की नई समरूप आबादी का पता लगाने और पहचानने के लिए विभिन्न राज्यों और केंद्र शासित प्रदेशों में सर्वेक्षण किया। 2023 के दौरान, 14 राज्यों - हिमाचल प्रदेश, आंध्र प्रदेश, गुजरात, उत्तर प्रदेश, मध्य प्रदेश, राजस्थान, ओडिशा, तमिलनाडु, महाराष्ट्र, अरुणाचल प्रदेश, नागालैंड, मेघालय और केंद्र शासित प्रदेश

अंडमान निकोबार एवं लद्दाख में सर्वेक्षण किए गए। 2023 के दौरान, आठ राज्यों में पंद्रह नई आबादियों की पहचान की गई। मिशन के तहत किए गए सभी अन्वेषणों के परिणामस्वरूप 48 नई आबादियों की पहचान हुई है। 2023 के दौरान मिशन के तहत आठ नई आबादियों की पहचान की गई है। कई आबादियों का नेटवर्क प्रोजेक्ट इकाइयों द्वारा भी लक्षण-निर्धारण किया जा रहा है।

पशु नस्लों का पंजीकरण

ICAR-NBAGR ने वर्ष 2023 के दौरान देश में देशी पशुधन प्रजातियों की सात नई नस्लों और एक सिंथेटिक गोवंश नस्ल का पंजीकरण किया है। इन नस्लों को शामिल करने के बाद पंजीकृत नस्लों की कुल संख्या 220 हो गई है, जिसमें गोवंश की 54, भैंस की 20, बकरी की 39, भेड़ की 45, घोड़े और टट्टू की 8, ऊंट की 9, सुअर की 14, गधे की 3, कुत्ते की 3, याक की 1, मुर्गी की 20, बत्तख की 3, हंस की 1 और कृत्रिम गोवंश की 1 नस्ल शामिल है। देश में नई पहचान की गई पशु नस्लों के पंजीकरण के लिए शीर्ष निकाय ICAR नस्ल पंजीकरण समिति (BRC) ने 5 दिसंबर, 2023 को आयोजित अपनी 11वीं बैठक में विभिन्न राज्यों की इन पशुधन नस्लों के पंजीकरण को मंजूरी दी। नई नस्लों के पंजीकरण से देश में विभिन्न विकास कार्यक्रमों और नीति निर्माण की शुरुआत होती है। नई नस्लों का संक्षिप्त विवरण इस प्रकार है-

अरावली मुर्गी एक दोहरे उद्देश्य वाली मुर्गी है जिसका उपयोग मांस और अंडे के लिए किया जाता है, जो गुजरात राज्य के बनासकांठा, साबरकांठा, अरावली और महिसागर जिलों में वितरित है। नर में बिर्चेन होता है, जबकि मादा में शाफ़्टी और/या लेसदार पंख पैटर्न होते हैं। ये पक्षी उत्कृष्ट ताप सहनशीलता दिखाते हैं। वयस्क नर में, औसत शरीर का वजन 2 किग्रा. होता है। मादा औसतन सालाना 72 अंडे देती है।

अंडमानी बत्तख एक दोहरे उद्देश्य वाली नस्ल है, जो अंडमान और निकोबार द्वीप समूह (यूटी) के निंबूडेरा से डिगलीपुर क्षेत्र में वितरित है। इन पक्षियों का पूरा शरीर काले पंखों से ढका होता है, जिसमें गर्दन के नीचे सफेद निशान होते हैं जो पेट तक फैले होते हैं। ड्रेक के लिए औसत वयस्क शरीर का वजन 1406 ग्राम है। औसत वार्षिक अंडा उत्पादन 266 अंडे है

अंजोरी बकरी एक मध्यम आकार की बकरी है, जिसका उपयोग मांस के उद्देश्यों के लिए किया जाता है। यह छत्तीसगढ़ राज्य के रायपुर, दुर्ग, राजनांदगांव, कांकेर, धमतरी और महासमुंद जिलों में वितरित है। अधिकांश जानवर भूरे रंग के होते हैं। यह कठोर और स्थानीय जलवायु के अनुकूल होता है। नर का औसत वयस्क शरीर का वजन 35 किग्रा. और मादा का 28 किग्रा. होता है।

अंडमानी बकरी एक मध्यम आकार का जानवर है, जिसे अंडमान और निकोबार द्वीप समूह (UT) के मध्य और उत्तरी अंडमान जिलों में मांस के उद्देश्य से पाला जाता है। ये बकरियाँ द्वीप के उष्णकटिबंधीय गर्म-आर्द्र जलवायु के अनुकूल हैं। स्थानीय लोग इसके मांस को इसकी उत्कृष्ट गुणवत्ता के लिए पसंद करते हैं। नर का औसत वयस्क शरीर का वजन 29 किग्रा. होता है। प्रति स्तनपान औसत दूध उत्पादन 29 किग्रा. है।

भीमथड़ी घोड़ा महाराष्ट्र के पुणे, सोलापुर, सतारा और अहमदनगर जिलों में वितरित है। घोड़े की औसत ऊंचाई लगभग 130 सेमी और घोड़ी की 128 सेमी होती है। प्रमुख कोट का रंग लिवर चेस्टनट है। छाती का बैरल अच्छी तरह से विकसित होता है। भीमथड़ी घोड़ों का उपयोग मुख्य रूप से पशुपालक लोगों के प्रवास के दौरान घरेलू सामग्रियों के परिवहन के लिए किया जाता है।

अंडमानी शूकर अंडमान और निकोबार (यूटी) के द्वीपों की मूल निवासी है और मुख्य रूप से मांस (सूअर का मांस) के लिए पाली जाती है। ये शूकर मज़बूत और मध्यम आकार के होते हैं। कोट

ज़्यादातर काला और कभी-कभी जंग लगे भूरे रंग का होता है। ये तेज़ दौड़ने वाले होते हैं और कम इनपुट प्रबंधन प्रणाली के तहत पालने के लिए विकसित हुए हैं। वयस्क नर का औसत शरीर का वजन 71 किग्रा. और मादा का 68 किग्रा. होता है।

माचेरला भेड़ आंध्र प्रदेश के गुंटूर, कृष्णा और प्रकाशम जिलों और तेलंगाना से सटे आस-पास के क्षेत्रों की मांस के उद्देश्य से पाली जाने वाली भेड़ की नस्ल है। यह मध्यम से बड़ी होती है। कोट का रंग सफ़ेद होता है और शरीर, चेहरे और पैरों पर काले या भूरे रंग के धब्बे होते हैं। वयस्क नर का औसत शरीर भार 43 किग्रा. होता है।

फ़्रीज़वाल एक सिंथेटिक डेयरी गोवंश की नस्ल है जिसमें साहीवाल (37.5) और होलस्टीन फ़्रीज़ियन (62.5) वंशागति होती है, जिसे ICAR-केंद्रीय गोवंश अनुसंधान संस्थान, मेरठ द्वारा विकसित किया गया है। यह एक मानक दुग्ध काल में लगभग 41 किग्रा की अधिकतम उपज के साथ लगभग 7000 किग्रा. दूध देने में सक्षम है। यह नस्ल देश के सभी कृषि-जलवायु क्षेत्रों के लिए अनुकूलित है।

देशी पशु आनुवंशिक संसाधन का लक्षण-निर्धारण

उत्तर-पूर्वी हिमालय सहित विभिन्न राज्यों में अनेक नई पहचानी गई समरूप अबादियों का प्ररूपी लक्षण-निर्धारण किया गया। इस वर्ष राजस्थान के वाग्वारी गोवंश और डुंगरी बकरियों, तमिलनाडु की मोलाई आडू बकरी, लद्दाख की स्थानीय जंस्कारी भेड़, नागालैंड के नागल सुअर, ओडिशा के गोला सुअर, सिक्किमी याक और उत्तर प्रदेश के रामपुर हाउंड कुत्ते का लक्षण-निर्धारण किया गया। इस वर्ष नेटवर्क परियोजना के तहत मोनबाह, उमरदा, खामगांव, बांका, जम्मू हिल, रुहेलखंडी, गंगावती, नट्टूकुट्टई, झाड़ी, पेरियार गोवंश, झारखंडी भैंस, बेलोना, मेलघाटी, तेलंगाना भैंस, बुस्टार भैंस, गोवा भैंस, सीमांचली, भद्रवाह, कौ-देबर, सिरा, मालवी भेड़, चंपारण, बत्तीसी, तंजावुर, मचेरेला, तोतापुरी गौट, बुस्टार सुअर, मैतेई-येन, शिखर/राम-अर, मरुई मुर्गी, माला, चरका, मुर्गी, पेरी बत्तख, बकरवाल कुत्ता, त्याजी टट्टू और ब्रज गधे जैसी कई नई आबादी का लक्षण-वर्णन भी शुरू किया गया है। नई आबादी का सारांश नीचे दिया गया है-

राजस्थान के **वाग्वारी गोवंश** छोटे आकार के, हल्के भूरे या भूरे रंग के, सुगठित शरीर वाले होते हैं, लेकिन बैल गहरे रंग के होते हैं, और उनकी गर्दन, कंधे, कूबड़ और क्वार्टर लगभग काले होते हैं। इनके छोटे कूबड़, छोटी गर्दन, पतले और छोटे पैर, सीधा चेहरा, छोटा और सीधा माथा और उभरे हुए सिर होते हैं। सींग भूरे, मध्यम आकार के, दरांती के आकार के और ऊपर और अंदर की ओर मुड़े हुए होते हैं, जिनके सिरे कुंद होते हैं। वयस्क मादाओं के लिए शरीर की लंबाई, कंधों की ऊंचाई और छाती की परिधि के औसत मान क्रमशः 94.6±0.38, 97.6±0.33 और 131.9±0.56 सेमी थे। नर की पहली प्रजनन आयु लगभग चार वर्ष होती है, जबकि मादा की लगभग चार से साढ़े चार वर्ष होती है। प्रतिदिन दूध की उपज एक से तीन लीटर तक होती है।

राजस्थान की **डूंगरी बकरियाँ** छोटे आकार की और दिखने में या तो काली या लाल-भूरे रंग की होती हैं। जाँघों पर गुच्छेदार बाल (काले या भूरे) देखे जा सकते हैं। मध्यम आकार के, लटकते हुए कान पत्ती जैसे दिखते हैं। चेहरा त्रिकोणीय और उत्तल होता है। सींग छोटे, पीछे की ओर मुड़े हुए, कुछ ऊपर की ओर उठे हुए, सामान्य रूप से पेंचदार होते हैं, हालांकि वे कभी-कभी गोल भी हो सकते हैं। वयस्क मादाओं के लिए शरीर की लंबाई, कंधों पर ऊंचाई और छाती की परिधि के औसत मान क्रमशः 58.9±0.24, 65.7±0.23 और 68.8±0.25 सेमी थे। एक डुंगरी बकरी का दैनिक दूध उत्पादन 300 से 500 मिली तक हो सकता है। पहला बच्चा आमतौर पर 15 से 17 महीने की उम्र के बीच होता है। जुड़वाँ प्रतिशत 10% से 15% तक होता है।

तमिलनाडु की मोलाई आडू बकरी मुख्य रूप से तमिलनाडु के इरोड जिले के गोबीचेट्टी पलायम, सत्यमंगलम और भवानी तालुकों में पाई जाती है। जानवरों के कोट का रंग सफेद होता है और कुछ जानवरों के नथुने, थन और निप्पल पर काले या भूरे रंग के धब्बे भी होते हैं। 80% से अधिक जानवर बिना सींग वाले होते हैं; इसलिए उन्हें मोलाई आडू भी कहा जाता है। मोलाई आडू बकरी में बहुत अधिक जुड़वाँ बच्चे होते हैं और अच्छी मातृत्व क्षमता के साथ चार बच्चे होते हैं। मादा 12-14 महीने की उम्र में यौन परिपक्वता प्राप्त करती है और प्रजनन की उम्र 14-16 महीने होती है। सबसे महत्वपूर्ण बायोमेट्रिक लक्षणों का औसत, जैसे शरीर की लंबाई, कंधों की ऊंचाई, छाती का घेरा, पेट का घेरा और शरीर का वजन क्रमशः 63.462±0.790, 68.038±0.404, 73.820±0.539, 79.481±0.686 और 34.445±1.100 (किग्रा.) था।

लद्दाख की **ज़ांस्कारी बकरी** का शरीर बालों से ढका हुआ होता है। कान आकार में छोटे और सीधे होते हैं। नर बकरी का जीवित वजन 18-45 किग्रा. और मादा बकरी का वजन 15-30 किग्रा. होता है। बकरी का बच्चा साल में एक बार पैदा होता है, आम तौर पर एक बार, पहली बकरी के बच्चे की औसत आयु 20 महीने होती है। प्रजनन प्राकृतिक है, नवंबर-दिसंबर, जुड़वाँ होने की सूचना नहीं है, पहली बकरी की आयु 2-2.5 वर्ष है, मुख्य मेमने का मौसम अप्रैल-मई है, बच्चे का दूध छुड़ाना आम तौर पर 4 महीने की उम्र में किया जाता है। मादा बकरी की औसत शरीर की लंबाई, शरीर की ऊँचाई, छाती की परिधि, थैली की परिधि 55.60±0.99, 55.09±0.62, 71.29±1.08 और 77.09±1.43 सेमी थी। लद्दाख की ज़ांस्कारी भेड़ें छोटे से मध्यम आकार की होती हैं और लचीलापन प्रदर्शित करती हैं। उनके कान, हालांकि आकार में छोटे हैं, विशेष रुचि के हैं, जो विशिष्ट लटकते हुए रूप के साथ छोटे और ट्यूबलर हैं। मादा ज़ांस्कारी भेड़ के लिए, औसत शरीर की लंबाई (बीएल), ऊंचाई (ऊंचाई), छाती का घेरा (सीजी), पेट का घेरा (पीजी) क्रमशः 52.74 ± 0.75, 54.66 ± 0.52, 73.36 ± 0.92, 80.05 ± 1.07 है।

नागालैंड के **नागल शूकर** लंबे, गहरे शरीर वाले और काले सूअर हैं। थूथन का आकार छोटा एवं खुर काले रंग का होता है। उनकी शीर्ष रेखा थोड़ी अवतल है। बहुत कम सूअरों के खुर सफेद होते हैं, और हॉक के नीचे पैरों पर, थूथन के अंतिम सिरे पर और पूंछ के स्विच पर सफेद धब्बे होते हैं। शूकरों की शारीरिक लंबाई, कंधों की ऊंचाई, हृदय की परिधि और गर्दन की परिधि के मान क्रमशः 124.8±1.07, 69.5±0.59,107.1±0.89 और 87.9±0.81 सेमी थे। मादा शूकरों का अनुमानित औसत शारीरिक वजन 101.3±2.5 किग्रा. था, जबकि नर शूकरों का 117.2±4.0 किग्रा. होता है । नागल शूकरों को गहन पिछवाड़े प्रबंधन के तहत पाला जाता है

ओडिशा का **गोला शूकर** पुरी, गंजम और जाजपुर जिले में पाई जाती है। मध्यम से बड़े आकार के इन सूअरों की विशेषता उनके आकर्षक काले कोट का रंग है जो उनके पैरों, सिर और पेट पर अलग-अलग सफेद निशानों से सुशोभित है। कठोर जलवायु परिस्थितियों के अनुकूल, ये लचीले सूअर शून्य इनपुट पर पनपते हैं, जिससे वे स्थानीय किसानों के लिए एक स्थायी विकल्प बन जाते हैं। सीधे और नुकीले थूथन के साथ, छोटे और सीधे कानों के साथ, गोल सूअर एक सपाट आकार का पेट और पूर्ण खुर की स्थिति प्रदर्शित करते हैं। इनके बाल मध्यम से लेकर लंबे आकार के होते हैं, जो इनके विशिष्ट स्वरूप को और भी निखारते हैं। अपने बेहतरीन प्रजनन प्रदर्शन के लिए जाने जाने वाले ये सूअर आम तौर पर 6 से 10 बच्चों को जन्म देते हैं, जिनमें से सूअरों की मृत्यु दर न्यूनतम होती है।

सिक्किमी याक मुख्य रूप से काले रंग के होते हैं, लेकिन इनमें शुद्ध भूरे, भूरे और सफेद से लेकर दोहरे रंग के काले और सफेद, भूरे और सफेद आदि रंग भी होते हैं। सिक्किमी याक में औसत दैनिक दूध उत्पादन 1.44 किग्रा. होता है, जिसमें अधिकतम

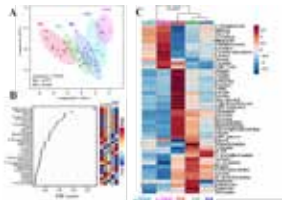
उत्पादन 1.95 किग्रा. होता है। पशु का स्तनपान अवधि लगभग 7 महीने होती है। औसतन, एक मादा याक को प्रति गर्भधारण 2 सेवाओं की आवश्यकता होती है और वह अपने जीवनकाल में 6-7 संतानों को जन्म देती है। उत्पादन प्रणाली मुख्य रूप से पशुपालन है और 100% प्राकृतिक गर्भाधान का प्रयोग किया जाता है। बैलों में पहली बार चढ़ने की औसत आयु 43 महीने होती है, जबकि पहली बार संभोग करने की आयु 48 महीने होती है।

रामपुर हाउंड श्वान की उत्पत्ति उत्तर प्रदेश के रामपुर क्षेत्र में हुई, हालाँकि, ये लखनऊ, तमिलनाडु, हरियाणा में भी पाए जाते हैं। तमिलनाडु, महाराष्ट्र और हरियाणा के गुरुग्राम के पास के कुछ प्रजनक भी इन कुत्तों को पालते हैं। माना जाता है कि इस कुत्ते को रामपुर के नवाब ने इंग्लिश ग्रे हाउंड और थाज़ी हाउंड को क्रॉस करके विकसित किया है। प्रजनकों द्वारा कुत्तों को एक रक्षक कुत्ते के रूप में रखा जाता है और कुत्ते बेहतरीन प्रशिक्षण योग्य जानवर हैं। फील्ड विजिट के दौरान चार रंग के श्वान देखे गए (काला कोट रंग, ब्रिंडल, हल्का भूरा और हल्का पीला रंग)। जानवरों की ऊंचाई कंधों पर लगभग 69.02±1.03 सेमी है।

जीजीपी 50के एसएनपी जीनोटाइपिंग प्लेटफॉर्म का उपयोग करके महाराष्ट्र, झारखंड और बिहार की गैर-वर्णित गोवंश आबादी की जीनोमिक संरचना को प्रकट करने और आनुवंशिक विशिष्टता की खोज करने के लिए। कुल 74,151 एसएनपी की जीनोटाइपिंग की गई, जिसमें औसत कॉल दर 93% थी। औसत माइनर एलील आवृत्ति 0.33054 और हेटेरोज़ायगोसिटी अनुपात 0.39762 पाया गया। जीनोटाइपिंग संदर्भ और लक्ष्य आबादी के लिए इस्तेमाल किए गए प्लेटफार्मों में पाए गए सामान्य एसएनपी (51,600) निकाले गए थे। प्रत्येक आंकड़े के शीर्ष 1,000 मार्करों में से 553 सामान्य पाए गए और आगे पीसीए और मिश्रण विश्लेषण के लिए उपयोग किए गए। पीसी 1 ने 92.23% भिन्नता को समझाया और अध्ययन के तहत विदेशी और स्वदेशी गोवंश की आबादी में अंतर किया, जबकि पीसी 2 ने कंगायम, ओंगोल, वेचुर और गाओलाओ को अन्य स्वदेशी आबादी से अलग किया। लक्ष्यों का नस्ल संरचना के लिए विश्लेषण किया गया, जिसमें पता चला कि कामगांव में ~ 44% की अपनी अनूठी संरचना थी; और शेष आबादी जैसे, साहबदी, झारखंडी में देशी पूर्वजों से महत्वपूर्ण मिश्रण पाया गया, और क्रॉसब्रेड अत्यधिक मिश्रित थे। भारतीय बकरियों में जीनोमिक विविधता के अध्ययन में कुल 51,705 आरओएच और 21,271 आम सहमति क्षेत्रों की पहचान की गई। प्रति पशु ROH की औसत संख्या मांस नस्ल झारखंड ब्लैक (2693) में सबसे अधिक थी और चंगथांगी (60) में सबसे कम थी। ROH (ALROH) की औसत लंबाई कन्नियाडू (KAN) (974.11 Kb) में सबसे अधिक और तेल्लीचेरी (T) (146.98 Kb) में सबसे कम थी। लंबे ROH आमतौर पर हाल ही में हुए अंतःप्रजनन से जुड़े होते हैं, जबकि छोटे ROH प्राचीन अंतःप्रजनन से जुड़े होते हैं। ROH पैटर्न ने डेयरी (जखराना और सुरती) और पश्मीना उत्पादक नस्लों (चंगथांगी) में कम स्तर की संगति का संकेत दिया, जबकि मांस नस्लों (झारखंड ब्लैक, कन्नियाडू, संगमनेरी और तेल्लीचेरी) में हाल ही में अंतःप्रजनन स्पष्ट था।

माइटोकॉन्ड्रियल डीएनए विविधताओं का आकलन करने और भारतीय घरेलू गधों में योगदान देने वाली वंशावली की पहचान करने का प्रयास किया गया। जांचे गए जानवरों में माइटोकॉन्ड्रियल जीनोम की लंबाई 16660 से 16664 तक भिन्न थी। माइटोजेनोम के तुलनात्मक विश्लेषण से 27 हैप्लोटाइप में योगदान देने वाले 201 परिवर्तनशील स्थलों की उपस्थिति का पता चला। हैप्लोटाइप और न्यूक्लियोटाइड विविधता क्रमशः 0.989 और 0.00395 थी, जो उच्च मातृ आनुवंशिक विविधता का सुझाव देती है। यह अध्ययन अफ्रीकी महाद्वीप में गधों के पालतू बनाने और सहारा के मरुस्थलीकरण के बाद दुनिया भर में फैलने की पिछली परिकल्पना का समर्थन करता है। अरुणाचल प्रदेश में पशुधन पारिस्थितिकी तंत्र सेवाओं (ईएसएस) पर एक पायलट अध्ययन किया गया था। अध्ययन

मुख्य रूप से मिथुन और सुअर द्वारा प्रदान की गई ईएसएस का आकलन करने और जीरो और क्रदादी जिलों में समग्र रूप से आयोजित किया गया था। मिथुन स्थानीय समाज और पर्यावरण को प्रावधान और विनियमन में सात और एक सांस्कृतिक सेवाओं में योगदान दे रहा है। इसी तरह, सुअर छह अनंतिम, तीन विनियमन और एक सांस्कृतिक सेवाओं में योगदान दे रहा है। शहरीकरण और भूमि उपयोग का एएनजीआर विविधता पर सबसे महत्वपूर्ण नकारात्मक प्रभाव पड़ा।



देशी पशु आनुवंशिक संसाधन का मूल्यांकन

लद्दाखी और साहीवाल गायों के कोलोस्ट्रम और परिपक्व दूध के मेटाबोलोम हस्ताक्षरों को चिह्नित करने का प्रयास किया गया। कोलोस्ट्रम (0-दिन: N=20) और परिपक्व दूध (>60 दिन: N = 20) के कुल 40 वसा रहित नमूनों का मूल्यांकन किया गया और विभिन्न वर्गों जैसे अमीनो एसिड, बेंजीनोइड्स, कार्बोहाइड्रेट, फैटी एसाइल, न्यूक्लिक एसिड, कार्बनिक यौगिक, कार्बनिक नाइट्रोजन यौगिकों से 46 मेटाबोलाइट्स की पहचान की गई। अधिकांश (30/46) मेटाबोलाइट्स कोलोस्ट्रम में समृद्ध थे जबकि परिपक्व दूध में उनका स्तर कम हो गया। लद्दाखी गायों की तुलना में साहीवाल गायों के कोलोस्ट्रम में केवल तीन मेटाबोलाइट्स जैसे UDP-ग्लूकोज, N-एसिटाइल ग्लूकोसामाइन और बीटाइन अधिक मात्रा में मौजूद थे। अधिकांश मेटाबोलाइट्स अध्ययनों में साहीवाल गाय के परिपक्व दूध की तुलना में लद्दाखी गाय के परिपक्व दूध में अपेक्षाकृत अधिक पाए गए।

उच्च ऊंचाई वाली लद्दाखी गायों और निम्न ऊंचाई वाली साहीवाल गायों के कोलोस्ट्रम और परिपक्व दूध के प्रोटिओम हस्ताक्षर को चिह्नित करने का प्रयास किया गया। एसडीएस-पीएजीई प्रोफाइल ने प्रदर्शित किया कि एसिड अवक्षेपण विधि की तुलना में अल्ट्रासेंट्रीफ्यूजेशन विधि ने बेहतर प्रोटीन पृथक्करण और समाधान प्रदान किया। मुख्य घटक विश्लेषण ने दोनों नस्लों के कोलोस्ट्रम और परिपक्व दूध के बीच प्रोटिओमिक पैटर्न में महत्वपूर्ण अंतर दिखाया। पीसीए स्कोर प्लॉट ने लद्दाखी गायों के कोलोस्ट्रम (0-दिन) और परिपक्व (50-60 दिन) दूध के नमूनों के बीच स्पष्ट अंतर को दर्शाया, मुख्य रूप से पीसी1 और पीसी2 अक्षों के साथ।

भारत के उष्णकटिबंधीय और समशीतोष्ण पारिस्थितिकी प्रणालियों के अनुकूल बकरी की नस्लों से जुड़ी आनुवंशिक विविधता, जनसंख्या संरचनाओं और संभावित जीन और मार्गों की पहचान की व्यापक जांच करने के लिए अध्ययन किया गया था। 150 बीपी पेयर-एंड केमिस्ट्री के साथ इल्लुमिना नोवासेक 6000 प्लेटफॉर्म का उपयोग करते हुए, 55 बकरी के नमूनों की अनुक्रमण किया गया, जिसमें उष्णकटिबंधीय पारिस्थितिकी तंत्र से चार भारतीय बकरी नस्लों और समशीतोष्ण पारिस्थितिकी तंत्र से तीन का प्रतिनिधित्व किया गया। प्रिंसिपल कंपोनेंट एनालिसिस (पीसीए) ने चंगथांगी और कन्नी अडू नस्लों में बढ़ी हुई विविधता को रेखांकित किया, जो उन्हें अध्ययन में अन्य नस्लों से उल्लेखनीय रूप से अलग करता है। चयन के तहत प्रमुख उम्मीदवार जीन की पहचान की गई और पाया गया कि वे विभिन्न लक्षणों से जुड़े हुए हैं, जिनमें बाल/फाइबर गुण और अनुकूली लक्षण, ठंड अनुकूलन, शरीर का वजन बढ़ना और फ़ीड दक्षता, तनाव प्रतिक्रिया और गर्मी सहनशीलता शामिल हैं। मुर्रा भैंस प्रजनन बैलों में गर्मियों के मौसम के दौरान शुक्राणु कोशिका प्रतिलेखों में भिन्नता पर ताप तनाव के प्रभाव का विश्लेषण किया गया है। सभी नमूनों में RIN मान 3.4 से कम थे, शुक्राणु RNA की विशेषता कम RIN मान। अनुक्रमों को STAR एलाइनर और स्ट्रिंगटाई असेंबलर का उपयोग करके बुबलस बुबलिस UOA_WB_1 जीनोम असेंबली के साथ संरेखित किया गया था। औसतन 87.39% रीड्स संदर्भ जीनोम पर संरेखित होते हैं। मुर्राह बैल शुक्राणुओं में ट्रांसक्रिप्टोम अध्ययन के निष्कर्ष गर्मी के

तनाव से निपटने में माइटोकॉन्ड्रियल अनुकूली जीन अभिव्यक्ति की संभावित भूमिका का संकेत देते हैं।

बोवाइन एनाप्लाज़मोसिस के लिए मेजबान प्रतिक्रिया का ट्रांसक्रिप्टोमिक्स विश्लेषण किया गया। स्वस्थ और संक्रमित गोवंश के बीच ट्रांसक्रिप्ट स्तरों के तुलनात्मक विश्लेषण ने 999 अलग-अलग व्यक्त जीन (डीईजी) की पहचान की, जो लॉग2 गुना परिवर्तन 2.0, पी <0.05 और एफडीआर <0.05 के मानदंडों को पूरा करते हैं। इन डीईजी में से, स्वस्थ जानवरों की तुलना में संक्रमित जानवरों में 676 अप-रेगुलेटेड और 323 डाउन-रेगुलेटेड थे। इनजेनिटी पाथवे एनालिसिस (आईपीए) ने संक्रमित जानवरों में सबसे महत्वपूर्ण मार्गों में से एक के रूप में प्रतिरक्षा कोशिकाओं के बीच संचार की मध्यस्थता में साइटोकिन्स की भूमिका की पहचान की।

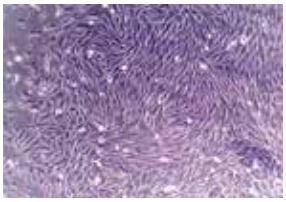
स्वदेशी बकरियों के लिए एक एक्सिओम-आधारित उच्च घनत्व (एचडी) एसएनपी चिप डिजाइन और मान्य किया गया था। सरणी को भारत की 15 विविध बकरी नस्लों के 225 नमूनों के पैनल का उपयोग करके डिज़ाइन किया गया था। कुल मिलाकर, 38 मिलियन से अधिक उच्च गुणवत्ता वाले एसएनपी को कठोर फ़िल्टरिंग के अधीन किया गया और 626,975 एसएनपी को अंततः सरणी पर टाइल किया गया। 26 देशी बकरी नस्लों/आबादी से 443 नमूनों की जीनोटाइपिंग करके एचडी चिप (एक्सिओम_काही) को मान्य किया गया। परिणामों से पता चला कि भारतीय बकरियों में 95.83% मार्कर अत्यधिक सूचनात्मक और बहुरूपी हैं। समान कृषि-पारिस्थितिक क्षेत्रों से बकरी की आबादी को निकट से संबंधित दिखाया गया। फीलोजेनेटिक विश्लेषण ने भौगोलिक निकटता के आधार पर नस्लों के स्तरीकरण का सुझाव दिया।

विशिष्ट लक्षणों में योगदान देने वाली आनुवंशिक असमानताओं को समझने के लिए, चंगथागी और मुज़फ़्फ़रनगरी भेड़ों की त्वचा की चार जैविक प्रतिकृतियों पर तुलनात्मक वैश्विक जीन अभिव्यक्ति प्रोफ़ाइलिंग की गई। विश्लेषण से पता चला कि मुजफ्फरनगरी भेड़ों की तुलना में चांगथांगी भेड़ों में 149 अप-रेगुलेटेड जीन और 2,139 डाउन-रेगुलेटेड जीन थे, जिनका p-समायोजित मान (padj) $\leq$0.05 और log2 गुना परिवर्तन $\geq$1.5 था। चांगथांगी भेड़ों में अप-रेगुलेटेड मेलानोजेनेसिस-संबंधी जीनों में TYR, TYRP1, DCT, SLC45A2, PMEL, MLANA और OCA2 शामिल थे, जो जानवरों के काले कोट के रंग और उच्च ऊंचाई पर UV सुरक्षा दोनों में मेलेनिन की महत्वपूर्ण भूमिका की पुष्टि करते हैं। उत्पादन लक्षणों और अनुकूलन से जुड़ी जीनोमिक पेचीदगियों को जानने के लिए, आधुनिक जीनोमिक उपकरणों का उपयोग करके स्वदेशी चिकन जर्मप्लाज्म की व्यापक खोज की गई। इस उद्देश्य के लिए भारत की दो स्वदेशी बैकयार्ड पोल्ट्री नस्लों - अंकलेश्वर, एक मुख्य भूमि नस्ल, और निकोबारी, एक नस्ल जो द्वीपों के लिए अनुकूलित है, से स्तन ऊतक की ट्रांसक्रिप्टोम प्रोफाइलिंग की गई। दोनों नस्लों में कुल 12,790 प्रतिलेख समान पाए गए, जिनमें से 657 अंकलेश्वर में और 169 निकोबारी में विशेष रूप से व्यक्त किए गए। दोनों समूहों में व्यक्त प्रमुख जीन मुख्य रूप से मांसपेशियों की संरचना, संकुचन और ऊर्जा चयापचय से जुड़े थे।

भारत में मांस-प्रकार की नस्ल असील और पंजाब ब्राउन के चार-चार जैविक प्रतिकृतियों पर कंकाल की मांसपेशी प्रतिलेख का व्यापक तुलनात्मक विश्लेषण किया गया। दोनों नस्लों में, अत्यधिक व्यक्त जीन मांसपेशियों के संकुचन और मोटर गतिविधि से निकटता से जुड़े थे। विभेदक अभिव्यक्ति विश्लेषण ने असील में 961 अप-विनियमित और 979 डाउन-विनियमित जीन का खुलासा किया, जिसमें लॉग2 गुना परिवर्तन सीमा ±2.0 (पैडज<0.05) थी। फैटी एसिड बीटा-ऑक्सीकरण, केमी-ऑस्मोटिक युग्मन द्वारा एटीपी गठन, ऑक्सीडेटिव तनाव की प्रतिक्रिया और मांसपेशियों के संकुचन से जुड़े जीनों ने उच्च अभिव्यक्ति दिखाई।

चिलिका भैंस के दही के जीवाणु विविधता विश्लेषण ने उच्च माइक्रोबियल विविधता का प्रदर्शन किया। अनुक्रम विश्लेषण ने विभिन्न जीवाणु प्रजातियों की उपस्थिति का खुलासा किया, जिसमें लैक्टिकैसीबैसिलस रम्नोसस, लैक्टोबैसिलस पैरासेसी, लैक्टोबैसिलस कैसी, लेंटिलैक्टोबैसिलस फैरागिनिस, लैक्टोबैसिलस डेलब्रुइकी, लैक्टोबैसिलस फर्मेंटम और लिमोसिलैक्टोबैसिलस फर्मेंटम शामिल हैं। चिलिका और चिलिका ग्रेड दही के नमूनों में मेटाबोलाइट संरचना की जांच एनएमआर स्पेक्ट्रोस्कोपी का उपयोग करके की गई थी। विश्लेषण ने लैक्टेट, लैक्टोज, ग्लूकोज, गैलेक्टोज, थ्रेओनीन, गुआनिडोसेटेट, ग्लाइसिन, साइट्रेट और एसीटेट जैसे विभिन्न मेटाबोलाइट्स की प्रचुर मात्रा का खुलासा किया।

मुर्रा भैंस में हानिकारक उत्परिवर्तन की पहचान करने के लिए अध्ययन किया गया था। इन एसएनपी में, 4,742 वेरिएंट के एक उपसमूह को SnpEff टूल का उपयोग करके गैर-समानार्थी के रूप में पहचाना गया। वीईपी (वैरिएंट इफेक्ट प्रिडिक्टर) टूल का उपयोग करते हुए, एसआईएफटी स्कोर के आधार पर कुल 980 मिसेंस वेरिएंट की पहचान हानिकारक के रूप में की गई। इनमें से, पैंथर, प्रेडिक्टएसएनपी, एमएपीपी, पॉलीफेन-1, पॉलीफेन-2 एसएनएपी और पीएचडी-एसएनपी जैसे विभिन्न पूर्वानुमान उपकरणों का उपयोग करके आगे के विश्लेषण से पता चला कि इन सभी उपकरणों में 47 मिसेंस एसएनपी को आमतौर पर हानिकारक के रूप में पूर्वानुमानित किया गया था।



देशी पशु आनुवंशिक संसाधन का संरक्षण

वर्ष 2023 के दौरान ब्यूरो के राष्ट्रीय जीन बैंक में कुल 24 नस्लों के जर्मप्लाज्म को वीर्य और दैहिक कोशिकाओं के रूप में क्रायोप्रिजर्व किया गया। 9 नस्लों के 18050 वीर्य खुराक और 15 नस्लों के 1760 दैहिक कोशिका शीशियों को क्रायोप्रिजर्व किया गया। (एसडीजी) संकेतक 2.5.1 के तहत एएनजीआर के मध्यम और दीर्घकालिक संरक्षण के तहत, ब्यूरो ने 63 देशी नस्लों/आबादियों के जर्मप्लाज्म-वीर्य को क्रायोप्रिजर्व किया है, और 49 नस्लों/आबादियों की सोमैटिक सेल को ब्यूरो के राष्ट्रीय जीन बैंक में 2023 तक क्रायोप्रिजर्व किया गया है। सोमैटिक सेल क्रायोप्रिजर्वेशन के माध्यम से एक विशेष प्रयास के रूप में, ब्रीड वॉच लिस्ट के अनुसार खतरे में चौदह देशी नस्लों को 2023 तक संरक्षित किया गया।

राष्ट्रीय गोजातीय जीनोमिक केंद्र – देशी नस्लें

गोवंश और भैंस एकीकृत जीनोमिक चिप्स को आईसीएआर-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो (एनबीएजीआर), राष्ट्रीय डेयरी विकास बोर्ड (एनडीडीबी), बीएआईएफ विकास अनुसंधान फाउंडेशन और राष्ट्रीय पशु जैव प्रौद्योगिकी संस्थान (एनआईएबी) से जीनोमिक डेटा एकत्र करके आईसीएआर के दिशा-निर्देशों और डेटा हस्तांतरण का पालन करके विकसित किया गया था। दोनों चिप्स को आईसीएआर-एनबीएजीआर, करनाल और एनडीडीबी द्वारा स्वतंत्र रूप से मान्य किया गया था।

पशु आनुवंशिक संसाधन पर नेटवर्क परियोजना

देशी AnGR के लक्षण वर्णन और संरक्षण के लिए देश भर में चौबीस नए NWP केंद्र शुरू किए गए। अब कुल केंद्र 27 हो गए हैं, जो 43 स्वदेशी पशुधन और मुर्गी आबादी के लक्षण वर्णन और पाँच महत्वपूर्ण नस्लों-तिब्बती और करनाह भेड़, मेवाड़ी ऊँट, ज़ांस्करी टट्टू और हलारी गधे के संरक्षण में शामिल हैं।

शोध परियोजनाएं और प्रकाशन

ब्यूरो के शोध प्रयासों को 28 संस्थान परियोजनाओं, 6 बाहरी रूप से वित्त पोषित परियोजनाओं और एक आईएईए अंतर्राष्ट्रीय परियोजना के तहत पूरा किया गया। वर्ष के दौरान ब्यूरो के वैज्ञानिकों द्वारा अंतर्राष्ट्रीय पत्रिकाओं में 36 सहित 47 शोध पत्र प्रकाशित किए गए।

पुरस्कार और मान्यताएँ

ब्यूरो के वैज्ञानिकों और विद्वानों के शोध प्रयासों को सम्मेलनों/ सेमिनारों और वैज्ञानिक समितियों की फैलोशिप के दौरान सर्वश्रेष्ठ प्रस्तुति पुरस्कारों के रूप में सराहा गया। भारत को FAO के अंतर सरकारी कार्यसमूह उपाध्यक्ष चुना गया और उसने रोम में एफएओ मुख्यालय में पशु आनुवंशिक संसाधनों पर अंतर-सरकारी तकनीकी कार्य समूह (आईटीडब्ल्यूजी-एएनजीआर) के 12वें सत्र में एशिया का प्रतिनिधित्व किया। यह वैश्विक मान्यता एएनजीआर संरक्षण और प्रबंधन में हमारे नेतृत्व को रेखांकित करती है।

क्षमता निर्माण

ब्यूरो ने 16 से 20 अक्टूबर 2023 तक "जीनोम विश्लेषण के लिए बुनियादी जैव सूचना विज्ञान उपकरण" पर पांच दिवसीय कौशल विकास प्रशिक्षण कार्यक्रम आयोजित किया है, जिसमें 18 राज्यों के विभिन्न क्षेत्रों से 76 प्रतिभागियों ने भाग लिया। इसके अतिरिक्त, राष्ट्रीय स्तर पर नस्ल-वार पशुधन जनगणना आयोजित करने के तकनीकी तौर-तरीकों पर चर्चा करने के लिए पशुपालन सांख्यिकी प्रभाग, डीएएचडी के साथ विभिन्न इंटरैक्टिव बैठकें भी आयोजित की गईं। ब्यूरो ने 16-17 नवंबर, 2023 को “सतत पशुधन परिवर्तन के लिए आनुवंशिकी और जीनोमिक्स में प्रगति और भारतीय पशु आनुवंशिकी और प्रजनन सोसायटी के XVII वार्षिक सम्मेलन” पर एक राष्ट्रीय संगोष्ठी का भी आयोजन किया है।

किसान जागरूकता कार्यक्रम

ब्यूरो ने विभिन्न एससीएसपी/ किसान जागरूकता कार्यक्रम आयोजित किए और देश के विभिन्न हिस्सों में 6 प्रदर्शनियाँ लगाईं।

समारोह

23 दिसंबर 2023 को किसान दिवस मनाया गया और देशी नस्लों के संरक्षण के लिए उनके उत्कृष्ट प्रयासों के लिए 8 किसानों और 9 संगठनों को नस्ल संरक्षण पुरस्कार-2023 प्रदान किया गया। वर्ष के दौरान अंतर्राष्ट्रीय जैव विविधता दिवस, राष्ट्रीय एकता दिवस, महिला किसान दिवस, विश्व खाद्य दिवस, राष्ट्रीय एकता दिवस, गणतंत्र दिवस और स्वतंत्रता दिवस पूरे उत्साह के साथ मनाए गए। राष्ट्रीय स्वच्छता अभियान और अपशिष्ट से धन अभियान जैसे विभिन्न कार्यक्रमों में ब्यूरो कर्मचारियों की सक्रिय भागीदारी स्पष्ट थी। लद्दाख में जैविक विविधता के लिए अंतर्राष्ट्रीय दिवस पर लद्दाखी गोवंश नस्ल सोसायटी की स्थापना की गई।

बैठकें

संस्थान अनुसंधान समिति (आईआरसी), अनुसंधान सलाहकार समिति (आरएसी) और नेटवर्क परियोजना की वार्षिक समीक्षा बैठक के समय पर आयोजन द्वारा विभिन्न अनुसंधान परियोजनाओं की प्रगति की समीक्षा सुनिश्चित की गई। संस्थान की बाहरी रूप से वित्त पोषित परियोजनाओं की भी संबंधित वित्त पोषण एजेंसियों द्वारा समीक्षा की गई। संस्थान प्रबंधन समिति की बैठक के दौरान संस्थान के विभिन्न प्रबंधन मुद्दों पर चर्चा की गई।

कार्मिक

वर्ष 2023 के दौरान ब्यूरो में तीन विभागाध्यक्ष, एक सहायक और एक एसएसएस ने कार्यभार ग्रहण किया। कई प्रतिष्ठित एवं विशिष्ठ अतिथियों ने संस्थान का दौरा किया।

Institute's Profile

Bureau at a Glance

Established on 21st September 1984, ICAR-National Bureau of Animal Genetic Resources (NBAGR) is working with a mission to protect and conserve indigenous Farm Animal Genetic Resources for sustainable utilization and livelihood security, with many important national and international commitments, to date. The bureau has achieved a number of milestones, including registration of 220 and Gazette notification of 212 animal breeds from all parts of the country. This has enabled the recognition of around 50 percent of native livestock of the country as descript. Further, with a target of zero non-descript AnGR in the country, the bureau has also initiated a country-wide survey since August 2021 in collaboration with State AHDs, ICAR institutes, SAUs, NGOs, etc. in mission mode. Since inception, hundreds of new potential breeds, were identified and characterized. For the long-term conservation program as also included under SDG Indicator 2.5.1, the bureau has cryopreserved the germplasm for native breeds in form of semen and somatic cells. Further, the bureau has also conserved many threatened breeds, in their native tracts through involving livestock keepers and stakeholders under the network program. The knowledge about genetic diversity and genomic uniqueness of native breeds has been enriched through genomics research. The molecular genetic work carried out at NBAGR has resulted in some important technologies including SNP chips for most of the animal species. Research at the bureau has also enabled to identify unique traits like thermotolerance, endurance as well as the uniqueness of the products of native breeds; which would help in the value addition of native breeds. The quality of research carried out by NBAGR scientists is authenticated by published articles in national and international research journals of very high impact factors and their citations. Apart from the research, NBAGR is actively involved in creating awareness about the indigenous livestock, their upkeep and conservation through interactions with farmers during their visits to the breeding tracts. Despite of its small scientific strength, the Bureau has born the greatest responsibility towards native animals and their keepers and strived hard to protect the precious animal biodiversity.

Vision

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

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.

Organogram

ICAR- National Bureau of Animal Genetic Resources

- Research Advisory Committee
- Director
- Institute Research Committee
- Institute Management Committee

Administration
- Establishment Section
- Finance & Accounts Section
- Cash & Bill Section
- Purchase Section
- Stores Section

Management
- Director Cell
- PME Cell
- Innovation Cell
- ITMU
- IBSC
- Breed Registration Cell
- Rajbhasha Cell
- Grievance Cell
- Women Cell
- IJSC
- HRD Cell

Research
- Division of Animal Genetic Resources
  - National Gene Bank
  - LIMU
- Division of Animal Genetics
- Division of Animal Biotechnology
  - DNA Bank
- Survey Groups
  - NEH Groups (8)
  - Functional Groups (7)
- Network Project on AnGR
  - Survey Unit
  - Conservation Unit
- Central Facilities
  - Library
  - Central Instrumentation Facility
  - Photography and Exhibition Unit
  - Computer Section
  - Farm Section
  - Estate Section
  - Guest House
  - Community Centre

History and Organisational Setup

Institute's history

With the realization of unique significance of tropical animal and poultry genetic resources and their potential utilization at global level, a need was felt for an organization which could undertake the responsibility of evaluating, certifying and conserving the rich and varied germplasm resources available in the country and whose genetic base is shrinking fast. Thus, the establishment of National Bureau of Animal Genetic Resources/National Institute of Animal Genetic in 1984 was a culmination of sustained efforts made by the leading geneticists in the country over the years.

The establishment of National Bureau of Animal Genetic Resources/Institute of Animal Genetics was approved in principal during IV-Five Year Plan. In this regard, effective follow-up steps were taken in the V and VI Five Year Plans. Finally, the Institute was set up on 21st September, 1984 at the campus at National Dairy Research Institute (Southern Regional Station), Bangalore. Subsequently on 19th July, 1985 the Institute was shifted to Karnal and temporarily located in the campus of National Dairy Research Institute, Karnal.

Landmark

1984 — Birth place of institute at NDRI, Banglore

1985 — Shifting of Institute To Karnal; Foundation stone of NBAGR/NIAG

1995 — NBAGR & NIAB merged; New office building foundation laid for NBAGR

1998 — NBAGR building inaugurated

2002 — First Information System AGR-IS

2008 — Initiation of Breed Registration process in India Registration of 129 extant breeds.; Bureau designated as repository for domestic animals by MoEF under BDA 2002

2009 — Bureau celebrated Silver Jubilee

2010 — Cryopreservation of 100 Thousand semen doses

2012 — Release of first river buffalo genome draft

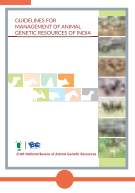
The foundation stone of NBAGR/NIAG was laid by Hon'ble Union Minister of Agriculture Sh. Buta Singh Ji, on 19th July, 1985. In 1995 the National Bureau of Animal Genetic Resources and National Institute of Animal Genetics were merged to function as a single unit, known as National Bureau of Animal Genetic Resources (NBAGR). The new office cum lab building of NBAGR was inaugurated on 28th November, 1998 by Hon'ble Sh. Som Pal Ji, Minister of State for Agriculture, Govt. of India.

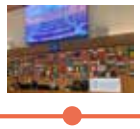
Institute's organisational setup

Since it's inception, ICAR-NBAGR has been evolved both in its organizational as well as functional setup. The institute engages in a variety of activities & posseses all traditional establishments such as divisions and sections. Additionally, it also has some of establishments unique to its kind, including National Gene Bank for cryopreservation of germplasm of native breeds, Functional Groups for conducting survey in various states and regions and Breed Registration Cell for registering the breeds and other germplasm in the country. Three Divisions, although existed since long, were formally approved by the ICAR in 2013 (ICAR letter. No. AS 5/21/2012. IA.I dated 22.07.2013). The division currently works in coordination to achieve the institute's mandated targets and objectives. Further, institute also serves as coordinating centre for Network Program on Animal Genetic Resources (NWP-AnGR) to characterize and conserve the native breeds in collaboration with various agencies in the country. In 2018, DAHD, GoI has also established a National Bovine Genomic Centre for Indigenous Breeds at NBAGR. A brief description of the organizational set up of NBAGR and its functioning is given below:

Animal Genetic Resource Division: The Animal Genetic Resources (AGR) division came into existence after a number of transformations. At present the AGR division is engaged in phenotypic characterization, sustainable utilization and conservation of indigenous livestock and poultry breeds. 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 actively working in the frontier areas of

Events





2013 Initiating Breed wise Census based on registered breeds of Bureau; Establishing Divisions

2015 Registration of lines initiated by ICAR-NBAGR

2016 Guidelines for the management of AnGR of India released; Cryopreservation of Somatic Cells

2017 Breed Conservation Award initiated by ICAR-NBAGR

2018 Establishment of NBGC-IB

2019 Gazette Notification of breeds by Govt. of India; bureau included in SDG2-NIF

2020 Indigenous Dog breeds registered for the first time in India; SNP chip for indigenous livestock & poultry developed

2021 Strengthening DNA repository of Indian breeds; Mission towards Zero Non-Descript AnGR of India initiated by ICAR-NBAGR; Establishing Breed Registration Cell

2022 Release of National Watchlist 2022; Germplasm cryopreservation for 29 breeds, the highest in any year

2023 India elected Vice-chair in 12th session of ITWG-AnGR of the FAO

long-term cryopreservation of germplasm with fully functional 'National Gene Bank'.

Animal Genetics Division: The AG division first time established in year 1996, and finally got the nod by the ICAR in 2013. The division's objective is 'Molecular, immunological, biochemical, cytogenetic characterization and candidate gene analysis of livestock species'. At present, the division is engaged in molecular characterization and population diversity analysis of native breeds of livestock and poultry species using genome-wide molecular markers such as microsatellites and SNPs. Cytogenetic and immunogenetics studies are also being pursued, cytogenetic testing lab provides service, support to all state animal husbandry department semen stations.

Animal Biotechnology Division: This Division was established in 2013 after re-organizing the erstwhile DNA Fingerprinting Unit. The division has the objective of 'Evaluation of functional genes/biomolecules for enhancing AnGR utilization'. Animal Biotechnology Division is dedicated to conduct the research on identification and evaluation of genes, and transcripts involved in adaptation, disease resistance and various production related traits of livestock species. DNA bank under this division provide support to National Gene Bank.

Network Project Unit: The Network project was established in 1996 with the following objectives- 1. To characterize the breeds in terms of both qualitative and quantitative traits, 2. To conduct molecular genetic characterization and candidate gene studies in indigenous breeds, 3. To develop the breed descriptors and conserve germplasm. Initially, there were eight centers in VII plan for characterization of breeds, which increased to 17 in XII plan. Presently, state wise centres are proposed in the current plan (2021-26).

Livestock Information Management Unit: This unit is engaged in digitalizing of information on AnGR in the country an easily retrievable format for the users.

NEH & State Functional Groups: Apart from the divisions, the state specific groups were created to conduct surveys of native AnGR in their respective state. There are eight North-East Hill (NEH) state groups, one for each eight NEH states. For other twenty states and two Union Territories, seven functional groups also exist in the bureau.

Functional Group 1: Uttarakhand, Uttar Pradesh & Karnataka

Functional Group 2: Andhra Pradesh, Telangana, Kerala & Tamil Nadu

Functional Group 3: Bihar, Jharkhand, Punjab & Haryana

Functional Group 4: Goa, Maharashtra, Gujarat & Himachal Pradesh

Functional Group 5: Madhya Pradesh, Chhattisgarh & Rajasthan

Functional Group 6: West Bengal, Odisha, Ladakh (UT) & Jammu & Kashmir (UT)

Functional Group 7: Union Territories (other than Jammu & Kashmir and Ladakh)

NEH Groups (1-8): Mizoram, Meghalaya, Arunachal Pradesh, Sikkim, Tripura, Nagaland, Manipur and Assam

National Gene Bank: A National Gene Bank has been established at NBAGR with the objective of maintaining the indigenous livestock biodiversity of the country. The Gene Bank preserves germplasm in the form of semen and somatic cells of native breeds for long term preservation. At present, the Gene Bank has the cryopreserved germplasm of 50 native breeds/ populations in form of semen (~2.5 Lakh doses) and 20 breeds/populations in form of somatic cells (4800 vials).

DNA Bank: A DNA bank has been established in the bureau as a DNA repository of native livestock and poultry breeds. At present DNA of 169 animal breeds/populations has been cryopreserved for medium term conservations.

Breed Registration Cell: This unit has been created in 2021 as a separate entity for registration of the breeds and other germplasm of the animal genetic resources in the country. It has well established framework of the registration of breeds from the entire country.

Photography and Exhibition Unit: This unit is working towards documenting the photographs and videos of native breeds and their production systems. The unit is also involved in raising awareness among farmers and stakeholders about native breeds through exhibitions and livestock fairs.

Central Instrumentation Facility and research labs: The institute possesses total 17 divisional and one Central Instrumentation Facility (CIF) laboratories for conducting lab-based research. All the labs are equipped with advanced molecular technology tools, required equipments and facilities.

Computer Section: This section provides LAN, Internet and computing facility to the institute.

High Performance Computing facility: This facility was established in 2014 to provide the computational power for various bioinformatics-based research. With the help of the HPC, a large whole genome-based sequences of native breeds are being analyzed.

Priorities and Activities

Testing services: The institute also provides various testing services to the stakeholders. It offers services such as karyotyping, genetic disease screening and A1-A2 milk testing of breeding bulls and cows to the various governmental agencies and farmers at nominal charges.

Institute Library: Institute has its own library with thousands of books specific to Animal Genetic Resources in country and world. It possesses all the monographs, bulletins, books and other scientific literature specific to native breeds and germplasm. The library also subscribes many National and International Journals in the specialized area of AnGR.

National Bovine Genome Centre for Indigenous Breeds (NBGC-IB): Department of Animal Husbandry and Dairying, Govt. of India, established National Bovine Genomics Center at ICAR-National Bureau of Animal Genetic Resources Karnal in 2018 to initiate the genomic selection in native cattle and buffalo breeds under Rastriya Gokul Mission. Seven breeds of cattle and four breeds of buffaloes have been prioritized for implementing in the first phase of Genomic Selection.

Institute's Priorities

Documenting all native AnGR in country with Zero non-descript target: AnGR documentation is the most crucial activity in management of AnGR biodiversity in country. The NBAGR with all its efforts has documented about 46 percent of all AnGR of the country. The institute priority is to document remaining 54 percent native AnGR in coming years. The mission of achieving zero non-discript AnGR has already been initiated in collaboration of state and central agencies.

Identification of new native breeds: NBAGR has recognized more than 100 new breeds and homogenous population in country. However, there are still several of unique populations of native AnGR which needs to be identified. Zero non-descript AnGR mission aims to recognize about 100 or more new breeds in country.

Completing breed inventory and providing statutory recognition: A total of 219 indigenous breeds & 1 synthetic breed have been registered by the NBAGR and 212 indigenous breeds have also been notified through Official Gazette to provide statutory recognition. In comming years, more than 100 new breeds would be given statutory recognition after their registration.

Cryopreservation of germplasm of all native AnGR in country: The institute is already engaged in cryopreservation of germplasm in form of semen, somatic cells and DNA to protect the native germplasm and to prevent the future extinction, also assessing temporal genomic changes in a breed. Germplasm of all kind of breeds/distinct populations would be preserved in gamete, somatic cell and embryo form on priority.

Assessing genetic diversity in native AnGR: Genetic diversity is the key factor for sustained improvement and adaptiveness to the future challenges. Assessing genetic diversity at population, breed and species level, is a continuous activity, with use of modern techniques like WGS, SNP chip etc.

Trait characterization of native AnGR: Identifying unique traits and characterizing them at phenotypic, biochemical and molecular levels will help in identifying specific alleles, genes, proteins or metabolites, pathways that can be utilized further. Traits like climatic adaptation, endurance, disease resistance, unique produce etc of native breeds will be characterized further. Validation of traditional knowledge pertaining to AnGR will also be essential in coming years.

Statutory framework for Protection of indigenous breeds and Livestock keepers' Rights: Establishing statutory framework is essential to provide benefits to community and livestock owners. Developing breed societies and maintaining Breed Register for each breed will be essential for implementing improvement programs and ensuring market benefits. Bureau is striving towards providing legel protection to indigenous breeds.

Fulfilling National and international commitments: NBAGR is fulfilling United Nations' Sustainable Development Goal 2 (Zero Hunger) for Target 2.5 (Indicator 2.5.1: Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities. NBAGR cryopreservation activities included as National Indicator Framework (NIF) 2.5.1 of the National Statistical Office. Documentation of native AnGR is as per FAO's Global Plan of Action, CBD's Aichi and Delhi Declaration' 2016 targets. Further NBAGR is also committed to fulfil the targets of different National Programs and Prime Minister's announcements and NITI Ayog- Output Outcome Framework.

Institute's activities

The institute has following major activities to fulfill the objectives and priorities:

Identification, Characterization and documentation of native AnGR in country

- Survey and documentation of entire livestock and poultry population in country with a target towards Zero Non- Descript AnGR in country.

- 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 registered breeds.
- Assessing risk status of native breeds and prioritising for conservation.

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 characterization of native AnGR for value addition

- Characterization of unique products of native germplasm for value addition and GI
- 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 other 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 management of AnGR.
- Providing consultancy services to government agencies for policy support.

What NBAGR can offer

- Registration of animal breeds/lines, applied by any citizen of India
- Expertise for policy formation and trainings on AnGR management and development in country
- Methodology for breed survey, identification, characterization, conservation
- Scientific literature and information on native breeds
- Karyotyping and DNA Testing for genetic diseases, A1A2 allele testing in bovines
- Recognising stakeholders for conserving native germplasm by conferring National level Awards
- Training programme on AnGR management

Major achievements and impact

INSTITUTE'S MAJOR ACHIEVEMENTS

- Characterization and documentation of 248 breed/populations of native livestock and poultry in country.
- Registration of 220 animal breeds and Gazatte notification of 212 indigenous animal breeds.
- Cryopreservation of germplasm of around 50% Indigenous animal breeds.
- *In situ* conservation of 17 native animal breeds.
- Omics based trait characterization of native breeds.
- AGR-IS database on native AnGR of India.
- SNP chips for native animal breeds.

INSTITUTE'S IMPACT

International

- Inducted in SDG-NIF/GBF goals: Nodal point for SDG 2.5.1 and 2.5.2.

National

- Statutory recognition & germplasm protection of 212 native animal breeds after notification.
- Descript livestock population increased upto about 46%.
- 91 new animal breeds described around 25 million livestock in country.
- Initiated Breed-wise Livestock Census in the country by DAHD, GoI.
- Induction of NBAGR registered breeds under National Kamdhenu Breeding Centre.
- Climate resilience in native breeds addressed the future need.

State

- Linkages with all states AHD for AnGR management in the country.
- Breeding policies for registered breeds being developed by respective states.
- Recognising more germplasm/ breeds from remote areas (NEH).
- *In situ* conservation of threatened animal breeds.
- Genetic testing of about 3300 tested bulls used for semen production in State Govt. agencies (SAHD/SLDB).
- Awareness about AnGR management among state AHD.

STAKEHOLDERS

- Increased registration of animal breeds applied by stakeholders.
- Establishing breed societies by the local livestock keepers.
- Recognition of farmers/stakeholders through Breed Conservation Award.

ब्यूरो एक नजर में

21 सितंबर 1984 को स्थापित, भाकृअनुप-राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो (रापआनुसं ब्यूरो) कई महत्वपूर्ण राष्ट्रीय और अंतरराष्ट्रीय प्रतिबद्धताओं के साथ, स्वदेशी कृषि पशु आनुवंशिक संसाधनों की रक्षा, संरक्षण एवं सतत उपयोग एवं लोगों की आजीविका सुरक्षा मिशन के साथ काम कर रहा है। ब्यूरो ने अब तक देश के सभी हिस्सों से 220 पशुधन की नस्लों के पंजीकरण एवं 212 देशी नस्लों की अधिसूचना सहित अनेक महत्वपूर्ण उपलब्धियां हासिल की है। इससे देश के लगभग 46 प्रतिशत देशी पशुधन को विवरण प्राप्त नस्ल के रूप में मान्यता मिल सकी है। इसके अलावा, देश में शून्य गैर-वर्णित पशु आनुवंशिक संसाधन के लक्ष्य के साथ, ब्यूरो ने मिशन मोड में राज्यों के पशुपालन विभाग एवं राज्य कृषि विश्वविद्यालयों के सहयोग से अगस्त 2021 से देशव्यापी सर्वेक्षण भी शुरू किया है। स्थापना के बाद से, सैकड़ों नई देशी पशु नस्लों की पहचान की गई और उनकी विशेषताओं का वर्णन किया गया। एसडीजी संकेतक 2.5.1 में सम्मिलित किए गए दीर्घकालिक संरक्षण कार्यक्रम के लिए, ब्यूरो ने वीर्य और दैहिक कोशिकाओं के रूप में देशी नस्लों के लिए जर्मप्लाज्म को संरक्षित रखा है। इसके अलावा, ब्यूरो ने नेटवर्क कार्यक्रम के तहत पशुधन रखने वालों और हितधारकों को शामिल करके विलुप्ति के कगार पर आई कई नस्लों को उनके मूल इलाकों में संरक्षित किया है। देशी नस्लों की आनुवंशिक विविधता और जीनोमिक विशिष्टता के बारे में ज्ञान को जीनोमिक्स अनुसंधान के माध्यम से समृद्ध किया गया। एनबीएजीआर में किए गए आणविक आनुवंशिक अनुसन्धान कार्यों के परिणामस्वरूप कई पशुधन और कुक्कुट प्रजातियों के लिए एसएनपी चिप सहित अनेक महत्वपूर्ण प्रौद्योगिकियां विकसित की गई हैं। ब्यूरो में हुए अनुसंधान कार्यों से देशी नस्लों के तापमान सहिष्णुता, सहनशक्ति जैसे अद्वितीय लक्षणों की पहचान के साथ-साथ उनके उत्पादों की विशिष्टताओं का वर्णन भी संभव हो सका है; जो देशी नस्लों के मूल्यांकन में मदद करेगा। वैज्ञानिकों द्वारा किए गए शोध की गुणवत्ता उच्च श्रेणी के राष्ट्रीय और अंतर्राष्ट्रीय शोध पत्रिकाओं में प्रकाशित लेखों द्वारा प्रमाणित होती है। अनुसंधान के अलावा, संस्थान किसानों में स्वदेशी पशुधन, उनका रखरखाव और संरक्षण के बारे में जागरूकता पैदा करने में सक्रिय रूप से शामिल है। छोटे वैज्ञानिक संसाधनों के बावजूद, ब्यूरो ने देश की पशु जैव विविधता की रक्षा के लिए कड़ी एवं सतत् मेहनत की है।

विजन

- स्वदेशी पशुधन की आनुवंशिक क्षमता की पहचान, सुधार और संरक्षण करने के लिए अभिनव अनुसंधान में उत्कृष्टता के लिए प्रयास करना।

मिशन

- स्थायी उपयोग और आजीविका के लिए स्वदेशी पशु आनुवंशिक संसाधनों की रक्षा और संरक्षण।

अधिदेश

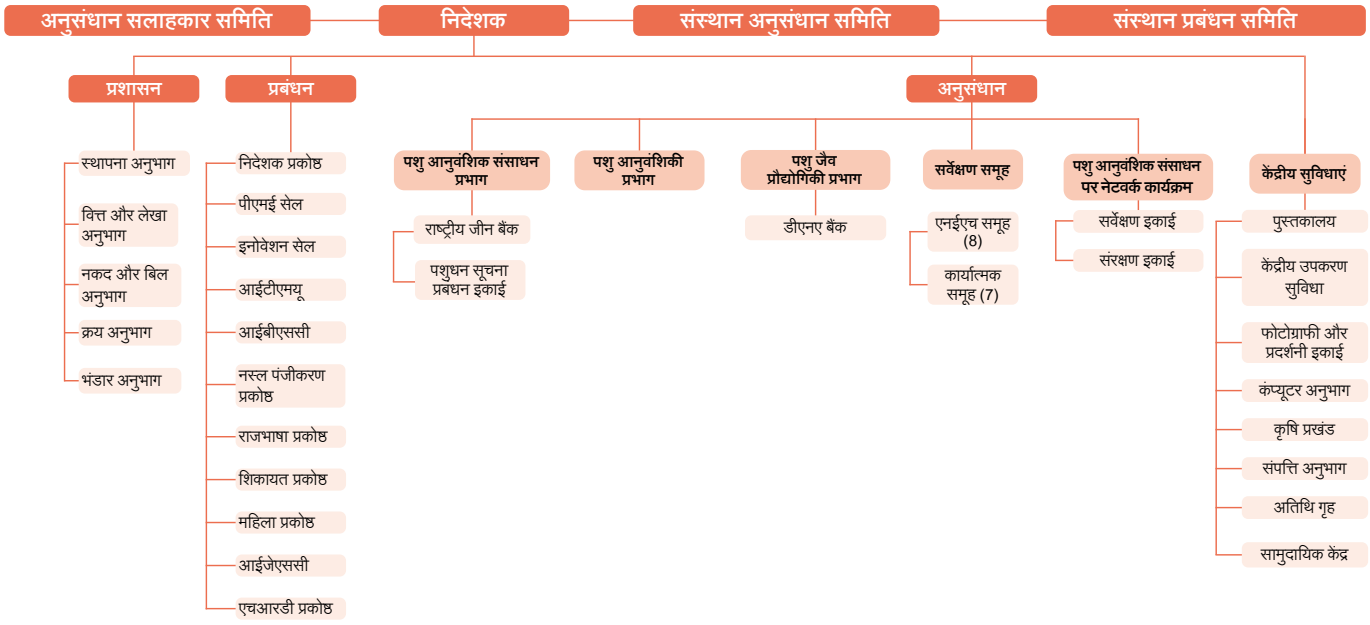
- देश के पशुधन और कुक्कुट आनुवंशिक संसाधन की पहचान, मूल्यांकन, लक्षण वर्णन, संरक्षण और सतत उपयोग।
- पशु आनुवंशिक संसाधन प्रबंधन और नीतिगत मुद्दों में समन्वय और क्षमता निर्माण।

उद्देश्य

- पशुधन और कुक्कुट आनुवंशिक संसाधनों की विशेषता, मूल्यांकन और सूची बनाने के लिए व्यवस्थित सर्वेक्षण करना और उनके राष्ट्रीय डाटा बेस को स्थापित करना।
- पशु आनुवंशिक संसाधन के एक्स-सीटू संरक्षण, इन-सीटू प्रबंधन और इष्टतम उपयोग के लिए कार्यप्रणाली तैयार करना।
- आणविक जीव विज्ञान की आधुनिक तकनीकों का उपयोग करते हुए आनुवंशिक लक्षण वर्णन पर अध्ययन करना।
- पशु आनुवंशिक संसाधन के मूल्यांकन, लक्षण वर्णन और उपयोग से संबंधित प्रशिक्षण कार्यक्रम आयोजित करना।

संगठनात्मक चार्ट

भाकृअनुप - राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो



इतिहास एवं संगठनात्मक स्थापना

ब्यूरो का इतिहास

देश में विविध पशु और कुक्कुट आनुवंशिक संसाधन के अद्वितीय महत्व और वैश्विक स्तर पर उनके संभावित उपयोग को ध्यान में रखते हुए एक ऐसे संस्थान की ज़रूरत महसूस हुई, जो देश में उपलब्ध विविध जर्मप्लाज्म के मूल्यांकन और संरक्षित करने की जिम्मेदारी ले सके। इस प्रकार, वर्ष 1984 में राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो/पशु आनुवंशिकी संस्थान की स्थापना देश के अग्रणी आनुवंशिकीविदों द्वारा किए गए प्रयास की परिणति थी। राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो/पशु आनुवंशिकी संस्थान की स्थापना चतुर्थ पंचवर्षीय योजना के दौरान मूल रूप से स्वीकृत हुई। इस संबंध में पांचवी और छठी पंचवर्षीय योजना में प्रभावी अनुवर्ती कदम उठाए गए। अंत में, संस्थान 21 सितंबर 1984 को राष्ट्रीय डेयरी अनुसंधान संस्थान के दक्षिणी क्षेत्रीय स्टेशन, बंगलौर परिसर में स्थापित किया गया। संस्थान को अस्थायी रूप से 19 जुलाई 1985 को राष्ट्रीय डेयरी अनुसंधान संस्थान, करनाल परिसर में स्थानांतरित कर दिया गया।

माननीय केंद्रीय कृषि मंत्री श्री बूटा सिंह जी द्वारा 19 जुलाई 1985 को संस्थान की आधारशिला रखी गई। राष्ट्रीय पशु आनुवंशिक संसाधन

ऐतिहासिक

1984 — संस्थान का जन्म स्थान-एनडीआरआई, बैंगलोर

1985 — करनाल में संस्थान का स्थानांतरण; एनबीएजीआर/एनआईएजी की आधारशिला

1995 — एनबीएजीआर/एनआईएजी का विलय; एनबीएजीआर के लिए नए कार्यालय भवन की नींव रखी गई

1998 — एनबीएजीआर भवन का उद्घाटन

2002 — प्रथम सूचना प्रणाली एजीआर-आईएस

2008 — आईसीएआर/एनबीएजीआर द्वारा भारत में पशु नस्ल पंजीकरण व्यवस्था की शुरुआत; MoEF/NBA द्वारा पशुओं के लिए जर्मप्लाज्म रिपोजिटरी सेंटर के रुप में नामित

2009 — भारत के मौजूदा पशुधन और कुक्कुट 130 नस्लों का पंजीकरण

2010 — 100 हजार वीर्य खुराक का प्रशीतन संरक्षण

2012 — पहला मैंस जीनोम ड्राफ्ट का विमोचन

ब्यूरो की आधार

ब्यूरो मे

ब्यूरो और राष्ट्रीय पशु आनुवंशिकी संस्थान का 1995 में राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो के रूप में विलय कर दिया गया। नए कार्यालय और प्रयोगशाला भवन का उद्घाटन 28 नवंबर 1998 को माननीय श्री सोमपाल जी, राज्य कृषि मंत्री, भारत सरकार द्वारा किया गया। आरंभ से ही, संस्थान का संगठनात्मक और कार्यात्मक विकास हुआ है। विभिन्न गतिविधियों के साथ, संस्थान में सभी पारंपरिक प्रतिष्ठान जैसे कि प्रभाग और अनुभाग, देशी नस्लों के जर्मप्लाज्म का क्रायोप्रिजर्वेशन करने के लिए नेशनल जीन बैंक, देश के विभिन्न राज्यों में सर्वेक्षण करने के लिए कार्यात्मक समूह और नस्लों और अन्य जर्मप्लाज्म के पंजीकरण के लिए नस्ल पंजीकरण प्रकोष्ठ हैं।

ब्यूरो की संगठनात्मक स्थापना

तीन विभाग, औपचारिक रूप से आईसीएआर द्वारा (आईसीएआर पत्र संख्या एएस 5/21/2012.आईए.आई दिनांकित 22.07.2013) 2013 में अनुमोदित हुए, जो वर्तमान में, संस्थान के अनिवार्य लक्ष्यों और उदेश्यों को प्राप्त करने के लिए समन्वय में काम करते हैं। इसके अलावा, संस्थान नेटवर्क कार्यक्रम के माध्यम से समन्वय केंद्र के रूप में देशी नस्लों का संरक्षण करने के लिए देश में विभिन्न एजेंसियों के साथ भी कार्य कर रहा है। वर्ष 2018 में भारत सरकार के पशुपालन और डेयरी विभाग द्वारा संस्थान में स्वदेशी नस्लों के लिए एक राष्ट्रीय गोजातीय जीनोमिक केंद्र भी स्थापित किया गया है।

पशु आनुवंशिक संसाधन विभाग: पशु आनुवंशिक संसाधन प्रभाग (एजीआर) कई परिवर्तनों के बाद अस्तित्व में आया। वर्तमान में एजीआर प्रभाग स्वदेशी पशुधन और कुक्कुट नस्लों के फेनोटाइपिक लक्षण वर्णन, सतत उपयोग और संरक्षण में लगा हुआ है तथा नस्लों के सुधार और संरक्षण के लिए नई रणनीतियाँ तैयार की गयी हैं। इस विभाग द्वारा विभिन्न पशुधन प्रजातियों की नस्लों के लिए यथास्थान संरक्षण लागू किया गया है। इसके साथ ही, विभाग पूरी तरह से पशुधन जर्मप्लाज्म के दीर्घकालिक क्रायोप्रिजर्वेशन के लिए नेशनल जीन बैंक के माध्यम से कार्य कर रहा है।

पशु आनुवंशिकी विभाग: यह विभाग वर्ष 1996 में स्थापित हुआ और 2013 में आईसीएआर द्वारा इसे मंज़ूरी मिली। आणविक, प्रतिरक्षाविज्ञानी, जैव रासायनिक, साइटोजेनेटिक लक्षण वर्णन और पशुधन प्रजातियों के उम्मीदवार जीन विश्लेषण इस विभाग का उद्देश्य हैं। वर्तमान में, माइक्रोसेटेलाइट्स सहित जीनोम-वाइड एसएनपी मार्कर के उपयोग से देशी पशुधन और कुक्कुट प्रजातियों में आणविक लक्षण और नस्लों

घटनाक्रम

2013
- ला मैंस जीनोम ट का विमोचन
- ी पंजीकृत नस्लों के पर नस्लवार गणना शुरु करना
- ं प्रभागों की स्थापना

2015
- आईसीएआर-एनबीएजीआर द्वारा कुक्कुट लाइन का पंजीकरण शुरु

2016
- भारत के पशु आनुवंशिक संसाधन के प्रबंधन के लिए दिशानिर्देश जारी
- पशु नस्लों की दैहिक कोशिकाओं का क्रायोप्रिजर्वेशन

2017
- आईसीएआर-एनबीएजीआर द्वारा नस्ल संरक्षण पुरस्कार शुरु

2018
- एनबीजीसी-आईबी की स्थापना

2019
- भारत सरकार द्वारा नस्लों की राजपत्र अधिसूचना ब्यूरो एसडीजी2 के एनआईएफ में शामिल

2020
- भारत में पहली बार देशी कुत्तों की नस्लें पंजीकृत
- स्वदेशी पशुधन और कुक्कुट के लिए एसएनपी चिप विकसित

2021
- भारतीय नस्लों का डीएनए रिपोजिटरी का सुदृढ़ीकरण
- शून्य गैर-वर्णित पशु आनुवंशिक संसाधन की ओर मिशन शुरु
- नस्ल पंजीकरण प्रकोष्ठ की स्थापना

2022
- पशुधन नस्ल निगरानी सूची -2022 का निर्माण, 29 नस्लों के जर्मप्लास्म का अतिहिमीकरण

2023
- भारत का एफएओ के 12वें आईटीडब्ल्यूजी-एएनजीआर सेशन में उपाध्यक्ष के रूप में चुनाव

की आनुवंशिक विविधता विश्लेषण वर्णन पर कार्य हो रहा है। साइटोजेनेटिक परीक्षण प्रयोगशाला सभी राज्यों के वीर्य स्टेशनों को गोवंश एवं भैंसों के प्रजनन हेतु नरों का क्रोमोसोमल जाँच के लिए सहायता प्रदान करती है।

पशु जैव प्रौद्योगिकी विभाग: यह विभाग डीएनए फ़िंगरप्रिंटिंग यूनिट को फिर से व्यवस्थित करने के बाद, 2013 में स्थापित किया गया। विभाग का कार्यात्मक उद्देश्य पशु आनुवंशिक संसाधन उपयोग को बढ़ावा देने के लिए जीनों/ जैव अणु का मूल्यांकन करना है। पशु जैव प्रौद्योगिकी विभाग विभिन्न पशुधन प्रजातियों के अनुकूलन क्षमता, रोग प्रतिरोधक क्षमता और उत्पादन संबंधी लक्षणों के जीन की पहचान और मूल्यांकन पर अनुसंधान करने के लिए समर्पित है। विभाग का डीएनए बैंक नेशनल जीन बैंक को सहायता प्रदान करता है।

नेटवर्क परियोजना इकाई: नेटवर्क परियोजना को 1996 में गुणात्मक और मात्रात्मक लक्षण दोनों के संदर्भ में नस्लों को चिह्नित करना, आणविक आनुवंशिक लक्षण वर्णन, स्वदेशी नस्लों में उम्मीदवार जीन अध्ययन, और नस्ल विवरणक विकसित करना और जर्मप्लाज्म संरक्षण करने जैसे उद्देश्यों के साथ स्थापित किया गया। प्रारंभ में, नस्लों के लक्षण वर्णन के लिए सातवीं योजना में आठ केंद्र थे जो बढ़कर बारहवीं योजना में 17 हो गए और वर्तमान 2021-26 योजना में राज्यवार केंद्र प्रस्तावित हैं।

पशुधन सूचना प्रबंधन इकाई: यह इकाई पशु आनुवंशिक संसाधन पर सूचना के डिजिटलीकरण में लगी हुई है।

कंप्यूटर अनुभाग: यह संस्थान के लिए लैन, इंटरनेट और कंप्यूटिंग सुविधाएं प्रदान करता है।

राज्यों के लिए कार्यात्मक समूह: पशु अनुवांशिक संसाधन के सर्वेक्षण के लिए वैज्ञानिकों को राज्यों के विशिष्ट समूहों के रूप में वर्गीकृत किया गया है। उत्तर पूर्वी हिमालयी क्षेत्र के प्रत्येक आठ राज्यों के लिए आठ एनईएच समूह हैं। अन्य बीस राज्यों और दो केंद्र शासित प्रदेशों के लिए, छह कार्यात्मक समूह ब्यूरो में विद्यमान है।

कार्यात्मक समूह 1: उत्तराखंड, उत्तर प्रदेश, कर्नाटक

कार्यात्मक समूह 2: आंध्र प्रदेश, तेलंगाना, केरल, तमिलनाडु

कार्यात्मक समूह 3: बिहार, झारखंड, पंजाब, हरियाणा

कार्यात्मक समूह 4: गोवा, महाराष्ट्र, गुजरात, हिमाचल प्रदेश

कार्यात्मक समूह 5: मध्य प्रदेश, छत्तीसगढ़, राजस्थान

कार्यात्मक समूह 6: पश्चिम बंगाल, ओडिशा, लद्दाख (यूटी) और जम्मू एवं कश्मीर (यूटी)

कार्यात्मक समूह 7: यूनियन टेरिटरीज (लद्दाख और जम्मू एवं कश्मीर के अलावा)

एनईएच समूह (1-8): मिजोरम, मेघालय, अरुणाचल प्रदेश, सिक्किम, त्रिपुरा, नागालैंड, मणिपुर और असम

राष्ट्रीय जीन बैंक: देश में स्वदेशी पशुधन जैव विविधता को बनाए रखने के उद्देश्य से राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो में नेशनल जीन बैंक को स्थापित किया गया है। बैंक में देशी नस्लों को वीर्य और दैहिक कोशिकाओं के रूप में दीर्घकालिक संरक्षण के लिए क्रायोप्रिजर्व्ड किया जाता है। वर्तमान में, जीन बैंक के पास 50 देशी पशु नस्लों/आबादियों के वीर्य के रूप में लगभग 2.5 लाख खुराक और 20 नस्लों/आबादियों के दैहिक कोशिकाओं के रूप में 4800 खुराक क्रायोप्रिजर्व्ड हैं।

डीएनए बैंक: ब्यूरो में देशी पशुओं और कुक्कुट नस्लों के डीएनए भंडार के रूप में एक डीएनए बैंक स्थापित किया गया है। वर्तमान में 169 पशु नस्लों/आबादी के डीएनए को मध्यम अवधि संरक्षण के लिए रखा गया है।

नस्ल पंजीकरण इकाई: वर्ष 2021 में देश के पशु नस्लों एवं आनुवंशिक संसाधनों के पंजीकरण के लिए इस इकाई की स्थापना की गयी। अब यह देश के समूचे पशुधन की नस्लों को पंजीकृत करने के लिए पूर्ण रूप से स्थापित है।

फोटोग्राफी और प्रदर्शनी इकाई: यह इकाई देशी नस्लों की तस्वीरों और वीडियो के दस्तावेजीकरण की दिशा में काम करने के लिए समर्पित है। यह इकाई किसानों और हितधारकों में प्रदर्शनियों के माध्यम से देशी नस्लों के बारे में जागरूकता फैलने का कार्य भी करती है।

केंद्रीय इंस्ट्रुमेंटेशन सुविधा और अनुसंधान प्रयोगशालाएं: संस्थान के पास प्रयोगशाला आधारित अनुसंधान करने के लिए 17 विभागीय एवं एक केंद्रीय इंस्ट्रुमेंटेशन (सीआईएफ) प्रयोगशाला है। प्रयोगशाला उन्नत आणविक प्रौद्योगिकी के आवश्यक उपकरण और सुविधाओं से लैस है।

उच्च निष्पादन कंप्यूटिंग सुविधा: विभिन्न जैव सूचना विज्ञान आधारित अनुसंधान के लिए कम्प्यूटेशनल शक्ति प्रदान करने के लिए 2014 में उच्च निष्पादन कंप्यूटिंग (एचपीसी) सुविधा को स्थापित किया गया। एचपीसी की मदद से देशी नस्लों में संपूर्ण जीनोम-आधारित अनुक्रम विश्लेषण किया जाता है।

परीक्षण सेवाएं: संस्थान शुल्क पर विभिन्न सरकारी एजेंसियों और किसानों को सांडों और गायों में कैरियोटाइपिंग, आनुवंशिक रोग स्क्रीनिंग और A1-A2 दूध परिक्षण की सेवाएं भी प्रदान करता है।

संस्थान पुस्तकालय: संस्थान का अपना एक पुस्तकालय भी है जिसमे पशु आनुवंशिकी से सम्बंधित देश और दुनिया की हजारों विशिष्ट पुस्तकें का संग्रहण है। इसमें पुस्तकों के अलावा, देशी नस्लों और जननद्रव्य से सम्बंधित मोनोग्राफ, बुलेटिन और अन्य वैज्ञानिक विशिष्ट साहित्य उपलब्ध हैं। पुस्तकालय ने कई राष्ट्रीय और अंतर्राष्ट्रीय जर्नल की सदस्यता भी ले रखी है।

प्राथमिकताएं एवं गतिविधियाँ

स्वदेशी नस्लों के लिए राष्ट्रीय गोजातीय जीनोम केंद्र (एनबीजीसी-आईबी): पशुपालन और डेयरी विभाग, भारत सरकार ने 2018 में राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो, करनाल में देशी मवेशियों और भैंस की नस्लों में जीनोमिक चयन शुरू करने के लिए राष्ट्रीय गोकुल मिशन के तहत राष्ट्रीय बोवाइन जीनोमिक्स केंद्र की स्थापना की। जीनोमिक चयन के पहले चरण में गोवंश की सात नस्लों और भैंसों की चार नस्लों को प्राथमिकता दी गई है।

संस्थान की प्राथमिकताएं

देश में शून्य गैर-विवरणित पशु आनुवंशिक संसाधन के लक्ष्य के साथ सभी पशु आनुवंशिक संसाधनों का दस्तावेज़ीकरण: देश में पशु आनुवंशिक संसाधन में जैव विविधता के प्रबंधन के लिए पशु आनुवंशिक संसाधनों का प्रलेखन सबसे महत्वपूर्ण है। देश में राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो ने अपने सभी प्रयासों के साथ पशु आनुवंशिक संसाधनों के लगभग 46 प्रतिशत को प्रलेखित किया है। अब अगले वर्षों में संस्थान का शेष 54 प्रतिशत का दस्तावेजीकरण करना सर्वोच्च प्राथमिकता है। राज्य और केंद्रीय एजेंसियों के सहयोग से मिशन मोड में कार्य शुरू कर दिया गया है।

नई देशी नस्लों की पहचान: देश में राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो ने 100 से अधिक नई नस्लों और देश में समरूप पशु संख्या को मान्यता दी है। हालांकि, अभी भी पशु आनुवंशिक संसाधन की कई अद्वितीय आबादी हैं, जिन्हें पहचानने की जरूरत है। देश में लगभग 100 या अधिक नस्लों को शून्य गैर-विवरणित पशु आनुवंशिक संसाधन मिशन के अंतरगर्त मान्यता देने की परिकल्पना है।

नस्ल सूची को पूरा और वैधानिक मान्यता प्रदान करना: राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो द्वारा कुल 219 देशी नस्लों एवं एक सिंथेटिक नस्ल को पंजीकृत किया गया है। कुल 212 नस्लों को आधिकारिक राजपत्र के माध्यम से अधिसूचित कर वैधानिक मान्यता

भी प्रदान की गयी है। आने वाले वर्षों में, 100 से अधिक नई नस्लों को उनके लक्षण वर्णन के बाद राजपत्र द्वारा जोड़ा जाएगा।

देश में सभी देशी पशु आनुवंशिक संसाधनों के जर्मप्लाज्म का क्रायोप्रिजर्वेशन: अस्थायी जीनोमिक परिवर्तनों के आकलन और भविष्य में विलुप्त होने से रोकने के लिए, देशी जर्मप्लाज्म का वीर्य, दैहिक कोशिकाओं और डीएनए के रूप में क्रायोप्रिजर्वेशन पहले से ही किया जा रहा है। आगे भी सभी प्रकार की नस्लों/विशिष्ट आबादी के जर्मप्लाज्म को युग्मक, कोशिका और भ्रूण रूप में संरक्षित किया जाएगा।

देशी पशु आनुवंशिक संसाधन में आनुवंशिक विविधता का आकलन: भविष्य की चुनौतियों के लिए आनुवंशिक विविधता एक महत्वपूर्ण कारक है। आनुवंशिक विविधता का जनसंख्या, नस्ल और प्रजातीय स्तर पर जीनोम-वाइड एसएनपी मार्कर/चिप जैसी आधुनिक तकनीकों, आदि द्वारा आकलन एक निरंतर गतिविधि है।

देशी पशु आनुवंशिक संसाधनों के विशेष लक्षण-वर्णन: अद्वितीय लक्षणों के लिए फेनोटाइपिक, जैव रासायनिक और आणविक स्तरों पर लक्षण वर्णन, विशिष्ट एलील और जीन की पहचान करने में मदद करेगा। लक्षण जैसे जलवायु अनुकूलन, सहनशक्ति, रोग प्रतिरोध शक्ति, अद्वितीय उपज की पहचान आवश्यक है। आने वाले वर्षों में पशु आनुवंशिक संसाधन से संबंधित पारंपरिक ज्ञान की मान्यता भी अनिवार्य रूप से आवश्यक होगी।

देशी नस्लों के संरक्षण के लिए वैधानिक ढांचा: पशुधन रखने वालों के लिए अधिकार" पशुपालकों के लिए अनिवार्य रूप से आवश्यक हैं। सुधार कार्यक्रमों को लागू करने और बाजार लाभ सुनिश्चित करने के लिए नस्ल समीतियों का विकास करना और प्रत्येक नस्ल के लिए नस्ल पंजीकरण को बनाए रखना अनिवार्य है। इस ओर ब्यूरो नस्ल संरक्षण को वैधानिक मान्यता देने की ओर अग्रसर है।

राष्ट्रीय और अंतरराष्ट्रीय प्रतिबद्धताओं को पूरा करना: राष्ट्रीय पशु अनुवांशिक संसाधन ब्यूरो संयुक्त राष्ट्र के सतत विकास लक्ष्य 2 (शून्य भूख) के लिए लक्ष्य 2.5 (संकेतक 2.5.1: भोजन और कृषि के लिए पौधे और पशु आनुवंशिक संसाधनों का मध्यम या दीर्घकालिक संरक्षण) को पूरा कर रहा है। ब्यूरो की क्रायोप्रिजर्वेशन गतिविधियाँ राष्ट्रीय सांख्यिकी कार्यालय (एनआईएफ) के 2.5.1 राष्ट्रीय संकेतक ढांचे में शामिल हैं। देशी पशु आनुवंशिक संसाधनों का दस्तावेजीकरण एफएओ की वैश्विक कार्य योजना, सीबीडी और दिल्ली घोषणा 2016 के अनुसार है। इसके अलावा राष्ट्रीय पशु आनुवंशिक संसाधन ब्यूरो विभिन्न राष्ट्रीय कार्यक्रमों और नीति आयोग- आउटपुट आउटकम फ्रेमवर्क के लक्ष्यों को पूरा करने के लिए भी प्रतिबद्ध है।

संस्थान की गतिविधियां

संस्थान के पास निम्नलिखित प्रमुख गतिविधियां हैं जिन्हें पूरा करना संस्थान का उद्देश्य और प्राथमिकता है:

- देश में देशी पशु आनुवंशिक संसाधन की पहचान, विशेषता और दस्तावेज़ीकरण करना।
- देश में शून्य गैर-विवरणित पशु आनुवंशिक संसाधन के लक्ष्य के साथ संपूर्ण पशुधन और कुक्कुट आबादी का सर्वेक्षण और प्रलेखन करना।
- नस्ल के लिए योग्य समरूप आबादी की पहचान और लक्षण वर्णन करना।
- पशुधन और कुक्कुट आबादी का पंजीकरण एवं उनकी अधिसूचना।

पशुधन की देशी नस्लों और कुक्कुट प्रजाति का संरक्षण

- विलुपत होने वाली पशुधन और कुक्कुट नस्लों का यथास्थान संरक्षण करना।
- सभी पंजीकृत नस्लों के जर्मप्लाज्म का क्रायोप्रिजर्वेशन करना।
- देशी नस्लों की जोखिम स्थिति का आकलन एवं संरक्षण के लिए नस्लों का प्राथमिकता देना।

देशी पशु आनुवंशिक संसाधन की जनसंख्या संरचना और विविधता के लिए जीनोमिक्स अनुसंधान

- सभी पंजीकृत पशुधन और कुक्कुट नस्लों में जीनोमिक विविधता और विशिष्टता का आंकलन करना।
- देशी नस्लों के लिए नस्ल आणविक हस्ताक्षर विकसित करना।
- उच्च महत्व की देशी नस्लों के लिए जीनोम असेंबलियों का निर्माण करना।

पशु आनुवंशिक संसाधन के मूल्यवर्धन के लिए विशेषता पहचान और लक्षण वर्णन

- मानव पोषण और स्वास्थ्य के लिए देशी जर्मप्लाज्म में दूध और मांस के जैव अणुओं की पहचान करना।
- मूल्यवर्धन एवं जी आई के लिए अद्वितीय उत्पादों की विशेषता और उनके प्रभाव का आकलन करना।
- देशी नस्लों में अनुकूली, सहनशक्ति और अन्य लक्षणों के मूल्यांकन के लिए अनुसंधान करना।

पशु आनुवंशिक संसाधन प्रबंधन के लिए नीति और क्षमता निर्माण

- देश में पशु आनुवंशिक संसाधन पर डेटाबेस और अन्य आईसीटी के निर्माण के लिए नीति समर्थन करना।
- राज्यों में पशु आनुवंशिक संसाधन के प्रबंधन के लिए नीति विकसित करना।
- पशु आनुवंशिक संसाधन के प्रबंधन के लिए प्रशिक्षण और संवेदीकरण कार्यक्रमों का आयोजन करना।
- नीतिगत के लिए सरकारी एजेंसीयो को परामर्श सेवाएं प्रदान करना।

ब्यूरो द्वारा प्रदत्त सेवाएं

- पशुओं की नस्लों का पंजीकरण, जिसके लिए भारत का कोई भी नागरिक आवेदन कर सकता है।
- देश में पशु आनुवंशिक संसाधन के प्रबंधन और विकास के लिए नीति निर्माण और प्रशिक्षण के लिए विशेषज्ञता।
- नस्ल सर्वेक्षण, पहचान, लक्षण वर्णन, संरक्षण के लिए विधियों का निर्माण।
- वैज्ञानिक साहित्य और देशी नस्लों पर जानकारी।
- कैरियोटाइपिंग और आनुवंशिक रोगों के लिए डीएनए परीक्षण, गोवंश में A1A2 एलील परीक्षण।
- देशी जर्मप्लाज्म के संरक्षण के लिए हितधारकों को राष्ट्रीय स्तर के पुरस्कार प्रदान करना।
- पशु आनुवंशिक संसाधन प्रबंधन पर प्रशिक्षण।

प्रमुख उपलब्धियां एवं प्रभाव

संस्थान की प्रमुख उपलब्धियां

- देशी पशुओं और कुक्कट की 248 नस्ल/आबादी की विशेषता का अध्ययन उनका और प्रलेखन।
- 220 पशु नस्लों का पंजीकरण एवं 212 देशी पशु नस्लों की गजट अधिसूचना।
- लगभग 50% से अधिक देशी पशु नस्लों के जननद्रव्य का हिमीकृत संरक्षण।
- 17 देशी पशु नस्लों का स्व-स्थानिक संरक्षण।
- ओमिक्स आधारित देशी पशु नस्लों की विशेषता व लक्षण का वर्णन।
- भारत के मूल पशु अनुवांशिक संसाधन पर एजीआर-आईएस डेटाबेस तैयार करना।
- देशी पशु नस्लों के लिए एसएनपी चिप का निर्माण।

संस्थान का प्रभाव

अंतरराष्ट्रीय

- एसडीजी-एनआईएफ/जीबीएफ लक्ष्यों में शामिल: एसडीजी 2.5.1 एवं 2.5.2 के लिए नोडल बिंदु।

राष्ट्रीय

- अधिसूचना के बाद 212 पशु नस्लों की वैधानिक मान्यता और जननद्रव्य संरक्षण।
- वर्णित पशुधन आबादी लगभग 46% तक पहुंची।
- 91 नई नस्लों ने देश में 2 करोड़ 50 लाख पशुओं को वर्णित किया।
- पशुपालन और डेयरी विभाग द्वारा देश में नस्ल-वार पशु संगणना शुरू करना।
- राष्ट्रीय कामधेनु प्रजनन केंद्र के तहत पंजीकृत नस्लों को शामिल करना।
- भविष्य की आवश्यकता को ध्यान में रखते हुए देशी नस्लों में जलवायु प्रतिरोध क्षमता का वर्णन।

राज्य

- देश में पशु अनुवांशिक संसाधन प्रबंधन के लिए सभी राज्यों के पशुपालन विभाग के साथ संबंध।
- संबंधित राज्यों द्वारा विकसित पंजीकृत नस्लों के लिए प्रजनन नीतियों का निर्धारण।
- दूरस्थ क्षेत्रों (उत्तर पूर्वी हिमालयी क्षेत्र) की और अधिक नस्लों की पहचान।
- संख्या की दृष्टि से खतरे में शामिल पशु नस्लों का स्व-स्थानिक संरक्षण।
- सरकारी एजेंसियां द्वारा वीर्य उत्पादन के लिए इस्तेमाल लगभग 3300 सांडों के नमूनों का आनुवंशिक परीक्षण।
- राज्यों के पशुपालन विभाग को पशु अनुवांशिक संसाधन प्रबंधन के बारे में जागरूकता प्रदान करना।

हितधारक

- हितधारकों में बढ़ता हुआ पशु नस्लों के पंजीकरण का रुझान।
- स्थानीय पशुपालकों द्वारा नस्ल समितियों की स्थापना।
- किसानों/हितधारकों को नस्ल संरक्षण पुरस्कार द्वारा मान्यता।

Financial Outlay

Budget Estimate under Grants & Network Project of NBAGR for the month of April, 2022 to March, 2023 along with expenditure

(Rs. In lakhs)

HEAD	Grants		Network Project	
	RE	Exp.	RE	Exp.
Capital				
Works	0.00	0.00	0.00	0.00
Other capital expenditure	20.00	19.99	0.00	0.00
Total Capital	**20.00**	**19.99**	**0.00**	**0.00**
Revenue				
Establishment expenses	1116.30	1116.28	0.00	0.00
Traveling Allowance	15.37	15.37	0.00	0.00
Research & Operational expenses	84.42	84.42	24.00	24.00
Administrative expenses	163.66	163.66	0.00	0.00
Miscellaneous expenses	1.55	1.55	0.00	0.00
Total Revenue	**1381.30**	**1107.20**	**24.00**	**24.00**
Pension & Retirement benefits	191.01	191.00	0.00	0.00
Grand Total	**1592.31**	**1592.27**	**24.00**	**24.00**
Additional financial support under Non-Scheme	78.49	78.48	0.00	0.00

Revenue Generated for the month April, 2022 to March, 2023

(Rs. in lakhs)

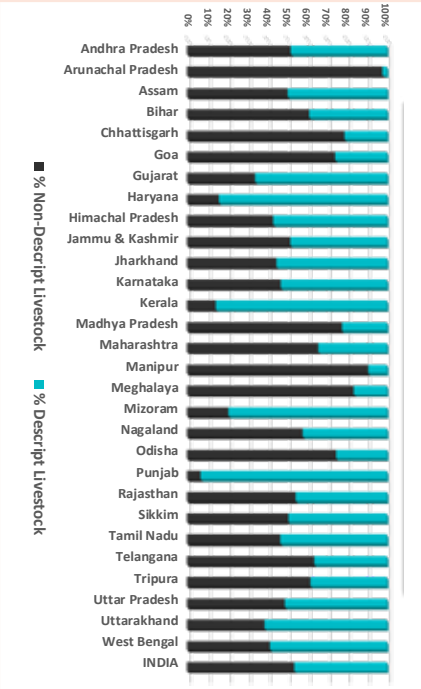
Head of Account	2022-23
Sale of Publication & Advertisement	29850
Licence Fee	277768
Hostel and Guest house rent	315965
Sale of Farm Produce	415000
Others Misc. Revenue Receipt	2261656
Total	**3300239**

Research Accomplishments

Mission towards zero non-descript AnGR of India

Mission at a glance

India possesses nearly 10 percent of the global livestock population; but only 4 percent of the global breeds. The ratio of breeds to livestock population in India is one breed per 3 million animals, which is significantly lower than the world average of one breed per 0.9 million animals. This ratio is about 4 to 6.5 million for cattle, buffalo and goat, the three most populous species in India. Around 54% percent of population of different species falls under the non-descript category, as per livestock Census (2019). Further, recognition of 83 new breeds since 2010 could be able to induct only about 5% of the native livestock population, in the descript category. The country still possesses a sizeable proportion of livestock and poultry undocumented, which includes several homogenous/unique populations those may have potential to be breeds. Further, there are large proportion of mixed populations that do not conform to any of the breed due to non-homogeneity in population, and/or cross breeding and other demographic factors. The non-descript populations, along with mixed populations of different livestock also widely vary across the states.



State with non-discript population

Considering large non-documented AnGR in the country, ICAR- NBAGR has undertaken the characterization and documentation of entire native livestock and poultry in the country in Mission mode in the coming years. "Mission towards Zero Non-Descript AnGR of India" was launched by Dr. T Mohapatra, Secretary, DARE & Director General, ICAR in a National Workshop organized on 11th August, 2021 virtually by NBAGR. The mission is aimed to significantly reduce the proportion of non-descript livestock and poultry, along with identification of potential breeds in the country as well as to understand the architecture of mixed populations of livestock species. Such gigantic tasks is only be accomplished through mission mode with immense cooperation, coordination and support of all of the involved agencies including central and state agencies including AHD of all States, SAU/SVUs, other ICAR institutes, NGOs etc.

Under the mission, unique/homogenous population of different livestock and poultry species would be identified in throughout country by initial surveys. This will specifically focus on indigenous AnGR. Further, survey for characterization of homogenous population may be conducted at farmer's herds/ flocks. Stratified two stage sampling design would be adopted for the survey. Data on physical and morphometric traits, production and reproduction performances may be recorded for different species. All the unique/homogenous populations of different species may be documented in the shape of breed monographs and breed descriptors and the eligible unique/homogenous populations of different species would be registered as breed. For defining graded

and admixed population, admixture analysis would be carried out using molecular markers, which would help in identifying the graded populations as well as population/breed admixture of mixed populations. The efforts would also yield the identification of unique populations and registering as native breeds. It is expected that the strategy would yield more than 100 distinct breeds of different livestock and poultry in coming years, which would be registered and notified accordingly.

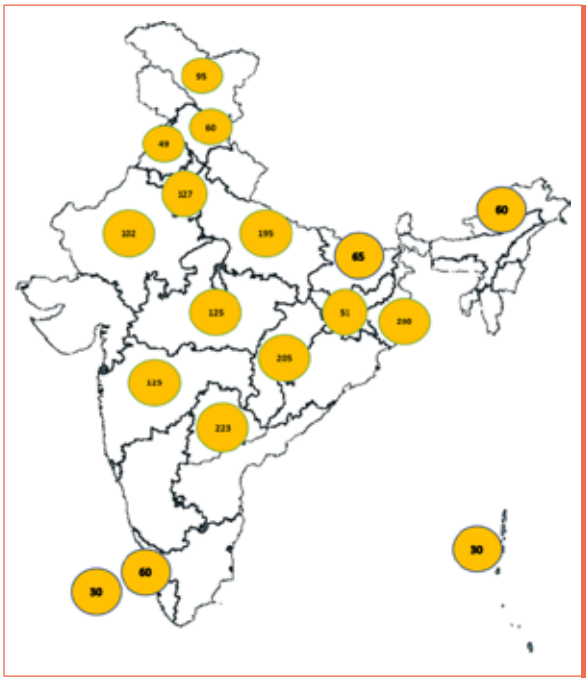
Interface meets with states

Under the Mission, Bureau is organizing State Interface Meets to sensitize Animal Husbandry Depts. SAU/SVU, Livestock Development Boards/Biodiversity Boards/ NGOs etc. for documentation of AnGR in respective state.

In year 2023, ICAR-NBAGR organized three state Interface Meets - Arunachal Pradesh, Andaman & Nicobar islands (UT) and Kerala under the 'Mission towards Zero Non-descript Animal Genetic Resource of India'. By the end of 2023, Interface Meets with 16 states / UTs has been competed (Ladakh (UT), Chhattisgarh, Maharashtra, Rajasthan, Uttar Pradesh, Jharkhand, Telangana, Punjab, Haryana, Madhya Pradesh, West Bengal, Himachal Pradesh, Bihar, Arunachal Pradesh, Andaman & Nicobar and Kerala).

Arunachal Pradesh

Under the Mission towards zero non-descript AnGR of India, ICAR-NBAGR organized 14th State Interface meet on 'Characterization and Documentation of Animal Genetic Resources of Arunachal Pradesh' in collaboration with Department of Animal Husbandry, Veterinary & Dairy Development (AHVDD), Arunachal Pradesh at Directorate of AHVDD Nirjuli-Itanagar on 23rd March, 2023. About 60 delegates of ICAR, AHVDD, Arunachal Pradesh State Biodiversity Board and Rajiv Gandhi University, Arunachal Pradesh participated in the state meet.



Interface Meet with 16 states (number of participants are given in circle)

Andaman & Nicobar Islands

15th State Interface Meet on Characterization & documentation of AnGR of Andaman & Nicobar (UT) under the Mission towards Zero Non-descript AnGR of India was organized at CIARI, Port Blair on 8th May 2023. More than 30 delegates of ICAR, KVK and Animal Husbandry Department attended the Meet jointly organized by ICAR-NBAGR and CIARI.

State Interface Meet on AnGR of Kerala state

Bureau organized Interface Meet with Kerala state for 'Documentation of Indigenous AnGR of Kerala' at College of Veterinary and Animal Sciences, Mannuthy on 8th September, 2023, in collaboration with Animal Husbandry Department, Govt. of Kerala and Kerala Veterinary and Animal Sciences University (KVASU). About 60 delegates including Officers of State Animal Husbandry Dept., Kerala Livestock Development Board, Faculty of College of Veterinary and Animal Sciences, research scholars, progressive farmers attended the meet.

Field surveys for identification of potential breeds

After launch of the Mission, institutional projects were initiated for survey and documentation of AnGR in 22 states and two Union Territories in collaboration with SAHD, KVKs, SAUs/SVUs (List of projects enclosed in next section). After launch of the Mission, Bureau has been surveyed in 24 states & 2 UTs to explore and identify new potential populations of indigenous livestock, poultry and dog. During 2023, surveys were conducted in 14 states/UTs – Andhra Pradesh, Arunachal Pradesh, Nagaland, Tamil Nadu, Odisha, HP, UP, Bihar, Rajasthan, Maharashtra, Meghalaya, Gujarat, Ladakh, Andaman & Nicobar.

During 2023, 15 new populations were identified in various states of the country. These populations are – Kongkali and Kuttai Madu cattle, Malai Adu goat of Tamil Nadu, Pahari and Umarda cattle, Melaghalti buffalo and Kaikadi donkey of Maharashtra; Zanskari goat and Zanskari sheep of Ladakh, Wak Tebi pig, Naked Neck chicken & Ruffled Feather chicken of Meghalaya, Malvi sheep of Madhya Pradesh and Malkangiri and Gola pig of Odisha. All that exploration under the Mission has resulted in identification of 46 new populations from 16 states in the country. These populations are being further characterized by the Bureau in collaboration with state agencies.

Madhya Pradesh

During February 2023, a survey was conducted in Indore, Dhar, Barwani, Khargaon and Khandwa districts of Indore division of Madhya Pradesh to document the native AnGR and explore the homogenous populations. A new Malvi, one of the tallest indigenous sheep populations was explored in Dhar & Indore districts of Malva (Madhya Pradesh). Malvi sheep is reared under pastoral system mainly for meat purpose.

Arunachal Pradesh

Team of NBAGR surveyed Kra Dadi and Lowe Sobansari district of Arunachal Pradesh during March 2023 and documented AnGR of the region. Team also recorded Ecosystem services from the farmers rearing pig and mithun in the region.

Odisha

Survey was conducted in five distinct blocks of Ganjam district of Odisha to characterize the native 'Gola' pig population during May 2023. Data on physical, morphometric, production traits were collected for 63 pigs during the survey.

Andaman & Nicobar (UT)

During May 2023, a survey was conducted in two districts of Andaman & Nicobar (UT) for documentation of various AnGR available in the region. Ecosystem Services on native AnGR were also recorded.

Ladakh (UT)

During May 2023, a survey was conducted in Leh district of Ladakh (UT) and phenotype, production and reproduction data on Native goat and sheep was collected. During October, 2023, another survey was conducted in Shila, Sunny and Rangdum, Mulbek villages of Zanskar region of Kargil district of Ladakh (UT). Two new native populations (Zanskari sheep and goat) were identified in the region. For further characterization.

Meghalaya

A survey conducted in the East, West and South Garo Hills region of Meghalaya during June, 2023 focused on identifying unique populations of livestock and poultry species. Three distinctive populations- Naked Neck poultry, Ruffled Feathered poultry, and Wak Tebi pig were targeted for characterization.

Himachal Pradesh

During June 2023, Bureau scientists conducted exploratory survey in Pangi block of Chamba district of the Himachal Pradesh for documentation of native Animal Genetics resources of these districts. Further, no new population was identified in the region.

Tamil Nadu

Survey on documentation of indigenous AnGR was conducted in Erode, Namakkal, Tirunelveli, Thoothukudi and Kanyakumari districts of Tamil Nadu under the Mission towards Zero non-descript AnGR during September 2023. Phenotypic characters, biometry, production and reproduction parameters for about 293 adult animals of Molai Aadu- a new goat population were recoded.

Rajasthan

Survey was conducted in districts of Udaipur division of Rajasthan for characterization of native cattle and goat populations during October 2023. Characterization of native Vagwari cattle and Dungri goat was completed in the native tract.

Gujarat

Exploratory survey was undertaken in December 2023 in Rajkot, Morbi and Kutch districts of Gujarat to identify the potential uniform populations. A new dog population -Tazi was identified in the region, however the population is very less and most of the dogs are of admixed type.

Uttar Pradesh

Visit of Bareilly, Lakhimpur and Rampur districts of Uttar Pradesh was made by the Bureau scientists during December 2023. Two lesser-known sheep population (Rampur black and Ruhelkhandi) and a local Horse/ Pony population were found to be unique for further characterization.

Bihar

A survey was undertaken in Aara, East and West Jagdishpur blocks of Aara district of Bihar and observed Aara goat, as potential population of this region.

Andhra Pradesh

Survey was conducted in Dr. BR Ambedkar Konaseema, East Godavari, Krishna, and Prakasam districts of Andhra Pradesh. A new uniform sheep population called Gaddaboli sheep was identified in different villages of Darsi Mandal of Prakasam district. Body biometry and other phenotypic characters for 50 adult animals and 15 lambs were recorded.

Nagaland

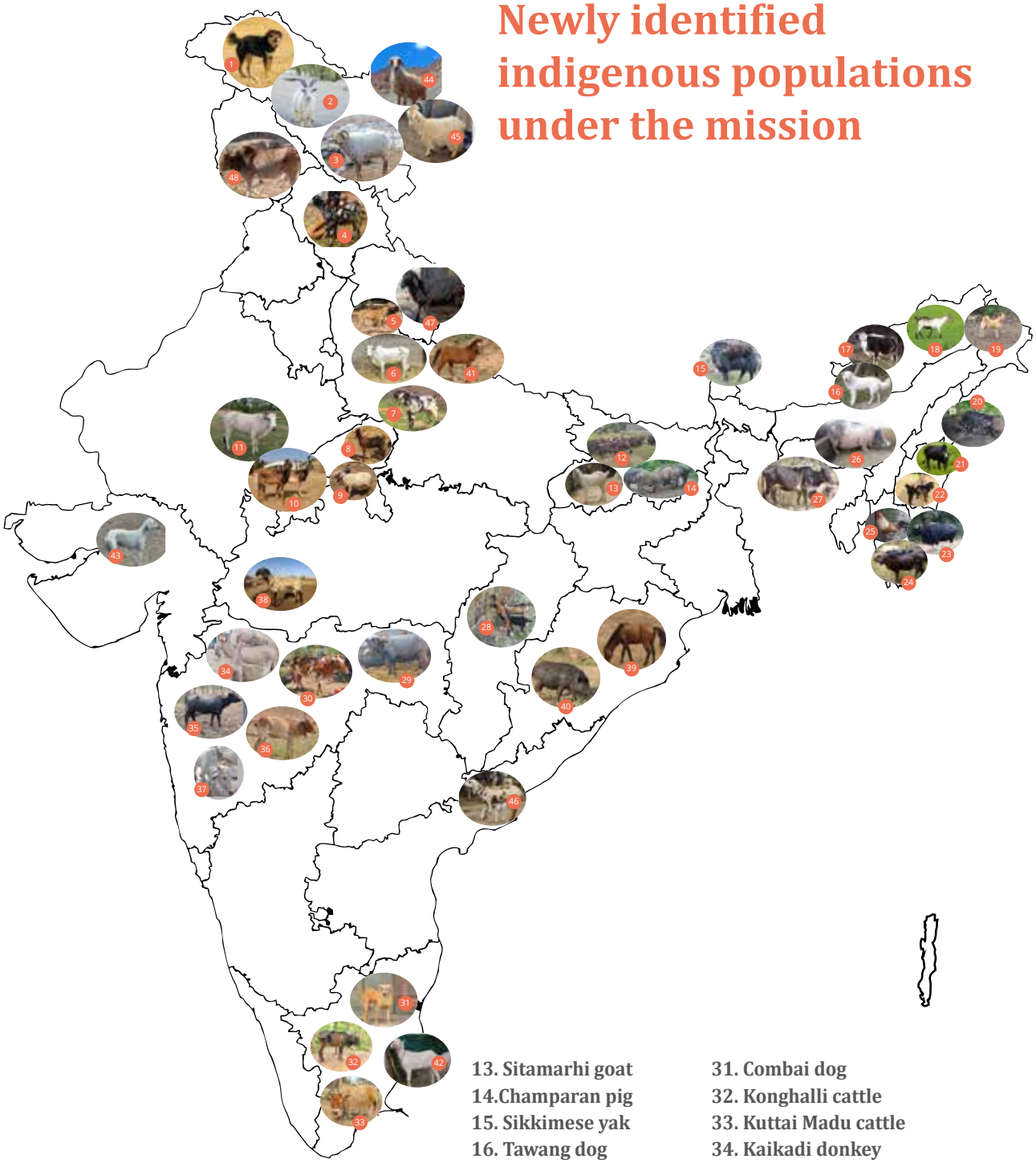
Survey was conducted to characterize a uniform new population 'Nagal' distributed across the state. Around 200 Nagal pigs were characterized from Chumukedima, Dimapur, Peren, Niuland, Kohima and Wokha districts.

State Network Units under Network Project on Animal Genetic Resources

As the task of the Mission is enormous and can be completed through country-wide networking with the larger participation of the stakeholders at local levels; 24 Network Centres involving State AHDs, SAUs/SVUs, ICAR institutions NGOs of 19 states were newly initiated during the year 2023.

Among forty-six potential populations explored country-wide under institutional projects, characterization following systematic survey with standardized questionnaires has been initiated for 43 populations by total 27 State Network Centres, at present. Further, *In situ* conservation program for five endangered breeds (Tibetan & Karnah sheep, Zanskari horse, Halari donkey and Mewari camel) have been initiated at five Network Centres during 2023-24.

Newly identified indigenous populations under the mission



1. Changkhi dog
2. Malra goat
3. Malluk sheep
4. Shivalik goat
5. Rampur Hound dog
6. Ruhelkhandi cattle
7. Battisi goat
8. Lahuri goat
9. Dang sheep
10. Vagdi goat
11. Mahi cattle
12. Seemanchali sheep
13. Sitamarhi goat
14. Champaran pig
15. Sikkimese yak
16. Tawang dog
17. Monbah cattle
18. Arunachali goat
19. Eki dog
20. Large Black pig
21. Manipuri cattle
22. Hoafa dog
23. Mizo mithun
24. Mizo cattle
25. Zoar chicken
26. Wak Chambil pig
27. Masilum cattle
28. Sarguja goat
29. Balona buffalo
30. Khamgaon cattle
31. Combai dog
32. Konghalli cattle
33. Kuttai Madu cattle
34. Kaikadi donkey
35. Melaghati buffalo
36. Pahari cattle
37. Umarda cattle
38. Malvi sheep
39. Malkangiri pony
40. Gola pig
41. Ruhelkhandi horse
42. Molai Aadu goat
43. Tazi dog
44. Zanskari sheep
45. Zanskari goat
46. Goddaboli sheep
47. Kow-Debar sheep
48. Jammu cattle

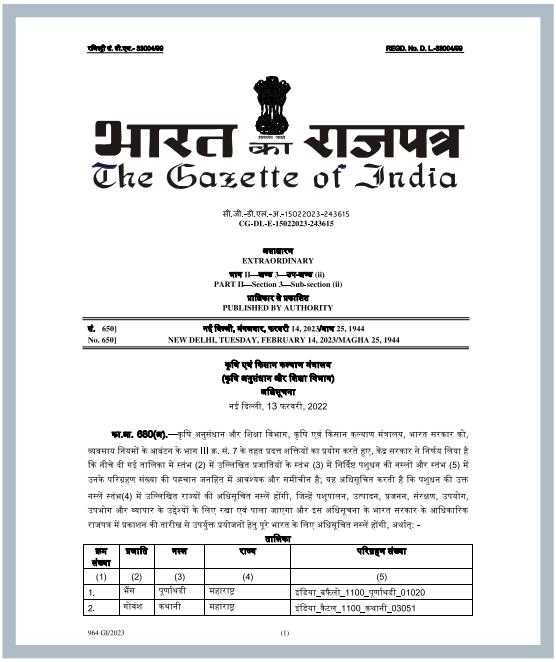
Registration of new animal breeds

Registration of native breeds of livestock and poultry has been envisioned to protect and check the bio piracy of indigenous AnGR. India has developed the mechanism for recognising breeds with known characteristics in form of authentic national documentation system. In 2007, Indian Council of Agricultural Research (ICAR) initiated "Registration of Animal Germplasm" specifically indigenous livestock and poultry breeds in the country. In the year, 2008, ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal was given the temporary authority for the registration of germplasm related to livestock and poultry in the country. Subsequently, in 2008, ICAR constituted a Breed Registration Committee (BRC) under the chairmanship of Deputy Director General (Animal Science), ICAR for the registration of new breeds. This mechanism is the sole recognised process for registration of "Animal Genetic Resources" at national level. Further to provide statutory recognition to the breeds, the registered breeds are the Gazette notified by the Govt. of India. Registration of animal breeds has shown a greater impact on socio-economic arena, including initiation of breed-based livestock census to formulating breeding policies and development programs for registered breeds in the country. The national framework for registration of native AnGR is unique in the world and is a model to other countries for claiming sovereignty over and protecting their own native germplasm. This framework has been very much useful for suitable policy formulating polices for conservation and development of endangered breeds.

The BRC chaired by Dr J K Jena, DDG (AS), ICAR, in its 11th meeting on 5th December, 2023 approved the registration of these livestock and poultry breeds of different states. Bureau in December 2023 registered seven new indigenous breeds-Andmani goat, Andamani pig and Andamani duck of Andaman & Nicobar, Bhimthadi horse of Maharashtra, Anjori goat of Chhattisgarh, Macherla sheep of Andhra Pradesh, Aravali chicken of Gujarat; and one synthetic breed -Frieswal cattle, based on recommendation of Breed Registration Committee (BRC) of ICAR. After registration of these breeds, total indigenous animal breeds are now 219 in the country. including 53 for cattle, 20 for buffalo, 39 for goat, 45 for sheep, 8 for horses & ponies, 9 for camel, 14 for pig, 3 for donkey, 3 for dog, 1 for yak, 20 for chicken, 3 for duck, 1 for geese. The Bureau also registered Frieswal cattle as a first synthetic breed in the country.

Registered indigenous animal breeds in India

Species	Extant breeds	Newly registered breeds	Total breeds
Cattle	30	23	53
Synthetic cattle breed	0	1	1
Buffalo	10	10	20
Sheep	39	6	45
Goat	21	18	39
Horse	6	2	8
Pig	0	14	14
Camel	8	1	9
Donkey	0	3	3
Yak	0	1	1
Chicken	15	5	20
Duck	0	3	3
Geese	0	1	1
Dog	0	3	3
Total	**129**	**91**	**220**



रजिस्ट्री सं. डी.एल.- 33004/99 REGD. No. D. L.-33004/99

भारत का राजपत्र
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PART II—Section 3—Sub-section (ii)
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PUBLISHED BY AUTHORITY

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कृषि एवं किसान कल्याण मंत्रालय
(कृषि अनुसंधान और शिक्षा विभाग)
अधिसूचना
नई दिल्ली, 13 फरवरी, 2022

का.आ. 680(अ).—कृषि अनुसंधान और शिक्षा विभाग, कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार को, व्यवसाय नियमों के आवंटन के भाग III क. सं. 7 के तहत प्रदत्त शक्तियों का प्रयोग करते हुए, केंद्र सरकार ने निर्णय लिया है कि नीचे दी गई तालिका में स्तंभ (2) में उल्लिखित प्रजातियों के स्तंभ (3) में निर्दिष्ट पशुधन की नस्लों और स्तंभ (5) में उनके परिग्रहण संख्या की पहचान जनहित में आवश्यक और समीचीन है; यह अधिसूचित करती है कि पशुधन की उक्त नस्लें स्तंभ(4) में उल्लिखित राज्यों की अधिसूचित नस्लें होंगी, जिन्हें पशुपालन, उत्पादन, प्रजनन, संरक्षण, उपयोग, उपभोग और व्यापार के उद्देश्यों के लिए रखा एवं पाला जाएगा और इस अधिसूचना के भारत सरकार के आधिकारिक राजपत्र में प्रकाशन की तारीख से उपर्युक्त प्रयोजनों हेतु पूरे भारत के लिए अधिसूचित नस्लें होंगी, अर्थात्: -

तालिका

क्रम संख्या	प्रजाति	नस्ल	राज्य	परिग्रहण संख्या
(1)	(2)	(3)	(4)	(5)
1.	भैंस	पुणाधिडी	महाराष्ट्र	इंडिया_भफैलो_1100_पुणाधिडी_01020
2.	गोवंश	कवानी	महाराष्ट्र	इंडिया_कैटल_1100_कवानी_03051

964 GI/2023 (1)

Breed registration & notification process

The registration of Indian livestock and poultry germplasm revolves around the concept of a breed. Breeds of domesticated animals, which are unique, stable and uniform, and have potential attributes of academic, scientific, or commercial value can be registered. Any livestock population which has been characterized must be documented and inventoried, if having the breed characters. First, all of the information recorded during phenotypic characterization, should be formatted in a shape of breed descriptor. Such an physical characterization along with management practices can be published in different scientific journals. After phenotypic characterization, it should be clear that If the population is found distinct, then only it should to be registered as breed.

First, all of the information recorded during phenotypic characterization should be shaped as a breed descriptor. Such a physical characterization along with management practices can be published in different scientific journals. The registration involves a process for screening of the applications submitted for registration as per Guidelines developed for this purpose. The application can be submitted by any citizen of India / breed society / NGO / Govt. Agency. The application must be accompanied by a complete description of the breed using standard descriptors. All claims concerning the material submitted for registration should accompany scientific evidence for uniqueness, reproducibility, and value. The population, for consideration of registration should have at least 1000 animals. The breed should complete a minimum of 10 generations. A detailed history of the breed, Difference, distinction, and details that are specific for that breed should also be provided. Representative photographs, a list of the registered animals of the breed, letters explaining certain questions about the breed from at least three different breeders/owners of the breed should also be submitted. After registration, NBAGR provides the unique Accession number to each breed after registration. The newly registered breeds are also notified through Official Gazetted published by the Government of India. Detailed guidelines, descriptors and application form for registration of new breeds can be accessed at www.nbagr.res.in/guidelines.html.

Further, Gazette notification for the livestock and poultry breeds was initiated by the Government of India in October, 2019 through publishing the Official Gazette. All registered breeds upto that year (total 184 breeds) were first time notified by the Government of India to provide statutory recognition of and claiming sovereignty over the native germplasm [Gazette Notification: Ministry of Agriculture and Farmers' Welfare, No. 3364 (S.O. 3699(E)) (October 14, 2019)] and further all newly registered breeds in subsequent years were notified through more Gazette notifications.

Ten indigenous animal breeds, registered in August 2022 were gazette notified by the DARE, Ministry of Agriculture and Farmers Welfare, Govt of India in February 2023 [No. 650 (S.O.680(E)) (Feb 13, 2023)]. These breeds are - Sanchori cattle (Rajasthan) and Masilum cattle (Meghalaya); Purnathadi buffalo (Maharashtra); Sojat goat (Rajasthan), Karauli goat (Rajasthan) and Gujari goat (Rajasthan); Banda pig (Jharkhand), Manipuri Black pig (Manipur) and Wak Chambil (Meghalaya). This was fifth gazette notification for the registered breeds. Till now 212 indigenous breeds have been gazette notified by the Government.

These breeds got the statutory recognition; and shall be the notified breeds for the whole of India for purposes of animal husbandry, production, breeding, conservation, utilization, consumption and trade from the date of publication of the notification in the official Gazette of Govt. of India. The notified breeds of the specified States received the statutory recognition; and were recognised as notified breeds for the whole of India for keeping and rearing for various purposes as mentioned in the notification.

New breeds registered in year 2023

S.N.	Breed	Home Tract	Accession number
Chicken			
1.	Aravali	Gujarat	INDIA_CHICKEN_0400_ARAVALI_12020
Duck			
2.	Andamani	Andaman & Nicobar	INDIA_DUCK_3300_ANDAMANI_11003
Goat			
3.	Andamani	Andaman & Nicobar	INDIA_GOAT_3300_ANDAMANI_06039
4.	Anjori	Chhattisgarh	INDIA_GOAT_2600_ANJORI_06038
Horse			
5.	Bhimthadi	Maharashtra	INDIA_HORSE_1100_BHIMTHADI_07008
Pig			
6.	Andamani	Andaman & Nicobar	INDIA_PIG_3300_ANDAMANI_09014
Sheep			
7.	Macherla	Andhra Pradesh	INDIA_SHEEP_0100_MACHERLA_14045
Synthetic cattle			
8.	Frieswal	Uttar Pradesh Uttarakhand	INDIA_PIG_3300_ANDAMANI_09014 INDIA_CATTLESYNTHETIC_2024_FRIESWAL_04001

Aravali chicken

Aravali chicken is a dual purpose chicken used for meat and egg, distributed in Banaskantha, Sabarkantha, Aravalli and Mahisagar districts of Gujarat state. Males have birchen, while females shafty and/or laced plumage patterns. These birds show excellent heat tolerance. In adult males, the average body weight is 2 Kg. Female produces 72 eggs annually, on average.

Andamani duck

Andamani duck is a dualpurpose breed, distributed in Nimbudera to Diglipur region of Andaman & Nicobar Islands (UT). The whole body of these birds is covered with black plumage with white markings under the neck extending up to the belly. The average adult body weight for drake is 1406 gm. The average annual egg production is 266 eggs

Anjori goat

Anjori goat is a medium sized goat, used for meat purposes. It is distributed in Raipur, Durg, Rajnandgaon, Kanker, Dhamtari, and Mahasamund districts of Chhattisgarh state. The majority of animals are brown in colour. It is hardy and well-adapted to the local climate. The average adult body weight for males is 35 kg and for females is 28 kg.

Macherla sheep

Macherla sheep is a meat purpose sheep breed of Guntur, Krishna, and Prakasam districts of Andhra Pradesh and nearby regions of Telangana. It is medium

to large. The coat color is white with large black or brown patches on the body, face and legs. The average adult body weight for males is 43 kg.

Bhimthadi horse

Bhimthadi horse is distributed in the Pune, Solapur, Satara, and Ahmadnagar districts of Maharashtra.

The average height of a stallion is about 130 cm and of a mare is 128 cm. The predominant coat colour is liver chestnut. The chest barrel is well-developed. Bhimthadi horses are mainly used for transportation of household materials during the migration of the pastoralist people.

Andamani pig

Andamani pig is a native to the islands of Andaman & Nicobar (UT) and is mainly reared for meat (pork). These pigs are sturdy and medium in size. The coat is mostly black and sometimes rusty grey. They are fast runners and have evolved to thrive under a low-input management system. The average adult body weight is 71 kg in males and 68 kg in females.

Andamani goat

Andamani goat is a medium sized animal, reared for meat purposes in the Middle and North Andaman districts of Andaman & Nicobar Islands (UT). These goats are well adapted to the tropical hot-humid climate of the island. Meat is preferred for its excellent quality by the local people. The average adult body weight of males is 29 kg. The average milk production per lactation is 29 kg.

Frieswal Cattle

Frieswal is synthetic dairy cattle with Sahiwal (37.5%) and Holstein Friesian (62.5%) inheritance, developed by ICAR-Central Institute for Research on Cattle, Meerut. It is capable of producing about 7000 kg of milk yield in a standard lactation with a peak yield of about 41 kg. This breed is acclimatized to all agro-climatic regions of the country.

Registered Animal Breeds of India

Cattle

1. Amritmahal
2. Bachaur
3. Bargur
4. Dangi
5. Deoni
6. Gaolao
7. Gir
8. Hallikar
9. Hariana
10. Kangayam
11. Kankrej
12. Kenkatha
13. Kherigarh
14. Khillar
15. Krishna Valley
16. Malvi
17. Mewati
18. Nagori
19. Nimari
20. Ongole
21. Ponwar
22. Punganur
23. Rathi
24. Red Kandhari
25. Red Sindhi
26. Sahiwal
27. Siri
28. Tharparkar
29. Umblachery
30. Vechur
31. Motu
32. Ghumusari
33. Binjharpuri
34. Khariar
35. Pulikulam
36. Kosali
37. Malnad Gidda
38. Belahi
39. Gangatiri
40. Badri
41. Lakhimi
42. Ladakhi
43. Konkan Kapila
44. Poda Thurpu
45. Nari
46. Dagri
47. Thutho
48. Shweta Kapila
49. Himachali Pahari
50. Purnea
51. Kathani
52. Sanchori
53. Masilum
54. Frieswal (Synthetic)

Buffalo

1. Bhadawari
2. Jaffarabadi
3. Marathwadi
4. Mehsana
5. Murrah
6. Nagpuri
7. Nili Ravi
8. Pandharpuri
9. Surti
10. Toda
11. Banni
12. Chilika
13. Kalahandi
14. Luit (Swamp)
15. Bargur
16. Chhattisgarhi
17. Gojri
18. Dharwadi
19. Manda
20. Purnathadi

Goat

1. Attapady Black
2. Barbari
3. Beetal
4. Black Bengal
5. Changthangi
6. Chegu
7. Gaddi
8. Ganjam
9. Gohilwadi
10. Jakhrana
11. Jamunapari
12. Kanni Adu
13. Kutchi
14. Malabari
15. Marwari
16. Mehsana
17. Osmanabadi
18. Sangamneri
19. Sirohi
20. Surti
21. Zalawadi
22. Konkan Kanyal
23. Berari
24. Pantja
25. Teressa
26. Kodi Adu
27. Salem Black
28. Sumi-Ne
29. Kahmi
30. Rohilkhandi
31. Assam Hill
32. Bidri
33. Nandidurga
34. Bhakarwali
35. Sojat
36. Karauli
37. Gujari
38. Andamani
39. Anjori

Sheep

1. Balangir
2. Bellary
3. Bhakarwal
4. Bonpala
5. Changthangi
6. Chokla
7. Chottanagpuri
8. Coimbatore
9. Deccani
10. Gaddi
11. Ganjam
12. Garole
13. Gurez
14. Hassan
15. Jaisalmeri
16. Jalauni
17. Karnah
18. Kenguri
19. Kilakarsal
20. Madras Red
21. Magra
22. Malpura
23. Mandya
24. Marwari
25. Mecheri
26. Muzzafarnagri
27. Nali
28. Nellore
29. Nilgiri
30. Patanwadi
31. Poonchi
32. Pugal
33. Ramnad White
34. Rampur Bushair
35. Shahbadi
36. Sonadi
37. Tibetan
38. Tiruchi Black
39. Vembur
40. Katchaikatty Black
41. Chevaadu
42. Kendrapada
43. Panchali
44. Kajali
45. Macherla

Horse

1. Bhutia
2. Kathiawari
3. Manipuri
4. Marwari
5. Spiti
6. Zanskari
7. Kachchhi-Sindhi
8. Bhimthadi

Camel

1. Bikaneri
2. Jaisalmeri
3. Jalori
4. Kutchi
5. Malvi
6. Marwari
7. Mewari
8. Mewati
9. Kharai

Pig

1. Ghoongroo
2. Niang Megha
3. Agonda Goan
4. Tenyi Vo
5. Nicobari
6. Doom
7. Zovawk
8. Ghurrah
9. Mali
10. Purnea
11. Banda
12. Manipuri Black
13. Wak Chambil
14. Andamani

Donkey

1. Spiti
2. Halari
3. Kachchhi

Yak

1. Arunachali

Chicken

1. Ankaleshwar
2. Aseel
3. Busra
4. Chittagong
5. Danki
6. Daothigir
7. Ghagus
8. Harringhata Black
9. Kadaknath
10. Kalasthi
11. Kashmir Favorolla
12. Miri
13. Nicobari
14. Punjab Brown
15. Tellichery
16. Mewari
17. Kaunayen
18. Hansli
19. Uttara
20. Aravali

Geese

1. Kashmir Anz

Duck

1. Pati
2. Maithili
3. Andamani

Dog

1. Rajapalayam
2. Chippiparai
3. Mudhol Hound

भारतीय पंजीकृत नस्लों का वितरण

Distribution of Registered Breeds of India

(as on 1st January, 2024)

ICAR-NBAGR

Characterization of Native AnGR

Vagwari cattle of Rajasthan

Vagwari cattle are small-sized, light grey or grey, with compact body, but bulls are darker, and their necks, shoulders, hump, and quarters are nearly black. They have small hump, short neck, thin and short legs, straight face, small and straight forehead with prominent poll.

The horns are grey, medium-sized, sickle-shaped and curved upward and inward with blunt tips. The udder is small-sized and bowl-shaped. The teats are small, cylindrical with rounded tips, and milk veins are not prominent. The muzzle, eyelids and tail switch are black and hooves are dark grey. Morphometric data were collected on 15 biometric traits (body length, wither height, rump height, rump length, chest girth, paunch girth, distance between hip bones, distance between pin bones, ear length, horn length, horn diameter, tail length, tail length with switch, head length, and head width) from 214 cattle(175 females and 39 males) aged 3 years and above. The mean values of body length, height at withers and chest girth for adult females were 94.6±0.38, 97.6±0.33 and 131.9±0.56 cm, respectively. The corresponding values for males were 98±1.1, 102.5±0.87 and 137.5±1.47, respectively. The estimated body weight was 153±1.73 kg for females and 173.4±5.3 kg for males. The Coefficient of variation was highest for horn length (30.9 %) and lowest for rump height (4.3%). Age at first breeding of males is around four years, while that of females is around four to four and a half years. The first calving age ranges from five to five and a half years, and calving interval is 15 to 18 months. Dry period of Vagwari cattle is almost seven months. The primary calving season occurs in July and August (80%), whereas the secondary calving season occurs in March and April (20%). The daily milk yield is from one to three litres. A lactation lasts for about six months. The range of milk fat (%) is three to five. Usually, milk is either given to the calves or consumed at home. However, some farmers sell their milk to dairy companies for ₹40/litre. A bullock typically sells for about ₹10000, a heifer for between ₹4000 and 6000, and a lactating cow for between ₹6000 and 12000.

Dungri goat of Rajasthan

Dungri goats are small-sized and either black or reddish-brown in appearance. The females have medium conical teats and a small udder. Tufted hairs (black or brown) can be seen on the thighs. The medium-sized, drooping ears have a leaf-like appearance. The face is triangular and convex. The tail is held upward and is small, thin, and bunchy. The teats on the small and pendulous udder are conical in shape. The horns are small, bent rearward, somewhat upturned, thick at the base, and tapered at the tip, normally screwed, though they can occasionally be round. Morphometric data were collected on 14 biometric traits (body length, wither height, rump height, rump length, chest girth, paunch

girth, ear length, horn length, tail length, head length, head width, and body weight) from 239 goats (209 females and 30 males).The meanvalues of body length, height at withers and chest girth for adult females were 58.9±0.24, 65.7±0.23 and 68.8±0.25 cm, respectively. The corresponding values for males were 57.0±0.64, 66.0±0.57 and 66.5±0.76, respectively.The body weight of does was 26±0.28 kg. The Coefficient of variation was highest for horn length (24.8 %) and lowest for rump height (4.6 %).

A Dungri goat's daily milk output can range from 300 to 500 ml. For females, the age at first breeding ranges from 10 to 12 months, whereas for males it varies from 8 to 10 months. First kidding usually occurs between 15 and 17 months of age. Twining percentages range from 10% to 15%. At one to one and a half years old, bucks are sold for ₹600/kg of live weight, which varies from 20 to 30 kg. The dressing percent is around 50. The sale price range for the does is ₹3000–4000.

Molai Aadu goat of Tamil Nadu

Molai Aadu goat or Mottai Aadu is predominantly found in Gobichettipalayam, Sathyamangalam and Bhavani taluks of Erode district. The coat colour of the animals are white in colour and few animals are also with black or brown patches on nostrils, udder and teat. More than 80% animals are poled, hence they are also called as Molai Aadu. More than 90% of the flocks surveyed one or two castrated male animals are reared for sacrificing to the God during the local festival. The Molai Aadu goat is having very high twining rate and quadruplets with good mothering ability. Even though the does are having good mothering ability about 85.5% of farmers give bottle feeding with cow milk for those kids born in quadruplets. The animals are vaccinated for goat pox, FMD etc., through State Animal Husbandry department. About 23.5 % famers reported mortality in kids when it does give quadruplets. About 90.5% of famers sell their animals in the local sandy based on the live body weight and rest of farmers sell their animals to the local middle man. Breeding males are selected

based on the phenotypic characters, growth rate, etc., and are used for breeding at young age about 12-14 month (age at first mating), for one or two breeding season only and there after replaced with bucks from other flock. Females also attains sexual maturity at an age of 12-14 months and age at breeding is 14-16 months. The phenotypic data on various morphometric traits were collected on 293 animals belonging different age and sex groups. The mean of most important biometric traits viz., Body length, Height at withers, Chest girth, Paunch girth, Face length, Face width, Horn length, Ear length, Tail length and Body weight were 63.462±0.790, 68.038±0.404, 73.820±0.539, 79.481±0.686, 15.889±0.213, 10.201±0.110, 13.290±0.731, 16.286±0.186, 15.045±0.192 (in cm) and 34.445±1.100 (kg), respectively. Generally the animals are calm in nature and fighting behaviour between them were not observed and can easily be maintained by old age personnel and ladies. In more than 85% of the flocks women are involved in rearing the animals through grazing and following other management practices. In few of the surveyed flocks women only is deciding the sale price of the animals. Male kids are sold at an age of 11-12 months at Rs 11,500 to 12,000 per kid and female kids at the same age are sold at a price of Rs 10,000 to 11,000 per animal. It was observed that the Molai Aadu goat is playing a major role in providing socio-economic and livelihood support to the women farmers and landless labours in that area, as they are getting income mostly through the sale of male kids whereas, the female stocks are raised as replacement animals.

Zanskari goat of Ladakh

Zanskari local Goat animals are having compact body covered with hairs. The ears are small in size and erect. The live weight of buck ranges from is 18-45 kg and doe ranges from 15-30 kg. Kidding takes place once a year, normally single, the average age at first kidding is 20 months. Breeding is natural, Nov- Dec, Twining not reported age of first kidding 2-2.5 yrs, Main Lambing season April-May, weaning of the young one is normally done at 4 months of age. The average BL, Height, CG, PG, FL, FW, HL, EL, TL for Female Goat are: 55.60±0.99, 55.09±0.62, 71.29±1.08, 77.09±1.43, 16.26±0.30, 9.46±0.24, 18.34±1.10, 7.50±0.25, 11.01±0.29, 14.91±0.56. The average BL, Height, CG, PG, FL, FW, HL, EL, TL for Male Goat are: 52.15±1.23, 54.88±1.39, 69.62±1.92, 75.35±2.34, 15.92±0.42, 9.54±0.35, 22.12±1.73, 13.00±0.71, 11.04±0.31, 15.65±0.62 cm.

Zanskari sheep of Ladakh

The Zanskari sheep, these small to medium-sized animals exhibit exceptional disease resistance, sturdiness, and known for their remarkable resilience and unique physical characteristics. One of the distinguishing features of the Zanskari sheep is their coat, which is comprised of small hairs that cover their face and legs. Their ears, though small in size, are of particular interest, being short and tubular with a distinctive drooping appearance. The wool of the Zanskari sheep is highly prized and is typically shorn twice a year, in April/May and August/September. This wool is not only valued for its quality but also for its ability to provide warmth in the harsh Himalayan winters, making it an essential commodity for the local community. For female Zanskari sheep, the average body length (BL), height (Height), chest girth (CG), paunch girth (PG), forelimb length (FL), forelimb width (FW), hindlimb length (HL), ear length (EL), and tail length (TL) are 52.74±0.75, 54.66±0.52, 73.36±0.92, 80.05±1.07, 16.90±0.23, 9.77±0.15, 12.80±1.35, 10.40±0.27, and 13.03±0.29, respectively. Male Zanskari sheep, on the other hand, exhibit slightly larger dimensions, with an average body length of 55.00±0.86, height of 55.87±0.73, chest girth of 75.30±1.22, paunch girth of 79.80±1.18, forelimb length of 17.96±0.22, forelimb width of 9.64±0.17, hind limb length of 21.17±1.06, ear length of 9.81±1.22, and tail length of 14.19±0.37.

Nagal pig of Nagaland

Nagals are long, deep-bodied and black pigs. They have a short snout and black hooves. Their top line is slightly concave. Very few pigs have white hooves, and white patches on legs below the hock, on the tip of the muzzle and on the tail switch. They have large, wide and dropping ears, partially obscuring their vision. Hoof placement is full. A total of 205 Nagal pigs (131 sows and 74 boars) were characterized from six districts viz. Chumukedima, Dimapur, Peren, Niuland, Kohima and Wokha on 11 biometric traits viz. total body length, height at withers, height at loin, chest girth, abdominal girth, neck girth, face length, snout length, ear length, ear width and tail length.The mean***± S.E.*** values of body length, height at withers, heart girth and neck girth of sows were 124.8±1.07, 69.5±0.59,107.1±0.89 and

87.9±0.81 cm, respectively. The corresponding values in boars were 130.2±1.51, 72.7±0.66, 112.5±1.41 and 92.4±1.08 cm.The estimated mean body weight of sows was 101.3±2.5 kg, while that of boars was 117.2±4.0 kg. The above traits were significantly different ($p<0.5$) in both sexes. The length of the tail and ears were around 32 cm and 23 cm, respectively, with non-significant difference between sexes.

Weight at birth ranges from 1 to 1.4 kg, while weight at 3 months, 6 months, 9 months and 12 months varies from 12 to 18 kg, 40 to 60 kg, 80 to 100 kg and 100 to 140 kg respectively. Wight at more than a year varies from 100 to 220 kg.For males, the age at first mating is 6-7 months, while in females it is 7-8 months. Age at first oestrous 7-8 months with an oestrous cycle of 18-22 days and oestrous duration of 2-3 days.The age at first farrowing is around 12 months with a farrowing internal of 5-6 months. Nagal sows give birth to large litter ranging from 7 to 20, but some have litters up to 26. In the eleventh farrowing, a sow was witnessed giving birth to twenty piglets. Lifetime farrowing ranges from 5 to 8.Sows are good at mothering ability and have 6 to 8 pairs of teats. Thegestation period is around 114-days. Boars have a two-year breeding life span, whereas sows have a three- to five-year lifespan, thereafter they are usually slaughtered. Nagal pigs bred round the year. Large ears, small snout, absence of hair, and black colour are used in the selection process.

Nagal pigs are raised for their pork and manure; the pork is preferred product.They are raised under intensive backyard management and fed on rice, corn, wheat bran, rice polish, plant leaves and leftover kitchen scraps. Breeding boars are raised for community service. In a village or group of villages, one farmer cares for a breeding boar and charges ₹ 1500–2000 every service. If the pregnancy fails, there is no charge for re-service. A boar is utilised four to five times per month. Piglets are typically sold when they are two months old, usually in pairs (one male and one female). The price of a single piglet is around ₹ 5000. Adult pigs are sold for ₹ 260 per kg of live weight. The sale price of breeding boars varies from ₹ 30000 to 35000. Giving pigs, mostly, black pigs, as gifts to marriages and to the local church (10% of the piglets) is a customary social practice. A sow can bring in between ₹ 70000 and 80000 a year, but each sow needs about ₹ 10000 in care each year. Mostly, the herd size varies from 2 to 5 but herd size of 8 to 15 were also observed. 50% of the herd is made up of piglets, 10% of boars, and 40% are sows.

Gola pig of Odisha

Gola pigs are found in Puri, Ganjam and Jajpur district of Odisha. These medium to large-sized pigs are characterized by their striking black coat color adorned with distinct white markings on their legs, head, and abdomen. Adapted to harsh climatic conditions, these resilient pigs thrive on zero input, making them a sustainable choice for local farmers. With straight and pointed snouts, along with short and erect ears, Goal pigs exhibit a flat-shaped belly and full hoof placement. Their bristles range from medium to long in size, adding to their distinctive appearance. Known for their excellent reproductive performance, these pigs typically yield litters sized between 6 and 10 with minimal piglet mortality. In addition to serving as a source of self-consumption for local communities, Goal pigs are also sold locally and in neighboring states, especially during high-demand festive seasons.

Sikkimese yak of Sikkim

Sikkimese yak are mainly black in color but have variation ranging from pure brown, grey and white to dual colored black and white, brown and white etc. Animals have a broad convex head with curved horns usually pointed upwards and horizontally placed ears (Fig 1 and 2). Animals have a small dewlap and naval flap and are generally docile in temperament. In females, udder is usually small, round in shape with cylindrical teats and rounded teat tips. Milk vein is not prominent. The average daily milk yield in Sikkimese yak is 1.44 kg with peak yield of 1.95 kg. The lactation length of the animal is about 7 months. In females, age at first estrous and first mating is co-synchronously exhibited at the age of 42 months and the average age at first calving is 51 months. Service period, gestation period and average calving interval are 90 days, 270 days and 392 days respectively. On an average, a female yak required 2 services per conception and gave birth to 6-7 off springs in her lifetime. Since the production system is mainly pastoral, the bulls are not being trained for semen collection and 100 % natural service is practiced. The average age at first mounting in bulls is 43 months whereas the age at first mating is 48 months.

Ruhelkhandi horse of Uttar Pradesh

A pilot survey was conducted to identify lesser known animal genetic resources of Bareilly, Rampur and Lakimpur Kheri districts of UP, and preliminary study revealed that a lesser known 'RUHELKHANDI EQUINE' population is distributed in the surveyed area. Most of the individuals were found to be of chestnut in colour with hairy mane and small erect ears. However, animals with bay and grey colours were also identified during the survey. A white strip marking was also present in many individuals. Survey revealed that these animals are mainly reared for transportation of goods in the city and villages, and no systematic breeding has been practised in the animals. Initial investigation validated

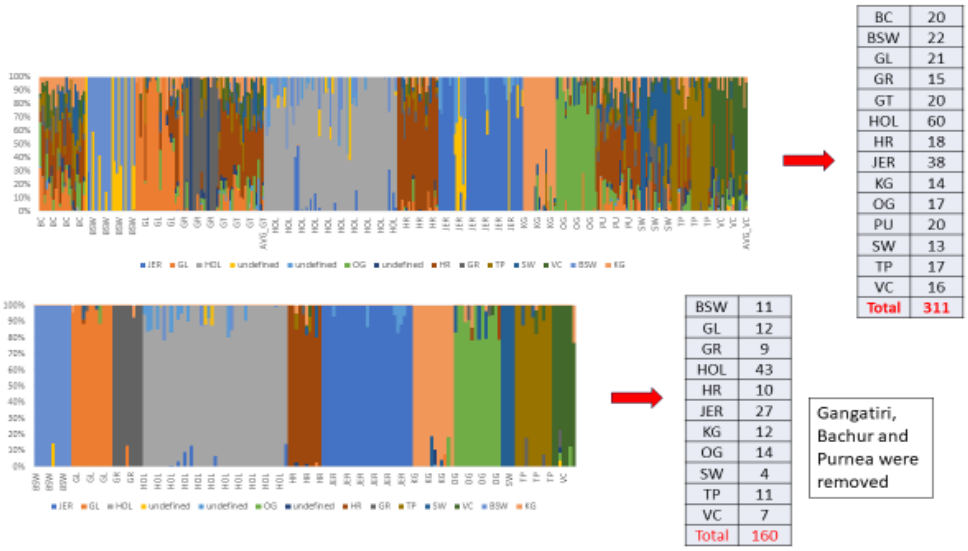
the existence of an underexplored equine population in Bareilly and neighbouring districts, which need to be characterized in detail.

Rampur Hound dog of Uttar Pradesh

The survey on Rampur Hound was undertaken in the villages (Rampur & Suar area) of Rampur district, Lucknow of Uttar Pradesh, Parbhani (Maharashtra) Coimbatore and Thoothukudi (Tamil Nadu) and Sultanpur, Sadhrana, Dhankot, Khedi Majra and Basai villages belonging Gurugram district (Haryana). During the survey it was observed that only very few breeders maintain the Rampur Hound dog in the Rampur area, but as per the interaction with the breeders good true to type breed animals found in Lucknow, Tamil Nadu, Haryana also. Few breeders from Tamil Nadu, Maharashtra and near Gurugram in Haryana also maintain these dogs. The dog is believed to be developed by Nawab of Rampur by crossing the English grey hound and Thazi hound. The dogs are maintained as a guard dog by the breeders and the dogs are excellent trainable animals. The dogs are locally called as Shikari. Four coat colours were observed during the field visit i.e Black coat colour, Brindle, Light brown and Fawn colour. Among these four coat colours fawn and light brown colours are predominant coat colours and black and brindle coat colours are found in about 3-4% of the animals. About 63% of animals are having straight head, normal fore head and straight nasal bridge. The top line is straight and with tucked-up abdomen. Animals are about 69.02±1.03 cm in height at withers. Age at first oestrus in bitch is about 15-18 months with October and November months are main breeding season and June-July months are minor breeding season. Age at first mating in dogs is about one year. Litter size ranges from 6-10 puppies and weaning is done at the age between 40-60 days. There is a huge demand for puppies among the dog lovers and the selling price ranges from Rs 10,000 to 15,000 per puppy depending on the pedigree of the parents and coat colour. Parvo is the major disease prevalent in this dog breed and breeders used to vaccinate the dogs with seven in one combined vaccine. Most of the breeders maintain these dogs under non-veg food feeding twice a day.

Admixture analysis of cattle

In order to reveal the genomic composition and to discover the genetic uniqueness of non-descript cattle populations of Maharashtra, Jharkhand and Bihar.Two non-descript populations viz., Kamgaon(n=21) and Vidarbha white (n=21), one cross bred population (n=23) from Maharashtra and Jharkhandi(n=21) from Jharkhand and Sahabadi(n=21) from Bihar and three registered breed i.e., Gaolao(n=21), Ganagatiri(n=21) and Purnea(n=21)were genotyped using the GGP 50K SNP genotyping platform. A total of 74,151 SNPs were genotyped with the average call rate was 93%. The Average Minor Allele Frequency found to be 0.33054 and heterozygosity proportion of 0.39762. The established cattle breeds which would have contributed to genome of non-descript cattle populations under the study were considered for reference panel building which included Gaolao(n=21), Gir(n=16), Hariana (n=18), Kangayam(n=18), Ongole(n=24), Sahiwal (n=19), Tharparkar(n=17) and Vechur(n=20) of Indian breeds and Brown Swiss(n=22), Holstein (n=60) and Jersey (n=38) of exotic breeds. The common SNPs (51,600) found across the platforms used for genotyping reference and target populations were extracted. Both target populations (n=108) and reference populations (n=273) were subjected to quality control (QC). Among top 1,000 markers from each of the statistics, 553 were found common and further used for PCA and admixture analysis. PC1 explained 92.23% variance and differentiated exotic and indigenous cattle populations under the study, while PC2



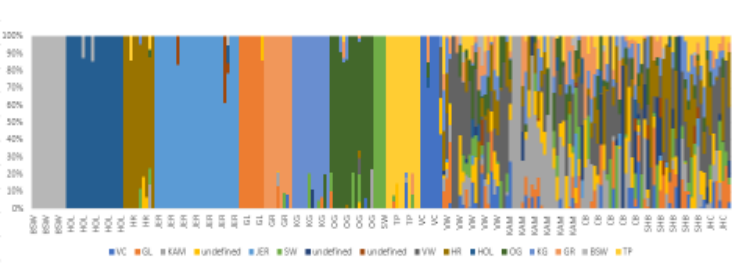
BC	20
BSW	22
GL	21
GR	15
GT	20
HOL	60
HR	18
JER	38
KG	14
OG	17
PU	20
SW	13
TP	17
VC	16
Total	311

BSW	11
GL	12
GR	9
HOL	43
HR	10
JER	27
KG	12
OG	14
SW	4
TP	11
VC	7
Total	160

Gangatiri, Bachur and Purnea were removed

Curation of reference panel

Reference panel	
BSW	11
HOL	43
HR	10
JER	27
GL	12
GR	9
KG	12
OG	14
SW	4
TP	11
VC	7
Total	160



Target populations	
VW	21
KAM	21
CB	21
SHB	19
JHC	10
Total	92

	VC	GL	KAM	AD1	JER	SW	AD2	AD3	VW	HR	HOL	OG	KG	GR	BSW	TP	Total
VW	0.05	0.06	0.04	0.07	0.00	0.05	0.00	0.01	0.35	0.10	0.01	0.08	0.06	0.06	0.02	0.04	1
KAM	0.03	0.03	0.44	0.08	0.00	0.03	0.01	0.00	0.10	0.06	0.00	0.06	0.05	0.06	0.00	0.03	1
CB	0.04	0.05	0.11	0.07	0.02	0.08	0.08	0.00	0.17	0.09	0.02	0.05	0.06	0.10	0.01	0.04	1
SHB	0.02	0.08	0.07	0.05	0.01	0.06	0.12	0.02	0.15	0.24	0.00	0.04	0.06	0.03	0.00	0.05	1
JHC	0.03	0.07	0.05	0.08	0.00	0.06	0.02	0.00	0.28	0.16	0.00	0.03	0.08	0.03	0.00	0.10	1

The admixture analysis using SNP markers to reveal the composition of cattle.

Target population: Kamgaon(KAM),Vidarbha white (VW), cross bred population (CB), Jharkhandi(JHC),Sahabadi(SHB)

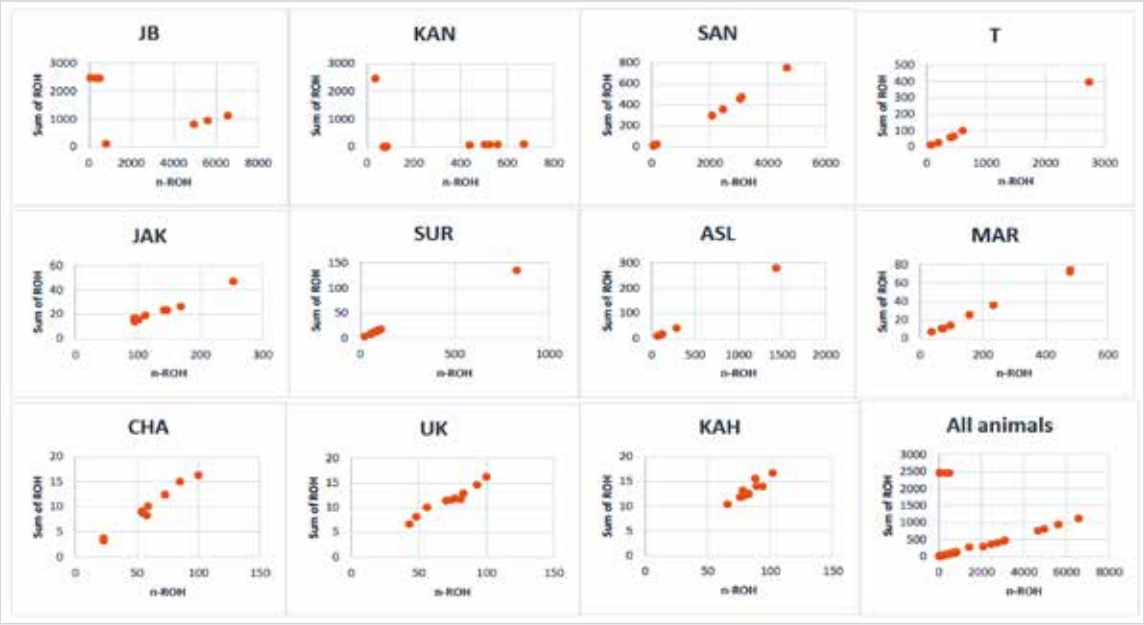
Reference Panel: Gaolao(GL), Gir(GR), Haryana (HR), Kangayam(KAM), Ongole(OG), Sahiwal (SW), Tharparkar(TP) and Vechur(VC) of Indian breeds and Brown swiss(BSW), Holstein (HOL) and Jersey (JER). AD for unidentified cattle

distinguished Kangayam, Ongole, Vechur and Gaolao from other indigenous populations. Initial admixture analysis was done at K=14 (predetermined number of clusters) for the reference panel curation, and the individuals with less than 80% of composition to their designated clusters were removed, retaining 160 individuals out of 311 individuals from the reference panel (Fig.1).The targets were then analyzed for breed composition which revealed Kamgaon found to have its own unique composition ~44%; and remaining populations viz., Sahabadi, Jharkandi found to have significant admixture from indicine ancestors, and crossbred were highly admixed (Fig 2).

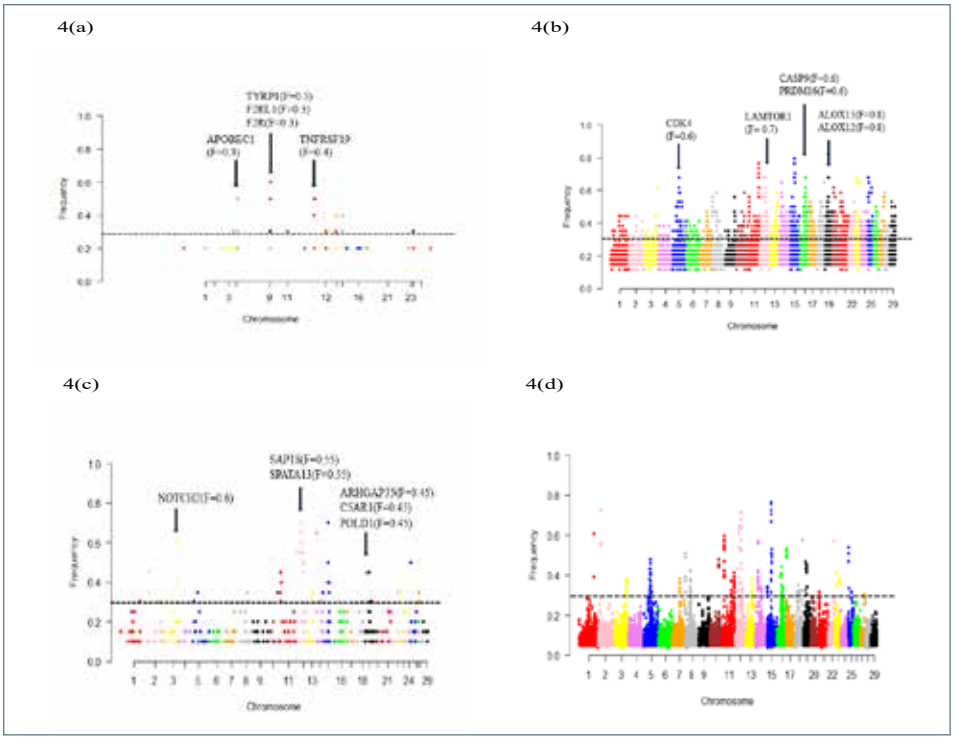
Genomic Diversity in Indian Goats

Runs of Homozygosity (ROH) are important in understanding demographic patterns, estimating inbreeding levels, mapping recessive alleles, and identifying selection signatures. In our study, we analyzed ROH and consensus ROH regions in 102 individuals representing eleven distinct Indian goat (Capra hircus) breeds/populations using whole-genome sequencing (~10X) on the Illumina NOVASEQ 6000 platform with 150 bp paired-end chemistry. A total of 51,705 ROH and 21,271 consensus regions were identified (Figure 1). The mean number of ROH per animal peaked in the meat breed Jharkhand Black (2693) and was lowest in the Changthangi (60). The average length of ROH (ALROH) was highest in Kanniadu (KAN) (974.11 Kb) and lowest in Tellicherry (T) (146.98 Kb). Long ROH are typically associated with recent inbreeding, while short ROH are linked to ancient inbreeding. KAN showed higher levels of recent inbreeding than JB, but due to the prevalence of both recent and ancient inbreeding, JB had a higher overall FROH than KAN. ROH patterns indicated lower levels of consanguinity in dairy (Jakhrana and Surti) and pashmina-producing breeds (Changthangi), while recent inbreeding was apparent in meat breeds (Jharkhand Black, Kanniadu, Sangamneri, and Tellicherry).

Analysis of ROH consensus regions identified selection sweeps in key genes governing traits such as intramuscular fat deposition, meat tenderization, lean meat production, and carcass weight (CDK4, ALOX15, CASP9, PRDM16, DVL1) in meat breeds; milk fat percentage and mammary gland development (POLD1, NOTCH2, ARHGAP35) in meat and dairy breeds; and cold adaptation and hair follicle development (APOBEC1, DNAJC3, F2RL1, FGF9) in pashmina breeds (Figure 2). Furthermore, the study highlighted the involvement of MAPK, RAS, BMP, and Wnt signaling pathways associated with hair follicle morphogenesis in Changthangi.



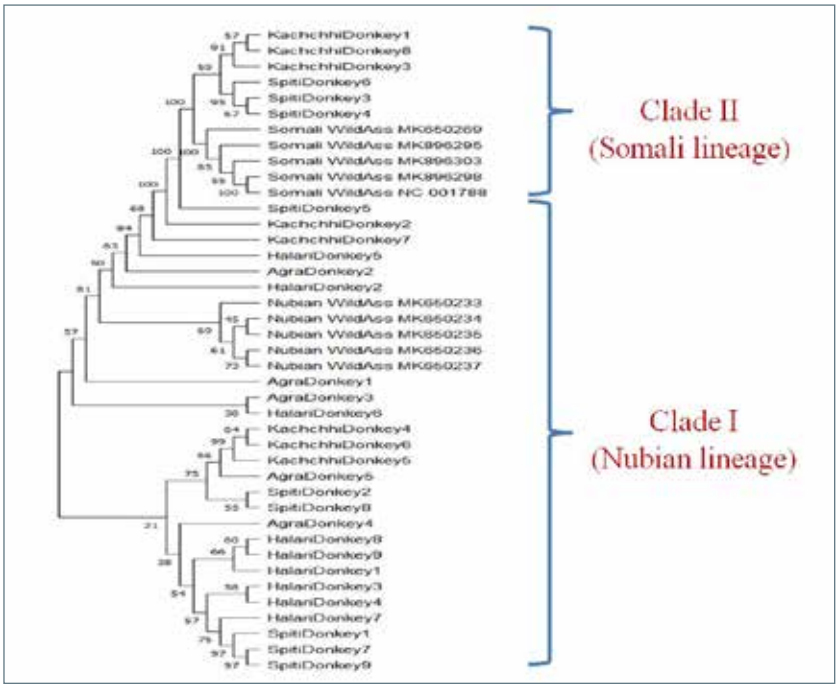
Scatter plots showing total number of ROH and total length of ROH (Mb) for each individual in a breed. Assam Hill (ASL), Changthangi (CHA), Jhakrana (JAK), Jharkhand Black (JB), Kanniadu(KAN), Marwari (MAR), Sangamneri (SAN), Surti (SUR), Tellicherry (T), Uttarakhand local (UK) and Kahmi (KAH)



Manhattan plots (a) Pashmina breed (b)Meat breeds (c)Meat & Dairy breeds (d)all 102 animals showing ROH consensus regions. Areas with a frequency exceeding 0.3 (30%) have been recognized as ROH hotspots. These regions have been subsequently employed for the examination and comparison of selection signatures across diverse groups.

Mitochondrial diversity analysis of Indian donkeys

Donkeys have played a central role in the development of human civilizations by being the 'beast of burden' to transport goods and people during trade and migration. The donkey genetic resources of India are characterized by three defined breeds (Spiti, Halari, and Kachchhi) and many lesser-known populations. Mitochondrial DNA has been an attractive tool for understanding the evolutionary history and domestication events of different species. In this study, an attempt was made to assess the mitochondrial DNA variations and to identify the lineages contributing to Indian domestic donkeys. The whole mitogenomes of 31 donkeys representing 4 breeds/populations, namely Halari, Kachchhi, Agra, and Spiti were analyzed. The length of mitochondrial genomes in the investigated animals varied from 16660 to 16664. The circular mitochondrial genome of Indian donkeys contained 2 rRNA genes, 22 tRNA genes, 13 protein-coding genes, and a non-coding D-loop region. Comparative analysis of the mitogenomes revealed presence of 201 variable sites contributing to 27 haplotypes. The haplotype and nucleotide diversity were 0.989 and 0.00395, respectively, suggesting high maternal genetic diversity. Although the phylogenetic analysis of Indian donkeys with the African wild asses revealed the presence of both the Somali and Nubian clade, the predominance of the Nubian clade was conspicuous in 80.65% of the sampled animals. Comprehensive analysis of the mitochondrial D-loop region of donkeys from Asia, Africa, Europe and South America divulged that Indian donkeys shared haplotypes with donkeys from other countries such as China, Egypt, Italy, Ethiopia, Nigeria, Peru, Balkan Peninsula, and Albania. The Asian wild asses were excluded as the possible progenitors of Indian donkeys. This study supports previous hypothesis of domestication of donkeys in the African continent and further spread across the globe following desertification of the Sahara. Further, it also substantiates that mobile pastoralism and dispersal ability of donkeys for inter-continental trade promoted their domestication worldwide.

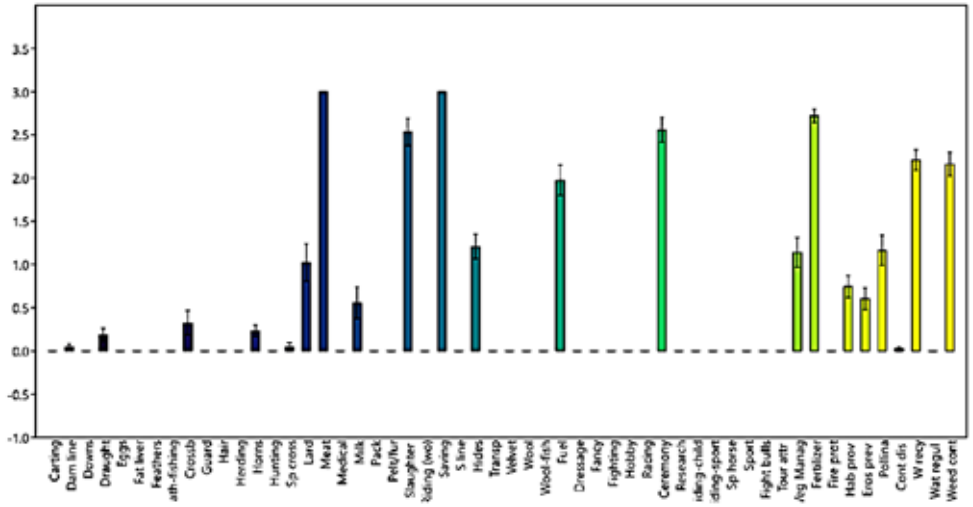


Neighbor joining tree based on the whole mitogenome sequences of Indian donkeys and African wild asses

Ecosystem Services of indigenous AnGR in Arunachal Pradesh

A pilot study on livestock Ecosystem Services (ESS) was studied in Arunachal Pradesh. The study was conducted mainly for assessing the ESS provided by the mithun and pig and overall in Zero and KraDaadi districts of Arunachal Pradesh. Mithun is contributing seven each of provisioning and regulating and one cultural services to the local society and environment. Similarly, pig six provisional, three regulating and one cultural services. In the region, cultural and ceremonial event are not possible without mithun and pig. When both of the species were considered, about 20 out of 55 different ESS were provided by these AnGR to the local society.

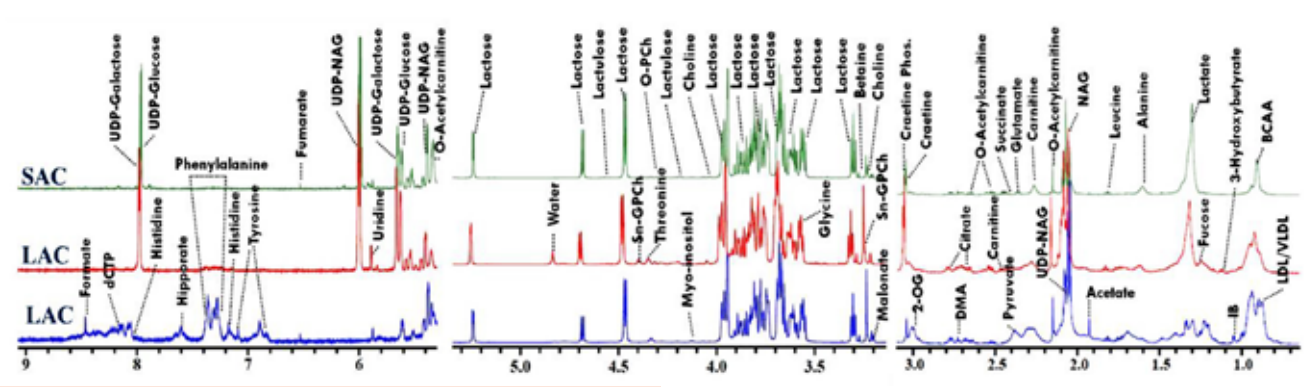
Drivers for AnGR diversity losses were also assessed from the same farmers group. Following drivers were included in the study - Change in land use, change in water use, pollution, over exploitation, climate change, natural disaster, invasive species, market trade, policies, population growth (urbanization) and change in economic/socio-/cultural factors. Among these Urbanization and land uses had the most significant negative impact on AnGR diversity. Marketing was found to have increase of new kinds of germplasm specially for pig and poultry in the region.



Evaluation and Trait Characterization of Native AnGR

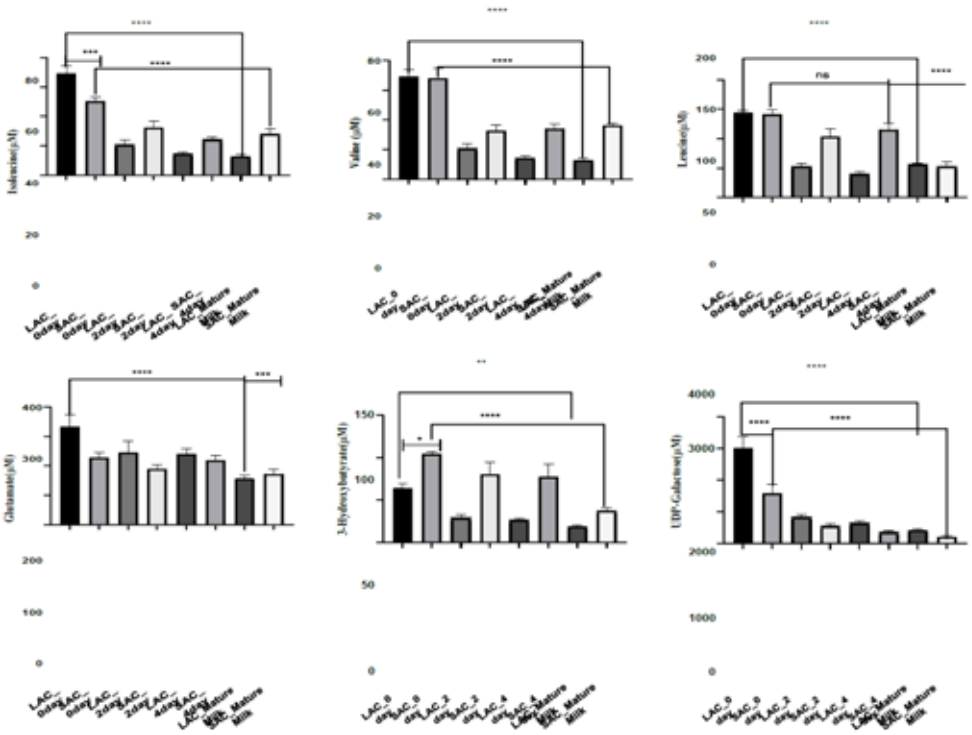
Metabolomic signatures of colostrum and mature milk from Ladakhi cows

The native cattle of Ladakh are naturally adapted to high altitude hypobaric hypoxia environment of Leh-Ladakh. The Ladakhi cows are integral to the livelihoods of local community and traditionally being reared on highland pastures for milk, butter and Churpi (traditional cheese). In the present study, an effort was made to characterise the metabolome signatures of colostrum (0-day: N = 20) and mature milk (>60 days: N = 20) of Ladakhi and Sahiwal cows in a comprehensive manner using ^{1}D ^{1}H 800 MHz NMR spectroscopy. A total of 40 defatted samples of colostrum, (0-day: N=20), and mature milk (>60 days: N = 20) were evaluated and identified 46 metabolites from different classes such as amino acids, benzenoids, carbohydrates, fatty acyls, nucleic acids, organic compound, organic nitrogenous compounds. The majority (30/46) of the metabolites were enriched in colostrum while their level declined in mature milk. The representative NMR spectra of Ladakhi and Sahiwal milk with annotated metabolites is shown in Figure. Some of the most abundant metabolites (in µM) in colostrum of Ladakhi cows were; UPD-galactose (3016.76±362.54), UDP-glucose (1385.48±76.18), O-phosphocholine (1648.23±83.86), myo-inositol (1523.44±164.09), N-acetyl glucosamine (1506.37±150.14µM), betaine (618.86±43.55), citrate (640.09±64.78), threonine (386.58±47.49) and glutamate (243.6±13.6). In comparison most of these metabolites were present in relatively lower concentration in colostrum of Sahiwal cows (UPD-galactose (1667.08±610.76 µM), O-phosphocholine (987.4±149.10 µM), myo-inositol (624.22±62.54 µM), citrate (67.27±9.05 µM), (1591.42±126.48µM), threonine (269.13±46.19µM) and glutamate (240.96±38.49 µM). Only three metabolites such as UDP-glucose (1634.94±614.48 µM), N-acetyl glucosamine (1591.42±126.4 µM) and betaine (756.07±114.76 µM) were present in higher abundance in colostrum of Sahiwal cows as compared to Ladakhi cows. Lactose (289.99±36.27mM), maltose (222.45±27.08 µM), glucose- phosphate (70.51±7.07 µM), acetate (68.85±7.04 µM), carnitine (218.58±22.36 µM) and 2-oxoglutarate (178.96±11.92 µM) were present in more abundance in mature milk. Most of these metabolites except, lactose (445.65±65.79mM) and maltose (363.58±69.08 µM), were found to be relatively high in Ladakhi cow's mature milk as compared to Sahiwal cow's mature milk. The PLS-DA

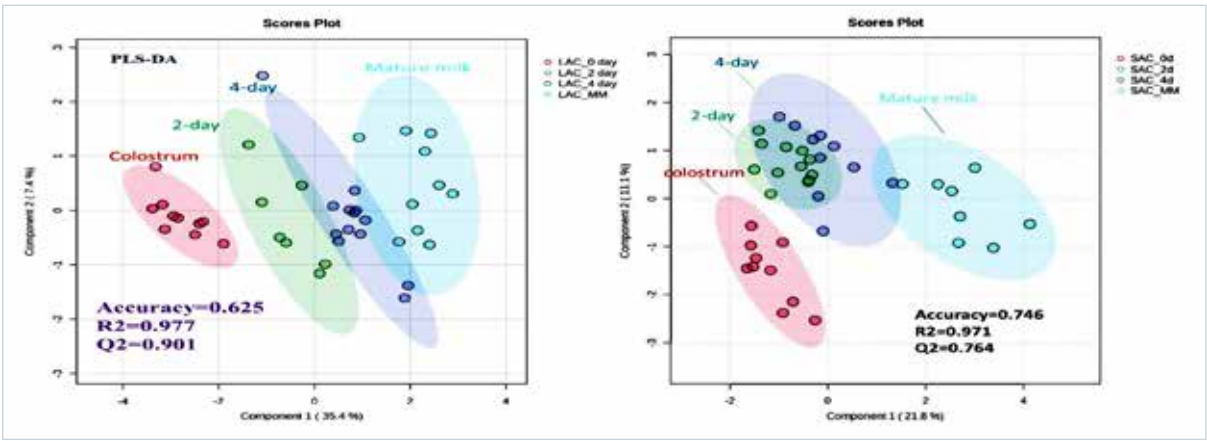


Representative NMR spectra of milk of Ladakhi and Sahiwal cows with annotatedmetabolites

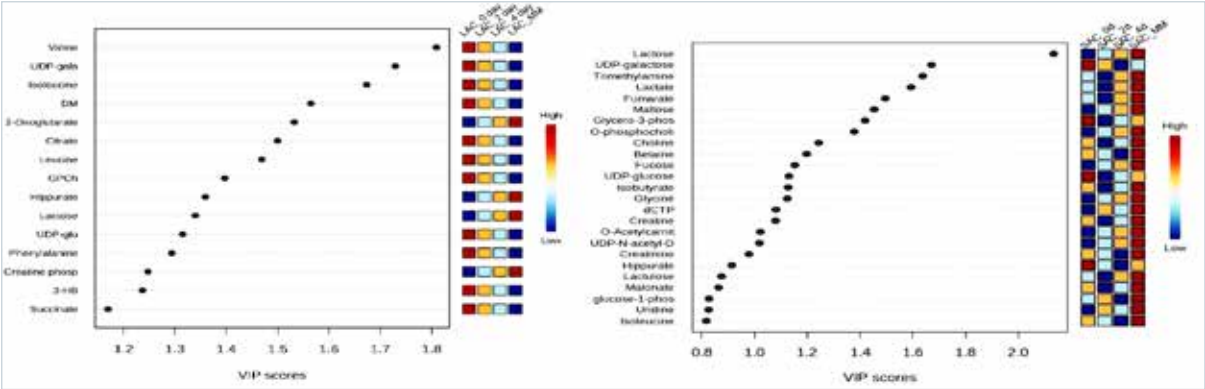
based multivariate analysis grouped colostrum (0-day) and mature milk (>60 days) samples into separate clusters. Some of the metabolites such as valine,UDP-galactose, isoleucine, dimethylamine, 2-oxoglutarate, citrate and leucine with high VIP score (>1.2) could help to differentiate the Ladakhi cow samples into colostrum and mature milk groups. Whereas lactose, UDP-galactose, trimethylamine, lactate, fumarate, maltose and glycerol3-phosphate were the metabolites with high VIP score (>1.2) that could differentiate the colostrum and mature milk samples of Sahiwal cows. The pathway analysis revealed; alanine, aspartate, and glutamate metabolism; the citrate cycle (TCA cycle); amino sugar and nucleotide sugar metabolism etc. in the breeds. Such kind of work will help to understand the metabolomic composition and milk attributes of native cows from diverse environments and will aid in better utilization and value addition of these breeds.



Metabolites showing significant differences in abundance across colostrum (0-day),transition (2-day; 4-day) and mature (50-60) milk. Statistical significance level is highlighted by asterisk: "", "**", "***", "****" for p-value ≤ 0.05, 0.01, 0.001 and 0.0001, respectively.*



PLS-DA score plot indicating distinct grouping of colostrum (0-day), transition (2- day; 4-day) and mature (50-60 day) milk samples of Ladakhi and Sahiwal cows.

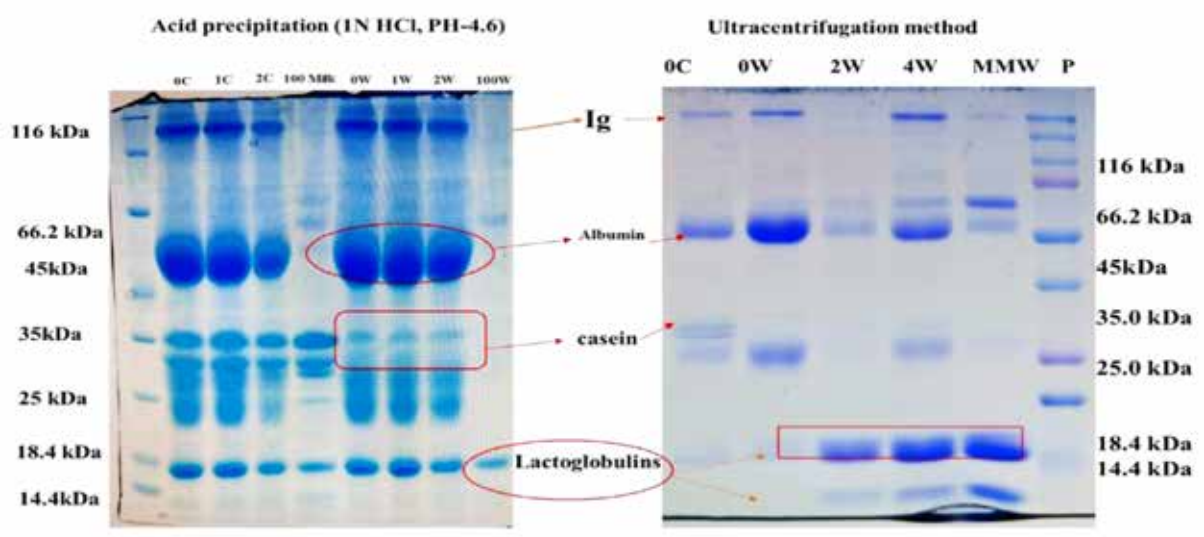


Variable Importance Projection (VIP) score plot indicating discriminating power of individualmetabolites to differentiate colostrum (0-day), transition (2-day; 4-day) and mature (50-60 day) milk samples of Ladakhi and Sahiwal cows in the PLS-DA score plot. The colored boxes depict the relativelevels of individual metabolites in 0-day, 2-day, 4-day and 50–60 day groups.

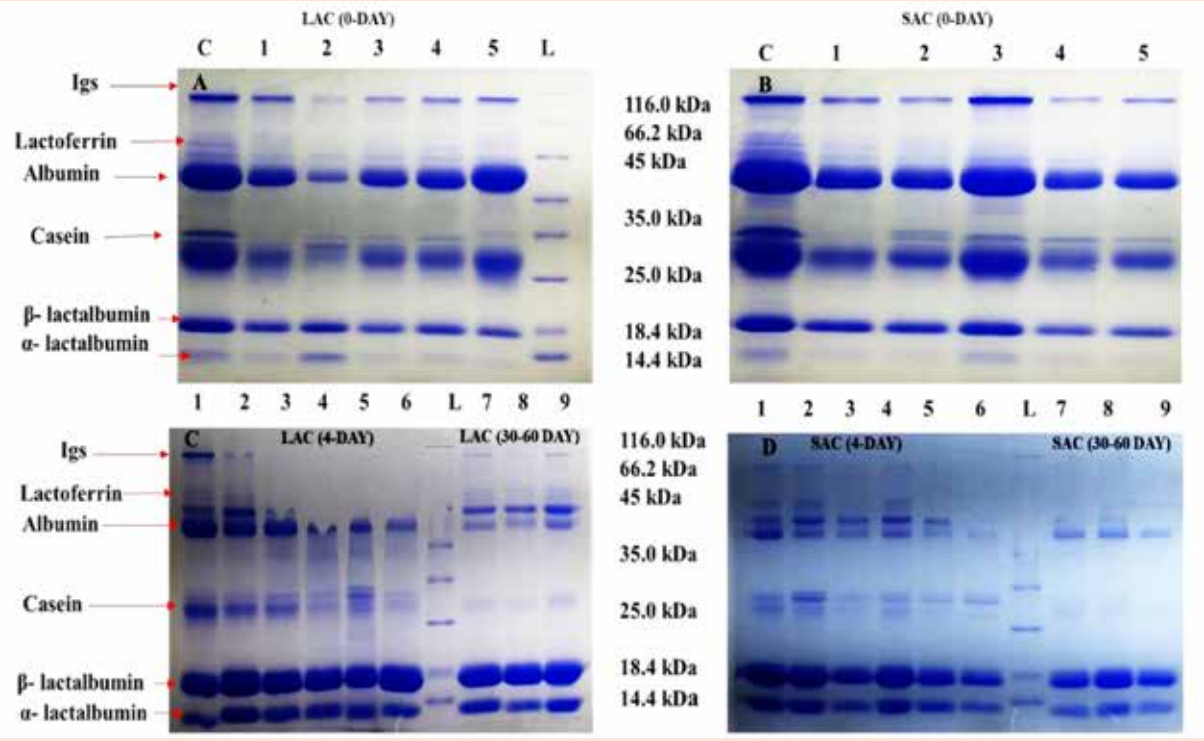
Proteomic Signatures of Colostrum and Milk in Ladakhi and Sahiwal Cows

In the present study, an effort was made to characterize the proteome signature of colostrum and mature milk of Ladakhi cows from high altitude and Sahiwal cows from low altitude in a comprehensive manner using high-resolution mass spectrometry-based quantitative proteomics nano-scale LC-MS/Q-TOF technique. Ladakhi cattle is a genetically unique population of Leh-Ladakh and constantly exposed to the hypobaric hypoxia environment prevalent at high altitude. These animals are an integral component of livelihood for the native population of Ladakh, especially as a major milk and protein source. On the other hand, Sahiwal cattle is the most important indigenous breeds of our country, mostly reared for qualitymilk and adapted to hot arid or semi-arid climate. This study has utilized 28 whey protein samples of colostrum (0-day: N = 14) and mature milk (>60 days: N = 14). Each sample was subjected to casein depletion using a series of ultracentrifugation steps in order to increase the chances of identifying minor whey proteins in the data set. The SDS-PAGE profiles demonstrated that the ultracentrifugation method yielded better protein separation and resolution compared to the acid precipitation method. SDS- PAGE- showing band pattern of colostrum, transition and mature milk samples of Ladakhi and Sahiwal cows. Three independent search engines, Comet, Tandem, and Mascot-based analysis, resulted in the discovery of over 6000 and 5610 spectra in milk samples of Ladakhi and Sahiwal cows, respectively. The filtering of spectra at 0.05 probability error and at 1% FDR resulted in identification of 3068 and 3757 peptides in colostrum and mature milk of Ladakhi cows. While a total of 3137 and 3577 peptides could be identified in colostrum and mature milk of Sahiwalcows. The identified proteins were subjected to quantification using MS2-based Normalised Spectral Index by implementing the St. Peter algorithm of TPP software, resulting in the identification of 815 and 911 proteins in the colostrum and mature milk samples of Ladakhi and Sahiwal cows. Comparative profile of most abundant proteins in colostrum (0-day) and mature (50-60 days) milk of Ladakhi and Sahiwal cows. The Principal Component Analysis showed significant differences in proteomic patterns between colostrum and mature milk from both the breeds. The PCA score plot illustrated a clear differentiation between colostrum (0-day) and mature (50-60 days) milk samples of Ladakhi cows, primarilyalong PC1 and PC2 axes. Together, PC1 and PC2 encapsulated 47.6% of the whey protein variance in the Ladakhi cow proteome, while subsequent PC2 contributed only 14.8% of the variation. Some of the most abundant proteins in colostrum vis-à-vis mature milk of Ladakhi cows (with a fold change > 2) were Clusterin (4.14), Alpha-1-acid glycoprotein (3.89), Alpha-1B-glycoprotein (3.57), DNA polymerase delta catalytic subunit Serotransferrin (2.90), and Alpha-2-macroglobulin (2.68). On the other hand, some of

the proteins enriched in mature milk were: alpha-lactalbumin (1.55), albumin (1.11), glycosylation-dependent cell adhesion molecule 1 (1.03), and beta-lactoglobulin (0.744). In colostrum of Sahiwal cows, some of the proteins present in high abundance were; Alpha-S1-casein (26.38), Serotransferrin (9.29), Cathelicidin-1 (7.38), Serum amyloid A-3 protein (6.62), Alpha-1B-glycoprotein (6.40), and Vitamin D-binding protein (4.05), whereas Alpha-lactalbumin (94.4), Albumin (20.10), and Glycosylation-dependent cell adhesion molecule 1 (53.62) were present in high abundance in mature milk. The classification of various proteins identified in the LC-MS data set ofcolostrum and mature milk is shown in figure.

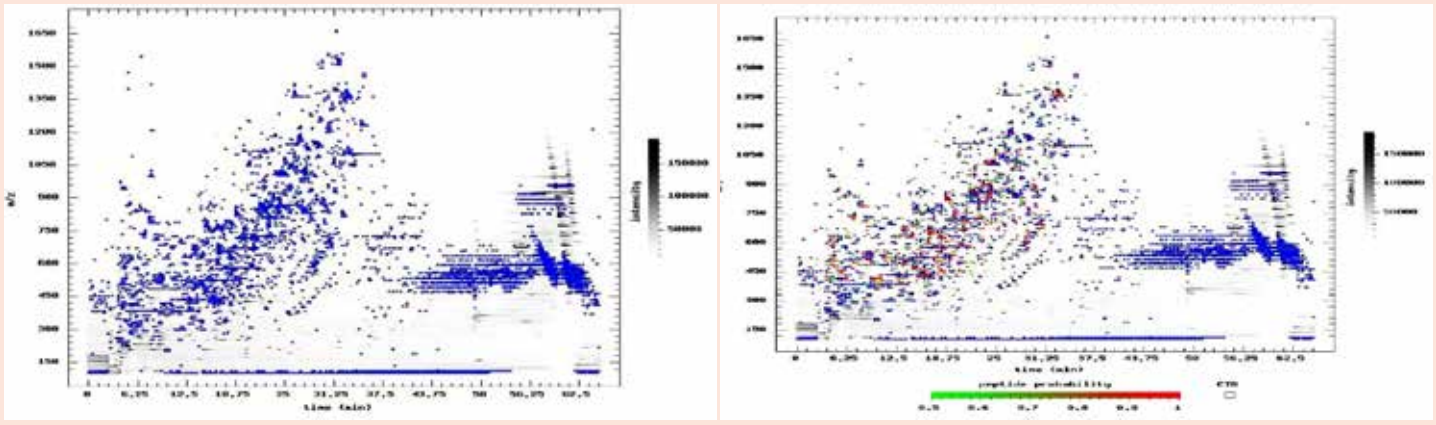


SDS-PAGE: Whey protein extraction using Acid precipitation and Ultracentrifugationmethod. 0C (0-day colostrum),0W (0-day whey protein), 2W (2-day whey), 4W (4-day whey),MMW (Mature milk whey) and P (protein ladder).

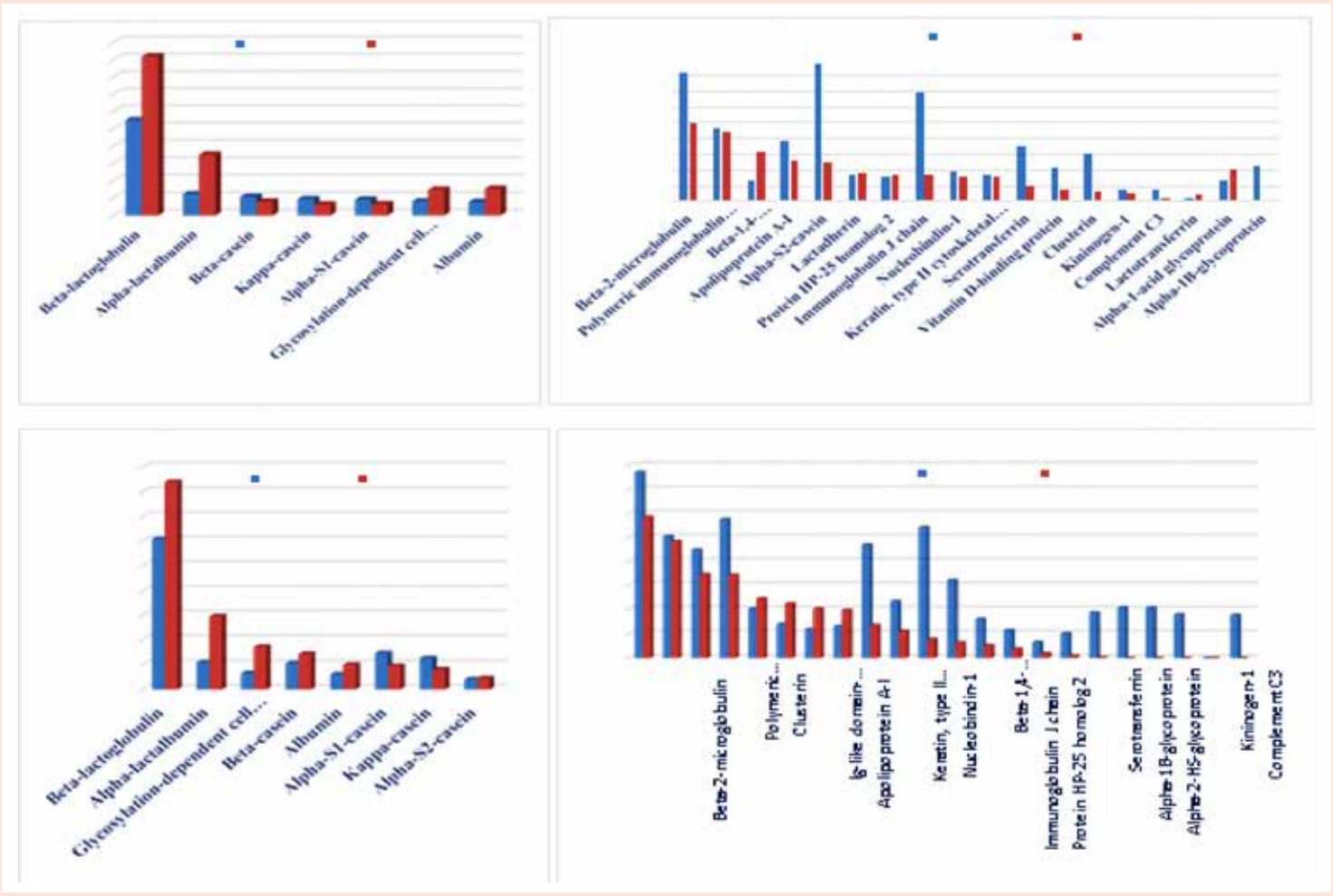


SDS- PAGE- showing band pattern of colostrum, transition and mature milk samples.

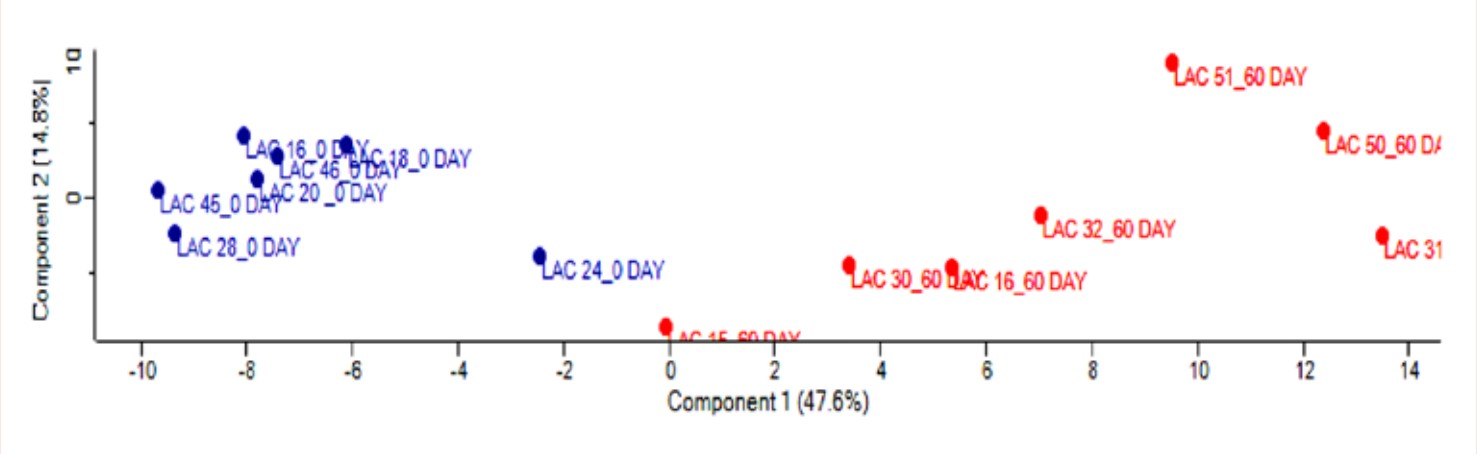
(A) Ladakhi cows = C:(0-day colostrum), 1-5: (0-day whey) and L: (Protein ladder) ;(B)Sahiwal cows=C:(0-day colostrum) and 2-6: (0-day whey); (C) Ladakhi cows= 1-6 (4-day), L= (Protein ladder) and 7-9 (Mature Milk); (D) Sahiwal cows= 1-6 (4-day), L= (Protein ladder)and 7-9 (Mature Milk).



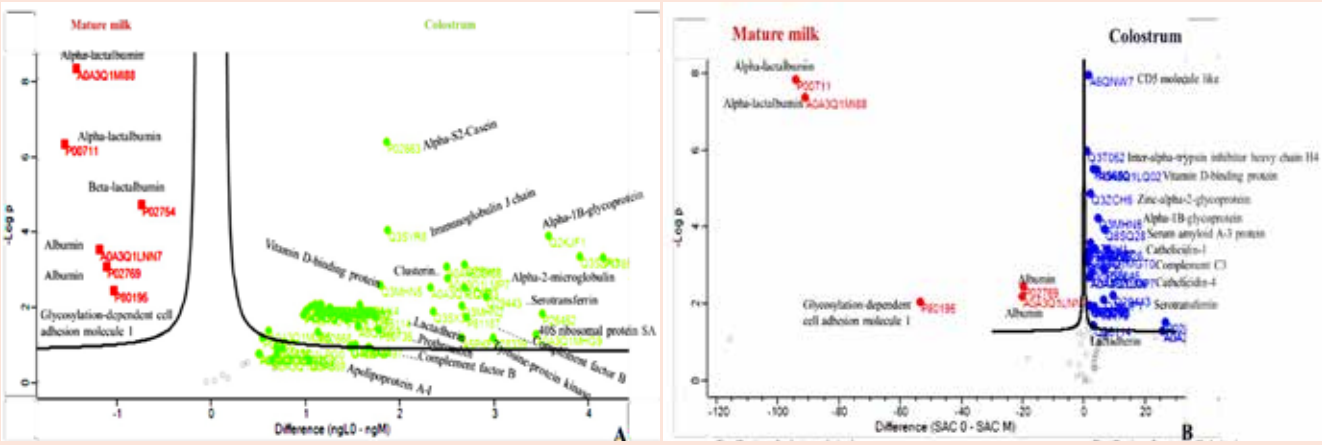
Peptide score plot from LC-MS data of Ladakhi cow colostrum and milk samples



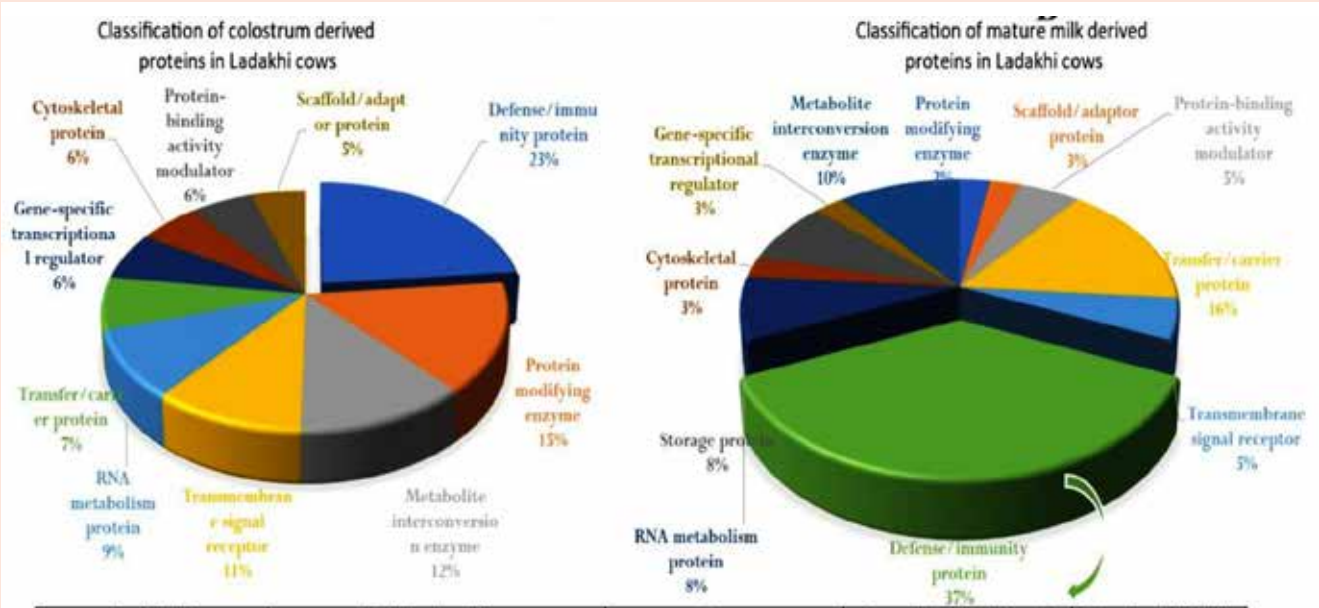
Comparative profile of most abundant proteins in colostrum (0-day) and mature (50-60days) milk of Ladakhi and Sahiwal cows. Where, X-Axis showed the concentration (ng/µl) andY-Axis represent the particular proteins.



The PCA plot derived from the analysis of LC-MS/MS spectra of Ladakhi cows milkproteome shows discrimination among colostrum (0-day) and mature (50-60 day) milk.



Differentially expressed proteins (DEPs):(A) DEPs in Ladakhi colostrum vs. maturemilk (B) DEPs in Sahiwal colostrum vs. mature milk.



Protein ID	Protein description	Gene	Conc. (ng/ul) (Colostrum)	Conc. (ng/ul) (Milk)
Q2KJF1	Alpha-1B-glycoprotein	A1BG	4.589	-
Q3SYR8	Immunoglobulin J chain	JCHAIN	13.92	3.39
P81265	Polymeric immunoglobulin receptor	PIGR	9.28	8.86
P01888	Beta-2-microglobulin	B2M	16.40	10.07
Q3MHN2	Complement component C9	C9	0.662	-
A0A3Q1NLL2	Ig-like domain-containing protein	LOC788175	29.02	7.5
E1BCC8	HERV-H LTR-associating 2	HHLA2	0.45	-
E1BNF9	SLAM family member 9	SLAMF9	5.07	0

Classification of identified proteins from LC-MS data of Ladakhi cow colostrum andmilk

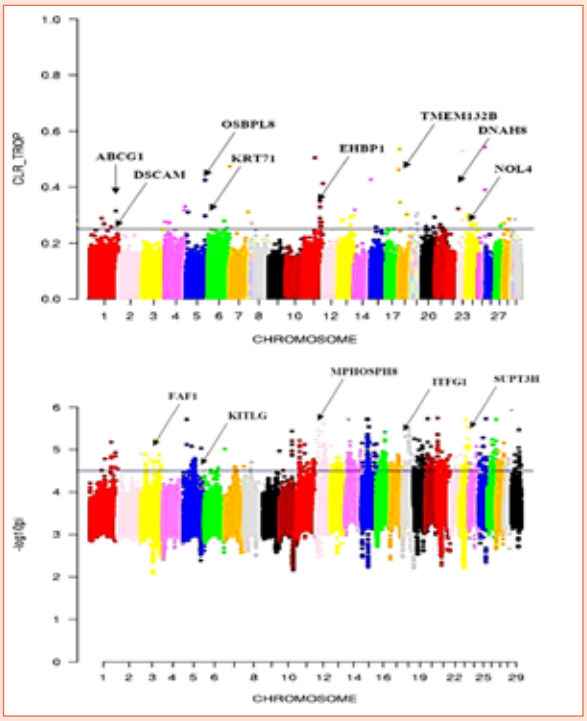
Genomic Insights into Adaptation and Productivity in Indian Goats

This study extensively investigates genetic diversity, population structures, and the identification of potential genes and pathways associated with goat breeds adapted to India's tropical and temperate ecosystems. Employing Illumina NOVASEQ 6000 platform with 150 bp paired-end chemistry, the sequencing of 55 goat samples was carried out, representing four Indian goat breeds from the tropical ecosystem (Beetal, Sirohi, Osmanabadi, Jamunapari) and three from the temperate ecosystem (Chegu, Chagthangi, Gaddi). The analysis revealed a comprehensive set of 40.02 million SNPs and 6.5 million INDELs across all samples, with

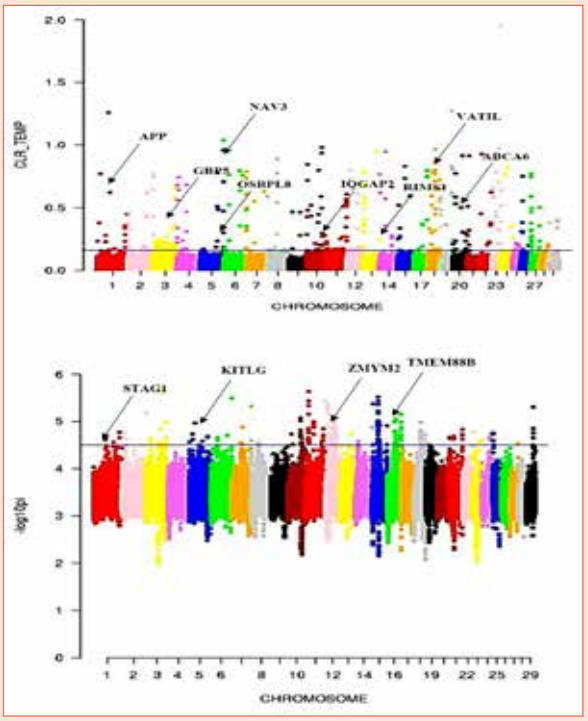
specific distinctions in SNP counts between the tropical (33.2 million SNPs) and temperate (30.1 million SNPs) groups. Assessing population genetic parameters, including LD decay and the genomic inbreeding coefficient (FROH), indicated lower inbreeding levels and a faster LD decay in the Changthangi breed. Principal Component Analysis (PCA) underscored increased diversity in the Changthangi and Kanni Adu breeds, distinguishing them notably from other breeds in the study. Prominent candidate genes under selection were identified and found to be associated with various traits, including hair/fiber qualities and adaptive traits (FGF5, FGF9, KRT71, TCF7L1, IGFBP7), cold adaptation (NOS2, DNAJC3, DNAJC28), body weight gain and feed efficiency (LCORL, HINT2, CYBR5R4, ZC2HC1B, CSMD3, XKR4), stress responses (NMNAT2, GABRB2), and heat tolerance (DNAJC6, DNAJB14), among others. Enriched KEGG pathways associated with hair follicle growth, morphogenesis, Ras Signaling, MAPK Signaling, and Focal Adhesion were highlighted. The study further indicated selection signatures in the HIF-1 signaling pathway, suggesting goats' adaptability to high-altitude hypoxic environments. Unique selective signals were observed in goat breeds from both tropical and temperate ecosystems. In conclusion, this study provides valuable insights into the genetic diversity and selection patterns of Indian goat breeds across diverse ecosystems, advocating for the use of a high-density SNP array for precise genetic profiling in selection processes.

Transcriptome analysis of buffalo sperm cells under heat stress

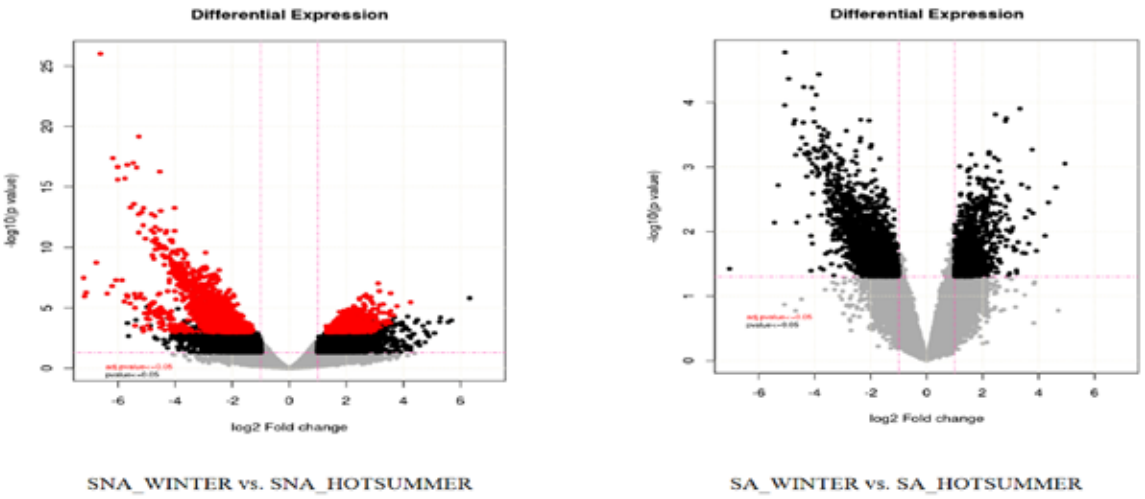
Impact of heat stress on variation in sperm cell transcripts during the hot summer season in Murrah buffalo breeding bulls, has been analysed. Bulls available at ABRC, NDRI Karnal and CIRB, Hisar, were classified in to seasonally affected (SA) and seasonally non-affected (SNA) categories on the basis of sperm viability, acrosomal integrity (AI), and HOST (hypo-osmotic swelling test), PM% (total progressive motility percentage), TM% (total motility percentage), RM% (rapid motility), exhibiting significant variations across seasons (winter, comfort, hot summer, and hot humid).



Manhattan plots of CLR and θπ showing results of selection signatures in temperate goat breeds

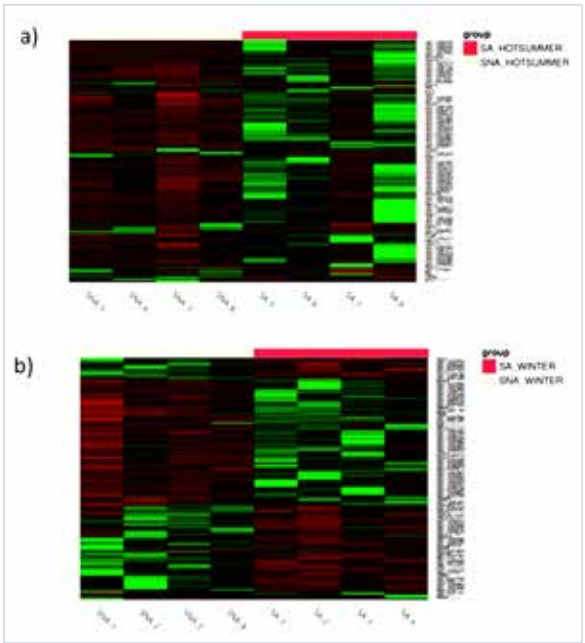


Manhattan plots of CLR and θπ showing results of selection signatures in tropical goat breeds



Volcano plot showing differential expression profile of transcripts. Black indicates log2 fold change≥1 and p value≤0.05. "Red" dots indicate absolute log2 fold change≥1 and FDR/adjusted p value≤0.05.

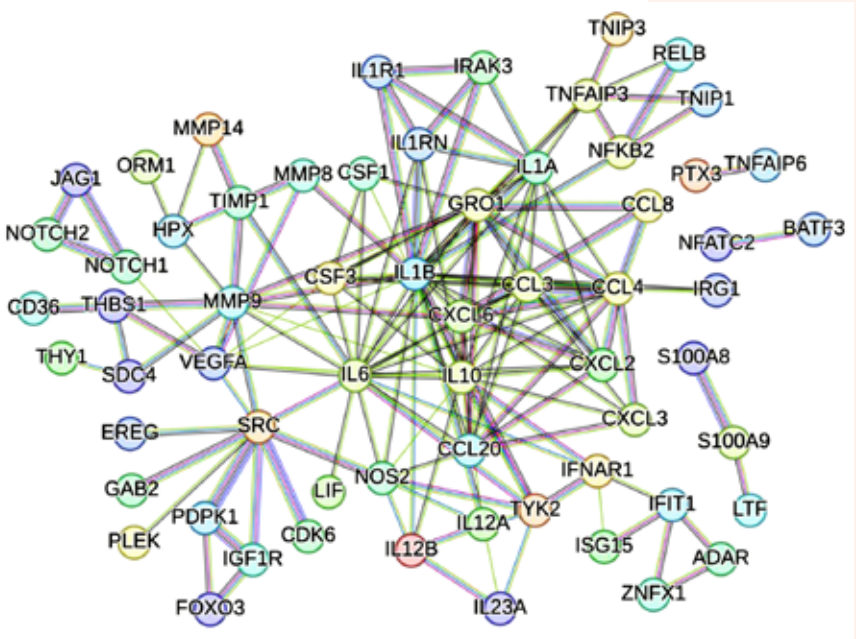
To evaluate the complete effect of heat stress on whole transcriptome of spermatozoa in two groups, RNA sequencing was done on the samples collected during summer and winter. All the samples were having RIN values below 3.4, lower RIN values characteristic of sperm RNA. The sequences were aligned with the *Bubalus bubalis* UOA_WB_1 genome assembly using STAR aligner and StringTie assembler. On an average 87.39% of the reads aligned onto the reference genome. The total 60649 protein coding transcripts were identified. The transcripts with padj/FDR corrected p-value ≤ 0.05 were found only in SNA_WINTER vs SNA_HOTSUMMER group, identifying 364 genes to be differentially expressed- 3 down-regulated and 361 up-regulated genes in hot summer as compared to winter. The functional enrichment of these genes revealed being related to the developmental process and DNA compaction, motility, mitochondrial oxidative phosphorylation, molecular chaperons, chromatin binding protein, DNA replication, recombination, and repair. The findings of the transcriptome study in Murrah bull spermatozoa indicate possible role of mitochondrial adaptive gene expression in coping heat stress. Overall in the list of the differentially expressed genes, several functionally unclassified, novel transcripts were also identified, which need to be investigated further. Comparison of hot summer SA and SNA groups, based on significant difference in FPKM values, identified genes associated with inflammation, protease inhibitors, mitochondrial ribosomal protein being upregulated in SA group during hot summer. The study has been able to identify the transcripts potentially associated with variable semen quality during heat stress in Murrah breeding bulls.



Expression profile of the significant differentially expressed transcripts across the samples. The heat map generated by calculating a z-score for each row from the normalized FPKM values of the samples comparison, a) SA hot-summer vs SNA hot-summer, b) SA winter vs SNA winter.

Transcriptomics Analysis of Host Response to Bovine Anaplasmosis

Among various tick-borne diseases, anaplasmosis caused by *Anaplasma marginale* is considered to be the most widespread and economically draining disease of cattle worldwide. It is regarded as one of the top ten economically important diseases affecting ruminants in India. The host genetics influences immune responsiveness against diseases and the zebu cattle are less susceptible to ticks and tick-borne diseases than the taurine and crossbred animals. This study investigated the differential gene expression profiles in peripheral blood mononuclear cells (PBMCs) across *A. marginale* naturally infected (N=4) and healthy (N=4) crossbred cows using RNA sequencing. Health status of the animals was determined based on clinical signs, blood smear examination and molecular detection using *A. marginale*-specific primers. The most profusely expressed genes in both groups were associated with the housekeeping roles such as translation. Comparative analysis of the transcript levels between healthy and infected cattle identified 999 differentially expressed genes (DEGs) meeting the criteria of log2 fold change ≥2.0, P <0.05 and FDR <0.05. Among these DEGs, 676 were up-regulated and 323 were down-regulated in the infected animals as compared to the healthy ones. The significantly enriched KEGG pathways in the diseased dataset were primarily associated with immune system processes such as cytokine-cytokine receptor interaction and many signaling pathways involving chemokines, IL17, TNF, MAPK, and PI3K-Akt. Intriguingly, many genes related to parasitic diseases such as amoebiasis, trypanosomiasis, toxoplasmosis, and leishmaniasis were up-regulated in the *A. marginale* infected group. These include CXCL8, IL10, IL12A, IL12B, IL1B, IL6, JAK2, LAMA5, MAPK13, NFKB1, and NOS2. Ingenuity Pathway Analysis (IPA) identified the role of cytokines in mediating communication between immune cells as one of the most significant pathways in the infected animals. The differentially expressed genes and pathways identified in this study represent important candidates for further investigation into host's response to the pathogenic perturbation.



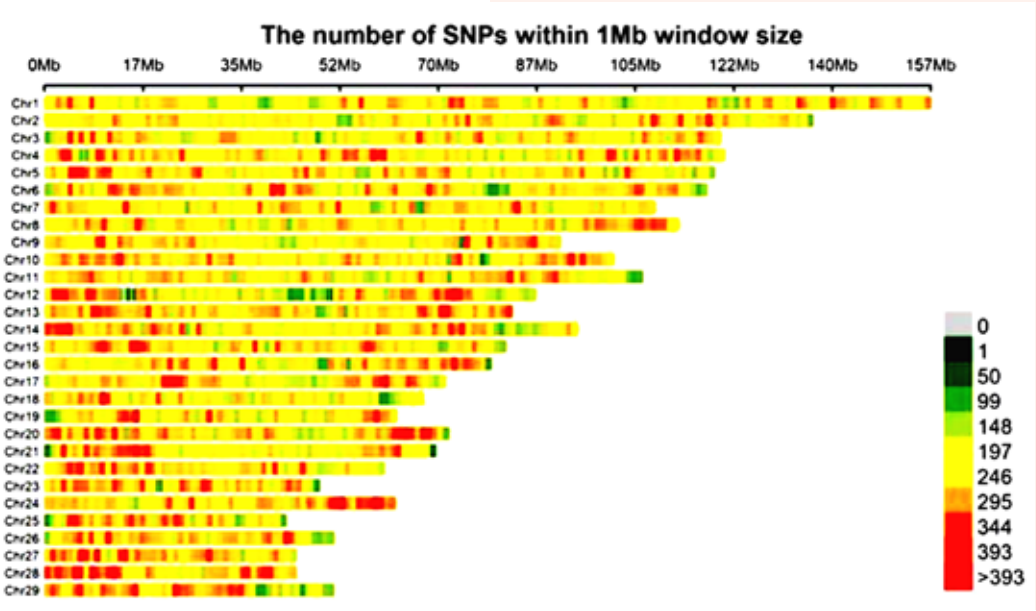
Interaction network of up-regulated immunity related genes in the infected animals (https://string-db.org). Nodes represent proteins and edges represent protein-protein associations.

Design and validation of high-density SNP array of goats

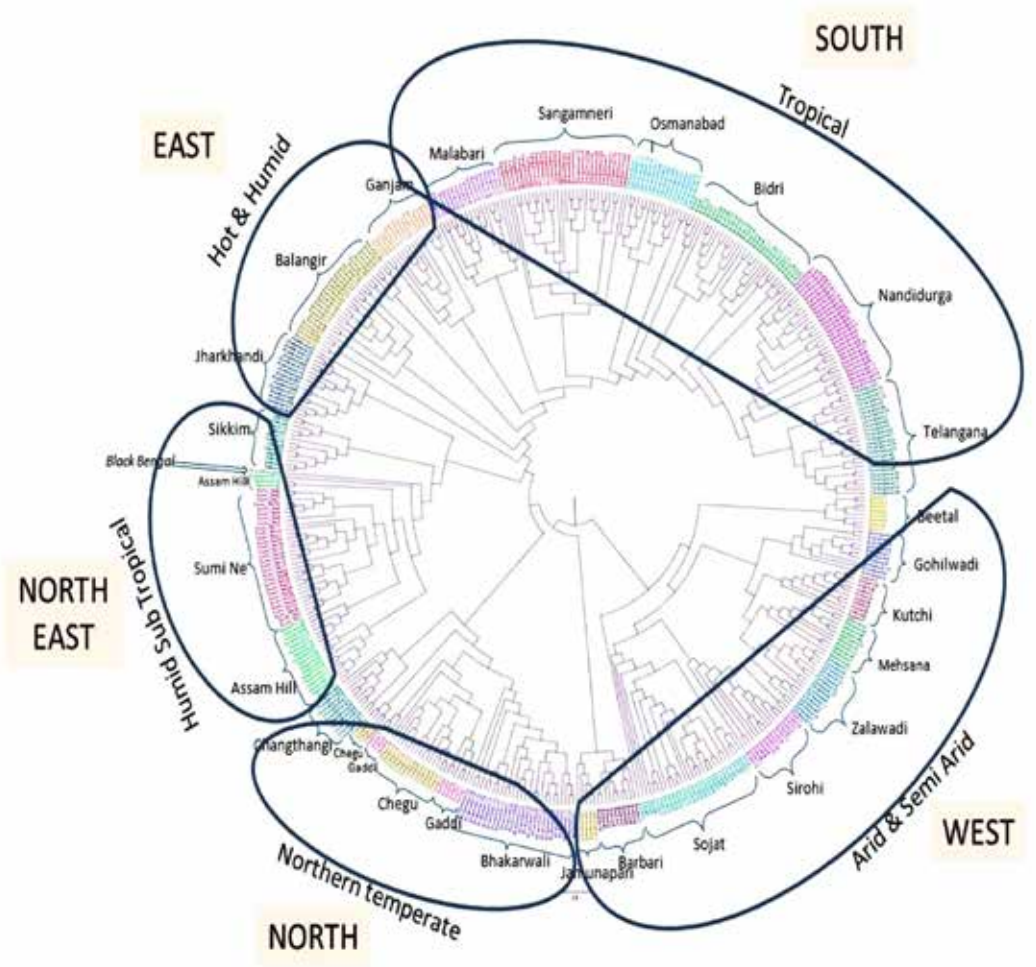
Goats are one of the main sources of animal protein in India and chevon is preferred over other animal proteins as it is leaner and has no religious taboo against its consumption. Due to higher rate of economic returns, goats have become species of choice for rearing in intensive and semi-intensive system of production. The increased demand for goat products necessitates their genetic characterization and improvement to augment the production of native breeds. Bi-allelic, genome wide, densely placed single nucleotide polymorphism (SNP) markers are most suitable for this purpose. Therefore, an Axiom-based high-density (HD) SNP chip was designed and validated for indigenous goats. The array was designed using a

panel of 225 samples from 15 diverse goat breeds of India. Unrelated individuals from different flocks were selected from each breed, to represent maximum genetic diversity. This set of 225 samples formed the SNP discovery panel. Wide geographical distribution, utility (meat, fibre, milk or leather quality) and adaptation of the goat breeds were the criteria for selection of breeds for sequencing. Genomic DNA was isolated from blood samples using phenol chloroform extraction method.

Whole genome sequencing (WGS) libraries were generated using commercially available sample preparation kit. Paired-end (PE, 2x151 bp) sequencing of the samples was performed on Novaseq 6000. Quality of the generated data was assessed using FastQC (version 0.11.8). Clean reads with a Phred score of 30 (Q30) or above were used for further analysis. The processed reads were aligned to the *Capra*



The density of distribution of SNPs along the length of 29 caprine autosomes



Neighbour joining phylogenetic tree representing clustering of 443 goats using the HD SNP Array

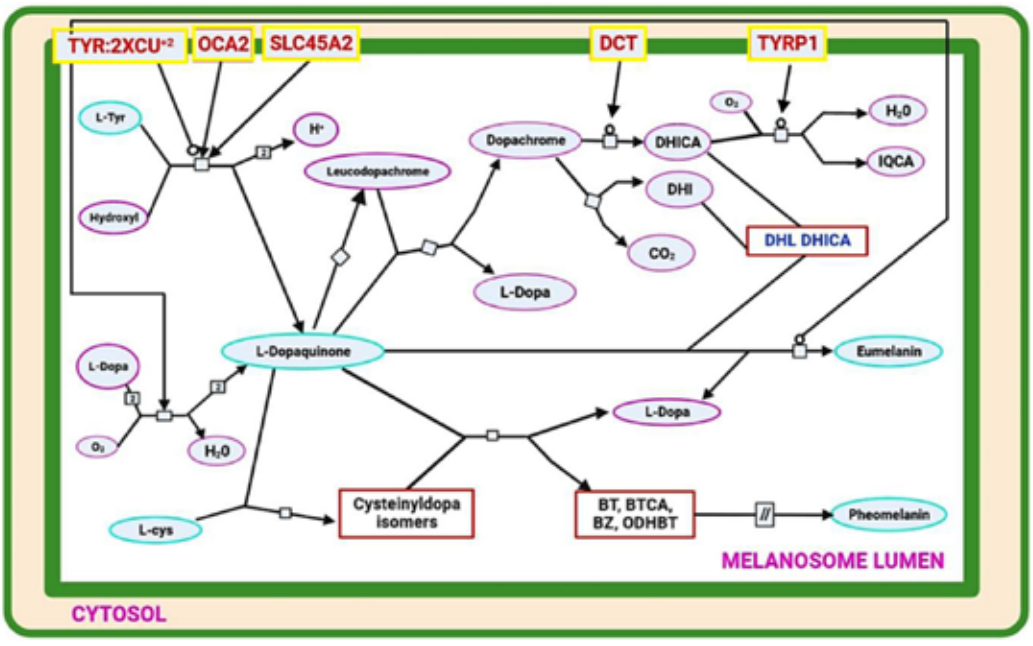
hircus reference genome downloaded from the public database of Ensembl (*Capra hircus:*ftp://ftp.ensembl.org/pub/release-101/fasta/capra_hircus/dna/). In total, more than 38 million high quality SNPs were subjected to stringent filtering and 626,975 SNPs were finally tiled on the array. The average coverage of SNPs in our chip is one SNP per four kilobase (kb), providing a denser coverage of the goat genome than previously available arrays.

The HD chip (Axiom_Cahi) was validated by genotyping 443 samples from 26 indigenous goat breeds/populations. The results revealed 95.83% markers to be highly informative and polymorphic in Indian goats. Multivariate analysis indicated population structuring, as 15 breeds could be segregated using the designed array. The genotyped data generated from the designed SNP array was further used to infer the genetic relationship between the Indian goat breeds/populations. A Neighbour joining phylogenetic tree based on isolation by distance (IBD) was constructed for all the 443 samples to better visualize their relationships. Goat populations from similar agro-ecological areas were shown to be closely related. Phylogenetic analysis suggested stratification of breeds by geographic proximity.

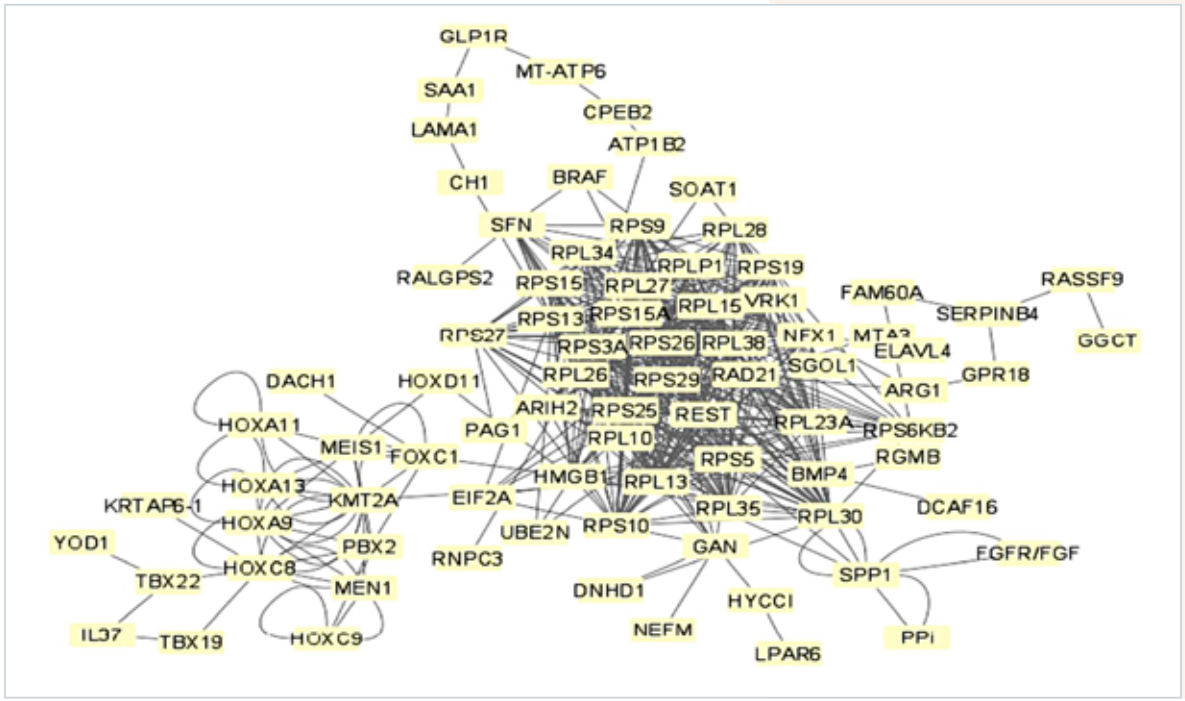
The array exhibits high genotyping accuracy as the selected SNPs were able to discriminate a large number of highly diverse goat breeds/populations. This chip holds promise in detecting genomic regions associated with phenotype traits of economic interest as well as in breeding applications. This HD SNP chip for goats is a valuable resource for genomic selection, genome wide association as well as population genetic studies in goats.

Transcriptomic insights into fiber quality, coat color and adaptation in Changthangi and Muzzafarnagri sheep

Changthangi sheep, inhabiting the high-altitude regions of Ladakh, are renowned for their exquisite fiber production and are characterized by grey skin with coats ranging in color from black to white. In contrast, Muzzafarnagri sheep from the plains of Uttar Pradesh produce coarse wool and feature white skin and coats. To delve into the genetic disparities contributing to these distinctive traits, a comparative global gene expression profiling was executed on four biological replicates of skin from each breed. The analysis revealed 149 up-regulated genes and 2,139 down-regulated genes in Changthangi sheep compared to Muzzafarnagri sheep, with a p-adjusted value (padj) of ≤0.05 and

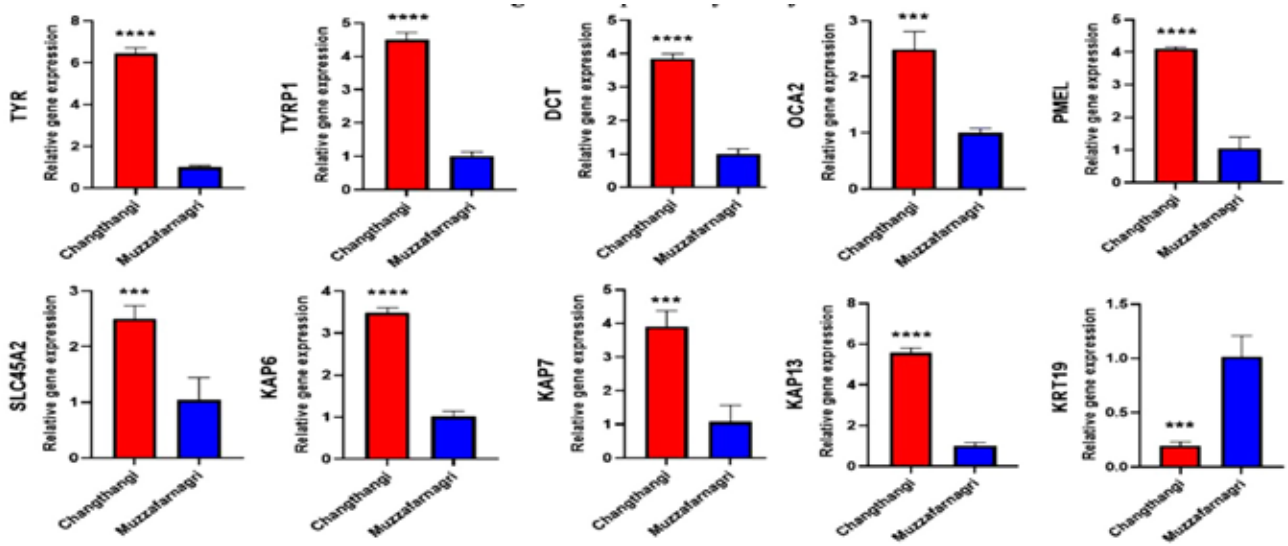


Melanin biosynthesis pathway revealing enrichment of up-regulated genes in Changthangi sheep skin (Adapted from Reactome pathway database). Genes shown in rectangles with yellow boundaries showed significantly higher expression in the Changthangi sheep.



Interaction network of the highly connected up-regulated genes in Changthangi sheep constructed using CPDP pathway analysis

a $\log_2$ fold change of ≥1.5. Gene Ontology analysis of the up-regulated genes uncovered an enrichment of terms associated with melanin biosynthesis and developmental pigmentation. Furthermore, enriched KEGG pathways included tyrosine metabolism and metabolic pathways. Among the up-regulated melanogenesis-related genes in Changthangi sheep were *TYR, TYRP1, DCT, SLC45A2, PMEL, MLANA* and *OCA2,* reaffirming the pivotal role of melanin in both the animals' black coat color and UV protection at high altitudes. Notably, there was a more pronounced expression of genes related to fiber quality, including *KRTAP6, KRTAP7, KRTAP13* and *KRTAP2*, in the fine wool-producing sheep from Ladakh. To validate these findings, real-time PCR was conducted on 10 genes governing fiber quality and coat color, with *ACTB* and *PPIB* serving as reference genes. The comprehensive skin transcriptome analysis of Changthangi and Muzzafarnagri sheep therefore, elucidates the genetic distinctions contributing to their diverse phenotypic traits and environmental adaptability, providing invaluable insights into the underlying mechanisms influencing these characteristics.



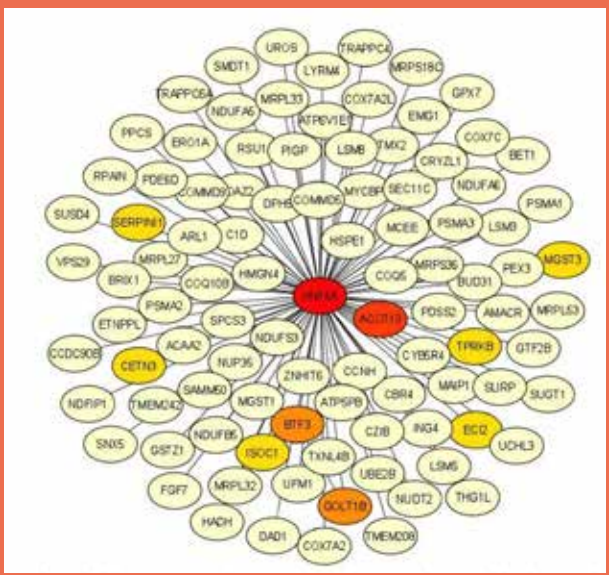
*Validation of DEGs between Changthangi and Muzzafarnagri sheep by qRT-PCR (p value: *** <0.001, and **** <0.0001).*

Comparative genomic analysis of Indian chicken breeds

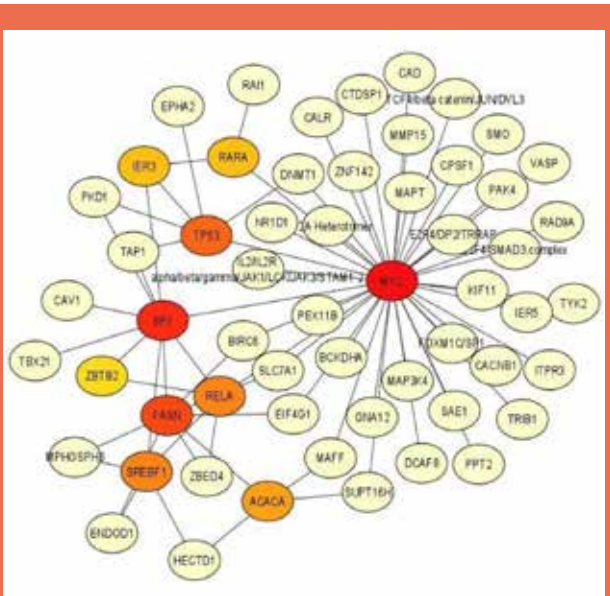
Free-range poultry production systems are recognized for yielding high-quality products and promoting enhanced animal welfare. The 19 diverse chicken breeds native to India have naturally evolved within free-range systems, displaying adaptation to various agro-climatic conditions. To unlock the genomic intricacies associated with production traits and adaptation, a comprehensive exploration of indigenous germplasm was undertaken using modern genomic tools. For this purpose the transcriptome profiling of breast tissue from two indigenous backyard poultry breeds of India – Ankaleshwar, a mainland breed, and Nicobari, a breed adapted to islands was conducted. The sequencing data underwent rigorous quality checks using FASTQC, and processed reads were aligned to the reference genome (bGalGal1), exhibiting over 94% mapping efficiency for all samples. A total of 12,790 transcripts were found to be common across both breeds, with 657 expressed exclusively in Ankaleshwar and 169 in Nicobari. The predominant genes expressed across both groups were primarily associated with muscle structure, contraction, and energy metabolism. Ankaleshwar, in particular, showcased highly expressed genes involved in fatty acid catabolism and oxidative stress mitigation. In Nicobari, functional terms, pathways, and hub genes were identified that participated in muscle fiber growth, adipogenesis, and fatty acid anabolism. The qRT-PCR results validated the RNA-seq findings. This wealth of molecular information serves as a valuable resource, advancing our understanding of the genetic foundations governing adaptation, meat quality, and egg production in indigenous backyard chicken breeds.

Exploration of Energy-Generating Metabolic Pathways in Aseel Chickens of India

A comprehensive comparative analysis of the skeletal muscle transcriptome was conducted on four biological replicates each of Aseel, a fighter-type breed and Punjab Brown, a meat-type breed in India. In both breeds, the highly expressed genes were closely linked to muscle contraction and motor activity. Differential expression analysis revealed 961 up-regulated and 979 down-regulated genes in Aseel, with a $\log_2$ fold



Highly connected up-regulated genes in Ankaleshwar chicken. Colour intensity of the top 10 genes changes from orange to red withincreasing order of rank

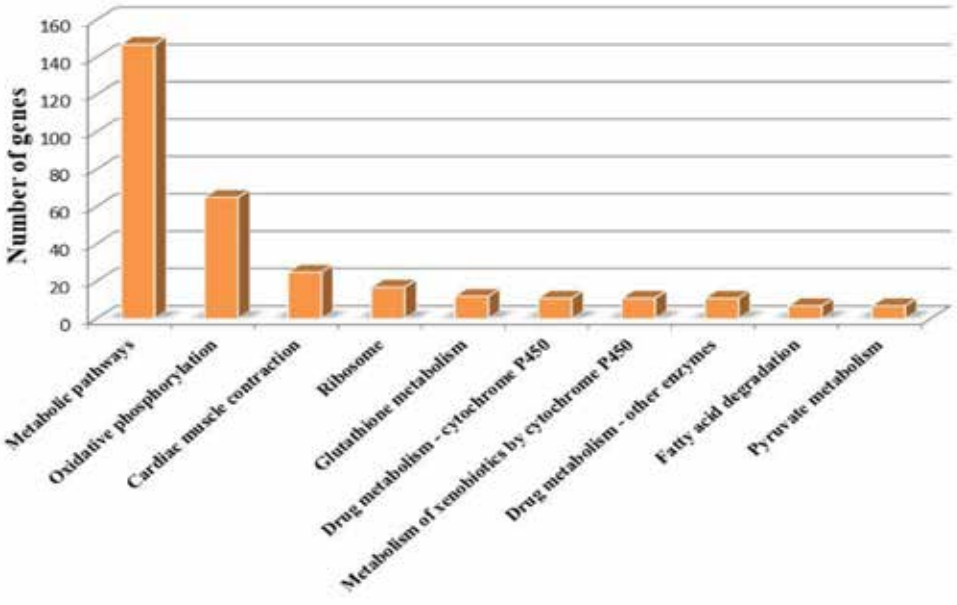


Highly connected down-regulated genes in Ankaleshwar chicken. Colour intensity of the top 10 genes changes from orange to red with increasing order of rank.

change threshold of ±2.0 (padj<0.05). In Aseel game cocks, significantly enriched KEGG pathways included metabolic pathways and oxidative phosphorylation (OXPHOS). Genes associated with fatty acid beta-oxidation, ATP formation by chemi-osmotic coupling, response to oxidative stress and muscle contraction showed higher expression. Gene network analysis identified highly connected hub genes such as *HNF4A, APOA2, APOB, APOC3, AMBP* and *ACOT13*, primarily associated with energy-generating metabolic pathways. On the other hand, the up-regulated genes in Punjab Brown chickens were related to muscle growth and differentiation. Enriched pathways in these birds included focal adhesion, insulin signaling pathway and ECM receptor interaction. The results point to the enrichment of OXPHOS system, which is majorly responsible for cellular ATP production in the Aseel gamecocks. These findings contribute to an enhanced understanding of the molecular mechanisms associated with the fighting ability in Aseel and muscle growth in Punjab Brown chicken. The identification of key genes and pathways provides valuable insights into the unique characteristics of these breeds.

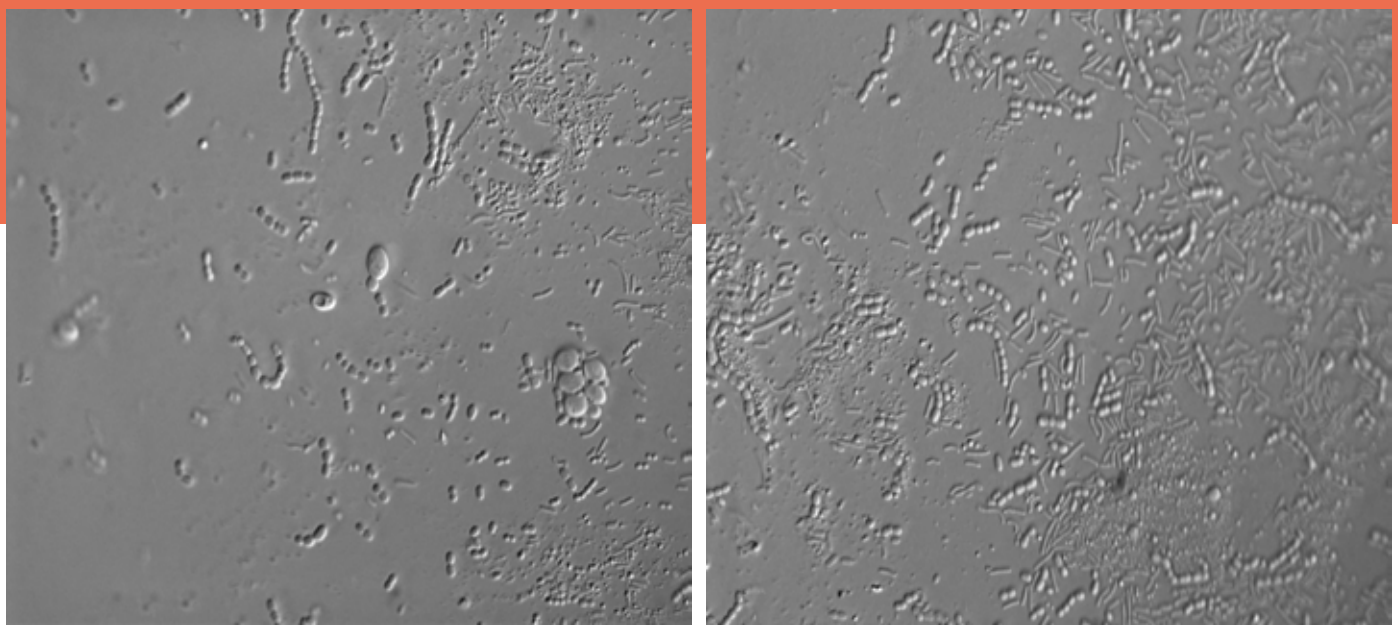
Characterization of Chilika Buffalo curd

Curd samples were collected from pure Chilika buffaloes from surrounding villages of Chilika lake of Odisha. Traditionally set in bamboo containers, The curd samples were collected in three sets: 1-day-old, 3-day-old, and 7-day-old, which were kept at room temperature. Interestingly, the curd from Chilika buffalo milk remained stable without deterioration for seven days at room temperature. Bacterial diversity was assessed by isolating lactic acid bacteria and yeast strains on MRS and M17 agar media. A standardized protocol for DNA isolation from the curd samples was followed, and the quality and integrity of the extracted DNA were verified using agarose gel electrophoresis. PCR was optimized for amplification and characterization of the 16S rRNA gene, followed by Sanger sequencing for identification. The bacterial diversity analysis of Chilika buffalo curd demonstrated a high microbial diversity. The sequencing analysis revealed the presence of various bacterial species, including Lacticaseibacillus rhamnosus, *Lactobacillus paracasei*, *Lactobacillus casei, Lentilactobacillus farraginis, Lactobacillus delbrueckii, Lactobacillus fermentum,* and *Limosilactobacillus fermentum*. Metabolite composition in Chilika and



Significantly enriched KEGG pathways for the up-regulated genes in Aseel chicken

Chilika Grade curd samples was investigated using NMR spectroscopy. Methanol extraction was used for extracting metabolites from the curd samples. NMR data acquisition, processing, visualization, and analysis were performed using Topspin software. Chenomx software was then utilized to identify and quantify metabolites present in the NMR spectra. The analysis revealed a rich abundance of various metabolites such as lactate, lactose, glucose, galactose, threonine, Guanidoacetate, glycine, citrate, and acetate.



DIC microscopy images of Chilika curd showing high microbial biodiversity

Chilika curd in traditional bamboo container

Identification of deleterious mutations in Murrah buffalo

Deleterious DNA mutations within functional regions of genes can exert adverse effects on an organism's overall fitness. For the identification of deleterious nsSNPs, the use of high throughput sequencing technology and related computational algorithms has become more crucial, specifically in Indian dairy animals due to absence of genetic disease records or *in vivo* trials. The present study was aimed towards identifying deleterious non-synonymous SNPs (nsSNPs) within the Murrah buffalo population; and investigating the potential association between the level of inbreeding within the population and the accumulation of these deleterious mutations. ddRAD sequence data of 96 Murrah buffaloes were analyzed *in silico* for the identification of deleterious nsSNPs. Following the initial quality control measures and the removal of low-quality reads, a dataset consisting of 855,563 SNPs was obtained. Among these SNPs, a subset of 4,742 variants were identified as non-synonymous utilizing the SnpEff tool. Using the VEP (Variant Effect Predictor) tool, a total of 980 missense variants were identified as deleterious based on the SIFT score. Out of these, further analysis using various prediction tools such as PANTHER, Predict SNP, MAPP, PolyPhen-1, PolyPhen-2 SNAP, and PhD-SNP revealed that 47 missense SNPs were commonly predicted as deleterious across all of these tools. Among these, only 24 SNPs were finally predicted to be deleterious based on their frequency in buffalo population and were selected for further analysis, to understand any association between the penetrance of these deleterious nsSNPs and inbreeding level of the population. Genomic inbreeding of individual animal was calculated based on runs of homozygosity (F_{ROH}) using a dataset consisting of 441,054 SNPs. A total of 1,284 runs of homozygosity (ROH) segments were detected using PLINK v1.9 software, with an average of 29.86 ROH segments per animal. The prevalence of relatively small-sized runs of homozygosity (ROH) segments, measuring less than 2 megabases (Mb), indicated the ancient inbreeding within the population. In order to evaluate the relationship between genomic inbreeding and nsSNPs, the initial population of 96 Murrah buffaloes was divided into specific groups in three ways. Initially, a division was made into two groups, consisting of 48 animals each, based on their level of inbreeding (low or high), followed by dividing the animals into low, intermediate, and high inbred groups, consisting of 36 individuals each. Lastly, the extreme ends of the spectrum were represented by 15 animals each, categorized as low inbred and high inbred. Subsequently, the allelic frequencies of these distinct groups were computed for analysis. Statistical analysis using Chi-square-based tests revealed difference between the observed and expected genotype frequencies for the genotyped nsSNPs and genomic inbreeding, indicating that the occurrence of these nsSNPs may be associated with the inbreeding level of the population. In conclusion, The study predicted 24 deleterious SNPs in Murrah *(Bubalus bubalis)* buffalo based on genome-wide in silico analysis. Further, their occurrences may be associated by genomic inbreeding. Identified deleterious DNA mutations may be validated for their deleterious effects through cohort studies as well as physiological and/or biochemical downstream analysis in Murrah buffaloes.

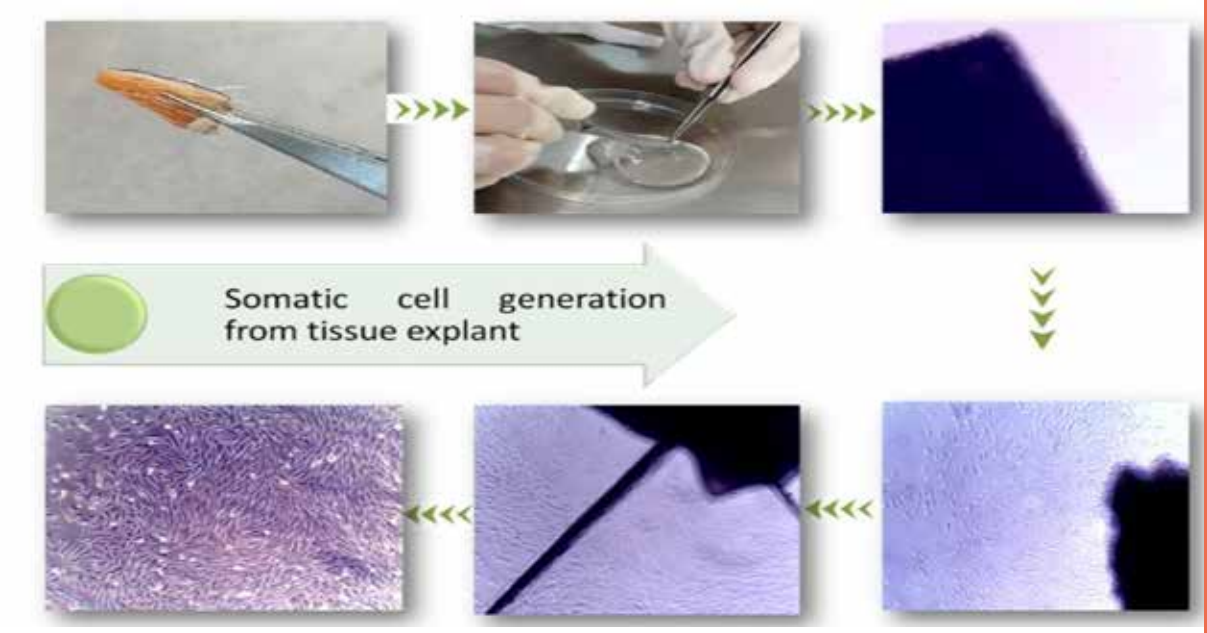
Conservation of Native AnGR

Cryopreservation of germplasm

Preservation of Animal Genetic Resources (AnGR) diversity is of utmost priority for posterity as an effective AnGR management in the country. ICAR-NBAGR has been notified as a Germplasm Repository for safe custody of the genetic material of domesticated animals by the Government of India in 2008 under the Biological Diversity Act. Cryopreservation of germplasm is an important activity under the United Nation's Sustainable Development Goal (SDG) 2 (Zero Hunger). During 2023, the germplasm of a total of 24 breeds was cryopreserved in the form of semen and somatic cells in the National Gene Bank of the Bureau. 18050 semen doses of 9 breeds and 1760 somatic cell vials of 15 breeds were cryopreserved. Under Medium & Long-term conservation of AnGR under (SDG) Indicator 2.5.1, the bureau has cryopreserved the germplasm- Semen of 60 indigenous breeds and 3 other populations, -and Somatic cell of 45 indigenous breeds and 4 other populations have been cryopreserved at the National Gene Bank of the Bureau upto 2023. Further, the Bureau has cryopreserved the germplasm of around 45 percent of indigenous breeds in the country and further committed to cryopreserve the germplasm of all indigenous breeds by 2030. As a special effort, the germplasm of 21 indigenous breeds at risk as per the Breed Watch List were conserved by 2023.

Somatic cell conservation

The somatic cell lines of different breeds across livestock species were generated and cryo-preserved under the Consortium Research Project on Agrobiodiversity (ICAR). Ear tissue samples of male and female animals were used to generate somatic cells using DMEM+10% FBS in a humidified incubator at 37°C and 5% CO_2. Fibroblast cells (1x10^6cells/ml) of the 4th passage that were following the normal sigmoid growth curve and free from any contamination were cryopreserved at -196°C in the LN_2. The inventory is maintained at the National Gene Bank of ICAR- NBAGR, Karnal, India. This year, 15 indigenous breeds belonging to five livestock species (Cattle, sheep, goat, horse, pig) were conserved as somatic cells. Four of these fall under the various risk categories as per the Breed Watch List 2022, ICAR- NBAGR, Karnal. So far, 49 livestock breeds/populations of 10 livestock species (Camel, including double humped- 9, pig- 10, cattle- 8, sheep- 6, goat- 7, horse- 4, donkey- 3, yak- 1, mithun- 1) have been cryopreserved in the ICAR-NBAGR National gene bank. It includes 14 critical/endangered/vulnerable populations (Breed Watch list 2022).

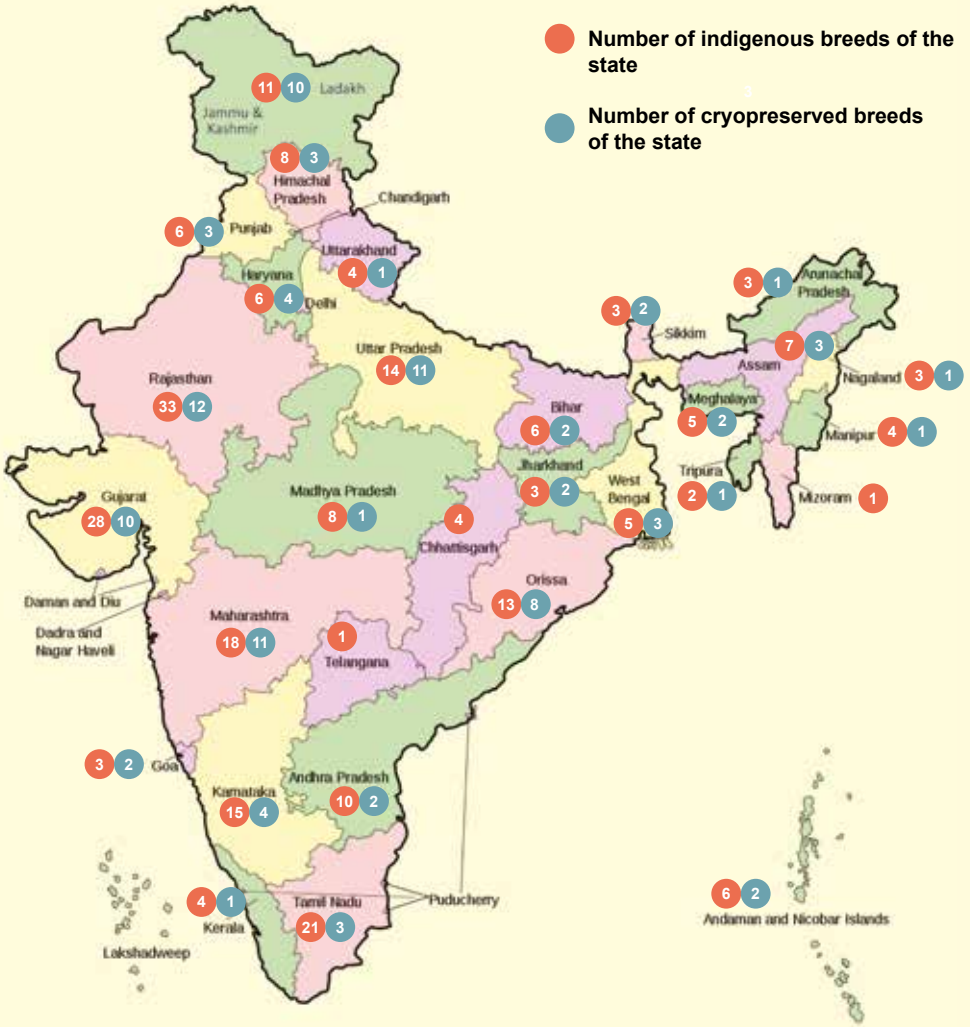


Breed Watchlist

The Breed Watchlist 2022 was prepared for assessing the risk status of indigenous breeds. The risk status was assessed based on population as mentioned in Breed wise Report of Livestock and Poultry (based on 20th Livestock Census) published by Dept. of Animal Husbandry & Dairying (DAHD), MoFAHD, Govt. of India during 2022. Breed Watchlist 2022 book published by ICAR-NBAGR was released by Hon'ble Minister of FAHD, MoS-A&FW, DG-ICAR during ICAR Foundation Day on 16th July, 2023. There are 38 indigenous breeds of different livestock and poultry species are 'at risk'. Among these, 14 breeds are under 'vulnerable', 19

breeds are under 'endangered' and 5 breeds are under 'critical', category; as per Food & Agriculture Organization (2013) guidelines.

Germplasm cryopreservation of indigenous breeds (state-wise)



National Bovine Genomic Center- Indigenous Breeds

Validation of unified genomic snp chips for cattle and buffalo

Cattle and buffalo unified genomic chips were developed by pooling the genomic data from ICAR-National Bureau of Animal Genetic Resources (NBAGR), National Dairy Development Board (NDDB), BAIF Development Research Foundation and National Institute of Animal Biotechnology (NIAB) by following the ICAR guidelines and Data transfer. Both the chips were validated by ICAR-NBAGR, Karnal and NDDB, indepdently.

Validation of Unified Buffalo Genomic Chip

For validation of unified buffalo SNP chip, a total of 384 DNA samples belonging to 11 (Mehsana, Jafarabadi, Murrah, Banni, Nagpuri, Chilika, Nili-Ravi, Bhadawari, Surti, Chhattisgarhi and Pandharpuri) breeds have been processed for SNP genotyping using unified buffalo SNP array chip after pooling the data from NDDB, BAIF and NBAGR. The validation was carried out in August, 2023 and out of the total 384 DNA samples, 18 samples have been failed during the quality control filtering. Breed-wise details of genotyped animals given below:

Sr. No.	Breed	No. of samples processed	Average call rate for passing samples (%)	Best and Recommended (%)
1	Banni	20	99.424	79.898
2	Bhadawari	25	99.687	83.967
3	Chhatishgarhi	31	99.613	80.397
4	Chilika	38	99.676	94.189
5	Jaffarabadi	48	99.565	92.119
6	Mehsana	61	99.676	93.964
7	Murrah	49	99.609	93.661
8	Nagpuri	34	99.713	93.647
9	Nili-Ravi	24	99.527	81.106
10	Pandharpuri	28	99.464	79.854
11	Surti	26	99.619	84.707

During the preliminary analysis, average call rate for passing samples and best recommended markers were found to be 99.736% and 98.484%, respectively. The overall markers metrics summary of genotyped animals is given below:

Conversion Type	Count	Percentage
Poly High Resolution	60328	98.329
MonoHigh Resolution	31	0.0505
Call Rate Below Threshold	322	0.525
OTV	10	0.0163

Further, out of the total markers tiled, 98.33 percent were found to be polymorphic and covered the whole genome. Based on these findings, the unified buffalo SNP chip may be used for genotyping and further studies.

Validation of Unified Cattle Genomic Chip

For validation of unified cattle SNP chip, a total of 384 DNA samples belonging to 12 breeds (Badri, Sahiwal, Gir, Malvi, Motu, Rathi, Kankrej, Umblachery, Hariana, Tharparkar, Siri, Thutho) have been processed for SNP genotyping using unified cattle SNP array after pooling the data from NIAB, Hyderabad, BAIF and ICAR-NBAGR. The validation was carried out during December , 2023.

Table 3 Breed-wise details of genotyped animals, number and percentage of best recommended markers given

Sr. No.	Breed	No. of samples processed	Number of Best and Recommended markers	Best and Recommended (%)
1	Gir	39	65463	98.675
2	Hariana	39	65370	98.535
3	Kankrej	35	65352	98.508
4	Malvi	18	63805	96.176
5	Motu	27	65278	98.396
6	Rathi	35	65360	98.52
7	Sahiwal	47	65811	99.2
8	Siri	23	65315	98.452
9	Tharparkar	46	65722	99.065
10	Thutho	30	65198	98.276
11	Umblachery	26	65371	98.536
12	Badri	19	63629	95.911

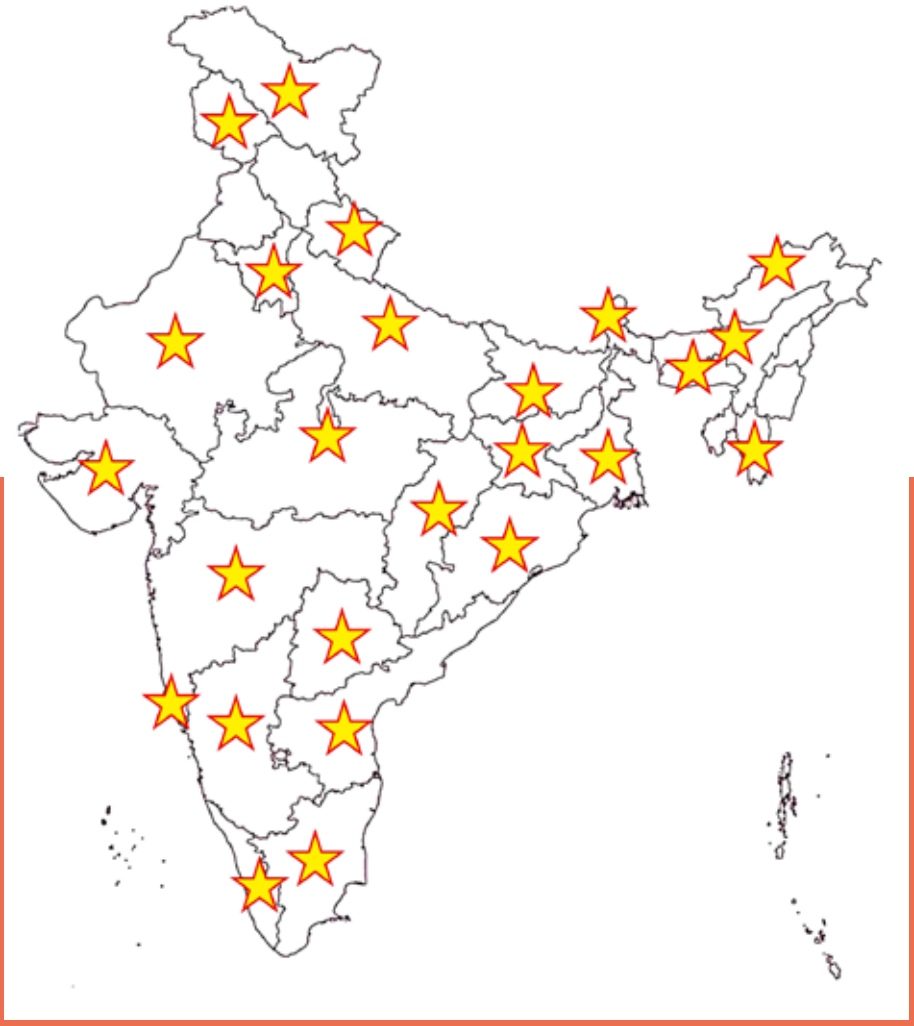
Out of the total 384 DNA samples, 06 samples have been failed during the quality control filtering. During the preliminary analysis, average call rate for passing samples and best and recommended markers were found to be 99.855 and 99.527 percent, respectively. Breed-wise details of genotyped animals, number and percentage of best recommended markers are given in table 3. The Overall markers metrics summary of genotyped animals is given in table 4.

Table 4 Overall markers metrics summary of genotyped animals.

Conversion Type	Count	Percentage
Poly High Resolution	62731	94.557
Mono High Resolution	522	0.787
Call Rate Below Threshold	77	0.116
OTV	1	0.00151

Further, out of the total markers tiled, 94.557 percent were found to be polymorphic and covered the whole genome. Based on these findings, the unified cattle SNP chip may be used for genotyping.

Network Project on Animal Genetic Resources



The project commenced during the VIII plan with a primary goal of characterizing various breeds. Subsequent plans, specifically the IX and X plans, saw the introduction of conservation activities alongside ongoing breed characterization efforts. Notably, genetic characterization initiatives were launched during the IX plan, marked by the establishment of three core labs. In the XI plan, project activities shifted towards buffalo genomics to establish baseline information on the buffalo genome. However, during the XII plan, the project realigned its focus to prioritize the basic mandate of the Bureau. The objectives of the project include: Characterizing breeds in terms of both qualitative and quantitative traits, Conducting molecular genetic characterization and candidate gene studies in indigenous breeds, Developing breed descriptors and conserving the germplasm.

List of Ongoing Centers and Livestock Populations Undertaken for Phenotypic Characterization/Conservation in 2023:

Name of Centre	Name of population under characterization /conservation
NEH	
AHD, Arunachal Pradesh	Monbah cattle and Eki dog.
AHD Sikkim	Conservation of Tibbetan sheep.
ICAR RC for NEH region, Umiam, Meghalaya	Wak Tebi pig.
CVS&AH, Aizawl	Meitei-yen, Shikhar/Ram-ar and Mrui chicken.
Other State	
ICAR-RCER, Patna	Seemanchali sheep, Jharkhandi buffalo, Mala Chicken and Charka Chicken.
MAFSU, Nagpur	Umarda& Khamgaon cattle and Belona and Melghati buffalo
BASU, Patna	Goat population of Champaran and Cattle population of Banka district.
OUAT, Bhubaneswar	Gola pig and Mayurbhanj chicken
Animal Husbandry Department, Leh	Conservation of Zanskari pony.
SKUAST, Jammu	Jammu Hill cattle, Bhadarwahi Sheep and Bakerwal Dog.
SKUAST, Srinagar	Conservation of Karnah sheep; Characterization of Local ponies of Kashmir.
WBUA&FS, Kolkata	Tyaji pony and Deshi chicken of Mursidabad districts and Peri duck.
ICAR- IVRI Bareilly	Rohilkhandi cattle
DUVASU Mathura	Battisi goat and Braj donkey
GBPUAT Pantanagar	Kow-debar Sheep
KVA&FSU, Bidar	Gangavathi cattle, Sira sheep and Kakkera chicken.
TANUVAS, Chennai, Tamil Nadu	Nattukuttai cattle and Thanjavur Black goat.
SVVU, Tirupathi, AP	Macherla Goat
PVNR-TVU, Hyderabad	Jhari cattle and Telangana buffalo.
KV&ASU, Pookode, Kerla	Periyar/ Kuttampuzha cattle
NDVSU, Jabalpur	Malvi sheep.
RAJUVAS, Bikaner	Totapuri goat
CKU, Durg	Bastar buffalo and Bustar Pig.
NRC Equines, Hisar	Conservation of Halari donkey (farm-based unit)
Sahjeevan, Bhuj, Gujarat	In – situ conservation of Halari donkey.
NRC on Camel	Conservation of Mewari camel.
ICAR-CCARI, Goa	Native buffalo of Goa.

Mon-Bhaah Cattle: Native cattle of Arunachal Pradesh are small to medium sized and mostly mixed type. However, temperate regions including Tawang, West Kameng seem to have unique population of native cattle, which may be further distributed to upper parts of Changlang, Subansiri, East Kameng, West Sing and Siang districts also. Coat colour of Tawang and West Kameng are reddish brown to black. White patches are also present on different body parts. Presence of hump, although less developed in most of the cases, however bulls may have prominent hump, which indicates its indicus lineage. Horns are short and stumpy in females and medium in males.

Mon-Bhaah Cattle Male

Rohilkhandi cattle: The breed is mainly distributed in Fareedpur, Bithri Chainpur, Fatehganj West, Bahedi, Bhuta, and Bhojipura blocks of Bareilly Bisauli, Dehgwan and Dataganj blocks of Badayun Lalorikhera and Marori block of Pilibhit district. The breed is mostly white in coat color with relatively thin and long horns (22 to 24 cm in females and 26-30 cm in males) and medium body size. The forehead is straight, the pole of the head is prominent, and the body's top line is straight with a small to medium hump in females and a prominent hump in males. The breed has a long face (43.4 cm in females and 51 cm in males) with a face width of 16.6 cm in females and 18.4 cm in males. The muzzle colour is black and the eyelids are white in colour. The tail switch, horn, and hoofs are black in colour. The ear is partially horizontal in orientation

Rohilkhandi cattle

with length and width more or less similar in males and females varying between 21 to 24 cm. A well-developed dewlap is present in both sexes. The body length, height at withers, chest girth, and punch girth (cm) are 131.8, 124, 162, and 164.2 in females while 140, 147, 183.4, and 189 in males. The tale length and tale switch length 107, 32.8 cm in females while 117, 37.4 cm in males. The rump length (cm) in females is 40.6 and 34.4 in males. In females, the udder is mostly bowled in shape and small to medium in size and has cylindrical teat and pointed teat tips. The daily milk yield is 5.4 Kg with a lactation length of 178 days. The fat percentage ranged between 3 to 3.5%. The reproductive performance of the local Rohilkhandi cattle breed is quite satisfying with inter calving interval of 358 days, a service period of 88 days, and an age at first estrous is 33.6 months.

Periyar cattle: "Periyar cattle" also called as Kuttampuzha cattle in the region. The home tract of the Periyar cattle mainly lies between Periyar and Chalakudy rivers and adjacent regions. Farmers and plantation workers rear these animals for milk. Some farmers use the urine to produce panchgavya. Mostly reared in semi-intensive housing system with free grazing or tethered grazing. Community grazing was practiced by the plantation workers. Animals are small in size with short legs. Four coat color variations were observed, predominantly brown (60%) followed by black (25%), grey (10%) and fawn. Mixed colors and combination with specific markings are also noticed.

Periyar cattle- cow

Tail is long and almost touches the ground. Horn pattern of this particular breed is very specific with three main patterns. Males have straight horns which are laterally upward and pointed. Females have curved horns with two patterns either pointed inwards or pointed outwards towards the face. Adult body weight of the cattle ranged from 140 to 180kg, with an average of 165.50±17.40 kg. Birth weight of calves ranged from 9 to 14kg. The recorded body length, height at withers, chest girth and paunch girth were 98.80±6.35cm, 101.12±4.72cm, 132.22±5.53cm and 139.15±6.06cm, respectively. Milk yield ranged from 1.5- 3.5 liters per day with peak yield of 3.80 liters during the lactation. The lactation length ranged from 180-210 days. The fat, SNF, protein, lactose and minerals of milk was 4.50, 9.10, 3.50, 4.90 and 0.70 percent, respectively.

Umarda cattle: Distributed in Digras, Darvha, Ner, Arni and Pusad tahsils of Yavatmal district and Manora, Mangrulpir and Karanja tahsils of Washim district and adjoining part of Amravati district. The overall mean of daily lactation milk yield, peak yield, total lactation milk yield and lactation length, were 1.04±0.02 kg, 1.20±0.03 kg, 176.80±1.08 kg, and 193.71±4.65 days, respectively. Horn length, ear length, face length, face width, paunch girth, body length, body height and heart girth, were 18.01±0.50, 24.83±0.19, 45.06±0.20, 18.69±0.18, 163.78±0.89, 122.93±0.58, 124.84±0.55 and 151.58±0.89 cms in adult Umarda cattle.

Umarda cattle

Khamgaon cattle: Khamgaon cattle distributed in Khamgaon, Malkapur, Jalgaon Jamod, Nandura, Shegaon and Sangrampur Tahsils of Buldhana district and adjoining tahsils of Akola district of Maharashtra. The overall mean of daily lactation milk yield, peak yield, total lactation milk yield, lactation length, Fat and SNF were 1.55±0.03 kg, 2.07±0.04 kg, 251.42±2.72 kg, 403.82±9.16 days, 4.49±0.06 % and 8.14±0.05 % respectively in Khamgaon cattle.

Khamgaon cattle

Horn length, ear length, face length, face width, paunch girth, body length, body height and heart girth, were 21.38±0.25, 20.50±0.06, 44.96±0.17, 19.74±0.15, 164.80±0.54, 122.00±0.27, 116.99±0.26 and 156.99±0.54 cms in adult Khamgaon cattle.

Jammu Hill cattle: It is generally known as desi cow and distributed hilly terrain of Jammu division. The utility of the population is milk, draught and manure. The population of hill cattle is known since time immemorial. The population is very docile and average

herd size is small (1-4). The body colour is generally light brown, black, white with dark shade with small body frame and short legs.

Hill cattle of Jammu

Native buffalo of Goa: Average body length of the buffalos was 51.3-inch, chest girth was 63.66 inch, average length of ears was 10.73 inch, average length of horns was 29.6 inch and body weight was 314.00 kg in adult buffalo. In a buffalo herd in the farmer's field of Aldona, Bardez taluka of Goa, the average daily milk yield per animal was 5.5 lit.

Melghati buffalo: Melaghati buffalo distributed in Melghhat region of Amravati district comprising Dharni and Chikhaldara tahsils, respectively. The overall mean of daily lactation milk yield, peak yield, total lactation milk yield, lactation length, were 4.32±0.05 kg, 6.45±0.07 kg , 1174.41±11.17 kg, 276.07±1.61 days, respectively in Melghati buffalo. Horn length, ear length, face length, face width, paunch girth, body length, body height and heart girth, were 51.75±0.53, 27.08±0.11,

Melghati buffalo

45.88±0.15, 25.22±0.12, 186.43±0.80, 131.28±1.97, 127.04±0.37 and 172.78±0.69 cms in adult Melghati buffalo.

Belona buffalo: Distributed in Kalamb, Yavatmal tehsil of Yavatmal district and villages of Bhabulgaon, Ner, Darwha, Arni, Ghatanji, Ralegaon tehsils adjacent to Kalamb and Yavatmal tehsil of Yavatmal district of Maharashtra. The overall mean of daily lactation milk yield, peak yield, total lactation milk yield, lactation length, Fat and SNF were 4.84±0.02 kg, 7.03±0.03 kg, 261.42±0.44 kg, 1248.12±6.10 days, 8.19±0.06 % and 8.98±0.03 % respectively in Belona buffalo. Horn length, ear length, face length, face width, paunch girth, body length, body height and heart girth, were 67.16±0.35, 23.72±0.09, 49.68±0.12, 23.43±0.12, 198.63±1.83, 131.26±0.17, 123.37±0.15 and 183.76±0.27 cms in adult Belona buffalo.

Belona buffalo

Jharkhandi buffalo: The study on Jharkhandi buffalo population was conducted in the southern part of the chotanagpur region viz. Ranchi, Gumla and adjoining parts of the districts of Jharkhand. Jharkhandi buffaloes are hardy and are mainly reared for draught purpose whereas milk and manure are additional income from them. Farmers prefer to use buffaloes for draught purpose because of larger body size than the native cattle, higher draught power ability, long working life and docile temperament. These buffaloes are able to thrive well in low input systems forming an integral part in the livelihood of farmers in the region. The size of buffalo was medium with compact body and had a black or grey body coat and skin colour. The most common colour of muzzle was black, light black eyelids and hooves, light grey horns and brownish black tail-switch. Tail is medium in length and extends below the hock joint. There were few buffaloes which had white marking on tail switch. Horns are medium in size and sickle shaped (curved) with curved backward and forward orientation. Dewlap is absent in both the sexes, naval flap and penis sheath are small in size in case of male. The average daily milk yield varies from 3-5 litres as reported by the farmers.

Kow-debar Sheep: Kow-debar sheep were found in Thalisain block of Pauri Garhwal, Sayldeh block of Almora and Gairsain block of Chamoli district. The native tracts of this breed are in Almora, Pauri Garhwal, and Chamoli districts, situated at elevations ranging from approximately 345 to 1690 meters above mean sea level. Kow-debar sheep exhibit small size, black color, and a compact body with a coarse fiber coat. Their heads are slightly convex with a small to medium forehead, tapering muzzle, alert eyes, and

Jharkhandi Buffalo

Kow-debar sheep

a black-colored nose. The ears are medium-sized and horizontally oriented, while the large, curved downward with flat ended horns are present in males and mostly absent in females. Black tongues and the absence of wattles are distinctive features. In the region, farmers practice an unorganized, semi-feral system of husbandry for rearing Kow-debar sheep. These sheep are grazed for four to six hours daily, covering a distance of 2 to 3 kilometres. The housing practices vary, with small flocks housed with cattle and buffaloes, while larger flocks are housed separately in closed pens with goats. Rams are kept with does at all times, and mating is uncontrolled. Breeding decisions primarily involve large flock-owned males, with surplus males being disposed of for meat purposes. Kow-debar sheep serve as a small dual-purpose meat and wool type breed, with coarse fiber. Farmers either sell them as live animals or slaughter them for meat consumption and use them as sacrificial animals in religious rituals. The marketing of live animals is unorganized, with prices determined based on live body weight.

Seemanchali sheep: The breeding tract of the sheep include Madhubani and Supaul districts of Bihar. However, some population is also present in adjacent Araria and Purnea districts. The breed exists in two coat colour. The primary variant is dark brown coated (83.4%) whereas the secondary variant is light brown coated. A total of 65.81% of males possessed rudimentary horns whereas the females are polled. Morphometric characteristics of Seemanchali lambs at the age of 3, 6, 9 and 12 months are given in Table 1. Body weight at three months of age was recorded 9.88±0.20 kg which increased to 14.18±0.24 kg in 6 months registering 43.52% of incremental gain. Comparing the body weights of Seemanchali sheep at different ages with other sheep breeds of India shows that Seemanchali is a medium sized sheep of Eastern region of Bihar.

Seemanchali Ram

Table 1: Morphometric characteristics (in cm.) of Seemanchali lambs under field conditions

Traits	3 months		6 months		9 months		12 months	
	Male (124)	Female (136)	Male (84)	Female (106)	Male (48)	Female (75)	Male (42)	Female (98)
Height	51.82±0.27	50.85±0.28	57.56±0.25	57.23±0.25	61.24±0.29	59.31±0.26	67.81±0.30	63.53±0.21
Body length	47.26±0.26	46.32±0.26	56.91±0.26	53.85±0.25	61.46±0.28	59.55±0.27	64.26±0.29	61.52±0.22
Chest girth	55.68±0.26	55.16±0.27	64.84±0.26	51.72±0.26	68.88±0.29	65.42±0.27	72.66±0.28	65.46±0.23
Face length	14.25±0.18	14.46±0.20	14.81±0.21	14.60±0.22	15.87±0.24	15.16±0.24	16.94±0.25	15.56±0.24
Ear length	14.88±0.24	13.95±0.25	15.22±0.22	15.03±0.24	15.77±0.24	15.56±0.23	16.87±0.25	16.48±0.24
Tail length	32.31±0.25	30.86±0.22	33.76±0.26	32.64±0.26	35.93±0.25	35.08±0.24	40.72±0.26	37.45±0.26

Table2: Body weights (in Kg.) of Seemanchali sheep under field conditions

Age group	Male	Female
3 months	10.34±0.27	9.88±0.20
6 months	16.25±0.26	14.18±0.24
9 months	24.12±0.26	20.28±0.23
12 months	27.16±0.28	24.41±0.24

Badarwahi sheep: It is mainly found in the Bhadarwah, Doda, Kishtawar, Bani, Ramnagar of Jammu & Kashmir. The population is around 50-60 thousands. The population is mainly reared by tribal community. The population is known since time immemorial. The population is very docile and average flock size is (20-40). The flock composition is 85% ewes, 5% rams and 10% lambs. The population is docile and body colour is generally white. Rams are mostly horned and ewes are in general polled.

Malvi sheep: The characterization of the Malvi breed of sheep has been undertaken in the Malwa region of Madhya Pradesh. Malvi sheep is one of the less well-known sheep breeds in the Malva region, with a medium to heavy-sized body. A random survey has been carried out in the districts of Rajgarh, Agar-Malva, and Dhar in Madhya Pradesh, and a noticeable population of Malvi sheep has been observed in these areas. The color pattern of Malvi sheep varies with mixes of white, black, and light brown to dark brown. Ewes are polled, and rams have horns. Males have generally larger body measures than females, mostly because of the steady growth from the milk teeth stage to the full mouth stage. Similar to other sheep breeds, Malvi sheep have coarse hair, with adult rams showing a thick bundle of hair growth. The most noticeable areas are the neck and dewlap regions, followed by the brisket, back, and thighs. Heads, faces, abdomens, and backs of Malvi sheep are covered with wool. The heads of both sexes are primarily convex, with long tails and pendulous ears. The local farmers and shepherds in the Malwa regions are acquainted with ethnoveterinary practices and know how to use them when required.

Malvi sheep

Battisi Goat: Battisi is a dual type goat population inhabiting Mathura district of UP and bordering area of Rajasthan and Haryana. Battisi animals are medium to large in size. The white coat color with black or brown patches on face, chest, abdomen and legs are the important characteristics of Battisi goat. Ears are medium to large in size. The average adult body weight was about 4 to 50 kg. Majority of the sheep farmers belong to backward communities. The goats are primarily maintained on grazing (extensive system) with zero input. Goat rearing constituted a vital component of livelihood security and economy of the farmers maintaining this goat population. Majority of the farmers informed that they are rearing this population from more than 30-40 years.

Battisi Goat

Mayurbhanj goat: Priliminary survey was conducted for phenotypic characterization of Mayurbhanj goat. During the visit Jashipur, Betanoti and Baripada blocks of Mayurbhanj district were surveyed. These goats are predominantly black in colour. However, brown coat colour is seen in few animals. These animals are of medium size reared for meat purpose. Males usually have beards at later stage of life. Head convex, ears are short and horizontal. Females are having a small udder and medium conical teats. Mayurbhanj goats are early

Mayurbhanj goat

maturing and highly prolific mostly kid twins at second and later kidding with triplets in few cases.

Totapuri goat: Totapuri goat is large to medium sized and dual purpose local goat, available in Alwar, Dausa and Karauli districts of Rajasthan which are locally known for Totapuri goats predominantly meat purpose type. The name 'Totapuri' is given because of the presence of parrot shaped bridge of the nose in goats. The predominant colour pattern is bicolour (majorly white) with the admixture of black and brown. Majority of the animals have convex head, pendulous, drooping, medium to large sized horizontal ears. Horns are small sized, short, straight and curved with backward orientation. This Totapuri goat is reared by farmers in small size flocks mainly for meat production. Totapuri goats are known to have high prolificacy with increased chances of twinning. As it is well known for meat production, the adult male and female gains the body weight of approximately 80 Kg and 50 Kg, respectively.

Totapuri

Local Pony of Kashmir: The ponies of Kashmir are nondescript and large in number. This important genetic resource is of prime requirement and important means of transportation during Shri Amarnath ji Yatra and tourism industry of J&K. They are the source of livelihood generation of thousands of Pony Wallas (rearers) many of who are registered with JK tourism department. These ponies need fitness certificates issued by Veterinary officers before leaving for yatra. The ponies in these areas are being reared for transportation and are used to drive the carts called ***Tongas***. These form the only source of transportation in the interior regions of Sopore and adjacent areas thereby creating sources of livelihood of these Tonga wallas. These ponies are excellent sources of transportation are hardy sturdy and well adapted to the high altitudes of the region.

Pony of Kashmir

Mala Chicken: The study was conducted in the southern part of the Chotanagpur plateau region province of Jharkhand. The black & golden mix followed by white & black mix plumage colour in males and white & black followed by brownish white to light brown plumage colour in females were dominant in the study area. Single comb was the dominant comb

Cock of Mala Chicken

Meitei-yen

type in all localities followed by pea comb. Hackle and saddle feathers of males are rich golden yellow in males forming mala like shape with lacing plumage pattern. The average flock size was observed to range from 11 to 17. The mean body weight of adult indigenous *Mala* male and female chickens was 1.86±0.04 kg and 1.10±0.02 kg, respectively.

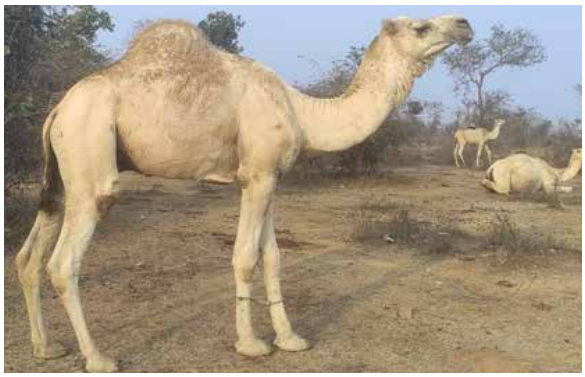
Meitei-yen chicken: The local chicken of Manipur is known as Meitei-yen. The female and male Meitei-yen have been found to weigh from 1.2 to 1.7 kg and from 1.6 to 2.2 kg respectively.

Shikhar chicken: Locally the indigenous chicken of Mizoram is known as Shikhar and also as Ram-ar. The female and male Sikhar are found to weigh from 7 to 1.0 kg and from 0.9 to 1.5 kg respectively.

Mrui chicken: The indigenous chicken of Nagaland is locally known as Mrui by the Zeliang community. The female and male Mrui chickens weigh from 1 to 1.4 kg and from 1.2 to 1.8 kg respectively.

Conservation Unit

Mewari camel: (ICAR-NRCC, Bikaner): The survey was conducted to know the status of the Mewari camel in Jhalawar, Baran, and Bundi districts of Rajasthan. The herd size varied from 5 to 250. Most of the animals in the herd were of the Mewari breed, but some animals of other breeds were also present. The major problems faced by the farmers were: no distribution of medicines to camel farmers; no permission to graze in the forest area; lack of grazing area; camel calf subsidy limited to 5 calves on one Janaadhar card; regulation on the sale of camels; and no market for selling camel milk.



Mewari camel

Karnah Sheep (SKUAST Kashmir): The population of Karnah sheep has declined at a logarithmic rate tremendously and the sheep are almost extinct. The preferences of sheep breeders have also changed as they are getting more profits from crosses of Kashmir Merino. The same were introduced by Dept. of Sheep Husbandry Department Govt. of J&K as a policy matter in an attempt to bridge the gap between demand and supply. The same was necessitated in view of non-vegetarian habits and the consumer demands which far outweighs the UTs produce. The unit organized various awareness camps and interaction sessions in collaboration with officers of the department of sheep husbandry wherein the breeders were made aware of the importance of this important native genetic resource.

Tibetan sheep (AH department Govt. of Sikim): The Tibetan sheep is one of the key sources of livelihood for the Dokpas; the high altitude tribal community has been designated as poorest of poor and remotest of the remote in India. Tibetan sheep is very hardy and thriving well in very harsh climatic condition of Tibetan plateau. At higher altitude sheep reared under transhumance system (seasonal cyclic movement) and their movements are mostly governed by weather and pasture availability. As per Breed Survey (2022) only 317 Tibetan sheep are available. The objective of project to revive the declining population of Tibetan sheep. Ten sheep (3 males) and 7 females were purchased.

Halari Donkey (NRC Equines HIssar): The Institute herd of Halari donkey is being strengthened by purchase/transfer of 5 breedable animals of the breed. Necessary exercise for the procurement has been done. After getting these animals, the strength of Halari donkeys at Bikaner will be 15.

Sahjeevan Bhuj: As part of the *in-situ* conservation efforts, the project has procured RFID microchips for the Halari donkeys tagging. This technological intervention is instrumental in the identification and tracking of individual donkeys, contributing to the overall management and monitoring of the breed. The acquisition of RFID microchips aligns with the project's

commitment to adopting modern tools to enhance conservation practices. Furthermore, a meticulous process of selecting purebred Halari donkey females is underway. This involves a combination of genetic evaluation and adherence to breed standards. The emphasis on purity ensures that the conservation efforts are directed towards preserving the unique genetic traits of the Halari donkey. Additionally, a socio-economic survey focused on Halari donkey owners and herders is currently in progress. This survey aims to gather valuable insights into the socio-economic dynamics associated with the Halari donkey community. Understanding the livelihoods and challenges faced by the stakeholders is crucial for designing effective conservation strategies that align with the community's needs.

Halari Donkey

Health Care Initiatives: Recognizing the importance of the health and well-being of the Halari donkeys, the project collaborated with the Animal Husbandry Department of Gujarat and Kamdhenu University to organize special health camps in February. These health camps catered to approximately 30-35 Halari donkey females. The objective was to address health issues, provide necessary vaccinations, and offer general healthcare services. This proactive approach ensures that the Halari donkey population remains robust and resilient to potential health challenges.

Capacity Building of Halari Donkey Sangathan: A pivotal aspect of the conservation project is the establishment of the Halari Donkey Sangathan. This organization plays a crucial role in facilitating communication, coordination, and collaboration among the community members involved in donkey husbandry. Meetings have been conducted at different taluka levels to foster a sense of community and shared responsibility. Within the Sangathan, an executive committee, known as Karobari, has been formed. This committee comprises 5 male herders and 6 female herders, serving as core members responsible for the day-to-day affairs of the organization. The detailed list of names has been submitted to the Charity Commissioner, officially recognizing the Sangathan as the Halari Donkey Pashu Ucherakh Sangathan. The Halari Donkey Conservation Project, in association with NBAGR, is making commendable strides in preserving this unique breed. Through a combination of technological advancements, health care initiatives, and community engagement, the project is contributing significantly to the long-term sustainability and well-being of the Halari donkey population.

Research Projects

Division & Group Wise Research Project

S.No.	Project Type	Project title	Workers	Duration	Status
Animal Genetic Resources Division					
1	*Institute*	Characterization and Documentation of Indigenous dog breeds of India.	**Raja KN**, AK Mishra and RK Pundir	August, 2021 to March, 2024	*Ongoing*
2	*Institute*	Characterization of milk and curd of Chilika buffaloes adapted to saline conditions of Odisha state	**MS Dige**, M Mukesh, M Sodhi, KV Singh, RS Kataria (ICAR-NBAGR), Sudarshan Kumar (ICAR-NDRI), SK Das (OUAT) and NK Navani & SK Ambatipudi (IIT, Roorkee)	August, 2021 to March, 2024	*Ongoing*
3	*Institute*	Computational Judgement of Livestock Population Uniformity on the Basis of Photographs.	**Avnish Kumar** and Dinesh Kumar Yadav	April, 2022 to March, 2024	*Ongoing*
4	*External (ICAR-AGRI-CRP)*	CRP on Agro-biodiversity Conservation of Animal Genetic Resources.	**Rekha Sharma** (PI from July, 2023), RAK Aggarwal, Reena Arora and Sonika Ahlawat (from Oct., 2023) MS Tantia, (PI up to 31.07.2023)	June, 2015 to Sept., 2026	*Ongoing*
5.	*External (DAHD GoI)*	National Bovine Genomic Centre- Indigenous Breeds (NBGC-IB)	**Dr. R.K. Pundir** and Dr. Amod Kumar	2018 cont.	*Ongoing*
6.	*Institute*	Network Project on Animal Genetic Resources	**BP Mishra**, Director from 04.05.2021 (Co-ordinator), AK Mishra (I/c w.e.f. 01.08.2023), MS Tantia (I/c up to 31.07.2023)	January 1996 cont.	*Ongoing*
Animal Genetics Division					
7.	*Institute (Service project)*	Karyotyping and DNA Testing for Screening Genetic Defects in Indian Bovines.	**SK Niranjan,** Amod Kumar and Monika Sodhi	April, 2016 to March, 2026	*Ongoing*

S.No.	Project Type	Project title	Workers	Duration	Status
8.	*Institute (Service project)*	Evaluation of genetic diversity in conserved cattle and buffalo bulls.	**Amod Kumar**	April, 2020 continued	*Ongoing*
9.	*Institute*	Genome Analysis for Adaptability to Salinity in Chilika Buffalo.	**Amod Kumar**, SK Niranjan, Sanjeev Singh and Indrajit Ganguly	August, 2021 to Jan., 2024	*Ongoing*
10.	*Institute*	Admixture Mapping of Cattle in Eastern and Western India	**SP Dixit**, Indrajit Ganguly, Sanjeev Singh, Avnish Kumar Bhatia, SK Niranjan, Rahul Behl, Amod Kumar **(**MS Tantia up to 31.07.2023)	August, 2021 to March, 2026	*Ongoing*
11.	*Institute*	Development of a Panel of Genome-Wide Ancestry Informative Markers in Indian horse and pony Breeds	**Indrajit Ganguly**, Sanjeev Singh, SK Niranjan, Amod Kumar, Rahul Behl, Sonika Ahlawat, RK Pundir and SP Dixit (NBAGR), K K Kanka (IIAB-Ranchi), S C Mehta, Anuradha Bhardwaj and T.K. Bhattacharya (NRCE)	Oct., 2023 to Sept., 2025	*New*
Animal Biotechnology Division					
12.	*Institute*	Exploring the mitochondrial DNA diversity of Indian pigs, horses and donkeys	**Sonika Ahlawat**, Reena Arora, Rekha Sharma and KV Singh	April, 2022 to March, 2024	*Ongoing*
13.	*External (ICAR-AGRI-CRP)*	CRP on Genomics: - Identification of markers for economic traits and Transcriptomics study in Buffalo and goats.	**Reena Arora** (PI from April, 2019)**,** RK Vijh (PI up to April, 2019), Sonika Ahlawat, Jayakumar S (up to 30.09.20)	June, 2015 to Sept., 2026	*Ongoing*
14.	*External (ICAR-CABin)*	Comparative Genome analysis of Indian chicken breeds.	**Reena Arora** (PI from 28.11.2020), Sonika Ahlawat and Rekha Sharma from June, 2022 (NBAGR) SB Lal (CCPI), DC Mishra, Md. Samir Farooqi & Sudhir Srivastava (IASRI)	April, 2020 to March, 2025.	*Ongoing*

S.No.	Project Type	Project title	Workers	Duration	Status
15.	*External*	Exploring molecular basis of seasonal variation of seminal attributes and identification of potential biomarkers for selection of Buffalo bulls with quality semen.	**RS Kataria**, Manishi Mukesh, RAK Aggarwal and MS Dige (from April, 2021) NBAGR, **Pawan Singh**-PI-NDRI, Pardeep Kumar-PI-CIRB and Dharmender Kumar-CIRB and AK Tyagi-NDRI.	Sept., 2020 to Sept., 2024	*Ongoing*
16.	*External (DST-ASACODER)*	Characterizing milk colostrum of Ladakhi cows and yak for identification of biomolecules with therapeutic potential	**Manishi Mukesh**, Monika Sodhi, RS Kataria and S K Niranjan (NBAGR), A Mohanty (NDRI), M Sharma, (DRDO-DIPAS), Mh Zahid Ashraf (JMI), Sathees Rd (IISc) and V Bharti (DRDO-DIHAR).	January, 2021 to June, 2024.	*Completed*
17.	*External (IAEA-CRP, Contract No. 24756)*	Delineating genomic diversity, population structure and demographic dynamics in diverse native buffalo breeds of India.	**Monika Sodhi**, RS Kataria Manishi Mukesh and BP Mishra	Nov., 2022-Oct., 2027	*Ongoing*
18.	*Institute*	Unravelling breed signatures behind variability susceptibility to Lumpy skin disease.	**Ravi Kumar Gandham** , M Mukesh, B Mishra, Amod Kumar and BP Mishra NBAGR and Vikas Vohra (NDRI, Karnal)	July, 2023 to March, 2026.	*New*
19.	*External* (Uttarakhand Council for Biotechnology; Govt. of Uttarakhand)	Biotechnological package for reducing new born mortality and optimizing age at puberty in Badri cattle and Pantja goat of Uttarakhand	**Monika Sodhi** and Manishi Mukesh	3 years	*New*
NEH Projects					
20.	*Institute*	Survey and documentation of native animal genetic resources of NEH region-Mizoram.	**Monika Sodhi,** RS Kataria, SP Dixit, and N Shyamsana Singh (CVS &AH, Aizawl)	Oct., 2019 to Mar., 2024	*Ongoing*
21.	*Institute*	Survey and documentation of native animal genetic resources of NEH region-Meghalaya	**RK Pundir,** I Ganguly, Avnish Kumar and Rakesh Kumar (ICAR Research Complex for NEH Region) from Aug., 2021	Oct, 2019 to March, 2023	*Completed*

S.No.	Project Type	Project title	Workers	Duration	Status
22.	*Institute*	Survey and documentation of native animal genetic resources of NEH region-Arunachal Pradesh.	**SK Niranjan,** AK Mishra, Amod Kumar, Bina Mishra (from Jan., 2023) and Jaideep Kumar Singh (KVK, Tawang)	Oct., 2019 to Mar., 2024	*Ongoing*
23.	*Institute*	Survey and documentation of native animal genetic resources of NEH region-Sikkim	**RAK Aggarwal,** HK Narula (from July, 2022), RS Gandhi (up to 30.4.2022) Jaykumar S (up to 30.9.20), KD Bhutia (SLDB) and Aneet Kaur (ICAR-NRC Yak from Aug., 2021)	Oct, 2019 to Sept., 2022	*Completed*
24.	*Institute*	Survey and documentation of native animal genetic resources of NEH region-Nagaland	**DK Yadav** (PI from 31.10.2020), Anand Jain PI up to 31.10.2020), NK Verma (up to 31.8.20), MS Dige, Hiabe Zeliang and Mahak Singh (ICAR-RC for NEHR, Nagaland) from Oct.,2021	Oct, 2019 to Mar., 2024	*Ongoing*
25.	*Institute*	Survey and documentation of native animal genetic resources of NEH region-Manipur.	**Sonika Ahlawat,** Reena Arora, Rahul Behl and Th. Ranadhir Singh (PK Vij up to 31.10.2020)	Oct, 2019 to Mar, 2023	*Completed*
Functional Group-I project					
Functional Group-I					
26.	*Institute*	Identification and Characterization of Indigenous AnGR of Uttar Pradesh	**AK Mishra**, RS Gandhi (upto 30.04.2022) Reena Arora, HK Narula (from July, 2022), Avnish Kumar, Amod Kumar, PS Dangi and Avneesh Kumar (DUVASU Mathura)	August, 2021 to March, 2025	*Ongoing*
27.	*Institute*	Identification and Characterization of Indigenous Animal Genetic Resources of Uttarakhand.	**Amod Kumar**, AK Mishra, Reena Arora, Avnish Kumar,	July 2023 to March 2027	*New*

S.No.	Project Type	Project title	Workers	Duration	Status
Functional Group-II project					
28.	*Institute*	Survey and Documentation of Indigenous AnGR of Tamil Nadu & Kerala	**Raja KN**, RK Pundir and Sonika Ahlawat	August, 2021 to March, 2025	*Ongoing*
29.	*Institute*	Survey and documentation of Indigenous AnGR of Andhra Pradesh and Telangana	**Sonika Ahlawat**, RK Pundir, Raja KN (NBAGR), R Vinoo and D. Sakaram	July, 2023 to March, 2026	*Ongoing*
Functional Group-III project					
30.	*Institute*	Characterization of AnGR of Bihar and Jharkhand states	**MS Tantia,** RAK Aggarwal, Rekha Sharma, PC Chandran, A Dey, Reena Kamal (ICAR for ER), RK Singh and B Kumar, (BAU) and Sushil Prasad (BU)	August, 2021 to July, 2023	*Completed*
Functional Group-IV project					
31.	*Institute*	Identification of Indigenous Animal Genetic Resources of Maharashtra, Gujarat, Goa and Himachal Pradesh	**Sanjeev Singh**, Indrajit Ganguly, SP Dixit and SV Kuralkar (PGIVAS)	August, 2021 to July, 2025	*Ongoing*
Functional Group-V project					
32.	*Institute*	Survey and documentation of native AnGR of Madhya Pradesh state	**SK Niranjan,** DK Yadav, Monika Sodhi, RS Kataria, Bina Mishra (from Jan.,2023) and Ajay Ramtake (DAH, MP)	August, 2021 to March, 2025.	*Ongoing*
33.	*Institute*	Identification, characterization, documentation and registration of non-descript animal and poultry genetic resources of Rajasthan.	**DK Yadav**, RS Kataria, SK Niranjan, Monika Sodhi, Bina Mishra (from Jan.,2023) and Sandeep Saraswat (DHD Rajasthan)	August, 2021 to March, 2026	*Ongoing*
34.	*Institute*	Characterization and documentation of farm animal genetic resources of Chhattisgarh state.	**Monika Sodhi**, RS Kataria, SK Niranjan and DK Yadav, Bina Mishra (from Jan., 2023) (NBAGR), Asit Jain Kishore Mukharjee (CGKV, Durg), Rohini Pathak (DVS, Chhattisgarh)	August, 2021 to March, 2026	*Ongoing*

S.No.	Project Type	Project title	Workers	Duration	Status
Functional Group-VI project					
35.	*Institute*	Cataloguing and characterization of native non-descript Animal Genetic Resources of	**Dige MS**, M Mukesh, KV Singh, R Behl and SK Dash, C Mishra (OUAT) MK Padhi (DPR, Bhubaneshwar)	August, 2021 to March, 2024	*Ongoing*
36.	*Institute*	Cataloguing and characterization of native non-descript Animal Genetic Resources of Ladakh (UT).	**Karan Veer Singh**, M Mukesh, R Behl and MS Dige, Feroz Din Sheik (KVK, SKUAST-Leh, Nodal Officer AHD, Ladakh (from Dec., 2022)	August, 2021 to March, 2025.	*Ongoing*
Functional Group-VII project					
37.	*Institute*	Survey and Documentation of Indigenous Animal Genetic Resources of Andaman & Nicobar Islands.	**Bina Mishra**, RK Gandhan, Monika Sodhi, SK Niranjan, Jai Sundar and T. Sujatha	July 2023 to March 2026	*New*

Publications & Awards

Publication: Research papers

International

Title	Authors	Journal	Volume/Issue	NAAS IF
Functional quality characteristics of the meat from a dual-purpose poultry crossbreed suitable for backyard rearing in comparison to commercial broilers	Rekha Sharma, Renuka Sehrawat, Sonika Ahlawat, Vivek Sharma, Mohan Singh Thakur, AK Mishra, Reena Arora, MS Tantia	Foods	13: 2434. doi.org/10.3390/ foods12132434	11.20
Genetic diversity and differentiation of Thutho cattle from northeast India using microsatellite markers	Rekha Sharma, Sonika Ahlawat, RK Pundir, Reena Arora, MS Tantia	Animal Biotechnology	DOI:10.1080 / 10495398.2023.2221704	9.70
Study on the muscle transcriptome of two diverse Indian backyard poultry breeds acclimatized to different agro-ecological conditions	Rekha Sharma, Reena Arora, Sonika Ahlawat, Pooja Chhabra, Ashish Kumar, Mandeep Kaur, Shashi Bhushan Lal, Dwijesh Chandra Mishra, Md Samir Farooqi, Sudhir rivastava	Molecular Biology Reports	https://doi.org/10.1007/ s11033-022-08223-1-08223-1	8.80
Transcriptomics reveals key genes responsible for functional diversity in pectoralis major muscles of native black Kadaknath and broiler chicken	Reena Arora, Rekha Sharma, Sonika Ahlawat, Pooja Chhabra, Ashish Kumar, Mandeep Kaur, Ramesh Kumar Vijh, Shashi Bhushan Lal, Dwijesh Chandra Mishra, Md. Samir Farooqi, Sudhir Srivastava	Biotech	Jul;13(7):253https://doi. org/10.1007/s13205-023-03682-0Epub 2023 Jun 29	8.80
Genetic differentiation of Indian dromedary and Bactrian camel populations based on mitochondrial ATP8 and ATP6 genes	D. Sai Satyanarayana, Sonika Ahlawat, Rekha Sharma, Reena Arora, Annu Sharma, MS Tantia & RK Vijh	Animal Biotechnology	34:3, 756-760, DOI: 10.1080 / 10495398.2021.1990079	9.70
Revelation of genes associated with energy generating metabolic pathways in the fighter type Aseel chicken of India through skeletal muscle transcriptome sequencing	Sonika Ahlawat, Reena Arora, Rekha Sharma, Pooja Chhabra, Ashish Kumar, Mandeep Kaur, Shashi Bhushan Lal, Dwijesh Chandra Mishra, Md. Samir Farooqi & Sudhir Srivastava	Animal Biotechnology	DOI: 10.1080 / 10495398.2023.2219718	9.70
Assessment of genetic diversity of the fat-tailed Dumba sheep of India by mitochondrial and microsatellite markers	A K Mishra, Sonika Ahlawat, Rekha Sharma, Reena Arora, Sanjeev Singh, Anand Jain	Animal Biotechnology	DOI:10.1080 / 10495398.2023.2176316	9.70

Title	Authors	Journal	Volume/Issue	NAAS IF
Unraveling the genetic mechanisms governing the host response to bovine anaplasmosis	Sonika Ahlawat, Vikas Choudhary, Rashmeet Kaur, Reena Arora, Rekha Sharma, Pooja Chhabra, Ashish Kumar, Mandeep Kaur	Gene	877. 147532, https://doi.org/10.1016/j.gene.2023.147532	9.50
Estimation of microsatellite-based autozygosity and its correlation with pedigree inbreeding coefficient in crossbred cattle	K Elavarasan, Subodh Kumar, Swati Agarwal, A Vani, Rekha Sharma, Sanjeev Kumar, Anuj Chauhan, Nihar Ranjan Sahoo, Med Ram Verma, Gyanendra Kumar Gaur	Animal Biotechnology	https://doi.org/10.1080/10495398.2023.2176318	9.70
Tracing the genetic footprints: India's role as a gateway for pig migration and domestication across continents	Annu Sharma, Sonika Ahlawat, Rekha Sharma, Reena Arora, Karan Veer Singh, Deepak Malik, Santanu Banik, Th Ranadhir Singh & MS Tantia	Animal Biotechnology	DOI: 10.1080/10495398.2023. 2268683	9.70
Genome-wide selection signatures address trait specific candidate genes in cattle indigenous to arid regions of India	Nidhi Sukhija, Anoop Anand Malik, Joel M. Devadasan, Aishwarya Dash, Kangabam Bidyalaxmi, D. Ravi Kumar, M. Kousalaya Devi, Anjali Choudhary, KK Kanaka, Rekha Sharma, Shashi Bhushan Tripathi, Saket Kumar Niranjan, Jayakumar Sivalingam, Archana Verma	Animal Biotechnology	DOI: 10.1080 / 10495398.2023.2290521	9.70
Identification and validation of stable reference genes for expression profiling of target genes in diverse ovine tissues	Mahanthi Vasu, Sonika Ahlawat, Vikas Choudhary, Rashmeet Kaur, Reena Arora, Rekha Sharma, Upasna Sharma, Pooja Chhabra, MA Mir, Manoj Kumar Singh	Gene	897; 148067, https://doi.org/10.1016/j.gene.2023.148067	9.50
Genetic insights into fiber quality, coat color and adaptation in Changthangi and Muzzafarnagri sheep: A comparative skin transcriptome analysis	Mahanthi Vasu, Sonika Ahlawat, Pooja Chhabra, Upasna Sharma, Reena Arora, Rekha Sharma, M A Mir, Manoj Kumar Singh	Gene	Sep 23:147826. doi: 10.1016/j.gene.2023.147826.	9.50

Title	Authors	Journal	Volume/Issue	NAAS IF
Mendelism: Connecting the Dots Across Centuries	Nidhi Sukhija, K. K. Kanaka, P. B. Purohit, Indrajit Ganguly, Anoop Anand Malik, Sanjeev Singh, S. P. Dixit, Archana Verma & Aishwarya Dash	Cytology and Genetics	57(5), 500–516. https://doi.org/10.3103/S0095452723050067	6.50
Canine umbilical cord tissue derived mesenchymal stem cells naturally express mRNAs of some antimicrobial peptides	Camelia Manna, Kinsuk Das, Durgadas Mandal, Dipak Banerjee, Joydip Mukherjee, Indrajit Ganguly, Shymal Naskar and Sadhan Bag	Veterinary Research Communications	47(4):2229-2233. doi: 10.1007/s11259-023-10098-x	8.20
Deciphering local adaptation of native Indian cattle (Bosindicus) breeds using landscape genomics and in-silicoprediction of deleterious SNP effects on protein structure and function	Shivam Bhardwaj, Sanjeev Singh, Indrajit Ganguly, Avnish Kumar Bhatia, S P Dixit	3 Biotech	13(3)86.https://doi.org/10.1007/s13205-023-03493-3	8.80
Comparative genomic diversity analysis of copy number variations (CNV) in indicine and taurine cattle thriving in Europe and Indian subcontinent	V K Singh, S Singh, P B Nandhini, A K Bhatia, S P Dixit, I Ganguly	Animal Biotechnology	1-12. DOI: 10.1080/10495398.2022.2162910	9.70
On the concepts and measures of diversity in the genomics era	Kanaka, K.K., Nidhi Sukhija, Rangasai Chandra Goli, Sanjeev Singh, Indrajit Ganguly, S.P Dixit, Aishwarya Dash and Anoop Anand Malik	Current Plant Biology	33(3):100278 DOI:10.1016/j.cpb.2023.100278	-
Whole genome resequencing revealed genomic variants and functional pathways related to adaptation in Indian yak populations	Amod Kumar, Mahesh Dige, Saket Kumar Niranjan, Sonika Ahlawat, Reena Arora, Aneet Kour, Ramesh Kumar Vijh	Animal Biotechnology	1-11. doi: 10.1080 / 10495398.2023.2282723	9.70
Mitogenomic phylogeny reveals the predominance of the Nubian lineage of African wild ass in Indian donkeys	Sonika Ahlawat, Upasna Sharma, Reena Arora, Rekha Sharma, Pooja Chhabra, KV Singh and RK Vijh	Gene	880, 147627. https://doi.org/10.1016/j.gene.2023.147627	9.50
Exploring the Transcriptome Dynamics of In Vivo Theileriaannulata Infection in Crossbred Cattle	Sonika Ahlawat, Vikas Choudhary, Reena Arora, Ashish Kumar, Mandeep Kaur and Pooja Chhabra	Genes	14, 1663. https://doi.org/10.3390 / genes14091663.	9.50

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Transcriptomics reveals key genes responsible for functional diversity in pectoralismajor muscles of native black Kadaknath and broiler chicken	Reena Arora, Rekha Sharma, Sonika Ahlawat, Pooja Chhabra, Ashish Kumar, Mandeep Kaur, Ramesh Kumar Vijh, Shashi Bhushan Lal, Dwijesh Chandra Mishra, Md Samir Farooqi, Sudhir Srivastava	3 Biotech	13(7), 253. https://doi.org/10.1007/s13205-023-03682-0.	8.80
Comparable Analysis of COMPSRA and Excerpt Pipelines for Mining Distinct Molecules of RNA	Pooja Chhabra, Brij Mohan Goel, Reena Arora	International Journal of Research in Science and Engineering	3(2), Feb-Mar 2023 https://doi.org/10.55529/ijrise.32.26.32	-
Validation of stable reference genes in peripheral blood mononuclear cells for expression studies involving vector-borne haemoparasitic diseases in bovines.	Rashmeet Kaur, Sonika Ahlawat, Vikas Choudhary, Anisha Kumari, Ashish Kumar, Mandeep Kaur, Reena Arora, Rekha Sharma, Ramesh Kumar Vijh	Ticks and Tick-borne Diseases	14 (4), 102168. https://doi.org/10.1016/j.ttbdis.2023.102168.	9.20
New insights into the muscle transcriptome of two diverse Indian backyard poultry breeds acclimatized to different agro-ecological conditions	Rekha Sharma, Reena Arora, Sonika Ahlawat, Pooja Chhabra, Ashish Kumar, Mandeep Kaur, Shashi Bhushan Lal, Dwijesh Chandra Mishra, Md Samir Farooqi, Sudhir Srivastava.	Molecular Biology Reports	https://doi.org/10.1007/s11033-022-08223-1	8.80
Design and validation of high-density SNP array of goats and population stratification of Indian goat breeds	Ramesh Kumar Vijh, Upasna Sharma, Prerna Kapoor, Meenal Raheja, Reena Arora, Sonika Ahlawat, Vandana Dureja	Gene	885, 15 November 2023, 147691 https://doi.org/10.1016/j.gene.2023.147691	9.50
ddRAD sequencing basedgenotyping of six indigenous dairy cattle breeds of India to infer existing genetic diversity and population structure	Nampher Masharing, Monika Sodhi, Divya Chanda, Inderpal Singh, Prince Vivek, Manish Tiwari, Parvesh Kumari, Manishi Mukesh	ScientificReports	Jun9;13 (1):9379. doi:10.1038/s41598-023-32418-6	10.60
Editing of HSF-1 and Na/K-ATPase α1 subunit by CRISPR/Cas9 reduces thermal tolerance of bovine skin fibro blasts to heat shock in vitro	Umesh K Shandilya, Ankita Sharma, Monika Sodhi, Manishi Mukesh	Animal Biotechnology	Dec;34(8):3626-3636.doi:10.1080/10495398.2023.2187403.Epub2023Mar10	9.70
Identification of stably expressed Internal Control Genes (ICGs) for normalization of expression data in liver of C57BL/6 mice injected with beta casomorphins.	Anurag Kumar, Monika Sodhi, Manishi Mukesh, Amandeep Kaur, Gaurav Bhakri, Vipul Chaudhary, Preeti Swami, Vishal Sharma, Ashok Kumar Mohanty, Ranjit SKataria	PLoSOne	May5;18(5):e0282994. doi:10.1371/journal.pone.0282994	9.70

Title	Authors	Journal	Volume/Issue	NAAS IF
Development and validation of most efficient RNA isolation method from buffalobull spermatozoa	Rashi Vasisth, Ankita Gurao, Namita Kumari, Gautam Kumar, Anurag Kumar, Karpenahalli Ranganatha Sriranga, Mahesh Shivanand Dige, Manishi Mukesh, Rajeev Anand Kumar Aggarwal, Pawan Singh, Ranjit Singh Kataria	Molecular Biology Reports	2023Aug;50(8):6717-6727. doi:10.1007/s11033-023-08593-0.	8.80
Genome wide association study revealed suggestive QTLs for production and reproduction traits in Indian Murrah buffalo	D Ravi Kumar, P B Nandhini, M Joel Devadasan, Jayakumar Sivalingam, Destaw Worku Mengistu, Archana Verma, I D Gupta, S K Niranjan, RS Kataria and M S Tantia	3 Biotech	13(3):100. doi: 10.1007/s13205-023-03505-2	8.80
Sequence characterization and comparative expression profile of buffalo WNT10B gene in adult and foetal tissues	Deepu Verma, Manmohan Singh Chauhan, Shailendra Kumar Mishra, Kumbha Ramesh Babu, KarnPratap Singh, Saroj Rani, Prem Kumar, Manoj Kumar Singh, Ankita Gurao and Ranjit Singh Kataria	Animal Biotechnology	https://doi.org/10.1080/10495398.2023.2225091	9.70
ASIP gene polymorphism associated with black coat and skin colourin Murrah buffalo	Namita Kumari, Rashi Vasisth, Ankita Gurao, Manishi Mukesh, Vikas Vohra, Sanjay Kumar and Ranjit Singh Kataria	Environmental and Molecular Mutagenesis	Jun;64(5):309 314,https://doi.org/10.1002/em.22554	8.80
Characterization of a unique Sikkimese yak population of India: a multivariate approach.	RAK Aggarwal, Aneet Kaur, R.S. Gandhi, S.K. Niranjan, Vijay Paul, Bhutia Tenzing Lobsang, Bhutia Karma doma	Tropical Animal Health and Production	55:208 (https://doi.org/10.1007/s11250-023-03627-y)	7.56
Exploring haplotype block structure, runs of homozygosity, and effective population size among dairy cattle breeds of India	Soumya Dash, Avtar Singh, SP Dixit, Avnish Kumar, RajalaxmiBehera	Tropical Animal Health Production	55, 129 (2023). https://doi.org/10.1007/s11250-023-03534-2	7.89
Epitope tailored vaccine construct for goat milk allergy	Nidhi Sukhija, Kanaka K K, Sona Sukhija, Nandhini P B, Pallavi Rathi, Vidhya Sagar, Indrajit Ganguly, SP Dixit, Sanjeev Singh, Chethan Raj	Acta Scientific Veterinary Sciences	23-30.DOI: 10.31080/ASVS.2023.05.0614	5.3

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Title	Authors	Journal	Volume/Issue	NAAS IF
Microsatellite-based analysis deciphers the uniqueness of three lesser-known Indian cattle populations	Rekha Sharma, Sonika Ahlawat, R.K.Pundir, Sabyasachi Das, Reena Arora, MS Tantia	Indian Journal of Animal Sciences	93 (8): 795–801, https://doi.org/10.56093/ijans.v93i8.127951	6.40
Genetic diversity analysis of Katchaikatty Black – an endangered sheep breed from Tamil Nadu.	Reena Arora, Anand Jain, Raja KN, Mandeep Kaur, Ashish Kumar, Sonika Ahlawat, Rekha Sharma	Indian Journal of Animal Sciences	93(10): 975–978. https://doi.org/10.56093/ijans.v93i10.129633	6.40
Ovarian expression analysis of fecundity candidate genes in the three Indian goat breeds differing in prolificacy	A. Maitra, Rekha Sharma, Sonika Ahlawat, Reena Arora, S. Prasad, MS Tantia	The Indian Journal of Small Ruminants	29(1):27-31 DOI : 10.5958/0973-9718.2023.00019.3	5.11
Dairy performance of recently registered Sanchori cattle of Rajasthan	Hitesh Purohit, Urmila Pannu, Rekha Sharma, Virendra Kumar, Sushma Prasad, Jayesh Vyas, Anil Harsh	The Pharma Innovation	12(1): 3004-3006	5.23
Draught and reproductive performance of Sanchori male cattle	Hitesh Purohit, Urmila Pannu, Rekha Sharma, Virendra Kumar, Sushma Prasad, Jayesh Vyas, Anil Harsh	The Pharma Innovation	12(2): 807-809	5.23
Evaluation of morphometric characteristics of goats by principal component analysis	Dinesh Kumar Yadav, Naresh Kumar Verma, Satpal Dixit and Rajeev Anand Kumar Aggarwal	Indian Journal of Small Ruminants	29(2): 198-204	5.95
Principal component analysis explains the associations between biometric characteristics of Indian sheep breeds and non-descript sheep	Dinesh Kumar Yadav, Anand Jain and Sanjeev Singh	Indian Journal of Small Ruminants	29(2): 215-221 DOI : 10.5958/0973-9718.2023.00047.8	5.95
Data mining uncovers non-coding RNAs from RNA sequences of skeletal muscles of Indian sheep	Pooja Chhabra, Brij Mohan Goel, Sonika Ahlawat, A.K. Mishra, Reena Arora	Indian Journal of Small Ruminants	29 (1) : 32-35 DOI : 10.5958/0973-9718.2022.00089.7	5.95
Use of SortMeRNA tool to find out diverse rna molecules from Buffalo milk transcriptome	Pooja Chhabra, Brij Mohan Goel, Reena Arora	BIOINFOLET – A Quarterly Journal of Life Sciences	20(1):30-33	_
Analysis of differentially expressed diverse non-coding RNAs in different stages of lactation of Murrah buffalo	Pooja Chhabra, Brij Mohan Goel, Reena Arora	BIOINFOLET-– A Quarterly Journal of Life Sciences	20 (3 B),524 - 530	_
Diversity analysis of DRB3 gene locus in indicus cattle-identification of novel PCR-RFLP allelic patterns.	Shallu Saini, Namita Kumari, S.K. Mishra, Anurag Kumar, Shubham Loat, Nitika Dhilor, Monika Sodhi and R.S. Kataria	Indian Journal Dairy Science	76 (1): 69-72 https://doi.org/10.33785/IJDS.2023.v76i01.009	5.24

Publication: Research Abstracts

Title	Authors	Title of Event	Date/Place
Candidate SNPs of caprine fecundity genes genotyped in Mahabub nagar goat	Rekha Sharma, Sonika Ahlawat, RAK Aggarwal, PS Dangi, NK Verma and MS Tantia	National Symposium on Animal genetic resources management for rural livelihood enhancement & XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Ex situ conservation of Mewati camel: A population of critical status	Sushma Prasad, Shalini Yadav, Rekha Sharma, Anoop Singh, RAK Aggarwal and MS Tantia	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Somatic cell conservation of Agonda Goan pig: the first recognized livestock breed of Goa	Rekha Sharma, Renuka Sehrawat, Sushma Prasad, Shalini Yadav, Amiya Ranjan Sahu, RAK Aggarwal and MS Tantia	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Genetic diversity status of only registered cattle breed of Nagaland-Thutho	Rekha Sharma, Sonika Ahlawat, RK Pundir and MS Tantia	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Genetic diversity among Indian cattle breeds using SNP genotyping array	Amod Kumar, RK Pundir, Rekha Sharma, Meenal Raheja, Anita Garsa, Vandana Dureja, Seema Yadav, Mehak Maggon and Kanika Popli	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Population structure of Indian cattle breeds using SNP genotyping array	RK Pundir, Amod Kumar, Rekha Sharma, Meenal Raheja, Anita Garsa, Vandana Dureja, Seema Yadav, Mehak Maggon and Kanika Popli	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani

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Validation of potential reference genes in peripheral blood mononuclear cells for expression studies involving vector-borne diseases in bovines	Rashmeet Kaur, Sonika Ahlawat, Mandeep Kaur, Reena Arora, Rekha Sharma, RK Vijh	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Study on phenotypic characterization of local buffalo population of Mahakaushal region of Madhya Pradesh	Rajesh Kumar Vandre, Shrikant Joshi, Mohan Singh Thakur, MS Tantia, Rekha Sharma, Ajit Pratap Singh, SS Tomar, Mona Sharma	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Genomic variant analysis of Barbari goats through whole genome sequencing	Sonika Ahlawat, Reena Arora, Rekha Sharma, Pooja Chhabra, Upasna Sharma	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
Expression kinetics of cytokine genes in Theileria annulata infected and healthy cross bred cattle	Rashmeet Kaur, Sonika Ahlawat, Vikas Chaudhary, Anisha Kumari, Ashish Kumar, Mandeep Kaur, Reena Arora, Rekha Sharma	National Symposium on Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity	23 -24 February 2023; College of Veterinary & Animal Sciences, MAFSU, Parbhani
An effort towards conserving livestock diversity of the Himalayan region by Somatic cell banking	Rekha Sharma, Sushma Prasad, Shalini Yadav, RAK Aggarwal, MS Tantia	Sustainable Mountain Agriculture: Challenges and Opportunities for Achieving Zero Hunger and Nutritional Security	05-06 July, 2023; ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora, and the Boshi Sen Society for Sustainable Mountain Agriculture (BoSSMA), Almora
In vitro conservation of Teressa goat and Nicobari pig of Andaman and Nicobar Islands	Sushma Prasad, Shalini Yadav, Rekha Sharma, RAK Aggarwal, J. Sunder, MS Tantia	Prospects and Challenges of Environment and Biological Sciences in Food Production System for Livelihood Security of Farmers (ICFPLS-2023)	18-20, September 2023; ICAR-CIARI, Port Blair, Andaman Nicobar Islands, India
Complete mitogenome sequence analysis provides insights into the maternal genetic diversity of Indian swamp buffaloes	Sonika Ahlawat, Upasna Sharma, Reena Arora, Rekha Sharma, Pooja Chhabra and KV Singh	National Conference of Indian Society for Buffalo Development (ISBD) and Symposium on “Modern approaches for sustainable buffalo production in the scenario of climate change	27-28 October, 2023; DUVASU, Mathura

Title	Authors	Title of Event	Date/Place
Uncovering the transcriptomic patterns of the host immune response to Anaplasmosis in buffaloes	Sonika Ahlawat, Vikas Choudhary, Pooja Chhabra, Reena Arora Rekha Sharma	National Conference of Indian Society for Buffalo Development (ISBD) and Symposium on "Modern approaches for sustainable buffalo production in the scenario of climate change	27-28 October, 2023; DUVASU, Mathura
In vitro conservation of indigenous livestock at risk: embracing the halfway mark	Shalini Yadav, Sushma Prasad, Rekha Sharma, RAK Aggarwal, Sonika Ahlawat, Reena Arora, MS Tantia	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Genome wide SNP mining and estimation of polymorphic SNPs in Bachaur cattle (Bos Indicus)	Aishwarya Dash, Sanjeev Singh, Indrajit Ganguly, Rekha Sharma, Nidhi Sukhija, Kanaka KK, Satpal Dixit	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Indian Camel (Camelus dromedarius and Camelus bactrianus) biodiversity conserved in vitro as somatic cells	Sushma Prasad, Shalini Yadav, Rekha Sharma, RAK Aggarwal, Sonika Ahlawat, Reena Arora, MS Tantia	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Transcriptomic profiling of heart tissues in Changthangi and Muzzafarnagri Sheep: Insights into adaptive gene expression patterns	Ritika Gera, Pooja Chhabra, Reena Arora, Rajesh Kumar, Mandeep Kaur, Ram Parsad, Mohsin Ayoub Mir, Manoj Kumar Singh, Sonika Ahlawat, Rekha Sharma	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Whole mitogenome based genetic diversity analysis reveals distinct maternal origins for the dromedary and bactrian camels	Sonika Ahlawat, Upasna Sharma, Reena Arora, Rekha Sharma, Pooja Chhabra	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Molecular insights into Pashmina fiber production: comparative transcriptomic analysis of Changthangi goats and sheep	Sonika Ahlawat, Mahanthi Vasu, MA Mir, MK Singh, Reena Arora, Rekha Sharma, Pooja Chhabra, Upasna Sharma	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal

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Identification of stable reference genes for Q-Real time PCR across different ovine tissues	Mahanthi Vasu, Sonika Ahlawat, Vikas Choudhary, Rashmeet Kaur, Reena Arora, Rekha Sharma, Upasna Sharma, Reena Arora, Pooja Chhabra, MA Mir, MK Singh	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Genome-wide runs of homozygosity signatures in diverse indian goat breeds	Dibyasha Kar, Indrajit Ganguly, Sanjeev Singh, Avnish Kumar Bhatia and S P Dixit	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Identification of genomic variants in kanniadu goat using whole genome resequencing	Ravina, S.T. Vanzampuii, S P Dixit, Indrajit Ganguly, Sanjeev Singh	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Unraveling x chromosome wide runs of homozygosity in indian zebu cattle	Rangasai Chandra Goli, Kusum Mehla, Indrajit Ganguly, Sanjeev Singh, S P Dixit	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Genome-wide snp mining and estimation of polymorphic snps in bachaur cattle (bos indicus)	Aishwarya Dash, Sanjeev Singh, Indrajit Ganguly, Rekha Sharma, Nidhi Sukhija Kanaka K K, Satpal Dixit	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Discovering the genetic uniqueness of non- descript cattle populations of maharashtra	Kanaka K K, S P Dixit, Nidhi Sukhija, Rangasai Chandra Goli, Indrajit Ganguly, Sanjeev Singh	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Analyzing the complete genome of indian native goats alongside global breeds uncovers rich within breed genetic diversity and distinct population structure	Nandhini Balasubramaniam, Satpal Dixit, Sanjeev Singh, Subrata Koloi, Avnish Kumar Bhatia, Indrajit Ganguly	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Unravelling the population structure of cattle populations of bihar	Aishwarya Dash, Sanjeev Singh, Indrajit Ganguly, Satpal Dixit, Rekha Sharma, Sarath Kumar T, Kiyevi G Chishi	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal

Title	Authors	Title of Event	Date/Place
Evidence of Adaptive Selection in Mitogenome of Indian Cattle Breeds	Sarath Kumar T, Sanjeev Singh, S P Dixit, Indrajit Ganguly, Nandhini P B, Aishwarya Dash	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Genome wide runs of homozygosity reveals selection signatures and inbreeding in indian 83 milch cattle breeds	Amod Kumar, RK Pundir, Divya Chanda, Meenal Raheja, Anita Kumari Garsa, Vandana Dureja, Seema Yadav, Mehak Maggon , Kanika Popli	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Characterization of Rampur hound dog an important dog breed of Uttar Pradesh	Raja K N, A K Mishra, Amod Kumar, Sonika Ahlawat, R K Pundir	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Genomic clues to mithun's unique qualities: meat, resilience, and immunity	Harshit Kumar, Saket Kumar Niranjan, Utsav Surati, Ymberza l Koul, Amod Kumar, K.A. Saravanan, Girish P S.	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Deciphering role of shutdown chicken pulmonary mirna during highly pathogenic avian 142 influenza (h5n1) infection	Amod Kumar, Muhasin Asaf VN, Nidhishree N S, Harshit Kumar, Ashwin Ashok Raut, Anamika Mishra	ISAGB National Conference on "Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17 November, 2023; ICAR-NBAGR, Karnal
Unraveling genomic footprints underlying saline adaptation in chilika buffalo using whole genome resequencing approach	Utsav Surati, Saket K Niranjan, Amod Kumar	National Symposium on Recent Biotechnological Advances in Health and Management of Livestock, Poultry and Companion Animals	October 5-7, 2023; College of Veterinary Science & Animal Husbandry, Mhow
Comparative whole genome analysis reveals footprints underlying saline adaptation in Chilika buffalo	Utsav Surati,Ymberzal Koul, Saket K. Niranjan , Amod Kumar	National Symposium on Modern Approaches for Sustainable Buffalo Production in The Scenario of Climate Change	October 27-28, 2023; DUVASU, Mathura
Some Lesser Known Livestock Population of Uttar Pradesh	A K Mishra, Reena Arora, H K Narula, Amod Kumar, Avnish Kumar, P S Dangi, Avneesh Kumar	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement	February 23-24, 2023; Department of Animal Genetics & Breeding College of Veterinary & Animal Sciences, Parbhani (MAFSU), Nagpur

Title	Authors	Title of Event	Date/Place
Survey, Characterization and Documentation of Combai and Rampur Hound Dog Populations	Raja K N, A K Mishra, Amod Kumar, R K Pundir, B P Mishra	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement	February 23-24, 2023; Department of Animal Genetics & Breeding College of Veterinary & Animal Sciences, Parbhani (MAFSU), Nagpur
Documentation of Native AnGR of Siang and Dibang Region of Arunachal Pradesh: Exploring A New Dog Population	S K Niranjan, A K Mishra, Jaideep K Singh, Amod Kumar, G B Garam	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement	February 23-24, 2023; Department of Animal Genetics & Breeding College of Veterinary & Animal Sciences, Parbhani (MAFSU), Nagpur
A Comparative Whole Genome Sequence Analysis of Indian Yak and Chinese Yak Populations	Mahar Karan, Ankita Gurao, G.R. Gowane, Amod Kumar, Meenakashi, S. K Niranjan, M.S. Dige, R.S. Kataria	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement	February 23-24, 2023; Department of Animal Genetics & Breeding College of Veterinary & Animal Sciences, Parbhani (MAFSU), Nagpur
Study on molecular characterization of buffalo population at Jabalpur, Mandla, Dindori, and Seoni district of Madhya Pradesh	Rajesh Kumar Vandre, Shrikant Joshi, Mohan Singh Thakur, Ajit Pratap Singh, Rekha Sharma, MS Tantia, Amod Kumar, Mona Sharma	International Conference on "Wildlife - Bioscience, Biotechnological Innovations and Avant-garde Genetic Technologies	February 20-21, 2023; Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan , Mathura (U.P)
Analysis of genetic diversity of a new ovine genetic group 'Gang-Fatehpuri' of Uttar Pradesh	MK Verma, Reena Arora, J Singh, Ashish Kumar , Mandeep Kaur	National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation & XVII Annual Convention of Indian Society of Animal Genetics & Breeding	November 16-17, 2023; ICAR-NBAGR, Karnal
Indian camel (Camelus dromedaries and Camelus bactrianus) biodiversity conserved in vitro as somatic cells	Prasad S, Yadav S, Rekha Sharma, Aggarwal RAK, Sonika Ahlawat, Reena Arora, MS Tantia	National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation & XVII Annual Convention of Indian Society of Animal Genetics & Breeding	November 16-17, 2023; ICAR-NBAGR, Karnal
Genome wide runs of homozygosity in 17 native cattle breeds adaptedto diverse agro-climatic regions of India	Divya Chanda, Nampher Masharing, Monika Sodhi, Manish Tiwari, Manishi Mukesh	National Symposium on "Animal Genetic Resources (AnGR)Management for Rural Livelihood Enhancement" and XX Annual Convention of SOCDAB - 2023	23-24 February, 2023; COVAS, Parbhani

Title	Authors	Title of Event	Date/Place
Higher abundance of immunoglobulins, antimicrobial proteins and growth factors in milk colostrum vis a vis transition and mature milk of native cattle and yak populations.	Amarjeet, Prince Vivek, Monika Sodhi, Umesh Kumar, SK Niranjan, RS Kataria, Abhishek, Manishi Mukesh	National Symposium on "Animal Genetic Resources (AnGR)Management for Rural Livelihood Enhancement" and XX Annual Convention of SOCDAB - 2023	23-24 February, 2023; COVAS, Parbhani
Genome wide methylation dynamics in cows of native and exotic Origin: An approach to understand heat stress adaptation.	Preeti Verma, Divya Chanda, Monika Sodhi, Ashok Mohanty, Manishi Mukesh	National Symposium on "Animal Genetic Resources (AnGR)Management for Rural Livelihood Enhancement" and XX Annual Convention of SOCDAB - 2023	23-24 February, 2023; COVAS, Parbhani
Characterizing metabolome signature of various biofluids (serum, milk, saliva, urine, and faces) of Ladakhi yak using NMR spectroscopy.	Umesh Kumar, Amarjeet, Monika Sodhi, Dinesh Kumar, SK Niranjan, RS Kataria, Abhishek Kumar, Manishi Mukesh	National Symposium on "Animal Genetic Resources (AnGR)Management for Rural Livelihood Enhancement" and XX Annual Convention of SOCDAB - 2023	23-24 February, 2023; COVAS, Parbhani
Delineating proteomic signatures of colostrum and mature milk of native cows adapted to high altitude environment of Leh-Ladakh	Amarjeet, Monika Sodhi, SK Niranjan, Sudarshan Kumar, RS Kataria, Abhishek Kumar, Manishi Mukesh	National Symposium Advances of ISAGB on "Genetics and Genomics for Sustainable Livestock Transformation" & XVII Annual Convention of Indian Society of Animal Genetics & Breeding organized	16-17 November, 2023; ICAR-NBAGR, Karnal
Transcriptome mapping of milk somatic cells derived from colostrum of native Ladakhi cows adapted to high altitude region of Leh-Ladakh	Amarjeet, Monika Sodhi, SK Niranjan, RS Kataria, Abhishek Kumar, Manishi Mukesh	National Symposium Advances of ISAGB on "Genetics and Genomics for Sustainable Livestock Transformation" & XVII Annual Convention of Indian Society of Animal Genetics & Breeding organized	16-17 November, 2023; ICAR-NBAGR, Karnal
Capturing physiological and molecular differences in Ladakhi cows adapted to cold arid hypoxia environment of Leh-Ladakh and Sahiwal cows adapted to hot arid normoxia environment.	Manish Tiwari, Monika Sodhi, Prince Vivek, Aman Jast, Saket K Niranjan, Vijay K Bharti, Ranjit S Kataria, Amarjeet, Manishi Mukesh	National Symposium on "Animal production systems and its role in sustainable use of AnGR" and XXI Annual Convention of SOCDAB-2024	15-16 February, 2024; NTR College of Veterinary Sciences, Gannavaram (SVVU), Andhra Pradesh.

Title	Authors	Title of Event	Date/Place
Characterizing metabolome signatures of colostrum and mature milk of Ladakhi cowsadapted to cold arid hypoxia environment of Leh-Ladakh and Sahiwal cows adapted to hot arid normoxia environment.	Amarjeet, Umesh Kumar, Monika Sodhi, Dinesh Kumar, Prince Vivek, Saket K Niranjan, Ranjit S Kataria, Manish Tiwari, Divya Chanda, Manishi Mukesh	National Symposium on "Animal production systems and its role in sustainable use of AnGR" and XXI Annual Convention of SOCDAB-2024	15-16 February, 2024; NTR College of Veterinary Sciences, Gannavaram (SVVU), Andhra Pradesh.
Comparing proteome signatures of colostrum and milk of Ladakhi cows adapted to cold arid hypoxia environment of Leh-Ladakh and Sahiwal cows adapted to hot arid normoxia environment	Amarjeet, Monika Sodhi, Umesh Kumar, Abhishek Kumar, Saket K Niranjan, Ranjit SKataria, Sudarshan Kumar, Divya Chanda, Manishi Mukesh	National Symposium on "Animal production systems and its role in sustainable use of AnGR" and XXI Annual Convention of SOCDAB-2024	15-16 February, 2024; NTR College of Veterinary Sciences, Gannavaram (SVVU), Andhra Pradesh.
Evaluation of biochemical changes and mitochondrial copy number variation in buffalo bulls' sperm cells with altered semen quality during summer stress	Eldho Mathai, Ankita Gurao, Rashivasisth, Harsimran Kaur, Meenakshi Chitkara, M.S. Dige, M. Mukesh, R.A.K. Aggarwal, Pawan Singh, R.S. Kataria	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB	23-24 February, 2023; COVAS, Parbhani, MH
Identifying the most stable internal control genes for transcriptional studies in frozen buffalo spermatozoa under varying heat stress conditions	Harsimran Kaur, Eldho Mathai, Meenakshi Chitkara, Ankita Gurao, M.S. Dige, M. Mukesh, RAK Aggarwal, Pawan Singh, R.S. Kataria	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB	23-24 February, 2023; COVAS, Parbhani, MH
Comparative evaluation based on genetic diversity reveals sufficient genetic differentiation in Chhattisgarhi buffalo	Gahlyan Rajesh Kumar, Vikas Vohra, Supriya Chhotaray, R.S. Kataria	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB	23-24 February, 2023; COVAS, Parbhani, MH

Title	Authors	Title of Event	Date/Place
Identification of epigenetic changes influencing the semen quality parameters in sperm cells during summer stress in Murrah buffalo bulls	Gautam Kumar, R.S. Kataria	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB	23-24 February, 2023; COVAS, Parbhani, MH
Purnathadi buffalo conservation: field constraints and plausible solutions	S. Sajid Ali, S. V. Kuralkar, P. S. Bankar, R. S. Kataria, Vikas Vohra	National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB	23-24 February, 2023; COVAS, Parbhani, MH
Comprehending the Correlation Between the Seasonal Variations Associated Gene Expression with Cellular Changes in Murrah Buffalo Sperm Cells	Eldho Mathai, Ankita Gurao, Harsimran Kaur, Meenakshi Chitkara, Rashi Vasisth, Karpenahalli Ranganatha Sriranga, Pawan Singh, Mahesh Shivanand Dige, Manishi Mukesh, Rajeev AK Aggarwal, Ranjit Singh Kataria	XVII Annual Convention of ISAGB and National Symposium on "Advances in Genetics and Genomics for Sustainable Livestock Transformation"	16-17 November, 2023; ICAR-NBAGR, Karnal
Exploring the Distribution and Methylation Dynamics of Non-CpG Islands in Buffalo Spermatozoa Under Heat Stress	Ankita Gurao, Gautam Kumar, Rashi Vasisth, Karpenahalli Ranganatha Sriranga, Meenakshi Chitkara, Pawan Singh, Manishi Mukesh, R.S. Kataria	XVII Annual Convention of ISAGB and National Symposium on "Advances in Genetics and Genomics for Sustainable Livestock Transformation"	16-17 November, 2023; ICAR-NBAGR, Karnal

Other scientific publications

Technical Articles

Title	Authors	Training	Date/Place
Sequence Alignment	Ravi Kumar Gandham, Amod Kumar, Mahesh Dige and Bina Mishra	Training on *Basic Bioinformatics Tools for Genome Analysis*	October 16-20, 2023; hybrid mode
Phylogenetic Analysis	Ravi Kumar Gandham, Mahesh Dige, Bina Mishra and Amod Kumar	Training on *Basic Bioinformatics Tools for Genome Analysis*	October 16-20, 2023; hybrid mode
Sanger sequencing, sequence chromatogram analysis and sequence submission	R.S. Kataria, M.S. Dige, Amod Kumar and Ankita Gurao	Training on *Basic Bioinformatics Tools for Genome Analysis*	October 16-20, 2023; hybrid mode
Real-Time PCR-based Gene Expression	Manishi Mukesh, Indrajit Ganguly, Amarjeet, MS Dige, Amod Kumar, Monika Sodhi	Training on *Basic Bioinformatics Tools for Genome Analysis*	October 16-20, 2023; hybrid mode
Genomic applications to understand evolution and domestication of animal genetic resource	Sanjeev Singh, Sarath Kumar T, Indrajit Ganguly and S. P. Dixit	Compendium of National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation	16-17, November, 2023; ICAR-NBAGR
Breed Registration System- Recognition to Indigenous Animal Genetic Resources	RK Pundir	Lecture in XX Annual Convention and National Symposium (SOCDAB) on 'Animal Genetic Resources (AnGR) management for Rural Livelihood Enhancement'	February 23-24, 2023; College of Veterinary and Animal Sciences, Prabhani (MAFSU), Nagpur, Maharashtra
Phenotypic data and computational infrastructure	RK Pundir	International on Application of Genomics in Animal Breeding and Animal Health	January 23-25, 2023; BAIF, Pune
SNP Chip Development, Validation and Genotyping Platforms	RK Pundir	International on Application of Genomics in Animal Breeding and Animal Health	January 23-25, 2023; BAIF, Pune
Reference Population and Estimation of GEBV	RK Pundir	International on Application of Genomics in Animal Breeding and Animal Health	January 23-25, 2023; BAIF, Pune
Protection and Recognition of Indigenous Animal Genetic Resources –Registration of New Breeds	RK Pundir	Lecture presented in XXI SOCDAB Annual Convention and National Symposium: Animal Production Systems and its Role in Sustainable use of AnGR	February 15-16, 2024; NTR College of Veterinary Science, Gannavaram, Andhra Pradesh

Title	Authors	Training	Date/Place
Conservation & Up-gradation of Indigenous Cattle	-	Lecture presented in Interface Meeting on Advances in Animal Health and Production with the Veterinary Officers of Animal Husbandry Department, KVKs & Faculty of MAFSU (Maharashtra)	July 28, 2023

Book Chapters

Title	Author	Publication
Kadaknath chicken: Black gold poultry breed of India.	Rekha Sharma, Renuka Sehrawat, Sonika Ahlawat, AK Mishra, MS Thakur, MS Tantia.	Poultry India TM- 4th Edition, Vol-1 (Poultry Year Book-2023): pp 51-64.
On the concepts and measures of diversity in the genomics era.	K.K.Kanka, Nidhi Sukhija, Rangasai Chandra Goli, Sanjeev Singh, Indrajit Ganguly, S.P. Dixit, Aishwarya Dash and Anoop Anand Malik	Current Plant Biology, Volume 33, January 2023, 100278. https://doi.org/10.1016/j.cpb.2023.100278.

Book/Compendium/ Monograph

Type of Publication	Title	Author	Publication Details
Compendium	Advances in Genetics and Genomics for Sustainable Livestock Transformation		National Conference and XVII Annual Convention of Indian Society of Animal Genetics & Breeding organized at ICAR-NBAGR Karnal, during November 16-17, 2023
Manual	Basic bioinformatics tools for genome analysis		Training course organized by HRD Cell, ICAR-NBAGR under the skill development programme from 16-20 October, 2023
Monograph	Camel Genetic Resources of India-Marwari Camel	Prakash V, Sawal RK, Sharma R, Tantia MS, Sahoo A.	NRCC /Technical Bulletin /2023 /Published by ICAR-National Research Centre on Camel, Bikaner, Rajasthan. Pages-42 (ISBN No: 978-81-927935-4-2)
Monograph	Ladakhi Cattle: A Unique Animal Genetic Resource Adapted to High Altitude of Leh-Ladakh	Manishi Mukesh, Monika Sodhi, RS Kataria, Saket K Niranjan, RK Pundir, Amarjeet, Parvesh Kumari, Preeti Verma, Ankita Sharma, Arjava Sharma, BP Mishra & others.	*Published by ICAR-NBAGR*

Database

A Gene Expression Atlas for various genes expressed across 16 different tissues of Kadaknath chicken was developed and named "**Kadak Express.**" The Kadak Express is a comprehensive database of gene expression in Kadaknath chicken that provides an insight into the genomic biology and function of various genes expressed across different tissues. The database is accessible at http://cabgrid.res.in:8080/kadakexpress/home.php

Dr. Reena Arora
Dr. Sonika Ahlawat
Dr. Rekha Sharma

Awards

- Dr. Sonika Ahlawat was bestowed with the **"Outstanding Young Woman Veterinarian Award"** by the National Academy of Veterinary Sciences, India on 1st July, 2023.
- Dr. Reena Arora conferred **Dr. D.S Balain Memorial Award 2022** for best research scientist in the discipline of Animal Sciences by Society for Conservation of Domestic Animal Biodiversity.
- **Best thesis award** for outstanding research work to Rashmeet Kaur, M.Sc. student of Dr. Sonika Ahlawat during 19th Convocation of ICAR-NDRI, Karnal on 24th April, 2023.
- Dr. Manishi Mukesh was awarded **"ISAGB Fellow"** during National Symposium Advances ofISAGB on "Genetics and Genomics for Sustainable Livestock Transformation" & XVII Annual Convention of Indian Society of Animal Genetics & Breeding organized at ICAR- NBAGR, Karnal from 16-17 November, 2023.
- **Best Poster award-** First Prize to Kaur Rashmeet, Ahlawat S, Kaur M, Arora R, Sharma R, RK Vijh to "Validation of potential reference genes in peripheral blood mononuclear cells for expression studies involving vector-borne diseases in bovines" in National Symposium *Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity* organized at College of Veterinary & Animal Sciences, MAFSU, Parbhani during 23 -24 February 2023.
- **Best Poster award-** Second Prize to Amod Kumar, RK Pundir, Rekha Sharma, Meenal Raheja, Anita Garsa, Vandana Dureja, Seema Yadav, Mehak Maggon and Kanika Popli for "Genetic diversity among Indian cattle breeds using SNP genotyping array" in National Symposium *Animal genetic resources management for rural livelihood enhancement& XX Annual Convention of Society for Conservation of Domestic Animal Biodiversity* organized at College of Veterinary & Animal Sciences, MAFSU, Parbhani during 23 -24 February 2023.
- **Second Best Oral Paper award** to Uncovering the transcriptomic patterns of the host immune response to Anaplasmosis in buffaloes by Ahlawat S, Choudhary V, Chhabra P, Arora R and Sharma R

in National Conference of Indian Society for Buffalo Development (ISBD) and Symposium on *"Modern approaches for sustainable buffalo production in the scenario of climate change"* held at DUVASU, Mathura during October 27-28, 2023.

- **3rd Best Oral Paper award** to Complete mitogenome sequence analysis provides insights into the maternal genetic diversity of Indian swamp buffaloes by Ahlawat S, Sharma U, Arora R, Sharma R, Chhabra P and Singh KV in National Conference of Indian Society for Buffalo Development (ISBD) and Symposium on *"Modern approaches for sustainable buffalo production in the scenario of climate change"* held at DUVASU, Mathura from October 27-28, 2023.
- Best article award- Third prize to the article published in पशुधन प्रकाश तेरहवाँ अंक: वैज्ञानिक साक्ष्यों के आधार पर अद्वितीय कड़कनाथ मुर्गे के मूल्य संवर्धन की दिशा में एक सार्थक पहल- रेणुका सेहरावत, रेखा शर्मा, सोनिका अहलावत, सुषमा प्रसाद और मधु सूदन टांटिया.
- **Best oral presentation award** during ISAGB-2023, for the paper entitled Genome-Wide Runs of Homozygosity Signatures in Diverse Indian Goat Breeds. Dibyasha Kar, Indrajit Ganguly, Sanjeev Singh, Avnish Kumar Bhatia and S P Dixit. In compendium of the National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation& XVII Annual Convention of Indian Society of Animal Genetics and Breeding (ISAGB-2023), November 16-17, 2023. ICAR-NBAGR, Karnal, Pp 73-74
- **ISAG Bursary Award 2023** received by Ph.D. student for presentation of the paper entitled **"***An insight into whole genome resequencing data of Indian native goats with global breeds reveals high within breed genetic diversity and distinct population structure"* authored by Nandhini Balasubramaniam, S P Dixit, S Singh, S Koloi and I Ganguly during39thInternational Society for Animal Genetics Conference held in Cape Town, South Africa 2 7 July, 2023.Oral presentation OP 107 (Page 35) &Poster presentation P 209 (Page 70, 92).
- **Second Best Poster presentation:** Amod Kumar, R. K. Pundir, Rekha Sharma, Meenal Raheja, Anita Garsa, Vandana Dureja, Seema Yadav, Mehak Maggon and Kanika Popli. Genetic Diversity among Indian Cattle Breeds Using SNP Genotyping Array. In: National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" organized by Department of Animal Genetics & Breeding College of Veterinary & Animal Sciences, Parbhani (MAFSU), Nagpur & Society for Conservation of Domestic Animal Biodiversity ICAR - NBAGR, Karnal, during February 23-24, 2023.
- **Best oral presentation award:** Vandre RK, Joshi S, Thakur MS, Singh AP, Sharma R, Tantia MS, Kumar A and Sharma M. (2023). Study on molecular characterization of buffalo population at Jabalpur, Mandla, Dindori, and Seoni district of Madhya Pradesh. In: International Conference on "Wildlife - Bioscience, Biotechnological Innovations and Avant-garde Genetic Technologies" organized byU.P. Pt. DeenDayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan in collaboration with Indian Society of Genetics, Biotechnology Research and Development during February 20-21, 2023.
- **Best Oral Presentation Award:** Utsav Surati, Saket K Niranjan and Amod Kumar. (2023). Unraveling genomic footprints underlying saline adaptation in chilika buffalo using whole genome resequencing approach. In National Symposium on *Recent Biotechnological Advances in Health and*

Management of Livestock, Poultry and Companion Animals during October 5-7, 2023 at College of Veterinary Science & Animal Husbandry, Mhow.

- **Second Best Poster presentation award:** Amod Kumar, RK Pundir, Divya Chanda, Meenal Raheja, Anita Kumari Garsa, Vandana Dureja, Seema Yadav, Mehak Maggon and Kanika Popli. (2023). Genome wide runs of homozygosity reveals selection signatures and inbreeding in indian 83 milch cattle breeds. In: National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation & Society for Conservation of Domestic Animal Biodiversity organized by ICAR - NBAGR, Karnal & ISAGB at ICAR-NBAGR, Karnal during November 16-17, 2023.
- **Best Poster Presentation award:** Amod Kumar, Muhasin Asaf VN, Nidhishree N S, Harshit Kumar, Ashwin Ashok Raut, Anamika Mishra. (2023). Deciphering role of shutdown chicken pulmonary mirna during highly pathogenic avian 142 influenza (H5N1) infection. In: National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation & Society for Conservation of Domestic Animal Biodiversity organized by ICAR - NBAGR, Karnal & ISAGB at ICAR-NBAGR, Karnal during November 16-17, 2023.
- **Second Best Hindi article award** during the Hindi Pakhwada-2023 held at ICAR-NBAGR, Karnal, for the Hindi article entitled "Kratim Buddhimatta aur machine learning ke Sath Pashu Prajanan aur Prabhandhan- aik nai aas ke sathVigyan ki aik nai Shakha authored by AnukaYadav and Sanjeev Singh .
- **Best poster award**: Kanaka KK and co-authors were awarded for poster entitled "AnGR Biodiversity of India: Readiness for impending climate change" during poster completion held at ICAR-NBAGR, on 40thFoundation day of Bureau (poster presentation).
- Dr. Sanjeev Singh, received the Reviewer certificate award for serving as a reviewer for Animal Genetics journal a journal of International Society of Animal Genetics on 25th April, 2023.
- **Best oral presentation award** to Arora R,Vijh R.K., Ahlawat S, Yadav D.K., Raja K.N, Chhabra P, Sharma U, Raheja M, Garsa A and Dureja V for 'Design and Validation of High Density SNP Array for Indian sheep population' *In*XX Annual Convention of SOCDAB and the National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" from 23-24 February, 2023 at College of Veterinary and Animal Sciences, (MAFSU) Parbhani, Maharashtra
- **Best poster presentation award** to Kaur R, Ahlawat S, Choudhary V, Kumari A, Kumar A, Kaur M, Arora R, Sharma R and Vijh RK for 'Validation of potential reference genes in peripheral blood mononuclear cells for expression studies involving vector-borne diseases in bovines' *In* XX Annual Convention of SOCDAB and the National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" from 23-24 February, 2023 at College of Veterinary and Animal Sciences, (MAFSU) Parbhani, Maharashtra
- **Third Best oral presentation award** to Ahlawat S, Sharma U, Arora R, Sharma R, Chhabra P and Singh KV for 'Complete mitogenome sequence analysis provides insights into the maternal genetic diversity of Indian swamp buffaloes,' in National Conference of Indian Society for Buffalo Development (ISBD) and Symposium on "Modern approaches for sustainable buffalo production in the scenario of climate change" during October 27-28, 2023.

- **Second Best oral presentation award** to Ahlawat S, Choudhary V, Chhabra P, **Arora R** and Sharma R for 'Uncovering the transcriptomic patterns of the host immune response to anaplasmosis in buffaloes,'in National Conference of Indian Society for Buffalo Development (ISBD) and Symposium on "Modern approaches for sustainable buffalo production in the scenario of climate change" during October 27-28, 2023.
- **Best oral paper presentations award**- S. Sajid Ali, S. V. Kuralkar, P. S. Bankar, R. S. Kataria and Vikas Vohra (2023). Purnathadi buffalo conservation: field constraints and plausible solutions. In National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB, held at COVAS, Parbhani, MH, during 23rd-24th February, 2023.
- **Second best oral presentation award-** Eldho Mathai, AnkitaGurao, Rashivasisth, Harsimran Kaur, Meenakshi Chitkara, M.S. Dige, M. Mukesh, R.A.K. Aggarwal, Pawan Singh and R.S. Kataria (2023). Evaluation of biochemical changes and mitochondrial copy number variation in buffalo bulls' sperm cells with altered se-men quality during summer stress. In National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement" & XX Annual Convention of SOCDAB, held at COVAS, Parbhani, MH, during 23rd-24th February, 2023.

Capacity Building

HRD Programme

Training organized

Type of Program	Title	Organizing Agency	Duration	Organizers/Resource person
Training Programme	Basic Bioinformatics Tools for Genome Analysis	ICAR-NBAGR, Karnal	October 16-20, 2023	Dr Ravi Kumar Gandham Dr. Manishi Mukesh Dr. R.S. Kataria Dr. Monika Sodhi Dr. Bina Mishra Dr. MS Dige Dr. Amod Kumar

Conference organized

Type of Program	Title	Organizing Agency	Duration	Organizing Secratery
Conference	Advances in Genetics and Genomics for Sustainable Livestock Transformation & XVII Annual Convention of Indian Society of Animal Genetics & Breeding	ICAR-NBAGR Karnal	November 16-17, 2023	Dr. S.P. Dixit

Training Attended

Type of Program	Title	Organizing Agency	Duration	Scientist Attended
Training Programme	Multivariate Data Analysis	ICAR-NAARM, Hyderabad	20-27 March, 2023	Dr. Indrajit Ganguly
Training Course	Laboratory Assessor's Training Course as per ISO/IEC 17025; 2017	NABL at ICAR-NDRI, Karnal	16-20 January, 2023	Dr. Amod Kumar
Skilling Course	Artificial Intelligency (AI) for India 2.0	-	16thAugust, 2023	Dr. Sanjeev Singh

Conferences/Seminars/ Symposia

Attended

Type of Program	Title	Organizing Agency	Duration	Scientist's Attended
Conference	17th Annual Convention of ISAGB and National Conference on Advances in Genetics and Genomics for Sustainable Livestock Transformation	ICAR-NBAGR Karnal	16-17 November, 2023	Dr. B.P. Mishra Dr. RK Pundir Dr. SP Dixit Dr. Ravi Gandham Dr. RAK Aggarwal Dr. R.S. Kataria Dr. Manishi Mukesh Dr. A.K. Mishra Dr. Monika Sodhi Dr. Dinesh Yadav Dr. Reena Arora Dr. Avnish Kumar Dr. Rekha Sharma Dr. Bina Mishra Dr. Saket Niranjan Dr. Indrajit Ganguly Dr. Sanjeev Singh Dr. Karanvir Singh Dr. Sonika Ahlawat Dr. MS Dige Dr. Amod Kumar
Symposium	XX Annual Convention of SOCDAB and the National Symposium on "Animal Genetic Resources (AnGR) Management for Rural Livelihood Enhancement"	College of Veterinary and Animal Sciences, (MAFSU) Parbhani, Maharashtra	23-24 February, 2023	Dr. B.P. Mishra Dr. RK Pundir Dr. RAK Aggarwal Dr. A.K. Mishra Dr. R.S. Kataria Dr. Reena Arora Dr. Saket Niranjan Dr. Raja KN Dr. Sonika Ahlawat Dr. MS Dige

Workshops/ Meetings / Attended:

Type of Program	Title	Organizing Agency	Duration	Scientist Attended
Workshop	Application of Genomics in Animal Breeding and Health	BAIF, Pune	23-25 January, 2023	Dr. Amod Kumar
Workshop	Bioinformatics, Genomics, Transcriptomics, Microbiome and NGS data analysis	-	13-29 March, 2023	Dr. Amod Kumar

As Member, Research Advisory Committee meeting	-	ICAR-NRC on Mithun, Nagaland	21-23 September, 2023	Dr. Reena Arora
As Outside Expert, Member, Meeting of the Institutional Biosafety Committee (IBSC)	-	ICAR-National Bureau of Fish Genetic Resources (NBFGR), Lucknow	7th October and 18th December, 2023	Dr. Reena Arora
Workshop	Application of Genomics in Animal Breeding and Animal health	Hotel Radission Blu, Kharadi, Pune, organized by BAIF	23-25 January, 2023	Dr. R.K. Pundir
Meeting	Registration of indigenous horse breeds	Chanderlok Building, Janpath, New Delhi.	14th April, 2023	Dr. R.K. Pundir

Lecture Delivered

Type of Program	Title	Organizing Agency	Duration	Scientist
Compendium	Genomic applications to understand evolution and domestication of animal genetic resources	ICAR-NBAGR, Karnal	16-17, November, 2023	Dr. SP Dixit, Dr. Manishi Mukesh, Dr. Sanjeev Singh, Dr. Indrajit Ganguly
Workshop	Igniting Young Minds for Career in Agricultural Science	ICAR-IIWBR, Karnal.	21st July, 2023	Dr. Reena Arora Dr. Sonika Ahlawat
State level National Children's Science Congress-2023	Inculcating scientific temper in young minds		16th December, 2023	Dr. Reena Arora Dr. Sonika Ahlawat

Azadi ka Amrit Mahotsav

NAAS Karnal Regional Chapter Special Lecture

National Academy of Agricultural Sciences (NAAS) Karnal Regional Chapter in association with ICAR-National Bureau of Animal Genetic Resources, Karnal organised a Special Lecture Series at ICAR-NBAGR on May 30, 2023. The lecture on 'Genomic Selection of Cattle and Buffaloes in India – Challenges and Prospects' was delivered by Dr S P Dixit, Head, Animal Genetics Division, ICAR-NBAGR

Dr M.L. Madan, Padma Shree Awardee and Convener of the National Academy of Agricultural Sciences, NAAS Karnal Regional Chapter, remarked over the use of genomic selection for increasing productivity of native cattle and buffalo in Indian context. Dr B P Mishra, Director, ICAR-NBAGR said that the technology has immense use for genetic improvement and NBAGR has been contributing in designing combined SNP chip for genomic selection of dairy animals in the country. Dr Arjava Sharma, Former Director, ICAR-NBAGR & CIRC and Dr Y S Rajput, Former Head, DC Division, ICAR-NDRI & NAAS Fellow also graced the occasion and provided their valuable inputs on use of the technology in the country. All the scientific staff of the Bureau attend the program.

Motivational lecture

Under Azadi ka Amrit Mahotsav, ICAR-NBAGR organized a motivational Speech on the "Power of Positive Thinking" by Prof. Onkar Chand Sharma (Mt Abu) on May 18, 2023. Dr Sharma is a renowned Motivational Speaker and his lectures have been telecasted multiple times on various TV channels. As an opportunity to improve our personality and thought process, the programme was attended by all the staff and students of the Bureau with full zeal and enthusiasm.

ISAGB-Distinguished Lecture

Under the ISAGB-Distinguished Lecture Series, a lecture on "Human Origin, Health and Diseases" was organized on August 23, 2023. The lecture was delivered by Dr K Thangaraj, JC Bose Fellow, CCMB and Former Director, Centre for DNA Fingerprinting, Hyderabad. All scientists, young researchers and students attended the lecture.

Symposium and Training Programs

ISAGB National Conference

National Conference and the XVII Annual Convention of ISAGB on "Advances in Genetics and Genomics for Sustainable Livestock Transformation" was held from 16 to 17 November, 2023 at ICAR-NBAGR, Karnal, in hybrid mode. A total of more than 150 delegates participated in the conference. There were four international speakers from Australia, USA and Brazil. Several oral presentations and posters reflecting cutting edge research in the field of Animal Genetics, Animal Genetic Resources and Animal Biotechnology were presented. Deliberations on implementation of genetic improvement programs utilizing modern genomic tools were held and it was emphasized that accurate phenotype recording is the crux of the any such programme to be successful. Specific attributes/characteristics of indigenous breeds like Ladhakhi have been established and identification of such unique signatures will help in long term conservation through sustainable utilization of indigenous germplasm.

A presentation on SWOT Analysis of Animal Breeding Practices in India and Way Forward was noteworthy and the chairman of the session emphasized the need to take the issues raised on a bigger platform for successful implementation. The session for the Young Scientist award saw active participation from budding scientists from different parts of the country. The round table on Integration of Genomics in Practical Animal Breeding drew new insights into implementation and use of genomic tools in Animal breeding. A need was felt on having an SOP for phenotype recording. It was suggested to focus on a few major breeds of cattle and buffalo for genomic selection to start with. The conference ended on a positive note with a target to holistically address to enhancing livestock productivity.

The symposium drew approximately 200 participants, including scientists, researchers, academicians, students from various institutes, and retired faculty members, both offline and online.

Dr. JK Jena addressing the delegates of the symposium

Skill Development Training on Bioinformatics for Genome Analysis

Five days long Skill Development Training Programme on "Basic Bioinformatics Tool for Genome Analysis" was conducted during 16-20 October, 2023 at ICAR-National Bureau of Animal Genetic Resources. Total 76 participants of diverse groups including Professors, teachers, scientists, Research Associates, SRF/JRFs, research scholars, and students of medical, plant, animal sciences fields from 18 states attended the training. The program was aimed towards capacity building for analysing the eukaryote genome for assessing genetic diversity and unique genomic regions identification using bioinformatics tools, divided in five different modules.

During inauguration, Dr. T. K. Datta, Director of ICAR-Central Institute for Research on Buffaloes, Hissar Chief Guest of the Training program congratulated the Bureau for overwhelming response and said that such trainings are vital, in analysing voluminous genomic and other omics data to decipher the uniqueness of AnGR, at molecular level. Dr. B. P. Mishra, Director, ICAR-NBAGR, Karnal highlighted the importance of basic tools in bioinformatics and urged the participants for undertaking the collaborative research for enhanced outcomes.

The program, conducted in a hybrid format was organized by the Human Resource Development (HRD) Cell of the Bureau and coordinated by Dr. Manishi Mukesh, PS & Nodal Officer HRD Cell and Dr. Ravi Kumar Gandham Head, Animal Biotechnology.

AnGR Sensitization program

State Interface Meet on AnGR of Arunachal Pradesh

Under the Mission towards zero non-descript AnGR of India, ICAR-NBAGR organized 14th State Interface meet on 'Characterization and Documentation of Animal Genetic Resources of Arunachal Pradesh' in collaboration with Department of Animal Husbandry, Veterinary & Dairy Development (AHVDD), Arunachal Pradesh at Directorate of AHVDD Nirjuli-Itanagar on 23rd March, 2023. About 60 delegates of ICAR, AHVDD, Arunachal Pradesh State Biodiversity Board and Rajiv Gandhi University, Arunachal Pradesh participated in the state Meet.

Ms Koj Rinya, Secretary, Arunachal Pradesh State Biodiversity Board during her address, appreciated the efforts of the Bureau for documenting the AnGR of the state. She further informed that native breeds and populations would be the part of the People Biodiversity Register, as an important task being carried out by the Board to preserve biodiversity and protecting the interest of stakeholders in the state. Dr BP Mishra, Director, ICAR-NBAGR delivered the keynote address on Mission towards Zero Non-descript AnGR and said that the Bureau has initiated documenting native AnGR of the state, which is largely non-descript; in collaboration with AHVDD. Dr Mihir Sarkar, Director, ICAR-NRC on Yak informed the efforts of the Centre for improvement of Arunachali yak in the Kameng-Tawang temperate region of the state. Dr Tachi Taku, Deputy Director, AHVDD welcomed the delegates and described the activities of the Department for development of state's AnGR.

During panel discussion on AnGR documentation, scientists of NBAGR and senior officers of AHVDD offered their views.

Delegates during Interface Meet on AnGR of Andaman & Nicabar

Interface Meet on AnGR of Andaman & Nicobar Islands

15th State Interface Meet on Characterization & documentation of AnGR of Andaman & Nicobar (UT) under the Mission towards Zero Non-descript AnGR of India was organized at CIARI, Port Blair on 8th May 2023. More than 30 delegates of ICAR, KVK and Animal Husbandry Department attended the Meet jointly organized by ICAR-NBAGR and CIARI.

Dr. B.N. Tripathi, DDG (AS), ICAR, New Delhi was the chief guest of the Interface Meet. During Presidential address, he made a call to transform A&N Islands into a disease-free island for production of export quality animals and further characterization of animals with the aid of modern molecular tools. Dr. P.K. Rout, ADG (AP&B), ICAR, New Delhi discussed the need for identification of genetic disorder traits, selection of other productive and reproductive tools through use of modern technologies. Dr. Dr. B.P. Mishra, Hon'ble Director, ICAR-NBAGR enlightened about indigenous AnGR used by resource poor farmers for energy budgeting, production and can thrive under impending climate change scenario. Dr. K.A. Naveen, Director, DAHVS, A&N Islands narrated the endemic animals which demands attention for characterization and conservation as well.

During interactive session, Dr. Jai Sunder of ICAR-CIARI, Dr. H.K. Narula, Dr. Monika Sodhi, Dr. Bina Mishra and Dr. S.K. Niranjan, of ICAR-NBAGR given presentation on various aspects of characterization, documentation and conservation of AnGR in the Union Territory.

Dr Tripathi also inaugurated the first conservation unit of Teressa goat at ICAR-CIARI. Teressa goat is one of the threatened indigenous breeds as per Breed Watchlist 2022 released by NBAGR, Karnal.

State Interface Meet on AnGR of Kerala state

Bureau organized Interface Meet with Kerala state for 'Documentation of Indigenous AnGR of Kerala' at College of Veterinary and Animal Sciences, Mannuthy on 8th September, 2023, in collaboration with Animal Husbandry Department, Govt. of Kerala and Kerala Veterinary and Animal Sciences University (KVASU). This was 16th State Interface Meet under the "Mission towards zero non-descript

AnGR of India". About 60 delegates including Officers of State Animal Husbandry Dept., Kerala Livestock Development Board, Faculty of College of Veterinary and Animal Sciences, research scholars, progressive farmers attended the Meet.

Dr A. Kowsigan IAS, Director, Animal Husbandry Department, Govt. of Kerala in his address appreciated the efforts of Bureau in documenting the indigenous AnGR across the country and initiating the drive in Kerala state. Dr BP Mishra, Director, ICAR-NBAGR, in his Keynote address outlined the Mission towards Zero Non-descript AnGR in the country and presented a roadmap to achieve the objective of the Mission. Prof Dr. Vijayakumar, Dean, CoVSc, Thrissur emphasized the need to document the indigenous non-descript animal genetic resources of Kerala state.

During the technical session, Dr K Anil Kumar, Professor, AG&B, CoVSc, Thrissur presented the current status of AnGR of Kerala in detail. Dr. R K Pundir, Head, AGR Division, ICAR-NBAGR during the presentation discussed in detail about the process for registering indigenous breeds and further Gazette notification. Dr Raja K N, Senior Scientist of the Bureau described strategies for characterization and documentation of native AnGR in the state. Dr Sindhu K, Additional Director, (AH), Animal Husbandry Department, Govt. of Kerala presented livestock policies and ongoing development programs implemented of the department. Dr Rajeev, Managing Director, Kerala Livestock Development Board informed about the research undergoing for productivity enhancement and conservation of AnGR by the organization.

Panel discussion on AnGR documentation of the state was also held during the Meet. Participating farmers, during interaction, apprised about the efforts of the department for indigenous cattle conservation through involving gram panchayat.

Farmers awareness and outreach program

Haryana

A farmer's scientist interactive meet was organized at Village Dabkoli, Indri block, Karnal district on 27th January 2023 and more than 100 farmers participated in the event. The scientists interacted with the farmers and explained in detail about the importance of rearing indigenous livestock. A kit for livestock, containing calcium, liver tonic, digestive stimulant and cattle feed were distributed to 100 beneficiaries belonging to SC category SCSCP program. All the participants were served with millet biscuits and millet based roasted multigrain. Dr. Raja K N, Senior Scientist, Dr. RAK Aggarwal, Principal Scientist and Dr. Sonika Ahlawat, Senior Scientist coordinated the program along with the officers of state AHD, Haryana.

On the occasion of Bureaus' 40th Foundation day a farmer-scientist interactive meet & International Year of millets-2023 was organized at Village Kirajpur, Kunjupura block, Karnal district on 21.09.2023 in collaboration with local panchayat body and AHD, Haryana and about 60 farmers participated in the event. The scientists interacted with the farmers and explained in detail about the importance of rearing indigenous livestock. As a part of celebrating International Year of Millets-2023 scientist also discussed with them about having millets in their diet at least once in day. A kit for livestock, containing mineral mixture, calcium, liver tonic, digestive stimulant and dewormer were distributed to 40 beneficiaries (5 female & 35 male beneficiaries) belonging to SC category under SCSCP plan. All the participants were served with millet based roasted multigrain. The programme was coordinated by Dr. R K Pundir, Head, AGR, Dr. A K Mishra, Principal Scientist, Dr. Raja K N, Senior Scientist, and Shri Subash Chander, TO of the bureau.

Farmer-Scientist interactive meet & International Year of millets-2023

A farmer's scientist interactive meet & International Year of millets-2023 was organized at Village Samalpur, Indri block, Karnal district on 17.03.2023 in collaboration with ICAR-NDRI, Karnal and about 60 farmers participated in the event. The scientists interacted with the farmers and explained in detail about the importance of rearing indigenous livestock. As a part of celebrating International Year of Millets-2023 scientist also discussed with them about having millets in their diet at least once in day. A kit for livestock, containing calcium, liver tonic, digestive stimulant and cattle feed were distributed to 55 beneficiaries belonging to SC category SCSCP program. All the participants were served with millet biscuits and millet based roasted multigrain. The programme was coordinated by Dr. Raja K N, Senior Scientist, along with Dr. A K Mishra, Principal Scientist and Dr. H K Narula, Principal Scientists of the bureau.

Further, Inaugural function of International Conference on "Enhancing Productivity and Value Addition in Millets" on 18th March 2023 at Indian Agricultural Research Institute, New Delhi by Hon'ble Prime Minister. 52 Farmers and staff members attended the program.

Arunachal Pradesh

ICAR-NBAGR also organized Farmers Awareness Programs on AnGR management at Ziro of Lower Sobansiri district and at Palin of Kra Daadi district in collaboration with AHVDDD under NEH Scheme on 24th and 25th of March, 2023, respectively. Bureau scientists also sensitized livestock keepers of the region for importance of native animals. Feed supplements were also distributed among the keepers for their animals.

Uttarakhand

A farmer's scientist interactive meet was organized at Chudyiala and Bhagwanpur villages of Haridwar district in Uttrakhand on 25.03.2023. The scientists interacted with the farmers and explained in detail about the importance of rearing indigenous livestock. A kit for livestock, containing calcium, liver tonic, digestive stimulant and cattle feed were distributed to 100 beneficiaries belonging to SC category SCSCP program. The programme was coordinated by Dr. A K Mishra, Principal Scientist and Dr. H K Narula, Principal Scientists of the bureau along with the officers of AHD, Uttrakhand.

Ladakh

Two Farmers Awareness Programs were organized in Kanji and Photoksar of Leh district in Ladakh (UT) during May 23-24, 2023. Farmers were sensitized for promotion and conservation of native breeds. More than 100 farmers attended the programs. Supplements were distributed among the farmers. Other Farmers Awareness Programs were conducted in Shila, Sunny and Rangdum, and Mulbek villages of Zanskar region of Kargil district with the help of Animal and Sheep Husbandry Department. The team distributed mineral mixtures and skin ointments to livestock keepers of these villages.

Exhibitions

Bureau displayed native farm animal breeds during exhibitions organized by research institutes or state animal husbandry departments wherein livestock keepers, entrepreneurs, industry personnel, NGOs, government organizations and other stakeholders were sensitized about the importance of indigenous livestock genetic resources, breed registration process, breed watchlist, and conservation of AnGR.

Date	Programme	Location	Number of farmers/ visitors visited the stall
11-13 March 2023	39th Livestock show organized by State Animal Husbandry Department, Haryana	Charkhi Dadri (Haryana)	500
24-26 March 2023	Maha Pashudhan Expo 2023 organized by Maharashtra Animal Husbandry Department.	Shirdi, Ahmednagar (Maharashtra)	3500
6-7 April 2023	Pashu mahostav and Pradashini organized by ICAR-CIRC, Meerut and Ministry of Fisheries, Animal Husbandry & Dairying, GoI.	Muzzaffarnagar (UP)	1500
14-15 September 2023	Kisan and Pashu Palan Mela, organized by GADUVAS, Ludhiana	Ludhiana (Punjab)	2500
10-13 October 2023	XVI agriculture science congress and ASC expo organized by ICAR-CMFRI, Kochi	Kochi (Kerala)	500
7 October 2023	Kisan Mela organized by KVK, ICAR-NDRI, Karnal	ICAR-NDRI, Karnal (Haryana)	1000
5 December 2023	World Soil Day campaign	Baras, Karnal (Haryana)	100

ICAR felicitated stakeholders for registering animal breeds

The Indian Council of Agricultural Research (ICAR) honored stakeholders for the registration of 28 indigenous animal breeds during the period of 2020 to 2022. A ceremonial event was hosted on February 16, 2023, at the NAS Complex, ICAR, New Delhi. Approximately 80 delegates, including 60 breed applicants from 17 states, were recognized for their contributions. The ceremony was attended by vice-chancellors and directors of various State Agricultural Universities, State Veterinary Universities, along with Deputy Directors General (DDGs) and Assistant Directors General (ADGs) of ICAR. Shri Narendra Tomar, the Honorable Union Minister of Agriculture & Farmers Welfare, Government of India, participated as the chief guest in virtual mode. Shri Tomar praised the applicants and other contributors for their efforts toward breed applications and emphasized the need for intensified efforts by all stakeholders to reduce the proportion of non-descript AnGR in the country. He appreciated ICAR's initiative for a country-wide mission to identify such breeds. Ms. Alka Nagia Arora, Additional Secretary, DARE & Financial Advisor, ICAR; Dr. B.N. Tripathi, Deputy Director General (Animal Sciences), ICAR; and Dr. Abhijit Mitra, Animal Husbandry Commissioner, Government of India, also commended the breed applicants. The program garnered extensive coverage in both print and electronic media nationwide.

Dignitaries felicitating the breed applicants

India elected Vice-chair in ITWG

India participated in the 12th Session of the Intergovernmental Technical Working Group (ITWG) on Animal Genetic Resources (WG-AnGR), held at Food and Agriculture Organization (FAO) headquarters in Rome during 18-20 January 2023 and elected as Vice-chair, representing Asia. Dr BN Tripathi, Deputy Director General (Animal Sciences), ICAR, the National Coordinator, Vice-chaired the Session. He also worked as a Rapporteur for the Session.

The WG-AnGR established by the FAO's Commission on Genetic Resources for Food and Agriculture (CGRFA), functions to review technical issues; advise and make recommendations to the Commission and further implementing the Commission's programme related to AnGR, at a global level. Earlier, India was elected as a member of the WG-AnGR in the 18th Session of the CGRFA held in September 2021. Other Asian members are China, Malaysia, the Philippines, and the Republic of Korea.

In the 12th Session of ITWG, implementation of the Global Plan of Action for Animal Genetic Resources, monitoring of AnGR diversity and preparing 3rd Country Report were reviewed. It also discussed role of microorganisms relevant to ruminant digestion, the role of genetic resources in mitigation of and adaptation to climate change; access and benefit-sharing for AnGR; and "digital sequence information" and potential implications for the conservation and sustainable use of genetic resources. Earlier, in the Global National Coordinators' Workshop held in Rome, during 16-17th January, 2023, Indian efforts to preserve its large AnGR diversity were widely appreciated. Dr BN Tripathi presented about the country's breed diversity, the cataloguing of native breeds, breed registration and notification system and efforts to document non-descript AnGR. In the workshop, he also shared the country's experience in filling the data in the Domestic Animal Diversity – Information System (DAD-IS) and suggested including more species and relevant data to define a breed in the DAD-IS portal. National priorities for germplasm cryopreservation and documenting non-descript AnGR to fulfill SDG indicators were widely commended by the FAO members.

Dr BN Tripathi, DDG (AS) ICAR attending ITWG at FAO, Rome

Institute's Activities

Celebrations

Breed Conservation Awards on Rashtriya Kisan Diwas

On December 23, 2023, the Bureau celebrated "National Farmers Day" by organizing the "Breed Conservation Award-2023." The event honored animal breeders/farmers and institutions nationwide for their conservation efforts of indigenous animal breeds. Dr. G.K. Gaur, Assistant Director General (AP&B), Indian Council of Agricultural Research, New Delhi, was chief guest of the program. A total of eight farmers/livestock keepers and nine institutions/organizations were recognized for their contributions to the conservation and improvement of indigenous breeds.

List of Awardees

Prize	Awardee	Breed conserved
Individual category		
First	Sh. D Ranjit Kuttan, Nilgiri (Tamil Nadu)	Toda buffalo
	Sh. Surendra Awana, Dudu (Rajasthan)	Gir cattle
Second	Sh. Harshit Jhuria, Sikar (Rajasthan)	Tharparkar cattle
	Sh. Prem Singh Rao, Jodhpur (Rajasthan)	Tharparkar cattle
Third	Sh. Deva Ram, Barmer (Rajasthan)	Marwari goat
	Sh. Jadeja GabhubhaVagha Ji, Kachchh (Gujarat)	Patanwadi sheep
Consolation	Sh. Satyajit Khachaar, Jasdan (Gujarat)	Gir cattle
	Sh. Surendra Kumar, Hanumangarh (Rajasthan)	Sojat goat
Institutional category		
First	Gomantak GausevakMahasang, Goa	Shweta Kapila cattle
	Amritmahal Cattle Breeding Centre, Chikkamagaluru, Karnataka	Amritmahal cattle
Second	ICAR-National Research Centre on Equines, Equine Production Campus, Bikaner, Rajasthan	Marwari horse
	Poultry Research Station, Tamil Nadu Veterinary and Animal Sciences University, Chennai	Aseel chicken
Third	Bargur Cattle Research Station, Bargur, Tamil Nadu	Bargur cattle
	AICRP on Cattle- Sahiwal, GBPUA&T, Pantnagar, Uttarakhand	Sahiwal cattle
Consolation	Sri Venkateswara Veterinary University, Lam, Andhra Pradesh	Ongole cattle
	ICAR- Central Avian Research Institute Izatnagar, Bareilly, UP	Nicobari chicken
	Red Kandhari Research & Instructional Farm, COVAS, Parbhani (M.S.)	Red Kandhari cattle

Breed Conservation Awardees at the Bureau

Dignitaries during the "Foundation Day celebration"

40th Foundation Day

ICAR-NBAGR celebrated its 40th Foundation Day on September 21, 2023, by organizing various activities involving farmers, scientists, and researchers. Dr. S.L. Goswami, former Vice Chancellor of Banda University of Agriculture & Technology and former Director of ICAR-NAARM, delivered the Foundation Lecture on "AnGR Biodiversity in India: Readiness for Impending Climate Change." Dr. G.K. Gaur, Assistant Director General (AP&B), ICAR, also addressed the Bureau staff on this occasion. An updated version of the Bureau's website was launched by the dignitaries.

In celebration of the Foundation Day, forty plants were planted on the Bureau premises by the staff.

A poster competition themed 'AnGR Biodiversity of India: Readiness for Impending Climate Change' was held at the Bureau on September 21, 2023. Research scholars participated in the competition, presenting their posters. Winners were awarded for their insightful contributions.

Research scholars participating in the poster competition

Glimpses of the plantation drive in the Bureau premises

International Biodiversity Day 2023

The Bureau commemorated International Day for Biological Diversity (IBD) on May 22, 2023, amongst Ladakhi cattle keepers in the high altitudes of Leh, Ladakh. The event was organized in collaboration with the Animal Husbandry Department of Ladakh (UT). Approximately 100 delegates, including scientists from the Bureau, officers from the Animal Husbandry Department of Leh, and livestock keepers, attended the program. Dr. B.N. Tripathi, DDG (Animal Science), ICAR, graced the occasion as the Chief Guest. Nineteen

Delegates during the International Day of Biodiversity celebration

Ladakhi cattle keepers from various regions of Ladakh were felicitated by the Chief Guest for their contribution to promoting Ladakhi cattle. Discussions on the Livestock Breeding Policy for Ladakh (UT) took place during the workshop. Additionally, a Breed Monograph on Ladakhi cattle was released.

Establishment of Ladakhi Cattle Breed Society: The Ladakhi Cattle Breed Society was established in Ladakh for the promotion of Ladakhi cattle in the region. During the "International Day for Biological Diversity (IBD)" celebration on May 22, the logo of the Society was released by the DDG (AS), ICAR. An MoU for the promotion of the Society was also signed between ICAR-NBAGR and AHD, Ladakh (UT). This was the first effort of the Bureau to established breed society in the Himalayan region of the country.

ICAR Foundation Day

On the occasion of ICAR-Foundation – Technology Day, a combined exhibition by the Animal Science Division was showcased at the NAS Complex. The exhibition highlighted activities on "Characterization and registration of indigenous breeds of India," capturing the Honorable Minister of FAHD's interest in the Bureau's mission activities. The "Breed Watchlist 2022," published by ICAR-NBAGR, was released by the Honorable Minister of FAHD, MoS-A&FW, DG-ICAR during the ICAR Foundation Day on July 16, 2023. This publication, based on the 20th Livestock Census data, assesses the threat status of indigenous breeds and outlines the population trends of registered breeds in the country. It serves as a crucial tool for prioritizing indigenous breeds for conservation and formulating appropriate strategies by stakeholders.

Republic Day

The 74th Republic Day was celebrated at the Bureau with great zeal and enthusiasm among the staff and their families. The National Flag was unfurled by the Director of ICAR-NBAGR in a ceremonial gesture. On this occasion, the "Best Division Award 2022" was bestowed upon the Animal Genetics Division of the Bureau, recognizing their exemplary contributions and achievements.

International Women's Day

ICAR-NBAGR commemorated "International Women's Day" on the 6th and 7th of March, 2023, with a series of events dedicated to women's empowerment, aligning with this year's theme, "Digit ALL: Innovation and Technology for Gender Equality." The events witnessed enthusiastic participation from all staff members and students. A variety of competitions, including speeches, extemporaneous speaking, and rangoli creation, were organized and outstanding contributions were awarded.

Rangoli competition participants with the judging team

World Intellectual Property Day

ICAR-NBAGR celebrated 'World Intellectual Property Day' on April 26, 2023, embracing the theme "Women & IP: Accelerating Innovation & Creativity." The celebration involved all scientific staff, research associates, senior research fellows, as well as Postgraduate and Ph.D. students engaged in research at the institute. A lecture on "Intellectual Property Rights (IPR)" was delivered by the In-charge ITMU to raise awareness among faculty members and young scholars about the importance of intellectual property rights.

Furthermore, an Extempore Competition focused on the theme of "Women & IP" was organized, with the participation of 15 research scholars, facilitating a platform for dynamic discussions on the subject.

Independence Day

The Bureau celebrated the 77th Independence Day with the unfurling of the National Flag by the Director, followed by a cultural program on the Bureau campus. The "Har Ghar Tiranga" campaign was also observed by the staff from August 13-15, 2023.

Vigilance Awareness Week

In accordance with the directive from the Central Vigilance Commission, the Bureau observed Vigilance Awareness Week from October 30 to November 5, 2023. The week's activities commenced with Dr. B.P. Mishra, the Director of the Institute, leading the officers and employees in taking an oath to "Say no to corruption; commit to the Nation," thereby reinforcing the commitment to transparency within the institution.

Meetings

RAC meeting

Meeting of the Research Advisory Committee of the institute was conducted on May 2, 2023. Various research programs including "Mission towards zero non-descript AnGR" were discussed and suggestions were made by the members.

RAC meeting proceedings

ISO 9001:2015 Meeting

A meeting of ISO implementation committee of the institute was held on June 20, 2023. Further, the annual surveillance for continuing the certification of the institute for ISO9001:2015 was also conducted.

Review meeting of NBGC-IB

The review meeting of National Bovine Genomic Centre-Indigenous Breeds (NBGC-IB) project was held on June 14, 2023 at ICAR-NBAGR, Karnal under the chairmanship of Dr. Abhijit Mitra, Animal Husbandry Commissioner (AHC), Department of Animal Husbandry and Dairying (DAHD), Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD), Govt. of India, New Delhi.

Review meeting of the Network Project

Review meeting of Network Project on AnGR was held on 15-6-2023 under the chair of Asst. Director General (AP&B), ICAR. The progress of three NWP centres in Maharashtra, Bihar and Arunachal Pradesh involved in characterization of six populations was presented and discussed.

Institute Research Committee Meeting

Institute Research Committee meeting was held on July 7 and 10, 2023 under the chairmanship of the Director, ICAR-NBAGR. A total of 39 projects were discussed. New projects for survey and documentation of AnGR of Uttarakhand, Andhra Pradesh, Telangana and Andaman & Nicobar (UT) were initiated under the zero non-descript AnGR mission.

QRT meeting

The first meeting of Quinquennial Review Team (QRT) of ICAR-NBAGR for the period of 2017-22 was held during October 30-31, 2023 at the institute under the chairmanship of Dr. MC Sharma, Former Director -cum- Vice-Chancellor, ICAR-IVRI.

QRT meeting in progress

Participation in G20 AWG Side-events

Bureau scientist of the Bureau attended the first meeting of G20-Agriculture Working Group side-event held on 13-2-2023 at Indore. Delegates of the G20 countries discussed agricultural issues during the program.

Interactive Meet with Bioversity International

ICAR-National Bureau of Animal Genetic Resources organized an Interactive Meet on Agrobiodiversity Index (ABDI)- AnGR Component with Alliance of Bioversity International & CIAT, Region-Asia (India Office) at NBAGR, Karnal on 11 August 2023. Dr J C Rana, Country Representative, India Office, Alliance of Biodiversity International & CIAT, Region-Asia along with his Team attended the Meet. Dr B P Mishra, Director, ICAR-NBAGR chaired the meeting.

FAO's Intergovernmental Technical Working Group-AnGR Meeting

An online meeting of the FAO's Intergovernmental Technical Working Group-AnGR for preparation of 3rd Report of State of the World Animal Genetic Resources for Food & Agriculture was attended by the DDG(AS), ICAR and Director, ICAR-NBAGR held on 17 August 2023.

Interface Meet with AHS, DAHD

Second interface Meet between Animal Husbandry Statistics, Dept. of Animal Husbandry & Dairying, GoI and ICAR-NBAGR was held on 12-12-2023. Mr. Jagat Hazarika, Advisor (Statistics) and Dr V P Singh, Director, AHS of the DAHD attended the meeting. Discussion on technical support for conducting the Breed-wise Livestock Census was held.

Review of Bureau by DG, ICAR

Dr Himanshu Pathak, Secretary, DARE & DG, ICAR reviewed the research activities and achievements and progress in different ICAR directives of the ICAR-NBAGR on 23-12-2023 through video conferencing. Dr Pathak appreciated new initiatives taken and global standing of the Bureau.

Breed Registration Committee meeting

11th meeting of Breed Registration Committee was held on 5th December 2023 at ICAR-NAS Complex New Delhi under the chairmanship of Dr J K Jena, Deputy Director General (Animal Science), ICAR. Seven new indigenous breeds-Andmani goat, Andamani pig and Andamani duck of Andaman & Nicobar, Bhimthadi horse of Maharashtra, Anjori goat of Chhattisgarh, Macherla sheep of Andhra Pradesh, Aravali chicken of Gujarat; and one synthetic breed -Frieswal cattle were recommended for the registration.

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SCIENTIFIC STAFF

S. No.	Name of Scientist	Designation
1	Dr. B.P. Mishra	Director
2	Dr. R.K. Pundir	Head, AGR Div.
3	Dr. Satpal Dixit	Head, AG Div.
4	Dr. R. K. Gandham	Head, AB Div. (from 02-06-2023)
5	Dr. M.S. Tantia	Principal Scientist (upto 31-07-2023)
6	Dr. R.A.K. Aggarwal	Principal Scientist
7	Dr. R.S. Kataria	Principal Scientist
8	Dr. Anil Kumar Mishra	Principal Scientist
9	Dr. Monika Sodhi	Principal Scientist
10	Dr. H.K. Narula	Principal Scientist (upto 01-09-2023)
11	Dr. Dinesh Kumar Yadav	Principal Scientist
12	Dr. Reena Arora	Principal Scientist
13	Dr. Manishi Mukesh	Principal Scientist
14	Dr. Avnish Kumar	Principal Scientist
15	Dr. Rahul Behl	Principal Scientist
16	Dr. Rekha Sharma	Principal Scientist
17	Dr. Bina Mishra	Principal Scientist
18	Dr. Saket Kumar Niranjan	Principal Scientist
19	Dr. Indrajit Ganguly	Principal Scientist
20	Dr. Sanjeev Singh	Principal Scientist
21	Dr. Karan Veer Singh	Principal Scientist
22	Dr. Raja K.N.	Senior Scientist
23	Dr. Sonika Ahlawat	Senior Scientist
24	Dr. Dige Mahesh Shivanand	Senior Scientist
25	Dr. Amod Kumar	Scientist

TECHNICAL STAFF

S.No.	Name	Designation
1	Dr. P. S. Dangi	Chief Technical Officer
2	Sh. S. K. Jain	Chief Technical Officer
3	Sh. Sanjeev Mathur	Asstt. Chief Technical Officer (upto 30-04-2023)
4	Sh. Harvinder Singh	Asstt. Chief Technical Officer
5	Sh. Jamer Singh	Technical Officer
6	Sh. Sat Pal	Technical Officer (upto 31-03-2023)
7	Sh. Ramesh Kumar	Technical Officer (upto 31-03-2023)
8	Smt. Pravesh Kumari	Technical Officer
9	Sh. Naresh Kumar	Sr. Technical Officer
10	Sh. Rakesh Kumar	Sr. Technical Officer
11	Sh. Subhash Chander	Technical Officer
12	Sh. Om Prakash	Technical Officer
13	Sh. Balvinder Singh	Sr. Technical Assistant (Driver)

ADMINISTRATIVE STAFF

S.No.	Name	Designation
1	Sh. Anil Kumar	Administrative Officer
2	Sh. Randhir Singh	Finance & Account Officer
3	Smt. Anita Chanda	Private Secretary
4	Sh. Ramesh Behl	Assistant Adm. Officer
5	Sh. Yoginder	Assistant Admn. Officer
6	Smt. Amita Kumari	Personal Assistant
7	Smt. Shashi Bala	Assistant
8	Sh. Jita Ram	Assistant (upto 01-04-2023)
9	Sh. Satish Kumar	Assistant
	Smt. Priya Phogat	Assistant (from 27.04.2023)
10	Sh. Shiv Chander	Upper Division Clerk
11	Smt. Neerja Kaul	Upper Division Clerk
12	Sh. Babu Ram	Upper Division Clerk
13	Sh. Naresh Kumar	Lower Division Clerk

SKLLED SUPPORTING STAFF

S.No.	Name of Official	Designation
1	Sh. Krishan Lal	Skilled Supporting Staff
2	Sh. Deepak	Skilled Supporting Staff
3	Sh. Satbir	Skilled Supporting Staff
4	Sh. Balwan Kumar	Skilled Supporting Staff (from 04-07-2023)

Joining

Mrs. Priya Phogat, Assistant, joined as ICAR-NBAGR on 27-04-2023.

Dr. S.P. Dixit, Head, AG, joined as ICAR-NBAGR on 10-05-2023.

Dr. R. K. Pundir, Head, AGR, joined as ICAR-NBAGR on 10-05-2023.

Dr. Ravi Kumar Gandham, Head, AB Joined as ICAR-NBAGR on 02-06-2023.

Sh. Balwan Kumar, SSS, Joined as ICAR-NBAGR on 04-07-2023.

Superannuation

Sh. Ramesh Kumar, Tech. Officer, superannuated on 31-03-2023.

Sh. Satpal, Tech. Officer, superannuated on 31-03-2023.

Sh. Jeeta Ram, Assistant, superannuated on 01-04-2023.

Sh. Sanjeev Mathur, ACTO. superannuated on 30-04-2023.

Sh. M. S. Tantia, Pri. Scientist, superannuated on 31-07-2023.

Transfer

Dr. H. K. Narula, Pri. Scientist, transferred on 01-09-2023.

Distinguished Visitors

Dr. Trilochan Mohapatra, Hon'ble President, NAAS & Former Director General, ICAR and Dr.S.K. Chaudhari, DDG(NRM), ICAR visited on 01-03-2023.

Dr. Abhijit Mitra, Animal Husbandry Commissioner, Department of Animal Husbandry & Dairying, Govt. of India, Dr. Bhushan Tyagi, Joint Commissioner (RJM), Department of Animal Husbandry & Dairying, Govt. of India and Dr. P.K. Rout, Assistant Director General (AP&B), ICAR visited on 14-06-2023.

Dr. R.K.Singh, Former Director, ICAR-IVRI visited on 03-07-2023.

Dr. Ashok Kumar, Asstt. Director General (AH), ICAR visited on 03-07-2023.

Dr. J C Rana, Country Director, India Office, Alliance of Biodiversity International & CIAT, Region-Asia visited on 11-08-2023.

Dr. Artabandhu Sahoo, Director, NRCC, Bikaner and Dr. Girish Patil S., Director, NRC on Mithun visited on 19-09-2023.

Dr.S.L.Goswami, Former VC, BUAT, Banda, Dr.G.K.Gaur, ADG(AP&B), ICAR and Dr. Gyanendra Singh, Director, ICAR-IIWBR visited on 21-09-2023.

Dr.T.K. Datta, Director, ICAR-CIRB, Hisar visited on 16-10-2023.

The Quinquennial Review Team consisting of Dr.M.C. Sharma, Chairman, QRT, Dr. B.K. Joshi, Member, QRT, Dr. J.R. Rao, Member, QRT, Dr. P. Kumarasamy, Member, QRT and Dr. Khem Chand, Member, QRT visited on 30 – 31-10-2023.

Dr. P. L. Gautam, National Member, NAHEP External Advisory Panel, Former Vice Chancellor (GBPUAT, Pantnagar), Former Chairman, PPVFRA, New Delhi and Former Chairman, NBA, Chennai visited on 02-11-2023.

Dr. J.K. Jena, Deputy Director General (AS), ICAR visited on 16-11-2023.

Dr. G.K.Gaur, Assistant Director General (AP&B), Dr.A.K. Tyagi, ADG (AN&P). Dr. A.R. Rao, ADG (PIM) ICAR visited on 16 – 17-11-2023.

Sadhu Brahmachintandays, BAPS Sarangpur, Gujarat visited on 24-11-2023.

Sh. Jagat Hazarika, Advisor, D/O Animal Husbandry and Dairying, New Delhi visited on 12-12-2023.

राजभाषा प्रकोष्ठ

संस्थान राजभाषा कार्यान्वयन समिति की बैठकें:

संस्थान में राजभाषा हिंदी के प्रचार-प्रसार और इसके प्रगामी प्रयोग की प्रगति को बल देने हेतु संस्थान राजभाषा कार्यान्वयन समिति की बैठकें दिनांक 16 जून 2023, 24 अगस्त 2023 व 13 नवम्बर 2023 को आयोजित की गई । इन बैठकों में संस्थान में राजभाषा हिंदी के प्रगामी प्रयोग की प्रगति की समीक्षा की गई तथा इसके प्रचार-प्रसार एवं प्रगामी प्रयोग को बल देने हेतु विभिन्न निर्णय लिए गए।

हिंदी कार्यशालाओं का आयोजन :

संस्थान में राजभाषा हिंदी के प्रचार-प्रसार के क्रम में दिनांक 25 जुलाई 2023 को "राजभाषा कार्यान्वयन-समस्याएं एवं समाधान" विषय पर हिंदी कार्यशाला का आयोजन किया गया जिसमें वक्ता के रूप में श्री धीरज शर्मा, उप-निदेशक (राजभाषा), राष्ट्रीय डेयरी अनुसन्धान संस्थान, करनाल को आमंत्रित किया गया। इसी क्रम में दिनांक 21 दिसम्बर 2023 को "सामान्य वित्तीय नियम: जागरूकता एवं सतर्कता" विषय पर एक और कार्यशाला का आयोजन किया गया जिसमें वक्ता के रूप में ब्यूरो के वित्त एवं लेखा अधिकारी श्री रणधीर सिंह उपस्थित रहे।

पशुधन प्रकाश के तेरहवे अंक (वर्ष-2022) के पुरस्कृत लेख:

प्रथम पुरस्कार:- "देशी पशु संसाधन उत्पादों से संबंधित भौगोलिक संकेतक (जी आई): भारतीय परिप्रेक्ष्य में" लेखक लवी शर्मा एवं साकेत कुमार निरंजन, भाकृअनुप-राष्ट्रीय पशु आनुवंशिक संसाधन, ब्यूरो, करनाल।

द्वितीय पुरस्कार (संयुक्त):-

1. "भदावरी भैंसों का संरक्षण: एक प्रयास" लेखक बद्री प्रसाद कुशवाहा, सुल्तान सिंह, दीपक उपाध्याय एवं के.के सिंह, भाकृअनुप-केन्द्रीय भैंस अनुसंधान संस्थान, हिसार।
2. "कृत्रिम बुध्दिमता और मशीन लर्निंग के साथ पशु प्रजनन और प्रबंधन – एक नई आस के साथ विज्ञान की एक नई शाखा" लेखम अनुका यादव एवं संजीव सिंह, भाकृअनुप- राष्ट्रीय पशु आनुवंशिक संसाधन, ब्यूरो, करनाल।

तृतीय पुरस्कार:- "वैज्ञानिक साक्ष्यों के आधार पर अद्वितीय कड़कनाथ मुर्गे के मूल्य संवर्धन की दिशा में एक सार्थक पहल" लेखक रेणुका सहरावत, रेखा शर्मा, सोनिका अहलावत, सुषमा प्रसाद एवं एम. एस टांटिया, भाकृअनुप- राष्ट्रीय पशु आनुवंशिक संसाधन, ब्यूरो, करनाल।

हिंदी पखवाड़े का आयोजन:

प्रत्येक वर्ष की भांति इस वर्ष भी संसथान में हिंदी पखवाड़ा 18-29 सितम्बर 2023 तक उत्साहपूर्वक मनाया गया। इस आयोजन में विभिन्न हिंदी की लिखित एवं मौखिक प्रतियोगिताएं करवाई गई। इस पूरे आयोजन की देख-रेख विधिवत रूप से गठित आयोजन समिति द्वारा की गई।

दिनांक 18 सितम्बर 2023 को निदेशक महोदय की उपस्थिति में हिंदी पखवाड़े का शुभारम्भ किया गया।

निबंध लेखन प्रतियोगिता:- सर्वप्रथम निबंध लेखन प्रतियोगिता का आयोजन हुआ जिसका विषय "श्रीअन्न का मानव स्वास्थ्य पर प्रभाव" था। इस प्रतियोगिता में कुल 10 प्रतिभागियों ने भाग लिया जिनमें सुश्री अमिता कुमारी प्रथम स्थान पर, श्री राम प्रसाद द्वितीय स्थान पर, सुश्री सुषमा प्रसाद तृतीय स्थान पर रहे तथा सुश्री रितिका गेरा ने प्रोत्साहन पुरस्कार प्राप्त किया।

पत्र-लेखन प्रतियोगिता:- दिनांक 19 सितम्बर 2023 को पत्र-लेखन प्रतियोगिता का आयोजन किया गया जिसमें पत्र लिखने के लिए तत्काल दिए गए चार विषयों में से कोई दो पत्र लिखने के लिए प्रतिभागियों को कहा गया। इस प्रतियोगिता में कुल 13 प्रतिभागियों ने भाग लिया जिनमें सुश्री प्रिया फोगाट प्रथम स्थान पर, सुश्री पूजा छाबड़ा द्वितीय स्थान पर, सुश्री अमिता कुमारी तृतीय स्थान पर रहे तथा सुश्री मनदीप कौर ने प्रोत्साहन पुरस्कार प्राप्त किया।

टिप्पणी-मसौदा लेखन प्रतियोगिता:- दिनांक 20 सितम्बर 2023 को टिप्पणी-मसौदा लेखन का आयोजन किया गया जिसमें कुल 11 प्रतिभागियों ने भाग लिया जिनमें सुश्री अमिता कुमारी प्रथम स्थान पर, सुश्री अनीता चन्दा द्वितीय स्थान पर, सुश्री रितिका गेरा तृतीय स्थान पर रहे तथा सुश्री प्रिया फोगाट ने प्रोत्साहन पुरस्कार प्राप्त किया। इस प्रतियोगिता में तत्काल दिए गए चार विषयों में से कोई दो विषयों पर टिप्पणी –मसौदा लिखने को कहा गया था।

शब्दार्थ/अनुवाद एवं सुलेख प्रतियोगिता:- दिनांक 22 सितम्बर 2023 को शब्दार्थ/अनुवाद एवं सुलेख प्रतियोगिताओं का आयोजन किया गया जिनमें कुल 12 तथा 16 प्रतिभागियों ने भाग लिया। शब्दार्थ/अनुवाद प्रतियोगिता में 20 अंग्रेजी तथा 20 हिंदी भाषा के शब्दों को क्रमश: हिंदी तथा अंग्रेजी में अनुदित करना था। इस प्रतियोगिता में कुल 12 प्रतिभागियों ने भाग लिया जिनमें सुश्री सुषमा प्रसाद प्रथम स्थान पर, सुश्री उपासना शर्मा द्वितीय स्थान पर, सुश्री रितिका गेरा तृतीय स्थान पर रहे तथा सुश्री मनदीप कौर ने प्रोत्साहन पुरस्कार प्राप्त किया। सुलेख प्रतियोगिता में एक हिंदी में दिया गया पैरा प्रतिभागियों को अपने हाथ से लिखने को कहा गया था। इस प्रतियोगिता में लिखाई की सुंदरता के आधार पर 16 प्रतिभागियों में से सुश्री सुषमा प्रसाद प्रथम स्थान पर,

सुश्री विधि गर्ग द्वितीय स्थान पर, सुश्री पूजा छाबड़ा तृतीय स्थान पर रहे तथा सुश्री शालिनी यादव ने प्रोत्साहन पुरस्कार प्राप्त किया।

आशु-भाषण एवं काव्य-पाठ प्रतियोगिता:- दिनांक 25 सितम्बर 2023 को आशु-भाषण एवं काव्य-पाठ प्रतियोगिताओं का आयोजन किया गया जिनमें क्रमश: कुल 13 तथा 21 प्रतिभागियों ने भाग लिया। आशु-भाषण में सुश्री अंकिता प्रथम स्थान पर, श्री कनक द्वितीय स्थान पर, श्री अनिल कुमार तृतीय स्थान पर रहे जबकि सुश्री प्रिया फोगाट ने प्रोत्साहन पुरस्कार प्राप्त किया। काव्य-पाठ प्रतियोगिता में सुश्री विधि गर्ग प्रथम स्थान पर, सुश्री प्रवेश कुमारी द्वितीय स्थान पर, सुश्री प्रिया फोगाट एवं सुश्री उपासना शर्मा संयुक्त रूप से तृतीय स्थान पर रहे जबकि सुश्री पूजा छाबड़ा ने प्रोत्साहन पुरस्कार प्राप्त किया।

वाद-विवाद प्रतियोगिता:- दिनांक 26 सितम्बर 2023 को वाद-विवाद प्रतियोगिता का आयोजन किया गया जिसका शीर्षक था "मोबाइल फोन युवाओं के लिए अभिशाप"। इस प्रतियोगिता में क्रमश: कुल 27 प्रतिभागियों ने भाग लिया जिनमें सुश्री प्रिया फोगाट प्रथम स्थान पर, श्री अनिल कुमार द्वितीय स्थान पर, सुश्री सुषमा प्रसाद तृतीय स्थान पर रहे जबकि सुश्री मनदीप कौर एवं सुश्री पूजा छाबड़ा ने प्रोत्साहन पुरस्कार प्राप्त किया।

उत्कृष्ट हिंदी कार्मिक प्रतियोगिता:- दिनांक 27 सितम्बर 2023 को "उत्कृष्ट हिंदी कार्मिक वर्ष 2022-23" प्रतियोगिता का आयोजन किया गया। विधिवत रूप से गठित समिति ने वर्ष 2022-23 में प्रतिभागियों द्वारा हिंदी भाषा में किए गए राजकीय कार्यो का गहनता से निरीक्षण किया तथा निर्विवाद रूप से श्री बाबू राम को प्रथम स्थान, श्री शिव चन्द्र को द्वितीय स्थान तथा श्री नरेश कुमार को तृतीय स्थान प्रदान किया।

हिंदी व्याख्यान:- दिनांक 29 सितम्बर 2023 को ब्यूरो परिवार के सभी सदस्यों के लिए "वित्तीय नियम एवं टिप्पणी-मसौदा लेखन" विषय पर एक व्याख्यान का आयोजन किया गया जिसके वक्ता श्री रणधीर सिंह, वित्त एवं लेखा अधिकारी थे। इस अवसर पर बहुत ही सरल एवं रोचक ढंग से वित्तीय नियमों की जानकारी दी गई। टिप्पणी मसौदा लेखन की प्रक्रिया को सहज रूप में समझाया गया ताकि ब्यूरो कर्मी फाइलों पर हिंदी भाषा के माध्यम से लिखते हुए झिझके नहीं। इस अवसर पर ब्यूरो परिवार के 24 सदस्य उपस्थित थे जिन्होने चर्चा के उपरान्त बहुत संतोष व्यक्त किया।

ब्यूरो के निदेशक डॉ. बी. पी मिश्रा ने दिनांक 3 अक्तूबर 2023 को सभी विजेताओ को प्रमाण-पत्र एवं पुरस्कारों से सम्मानित किया।

ICAR-NBAGR is committed to the UN's

Sustainable Development Goal 2: Zero Hunger

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.*

ICAR-NATIONAL BUREAU OF ANIMAL GENETIC RESOURCES

ISO 9001:2015 Certified Institute

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